Research Reporting Conference Reports

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FINAL RESEARCH REPORT 2010

Project Title:
Molecular basis for potato tuber disease resistance

Investigator:
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Description and Objective of Research:

Worldwide, late blight disease of potato results in multi-billion dollar yield losses and the application of millions of tons of fungicides each year. Chemical-dependent potato farming carries high production and environmental costs. One of the most economical and environmentally sound ways to reduce fungicide usage is deployment of late blight resistance genes. We have a long research history of working with *RB,* a foliar late blight resistance gene from a wild potato species. As we move towards large-scale deployment of the *RB* gene in India and other parts of the world, its impact on both foliar and tuber late blight disease must be considered.

This project utilizes "next generation", high-throughput RNA sequencing to identify plant genes involved in resistance to late blight in foliage and tubers. Our research will enhance basic understanding in the plant sciences and will assist researchers in developing specific deployment strategies for *RB* in a no- or reduced-fungicide production setting.

This project encompasses a series of experiments aimed at testing the following hypotheses:

- Hypothesis 1: Different organs of potato (e.g., foliage *vs.* tubers) use the same or similar defense mechanisms against the late blight pathogen, *Phytophthora infestans*.
- Hypothesis 2: Differences in disease phenotypes in different organs within the same genotype are due to differences in timing of defense initiation.
- Hypothesis 3: High resistance gene transcript levels lead to earlier initiation of defense mechanisms in all plant organs.

Summary of Findings (Outputs/Outcomes):

(1) More than 215 million RNA sequences from potato tubers infected with *P. infestans* were generated. This represents a >1,300-fold increase in data generation relative to our previous expectation of 160,000 sequence reads. This increase was achieved by capitalizing upon emerging next generation sequencing technology (Illumina Solexa).

(2) Bioinformatic comparison of tuber and foliar datasets from potato reveal that while many of the same genes are activated in both tissues when *P. infestans* attacks, overall defense response mechanisms in leaves and tubers might be substantially different. These analyses are ongoing.

(3) We have identified a large set of genes that are responsive in the potato tuber to attack by *P. infestans.* These genes constitute candidates for genes involved in resistance mechanisms in the tuber.

(4) Although this project focused on potato gene transcription, application of newer sequencing technologies allowed us to simultaneously develop a large dataset of genes transcribed in the pathogen as well. Some of these genes may be critical in defining a microbe's ability to attack certain plant genotypes. Future analyses of these genes may reveal new disease control strategies. These genes may also be utilized in future studies as molecular markers to quantify late blight disease development.

Background:

Potato is the world's fourth most important human food crop (Bradeen et al. 2008) and yields more calories per acre than any grain (Rubatzky and Yamaguchi 1997). *Phytophthora infestans*, an oomycete "fungus" that causes late blight disease, is a notorious plant destroyer with the capacity to destroy all parts of a potato plant, including foliage, stem, flower and tubers. Late blight is the most devastating disease for the world's potato production. The disease caused the Irish Potato Famine in the 1840s and still today results in multi-billion dollar losses worldwide annually (Duncan 1999; Fry 2008). Millions of tons of fungicide are applied to the world's potato crop to prevent late blight disease each year. Effective, environmentally-responsible management of late blight disease is possible with a combination of genetic resistance and reduced fungicide usage. We have a long history of research on the *RB* late blight resistance gene, a gene originating from wild potato species (Bradeen et al. 2009a; Bradeen et al. 2003; Millett and Bradeen 2007; Millett et al. 2009; Naess et al. 2000, 2001; Sanchez and Bradeen 2006; Song et al. 2003a; Song et al. 2003b). Important to this project, *RB* is the single most significant late blight resistance gene characterized to date and is scheduled to be deployed in India beginning in 2012 (K.V. Raman, *personal communication*). Our experiments were aimed at achieving the eventual goal of reducing fungicide input for potato production.

One potential challenge for employing genetic resistance for potato production is that foliar resistance to late blight does not guarantee tuber resistance to the same disease—contrasting phenotypes between tubers and foliage can be found even within the same cultivar or genotype (Figure 1)(Collins et al. 1999; Kirk et al. 2001). To effectively control late blight disease, there is a need to understand how the potato defends against the late blight pathogen in different organs (foliage vs. tubers). In order to understand these defense mechanisms, researchers worldwide have conducted a number of studies focusing on "transcriptome" dynamics of potato foliage under pathogen attack. The term "transcriptome" refers to the set of all mRNAs transcribed (from gene DNA to RNA) in a given cell type or tissue at any particular point in time. Importantly, to date, there has been no published study focusing on potato tuber disease response transcriptome dynamics. Our project aims to unravel potato defense mechanisms in the tubers, thus providing potential windows to effectively manage late blight disease both in foliage and tubers. The project is also among the first to study how resistance genes are utilized in different plant organs.

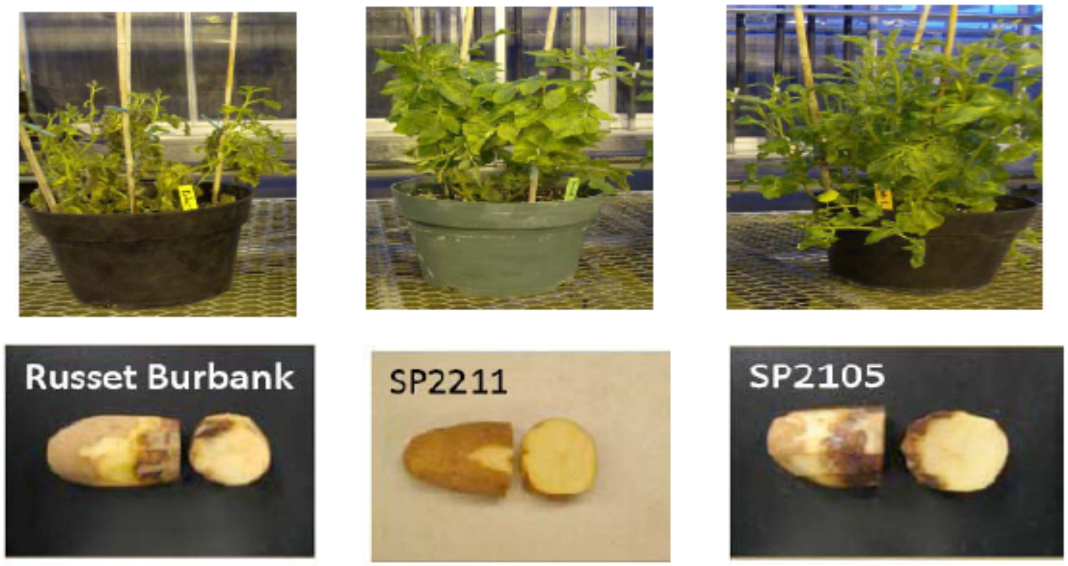

Figure 1. Potato late blight disease phenotypes. 'Russet Burbank' is a popular U.S. potato cultivar. SP2211 and SP2105 are 'Russet Burbank' lines with varying numbers of copies of the resistance gene "*RB*" (Song et al. 2003c). Note that 'Russet Burbank' is susceptible to late blight in both the foliage and the tuber; SP2105 is resistant in foliage but susceptible in tubers; SP2211 is resistant in both foliage and tubers.

Objectives:

The purpose of this project was to support the use of genetic (rather than chemical) control of potato late blight disease by unraveling potato tuber defense mechanisms effective against the late blight pathogen and to comparing tuber and foliar defense response transcriptomics.

Our objectives tested three hypotheses:

- Hypothesis 1: Different organs of potato (e.g., foliage *vs.* tubers) use the same or similar defense mechanisms against the late blight pathogen, *P. infestans*.
- Hypothesis 2: Differences in disease phenotypes in different organs within the same genotype are due to differences in timing of defense initiation.
- Hypothesis 3: High resistance gene transcript levels lead to earlier initiation of defense mechanisms in all plant organs.

Data, Findings, Outputs/Outcomes:

To facilitate understanding of this project report, we define several terms related to our research:

Gene: A gene is a segment of DNA that encodes a protein.

EST: Expressed Sequence Tags; RNA sequence data representing activated genes. The abundance of an EST in a dataset is a measurement of how active the corresponding gene is.

UniGene: Assembled from ESTs, one UniGene represents a unique gene sequence. In our analyses, UniGene may be considered as a synonym of gene.

Summary of Approaches:

We utilized Illumina Solexa sequencing technology on eight RNA samples derived from potato tubers infected with *P. infestans* (Table 1). Included were three potato genotypes and three time points. In total, 215 million sequence reads (ESTs) were generated. More than 70 million could be directly mapped to the NCBI (National Center for Biotechnology Information) potato UniGene database using Bowtie bioinformatics alignment tool (http://bowtie-bio.sourceforge.net/index.shtml). This procedure allows us to predict what potato gene each EST represents. Of mapped ESTs, 18,573 out of 18,825 (98.7%) known potato UniGenes were represented. To enable cross-sample and cross-time comparisons, we normalized our mapping data using RPKM (number of mapped Reads Per Kilobase of transcript per Million total reads) approaches (Mortazavi et al. 2008).

Table 1. RNA samples submitted for next-generation sequencing (Illumina GA II)

Tissue	Cultivar/lines	0 hour*	24 hour	48 hour
	'Russet Burbank'	Sample 1	Sample 4	Sample 6
Tuber	SP2211	Sample 2	Sample 5	Sample 7
	SP2105	Sample 3		Sample 8

*Times indicated are hours post pathogen inoculation

One of the major approaches for transcriptome analysis involves identifying differentially expressed genes among different times or different tissues. Through pair-wise comparisons among different time points, we detected a total of 10,829 differentially expressed genes using a 2-fold change cut-off. The results are summarized in Figure 2.

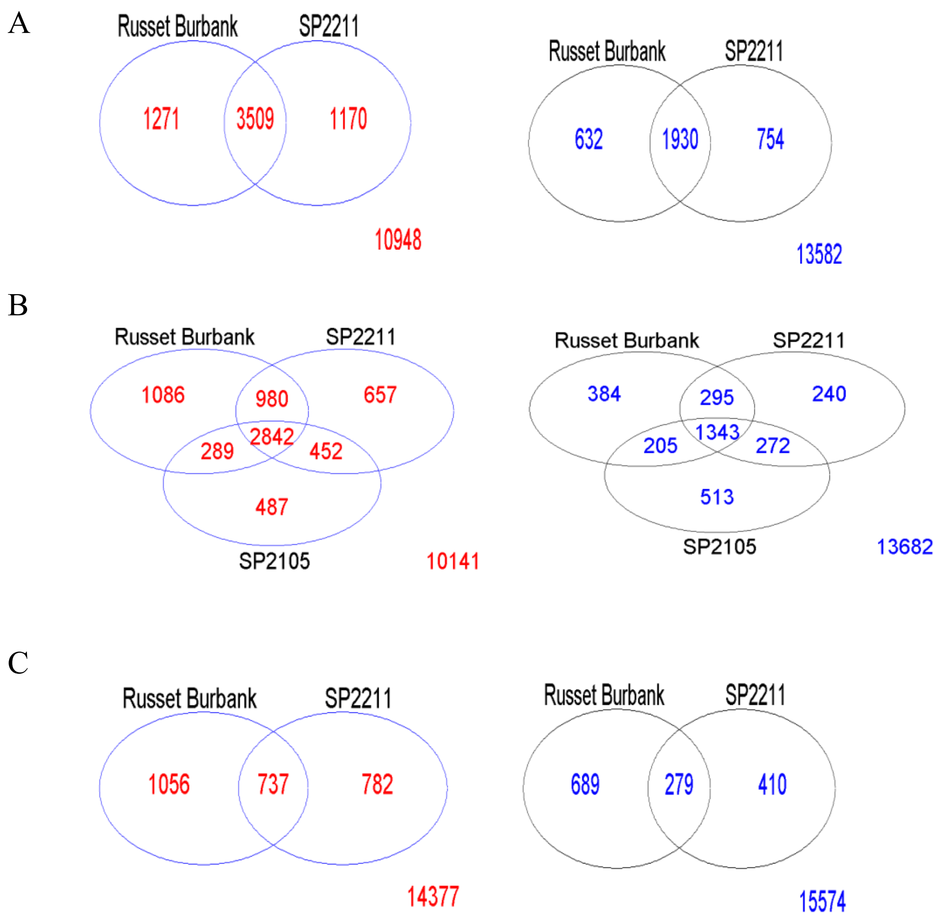

Figure 2. Differentially expressed genes in potato cultivar 'Russet Burbank' and the +*RB* lines SP2105 and 2211. Red numbers within a circle indicate the number of up-regulated genes for a given potato line/cultivar; these genes are turned "on" (or at least up) when a pathogen attacks. Blue numbers within a circle indicate the number of down-regulated genes in a given potato line/cultivar; these genes are turned "off" (or at least down) when a pathogen attacks. Intersection between two circles indicates the number of regulated genes shared by the two (or three) potato lines. (A) Genes up- (red) or down- (blue) regulated at 24 hours post pathogen inoculation vs. 0 hours; (B) Genes up- (red) or down- (blue) regulated at 48 hours post pathogen inoculation vs. 0 hours; (C) Genes up- (red) or down- (blue) regulated at 48 hours vs. 24 hours post pathogen inoculation.

Several studies have investigated potato-*P. infestans* interactions in the foliage (Birch et al. 1999; Restrepo et al. 2005; Ronning et al. 2003; Tian et al. 2006). Based on these reports, we generated a list of potato genes differentially expressed (up- or down-regulated) in the foliage when *P. infestans* attacks (Table 2).

Table 2. Summary of published studies on potato-*P. infestans* interactions in the foliage

Tissue Examined	# Differentially ExpressedGenes*	Total Genes Examined	Reference
Foliage	76	SSH**	Tian et al. 2006
Foliage	35	SSH	Birch et al. 1999
Foliage	643	7680	Restrepo et al. 2005
Foliage	567	3465	Ronning et al. 2003
Tubers	10829	18573	The Current Project

*In the current study we used a 2-fold change to define differential expression.
**SSH means the article is based on the Suppression Subtractive Hybridization process; it is not possible to estimate how many genes were examined.

Genes shown in previous studies to respond when the late blight pathogen attacks the foliage (Table 2) were matched to the NCBI potato UniGene database. Each of these genes could be matched to a UniGene with identity >90% (average is 97%). After removing redundancy, we found that defense response genes from the foliage belong to 1,003 UniGenes. These 1,003 UniGenes therefore form a dataset for comparisons with tuber data generated in our project.

Hypothesis 1: Different organs of potato (e.g., foliage *vs.* tubers) use the same or similar defense mechanisms against the late blight pathogen, *P. infestans*.

To enable transcriptome comparison between potato foliage and tubers, we examined expression dynamics of the 1,003 foliage UniGenes in our tuber samples to see if the same set of genes are differentially regulated in the tubers when *P. infestans* attacks. We summarize the results in Table 3. Our results show that 668 of the 1,003 (67%) genes that are responsive in potato foliage to pathogen attack are also responsive in the potato tubers.

Hypothesis 2: Differences in disease phenotypes in different organs within the same genotype are due to differences in timing of defense initiation.

Our previous research revealed that foliar and tuber responses to *P. infestans* differed in 'Russet Burbank' and its derived lines SP2105 and SP2211. Specifically, 'Russet Burbank' is susceptible to late blight disease in both the foliage and tuber; SP2105 is resistant to late blight in the foliage, but susceptible in the tuber; and SP2211 is resistant to late blight in both the foliage and tuber. Our previous research also revealed that these lines differ in the number of copies of the *RB* late resistance gene they carry: 'Russet Burbank' (0 *RB* copies), SP2105 (3 *RB* copies), and SP2211 (15 *RB* copies). Using these lines, in this experiment we tested if defense initiation in the tubers is faster in potato line with higher numbers of copies of the *RB* gene (Gao and Bradeen 2010) using two approaches.

Table 3. Potato genes differentially expressed (DE) during infection by *P. infestans* of the tuber and foliage

	Genes Differentially Expressed in Foliage	Genes NOT Differentially Expressed in Foliage	
Genes Differentially Expressed in Tuber	668	10,191	10,859 *P. infestans*-responsive Tuber UniGenes
Genes NOT Differentially Expressed in Tuber	335	7,379	7,714
	1,003 *P. infestans*-responsive Foliar UniGenes	17,570	Fisher's exact test for count data p-value <0.001

First, we employed quantitative RT-PCR to measure transcript levels of defense-related genes discovered in previous *foliar* based studies. Here, transcript levels were measured in tubers at several time points post-inoculation with *P. infestans*. Our raw data do not support our initial hypothesis; we observed no systematic bias in resistant tuber for earlier activation of the target genes. An alternative possibility, that the genes targeted in this survey (genes known to respond with *P. infestans* attacks *foliage*) may not be involved in defense of the tuber, warrants further investigation.

Second, we employed next-generation sequencing to examine genes differentially activated in the tubers of 'Russet Burbank', SP2105, and SP2211. We found 1,348 UniGenes that have a 2-fold higher expression in SP2211 than in'Russet Burbank'. Interestingly, of these 1,348 Unigenes, only 92 are shared with those foliage responsive genes described in Table 2. This indicates that foliage and tuber might use quite different mechanisms to defense against pathogen attack and may offer an explanation for our quantitative RT-PCR results. Further studies are on-going.

Hypothesis 3: High resistance gene transcript levels lead to earlier initiation of defense mechanisms in all plant organs.

Previously, we demonstrated that the number of copies of *RB* in a potato line correlates with resistance gene transcript levels: 'Russet Burbank' lack *RB* and show no transcript; SP2105 has three *RB* gene copies and has moderate *RB* transcript levels; SP2211 has 15 *RB* gene copies and has high transcript levels (Bradeen et al. 2009b). This correlation holds true in both potato foliage and tuber.

We examined our next-generation sequencing dataset to determine whether high transcript levels (line SP2211) result in more rapid initiation of defense-related genes. As Figure 3 shows, we found at 24 hour post inoculation that there are >1,000 genes whose expression level in SP2211 (high *RB* copy line) is significantly higher than in 'Russet Burbank' (no *RB*). At 48 hours, the gene expression level among the three potato lines tend to become more similar. However, in lines containing *RB* (SP2211 and SP2105) gene induction tends to be more dramatic than in 'Russet Burbank' (Figure 3).

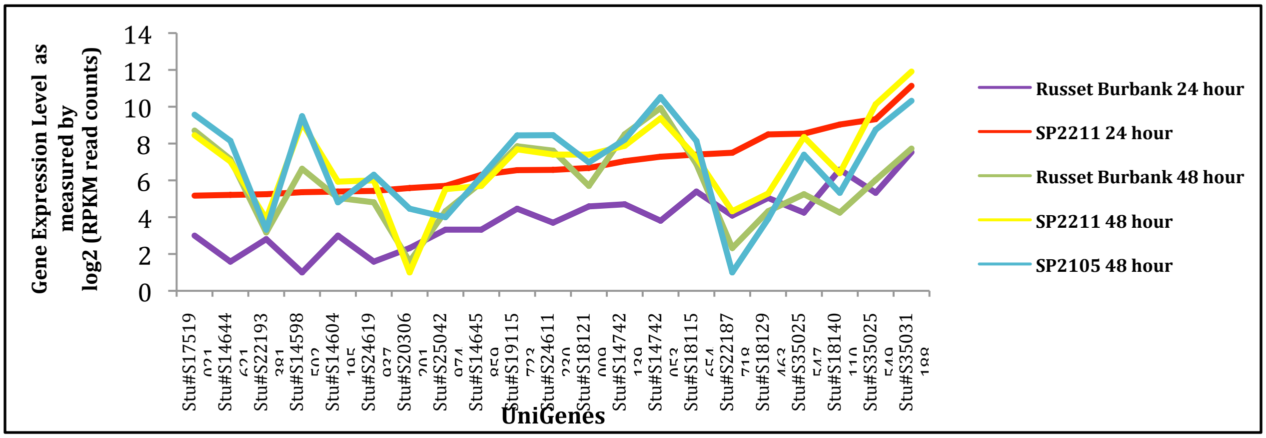

Figure 3. Comparison of the expression levels of 20 selected UniGenes based on Illumina Solexa sequencing results. Note that transcription of all genes at 24 hours post pathogen inoculation is higher in the high *RB* copy number line SP2211 (red line) than in 'Russet Burbank' (purple line), which lacks *RB*.

Discussion:

Our project greatly exceeded expectations. Modifying our experimental approaches to capitalize upon emerging technology enabled us to generate >1,300-fold more data than originally predicted. Specifically, switching from 454 pyrosequencing to Solexa Illumina RNA sequencing technology yielded 215 million sequence reads compared to an anticipated 160,000 454 pyrosequencing reads. Our study ranks among the first potato-*P. infestans* transcriptome studies and among the first plant-pathogen interaction studies to employ Solexa Illumina technology. Our results should yield a peer-reviewed article in the near future and will serve as a roadmap for the scientific community for the application of next generation technologies to study plant-microbe interactions.

Our project revealed a large set of potato genes involved in *RB*-mediated tuber defense against the late blight pathogen. Our data suggest that the induction of pathogen-responsive genes is generally more robust in +*RB* lines SP2211 and SP2105 than in 'Russet Burbank', which lacks *RB* (Figure 3). Specific defense-related genes were up-regulated in our samples >10-fold in SP2211 than in 'Russet Burbank'. These genes are candidates for further study. Our molecular analyses in combination with phenotypic assays indicate that the foliar late blight resistance gene *RB* can function in the tuber to impart tuber blight resistance, under specific conditions. Our novel approaches and results deepen our understanding of how plants modulate defense responses in different organs (i.e. foliage vs. tubers) and have broad implications for the basic and applied plant sciences.

In addition to plant genes identified in our sequencing effort, our project generated a large data set of *P. infestans* genes up- or down-regulated when this pathogen interacts with the potato tuber. These genes are candidates for future study and may result in the development of novel disease management strategies. These same genes will be useful as molecular markers to estimate progressive disease development in future potato-*P. infestans* interaction research.

Conclusions:

(1) The foliar late blight resistance gene *RB,* the most-promising genetic resource for reducing fungicide usage for potato production, can also be utilized to reduce incidence of tuber late blight disease. This finding has worldwide significance as *RB* is likely to be deployed on a large-scale. Most immediately, *RB* will be deployed in India, the third largest potato producing nation, beginning in 2012.

(2) Our study reveals basic strategies used by plants to defend against plant pathogens and suggests that defense mechanisms can be modulated in different plant tissues. This research has yielded large plant and pathogen datasets for downstream analyses.

(3) Our research is among the first to utilize next generation sequencing technologies to study plant-microbe interactions and, to our knowledge, is the very first to study the potato tuber-*P. infestans* interaction transcriptome. Our research provides a roadmap for other plant scientists. Importantly, the methodologies we tested and employed in this study can be capitalized upon to further refine our understanding of potato-*P. infestans* interactions, yielding strategies for resistance gene deployment in a no- or reduced-fungicide production setting.

Publications/Presentations:

Bradeen, J.M. 2010. The genomics to potato tuber disease resistance. *Minnesota Area II Potato Research & Promotion Council 9th Annual Education Event.* Big Lake, MN

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Acknowledgements:

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Advanced potato breeding clones: storage and processing evaluation

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The concentration of reducing sugars (glucose and fructose) that accumulate in a potato cultivar during storage determines its marketing potential for chips, fries, or fresh markets (Sowokinos and Glynn, 2000). The undesirable effect that reducing sugars have on the color of chip and fry products is well known. Potatoes that resist sweetening when cold-stressed generally have a greater ability to resist sweetening when subjected to field stresses such as temperature, moisture, fertility and early dying (Sowokinos et al., 2000).

Potato breeding is an expensive and labor-intensive process. Tens of thousands of potato clones are grown annually by breeders in an effort to find a “single clone” that may meet all of the horticultural requirements necessary to make a successful cultivar (i.e., high yield and solids, disease resistance, etc.). Once a new clone has undergone several years of field trials, it often fails because of storage- and marketing-related problems. This report describes the storage characteristics of advanced potato clones provided by state and federal breeders and is funded, in part, by the Northern Plains Potato Growers Association.

Materials and Methods:
Eighty-seven advanced clones from Idaho, Maine, Michigan, Minnesota, New York, North Dakota, Oregon, Texas, Wisconsin and Alberta, Canada were grown under irrigation south of Larimore, ND. All potatoes were harvested mid-September, suberized two weeks at room temperature and then placed into 45 F, 42 F and 38 F storage. Several tubers of each clone were evaluated for sugar content, Agtron color values and chip appearance at three intervals (i.e., harvest, three and seven month’s storage). Potatoes were also reconditioned at 55 F for two months following storage at 42 F for five months. All storage and processing evaluations were conducted at the USDA/ARS Potato Research Worksite, East Grand Forks, Mn.

Results
The individual clones demonstrated a wide range of glucose (Glc) accumulation when subjected to cold stress. At 42 F storage, the concentration of glucose ranged from 0.058 mg/g in W 4013-1 (Table 1) to 6.481 mg/g in Red Pontiac (Table 3). These glucose values represents greater than a 100-fold difference in their ability to sweeten in storage.

Based on sugar content and chip appearance the clones were categorized into three classes.

- Class A: Clones that can be chipped directly from 42 F storage (Table 1).
- Class B: Clones that chip from 45 F but not from 42 F storage (Table 2).
- Class C: Clones that chip from neither 45 F nor 42 F storage (Table 3).

Table 1 shows nineteen 'Class A' clones that chipped successfully from 42 F without reconditioning. Reconditioning, however, did improve most of the Agtron scores (data not shown). Seven of the top performers were from Wisconsin, (W 4013-1, W 4016-4, W 2438-3Y, W 2310-3, W2717-5, W 2978-3 and Snowden). Five from North Dakota (ND 7519-1, ND 7192-1, Dakota Crisp, ND 8-14 and Dakota Pearl) four from Michigan (MSK 061-4, MSH 228-6, MSN246-B and MSJ 126-9Y), two from New York (NY 138 and NY 139) and one from USDA (Atlantic). This is the first year Atlantic was in the 'Class A ' clones.

Table 2 shows the 'Class B' clones that chip from 45 F but not from 42 F. There were seventeen clones represented. They were from North Dakota, Wisconsin, Oregon, Texas, Colorado, Idaho, USDA, Maine, Michigan and Minnesota. Although these clones do not have the low glucose-forming potential (GFP) of clones listed in Table 1 (Class A), their level of performance is still considerably better than the original chipping standard, Norchip. Consequently, the clones listed in Table 2, can play an important role in meeting grower and industry needs.

Table 3 lists 'Class C' clones that chip neither from 42 F or 45 F storage. Cultivars such as Russet Burbank, Russet Norkotah and Red Pontiac fall into this class. Their higher inherent 'basal level' of glucose serves to direct their end use more towards the fry and fresh markets. Dark Red Norland and Red Pontiac with high glucose values of 5.26 and 6.48 mg/g, respectively, are fresh market clones..

Summary

The Class A' clones listed in Table 1 provide the quality advantages from storage as listed below**.**

- Decreased microbial spoilage.
- Retention of dry matter
- Reduced shrinkage
- Decreased need for sprout inhibition
- Decreased physiological aging
- Increased marketing window.
  Negligible acrylamide formation

For a new potato cultivar to be successful, it must also demonstrate a variety of other horticultural and marketing qualities that are required by the producer and consumer. Contact the respective potato breeder (listed below) if you are interested in any additional quality traits demonstrated by the potato clones listed.

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<u>Table 1. 2008-2009 Class A</u>: Potato clones that chip following seven months storage at 42 F. Clones are aligned in order of increasing glucose (Glc) values from 42 F.

Clone	Source	45 F			42 F		
		CC[1]	AGTRON[2]	Glc[3] (mg/g)	CC[1]	AGTRON[2]	Glc[3] (mg/g)
W 4013-1	WI	2	60	0.045	1	60	0.058
MSK 061-4	MI		*****	******	1	63	0.084
W 4016-4	WI	2	59	0.094	1	57	0.110
ND 7519-1	ND	2	60	0.042	1	60	0.122
ND 7192-1	ND	2	59	0.035	1	62	0.129
SNOWDEN	WI	2	60	0.077	1	60	0.155
W 2438-3Y	WI	2	55	0.357	1	60	0.160
W 2310-3	WI	2	57	0.184	1	59	0.169
ATLANTIC	USDA	2	58	0.061	1	58	0.176
MSH 228-6	MI	2	59	0.062	1	65	0.193
NY 138	NY	2	58	0.646	1	58	0.235
MSN 246-B	MI	2	60	0.119	1	60	0.280
MSJ 126-9Y	MI	2	61	0.232	2	57	0.312
DAKOTA CRISP	ND	2	61	0.232	2	55	0.330
NY 139	NY	2	61	0.061	2	61	0.353

W 2717-5	WI	2	59	0.199	2	58	0.361
W 2978-3	WI	2	57	0.287	2	55	0.361
ND 8-14	ND	2	61	0.064	2	58	0.405
DAK PEARL	ND	3	54	0.487	2	63	0.461

[1]CC = Represents chip color relating to the Potato Chip/Snack Food Association five-code color chart: 1 and 2 are acceptable, 3 is marginal, 4 and 5 are unacceptable.
[2]Agtron values of 60 or greater yield acceptable colored chips.
[3]Desirable values for Glc (glucose) are 0.50 mg/g or less

<u>Table 2. 2008-2009 Class B</u>: Potato clones that chip following seven months storage at 45 F, but not 42 F. Clones are aligned in order of increasing glucose (Glc) values from 45 F storage.

Clone	Source	45 F CC[1]	45 F AGTRON[2]	45 F Glc[3] (mg/g)	42 F CC[1]	42 F AGTRON[2]	42 F Glc[3] (mg/g)
MN 99380-1	MN	2	60	0.172	2	56	0.626
B 2460-3	USDA	2	61	0.094	3	47	0.672
COMN 02 588	CO/OR/MN	2	57	0.245	2	58	0.699
MSN 191-2Y	MI	2	58	0.194	2	49	0.718
COTX 03270-1W	CO/OR/TX	2	60	0.299	3	50	0.787
IVORY CRISP	ND/OR/ID/USDA	2	62	0.093	3	54	0.790
MSJ 147-1	MI	2	63	0.231	3	53	0.845
NORVALLEY	ND	3	58	0.231	2	57	0.882
ND 5255-59	ND	2	58	0.275	3	51	0.942
WIMN 04855-02	WI/MN	2	56	0.536	3	54	0.964
MSJ 316-A	MI	2	60	0.389	3	49	1.361
MN 02 678	MN	2	60	0.212	3	49	1.407
WIMN 04844-07	WI/MN	2	58	0.860	3	49	1.788
COTX 02377-1W	CO/TX	2	59	0.480	3	52	2.099
AOTX 95309-1W	ID/OR/TX	2	61	0.686	3	54	2.736
AF 2497-2	MA	2	58	1.586	3	48	3.034
AOTX 95309-3W	ID/OR/TX	2	61	0.265	2	57	1.797

[1]CC = Represents chip color relating to the Potato Chip/Snack Food Association five-code color chart: 1 and 2 are acceptable, 3 is marginal, 4 and 5 are unacceptable.
[2]Agtron values of 60 or greater yield acceptable colored chips.
[3]Acceptable values for Glc (glucose) are 0.50 mg/g or less

Table 3. 2008-2009 Class C: Potato clones that do not chip following seven months storage from either 45 F or 42 F storage. Clones are aligned in order of increasing glucose (Glc) values from 42 F storage.

Clone	Source	45 F CC[1]	45 F AGTRON[2]	45 F Glc[3] (mg/g)	42 F CC[1]	42 F AGTRON[2]	42 F Glc[3] (mg/g)
MSK 409-1	MI	***	*****	*****	2	58	0.620
SPORT 860	ND	3	51	0.864	2	57	0.655
CO 95051-7W	CO	3	54	0.586	3	50	0.712
B 2500-3	USDA	3	53	0.225	3	54	1.020
NDA 5507-3Y (YUKON GEM)	ND/ID	2	57	0.640	3	54	1.021
B 2467-21	USDA	***	*****	****	4	44	1.301
MN 15620	MN	3	53	0.736	3	51	1.398
B 2463-16	USDA	3	52	0.446	3	54	1.403
WIMN 04844-12	WI/MN	***	*****	****	3	48	1.664
WIMN 04844-06	WI/MN	3	54	1.176	3	51	1.691
CO 97087-2RU	CO	3	50	1.373	3	50	1.714
AOTX 95295-1W	ID/OR/TX	2	57	0.474	3	53	1.755
B 2460-23	USDA	3	54	2.287	3	51	1.838
W 5716-1 RUSS	WI	3	48	2.273	3	48	1.852
W 2683-2 RUSS	WI	2	55	0.944	4	43	1.875
AC 96052-1RU	ID/CO	3	52	0.448	3	45	2.050
CO 97065-7W	CO/OR	3	54	1.062	3	45	2.113
PREMIER RUSSET	ID	***	*****	*****	4	42	2.118
B 2459-13	USDA	***	*****	1.645	3	46	2.150
MN 00467-4	MN	3	48	1.706	3	49	2.154
CO 96141-4W	CO/OR	2	56	0.815	3	53	2.457
UMATILLA	ID/OR	***	*****	*****	3	45	2.512
W 2324-1	WI	2	57	0.561	3	47	2.558
ND 8307C-7	ND	3	54	1.953	3	48	2.575
CO 97043-14W	CO/OR	3	49	0.862	4	44	2.576
A 91814-5	ID	3	49	1.105	3	49	2.576
COMN 03051-1NY	CO/OR/MN	3	50	2.029	3	47	2.732
AF 2291-10	MA	3	54	1.358	3	47	2.755
RUSS NORKOTAH	ND	3	50	1.801	4	42	2.867
AF 2199-6	MA	3	52	0.987	2	55	2.947
AOA 95154-1	ID/OR/ID	2	55	1.236	4	44	3.002
AF 2850-9	MA	3	52	1.402	4	40	3.025
A 95109-1	ID	***	*****	*****	4	43	3.098
ND 5775-3	ND	3	46	1.636	3	49	3.112
WIMN 04844-03	WI/MN	3	47	2.085	4	39	3.126
RUSS BURBANK	CO	3	54	1.094	3	45	3.199
YUKON GOLD		3	48	2.677	4	40	3.240
B 2461-15	USDA	4	41	2.695	4	41	3.474
SHEPODY	CAN/NB	***	*****	*****	4	44	3.589
B 2464-14	USDA	4	43	2.865	4	41	3.781
TX 03196	TX	3	46	2.952	4	42	4.134

CO 95172-3RU	CO/OR	3	47	1.242	4	43	4.185
AF 3000-1	MA	3	48	1.980	4	43	4.380
A 95409-1	ID	3	50	1.186	4	41	4.560
HIGHLAND RUSSET	ID	4	42	3.305	4	37	5.124
DR NORLAND	ND	3	45	2.663	4	36	5.266
A 96510-4Y	ID	3	48	2.901	2	57	6.064
RED PONTIAC	USDA/MI/FL	3	45	5.184	4	35	6.481

[1]CC = Represents chip color relating to the Potato Chip/Snack Food Association five-code color chart: 1 and 2 are acceptable, 3 is marginal, 4 and 5 are unacceptable.
[2]Agtron values of 60 or greater yield acceptable colored chips.
[3]Acceptable values for Glc (glucose) are 0.50 mg/g or less
***** denotes no data**

Marketing Potential
of Advanced Breeding Clones

Martin Glynn
USDA/ARS
Potato Research Worksite
East Grand Forks, Mn

Dr. Joe Sowokinos, Emeritus Professor
Department of Horticultural Science
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Using a scale based on a the harvest sucrose-rating (SR) and its glucose-forming- potential (GFP) in storage (Sowokinos, 1987), eighty-four of the most promising potato clones were evaluated for chipping, fry and/or fresh market utilization potential .

The purpose of this information is intended to (1) assist the potato breeder in correctly marketing their new breeding selections and (2) to aid in the identification of promising genotypes for future crosses. Marketing suggestions are based on sugar content and processing characteristics as described previously by Sowokinos and Preston (1988).

Storage and processing evaluations were conducted at the U.S. Department of Agriculture (USDA) Potato Research Worksite in East Grand Forks, MN. For acceptable chip color, two genetic requirements must be met. First, the potato line should be capable of reducing its SR value less than or equal to 1.0 mg sucrose/g tuber FW by harvest or less. Secondly, the potato line should demonstrate a low GFP in storage (i.e., 0.35 mg glucose/g tuber FW or less for chips and 1.0 mg glucose/g tuber FW for fries). Higher levels of glucose lead to the production of unacceptable dark brown to black pigmented chips or fries after the raw product is cooked in oil at a high temperature. This study is funded, in part, by the Northern Plains Potato Growers Association.

Results

Breeding programs nationwide provide the advanced breeding clones used in this study. Along with control varieties, the sugar content and processing quality of all clones directly from 9^{o} C (48.2^{o} F) storage were evaluated. In addition to harvest analysis, clones were evaluated following 3 and 7 months in storage. Potatoes with a glucose content of 0.35 mg/g or less should yield acceptable colored potato chips. This amount of glucose is equivalent to 0.035 % on a FW weight basis and represents chips giving an Agtron value of 60 or higher. Clones with glucose levels of 1.0 mg/g to 1.3 mg/g are still acceptable for french fry quality, although lower levels are generally desired. Potatoes with higher levels of glucose are destined for fresh market utilization.

A summary of results for the 2008-2009 storage season is presented in Table 1.

References

Sowokinos, J.R., 1987. Variations in glucose forming potential (GFP) between potato clones. Amer. Potato J. 64:459

Sowokinos, J. R., and D. A. Preston, 1988, Maintenance of potato processing quality by chemical maturity monitoring (CMM) Minn. Ag Expt. Station Bulletin, 586-1988(Item No. AD-SB-3441), pp 1-11

Table 1. 2008 -2009 Marketing-potential of advanced potato breeding clones stored at 9^{o} C(48.2^{o} F) for 3 and 7 months. Clones are aligned in order of decreasing Agtron values following 7 months in storage.

VARIETY	3 months Desired Value Glucose35 mg (mg/g)	7 months Glucose For Chips or less (mg/g)	3 months Desired Chip 60 or AGT	7 Months Agtron Value Above AGT	Market On Chips	Potential Sugar Fries	Based Content Fresh
MSN 246-B	0.035	0.029	59	67	X	X	X
MSK 061-4	0.143	0.386	62	67	X	X	X
COMN 03051-1NY	0.953	0.936	60	67	X	X	X
ND 8-14	0.118	0.052	67	66	X	X	X
NY 139	0.029	0.026	59	65	X	X	X
MSK 409-1	0.119	0.056	71	65	X	X	X
MSN 191-2Y	0.075	0.176	68	65	X	X	X
W 2324-1	0.197	0.231	64	65	X	X	X
W 2438-3Y	0.086	0.029	59	64	X	X	X
W 2310-3	0.044	0.044	68	64	X	X	X
W 4013-1	0.023	0.057	67	64	X	X	X
Comm 02 588	0.103	0.105	68	64	X	X	X
AF 2291-10	0.291	0.109	54	64	X	X	X
B 2500-3	0.100	0.169	66	64	X	X	X
W 4016-4	0.061	0.023	59	63	X	X	X
W 2978-3	0.170	0.028	62	63	X	X	X
MSJ 126-9Y	0.073	0.030	65	63	X	X	X
MSH 228-6	0.035	0.038	65	63	X	X	X
SNOWDEN	0.038	0.072	62	63	X	X	X
WIMN 04844-12	0.502	0.091	56	63	X	X	X
COTX 02377-1W	0.242	0.099	55	63	X	X	X
B 2460-3	0.046	0.100	69	63	X	X	X
MSJ 316-A	0.373	0.125	65	63	X	X	X
ND 5775-3	0.300	0.294	61	63	X	X	X
B 2463-16	0.182	0.303	68	63	X	X	X
SPORT 860	0.064	0.403	67	63	X	X	X
ND 7519-1	0.027	0.418	68	63	X	X	X
W 3186-2	0.610	0.019	56	62	X	X	X
MSJ 147-1	0.261	0.029	64	62	X	X	X
ATLANTIC	0.169	0.059	62	62	X	X	X
ND 7192-1	0.039	0.061	64	62	X	X	X

IVORY CRISP	0.191	0.083	67	62	X	X	X
ND 5255-59	0.456	0.121	59	62	X	X	X
AOTX 95309-1W	0.533	0.197	58	62	X	X	X
CO 96141-4W	0.199	0.215	66	62	X	X	X
NORVALLEY	0.099	0.285	65	62	X	X	X
DAK PEARL	0.042	0.297	66	62	X	X	X
AOA 95154-1	1.017	0.400	56	62	X	X	X
WIMN 04844-06	0.535	1.319	60	62	X	X	X
NY 138	0.087	0.044	62	61	X	X	X
MN 99380-1	0.082	0.132	62	61	X	X	X
DAKOTA CRISP	0.434	0.159	58	61	X	X	X
B 2459-13	0.570	0.187	60	61	X	X	X
W 2683-2 RUSS	0.544	0.251	59	61	X	X	X
MN 02 678	0.253	0.285	63	61	X	X	X
NDA 5507-3Y (YUKON GEM)	0.434	0.305	61	61	X	X	X
W 2717-5	0.076	0.039	55	60	X	X	X
W 2133-1	0.356	0.048	59	60	X	X	X
COTX 03270-1W	0.125	0.065	59	60	X	X	X
MN 15620	0.278	0.193	62	60	X	X	X
AOTX 95295-1W	0.284	0.249	49	60	X	X	X
AF 2199-6	0.298	0.288	64	60	X	X	X
AOTX 95309-3W	0.204	0.357	63	60	X	X	X
WIMN 04844-07	0.179	0.372	64	60	X	X	X
CO 95051-7W	0.076	0.395	56	60	X	X	X
AC 96052-1RU	0.237	0.120	60	59	X	X	X
WIMN 04855-02	0.226	0.307	68	59		X	X
W 5716-1 RUSS	1.636	0.796	48	59		X	X
B 2467-21	0.126	0.802	66	59		X	X
UMATILLA	1.281	0.901	55	59		X	X
A 91814-5	1.103	0.606	58	58		X	X
CO 97043-14W	0.044	0.740	66	58		X	X
AF 2850-9	0.780	0.920	64	58		X	X
B 2461-15	0.758	0.947	57	58		X	X
MN 00467-4	0.307	1.315	67	58		X	X
PREMIER RUSSET	0.288	0.767	62	57		X	X
AF 2497-2	0.639	0.856	58	57		X	X
A 95409-1	1.278	1.298	54	57		X	X
CO 97065-7W	0.146	1.632	61	57		X	X
ND 8307C-7	0.397	0.940	65	56		X	X
WIMN 04844-03	1.052	0.951	59	56		X	X
YUKON GOLD	1.705	2.388	45	55		X	X
CO 97087-2RU	0.637	0.749	56	54		X	X
SHEPODY	0.726	1.778	59	54		X	X
RUSS BURBANK	1.568	0.910	51	53		X	X
A 95109-1	1.288	1.388	53	52		X	X
DR NORLAND	2.415	1.590	45	52		X	X
CO 95172-3RU	0.960	1.158	61	51		X	X
RUSS NORKOTAH	1.008	1.281	49	51		X	X

B 2460-23	0.125	1.792	63	50		X	X
AF 3000-1	0.864	2.846	59	50			X
A 96510-4Y	1.737	2.388	50	49			X
TX 03196	0.949	1.269	57	48			X
HIGHLAND RUSSET	1.503	2.750	47	48			X
B 2464-14	0.358	2.402	63	47			X
RED PONTIAC	2.434	2.599	49	44			X

[1] Glucose content of <35 mg/g for chips
[2] Agtron Value >60 for chips

Proposal Title: Effective Pink Rot and Late Blight Disease Control Using Phosphorous Acid Fungicides

Submitted to MN Area II Potato Growers & Northern Plains Potato Growers Association

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Executive Summary:
Pink rot has been a major problem in stored potatoes in the Northern Great Plains of the USA. Many growers have previously relied on mefenoxam-based fungicides (Ridomil® and Ultraflourish®) for effective management of pink rot disease. Mefenoxam resistance in the pink rot pathogen is present in Minnesota and surveys conducted in 2007 and 2008 indicate that nearly 40% of the *Phytophthora erythroseptica* population is resistant to mefenoxam. As a result, many growers have begun to use phosphorous acid based fungicides to control of pink rot. Previous studies funded by MN Area II and the NPPGA have demonstrated that two applications of phosphorous acid to cultivars such as Russet Burbank provides adequate and long residual control of pink rot in storage. However, the label rate of 10 pt/a can frequently burn potato foliage causing defoliation. Furthermore, following the 2009 late blight epidemic in North Dakota, questions regarding the role phosphorous acid fungicides may have in reducing late blight tuber rot are also of interest. The purpose of the studies proposed here are to develop effective management strategies for pink rot and late blight using phosphorous acid fungicides in Minnesota and North Dakota. The data obtained suggest that 5 pt/a phosphorous acid applied weekly will provide pink rot control equivalent to the label rate of 10 pt/a applied on a biweekly basis. The weekly rate of 5 pt/a should help avoid the foliar burning growers experience using the higher 10 pt/a application rate.

Rationale:

Pink rot is caused primarily by the soil-borne pathogen *Phytophthora erythroseptica* and late blight is caused by a related pathogen, *P. infestans*. These two diseases cause problems with tuber quality and integrity of the stored potato crop. Pink rot is a chronic and endemic disease, present every year in nearly every potato production region. Storage surveys conducted in 2008 by NDSU in Minnesota indicated that 87% of all wet breakdown of potato tubers was due to pink rot. Pink rot was the only storage disease found in 61% of the storages. Late blight tuber rot is an acute disease problem that can be overwhelmingly devastating under adverse harvest conditions. Late blight tuber rot was the primary cause of catastrophic losses in storage following the 1999 growing season.

Background and Justification:

Differences in etiology of pink rot and late blight tuber rot are significant and can affect disease management strategies. Infections of pink rot typically occur in the field, prior to harvest from soil borne inoculum. Zoospores of *P. erythroseptica* infect stolons, tuber eyes or lenticels (Lambert and Salas, 2001). Infection by *P. infestans* is very similar except that sporangia give rise to the zoospores and this inoculum orginiates from foliar infections rather than soil inoculum. Late blight tuber rot generally occurs late in the season and many of these infections occur during harvest.

Phosphorous acid-based fungicides have been shown to provide suppression of pink rot and late blight, but have no effect on leak (Johnson et al, 2004). Phosphorous acid-based fungicides, which belong to the group of fungicides referred to as 'phosphonates', are unique in that they have two modes of action. These types of fungicide not only kill the pathogen on contact, but they also stimulate the plants own defense mechanisms, thereby providing additional control. Previous research funded by MN Area II and NPPGA demonstrated that phosphorous acid fungicides provide long residual pink rot control, superior to mefenoxam, in the presence of post-harvest wounds in storage. Unfortunately, multiple applications of phosphorous acid are required to achieve this level of control is very expensive, approximately 2-3X the cost of mefenoxam-based fungicides and they are prone to cause defoliation if applied under adverse environmental conditions. Post-harvest infections of *P. erythroseptica* can also be reduced with the application of phosphorous acid onto tubers being placed into storage (Miller et al., 2006) and data generated by our research group confirmed these studies.

The overall objective of the work proposed here is to determine if reduced rates of phosphorous acid can be used to control of pink rot and late blight tuber rot in storage. We will also evaluate the timing of applications and the impact on effectiveness. Current recommendations are for phosphorous acid fungicides to be applied to foliage during early tuberization and bulking on a 14 day interval. However, many potato growers would like to be able to apply these fungicides much later in the season, during late tuber bulking, in those years when late blight tuber rot is a threat. Therefore, we will compare weekly reduced rates of phosphorous acid to full rates on a 14 day interval and early applications to late season applications for disease control efficacy.

Research Objectives:

1. Determine the effectiveness of weekly half-rate (5 pt/a) phosphorous acid applications on pink rot and late blight tuber rot disease control.
2. Determine effectiveness of late season phosphorous acid applications on pink rot and late blight disease control.

Procedures:

Field plots and phosphorous application. Fungicide application trials will be conducted under center pivot irrigation over two consecutive growing seasons. Fungicide treatments will be established each year to provide different levels of pink rot control in treated versus non-treated tubers (Table 1). At planting, mefenoxam sensitive isolates of the pink rot pathogen will be applied in the seed piece zone. Fungicide treatments will be applied at the recommended label rate. Two and three phosphorous acid (Phostrol) application will all be made at a rate of 10 pt/a (Table 1). The foliar phosphorous acid treatments will be applied when tubers are 10mm in diameter (early bulking) and 14 days later (2 applications) and the same treatment regime with a third application 14 days after the second application (total of three foliar applications). These treatments will be compared to four and six weekly applications (7 day intervals) of phosphorous acid at a rate of 5 pt/a (Table 1).

The above mentioned applications will be initiated at early bulking, the treatments will be repeated with applications beginning in early August during late tuber bulking (Table 1).

Disease evaluations at harvest. Pink rot tubers will be obtained at harvest from all non-treated and all fungicide treated plots. These pink rot infected tubers will be taken to the laboratory and isolations for *P. erythroseptica* will be performed. All isolates obtained will be maintained on a treatment X replication basis and tested for their sensitivity to mefenoxam based on the methods previously described. The purpose of this portion of the proposed research is to determine the effect of non-mefenoxam fungicides on the mefenoxam sensitive and insensitive populations of *P. erythroseptica*.

Post-harvest pink rot inoculations. Plants will be killed by mechanical flailing 2 to 3 weeks prior to maturity to insure the availability of a sufficient quantity of tubers of the desired size and adequate skin set. After harvest, tubers were stored for 2 weeks at 15ºC and 90% relative humidity to facilitate wound healing. For challenge inoculations, tubers will be placed in plastic moist chamber boxes and inoculated with 10 µl of the zoospore suspension of *P. erythroseptica* or *P. infestans*. Inoculated tubers will be covered with four layers of paper towels moistened to saturation with deionized water. The chamber boxes will be sealed to establish high humidity to promote infection and incubated in the dark at ambient temperature at 20 to 22ºC for 10 days.

Disease assessment. Inoculated tubers will removed from the moist chambers and infection will be determined by cutting each tuber in half through the axis from the sites of inoculation on the apical bud end to the basal stem end. Split tubers will be covered with moist paper towels and incubated at ambient temperatures of 20 to 24ºC for approximately 30 min to enhance the development of the discoloration diagnostic of pink rot or late blight tuber rot. Infected tubers will be counted and disease incidence calculated as (number of diseased tubers/number of inoculated tubers) × 100. To determine pink rot severity, the maximum width of rot (W) and the depth (D) of rot from the inoculation point will be measured and penetration (P) of rot was calculated as $P = (W/2 + [D - 5])/2$. Disease incidence will be transformed to percent disease control using the formula ([disease incidence of nontreated control – disease incidence of treatment]/disease incidence of nontreated control) × 100.

Results:

Infection of *P. erythroseptica* and the development of pink rot was low at the time of harvest (Table 1). However, significant differences among treatments were evident after challenge inoculation. Four applications of phosphorous acid at 5 pt/a applied on a weekly schedule was significantly better than 10 pt/a applied every other week when tubers were inoculated with a mefenoxam-resistant isolate but not when treated tubers were inoculated with a mefenoxam-sensitive isolate (Table 2, Figure 1A, B). However, there was no difference in the control of pink rot caused by either mefenoxam-resistant or –sensitive isolates of *P. erythroseptica* if phosphorous acid was applied 6 times on a weekly basis at 5 pt/a versus three biweekly applications of 10 pts/a. There were no differences in the residual control of phosphorous acid at 122 days after harvest regardless of application rate (Table 2). Additionally, applications of phosphorous acid applied weekly at 5 pt/a were as effective as biweekly applications of the fungicide applied at 10 pt/a in controlling late blight tuber rot (Table 3).

We interpret these data to mean that growers can avoid the burning of potato foliage when phosphorous acid is applied on a 14 day schedule at 10 pt/a by simply reducing the rate to 5 pt/a and applying this chemical on a 7-day schedule.

Literature Cited:

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Table 1. Percentage emergence, total yield and percentage tuber rot evaluated at harvest and 28 days after harvest (DAH). Mean separation among treatments based on Fisher's protected least significant difference (LSD) test ($P = 0.05$).

Treatment	Rate	Application Timing	Emergence (%)				Total Yield (cwt/a)	Rot (cwt/a)	Tuber Rot at Harvest (%)	Tuber Rot 28 Days Post-Harvest (%)
			5/25	6/1	6/9	6/18				
Non-treated			52.1	70.0	73.3	84.0	609.8	0.0	0.0	0.5
Ridomil Gold SL	6.1 fl oz/ a	In-Furrow	54.2	70.4	72.5	85.5	582.3	1.3	0.2	0.6
Ridomil Gold MZ	2.0 lb / a	@ dime sized tubers								
Phostrol	10.0 pt / a	@ dime sized tubers	53.3	72.1	73.8	90.0	564.5	0.3	0.1	0.6
Phostrol	10.0 pt / a	@ dime + 14 days								
Phostrol	10.0 pt / a	@ dime sized tubers	58.3	72.1	73.3	83.0	554.4	1.1	0.2	0.4
Phostrol	10.0 pt / a	@ dime + 14 days								
Phostrol	10.0 pt / a	@ dime + 28 days								
Phostrol	5.0 pt / a	@ dime sized tubers	63.3	73.8	76.3	88.5	557.3	1.0	0.2	0.4
Phostrol	5.0 pt / a	@ dime + 7 days								
Phostrol	5.0 pt / a	@ dime + 14 days								
Phostrol	5.0 pt / a	@ dime + 21 days								
Phostrol	5.0 pt / a	@ dime sized tubers	62.1	71.7	72.5	80.5	584.2	0.5	0.1	0.3
Phostrol	5.0 pt / a	@ dime + 7 days								
Phostrol	5.0 pt / a	@ dime + 14 days								
Phostrol	5.0 pt / a	@ dime + 21 days								
Phostrol	5.0 pt / a	@ dime + 28 days								
Phostrol	5.0 pt / a	@ dime + 35 days								
$LSD_{P = 0.06}$			NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Percentage rot in tubers challenge inoculated with a mefenoxam resistant and sensitive isolate of *Phytophthora erythroseptica* at 30, 59, 94 and 122 days after harvest (DAH). Mean separation based on Fisher's protected least significant difference (LSD) test (P = 0.05).

Treatment	Rate	Application Timing	*P. erythroseptica* isolate	*P. erythroseptica* challenge inoculation (% incidence)			
				30 DAH	59 DAH	94 DAH	122 DAH
Non-treated			Mefenoxam Resistant	27.5	35.0	25.0	15.0
Ridomil Gold SL	6.1 fl oz/ a	In-Furrow	Mefenoxam Resistant	32.5	25.0	32.5	10.0
Ridomil Gold MZ	2.0 lb / a	@ dime sized tubers					
Phostrol	10.0 pt / a	@ dime sized tubers	Mefenoxam Resistant	12.5	7.5	0.0	5.0
Phostrol	10.0 pt / a	@ dime + 14 days					
Phostrol	10.0 pt / a	@ dime sized tubers	Mefenoxam Resistant	0.0	0.0	2.5	0.0
Phostrol	10.0 pt / a	@ dime + 14 days					
Phostrol	10.0 pt / a	@ dime + 28 days					
Phostrol	5.0 pt / a	@ dime sized tubers	Mefenoxam Resistant	2.5	2.5	0.0	2.5
Phostrol	5.0 pt / a	@ dime + 7 days					
Phostrol	5.0 pt / a	@ dime + 14 days					
Phostrol	5.0 pt / a	@ dime + 21 days					
Phostrol	5.0 pt / a	@ dime sized tubers	Mefenoxam Resistant	2.5	2.5	0.0	2.5
Phostrol	5.0 pt / a	@ dime + 7 days					
Phostrol	5.0 pt / a	@ dime + 14 days					
Phostrol	5.0 pt / a	@ dime + 21 days					
Phostrol	5.0 pt / a	@ dime + 28 days					
Phostrol	5.0 pt / a	@ dime + 35 days					
$LSD_{P = 0.05}$				10.0	12.6	11.5	NS
Non-treated			Mefenoxam Sensitive	40.0	35.0	27.5	22.5
Ridomil Gold SL	6.1 fl oz/ a	In-Furrow	Mefenoxam Sensitive	25.0	7.5	2.5	5.0
Ridomil Gold MZ	2.0 lb / a	@ dime sized tubers					
Phostrol	10.0 pt / a	@ dime sized tubers	Mefenoxam Sensitive	12.5	5.0	0.0	0.0
Phostrol	10.0 pt / a	@ dime + 14 days					
Phostrol	10.0 pt / a	@ dime sized tubers	Mefenoxam Sensitive	0.0	0.0	0.0	0.0
Phostrol	10.0 pt / a	@ dime + 14 days					
Phostrol	10.0 pt / a	@ dime + 28 days					
Phostrol	5.0 pt / a	@ dime sized tubers	Mefenoxam Sensitive	12.5	0.0	0.0	0.0
Phostrol	5.0 pt / a	@ dime + 7 days					
Phostrol	5.0 pt / a	@ dime + 14 days					
Phostrol	5.0 pt / a	@ dime + 21 days					
Phostrol	5.0 pt / a	@ dime sized tubers	Mefenoxam Sensitive	0.0	0.0	0.0	0.0
Phostrol	5.0 pt / a	@ dime + 7 days					
Phostrol	5.0 pt / a	@ dime + 14 days					
Phostrol	5.0 pt / a	@ dime + 21 days					
Phostrol	5.0 pt / a	@ dime + 28 days					
Phostrol	5.0 pt / a	@ dime + 35 days					
$LSD_{P = 0.05}$				NS	5.9	6.2	6.7

Table 2. (con't)

Treatment	Rate	Application Timing	*P. erythroseptica* isolate	*P. erythroseptica* challenge inoculation (% incidence)			
				30 DAH	59 DAH	94 DAH	122 DAH
Non-treated				33.8	35.0	26.3	18.8
Ridomil Gold SL	6.1 fl oz/ a	In-Furrow		28.8	16.3	17.5	7.5
Ridomil Gold MZ	2.0 lb / a	@ dime sized tubers					
Phostrol	10.0 pt / a	@ dime sized tubers		12.5	6.3	0.0	2.5
Phostrol	10.0 pt / a	@ dime + 14 days					
Phostrol	10.0 pt / a	@ dime sized tubers		0.0	0.0	1.3	0.0
Phostrol	10.0 pt / a	@ dime + 14 days					
Phostrol	10.0 pt / a	@ dime + 28 days					
Phostrol	5.0 pt / a	@ dime sized tubers		7.5	1.3	0.0	1.3
Phostrol	5.0 pt / a	@ dime + 7 days					
Phostrol	5.0 pt / a	@ dime + 14 days					
Phostrol	5.0 pt / a	@ dime + 21 days					
Phostrol	5.0 pt / a	@ dime sized tubers		1.3	1.3	0.0	1.3
Phostrol	5.0 pt / a	@ dime + 7 days					
Phostrol	5.0 pt / a	@ dime + 14 days					
Phostrol	5.0 pt / a	@ dime + 21 days					
Phostrol	5.0 pt / a	@ dime + 28 days					
Phostrol	5.0 pt / a	@ dime + 35 days					
$LSD_{P=0.05}$				13.6	6.8	6.5	7.7
			Mefenoxam Resistant	12.9	12.1	10.0	5.8
			Mefenoxam Sensitive	15.0	7.9	5.0	4.6
$LSD_{P=0.05}$				NS	3.9	3.8	NS

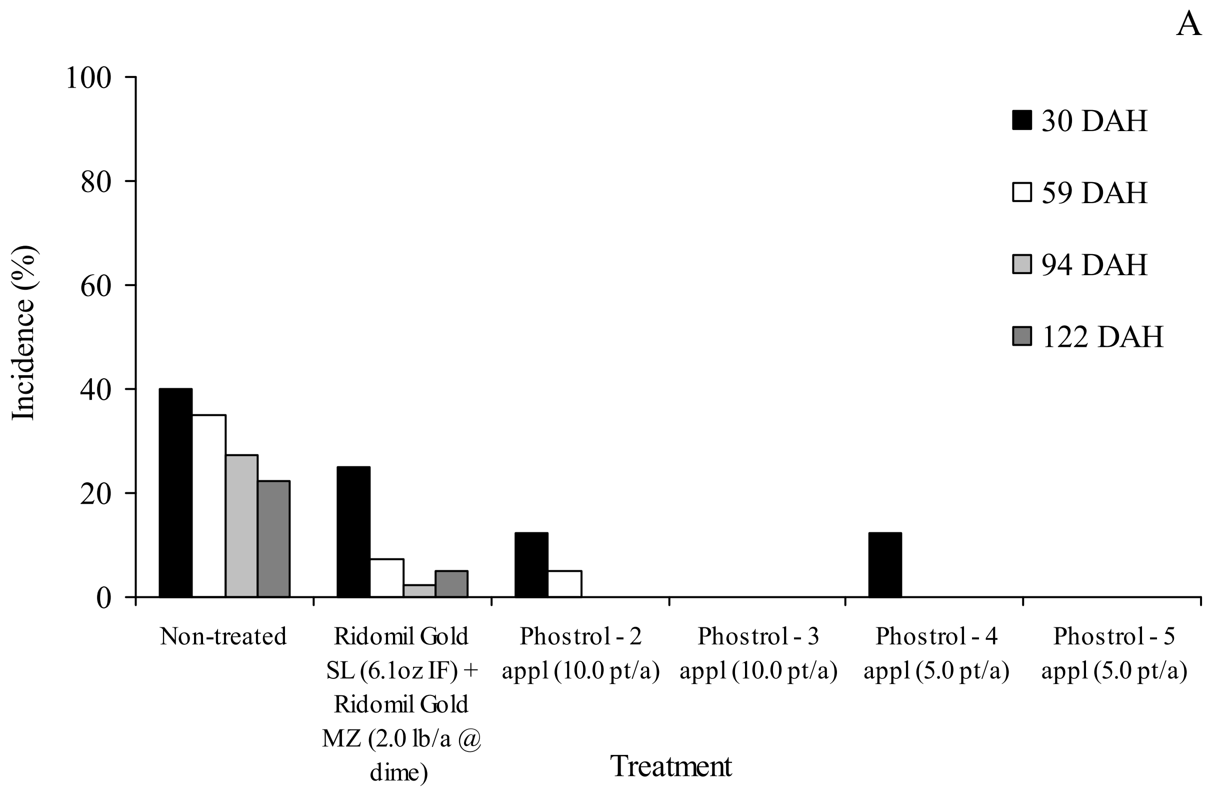
Note: Interaction of main effects of treatment and mefenoxam resistance was not significant for incidence at 30 or 59 days after harvest (DAH) (α = 0.05)

Table 3. Percentage rot in tubers challenge inoculated with *Phytophthora infestans* 101 and 102 days after harvest. Mean separation based on Fisher's protected least significant difference (LSD) test ($P = 0.05$).

Treatment	Rate	Application Timing	*P. infestans* challenge inoculation (% incidence)
Non-treated			11.3
Ridomil Gold SL	6.1 fl oz/ a	In-Furrow	NT
Ridomil Gold MZ	2.0 lb / a	@ dime sized tubers	
Phostrol	10.0 pt / a	@ dime sized tubers	1.3
Phostrol	10.0 pt / a	@ dime + 14 days	
Phostrol	10.0 pt / a	@ dime sized tubers	0.0
Phostrol	10.0 pt / a	@ dime + 14 days	
Phostrol	10.0 pt / a	@ dime + 28 days	
Phostrol	5.0 pt / a	@ dime sized tubers	0.0
Phostrol	5.0 pt / a	@ dime + 7 days	
Phostrol	5.0 pt / a	@ dime + 14 days	
Phostrol	5.0 pt / a	@ dime + 21 days	
Phostrol	5.0 pt / a	@ dime sized tubers	2.5
Phostrol	5.0 pt / a	@ dime + 7 days	
Phostrol	5.0 pt / a	@ dime + 14 days	
Phostrol	5.0 pt / a	@ dime + 21 days	
Phostrol	5.0 pt / a	@ dime + 28 days	
Phostrol	5.0 pt / a	@ dime + 35 days	
$LSD_{P = 0.05}$			6.9

NT = not tested

Note: Incidence of *P. infestans* was not significantly different between Trial 1 and Trial 2 and variances were homogeneous.



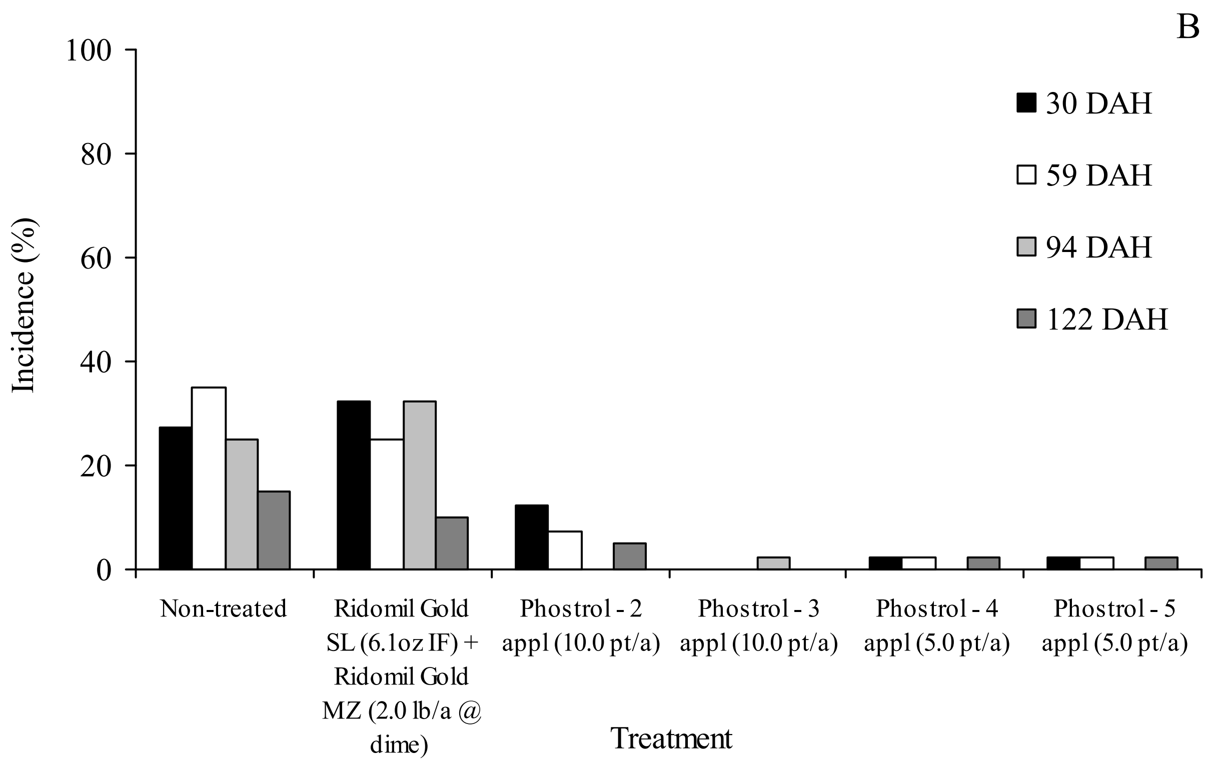


Figure 1. Incidence of pink rot caused by mefenoxam sensitive (A) and resistant (B) isolates of *Phytophthora erythroseptica* in potato tubers treated with mefenoxam or phosphorus acid. Challenge inoculations were performed 30 59, 94 and 122 days after harvest (DAH).

Title: Quantification of soilborne pathogens of potato using real-time PCR

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Submitted to Minnesota Area II Potato Growers and NPPGA

Executive Summary:
Soilborne diseases of potato are generally regarded as the one of the most serious economic constraints facing the potato industry when disease losses are coupled with the cost of control. The principle pathogens involved in early dying are *Verticillium dahliae* and *Colletotrichum coccodes*. *C. coccodes* also causes black dot and is a major tuber blemish disease of potato in this region. Another important soilborne disease emerging in this region is powdery scab, caused by *Spongospora subterranea.* This pathogen is also the vector of potato mop top virus, an important tuber necrosis virus recently detected in North Dakota. Methods to determine the presence and concentration of these important plant pathogens are costly, time-consuming, and in the case of powdery scab, nonexistent. The development of a multiplex real-time PCR method capable of detecting and quantifying soil inocula of these three soilborne pathogens of potato would assist growers in making management decisions.

Rationale:
A number of important soilborne pathogens affect potato development and tuber quality. These diseases include powdery scab, caused by *Spongospora subterranea*, Verticillium wilt, caused by *Verticillium dahliae*, and black dot, caused by *Colletotrichum coccodes*.

Powdery scab can affect crop development by infecting roots and negatively impacting nutrient and water uptake but this disease also affects tuber quality. The powdery scab pathogen is also the vector of the potato mop top virus. *V. dahliae* and *C. coccodes* affect crop development and are components of the early dying complex, although the former is generally acknowledged as the primary pathogen (Davis and Johnson, 2001; Johnson, 1994; Tsror et al., 1999). Vegetative group 4 is the most important group of *V. dahliae* affecting potato. *C. coccodes* also affects tuber quality, particularly as it affects the fresh market and the chip processing sectors of the potato industry (Read and Hide, 1988).

Disease management of these diseases usually involved the implementation of various agrochemicals, which are expensive and in some cases, such as with metam sodium used to control Verticillium wilt, can potentially harm the environment. Diseases such as powdery scab cannot be controlled chemically leaving growers with the option of avoiding the disease by not planting a field or using less susceptible cultivars.

Soil population levels of a pathogen usually impacts disease development and severity. In the Midwestern US, soil populations of *V. dahliae* >8 microsclerotia/g of soil are generally regarded as economically damaging. Preliminary studies on *C. coccodes* suggest soil populations >70 microsclerotia are yield limiting (Gudmestad et al., 2005). Soil population studies on these two pathogens were performed using classical soil dilution and culture plating in the laboratory. These types of studies are very difficult or impossible to do with pathogens such as *S. subterranea,* a pathogen that cannot be cultured. Additional studies on the relationships between populations of soilborne pathogens and yield and quality losses would be aided by methods of detection and quantification that are precise, rapid and relatively inexpensive.

Quantification of soilborne pathogen inocula has been recently facilitated by the implementation of polymerase chain reaction (PCR) technology, either in classical or in real-time format (Cullen, et al., 2002; Gudmestad, et al., 2007; Qu, et al., 2006). Real-time PCR has proven to be useful in quantifying *C. coccodes* resulting in a relationship being detected between soil population of the pathogen and the number of potato crops in a given field (Figure 1). This work was funded by MN Area II in 2006. Similar studies have been performed using *S. subterranea* (Qu et al., 2006).

The goal of the research proposed here is to develop a multiplex real-time PCR method that will allow quantification of several soilborne pathogens simultaneously within the same sample. The target pathogens include *V. dahliae, C. coccodes,* and *S. subterranea.* The development of the real-time PCR assay for *C. coccodes,* and *S. subterranea* is complete. The research proposed here will concentrate on improving the PCR assay for *V. dahliae* and the development of the multiplex so that one soil sample can be tested for all three pathogens simultaneously. Studies on soil sampling and soil processing will also be performed to optimize DNA extraction for the PCR detection protocol.

Research Objectives:

1) Develop sensitive and genomic primers for *V. dahliae* that can be used in real-time PCR to detect this pathogen in soil.
2) Develop a multiplex real-time PCR method for the detection and quantification of *V. dahliae, C. coccodes,* and *S. subterranea* in a single reaction.

Research Plan:

The real-time PCR method for the black dot pathogen, *C. coccodes,* has been successfully developed by our laboratory with funding from MN Area II in 2006 and 2007 and was used on a trial basis during the last two growing seasons (see MN Area II research report submitted in November, 2006 & 2007). A primer for the detection of *S. subterranea* in real-time PCR is now available and had been used to quantify this pathogen in 186 commercial and seed production fields. The only remaining pathogen remaining for the multiplex real-time PCR system is *V. dahliae*.

The entire genome for *V. dahliae* has now been successfully sequenced which provides this project with an excellent opportunity to screen the genome and to evaluate a very large number of primer candidates.

http://www.broadinstitute.org/annotation/genome/verticillium_dahliae/MultiHome.html

A real-time PCR assay for *V. dahliae* will be developed by analyzing DNA sequences of *V. dahliae* with Primer Express Software. The species specificity of each real-time assay will be confirmed by amplifying target DNA and non-target DNAs including the three other fungi and purified potato DNA. Real-time PCR reactions and thermocycling conditions will be as described by Vandemark et al. (2000).

In order to develop multiplex real-time PCR assays that can detect all possible combinations of the four pathogens (*V. dahliae* x *C. coccodes*, *V. dahliae* x *S. subterranea*, *C. coccodes* x *S. subterranea*), two Taqman probes will be synthesized for each pathogen, with one being labeled at the 5' terminus with the fluorochrome 6-carboxyfluorescein (FAM), and the other labeled at the 5' terminus with the fluorochrome VIC (Applied Biosystems). Initial real-time PCR assays will include purified DNA (25 ng) of each pathogen in all six pair-wise combinations. Primer and probe limiting experiments will be performed according to manufacturer's recommendations (Applied Biosystems) to determine the minimum, most cost effective amount of primers and Taqman probe that can be used in multiplex reactions.

After verifying the sensitivity and specificity of the multiplex real-time PCR assays with purified pathogen DNAs, soil will be collected from potato fields. Mycelia of *V. dahliae* and *C. coccodes*, along with spore balls of *S. subterannea*, will be added in known quantities to the soil samples. DNA will be extracted from 5 g soil samples with the MegaPrep DNA extraction kit (Mo Bio Inc.) and multiplex real-time PCR will be performed using 10 µL of the soil DNA extract in a 50 µL reaction volume. The amount of each respective pathogen detected in the soil sample will be determined based on standard curves using purified pathogen DNA as template. Serial dilutions of the DNA extracts from pathogen infested soil will be made and examined by real-time PCR to determine threshold levels for reliable detection of each pathogen. DNA extracted from the original soil sample prior to infestation by the four respective pathogens will also be amplified by real-time PCR to examine baseline levels of detection from non-infested soil.

Results:

The three PCR primers for *V. dahliae*, *C. coccodes*, and *S. subterannea* have been successfully multiplexed so that the relative quantity of each pathogen can be determined with one reaction (Figure 1). However, we still have some optimization to do to make this test consistent from soil type to soil type. Nonetheless, the progress to date has been positive.

We have performed a number of 'beta' tests of using the soil PCR to detect and quantify the pathogens that cause Verticillium wilt, black dot and powdery scab (Table 2). Using these data, a number of potato growers have been able to avoid planting red-skinned cultivars, which are extremely susceptible to powdery scab, into fields with high levels of powdery scab. We have optimized the relationship between PCR and the plate counts of microsclerotia of *V. dahliae* which is now very high (Figure 2). We feel this will dramatically improve the results we will obtain in determining soil populations of this pathogen.

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Vandemark, G. J., B. M. Barker and M. A. Gritsenko. 2002. Phytopathology 92:265-272.

Table 1. Frequency of real-time PCR detection of *Spongospora subterranea* , the causal agent of Powdery Scab, in soil samples collected in North Dakota and Minnesota in 2010.

Farm	# Samples	# Positive Samples	% Positive Samples
ND Farm A	10	4	40%
ND Farm B	82	23	28%
ND Farm C	7	7	100%
ND Farm E	22	4	18%
MN Farm A	5	3	60%

Table 2. Frequency of real-time PCR detection of *Colletotrichum coccodes* , the causal agent of Black Dot, in soil samples collected in North Dakota and Wisconsin in 2010.

Farm	# Samples	# Positive Samples	% Positive Samples
WI Farm	7	1	14%
ND Farm E	22	15	68%

Table 3. Frequency of real-time PCR detection of *Verticillium dahliae* , the causal agent of Verticillium Wilt, in soil samples collected in North Dakota, Minnesota and Wisconsin in 2010.

Farm	# Samples	# Positive Samples	% Positive Samples
WI Farm	7	5	71%
MN Farm A	11	7	64%
MN Farm B	105	67	64%
MN Farm C	7	4	57%
ND Farm D	2	2	100%

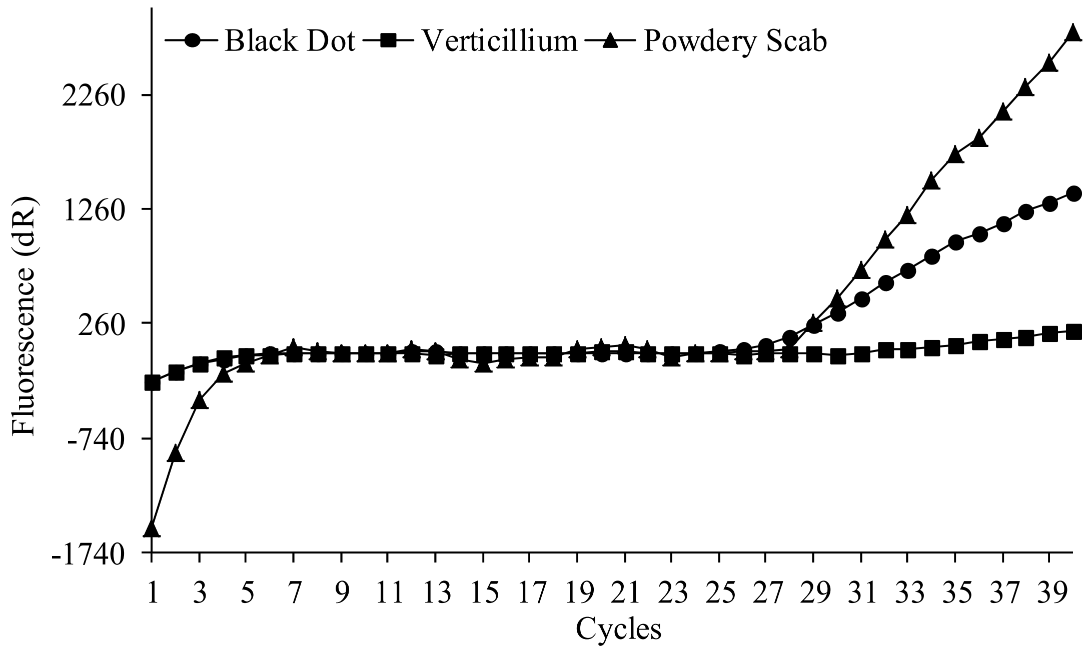

Figure 1. Flourescence emission (dR) in a real-time PCR assay for the quantification of *Colletotrichum coccodes* (Black Dot), *Verticillium dahlliae* (Verticillium Wilt) and *Spongospora subterranea* (Powdery Scab) from field soil.

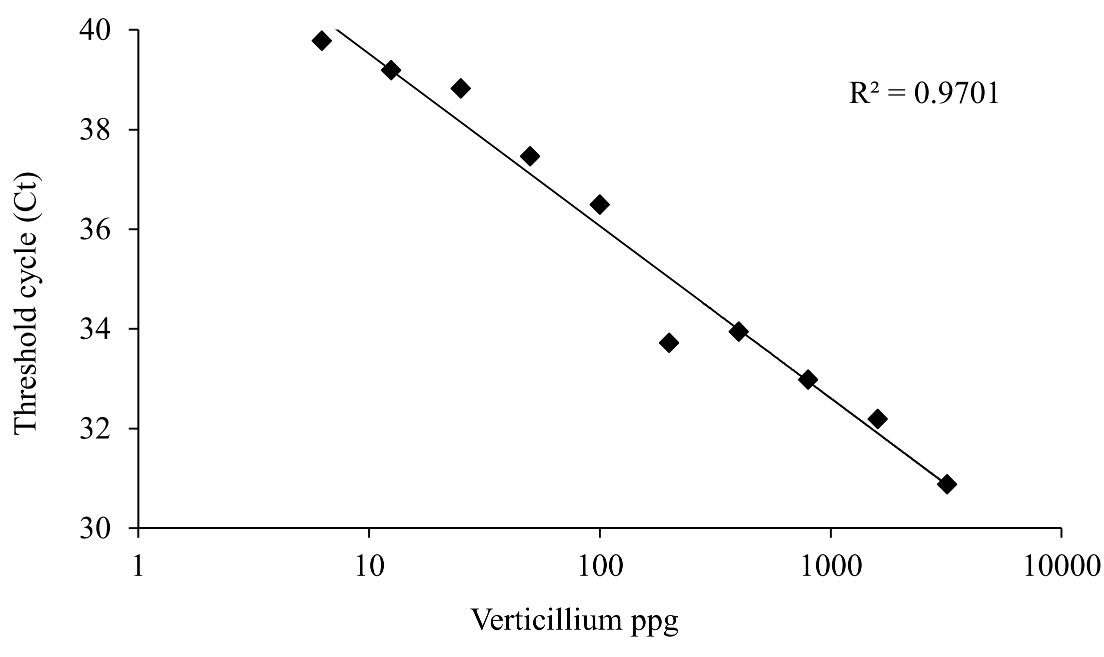

Figure 2. Relationship between real-time PCR crossing threshold (Ct) and number of *Verticillium dahliae* propagules per gram (ppg) in sterile soil infested with microscerotia.

Interaction of Inoculum Levels of *Verticillium dahliae* and Cultivar Resistance

Submitted to MN Area II and NPPGA

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Executive Summary

Verticillium wilt, caused by *Verticillium dahliae*, is the principle pathogen involved in the early dying syndrome. Early dying is arguably the most economically damaging disease of potato in the USA when considering direct and indirect losses due to the disease and the cost of control. Soil fumigation with metam sodium is the primary means by which irrigated potato producers manage this disease and a soil level of >8 *Verticillium* propagules per gram (vppg) of soil triggers fumigation with cultivars such as Russet Burbank. Approximately 34 million pounds of the active ingredient metam sodium are applied by the potato industry each year for the control of *Verticillium* wilt at cost of nearly $170 million, not including the cost of application. Metam sodium has been recently been re-registered by the Environmental Protection Agency (EPA) but with considerable restrictions placed on its use. Potato cultivars that resist *V. dahliae* are economically and environmentally more favorable for the control *Verticillium* wilt and can potentially eliminate the need for soil fumigation. However, preliminary data suggests high levels of the *V. dahliae* may overcome genetic resistance to this pathogen. The research proposed here will investigate the interaction of soil inoculum levels of *V. dahliae* and cultivar resistance to determine if genetic resistance can succumb to high levels of this pathogen. The aim of this research is to establish the economic threshold of soil inoculum for potato cultivars moderately resistant and highly resistant to *Verticillium* wilt.

Introduction

Verticillium dahliae infects the water conducting tissues of many plant species, including the potato (*Solanum tuberosum* L.), causing a disease known as *Verticillium* wilt. This pathogen is also the principle component of the early dying complex. The fungus survives in the soil as microsclerotia which allow the pathogen to survive long periods of time in the absence of a suitable plant host. The application of metam sodium to the soil kills the microsclerotia and is the primary means by which the potato industry controls this disease. The economic threshold for densities of *V. dahliae* in soil for susceptible cultivars such as Russet Burbank is 8 vppg, which is not a very high level of the pathogen. However, we know from previous research performed in Minnesota that soil densities after multiple potato crops can easily exceed 200 vppg (Taylor et al., 2005). These levels of *V. dahliae* make soil fumigation less effective especially when you consider studies in which places metam sodium efficacy at approximately 72% (Taylor et al., 2005). High soil densities of *V. dahliae* may also affect disease expression in *Verticillium* resistant cultivars.

A number of potato cultivars have been described as possessing resistance to *V. dahliae*. These cultivars include Alturas (Novy et al. 2003), Defender (Novy et al. 2006), Goldrush (Johansen et al. 1994), Ranger Russet (Pavek et al. 1992), Reddale, Russet Nugget (Holm et al. 1992), Umatilla Russet (Mosley et al. 2000), and Western Russet (Love et al. 2006), among others. While Ranger Russet and Umatilla Russet have impacted the processing industry, most cultivars with purported resistance are not widely grown and/or are unsuitable for French fry processing. Unfortunately, most cultivars reported as resistant to *Verticillium* wilt have been evaluated only in small plot trials for their ability to yield well in soils infested with *V. dahliae*. This method of evaluation fails to distinguish tolerance from resistance or moderate resistance, a flaw in methodology employed by many potato breeding programs. Cultivars tolerant to *V. dahliae* do not resist the pathogen but may not express symptoms in the field and, therefore, return as many propagules of the pathogen to the soil as a susceptible cultivar due to colonization of the stems. This can lead to a build up of inoculum in the soil which can lead to a breakdown of the tolerant reaction. A methodology has been proposed recently for evaluating potato clones for resistance to *V. dahliae* which involves a three-pronged approach, including determining the levels of the pathogen multiplying in the plant (Jansky, 2009). This methodology is very similar to the one used at the University of Minnesota in the 1970's (Hoya, et al. 1991, 1993).

More recently, studies conducted at NDSU have verified that a number of potato cultivars have moderate to high levels of resistance to *V. dahliae* (Pasche, Gudmestad & Thompson, unpublished data). These cultivars vary in the degree of wilt expressed during the growing season and in the quantity of *V. dahliae* present in the plant. Preliminary data from these trials also suggests that genetic resistance in these cultivars may 'break' under high inoculum pressure, reducing yield. Six of eight cutlivars evaluated had lower yields under high inoculum density compared to low inoculum density (12 vppg).

The research proposed here will investigate the interaction of *V. dahliae* levels in soil and genetic resistance to *Verticillium* wilt in several potato cultivars. The ultimate goal will be to determine if there are economic thresholds at which the yield of Verticillium resistant cultivars will be significantly reduced. In these cultivars, soil fumigation may be warranted when extremely high soil levels of *V. dahliae* exist.

Research Objectives

1) Evaluate potato cultivars with varying levels of resistance for Verticillium wilt development under several levels of inoculum density
2) Determine economic thresholds of *V. dahliae* in potato cultivars that are moderately resistant and highly resistant to the pathogen and compare to susceptible cultivars

Research Plan

These research studies will be conducted initially under greenhouse conditions to rapidly determine soil levels of *V. dahliae* at which genetic resistance may be insufficient to prevent yield loss. Levels of *V. dahliae* will include 0, 10, 100, 300 and 1,000 vppg dry soil. Seed pieces of susceptible, moderately resistant and highly resistant potato cultivars such as Russet Nortkotah, Russet Burbank, Umatilla Russet, Ranger Russet, Classic Russet, Premier Russet, Dakota Trailblazer, and Alturas will be inoculated at each inoculum density. *V. dahliae* will be grown on sterilized wheat seed for approximately three months, air-dried, and ground into a powder so that it can be applied in furrow at planting to achieve varying levels of soil inoculum.

The study will be conducted as a completely random design with three replications and 5 potato plants at each cultivar X soil inoculum concentration. Data on the degree of wilting, colonization of the pathogen in each cultivar at each inoculum concentration and yield will be taken for each treatment combination.

Results

Under greenhouse conditions increasing levels of *V. dahliae* inoculum increased the level of wilt severity in the susceptible cultivar Russet Norkotah and to some degree in the moderately susceptible cultivar Russet Burbank (Figure 1, Table 1). Wilt severity, as measured by the relative area under the wilt progress curve (RAUWC) also increased slightly for the highly resistant cultivar Dakotah Trailblazer. However, increasing levels of inoculum did not increase wilt severity in the moderately resistant cultivar Bannock Russet.

Verticillium wilt severity progressed as expected over the course of the growing season in all cultivars (Figure 2). Verticillium wilt progressed the most rapidly in the susceptible check cultivar Russet Norkotah and was significantly slower in moderately resistant and resistant cultivars Premier Russet and Dakota Trailblazer, respectively, resulting in significantly different relative areas under the wilt progress curve (RAUWPC) (Figure 3).

Unfortunately, *V. dahliae* inoculum levels introduced into the soil at planting did not appreciably increase wilt levels in any cultivar (Table 2). As a result, increasing levels of *V. dahliae* inoculum did not significantly affect yield (Table 3).

These results are difficult to interpret. Either the Verticillium-infested wheat we introduced was nonviable, or the inoculum levels left in the soil after fumigation of the Inkster plot land were sufficiently high to negate any soil inoculum effect. Soil inoculum levels determined during the growing season revealed *V. dahliae* levels up to 16 Verticillium progagules per gram of soil, approximately 2X the economic threshold for Russet Burbank. Although the Inkster plot land was fumigated in November, 2009, the land were the Verticillium wilt research was placed was the sandiest and highest ground in the approximately 20 acre plot area. We speculate that this area may have been too dry prior to fumigation and, therefore, we did not obtain sufficient kill of the resident *V. dahliae* microsclerotia. As a result, the additional inoculum infested into the soil had no effect on increasing wilt disease incidence and severity.

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Table 1.Wilt severity, area under the wilt progress curve (AUWPC) and relative are under the wilt progress curve (RAUWPC) among four Russet cultivars inoculated via soil infestation at planting with varying levels of *Verticillium dahliae* microsclerotia (ms) under greenhouse conditions. Mean separation based on Fisher's protected least significant difference (LSD) test (P = 0.05).

Cultivar	Reported Susceptibility	Inoculation Rate	Wilt Severity (%)				AUWPC	RAUWPC
			6/3	6/10	6/16	6/22		
Russet Norkotah	Susceptible check	Non-inoculated	6.9	13.8	19.7	50.4	383.5	0.202
Russet Norkotah	Susceptible check	10 ms/g	13.5	20.1	44.6	60.6	627.0	0.330
Russet Norkotah	Susceptible check	100 ms/g	7.2	15.2	44.8	77.2	624.2	0.329
Russet Norkotah	Susceptible check	1000 ms/g	20.5	49.8	79.8	90.4	1144.9	0.603
Russet Norkotah	Susceptible check	7500 ms/g	18.3	48.1	95.3	100.0	1247.9	0.657
Bannock Russet	Moderately Resistant	Non-inoculated	3.0	5.7	6.9	22.1	135.4	0.071
Bannock Russet	Moderately Resistant	10 ms/g	2.5	6.8	7.4	11.7	121.5	0.064
Bannock Russet	Moderately Resistant	100 ms/g	4.0	5.1	14.7	39.0	210.3	0.111
Bannock Russet	Moderately Resistant	1000 ms/g	3.1	4.1	5.2	18.3	123.3	0.065
Bannock Russet	Moderately Resistant	7500 ms/g	3.6	4.5	6.1	13.2	117.8	0.062
Russet Burbank	Moderately Susceptible-Moderately Resistant	Non-inoculated	5.0	7.2	11.5	17.7	186.2	0.098
Russet Burbank	Moderately Susceptible-Moderately Resistant	10 ms/g	1.9	9.1	12.3	19.4	148.6	0.078
Russet Burbank	Moderately Susceptible-Moderately Resistant	100 ms/g	8.1	11.5	20.6	33.1	217.5	0.115
Russet Burbank	Moderately Susceptible-Moderately Resistant	1000 ms/g	11.1	19.1	21.3	47.1	431.6	0.227
Russet Burbank	Moderately Susceptible-Moderately Resistant	7500 ms/g	12.3	16.1	38.3	63.3	567.7	0.299
Dakota TrailBlazer	Very Resistant	Non-inoculated	5.7	5.3	6.9	22.4	156.2	0.082
Dakota TrailBlazer	Very Resistant	10 ms/g	3.0	2.9	7.5	21.3	138.2	0.073
Dakota TrailBlazer	Very Resistant	100 ms/g	5.0	7.6	8.4	31.3	211.0	0.111
Dakota TrailBlazer	Very Resistant	1000 ms/g	11.7	10.4	11.5	30.8	270.0	0.142
Dakota TrailBlazer	Very Resistant	7500 ms/g	6.0	6.8	9.6	29.4	210.6	0.111
$LSD_{P = 0.05}$			6.3	10.5	11.7	17.4	165.1	0.087
Russet Norkotah	Susceptible check		12.2	26.8	50.6	71.5	735.2	0.387
Bannock Russet	Moderately Resistant		3.2	5.3	7.7	20.6	140.6	0.074
Russet Burbank	Moderately Susceptible-Moderately Resistant		7.4	11.8	19.5	33.7	289.7	0.152
Dakota TrailBlazer	Very Resistant		6.2	6.4	8.5	26.3	190.4	0.100
$LSD_{P = 0.05}$			2.7	4.5	5.0	7.4	71.1	0.037

Table 1. (con't)

Cultivar	Reported Susceptibility	Inoculation Rate	Wilt Severity (%)				AUWPC	RAUWPC
			6/3	6/10	6/16	6/22		
Russet Norkotah	Susceptible check	Non-inoculated	6.9	13.8	19.7	50.4	383.5	0.202
Russet Norkotah	Susceptible check	10 ms/g	13.5	20.1	44.6	60.6	627.0	0.330
Russet Norkotah	Susceptible check	100 ms/g	7.2	15.2	44.8	77.2	624.2	0.329
Russet Norkotah	Susceptible check	1000 ms/g	20.5	49.8	79.8	90.4	1144.9	0.603
Russet Norkotah	Susceptible check	7500 ms/g	18.3	48.1	95.3	100.0	1247.9	0.657
$LSD_{P\ =\ 0.05}$			9.9	18.5	19.7	21.4	287.2	0.151
Bannock Russet	Moderately Resistant	Non-inoculated	3.0	5.7	6.9	22.1	135.4	0.071
Bannock Russet	Moderately Resistant	10 ms/g	2.5	6.8	7.4	11.7	121.5	0.064
Bannock Russet	Moderately Resistant	100 ms/g	4.0	5.1	14.7	39.0	210.3	0.111
Bannock Russet	Moderately Resistant	1000 ms/g	3.1	4.1	5.2	18.3	123.3	0.065
Bannock Russet	Moderately Resistant	7500 ms/g	3.6	4.5	6.1	13.2	117.8	0.062
$LSD_{P\ =\ 0.05}$			NS	NS	5.4	16.5	NS	NS
Russet Burbank	Moderately Susceptible-Moderately Resistant	Non-inoculated	5.0	7.2	11.5	17.7	186.2	0.098
Russet Burbank	Moderately Susceptible-Moderately Resistant	10 ms/g	1.9	9.1	12.3	19.4	148.6	0.078
Russet Burbank	Moderately Susceptible-Moderately Resistant	100 ms/g	8.1	11.5	20.6	33.1	217.5	0.115
Russet Burbank	Moderately Susceptible-Moderately Resistant	1000 ms/g	11.1	19.1	21.3	47.1	431.6	0.227
Russet Burbank	Moderately Susceptible-Moderately Resistant	7500 ms/g	12.3	16.1	38.3	63.3	567.7	0.299
$LSD_{P\ =\ 0.05}$			5.6	6.3	9.5	16.5	129.9	0.068
Dakota TrailBlazer	Very Resistant	Non-inoculated	5.7	5.3	6.9	22.4	156.2	0.082
Dakota TrailBlazer	Very Resistant	10 ms/g	3.0	2.9	7.5	21.3	138.2	0.073
Dakota TrailBlazer	Very Resistant	100 ms/g	5.0	7.6	8.4	31.3	211.0	0.111
Dakota TrailBlazer	Very Resistant	1000 ms/g	11.7	10.4	11.5	30.8	270.0	0.142
Dakota TrailBlazer	Very Resistant	7500 ms/g	6.0	6.8	9.6	29.4	210.6	0.111
$LSD_{P\ =\ 0.05}$			4.1	4.3	NS	NS	74.5	0.039

A significant interaction was observed between the main effects of cultivar and inoculation was observed in wilt severity on all dates as well as the AUWPC and RAUWPC ($P = 0.05$).

Table 2. Wilt incidence, area under the wilt progress curve (AUWPC) and relative are under the wilt progress curve (RAUWPC) among five Russet cultivars inoculated in-furrow with varying levels of *Verticillium dahliae* . Mean separation based on Fisher's protected least significant difference (LSD) test (*P* = 0.05).

Cultivar	Reported Susceptibility	Inoculation Rate	Vigor (6/29)	Wilt Incidence (%)					AUWPC	RAUWPC
				7/26	8/5	8/18	8/30	9/8		
Russet Norkotah	Susceptible check	-	3.0	5.5	18.9	22.4	84.4	90.5	1852.1	0.421
Russet Norkotah	Susceptible check	1X	3.0	4.7	22.1	21.5	89.5	94.0	1942.5	0.441
Russet Norkotah	Susceptible check	2X	3.0	9.2	19.6	26.7	85.7	85.4	1922.0	0.437
Russet Norkotah	Susceptible check	4X	2.8	6.9	14.6	38.5	93.4	95.7	2134.9	0.485
Premier Russet	Moderately Resistant	-	2.0	1.1	11.4	11.9	25.1	42.6	747.3	0.170
Premier Russet	Moderately Resistant	1X	2.0	1.0	4.2	4.7	25.1	45.5	591.5	0.134
Premier Russet	Moderately Resistant	2X	2.0	1.3	4.2	6.0	26.4	44.6	619.3	0.141
Premier Russet	Moderately Resistant	4X	2.0	2.0	4.8	5.6	24.1	45.4	601.3	0.137
Russet Burbank	Moderately Susceptible-Moderately Resistant	-	4.0	1.4	12.0	21.0	45.9	66.7	1206.6	0.274
Russet Burbank	Moderately Susceptible-Moderately Resistant	1X	4.0	0.7	5.6	16.7	48.6	67.1	1110.2	0.252
Russet Burbank	Moderately Susceptible-Moderately Resistant	2X	4.0	2.1	4.7	14.8	48.3	67.2	1081.4	0.246
Russet Burbank	Moderately Susceptible-Moderately Resistant	4X	4.0	0.3	3.4	13.4	42.0	65.6	963.6	0.219
Ranger Russet	Resistant Check	-	3.8	6.4	12.2	8.8	31.5	45.8	829.3	0.188
Ranger Russet	Resistant Check	1X	3.8	9.0	7.4	5.9	34.5	50.3	805.0	0.183
Ranger Russet	Resistant Check	2X	3.5	9.1	6.6	6.7	38.3	47.9	839.1	0.191
Ranger Russet	Resistant Check	4X	3.5	9.8	7.2	9.1	41.9	46.7	913.4	0.208
Dakota Trailblazer	Very Resistant	-	2.5	0.6	11.6	15.9	24.8	38.0	773.7	0.176
Dakota Trailblazer	Very Resistant	1X	2.8	0.6	4.9	7.6	22.2	37.4	563.8	0.128
Dakota Trailblazer	Very Resistant	2X	2.8	0.6	5.2	9.5	28.7	46.1	701.7	0.159
Dakota Trailblazer	Very Resistant	4X	2.5	1.5	5.2	9.2	29.9	50.1	733.8	0.167
$LSD_{P = 0.06}$			0.5	3.5	4.6	6.7	14.7	14.3	275.2	0.063
Russet Norkotah	Susceptible check		2.9	6.6	18.8	27.3	88.3	91.4	1962.9	0.446
Premier Russet	Moderately Resistant		2.0	1.4	6.1	7.1	25.2	44.5	639.9	0.145
Russet Burbank	Moderately Susceptible-Moderately Resistant		4.0	1.1	6.4	16.5	46.2	66.6	1090.5	0.248
Ranger Russet	Resistant Check		3.6	8.6	8.3	7.6	36.6	47.7	846.7	0.192
Dakota Trailblazer	Very Resistant		2.6	0.8	6.7	10.5	26.4	42.9	693.3	0.158
$LSD_{P = 0.06}$			0.2	1.7	2.3	3.3	7.4	7.1	137.6	0.031
		-	3.1	3.0	13.2	16.0	42.3	56.7	1081.8	0.246
		1X	3.1	3.2	8.8	11.3	44.0	58.9	1002.6	0.228
		2X	3.1	4.5	8.1	12.7	45.5	58.2	1032.7	0.235
		4X	3.0	4.1	7.0	15.2	46.3	60.7	1069.4	0.243
$LSD_{P = 0.06}$			NS	NS	2.1	3.0	NS	NS	NS	NS

Table 2. (con't)

Cultivar	Reported Susceptibility	Inoculation Rate	Vigor (6/29)	Wilt Incidence (%)					AUWPC	RAUWPC
				7/26	8/5	8/18	8/30	9/8		
Russet Norkotah	Susceptible check	-	3.0	5.5	18.9	22.4	84.4	90.5	1852.1	0.421
Russet Norkotah	Susceptible check	1X	3.0	4.7	22.1	21.5	89.5	94.0	1942.5	0.441
Russet Norkotah	Susceptible check	2X	3.0	9.2	19.6	26.7	85.7	85.4	1922.0	0.437
Russet Norkotah	Susceptible check	4X	2.8	6.9	14.6	38.5	93.4	95.7	2134.9	0.485
$LSD_{P = 0.06}$			NS	NS	NS	10.2	NS	NS	NS	NS
Premier Russet	Moderately Resistant	-	2.0	1.1	11.4	11.9	25.1	42.6	747.3	0.170
Premier Russet	Moderately Resistant	1X	2.0	1.0	4.2	4.7	25.1	45.5	591.5	0.134
Premier Russet	Moderately Resistant	2X	2.0	1.3	4.2	6.0	26.4	44.6	619.3	0.141
Premier Russet	Moderately Resistant	4X	2.0	2.0	4.8	5.6	24.1	45.4	601.3	0.137
$LSD_{P = 0.06}$			.	NS	4.4	4.7	NS	NS	NS	NS
Russet Burbank	Moderately Susceptible-Moderately Resistant	-	4.0	1.4	12.0	21.0	45.9	66.7	1206.6	0.274
Russet Burbank	Moderately Susceptible-Moderately Resistant	1X	4.0	0.7	5.6	16.7	48.6	67.1	1110.2	0.252
Russet Burbank	Moderately Susceptible-Moderately Resistant	2X	4.0	2.1	4.7	14.8	48.3	67.2	1081.4	0.246
Russet Burbank	Moderately Susceptible-Moderately Resistant	4X	4.0	0.3	3.4	13.4	42.0	65.6	963.6	0.219
$LSD_{P = 0.06}$			.	NS	3.1	NS	NS	NS	NS	NS
Ranger Russet	Resistant Check	-	3.8	6.4	12.2	8.8	31.5	45.8	829.3	0.188
Ranger Russet	Resistant Check	1X	3.8	9.0	7.4	5.9	34.5	50.3	805.0	0.183
Ranger Russet	Resistant Check	2X	3.5	9.1	6.6	6.7	38.3	47.9	839.1	0.191
Ranger Russet	Resistant Check	4X	3.5	9.8	7.2	9.1	41.9	46.7	913.4	0.208
$LSD_{P = 0.06}$			NS	NS	4.1	NS	NS	NS	NS	NS
Dakota Trailblazer	Very Resistant	-	2.5	0.6	11.6	15.9	24.8	38.0	773.7	0.176
Dakota Trailblazer	Very Resistant	1X	2.8	0.6	4.9	7.6	22.2	37.4	563.8	0.128
Dakota Trailblazer	Very Resistant	2X	2.8	0.6	5.2	9.5	28.7	46.1	701.7	0.159
Dakota Trailblazer	Very Resistant	4X	2.5	1.5	5.2	9.2	29.9	50.1	733.8	0.167
$LSD_{P = 0.06}$			NS	NS	NS	3.9	NS	8.9	106.4	0.024

A significant interaction was observed between the main effects of cultivar and inoculation in percent wilted stems on 8/18 ($P = 0.05$).

Table 3. Wilt severity, area under the wilt progress curve (AUWPC), relative are under the wilt progress curve (RAUWPC) and total yield among five Russet cultivars inoculated in-furrow with varying levels of *Verticillium dahliae* . Mean separation based on Fisher's protected least significant difference (LSD) test (P = 0.05).

Cultivar	Reported Susceptibility	Inoculation Rate	Wilt Severity (%)					AUWPC	RAUWPC	Total Yield (cwt/a)
			7/26	8/5	8/18	8/30	9/8			
Russet Norkotah	Susceptible check	-	6.7	7.0	19.8	92.4	99.2	1800.4	0.409	473.0
Russet Norkotah	Susceptible check	1X	3.6	9.3	23.7	93.7	99.4	1880.2	0.427	482.5
Russet Norkotah	Susceptible check	2X	5.1	10.4	33.1	95.2	99.3	2072.6	0.471	447.6
Russet Norkotah	Susceptible check	4X	6.6	12.3	28.9	94.8	99.7	1994.0	0.453	476.6
Premier Russet	Moderately Resistant	-	0.6	2.1	2.6	3.6	9.5	131.5	0.030	429.0
Premier Russet	Moderately Resistant	1X	0.7	1.4	1.8	2.9	11.8	121.6	0.028	434.3
Premier Russet	Moderately Resistant	2X	0.7	1.4	1.5	5.5	19.0	171.1	0.039	460.1
Premier Russet	Moderately Resistant	4X	1.1	1.5	2.0	5.8	16.9	169.3	0.038	437.8
Russet Burbank	Moderately Susceptible-Moderately Resistant	-	1.5	3.2	5.9	63.3	88.5	1072.6	0.244	490.1
Russet Burbank	Moderately Susceptible-Moderately Resistant	1X	0.7	2.8	11.0	70.2	87.4	1279.0	0.291	498.8
Russet Burbank	Moderately Susceptible-Moderately Resistant	2X	1.1	2.1	6.9	61.7	87.7	1085.6	0.247	527.7
Russet Burbank	Moderately Susceptible-Moderately Resistant	4X	0.2	2.2	5.4	60.6	90.1	1053.1	0.239	547.1
Ranger Russet	Resistant Check	-	2.9	2.9	2.5	15.3	37.1	426.5	0.097	480.3
Ranger Russet	Resistant Check	1X	3.1	1.9	2.3	16.4	48.3	445.7	0.101	482.7
Ranger Russet	Resistant Check	2X	3.3	1.9	2.4	11.1	43.9	392.6	0.089	520.3
Ranger Russet	Resistant Check	4X	2.8	2.2	2.5	15.9	44.6	434.1	0.099	506.4
Dakota Trailblazer	Very Resistant	-	0.3	1.7	1.5	2.8	5.2	90.4	0.021	471.3
Dakota Trailblazer	Very Resistant	1X	0.5	1.5	1.5	3.3	7.4	107.0	0.024	479.4
Dakota Trailblazer	Very Resistant	2X	0.3	1.4	4.0	5.8	10.3	151.3	0.034	447.2
Dakota Trailblazer	Very Resistant	4X	0.6	1.6	1.7	5.2	5.9	129.9	0.030	481.6
$LSD_{P\ =0.06}$			3.5	6.0	9.4	5.6	4.4	164.5	0.037	50.8
Russet Norkotah	Susceptible check		5.6	9.6	27.0	94.0	99.4	1936.8	0.440	469.9
Premier Russet	Moderately Resistant		0.8	1.7	2.1	4.5	14.4	148.4	0.034	440.3
Russet Burbank	Moderately Susceptible-Moderately Resistant		0.9	2.8	7.3	64.0	88.4	1122.6	0.255	515.9
Ranger Russet	Resistant Check		3.0	2.3	2.4	14.6	43.5	424.7	0.097	497.4
Dakota Trailblazer	Very Resistant		0.4	1.6	2.1	4.3	7.3	119.6	0.027	469.9
$LSD_{P\ =0.06}$			1.7	2.8	4.5	2.8	2.2	82.3	0.019	25.4
		-	3.4	4.0	8.8	59.3	66.4	704.3	0.160	468.7
		1X	2.5	5.8	13.6	61.6	68.1	766.7	0.174	475.5
		2X	3.3	6.3	17.5	57.2	66.5	774.7	0.176	480.6
		4X	3.4	6.3	16.8	58.5	68.7	756.1	0.172	489.9
$LSD_{P\ =0.06}$			NS	NS	NS	NS	1.8	NS	NS	NS

Table 3. (con't)

Cultivar	Reported Susceptibility	Inoculation Rate	Wilt Severity (%)					AUWPC	RAUWPC	Total Yield (cwt/a)
			7/26	8/5	8/18	8/30	9/8			
Russet Norkotah	Susceptible check	-	6.7	7.0	19.8	92.4	99.2	1800.4	0.409	473.0
Russet Norkotah	Susceptible check	1X	3.6	9.3	23.7	93.7	99.4	1880.2	0.427	482.5
Russet Norkotah	Susceptible check	2X	5.1	10.4	33.1	95.2	99.3	2072.6	0.471	447.6
Russet Norkotah	Susceptible check	4X	6.6	12.3	28.9	94.8	99.7	1994.0	0.453	476.6
$LSD_{P\ =\ 0.06}$			NS	NS	7.7	NS	NS	172.7	0.039	NS
Premier Russet	Moderately Resistant	-	0.6	2.1	2.6	3.6	9.5	131.5	0.030	429.0
Premier Russet	Moderately Resistant	1X	0.7	1.4	1.8	2.9	11.8	121.6	0.028	434.3
Premier Russet	Moderately Resistant	2X	0.7	1.4	1.5	5.5	19.0	171.1	0.039	460.1
Premier Russet	Moderately Resistant	4X	1.1	1.5	2.0	5.8	16.9	169.3	0.038	437.8
$LSD_{P\ =\ 0.06}$			NS	0.6	0.8	NS	5.0	NS	NS	NS
Russet Burbank	Moderately Susceptible-Moderately Resistant	-	1.5	3.2	5.9	63.3	88.5	1072.6	0.244	490.1
Russet Burbank	Moderately Susceptible-Moderately Resistant	1X	0.7	2.8	11.0	70.2	87.4	1279.0	0.291	498.8
Russet Burbank	Moderately Susceptible-Moderately Resistant	2X	1.1	2.1	6.9	61.7	87.7	1085.6	0.247	527.7
Russet Burbank	Moderately Susceptible-Moderately Resistant	4X	0.2	2.2	5.4	60.6	90.1	1053.1	0.239	547.1
$LSD_{P\ =\ 0.06}$			NS	NS	3.6	6.5	NS	NS	NS	NS
Ranger Russet	Resistant Check	-	2.9	2.9	2.5	15.3	37.1	426.5	0.097	480.3
Ranger Russet	Resistant Check	1X	3.1	1.9	2.3	16.4	48.3	445.7	0.101	482.7
Ranger Russet	Resistant Check	2X	3.3	1.9	2.4	11.1	43.9	392.6	0.089	520.3
Ranger Russet	Resistant Check	4X	2.8	2.2	2.5	15.9	44.6	434.1	0.099	506.4
$LSD_{P\ =\ 0.06}$			NS	0.5	NS	NS	7.0	NS	NS	NS
Dakota Trailblazer	Very Resistant	-	0.3	1.7	1.5	2.8	5.2	90.4	0.021	471.3
Dakota Trailblazer	Very Resistant	1X	0.5	1.5	1.5	3.3	7.4	107.0	0.024	479.4
Dakota Trailblazer	Very Resistant	2X	0.3	1.4	4.0	5.8	10.3	151.3	0.034	447.2
Dakota Trailblazer	Very Resistant	4X	0.6	1.6	1.7	5.2	5.9	129.9	0.030	481.6
$LSD_{P\ =\ 0.06}$			NS	NS	NS	NS	3.4	NS	NS	NS

A significant interaction was observed between the main effects of cultivar and inoculation in percent wilted stems on 8/30 and 9/8 (*P* = 0.05).

No significant interaction was observed between the main effects of cultivar and inoculation in AUWPC, RAUWPC or yield (*P* = 0.05).

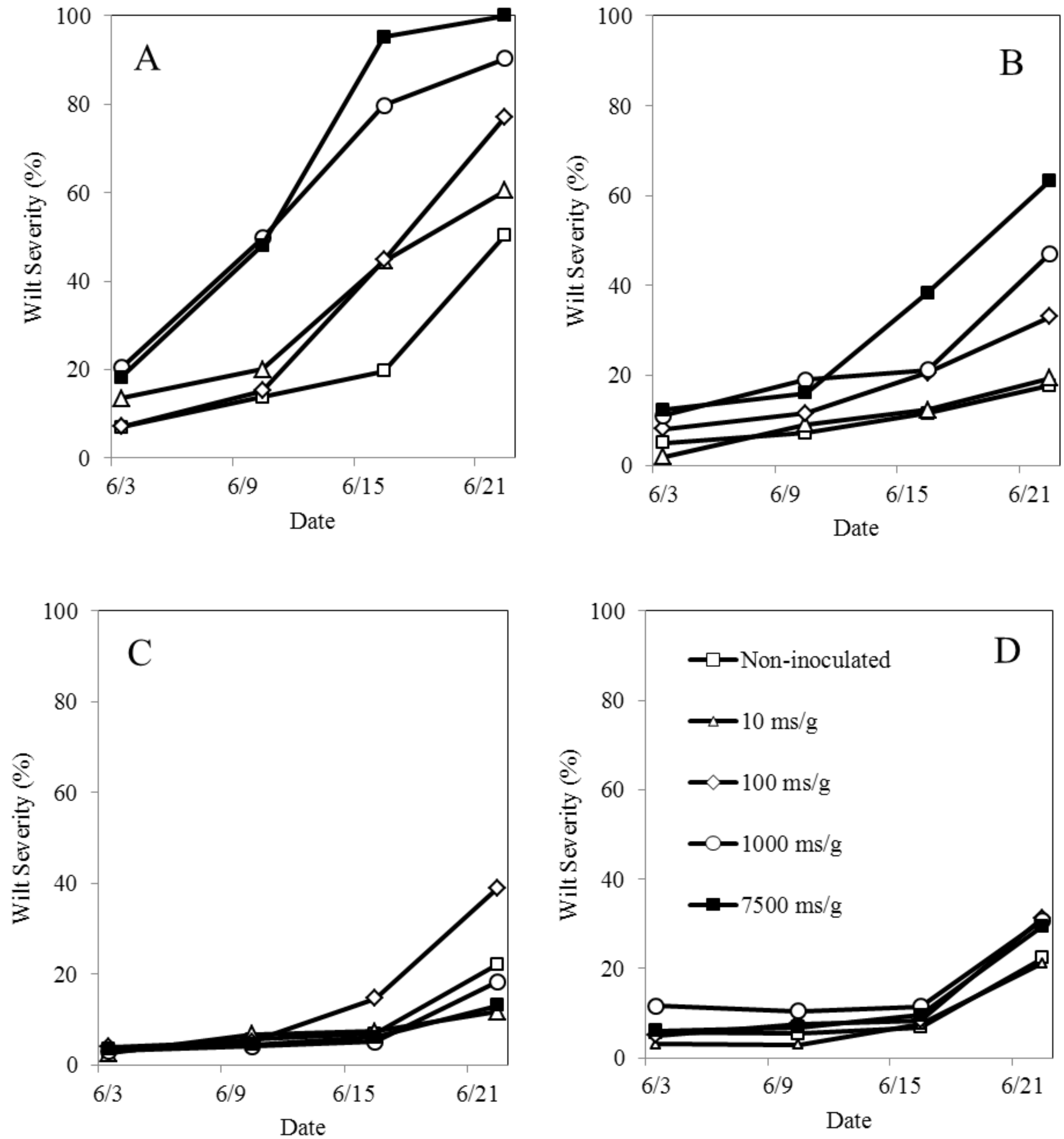

Figure 1. Verticillium wilt severity at five inoculation levels as measured under greenhouse conditions for four russet cultivars [Russet Norkotah (A), Russet Burbank (B), Bannock Russet (C) and Dakota Trailblazer (D)] with varying levels of resistance to Verticillium wilt caused by *Verticillium dahliae*.

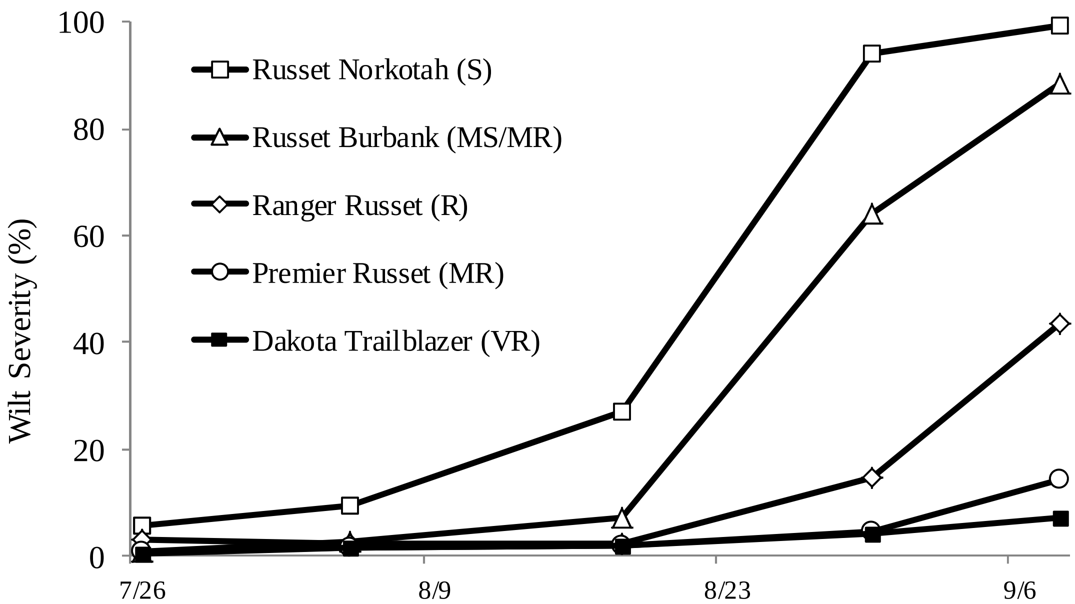

Figure 2. Verticillium wilt severity as measured across the growing season for five russet cultivars with varying levels of resistance to Verticillium wilt caused by *Verticillium dahliae*.

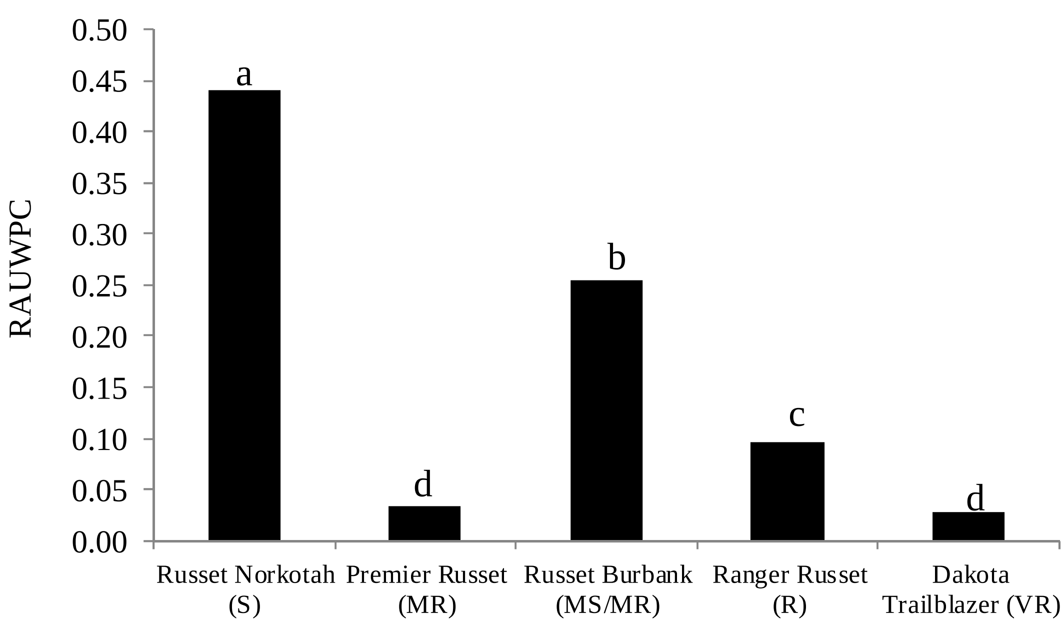

Figure 3. Verticillium wilt severity as measured by relative area under the wilt progress curve (RAWPC) for five russet cultivars with varying levels of resistance to Verticillium wilt caused by *Verticillium dahliae*.

Solida for weed control in irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Irrigation Research site near Inkster, ND to determine the efficacy and selectivity of SOLIDA compared to Matrix FNV on Russet Burbank Potato. Wheat was the previous crop in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 20, 2010. Treatments were applied on June 4 (2 days after hilling) for the PRE applications and June 23 for the POST applications to the middle 2 rows. Crop injury and weed control were evaluated 14 and 45 days after application “A” (DAA A). Water was not limiting as irrigation was scheduled every 3 to 4 days once potatoes had emerged following hilling. Potatoes were machine harvested September 29 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		6/4/10	6/23/10
Treatment:		PRE	POST
Sprayer:	GPA:	20	20
	PSI:	40	40
	Nozzle:	8002	8002
Air temperature (F):		67	65
Relative humidity (%):		77	83
Wind (MPH):		7	7
Soil moisture:		Adequate	Adequate
Cloud cover (%):		0	100

There was no observed crop injury during this trial. The primary weeds that were examined were common lambsquarters, redroot pigweed, and green foxtail. Common lambsquarters was the most abundant of the three, followed by green foxtail, and then redroot pigweed. At 14 DAA A, all PRE treatments provided between 88-91% common lambsquarters control. At 45 DAA A or 26 DAA B, all POST treatments provided significantly greater common lambsquarters control compared to the PRE treatments (>93% and <86%, respectively).

Tuber yields indicated no significance differences among treatments even though yields differed as much as 171 cwt/A. The highest yielding treatment was SOLIDA @ 0.047 lb ai/a + Preference @ 0.25% v/v POST at 600 cwt/a. The treatment with the lowest yield was the untreated at 429 cwt/a.

Table 1. Weed Control 14 and 45 DAA A.

				-----6/18/10-----			-----7/19/10-----		
			App	Colq	RRpw	Grft	Colq	RRpw	Grft
Name	Rate	Unit	Code	-----------------------% Control---------------------					
Untreated				0 b	0 b	0 b	0 c	0 b	0 b
Solida	0.0117	lb a/a	A	89 a	100 a	96 a	85 b	98 a	98 a
Solida	0.0.234	lb a/a	A	88 a	100 a	91 a	86 b	99 a	98 a
Solida	0.047	lb a/a	A	91 a	100 a	99 a	86 b	98 a	100 a
Matrix	0.0234	lb a/a	A	89 a	100 a	99 a	85 b	100 a	100 a
Solida Preference	0.0117 0.25	lb a/a % v/v	B B				94 a	100 a	99 a
Solida Preference	0.0234 0.25	lb a/a % v/v	B B				93 a	100 a	100 a
Solida Preference	0.047 0.25	lb a/a % v/v	B B				94 a	100 a	99 a
Matrix Preference	0.0234 0.25	lb a/a % v/v	B B				94 a	100 a	100 a
			LSD (P ≤.05)	4	0	6	3	2	4

Table 2. Effect of herbicides on yield and grade.

			App	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz
Name	Rate	Unit	Code	-------------------- Cwt/a -------------------					
Untreated				429 a	134 a	124 a	146 a	25 a	295 a
Solida	0.0117	lb a/a	A	589 a	203 a	182 a	188 a	16 a	386 a
Solida	0.0.234	lb a/a	A	449 a	161 a	158 a	118 a	12 a	288 a
Solida	0.047	lb a/a	A	555 a	196 a	176 a	164 a	19 a	359 a
Matrix	0.0234	lb a/a	A	588 a	173 a	180 a	203 a	33 a	415 a
Solida Preference	0.0117 0.25	lb a/a % v/v	B B	498 a	163 a	151 a	153 a	31 a	335 a
Solida Preference	0.0234 0.25	lb a/a % v/v	B B	518 a	168 a	160 a	163 a	27 a	350 a
Solida Preference	0.047 0.25	lb a/a % v/v	B B	600 a	188 a	168 a	201 a	43 a	412 a
Matrix Preference	0.0234 0.25	lb a/a % v/v	B B	598 a	179 a	174 a	204 a	41 a	419 a
			LSD (P ≤.05)	208	62	75	80	33	155

Red Norland desiccation with Vida and Aceto Diquat. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Non-irrigated Research site near Grand Forks, ND to evaluate Vida and Aceto Diquat herbicides as desiccants. Soybean was the previous crop in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (s oz) were planted on 36 inch rows and 12 inch spacing on June 16, 2010. Treatments were applied when potatoes were beginning to senesce on September 14. Two treatments had a second application which occurred on September 21. Treatments were applied to the middle 2 rows. Leaf and stem necrosis data were taken 3 times, September 22, 8 days after application A (DAA A), September 28 (14 DAA A), and October 5 (21 DAA A). Potatoes were machine harvested on October 20 and graded a few weeks later. Application, environmental, and crop data are listed below.

Date:		9/14/10	9/21/10
Treatment:		A	B
Sprayer:	GPA:	20	20
	PSI:	40	40
	Nozzle:	8002	8002
Air temperature (F):		60	53
Relative humidity (%):		55	68
Wind (MPH):		5	11
Soil moisture:		Adequate	Adequate
Cloud cover (%):		75	100
Next rainfall		9/16/10	9/23/10

At 8 DAA A, all treatments quickly burned the leaf tissue, except for Vida @ 5.5 fl oz/a + Herbimax @ 1% v/v + AMS @ 2.5 lb/a. This treatment had 33% leaf necrosis, while all other treatments had >69% desiccation. However, by 21 DAA A, all treatments provided >98% necrosis of both leaves and stems. Tuber yield and grade with the desiccation treatments were similar to the untreated indicating that additional tuber bulking was not occurring.

Table 1. Desiccant data 8, 14, 21 DAA A.

					----9/22/10----		-----9/28/10-----		-----10/5/10-----	
				App	Leaf	Stem	Leaf	Stem	Leaf	Stem
No	Name	Rate	Unit	Code	--------------------% Desiccated----------------------					
1	Untreated				0 d	0 e	0 c	0 c	0 b	0 c
2	Vida Herbimax AMS	5.5 1 2.5	fl oz/a % v/v lb/a	A A A	33 c	10 de	85 b	74 b	100 a	98 b
3	Rely 200 AMS	29 2.5	fl oz/a lb/a	A A	80 a	26 a-d	99 a	93 a	100 a	100 a
4	Vida Rely 200 AMS	2.75 24 2.5	fl oz/a fl oz/a lb/a	A A A	79 a	31 a-d	96 a	91 a	100 a	100 a
5	Vida Reglone Preference AMS	2.75 1 0.25 2.5	fl oz/a pt/a % v/v lb/a	A A A A	79 a	29 a-d	100 a	97 a	100 a	100 a
6	Vida Reglone Herbimax AMS	2.75 1 1 2.5	fl oz/a pt/a % v/v lb/a	A A A A	69 a	18 b-e	96 a	90 a	100 a	100 a
7	Reglone Preference AMS	2 0.25 2.5	pt/a % v/v lb/a	A A A	79 a	40 ab	99 a	96 a	100 a	100 a
8	Reglone Preference Reglone Preference	1 0.25 1 0.25	pt/a % v/v pt/a % v/v	A A B B	70 ab	26 a-d	96 a	92 a	100 a	100 a
9	Aceto Diquat Preference	1 0.25	pt/a %v/v	A A	58 b	15 cde	95 a	89 a	100 a	100 a
10	Aceto Diquat Preference	2 0.25	pt/a % v/v	A A	89 a	48 a	100 a	99 a	100 a	100 a
11	Aceto Diquat Preference Aceto Diquat Preference	1 0.25 1 0.25	pt/a % v/v pt/a % v/v	A A B B	80 a	36 abc	100 a	99 a	100 a	100 a
LSD (P≤.05)					13	15	5	8	1	1

Table 2. Yield and grade.

				App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	> 4 oz
No	Name	Rate	Unit	Code	------------------------------cwt/a------------------------------					
1	Untreated				283 a	78 a	129 a	55 a	20 a	205 a
2	Vida Herbimax AMS	5.5 1 2.5	fl oz/a % v/v lb/a	A A A	265 a	88 a	116 a	41 a	21 a	178 a
3	Rely 200 AMS	29 2.5	fl oz/a lb/a	A A	264 a	89 a	120 a	38 a	18 a	176 a
4	Vida Rely 200 AMS	2.75 24 2.5	fl oz/a fl oz/a lb/a	A A A	261 a	83 a	117 a	39 a	21 a	178 a
5	Vida Reglone Preference AMS	2.75 1 0.25 2.5	fl oz/a pt/a % v/v lb/a	A A A A	268 a	89 a	126 a	37 a	16 a	180 a
6	Vida Reglone Herbimax AMS	2.75 1 1 2.5	fl oz/a pt/a % v/v lb/a	A A A A	269 a	86 a	120 a	43 a	20 a	183 a
7	Reglone Preference AMS	2 0.25 2.5	pt/a % v/v lb/a	A A A	281 a	85 a	118 a	44 a	34 a	196 a
8	Reglone Preference Reglone Preference	1 0.25 1 0.25	pt/a % v/v pt/a % v/v	A A B B	282 a	85 a	136 a	43 a	19 a	197 a
9	Aceto Diquat Preference	1 0.25	pt/a %v/v	A A	262 a	97 a	117 a	33 a	15 a	165 a
10	Aceto Diquat Preference	2 0.25	pt/a % v/v	A A	276 a	88 a	134 a	45 a	9 a	187 a
11	Aceto Diquat Preference Aceto Diquat Preference	1 0.25 1 0.25	pt/a % v/v pt/a % v/v	A A B B	253 a	97 a	113 a	34 a	10 a	157 a
LSD ($P \leq .05$)					36	22	24	12	17	35

Russet Burbank injury from varying glyphosate droplet concentration. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Irrigation Research site near Inkster, ND to evaluate the effect of glyphosate droplet concentration when applied to Russet Burbank potato at different growth stages. Wheat was the previous crop in 2009. Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 17, 2010. Treatments were applied on July 19 (tuber initiation), August 6 (early tuber bulking), and September 8 (late tuber bulking) to the middle 2 rows with a modified ATV sprayer. Roundup Weathermax (5.5 lb/gal ai glyphosate) and AMS @ 4 pounds/100 gallons were used in this trial. Potatoes were machine harvested October 7 and graded a few weeks later. Application, environmental, and crop data are listed below:

Date:		7/19/10			8/6/10			9/8/10	
Treatment:		TI (A)			EB (B)			LB (C)	
Sprayer:	GPA:	5(1)	10(2)	20(3)	5(1)	10(2)	20(3)	5(1)	20(3)
	PSI:	40			40			40	
	Nozzle:	80005	8001	8002	80005	8001	8002	80005	8002
Air temperature (F):		71			72			60	
Relative humidity (%):		69			65			65	
Wind (MPH):		7			5			6	
Soil moisture:		Adequate			Adequate			Adequate	
Cloud cover (%):		5			75			10	

There were no significant yield or grade differences. However, there was a tendency at each growth stage (TI, EB, or LB), for yield to decrease as the rate of glyphosate increased with the exception for 20 GPA at TI and LB. When glyphosate was applied at the TI stage, total tuber counts (averaged 291 tubers) were less than tuber counts for plants treated with glyphosate at the EB and LB stages as well as untreated plants with 329, 310, and 318 tubers/25 ft, respectively. Last year, potato responded in a similar manner, suggesting that for potato, droplet concentration does not increase absorption to the point where yield is affected.

Table 1. Russet Burbank yield and grade.

			App	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz
Name	Rate	Unit	Code	------------------------------cwt/a--------------------------						--------------Tuber counts in 25 feet-------------					Tuber %
Unt				525 a	140 a	139 a	198 a	47 a	385 a	318 a	163 a	78 a	69 a	9 a	49 a
RU*	0.125	lb ai/a	A1	455 a	122 a	119 a	166 a	49 a	333 a	269 a	137 a	66 a	57 a	9 a	49 a
RU*	0.0625	lb ai/a	A1	518 a	118 a	140 a	207 a	54 a	401 a	292 a	133 a	77 a	72 a	10 a	54 a
RU*	0.125	lb ai/a	A2	495 a	141 a	131 a	187 a	37 a	354 a	299 a	155 a	72 a	65 a	7 a	48 a
RU*	0.0625	lb ai/a	A2	520 a	145 a	143 a	176 a	56 a	375 a	315 a	164 a	80 a	62 a	10 a	48 a
RU*	0.125	lb ai/a	A3	496 a	156 a	138 a	183 a	19 a	340 a	323 a	178 a	77 a	64 a	4 a	45 a
RU*	0.0625	lb ai/a	A3	394 a	111 a	134 a	139 a	11 a	283 a	249 a	123 a	74 a	49 a	2 a	51 a
RU*	0.125	lb ai/a	B1	515 a	149 a	149 a	189 a	29 a	366 a	317 a	163 a	83 a	66 a	6 a	49 a
RU*	0.0625	lb ai/a	B1	579 a	163 a	193 a	281 a	55 a	415 a	400 a	184 a	107 a	98 a	11 a	54 a
RU*	0.125	lb ai/a	B2	510 a	140 a	131 a	199 a	39 a	369 a	311 a	162 a	73 a	69 a	7 a	48 a
RU*	0.0625	lb ai/a	B2	521 a	142 a	145 a	187 a	47 a	379 a	310 a	155 a	81 a	66 a	8 a	50 a
RU*	0.125	lb ai/a	B3	503 a	152 a	144 a	168 a	39 a	351 a	323 a	177 a	80 a	59 a	8 a	45 a
RU*	0.0625	lb ai/a	B3	530 a	131 a	141 a	223 a	34 a	399 a	313 a	151 a	78 a	77 a	7 a	52 a
RU*	0.125	lb ai/a	C1	540 a	127 a	146 a	209 a	57 a	413 a	307 a	144 a	81 a	72 a	10 a	53 a
RU*	0.0625	lb ai/a	C1	544 a	148 a	165 a	187 a	45 a	397 a	335 a	170 a	91 a	66 a	8 a	49 a
RU*	0.125	lb ai/a	C3	529 a	122 a	132 a	209 a	66 a	407 a	303 a	145 a	74 a	71 a	12 a	52 a
RU*	0.0625	lb ai/a	C3	504 a	130 a	133 a	180 a	61 a	374 a	395 a	149 a	74 a	62 a	10 a	49 a
*AMS added		LSD ($P \leq .05$)		124	56	54	83	38	129	91	64	30	28	7	14

Red Lasoda injury from simulated glyphosate drift. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Non-Irrigation Research site near Grand Forks, ND to evaluate glyphosate drift at different growth stages on Red Lasoda Potato. Soybeans were grown in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 16, 2010. Treatments were applied on July 29 (tuber initiation), August 19 (early tuber bulking), and September 8 (late tuber bulking) to the middle 2 rows with a modified ATV sprayer. Roundup Weathermax (5.5 lb/gal ai glyphosate) and AMS @ 4 pounds/100 gallons were used in this trial. Potatoes were machine harvested October 20 and graded a few weeks later. Application, environmental, and crop data are listed below:

Date:		7/29/10	8/19/10	9/8/10
Treatment:		TI	ETB	LTB
Sprayer:	GPA:	5	5	5
	PSI:	40	40	40
	Nozzle:	80005	80005	80005
Air temperature (F):		75	69	62
Relative humidity (%):		58	63	60
Wind (MPH):		6	10	6
Soil moisture:		Adequate	Adequate	Adequate
Cloud cover (%):		10	0	10
Next rain:		7/30/10	8/23/10	9/10/10

Glyphosate at the rate of 0.25 lb ai/a at either the tuber initiation (TI), early tuber bulking (EB), and late tuber bulking (LB) stage had the greatest affect on yield. The lowest yield was when plants were treated with 0.25 lb ai/a glyphosate at the EB stage with 103 cwt/a, followed by 0.25 lb ai/a glyphosate at the TI stage with 150 cwt/a, and 0.25 and 0.125 lb ai/a glyphosate at the LB and EB stages, respectively, with 165 cwt/a. The highest yield was from untreated plants with 326 cwt/a. The next three highest yields were from plants treated with 0.0625 lb ai/a glyphosate at the LB, TI, and EB stages, respectively. Tuber counts in 20 feet showed similar results with the greatest tuber production from plants receiving the lowest rate of glyphosate or untreated plants. Plants treated with glyphosate @ 0.25 lb ai/a produced the fewest tubers at all three application timings.

Table 1. Effect of glyphosate drift on yield and grade on Red Lasoda potatoes.

			App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz
Name	Rate	Unit	Time	-----------------------------cwt/a-----------------------------						--------------Tuber counts in 20 feet--------------					Tuber %
Unt				326 a	55 a	96 a	47 ab	128 a	271 a	132 ab	65 ab	35 a	13 a	19 a	50 a
RU*	.25	lb ai/a	TI	150 cd	54 a	34 d	15 cd	46 bc	96 cd	93 bcd	69 ab	13 d	4 bc	7 bc	25 c
RU*	.125	lb ai/a	TI	213 bc	72 a	67 abc	31 a-d	44 bc	142 bcd	130 ab	88 a	26 abc	9 abc	7 bc	32 bc
RU*	.0625	lb ai/a	TI	309 a	67 a	96 a	50 a	96 ab	241 a	141 a	77 ab	35 a	13 a	15 ab	46 ab
RU*	.25	lb ai/a	EB	103 d	39 a	38 d	12 d	14 c	65 d	66 d	45 b	15 cd	4 c	2 c	31 bc
RU*	.125	lb ai/a	EB	165 cd	63 a	48 cd	18 cd	36 bc	102 cd	105 a-d	75 ab	18 bcd	5 bc	6 c	27 c
RU*	.0625	lb ai/a	EB	280 ab	73 a	79 ab	35 abc	93 ab	207 ab	139 a	85 a	30 ab	10 ab	15 ab	39 abc
RU*	.25	lb ai/a	LB	165 cd	42 a	61 bcd	27 bcd	35 bc	123 cd	79 cd	43 b	23 a-d	7 abc	6 c	46 ab
RU*	.125	lb ai/a	LB	210 bc	46 a	72 abc	35 abc	57 bc	164 bc	94 bcd	49 b	26 abc	10 ab	9 bc	48 a
RU*	.0625	lb ai/a	LB	308 a	51 a	80 ab	43 ab	134 a	257 a	117 abc	55 ab	29 ab	12 a	21 a	53 a
*AMS added		LSD (P≤.05)		63	21	21	14	41	58	28	21	8	4	6	11

Red Norland injury from simulated glyphosate drift. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Non-Irrigation Research site near Grand Forks, ND to evaluate glyphosate drift at different growth stages on Red Norland Potato. Soybean was the previous crop in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 16, 2010. Treatments were applied on July 29 (tuber initiation-TI), August 19 (early tuber bulking-EB), and September 8 (late tuber bulking-LB) to the middle 2 rows with a modified ATV sprayer. Roundup Weathermax (5.5 lb/gal ai glyphosate) and AMS @ 4 pounds/100 gallons were used in this trial. Potatoes were machine harvested October 20 and graded a few weeks later. Application, environmental, and crop data are listed below:

Date:		7/29/10	8/19/10	9/8/10
Treatment:		TI	ETB	LTB
Sprayer:	GPA:	5	5	5
	PSI:	40	40	40
	Nozzle:	80005	80005	80005
Air temperature (F):		75	69	62
Relative humidity (%):		58	63	60
Wind (MPH):		6	10	6
Soil moisture:		Adequate	Adequate	Adequate
Cloud cover (%):		10	0	10
Next rain:		7/30/10	8/23/10	9/10/10

Glyphosate applied at the tuber initiation (TI) stage showed to have the greatest effect on yield and tuber counts for this cultivar. Glyphosate applied at 0.25 and 0.125 lb ai/a (TI stage) had a total yield of 24 and 79 cwt/a, respectively. The untreated had the highest yield with 268 cwt/a. Glyphosate applied at 0.25 lb ai/a (TI stage) had no tuber >4 oz, while the 0.125 lb ai/a had only 8 cwt/a. The untreated had the highest "A" size yield with 169 cwt/a >4 oz. Glyphosate applied at 0.25 lb ai/a (TI stage) only had 57 tubers in 20 feet of row or 2.85 tubers/plant while the untreated had 160 tubers in 20 feet or 8 tubers/plant.

Table 1. Effect of glyphosate drift on yield and grade on Red Norland potatoes.

			App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz
Name	Rate	Unit	Code	-----------------------------cwt/a-----------------------------						--------------Tuber counts in 20 feet---------------					Tuber %
Unt				268 a	99 ab	113 a	39 a	17 a	169 a	160 a	101 abc	45 a	12 a	3 a	39 a
RU*	.25	lb ai/a	TI	24 b	24 c	0 b	0 b	0 a	0 b	57 b	57 c	0 b	0 b	0 a	0 c
RU*	.125	lb ai/a	TI	79 b	71 b	8 b	0 b	0 a	8 b	112 a	108 ab	4 b	0 b	0 a	3 c
RU*	.0625	lb ai/a	TI	174 a	113 a	48 ab	11 ab	1 a	60 ab	162 a	139 a	20 ab	4 ab	.3 a	13 bc
RU*	.25	lb ai/a	EB	216 a	90 ab	98 a	24 ab	4 a	126 a	139 a	91 bc	40 a	7 ab	.8 a	34 a
RU*	.125	lb ai/a	EB	194 a	100 ab	72 a	18 ab	4 a	95 ab	153 a	117 ab	30 a	6 ab	.8 a	24 ab
RU*	.0625	lb ai/a	EB	230 a	84 ab	92 a	31 a	23 a	146 a	137 a	88 bc	36 a	9 a	4.3 a	35 a
RU*	.25	lb ai/a	LB	211 a	92 ab	90 a	21 ab	9 a	120 a	136 a	90 bc	37 a	6 ab	1.8 a	34 a
RU*	.125	lb ai/a	LB	221 a	91 ab	88 a	30 a	12 a	130 a	138 a	91 bc	36 a	9 a	2.3 a	34 a
RU*	.0625	lb ai/a	LB	245 a	98 ab	104 a	28 a	15 a	146 a	146 a	93 bc	43 a	9 a	2.8 a	36 a
*AMS added		LSD (P=.05)		82	24	49	18	17	76	33	30	19	5	3.2	13

Sangre injury from simulated glyphosate drift. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Non-Irrigation Research site near Grand Forks, ND to evaluate glyphosate drift at different growth stages on Sangre Potato. Soybeans were grown in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 24, 2010. Treatments were applied on August 6 (tuber initiation-TI), August 25 (early tuber bulking-EB), and September 14 (late tuber bulking-LB) to the middle 2 rows with a modified ATV sprayer. Roundup Weathermax (5.5 lb/gal ai glyphosate) and AMS @ 4 pounds/100 gallons were used in this trial. Potatoes were machine harvested October 20 and graded a few weeks later. Application, environmental, and crop data are listed below:

Date:		8/6/10	8/25/10	9/14/10
Treatment:		TI	ETB	LTB
Sprayer:	GPA:	5	5	5
	PSI:	40	40	40
	Nozzle:	80005	80005	80005
Air temperature (F):		65	66	61
Relative humidity (%):		80	50	50
Wind (MPH):		3	7	5
Soil moisture:		Adequate	Adequate	Adequate
Cloud cover (%):		10	0	75
Next rain:		8/10/10	8/30/10	9/16/10

Glyphosate at the rate of 0.25 lb ai/a at either the tuber initiation (TI), early tuber bulking (EB), and late tuber bulking (LB) stage had the greatest affect on yield. The lowest yield was when glyphosate @ 0.25 lb ai/a was applied at the EB stage with 47 cwt/a, followed by glyphosate @ 0.25 lb ai/a applied at the LB stage with 76 cwt/a. The highest yield was when glyphosate @ 0.0625 lb ai/a was applied at TI with 216 cwt/a. The untreated plants had the second highest yield with 194 cwt/a, and was followed by plants treated with 0.0625 lb ai/a glyphosate at EB, and LB, respectively. Tuber counts in 20 feet of row showed that plants treated with 0.0625 lb ai/a glyphosate at the EB stage produced the most tubers, with 135, followed by plants treated with 0.25 lb ai/a glyphosate at the TI stage with 118 tubers. The untreated plants were in the middle of total tuber counts, but had 49% of the tubers > 4 oz. The highest percentage of “A-size” tubers was from plants treated with 0.0625 lb ai/a glyphosate at the TI stage with 51%. Plants within all glyphosate treatments of 0.625 lb ai/a, regardless of the growth stage timing, produced more “A-size” tubers compared to plants receiving higher glyphosate rates.

Table 1. Effect of glyphosate drift on yield and grade on Sangre potatoes.

			App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz
Name	Rate	Unit	Code	------------------------------cwt/a------------------------------						--------------Tuber counts in 20 feet--------------					Tuber %
Unt				194 ab	37 a	59 a	31 a	67 a	157 ab	85 ab	43 b	21 ab	9 a	12 a	49 ab
RU*	.25	lb ai/a	A	150 abc	71 a	51 ab	19 ab	8 b	78 a-d	118 ab	91 ab	20 ab	6 ab	2 b	23 bcd
RU*	.125	lb ai/a	A	138 abc	50 a	54 ab	21 ab	12 b	88 a-d	83 ab	54 ab	22 ab	6 ab	2 b	43 abc
RU*	.0625	lb ai/a	A	216 a	47 a	73 a	28 ab	68 a	169 a	95 ab	47 ab	27 a	8 ab	12 a	51 a
RU*	.25	lb ai/a	B	47 c	35 a	6 b	3 b	3 b	12 d	67 b	63 ab	3 b	1 b	1 b	6 d
RU*	.125	lb ai/a	B	118 abc	56 a	29 ab	12 ab	20 b	62 bcd	95 ab	77 ab	11 ab	3 ab	4 b	20 cd
RU*	.0625	lb ai/a	B	188 ab	78 a	63 a	23 ab	25 b	110 abc	135 a	99 a	25 a	7 ab	4 b	27 a-d
RU*	.25	lb ai/a	C	76 bc	38 a	25 ab	3 b	10 b	38 cd	59 b	45 ab	11 ab	1 b	2 b	24 bcd
RU*	.125	lb ai/a	C	118 abc	45 a	43 ab	19 ab	12 b	74 bcd	76 ab	52 ab	16 ab	5 ab	2 b	30 a-d
RU*	.0625	lb ai/a	C	182 ab	45 a	54 ab	24 ab	58 a	137 ab	88 ab	51 ab	20 ab	7 ab	10 a	42 abc
*AMS added		LSD (P≤.05)		74	27	33	17	20	61	39	33	13	4	4	17

2010 Nutrisphere – Harlene Hatterman-Valenti and Collin Auwarter. The study was conducted at the Northern Plains Potato Grower's Association Irrigation Research site near Inkster, ND to evaluate if nitrogen applications during the growing season could be reduced. The study was conducted on a sandy loam soil with 2.4% O.M., 6.2 ph, and 12 lbs of residual N. Wheat was the previous crop during 2009. Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 17, 2010. Treatments were hilled June 3. Potash was the potassium source and was applied prior to planting (May 12). Phosphorus was applied before planting as MAP and at planting as 10-34-0. Nitrogen applications were made prior to planting, at planting (10-34-0 starter), hilling, June 30, and July 30. The standard grower practice (treatment 1) consisted of five nitrogen applications. The goal of total nitrogen for the year was 230 lbs/A. Potatoes were machine harvested September 30 and graded in late November.

Treatment 1: 100% N as GSP
May 12: 59N
May 17: 29N
June 3: 50N
June 30: 50N
July 30: 30N

Treatment 2: 85% N as GSP
May 12: 44N
May 17: 29N
June 3: 37N
June 30: 37N
July 30: 37N

Treatment 3: 100% NUT PPI
May 12: 26N + 163 NUT
May 17: 29N

Treatment 4: 100% NUT Split App(60% PPI & 40% @ hilling)
May 12: 26N + 98 NUT
May 17: 29N
June 3: 65 NUT

Treatment 5: 85% NUT PPI
May 12: 26N + 128 NUT
May 17: 29N

Treatment 6: 85% NUT Split App (60% PPI & 40% @ hilling)
May 12: 26N + 77 NUT
May 17: 29N
June 3: 51 NUT

Treatment 7: 100% ESN
May 12: 26N + 163 ESN
May 17: 29N

Treatment 8: 100% N + ESN
May 12: 61N + 128 ESN
May 17: 29N

Results:
The highest total yielding treatment was Treatment 1, having 629 cwt/a, in which 449 cwt/a was marketable. However, treatment 2, at 85% of GSP, had a total yield of 465 cwt/a, only 74% as productive as the 100% GSP. The treatments including Nutrisphere (100% vs 85% Nut PPI, and 100% vs 85% NUT split app) showed a slight difference versus comparable treatments. Treatment 5 (85% Nut PPI) had only a 13% yield loss compared to treatment 3 (100% Nut PPI), while treatment 6 (85% Nut split app) had an 11% decrease in total yield compared to treatment 4 (100% Nut split app). There were significant difference in marketable yield between treatments 1 3, and 4. Treatment 3 was the second highest total yielding treatment with 542 cwt/a, and a marketable yield of 395 cwt/a. This was significantly less than treatment 1 for total yield but not for marketable yield. The lowest total and marketable yielding treatment was treatment 2 with 449 cwt/a and 291 cwt/a, respectively. Total tubers counted showed that the main differences in yield came from the number of tubers in the 6-8 oz and 8-10 oz categories. All treatments had tuber counts between 323 and 395.

Crop Code	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU
BBCH Scale	BPOT	BPOT	BPOT	BPOT	BPOT	BPOT	BPOT
Crop Name	Potato	Potato	Potato	Potato	Potato	Potato	Potato
Crop Variety	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>
Description	Total	0-4 oz	4-6 oz	6-8 oz	8-10 oz	10-12 oz	>12 oz
Rating Date	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10
Rating Data Type	YIELD	YIELD	YIELD	YIELD	YIELD	YIELD	YIELD
Rating Unit	LB	LB	LB	LB	LB	LB	LB
Sample Size	25	25	25	25	25	25	25
Sample Size Unit	FT	FT	FT	FT	FT	FT	FT
Days After First/Last Applic.	164 164	164 164	164 164	164 164	164 164	164 164	164 164
Trt-Eval Interval	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A
Plant-Eval Interval	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1
No Treatment							
1 100% N as GSP	108.4 a	31.1 a	27.4 a	21.5 a	14.3 a	6.4 a	7.7 a
2 85% N as GSP	80.0 c	29.9 a	23.5 a	13.0 b	6.6 b	3.1 a	4.0 a
3 100% NUT as PPI	93.4 b	25.4 a	24.7 a	16.2 b	10.5 ab	6.6 a	10.0 a
4 100% NUT Split (60% NUT as PPI 40% @ hilling)	92.9 b	26.9 a	25.7 a	16.3 b	10.3 ab	6.1 a	7.5 a
5 85% NUT as PPI	81.3 c	28.7 a	22.9 a	13.2 b	9.2 ab	3.3 a	4.0 a
6 85% NUT Split (60% NUT as PPI 40% @ hilling)	83.0 bc	28.6 a	24.0 a	14.1 b	8.4 ab	3.5 a	4.5 a
7 100% ESN as PPI	92.1 b	30.4 a	24.8 a	16.5 b	8.9 ab	5.1 a	6.5 a
8 85% ESN as PPI	86.5 bc	31.0 a	23.7 a	13.9 b	6.9 b	5.6 a	5.4 a
LSD (P=.05)	7.5	7.9	2.9	3.4	4.0	3.2	4.3
Standard Deviation	5.0958	5.40039689	1.9920	2.335493083	2.7506	2.156590439	2.956914244
CV	5.68	18.62	8.1	14.98	29.34	43.61	47.69
Bartlett's X2	2.685	13.164	2.888	7.32	4.576	3.203	13.415
P(Bartlett's X2)	0.913	0.068	0.895	0.396	0.712	0.866	0.063
Replicate F	5.460	1.121	5.445	2.632	0.768	0.676	0.580
Replicate Prob(F)	0.0062	0.3629	0.0063	0.0766	0.5246	0.5762	0.6344
Treatment F	13.132	0.564	2.069	5.669	3.160	1.856	2.044
Treatment Prob(F)	0.0001	0.7766	0.0933	0.0009	0.0191	0.1289	0.0969

Crop Code	SOLTU		SOLTU		SOLTU		SOLTU		SOLTU		SOLTU		SOLTU	
BBCH Scale	BPOT		BPOT		BPOT		BPOT		BPOT		BPOT		BPOT	
Crop Name	Potato		Potato		Potato		Potato		Potato		Potato		Potato	
Crop Variety	Russet Burb>		Russet Burb>		Russet Burb>		Russet Burb>		Russet Burb>		Russet Burb>		Russet Burb>	
Description	Total CWT		0-4 oz		4-6 oz		6-8 oz		8-10 oz		10-12 oz		>12 oz	
Rating Date	15/11/10		15/11/10		15/11/10		15/11/10		15/11/10		15/11/10		15/11/10	
Rating Data Type	YIELD		YIELD		YIELD		YIELD		YIELD		YIELD		YIELD	
Rating Unit	CWT		CWT		CWT		CWT		CWT		CWT		CWT	
Sample Size	1		1		1		1		1		1		1	
Sample Size Unit	A		A		A		A		A		A		A	
Days After First/Last Applic.	164	164	164	164	164	164	164	164	164	164	164	164	164	164
Trt-Eval Interval	164 DA-A		164 DA-A		164 DA-A		164 DA-A		164 DA-A		164 DA-A		164 DA-A	
Plant-Eval Interval	178 DP-1		178 DP-1		178 DP-1		178 DP-1		178 DP-1		178 DP-1		178 DP-1	
No Treatment														
1 100% N as GSP	629.4	a	180.7	a	159.0	a	124.8	a	83.1	a	37.0	a	44.7	a
2 85% N as GSP	464.8	c	173.6	a	136.4	a	75.4	b	38.3	b	17.8	a	23.4	a
3 100% NUT as PPI	542.3	b	147.5	a	143.5	a	94.0	b	61.1	ab	38.4	a	57.8	a
4 100% NUT Split (60% NUT as PPI 40% @ hilling)	539.5	b	156.2	a	149.6	a	94.9	b	59.7	ab	35.5	a	43.7	a
5 85% NUT as PPI	472.3	c	166.8	a	132.9	a	76.8	b	53.5	ab	19.0	a	23.2	a
6 85% NUT Split (60% NUT as PPI 40% @ hilling)	482.2	bc	166.1	a	139.5	a	81.6	b	48.6	ab	20.2	a	26.1	a
7 100% ESN as PPI	535.1	b	176.4	a	144.0	a	95.8	b	51.4	ab	29.7	a	37.8	a
8 85% ESN as PPI	502.2	bc	180.0	a	137.9	a	80.8	b	39.8	b	32.3	a	31.4	a
LSD (P=.05)	43.5		46.1		17.0		20.0		23.5		18.4		25.3	
Standard Deviation	29.5970737		31.3695		11.5682		13.5657		15.9748808		12.5262		17.1748	
CV	5.68		18.63		8.1		14.99		29.34		43.62		47.7	
Bartlett's X2	2.687		13.164		2.892		7.315		4.581		3.201		13.44	
P(Bartlett's X2)	0.912		0.068		0.895		0.397		0.711		0.866		0.062	
Replicate F	5.461		1.122		5.446		2.631		0.768		0.677		0.580	
Replicate Prob(F)	0.0062		0.3628		0.0063		0.0767		0.5248		0.5761		0.6346	
Treatment F	13.133		0.564		2.070		5.669		3.163		1.857		2.042	
Treatment Prob(F)	0.0001		0.7763		0.0932		0.0009		0.0191		0.1286		0.0972	

Crop Code	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU	SOLTU
BBCH Scale	BPOT	BPOT	BPOT	BPOT	BPOT	BPOT	BPOT	BPOT
Crop Name	Potato	Potato	Potato	Potato	Potato	Potato	Potato	Potato
Crop Variety	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>	Russet Burb>
Description	> 4 oz	Total	0-4 oz	4-6 oz	6-8 oz	8-10 oz	10-12 oz	>12 oz
Rating Date	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10	15/11/10
Rating Data Type	YIELD	YIELD	YIELD	YIELD	YIELD	YIELD	YIELD	YIELD
Rating Unit	CWT	# Tubers	# Tubers	# Tubers	# Tubers	# Tubers	# Tubers	# Tubers
Sample Size	1	25	25	25	25	25	25	25
Sample Size Unit	A	FT	FT	FT	FT	FT	FT	FT
Days After First/Last Applic.	164 164	164 164	164 164	164 164	164 164	164 164	164 164	164 164
Trt-Eval Interval	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A	164 DA-A
Plant-Eval Interval	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1	178 DP-1
No Treatment								
1 100% N as GSP	449 a	395 a	214.4 a	88.1 a	49.3 a	25.6 a	9.4 a	8.6 a
2 85% N as GSP	291 d	328 a	200.4 a	76.4 a	30.3 b	11.9 b	4.5 a	4.5 a
3 100% NUT as PPI	395 ab	328 a	171.6 a	79.9 a	37.3 b	18.9 ab	9.8 a	10.8 a
4 100% NUT Split (60% NUT as PPI 40% @ hilling)	383 abc	336 a	179.6 a	83.5 a	37.8 b	18.3 ab	9.0 a	8.1 a
5 85% NUT as PPI	305 cd	323 a	192.4 a	74.3 a	30.5 b	16.5 ab	4.8 a	4.4 a
6 85% NUT Split (60% NUT as PPI 40% @ hilling)	316 bcd	327 a	192.0 a	77.6 a	32.8 b	15.0 ab	5.0 a	4.4 a
7 100% ESN as PPI	359 bcd	349 a	199.6 a	80.5 a	38.1 b	16.0 ab	7.5 a	6.8 a
8 85% ESN as PPI	322 bcd	339 a	203.5 a	77.3 a	32.4 b	12.4 b	8.1 a	5.4 a
LSD (P=.05)	58	49.2	54.5	9.7	7.8	7.2	4.6	4.5
Standard Deviation	39.2507	33.47	37.07	6.58	5.31	4.87	3.11	3.08
CV	11.13	9.83	19.09	8.26	14.73	28.98	42.92	46.43
Bartlett's X2	4.232	9.649	15.508	2.125	7.473	4.555	3.454	13.345
P(Bartlett's X2)	0.753	0.209	0.03*	0.953	0.381	0.714	0.84	0.064
Replicate F	3.279	2.098	1.475	5.360	2.719	0.776	0.725	0.495
Replicate Prob(F)	0.0411	0.1311	0.2501	0.0067	0.0704	0.5202	0.5483	0.6893
Treatment F	7.509	1.994	0.537	1.809	5.510	3.179	1.979	2.352
Treatment Prob(F)	0.0001	0.1045	0.7969	0.1384	0.0011	0.0186	0.1069	0.0611

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Pruvin for weed control in irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Irrigation Research site near Inkster, ND to evaluate and compare the efficacy of Pruvin 25DF with Matrix 25DF on Russet Burbank Potato. Wheat was grown in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 17, 2010. Treatments were applied on June 4 (2 days after hilling) for the PRE applications and June 23 for the POST applications to the middle 2 rows. Crop injury and weed control were evaluated 14 and 45 DAA A. Water was not a limiting as irrigation was scheduled every 3 to 4 d once potatoes had emerged following hilling. Potatoes were machine harvested September 30 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		6/4/10	6/23/10
Treatment:		PRE	POST
Sprayer:	GPA:	20	20
	PSI:	40	40
	Nozzle:	8002	8002
Air temperature (F):		64	65
Relative humidity (%):		89	83
Wind (MPH):		7	7
Soil moisture:		Adequate	Adequate
Cloud cover (%):		0	100

There was no crop injury observed during the trial. The primary weeds that were examined were common lambsquarters, redroot pigweed, and green foxtail. Common lambsquarters was the most prevalent of the three, followed by green foxtail, and then redroot pigweed. Both PRE treatments of Pruvin 25 DF @ 1 oz/a + Metribuzin 480F @ 8 fl oz/a, and Matrix @ 1 oz/a + Metribuzin 480F @ 8 fl oz/a had 97% control of common lambsquarters 14 DAA. All other PRE treatments had between 84-88% control of common lambsquarters 14 DAA A. At 45 DAA A, all POST treatments provided greater control of common lambsquarters compared to PRE treatments with the exception of the two previously mentioned PRE treatments (95% and 94%, respectively 45 DAA A).
Yields showed no significant differences among treatments. The highest yielding treatments were Matrix @ 1 oz/a + Preference @ 0.2% v/v POST with 619 cwt/a, Matrix @ 0.5 oz/a + Preference @ 0.2% v/v POST with 590 cwt/a, and Pruvin 25 DF @ 1.5 oz/A PRE with 579 cwt/a. The lowest yielding treatments were Matrix @ 1.5 oz/a with 463 cwt/a, Pruvin 25 DF @ 1 oz/a + Preference @ 0.2% v/v POST with 470 cwt/a, Sencor 75 DF @ 0.67 lb/a + Select Max @ 16 fl oz/a + Destiny @ 1% v/v with 512 cwt/a, and untreated with 517 cwt/a.

Table 1. Weed Control 14 and 45 DAA A.

				-----6/18/10-----			-----7/19/10-----		
			App	Colq	RRpw	Grft	Colq	RRpw	Grft
Name	Rate	Unit	Code	------------------------% Control----------------------					
Unt				0 c	0 b	0 b	0 e	0 b	0 b
Pruvin 25 DF	0.5	oz/a	A	85 b	100 a	95 a	84 d	100 a	99 a
Matrix	0.5	oz/a	A	84 b	100 a	99 a	84 d	100 a	100 a
Pruvin 25 DF	1	oz/a	A	88 b	100 a	98 a	84 d	100 a	98 a
Matrix	1	oz/a	A	85 b	100 a	95 a	86 cd	100 a	100 a
Pruvin 25 DF	1.5	oz/a	A	86 b	100 a	99 a	88 bcd	100 a	100 a
Matrix	1.5	oz/a	A	86 b	100 a	98 a	84 d	100 a	100 a
Pruvin 25 DF Metribuzin 480 F	1 8	oz/a oz/a	A A	97 a	100 a	99 a	95 a	100 a	100 a
Matrix Metribuzin 480 F	1 8	oz/a oz/a	A A	97 a	100 a	98 a	94 ab	100 a	100 a
Pruvin 25 DF Preference	0.5 0.2	oz/a % v/v	B B				86 cd	100 a	95 a
Matrix Preference	0.5 0.2	oz/a % v/v	B B				91 abc	100 a	99 a
Pruvin 25 DF Preference	1 0.2	oz/a % v/v	B B				91 abc	100 a	100 a
Matrix Preference	1 0.2	oz/a % v/v	B B				95 a	100 a	99 a
Pruvin 25 DF Preference	1.5 0.2	oz/a % v/v	B B				94 ab	100 a	99 a
Matrix Preference	1.5 0.2	oz/a % v/v	B B				94 ab	100 a	99 a
Pruvin 25 DF Metribuzin 480 F Preference	1 8 0.2	oz/a oz/a % v/v	B B B				93 abc	100 a	99 a
Matrix Metribuzin 480 F Preference	1 8 0.2	oz/a oz/a % v/v	B B B				96 a	100 a	95 a
Sencor 75 DF Select Max Destiny	0.67 16 1	lb/a oz/a % v/v	B B B				98 a	100 a	99 a
			LSD (P≤ .05)	4	0	5	4	0	4

Table 2. Effect of herbicides on yield and grade.

			App	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz
Name	Rate	Unit	Code	---------------------------cwt/a---------------------------					
Unt				517 a	130 a	169 a	169 a	49 a	387 a
Pruvin 25 DF	0.5	oz/a	A	530 a	135 a	150 a	199 a	46 a	397 a
Matrix	0.5	oz/a	A	530 a	138 a	149 a	176 a	68 a	392 a
Pruvin 25 DF	1	oz/a	A	537 a	135 a	137 a	231 a	34 a	402 a
Matrix	1	oz/a	A	539 a	167 a	166 a	179 a	27 a	372 a
Pruvin 25 DF	1.5	oz/a	A	579 a	128 a	174 a	223 a	55 a	451 a
Matrix	1.5	oz/a	A	463 a	126 a	130 a	156 a	51 a	337 a
Pruvin 25 DF Metribuzin 480 F	1 8	oz/a oz/a	A A	569 a	192 a	169 a	175 a	33 a	377 a
Matrix Metribuzin 480 F	1 8	oz/a oz/a	A A	533 a	147 a	136 a	220 a	31 a	387 a
Pruvin 25 DF Preference	0.5 0.2	oz/a % v/v	B B	542 a	148 a	149 a	203 a	42 a	394 a
Matrix Preference	0.5 0.2	oz/a % v/v	B B	590 a	144 a	170 a	231 a	45 a	446 a
Pruvin 25 DF Preference	1 0.2	oz/a % v/v	B B	470 a	126 a	130 a	153 a	61 a	344 a
Matrix Preference	1 0.2	oz/a % v/v	B B	619 a	132 a	157 a	252 a	79 a	487 a
Pruvin 25 DF Preference	1.5 0.2	oz/a % v/v	B B	562 a	123 a	122 a	243 a	74 a	439 a
Matrix Preference	1.5 0.2	oz/a % v/v	B B	558 a	153 a	142 a	220 a	43 a	405 a
Pruvin 25 DF Metribuzin 480 F Preference	1 8 0.2	oz/a oz/a % v/v	B B B	534 a	138 a	146 a	208 a	41 a	396 a
Matrix Metribuzin 480 F Preference	1 8 0.2	oz/a oz/a % v/v	B B B	563 a	113 a	136 a	254 a	59 a	450 a
Sencor 75 DF Select Max Destiny	0.67 16 1	lb/a oz/a % v/v	B B B	512 a	137 a	151 a	200 a	25 a	375 a
LSD (P≤.05)				103	49	41	74	44	107

Reflex combinations for weed control in Ranger Russet. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Irrigation Research site near Inkster, ND to evaluate crop tolerance and weed control of Reflex +/- Dual or +/- Boundary as a pre-emergence treatment in Ranger Russet Potato. The previous crop was wheat. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 21, 2010. Treatments were applied on June 4 (2 days after hilling) to the middle 2 rows. Crop injury and weed control were evaluated 14 and 45 days after application (DAA). Water was not a limiting as irrigation was scheduled every 3 to 4 days once potatoes had emerged following hilling. Potatoes were machine harvested September 29 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		6/4/10
Treatment:		PRE
Sprayer:	GPA:	20
	PSI:	40
	Nozzle:	8002
Air temperature (F):		67
Relative humidity (%):		77
Wind (MPH):		9
Soil moisture:		Adequate
Cloud cover (%):		0

No crop injury was observed in this trial. The primary weeds that were examined were common lambsquarters, redroot pigweed, and green foxtail. Common lambsquarters had the most abundant of the three, followed by green foxtail, and then redroot pigweed. At 14 DAA, Sencor @ 0.67 lb/a + Outlook @ 16 fl oz (100%) and Reflex @ 1 pt/a + Boundary @ 1.5 pt/a (98%) provided significantly better common lambsquarters control compared to the other treatments (<96%). Results were similar at 45 DAA for common lambsquarters control.

Matrix @ 1 oz/a + Outlook @ 16 fl oz/a had the highest yield with 551 cwt/a, which was significantly greater than the untreated. Plants treated with Reflex @ 1 pt/a + Dual Magnum @ 1 pt/a had the second highest yield at 522 cwt/a. The untreated plants had the lowest yield with 374 cwt/a.

Table 1. Weed Control 14 and 45 DAA.

No	Name	Rate	Unit	App Code	------6/18/10------ Colq	RRpw	Grft	-------7/19/10------- Colq	RRpw	Grft
					-----------------------% Control---------------------					
1	Untreated				0 d	0 b	0 c	0 c	0 b	0 b
2	Reflex 2SL	1	pt/a	A	90 c	100 a	88 b	90 b	100 a	91 a
3	Reflex 2SL	2	pt/a	A	96 ab	100 a	90 ab	93 b	100 a	94 a
4	Reflex 2SL Dual Magnum	1 1	pt/a pt/a	A	96 ab	100 a	91 ab	91 b	100 a	95 a
5	Reflex 2SL Boundary	1 1.5	pt/a pt/a	A	98 a	100 a	91 ab	97 a	100 a	94 a
6	Matrix Outlook	1 16	oz/a fl oz/a	A	94 b	100 a	93 ab	90 b	100 a	96 a
7	Sencor 75DF Outlook	0.67 16	lb/a fl oz/a	A	100 a	100 a	95 a	98 a	100 a	96 a
				LSD (P ≤.05)	3	0	4.3	2.9	1.4	11.9

Table 2. Effect of herbicides on yield and grade.

No	Name	Rate	Unit	App Code	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz
					------------------------------ cwt/a --------------------------					
1	Untreated				374 b	78 a	97 a	172 a	27 b	295 b
2	Reflex 2SL	1	pt/a	A	478 ab	106 a	120 a	206 a	46 ab	372 ab
3	Reflex 2SL	2	pt/a	A	508 a	92 a	121 a	246 a	48 ab	416 ab
4	Reflex 2SL Dual Magnum	1 1	pt/a pt/a	A	522 a	101 a	118 a	243 a	60 ab	421 ab
5	Reflex 2SL Boundary	1 1.5	pt/a pt/a	A	492 ab	101 a	124 a	213 a	55 ab	392 ab
6	Matrix Outlook	1 16	oz/a fl oz/a	A	551 a	92 a	120 a	249 a	90 a	459 a
7	Sencor 75DF Outlook	0.67 16	lb/a fl oz/a	A	492 ab	108 a	125 a	227 a	31 b	384 ab
				LSD (P ≤.05)	89.6	22.3	30.4	57.7	30.8	86.8

Reflex combinations for weed control in Russet Burbank. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Irrigation Research site near Inkster, ND to evaluate crop tolerance and weed control of Reflex +/- Dual or +/- Boundary as a pre-emergence treatment in Russet Burbank Potato. Wheat was the previous crop in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 21, 2010. Treatments were applied on June 4 (2 days after hilling) to the middle 2 rows. Crop injury and weed control were evaluated 14 and 45 days after application (DAA). Water was not a limiting as irrigation was scheduled every 3 to 4 d once potatoes had emerged following hilling. Potatoes were machine harvested September 29 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		6/4/10
Treatment:		PRE
Sprayer:	GPA:	20
	PSI:	40
	Nozzle:	8002
Air temperature (F):		67
Relative humidity (%):		77
Wind (MPH):		9
Soil moisture:		Adequate
Cloud cover (%):		0

No crop injury was observed following herbicide applications. The primary weeds that were evaluated were common lambsquarters, redroot pigweed, and green foxtail. Common lambsquarters was the most abundant, followed by green foxtail, and then redroot pigweed. At 14 DAA the only treatment that was significantly different (besides untreated) was Reflex @ 1 pt/a, which had 90% control of common lambsquarters while all other treatments provided >95% control. At 45 DAA, Reflex @ 1 pt/a + Boundary @ 1.5 pt/a and Sencor @ 0.67 lb/a + Outlook @ 16 fl oz/a provided significantly better common lambsquarters control than the other treatments (96 and 98%, respectively).
There were no significant differences among Russet Burbank tuber yield and grade.

Table 1. Weed Control 14 and 45 DAA.

				------6/18/10------			-------7/19/10-------		
			App	Colq	RRpw	Grft	Colq	RRpw	Grft
Treatment	Rate	Unit	Code	-------------------------% Control----------------------					
Untreated				0 c	0 b	0 b	0 c	0 b	0 b
Reflex 2SL	1	pt/a	A	90 b	100 a	89 a	90 b	100 a	96 a
Reflex 2SL	2	pt/a	A	96 a	100 a	90 a	91 b	100 a	96 a
Reflex 2SL Dual Magnum	1 1	pt/a pt/a	A	95 a	100 a	90 a	91 b	100 a	94 a
Reflex 2SL Boundary	1 1.5	pt/a pt/a	A	97 a	100 a	94 a	96 a	100 a	96 a
Matrix Outlook	1 16	oz/a fl oz/a	A	96 a	100 a	95 a	90 b	100 a	95 a
Sencor 75DF Outlook	0.67 16	lb/a fl oz/a	A	100 a	100 a	91 a	98 a	100 a	96 a
LSD (P ≤.05)				3.9	0	6.3	2.8	0	4.7

Table 2. Effect of herbicides on potato yield and grade.

			App	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz
Name	Rate	Unit	Code	-----------------------------cwt/a--------------------------					
Untreated				424 a	122 a	119 a	159 a	24 a	302 a
Reflex 2SL	1	pt/a	A	362 a	105 a	97 a	140 a	20 a	257 a
Reflex 2SL	2	pt/a	A	539 a	140 a	134 a	222 a	43 a	399 a
Reflex 2SL Dual Magnum	1 1	pt/a pt/a	A	491 a	136 a	138 a	177 a	40 a	355 a
Reflex 2SL Boundary	1 1.5	pt/a pt/a	A	544 a	135 a	138 a	222 a	49 a	409 a
Matrix Outlook	1 16	oz/a fl oz/a	A	489 a	130 a	140 a	182 a	38 a	359 a
Sencor 75DF Outlook	0.67 16	lb/a fl oz/a	A	494 a	149 a	145 a	163 a	38 a	346 a
LSD (P ≤.05)				166.4	46.1	59.3	76.2	25.3	131.2

Reflex combinations for weed control in Shepody. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Irrigation Research site near Inkster, ND to evaluate crop tolerance and weed control of Reflex +/- Dual or +/- Boundary as a pre-emergence treatment in Shepody Potato. Wheat was the previous crop in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 21, 2010. Treatments were applied on June 4 (2 days after hilling) to the middle 2 rows. Crop injury and weed control were evaluated 14 and 45 days after application (DAA). Water was not a limiting as irrigation was scheduled every 3 to 4 days once potatoes had emerged following hilling. Potatoes were machine harvested September 29 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		6/4/10
Treatment:		PRE
Sprayer:	GPA:	20
	PSI:	40
	Nozzle:	8002
Air temperature (F):		67
Relative humidity (%):		77
Wind (MPH):		9
Soil moisture:		Adequate
Cloud cover (%):		0

No injury was observed following the herbicide applications. The primary weeds that were evaluated were common lambsquarters, redroot pigweed, and green foxtail. Common lambsquarters was the most prevalent of the three, followed by green foxtail, and then redroot pigweed. At 14 DAA, Sencor @ 0.67 lb/a + Outlook @ 16 fl oz (100%) and Reflex @ 1 pt/a + Boundary @ 1.5 pt/a (99%) provided significantly better control of common lambsquarters compared to the other treatments, <96%. Similar results occurred at 45 DAA for common lambsquarters control. There were no significant differences among Shepody tuber yield and grade.

Table 1. Weed Control 14 and 45 DAA.

					------6/18/10------			-------7/19/10-------		
				App	Colq	RRpw	Grft	Colq	RRpw	Grft
No	Name	Rate	Unit	Code	------------------------ % Control ------------------------					
1	Untreated				0 d	0 b	0 b	0 e	0 b	0 b
2	Reflex 2SL	1	pt/a	A	91 c	99 a	90 a	89 d	100 a	95 a
3	Reflex 2SL	2	pt/a	A	96 b	100 a	91 a	93 bc	100 a	95 a
4	Reflex 2SL Dual Magnum	1 1	pt/a pt/a	A	95 b	99 a	90 a	90 cd	100 a	96 a
5	Reflex 2SL Boundary	1 1.5	pt/a pt/a	A	99 a	100 a	91 a	95 ab	100 a	96 a
6	Matrix Outlook	1 16	oz/a fl oz/a	A	95 b	100 a	94 a	90 cd	100 a	96 a
7	Sencor 75DF Outlook	0.67 16	lb/a fl oz/a	A	100 a	100 a	94 a	97 a	100 a	96 a
				LSD (P ≤.05)	2.8	2	5.3	2.8	0	2.9

Table 2. Effect of herbicides on yield and grade.

				App	Total	<4 oz	4-6 oz	6-12 oz	>12 oz	>4 oz
No	Name	Rate	Unit	Code	------------------------------- cwt/a ----------------------------					
1	Untreated				460 a	26 a	39 a	184 a	212 a	434 a
2	Reflex 2SL	1	pt/a	A	475 a	32 a	47 a	167 a	229 a	443 a
3	Reflex 2SL	2	pt/a	A	528 a	38 a	50 a	212 a	228 a	491 a
4	Reflex 2SL Dual Magnum	1 1	pt/a pt/a	A	501 a	30 a	46 a	172 a	173 a	391 a
5	Reflex 2SL Boundary	1 1.5	pt/a pt/a	A	509 a	32 a	45 a	215 a	218 a	477 a
6	Matrix Outlook	1 16	oz/a fl oz/a	A	516 a	38 a	41 a	194 a	243 a	478 a
7	Sencor 75DF Outlook	0.67 16	lb/a fl oz/a	A	385 a	38 a	38 a	175 a	133 a	347 a
				LSD (P ≤.05)	15.2	9.7	20	60.6	110	134.3

Adjuvant effect on Sharpen desiccation in Red Lasoda. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Non-Irrigation Research site near Grand Forks, ND to evaluate adjuvants with Sharpen herbicide as a desiccant compared to local standards. Soybeans were grown in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 16, 2010. Treatments were applied when potatoes were beginning to senesce on September 22. One treatment had a second application which occurred on September 27. Treatments were applied to the middle 2 rows. Leaf and stem necrosis data were taken three times, September 28, 6 days after application A (6 DAA A), October 5 (13 DAA A), and October 12 (20 DAA A). Potatoes were machine harvested October 20 and graded a few weeks later. Application, environmental, and crop data are listed below.

Date:		9/22/10	9/27/10
Treatment:		A	B
Sprayer:	GPA:	20	20
	PSI:	40	40
	Nozzle:	8002	8002
Air temperature (F):		54	63
Relative humidity (%):		69	73
Wind (MPH):		7	8
Soil moisture:		Adequate	Adequate
Cloud cover (%):		100	100
Next rainfall		9/23/10	9/29/10

All treatments except Sharpen @ 2 fl oz/a + Class Act NG @ 2.5% v/v + Destiny HC @ 0.75 pt/a provided similar plant desiccation at 20 DAA A compared to the standards. Reglone @ 2 pt/a + Preference @ 0.25% v/v provided complete necrosis of leaves and stems by 20 DAA A. Splitting the application (Reglone @ 1 pt/a + Preference @ 0.25% v/v applied 2X) provided slightly less stem necrosis. By 20 DAA A, all Sharpen treatments had leaf necrosis between 91-98%. Sharpen @ 2 fl oz/a + Class Act NG @ 2.5% v/v + Destiny @ 1 pt/a had the greatest desiccation of the Sharpen treatments with 98% necrosis of the leaves and 90% of the stems.
Yields were statistically similar for all treatments.

Table 1. Leaf and stem necrosis at 6, 13,and 20 DAA A.

					--9/28/10--		-----10/5/10-----		----10/12/10----	
				App	Leaf	Stem	Leaf	Stem	Leaf	Stem
No	Name	Rate	Unit	Code	--------------------% Desiccated----------------------					
1	Untreated				0 b	0 c	0 e	0 e	0 c	0 c
2	Sharpen	2	fl oz/a	A	11 a	3 ab	41 cd	14 d	91 ab	79 ab
3	Sharpen Class Act NG InterLock	2 2.5 2	fl oz/a % v/v fl oz/a	A A A	16 a	5 ab	50 bcd	21 bcd	91 ab	80 ab
4	Sharpen AG 06011 NPAK AMS Liq	2 6 2.5	fl oz/a fl oz/a % v/v	A A A	14 a	4 ab	54 bcd	25 bcd	91 ab	80 ab
5	Sharpen Class Act NG Destiny HC	2 2.5 0.75	fl oz/a % v/v pt/a	A A A	10 a	2 b	35 d	14 d	66 b	60 b
6	Sharpen Class Act NG Destiny HC	2 2.5 0.5	fl oz/a % v/v % v/v	A A A	16 a	4 ab	63 bc	33 bc	95 ab	86 ab
7	Sharpen Class Act NG Destiny HC	2 2.5 1	fl oz/a % v/v pt/a	A A A	14 a	5 ab	55 bcd	23 bcd	98 a	90 ab
8	Sharpen NPAK AMS Liq Destiny (MSO)	2 2.5 1	fl oz/a % v/v % v/v	A A A	13 a	5 ab	51 bcd	25 bcd	95 ab	85 ab
9	Sharpen AG 07043	2 1	fl oz/a % v/v	A A	16 a	5 ab	58 bcd	26 bcd	95 ab	85 ab
10	Sharpen Prime Oil 1% NPAK AMS Liq	2 1 2.5	fl oz/a % v/v % v/v	A A A	13 a	4 ab	49 bcd	20 cd	94 ab	85 ab
11	Sharpen AG 07010 Class Act NG	2 1 2.5	fl oz/a pt/a % v/v	A A A	11 a	4 ab	45 cd	16 d	91 ab	79 ab
12	Sharpen AG 08001 Class Act NG	2 1 2.5	fl oz/a pt/a % v/v	A A A	15 a	4 ab	55 bcd	28 bcd	94 ab	85 ab
13	Sharpen AG 08050 Class Act NG	2 0.5 2.5	fl oz/a % v/v % v/v	A A A	11 a	3 ab	45 cd	15 d	91 ab	84 ab
14	Reglone Preference	2 0.25	pt/a % v/v	A A	19 a	6 a	81 a	50 a	100 a	100 a
15	Regone Preference Reglone Preference	1 0.25 1 0.25	pt/a % v/v pt/a % v/v	A A B B	15 a	5 ab	69 ab	35 b	100 a	98 a
LSD (P≤.05)					5	2	14	9	18	18

Table 2. Yield and grade.

				App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	> 4 oz
No	Name	Rate	Unit	Code	-------------------------------- cwt/a -----------------------------					
1	Untreated				303 a	71 a	90 a	37 a	106 a	233 a
2	Sharpen	2	fl oz/a	A	303 a	70 a	112 a	55 a	66 a	233 a
3	Sharpen Class Act NG InterLock	2 2.5 2	fl oz/a % v/v fl oz/a	A A A	305 a	62 a	96 a	45 a	102 a	243 a
4	Sharpen AG 06011 NPAK AMS Liq	2 6 2.5	fl oz/a fl oz/a % v/v	A A A	309 a	59 a	92 a	42 a	116 a	250 a
5	Sharpen Class Act NG Destiny HC	2 2.5 0.75	fl oz/a % v/v pt/a	A A A	316 a	66 a	86 a	37 a	126 a	250 a
6	Sharpen Class Act NG Destiny HC	2 2.5 0.5	fl oz/a % v/v % v/v	A A A	276 a	68 a	88 a	40 a	79 a	208 a
7	Sharpen Class Act NG Destiny HC	2 2.5 1	fl oz/a % v/v pt/a	A A A	295 a	64 a	82 a	39 a	110 a	231 a
8	Sharpen NPAK AMS Liq Destiny (MSO)	2 2.5 1	fl oz/a % v/v % v/v	A A A	320 a	57 a	95 a	51 a	117 a	263 a
9	Sharpen AG 07043	2 1	fl oz/a % v/v	A A	318 a	54 a	95 a	46 a	123 a	264 a
10	Sharpen Prime Oil 1% NPAK AMS Liq	2 1 2.5	fl oz/a % v/v % v/v	A A A	292 a	61 a	90 a	43 a	97 a	231 a
11	Sharpen AG 07010 Class Act NG	2 1 2.5	fl oz/a pt/a % v/v	A A A	320 a	66 a	93 a	41 a	119 a	254 a
12	Sharpen AG 08001 Class Act NG	2 1 2.5	fl oz/a pt/a % v/v	A A A	264 a	60 a	96 a	43 a	66 a	204 a
13	Sharpen AG 08050 Class Act NG	2 0.5 2.5	fl oz/a % v/v % v/v	A A A	339 a	68 a	102 a	47 a	122 a	271 a
14	Reglone Preference	2 0.25	pt/a % v/v	A A	287 a	64 a	93 a	48 a	82 a	223 a
15	Regone Preference Reglone Preference	1 0.25 1 0.25	pt/a % v/v pt/a % v/v	A A B B	297 a	58 a	92 a	42 a	105 a	239 a
LSD (P≤.05)					51	17	22	14	42	48

Solida for weed control in non-irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted near Glyndon, MN to determine the efficacy and selectivity of SOLIDA compared to Matrix FNV on Red Norland Potato. Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 38 inch rows and 12 inch spacing on June 2, 2010. Treatments were applied on June 14 for the PRE applications and June 29 for the POST applications to the middle 2 rows. Crop injury and weed control were evaluated 15, 23, and 49 days after application "A" (DAA A). Potatoes were machine harvested October 6, and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		6/14/10	6/29/10
Treatment:		PRE	POST
Sprayer:	GPA:	20	20
	PSI:	40	40
	Nozzle:	8002	8002
Air temperature (F):		71	72
Relative humidity (%):		24	44
Wind (MPH):		8	6
Soil moisture:		Adequate	Adequate
Cloud cover (%):		40	10
Next rain:		6/15/10	7/3/10

No crop injury was observed throughout the trial. The primary weeds that were examined were common lambsquarters, redroot pigweed, and green foxtail. Common lambsquarters was the most prevalent of the three, followed by green foxtail, and then redroot pigweed. At 15 and 23 DAA with the PRE treatments, common lambsquarters control increased as the rate of SOLIDA increased. On August 2 (34 DAA B), provided the greatest control of common lambsquarters, with 95%. At that same time, SOLIDA @ 0.0117 lb ai/a PRE treatment provided unacceptable common lambsquarters control (78%) and significantly less common lambsquarters control than the SOLIDA @ 0.047 lb ai/a + Preference @ 0.25% v/v POST treatment.
Tuber yields were all similar except for the untreated. The untreated plants had a yield of 129 cwt/a, while in all other treatments, plants yielded >184 cwt/a.

Table 1. Weed Control 14 and 45 DAA.

					------6/29/10------			------7/7/10------			------8/2/10------		
				App	Colq	RRpw	Grft	Colq	RRpw	Grft	Colq	RRpw	Grft
No	Name	Rate	Unit	Code	------------------------------------% Control----------------------------------								
1	Unt				0 c	0 b	0 c	0 b	0 b	0 c	0 c	0 c	0 c
2	Solida	0.0117	lb a/a	A	92 b	98 a	95 a	86 a	96 a	88 b	78 b	93 ab	84 ab
3	Solida	0.0.234	lb a/a	A	96 ab	100 a	95 a	90 a	98 a	89 ab	85 ab	93 ab	85 ab
4	Solida	0.047	lb a/a	A	98 a	100 a	95 a	93 a	96 a	91 ab	84 ab	94 ab	90 a
5	Matrix	0.0234	lb a/a	A	95 ab	100 a	93 b	90 a	99 a	90 ab	86 ab	93 ab	90 a
6	Solida Preference	0.0117 0.25	lb a/a % v/v	B B				88 a	98 a	91 ab	86 ab	98 a	94 a
7	Solida Preference	0.0234 0.25	lb a/a % v/v	B B				89 a	100 a	93 ab	93 ab	100 a	93 a
8	Solida Preference	0.047 0.25	lb a/a % v/v	B B				91 a	100 a	93 ab	95 a	100 a	94 a
9	Matrix Preference	0.0234 0.25	lb a/a % v/v	B B				86 a	98 a	95 a	91 ab	99 a	91 a
10	Lorox Prowl H2O	3 2	lb/a pt/a	A A	99 a	100 a	95 a	90 a	93 a	88 b	84 ab	81 b	78 b
11	Sencor Prowl H2O	0.67 2	lb/a pt/a	A A	100 a	100 a	95 a	95 a	98 a	89 ab	90 ab	91 ab	79 b
				LSD (P≤.05)	4	3	2	5	5	4	9	9	8

Table 2. Effect of herbicides on yield and grade.

			App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz
Name	Rate	Unit	Code	-- cwt/a	--				
Untreated				129 b	41 a	65 b	20 b	3 a	88 b
Solida	0.0117	lb a/a	A	200a	39 a	107 a	38 a	15 a	160 a
Solida	0.0.234	lb a/a	A	193 a	41 a	97 a	40 a	15 a	152 a
Solida	0.047	lb a/a	A	184 a	35 a	97 a	39 a	13 a	149 a
Matrix	0.0234	lb a/a	A	195 a	39 a	98 a	42 a	16 a	156 a
Solida Preference	0.0117 0.25	lb a/a % v/v	B B	205 a	44 a	105 a	40 a	15 a	161 a
Solida Preference	0.0234 0.25	lb a/a % v/v	B B	208 a	40 a	109 a	39 a	19 a	167 a
Solida Preference	0.047 0.25	lb a/a % v/v	B B	227 a	48 a	109 a	49 a	22 a	179 a
Matrix Preference	0.0234 0.25	lb a/a % v/v	B B	225 a	42 a	114 a	48 a	20 a	183 a
Lorox Prowl H2O	3 2	lb/a pt/a	A A	207 a	45 a	107 a	40 a	15 a	163 a
Sencor Prowl H2O	0.67 2	lb/a pt/a	A A	229 a	49 a	113 a	49 a	18 a	180 a
			LSD (P≤.05)	33	15	18	10	10	28

Use of adjuvants with pre-emergence herbicides for dryland weed control. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Grower's Non-Irrigation Research site near Grand Forks, ND to evaluate different adjuvants tank-mixed with common pre-emergence herbicides used on Red Norland Potato. Soybean was the previous crop in 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 16, 2010. Treatments were applied on July 7 to the middle 2 rows. Crop injury and weed control were evaluated 12 and 22 days after application (DAA). Potatoes were machine harvested October 18 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		7/7/10
Treatment:		PRE
Sprayer:	GPA:	20
	PSI:	40
	Nozzle:	8002
Air temperature (F):		76
Relative humidity (%):		57
Wind (MPH):		5
Soil moisture:		Adequate
Cloud cover (%):		33
Next rain:		7/9/10

No crop injury was observed throughout the trial. The primary weeds that were examined were common lambsquarters, redroot pigweed, and green foxtail. There were no significant differences in weed control, yield, and grade. The lack of common lambsquarters, redroot pigweed, and green foxtail control differences suggest that when these weed pressures are low, reduced metribuzin or dimethenamid-P rates may provide similar control as the labeled rates. Yield variability did not allow for treatment separation at the 5% level even though a difference of 146 cwt/a in total yield occurred between the highest and lowest yielding treatments.

Table 1. Weed Control 12 and 22 DAA.

					-----7/19/10-----			-----7/29/10-----		
				App	Colq	RRpw	Grft	Colq	RRpw	Grft
No	Name	Rate	Unit	Code	------------------------% Control----------------------					
1	Kalo 1 Metribuzin	1 5.4	qt/a oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
2	Kalo 1 Metribuzin	1 2.7	qt/a oz/a	A A	100 a	100 a	100 a	100 a	100 a	99 a
3	Kalo 1 Outlook	1 10.5	qt/a fl oz/a	A A	100 a	100 a	99 a	100 a	99 a	100 a
4	Kalo 1 Outlook	1 5.25	qt/a fl oz/a	A A	100 a	99 a	100 a	100 a	100 a	100 a
5	Kalo 2 Metribuzin	1 5.4	qt/a oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
6	Kalo 2 Metribuzin	1 2.7	qt/a oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
7	Kalo 2 Outlook	1 10.5	qt/a fl oz/a	A A	100 a	99 a	100 a	100 a	100 a	100 a
8	Kalo 2 Outlook	1 5.25	qt/a fl oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
9	Winfield 1 Metribuzin	1 5.4	qt/a oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
10	Winfield 1 Metribuzin	1 2.7	qt/a oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
11	Winfield 1 Outlook	1 10.5	qt/a fl oz/a	A A	100 a	100 a	100 a	100 a	100 a	100 a
12	Winfield 1 Outlook	1 5.25	qt/a fl oz/a	A A	100 a	98 a	99 a	100 a	100 a	98 a
13	Metribuzin	5.4	oz/a	A	100 a	100 a	100 a	100 a	100 a	100 a
14	Metribuzin	2.7	oz/a	A	100 a	100 a	100 a	99 a	100 a	100 a
15	Outlook	10.5	fl oz/a	A	100 a	99 a	100 a	100 a	99 a	100 a
16	Outlook	5.25	fl oz/a	A	100 a	98 a	99 a	100 a	98 a	100 a
17	Metribuzin	10.7	oz/a	A	100 a	100 a	100 a	100 a	100 a	100 a
18	Outlook	21	fl oz/a	A	100 a	99 a	95 a	100 a	100 a	100 a
19	Preference Metribuzin	1 2.7	qt/a oz/a	A A	100 a	100 a	99 a	100 a	100 a	100 a
20	Preference Outlook	1 5.25	qt/a fl oz/a	A A	100 a	100 a	98 a	100 a	100 a	99 a
21	Untreated				0 b	0 b	0 b	0 b	0 b	0 b
LSD (P≤.05)					1	2	4	1	1	2

Table 2. Effect of herbicides on yield and grade.

				App	Total	<4 oz	4-6 oz	6-10 oz	>10 oz	>4 oz
No	Name	Rate	Unit	Code	------------------------------cwt/a------------------------------					
1	Kalo 1 Metribuzin	1 5.4	qt/a oz/a	A A	222 a	52 a	90 a	31 a	49 a	170 a
2	Kalo 1 Metribuzin	1 2.7	qt/a oz/a	A A	280 a	90 a	111 a	36 a	43 a	190 a
3	Kalo 1 Outlook	1 10.5	qt/a fl oz/a	A A	249 a	95 a	116 a	30 a	7 a	153 a
4	Kalo 1 Outlook	1 5.25	qt/a fl oz/a	A A	257 a	111 a	109 a	31 a	5 a	146 a
5	Kalo 2 Metribuzin	1 5.4	qt/a oz/a	A A	219 a	100 a	89 a	21 a	8 a	119 a
6	Kalo 2 Metribuzin	1 2.7	qt/a oz/a	A A	296 a	76 a	98 a	37 a	85 a	220 a
7	Kalo 2 Outlook	1 10.5	qt/a fl oz/a	A A	231 a	91 a	76 a	24 a	40 a	140 a
8	Kalo 2 Outlook	1 5.25	qt/a fl oz/a	A A	228 a	92 a	98 a	30 a	7 a	135 a
9	Winfield 1 Metribuzin	1 5.4	qt/a oz/a	A A	226 a	95 a	95 a	30 a	6 a	131 a
10	Winfield 1 Metribuzin	1 2.7	qt/a oz/a	A A	235 a	101 a	101 a	26 a	7 a	134 a
11	Winfield 1 Outlook	1 10.5	qt/a fl oz/a	A A	228 a	84 a	77 a	27 a	41 a	144 a
12	Winfield 1 Outlook	1 5.25	qt/a fl oz/a	A A	272 a	101 a	117 a	40 a	13 a	171 a
13	Metribuzin	5.4	oz/a	A	272 a	96 a	119 a	36 a	20 a	175 a
14	Metribuzin	2.7	oz/a	A	209 a	84 a	89 a	28 a	9 a	125 a
15	Outlook	10.5	fl oz/a	A	287 a	99 a	126 a	44 a	18 a	187 a
16	Outlook	5.25	fl oz/a	A	272 a	84 a	121 a	36 a	31 a	188 a
17	Metribuzin	10.7	oz/a	A	236 a	95 a	92 a	28 a	21 a	141 a
18	Outlook	21	fl oz/a	A	292 a	76 a	116 a	44 a	56 a	216 a
19	Preference Metribuzin	1 2.7	qt/a oz/a	A A	240 a	117 a	89 a	27 a	7 a	123 a
20	Preference Outlook	1 5.25	qt/a fl oz/a	A A	365 a	83 a	115 a	48 a	118 a	282 a
21	Untreated				311 a	85 a	115 a	50 a	61 a	226 a
LSD (P≤.05)					89	32	47	21	72	95

Use of adjuvants with pre-emergence herbicides for irrigated weed control.
Harlene Hatterman-Valenti and Collin Auwarter.

This study was conduced in an irrigated field near Oakes, ND to evaluate different adjuvants tank-mixed with common pre-emergence herbicides used on Russet Potato. Plots were 2 rows by 20 ft arranged in a randomized complete block design with four replicates. Planting occurred mid-May on 36 inch rows and 12 inch spacing. Treatments were applied June 4 when potatoes were around 4 inch, and common lambsquarters (only weed present) were around 2 inch. Crop injury (none) and weed control were evaluated 19, 37, and 56 days after application (DAA). Herbicides used were Metribuzin 75 DF and Outlook. Potatoes were not harvested because of being in the growers field. Application, environmental, and weed data are listed below:

Date:		6/2/10
Treatment:		POST
Sprayer:	GPA:	20
	PSI:	40
	Nozzle:	8002
Air temperature (F):		69
Relative humidity (%):		33
Wind (MPH):		2
Soil moisture:		Adequate
Cloud cover (%):		0

No crop injury was observed throughout the trial. Treatment 1 (Kalo 1 + Metribuzin @ 5.4 oz/a) showed the highest control of COLQ 19 DAA with 96% control, significantly better than all others. The lowest control was Treatment 11 (Win 1 + Outlook @ 10.5 fl oz/a) with 70% control. 56 DAA, no control was significant better, however there was a wide range of control. Treatment 1 remained the highest, while treatment 5 (Kalo 2 + metribuzin @ 5.4 oz/a) with 63% control had the least control of COLQ.

Table 1. Common lambsquarters control with pre-emergence herbicides and adjuvants.

					19 DAA	37 DAA	56 DAA
				App	6/21/10	7/9/10	7/28/10
No.	Name	Rate	Unit	Code	-------% Control COLQ-------		
1	Kalo 1 Metribuzin	1 5.4	qt/a oz/a	A A	96 a	93.8 a	96.3 a
2	Kalo 1 Metribuzin	1 2.7	qt/a oz/a	A A	88.8 a	95.0 a	91.3 a
3	Kalo 1 Outlook	1 10.5	qt/a fl oz/a	A A	80.0 abc	87.5 a	71.3 a
4	Kalo 1 Outlook	1 5.25	qt/a fl oz/a	A A	77.5 abc	83.8 a	72.5 a
5	Kalo 2 Metribuzin	1 5.4	qt/a oz/a	A A	88.8 abc	80.0 a	62.5 a
6	Kalo 2 Metribuzin	1 2.7	qt/a oz/a	A A	93.8 ab	96.3 a	95.0 a
7	Kalo 2 Outlook	1 10.5	qt/a fl oz/a	A A	77.5 abc	93.8 a	86.3 a
8	Kalo 2 Outlook	1 5.25	qt/a fl oz/a	A A	77.5 abc	86.3 a	73.8 a
9	Win 1 Metribuzin	1 5.4	qt/a oz/a	A A	92.3 abc	90.0 a	95.0 a
10	Win 1 Metribuzin	1 2.7	qt/a oz/a	A A	92.5 abc	95.0 a	81.3 a
11	Win 1 Outlook	1 10.5	qt/a fl oz/a	A A	69.8 c	88.8 a	91.3 a
12	Win 1 Outlook	1 5.25	qt/a fl oz/a	A A	72.5 bc	92.5 a	85.0 a
13	Metribuzin	5.4	oz/a	A	82.5 abc	88.8 a	78.8 a
14	Metribuzin	2.7	oz/a	A	81.3 abc	90.0 a	90.0 a
15	Outlook	10.5	fl oz/a	A	80.0 abc	97.5 a	96.3 a
16	Outlook	5.25	fl oz/a	A	75.0 abc	90.0 a	85.0 a
17	Metribuzin	10.7	oz/a	A	90.0 abc	87.5 a	80.0 a
18	Outlook	21	fl oz/a	A	83.8 abc	88.8 a	78.8 a
				LSD (P=.05)	12.62	13.13	20.20

Potato and Sweet Corn Response to Ammonium Sulfate Nitrate (ASN)

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Summary: A field experiment at the Sand Plain Research Farm in Becker, MN was conducted in 2010 to evaluate ammonium sulfate nitrate (ASN) as an alternative to other nitrogen sources in Red Norland potato and sweet corn. Treatments included ASN, 50/50 urea + ASN, ammonium nitrate (AN), urea ammonium-nitrate (UAN, 28%), urea, and a low N control. Potato yield and quality were not affected by treatment - possibly due to significant freeze damage early in the study. For the sweet corn study which was planted after the freeze, application of ASN plus urea or ASN alone resulted in higher green and husked yields than AN or UAN. Sweet corn yields with urea were intermediate between AN, UAN and the ASN treatments. The positive yield response in the sweet corn with ASN is not entirely clear, but it is likely related to better S nutrition and possibly to less leaching of N as more of the N is in the ammonium/urea form than ammonium nitrate. Application of ASN plus urea or ASN alone consistently resulted in a higher mean N and S concentrations in petiole samples from the potatoes than other treatments, although not always by a significant amount. The ASN treatments also resulted in consistently higher N and S concentrations in sweet corn ear leaf samples compared with AN and UAN treatments, but not always significantly higher. ASN appears to be a suitable N and S source for sweet corn. Further research is needed to evaluate ASN for potato.

Background: As the fertilizer ammonium nitrate (AN) becomes less readily available in many areas, alternatives are being sought for high N demand crops such as potato and sweet corn. Ammonium sulfate nitrate (ASN) is one alternative product that can potentially provide the benefits of AN (i.e. steady N supply, reduced ammonia volatilization) as well as provide sulfur. However, there are few studies comparing ASN to AN in sweet corn and potato production – particularly for early maturing potato varieties such as the cultivar 'Red Norland'. Studies of this type are needed to allow growers to make informed decisions about alternative N fertilizer use.

The objective of this study was to evaluate the effects of ASN on yield and quality of 'Red Norland' potato and 'Delectable' sweet corn when compared with AN and other conventional N fertilizers.

Materials and Methods

The study was conducted at the Sand Plain Research Farm in Becker, Minnesota on a Hubbard loamy sand. The previous crop was rye. Selected soil chemical properties before planting were as follows (0-6") – for potato: water pH, 6.0; organic matter, 2.0%; Bray P1, 21 ppm; ammonium acetate extractable K, Ca, and Mg, 111, 791, and 142 ppm, respectively; Ca-phosphate extractable SO_4-S, 5 ppm; and DTPA extractable Zn, Cu, Fe, and Mn, 0.9, 0.3, 39.7, and 11.2 ppm, respectively, and for sweet corn: water pH, 6.5; organic matter, 1.5%; Bray P1, 84 ppm; ammonium acetate extractable K, 50 ppm; and Ca-phosphate extractable SO_4-S, 6 ppm. Extractable nitrate-N in the top 2 ft prior to planting was equivalent to 8.2 lb/A.

Whole "B" potato Red Norland seed was hand planted in furrows on April 12, 2010. Sweet corn (Delectable) was planted on May 21, 2010 with a four row mechanical seeder. Four, 20 ft rows were planted for each plot with 15 ft of each of the middle two rows used for sampling and harvest. Spacing for potatoes was 36 inches between rows and 12 inches within each row. Corn was spaced with 30 inches between rows and 8 inches within each row. Each treatment was replicated four times in a randomized complete block design. Weeds, diseases, and insects were controlled using standard practices. Rainfall was supplemented with sprinkler irrigation using the checkbook method of irrigation scheduling.

Six treatments, two of which included ASN, were tested and are listed below (Table 1).

Table 1. Nitrogen treatments tested in the Red Norland and sweet corn ASN study.

Trmt #	Source	Potato			Sweet Corn			
		Planting	Emerg.	Total	Planting	Emerg.	Sidedr.	Total
		lb / A						
1	Control	64	0	64	8	0	0	8
2	AN	64	110	174	8	81	81	170
3	Urea	64	110	174	8	81	81	170
4	ASN	64	110	174	8	81	81	170
5	Urea + ASN	64	110	174	8	81	81	170
6	UAN 28%	64	110	174	8	81	81	170

Prior to planting, 0-0-60 at the rate of 250 lb/A was applied for each crop and incoprated with a moldboard plow. No preplant S fertilizer was used for either crop. A starter fertilizer containing 64 lb N/A and 48 lb S/A as 8-16-16-6(S) was applied to the potato at planting as a band, while sweet corn received a liquid starter fertilizer containing 8 lb N/A and 0 lb S/A as 10-34-0. The 8-16-16-6 was used as this is the common starter used in the region. The remaining 110 lb N/A was applied to the potato on May 10 at emergence as a sidedress. Urea and AN were applied using a Gandy drop spreader and incorporated via hilling. Because the ASN was a prototype product it was difficult to mechanically apply in granulated form as it would readily absorb moisture and clog the metering tubes. As a result, the ASN treatments were individually weighed out and applied by hand. The commercial ASN, once available, will be designed to prevent these application problems. UAN was applied as a liquid using metered drop hoses and watered in. Sweet corn was fertilized 50% as a sidedress on June 4 at emergence and 50% on June 17.

Potato plant stands were measured and the number of stems per plant was counted on June 2. Petiole samples were collected in the potatoes from the 4th leaf from the terminal on June 7, June 22, and July 1. Petioles were analyzed for nitrate-N, and total N, and S on a dry weight basis. On July 12 and July 19 potato vines were killed via mechanical beating. Potato plots were machine-harvested on August 4 and total tuber yield, tuber color, and the incidence of scab, hollow heart, and brown center were measured. Sweet corn stands were counted and ear leaf samples were collected on July 26. Samples were analyzed for total N and S on a dry weight basis. Corn was harvested by hand on August 9 and mature/immature ears, green and husked yield were measured.

All trials of the experiment were statistically analyzed using ANOVA procedures on SAS and means were separated using a Waller-Duncan LSD test at P = 0.10.

Results

Rainfall and irrigation amounts are presented in Figure 1. Potato plants suffered freeze damage at emergence that although not quantified, was severe enough that it potentially affected later yield results. There were also numerous leaching events (rainfall 1.5 inches in 24 hours) that occurred throughout the growing season.

Tuber Yield and Quality: There were no significant differences among treatments with respect to total yield or yields within any tuber size category (Table 1), although yields from the ASN treatment did trend lower in the < 2.50" categories and higher in the >2.50" categories. Treatment also did not significantly affect visual red color grading, brown center, or hollow heart (Table 2). Minor surface scab levels were high, but not significantly different among treatments with means that ranged from 62 (control trmt 1) to 77% (urea + ASN trmt 5). Stand for all treatments was > 96%. There were significantly more stems per plant in the control and AN treatments when compared with the UAN and ASN treatments with a difference of about 1 stem between highest and lowest counts.

Corn Yield: Green yield, husked yield, and the total number of mature ears were significantly higher with ASN and ASN + urea, and urea treatments compared with the UAN and AN treatments (Table 4). As expected lowest green and husked yields and number of mature ears were lowest with the control compared with all other treatments. There were no statistical differences among treatments in the numbers of immature ears produced, but numerically the control treatment resulted in the highest number while urea resulted in the fewest. The urea + ASN treatment (trmt 5) produced the most plants per acre and the highest husked yield, which was significantly higher than any other treatment except with ASN. The positive yield response in the sweet corn with ASN is not entirely clear, but it is likely related to better sulfur nutrition and possibly to less leaching of N as more of the N is in the ammonium/urea form than ammonium nitrate. However, UAN and ASN have the same amount of nitrate. In addition based on ear leaf samples (see below), sulfur was not at deficient levels. Further research is needed to elucidate the exact causes for this yield increase with ASN.

Petiole and Ear Leaf Nutrient Analysis: The starter only control (trmt 1) resulted in lower petiole nitrate concentrations than all other treatments on all three sampling dates, although only significantly lower on the first two (June 7 and June 22). On June 7, the urea treatment (trmt 3) resulted in the highest petiole NO_3^- concentrations, but only significantly higher concentrations than those from the control, AN (trmt 2), and ASN (trmt 4) treatments. On June 22, the ASN treatment petiole nitrate concentrations were significantly higher than those of the control (trmt 1), urea (trmt 3) and urea + ASN (trmt 5) treatments. On July 1, petiole nitrate concentrations from the control were significantly lower than those from the AN and urea + ASN treatments, although none of the petiole nitrate concentrations were significantly different from one another among the fertilized treatments.

Total N was significantly lower in the petioles collected from the control when compared with those from the fertilized treatments on all three dates. On June 7, the AN treatment also resulted in significantly lower petiole N than the ASN and urea treatments. There were no significant differences among fertilized treatments with respect to N concentrations on the later two dates, although the N concentrations in the petioles from the ASN treatment were numerically highest in all three sampling dates.

There were no significant differences in mean petiole S among treatments on June 7, although the ASN treatment resulted in numerically the highest petiole S and UAN treatment numerically the lowest. The mean petiole S on June 22 was highest from plants grown with ASN (but not significantly different from plants grown under the urea + ASN treatment) and lowest from those grown in the control (but not significantly different in %S from the AN treatment petioles). On July 1, petioles sampled from the AN treatment contained the lowest S by a significant amount, while petioles from the control displayed the highest S, although not significantly different from the ASN treatment petioles. The ASN treatment also resulted in significantly higher petiole S than was seen in petioles from the urea + ASN and UAN treatments. Inconsistent response to sulfur form ASN was likely due to the large amount of S in the starter fertilizer.

Corn ear leaf samples collected from the control were significantly lower in total N concentrations than all other treatments. The numerically highest N concentrations were with the urea treatment samples, but these were not significantly different from N concentrations in ASN or urea + ASN treatment ear leaf samples (Table 5). Ear leaf S concentrations were not significantly affected by treatment although ASN treatments resulted in numerically higher ear leaf S concentrations than the other treatments tested. All ear leaf sulfur concentrations were above the critical value of 0.20% S.

Conclusions

Potato yield and quality were not affected by treatment - possibly due to significant freeze damage early in the study. For the sweet corn study which was planted after the freeze, application of ASN plus urea or ASN resulted in higher green and husked yields than AN or UAN, or urea alone and also consistently resulted in a higher mean total N in petiole samples from the potatoes than other treatments, although not always by a significant amount. The ASN treatment also resulted in consistently higher (although not always significant) total S in petiole and sweet corn ear leaf samples compared with other treatments. ASN appears to be a suitable N and S source for sweet corn. Further research is needed to evaluate ASN for potato.

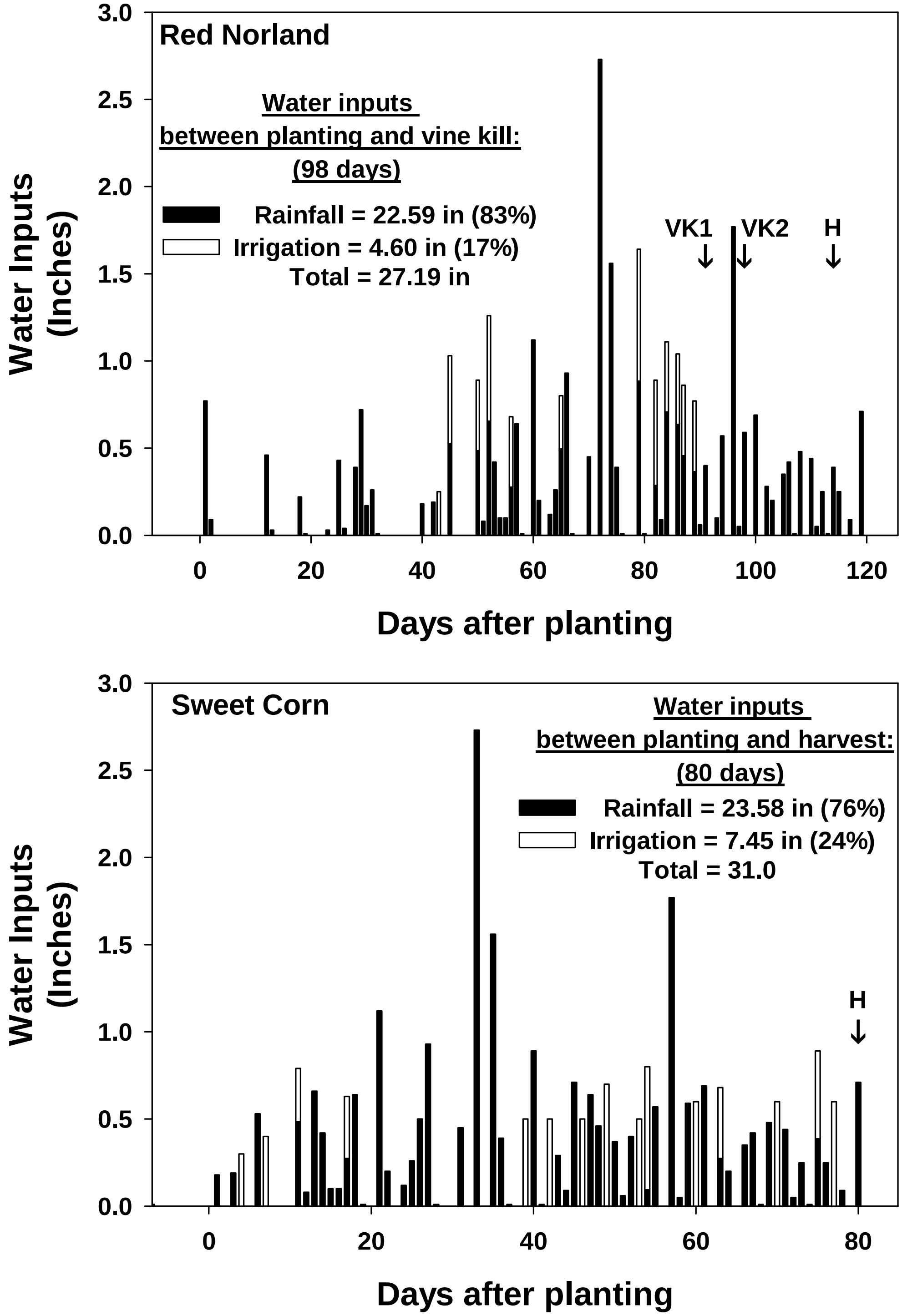

Figure 1. Rainfall and irrigation amounts during the 2010 growing season. Planting (Potato: April 12; Sweet Corn: May 21); VK = Vine Kill (July 12, July 19); H = Harvest (Potato: August 4; Sweet Corn: August 9)

Table 1. Effects of nitrogen source on Red Norland tuber yield and size.

Trmt #	N Source[1]	N Rate	Tuber Yield					
			< 1.75"	1.75-2.25"	2.25-2.50"	2.50-3.00"	> 3.00"	Total
		lb N / A	cwt / A					
1	None	64	19.6	114.0	119.4	51.2	25.7	329.9
2	Ammonium Nitrate	174	25.3	110.4	115.3	53.8	26.0	330.8
3	Urea	174	18.9	112.0	117.9	63.1	35.8	347.7
4	ASN	174	20.7	97.6	107.8	67.4	31.4	324.9
5	Urea + ASN	174	23.2	114.4	111.3	52.6	28.6	330.1
6	UAN 28%	174	19.5	125.8	115.3	51.7	26.6	338.9
		Significance[2]	NS	NS	NS	NS	NS	NS
		LSD (0.1)	--	--	--	--	--	--

[1]ASN = Ammonium Sulfate-Nitrate; UAN = Urea Ammonium Nitrate

[2]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively

Table 2. Effects of nitrogen source on Red Norland tuber quality.

Trmt #	N Source[1]	N Rate	Tuber Quality[2]				# Stems per Plant	Visual Red[3]
			HH	BC	Scab	Stand		
		lb N / A	%					
1	None	64	1.7	1.7	62.0	96.0	4.8	2.3
2	Ammonium Nitrate	174	1.6	1.6	69.9	96.6	4.5	2.6
3	Urea	174	0.8	0.8	63.1	95.5	4.2	2.4
4	ASN	174	0.0	0.0	71.0	99.4	3.7	2.4
5	Urea + ASN	174	0.8	0.0	77.3	97.7	4.4	2.5
6	UAN 28%	174	0.8	0.8	75.0	97.2	4.0	2.9
		Significance[4]	NS	NS	NS	NS	**	NS
		LSD (0.1)	--	--	--	--	0.5	--

[1]ASN = Ammonium Sulfate-Nitrate; UAN = Urea Ammonium Nitrate

[2]HH = Hollow Heart; BC = Brown Center

[3]Pale Red = 1 --- 5 = Dark Red

[4]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively

Table 3. Effects nitrogen source on nitrate-N concentrations and percent N, C, and S in petioles of Red Norland potato on three sampling dates.

Trtmt #	**N Source**[1]	**N Rate**	**Nutrient analysis results by sampling date**		
			June 7		
		lb N / A	**NO_3^- (ppm)**	**%N**	**%S**
1	None	64	16771	5.26	0.29
2	Ammonium Nitrate	174	21294	6.04	0.29
3	Urea	174	23707	6.22	0.30
4	ASN	174	21462	6.23	0.31
5	Urea + ASN	174	22604	6.21	0.29
6	UAN 28%	174	23042	6.13	0.27
Significance[2]			**	**	**
LSD (0.1)			1771	0.17	1.0
			June 22		
1	None	64	712	1.66	0.26
2	Ammonium Nitrate	174	5180	2.84	0.27
3	Urea	174	4309	2.70	0.30
4	ASN	174	6133	2.99	0.33
5	Urea + ASN	174	4256	2.72	0.31
6	UAN 28%	174	4890	2.72	0.28
Significance[2]			**	**	NS
LSD (0.1)			1592	0.44	--
			July 1		
1	None	64	379	1.22	0.35
2	Ammonium Nitrate	174	1955	1.56	0.26
3	Urea	174	685	1.55	0.32
4	ASN	174	1848	1.65	0.35
5	Urea + ASN	174	1955	1.52	0.31
6	UAN 28%	174	1740	1.47	0.31
Significance[2]			NS	**	NS
LSD (0.1)			--	0.23	--

[1]ASN = Ammonium Sulfate-Nitrate; UAN = Urea Ammonium Nitrate
[2]NS – Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively

Table 4. Effects of nitrogen source on sweet corn yield.

Trmt #	N Source[1]	N Rate	Sweet Corn Yield				
			Plants	Mature Ears	Immature Ears	Green Yield	Husked Yield
		lb N / A	per Acre			ton / A	
1	None	8	20328	290	8131	0.32	0.15
2	Ammonium Nitrate	170	19166	13068	7260	6.36	3.85
3	Urea	170	19747	15972	4066	7.49	4.55
4	ASN	170	21780	17279	4937	7.62	4.64
5	Urea + ASN	170	23377	17424	6244	7.78	5.10
6	UAN 28%	170	20473	13358	6534	5.95	3.72
		Significance[2]	++	**	NS	**	**
		LSD (0.1)	2788	1539	--	0.97	0.54

[1]ASN = Ammonium Sulfate-Nitrate; UAN = Urea Ammonium Nitrate

[2]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively

Table 5. Effects nitrogen source on percent N, C, and S in ear leaf samples of sweet corn.

Trmt #	N Source[1]	N Rate	Nutrient concentrations	
		lb N / A	%N	%S
1	None	64	0.93	0.26
2	Ammonium Nitrate	174	2.52	0.27
3	Urea	174	2.91	0.28
4	ASN	174	2.80	0.29
5	Urea + ASN	174	2.87	0.30
6	UAN 28%	174	2.42	0.28
Significance[2]			**	NS
LSD (0.1)			0.28	--

[1]ASN = Ammonium Sulfate-Nitrate; UAN = Urea Ammonium Nitrate

[2]NS – Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively

Evaluation of Polymer Coated Urea and Stabilized Nitrogen Products on Irrigated Potato Production

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Summary: Field experiments were conducted at the Sand Plain Research Farm in Becker, MN to evaluate controlled release fertilizers and stabilized N products. Treatments compared differences in N release rates and tuber yield and quality between dealer grade ESN and potentially damaged ESN collected from airboom deflector plates. Stabilized N products SuperU and Agrotain Plus were also evaluated. Fifteen treatments in total were examined, all of which included the equivalent of 30 lb N/A in a starter blend. Except for a starter only control, all treatments received a total of 240 lb N/A. Three of the treatments were solely urea with the following rates (lb N/A), 210 as preplant, 210 at emergence, and a combination of 100 as preplant and 110 at emergence. Three other treatments included 110 lb N/A at emergence as either urea, UAN, or UAN + Agrotain Plus, and also included 4 post-hilling applications of UAN at 20, 20, 30, and 30 lb N/A. Four treatments included dealer grade ESN(C) at the following rates (lb N/A): 210 as preplant, 100 as preplant and 110 at emergence, 210 at emergence, and a combination of 110 of urea and 100 ESN(C), both applied at emergence. In addition, one treatment included 210 lb N/A as airboom ESN(A) applied at emergence. The remaining three treatments include SuperU at the following rates (lb N/A): 210 as preplant, 210 at emergence, and 100 as preplant combined with 110 of UAN and Agrotain Plus applied at emergence. Nitrogen release from the airboom ESN(A) was found to be much more rapid than release from a comparable application of dealer grade product – ESN(C) - which released N at a rate consistent with what was seen in previous years: 60% of the N had been released 8 days after application for the air boom ESN sample (ESN-A), while only 12% had been released from the undamaged control ESN sample (ESN-C). Tuber yields with ESN(C) were numerically higher than with ESN(A), but these differences were not statistically significant. In a leaching year, risk of losses would be minimized by using undamaged ESN. Marketable yield was significantly higher from plants fertilized at emergence solely with ESN(C) or SuperU treatments when compared with urea + ESN(C) and urea + split applied UAN treatments. Petiole nitrate concentration data suggest that when applied at equivalent rates and timing, the undamaged ESN has the potential to release N through the season longer than SuperU and damaged ESN. Overall results indicate that the use of emergence applied ESN, SuperU, or adding Agrotain Plus to a UAN treatment can produce marketable yield and tuber quality comparable to or higher than conventional fertilizer treatments. However, yields in all treatments in this study were somewhat compromised as a result of early vine death in August due to unknown causes.

Background: This study is a continuation of research conducted over a six year period on enhanced efficiency N fertilizers – primarily polymer coated urea. The study was expanded this year to include stabilized N products, SuperU and Agrotain Plus. While plot research results have been quite positive with ESN, a polymer coated controlled release N fertilizer manufactured by Agrium, responses from on-farm grower trials are sometimes less favorable. One possible reason for these differences is increased abrasion of the ESN polymer coating in grower trials, particularly when product is applied with air boom spreaders. Abrasion damage to prills results in faster N release (up to 56% release after 24 h in laboratory water tests), negating some of the enhanced efficiency benefits. In this current potato response study, we compared ESN collected from the deflector plates of an airboom spreader to the dealer grade ESN that we have used in earlier trials. Additionally we examined stabilized N products SuperU (granular urea) and Agrotain Plus (a UAN solution additive), both manufactured by Agrotain. These products are designed to slow nitrate-N loss by including urease and nitrification inhibitors, in contrast to the physical barrier of a polymer coating.

The objectives of this study were, under field conditions, to 1) compare the effects of dealer grade ESN with ESN collected from an air boom spreader on potato yield and quality, and 2) evaluate the effectiveness of stabilized N products on potato yield and quality.

Materials and Methods

The study was conducted at the Sand Plain Research Farm in Becker, Minnesota on a Hubbard loamy sand using the potato cultivar Russet Burbank. The previous crop was rye. Selected soil chemical properties before planting were as follows (0-6"): water pH, 6.7; organic matter, 1.7%; Bray P1, 37 ppm; ammonium acetate extractable K, Ca, and Mg, 107, 890, and 178 ppm, respectively; Ca-phosphate extractable SO_4-S, 1 ppm; and DTPA extractable Zn, Cu, Fe, and Mn, 0.8, 1.0, 16.6, and 4.7 ppm, respectively. Extractable nitrate-N in the top 2 ft prior to planting was equivalent to 14.3 lb/A.

Whole "B" seed was hand planted in furrows on April 15, 2010. Four, 20 ft rows were planted for each plot with 18 ft of each of the middle two rows used for sampling and harvest. Spacing was 36 inches between rows and 12 inches within each row. Each treatment was replicated four times in a randomized complete block design. Weeds, diseases, and insects were controlled using standard practices. Rainfall was supplemented with sprinkler irrigation using the checkbook method of irrigation scheduling.

Agrium, Inc. produces Environmentally Smart Nitrogen (ESN, 44-0-0), which is a polymer coated urea. Two grades of ESN were tested in this study (dealer grade and ESN collected from the deflector plates of an air boom spreader), along with uncoated urea (46-0-0). In addition two stabilized N products were examined: SuperU (46-0-0) and Agrotain Plus (an additive used for UAN solutions) – both produced by Agrotain International L.L.C. Fifteen treatments were tested and are listed below (Table 1).

Table 1. Nitrogen treatments tested in the controlled release/stabilized N fertilizer study.

Trmt	N Timing[1]				Total
	Preplant	Planting	Emergence/Hilling	Post-Hilling[2] (4 apps)	
	lb N / A				
1	0	30	0	0	30
2	0	30	110 Urea	100 UAN	240
3	0	30	110 UAN	100 UAN	240
4	0	30	110 UAN + Agrotain Plus	100 UAN	240
5	0	30	110 Urea + 100 ESN(C)	0	240
6	0	30	210 Urea	0	240
7	0	30	210 ESN(C)	0	240
8	0	30	210 ESN(A)	0	240
9	0	30	210 SuperU	0	240
10	100 Urea	30	110 Urea	0	240
11	100 ESN(C)	30	110 ESN(C)	0	240
12	100 SuperU	30	110 UAN + Agrotain Plus	0	240
13	210 Urea	30	0	0	240
14	210 ESN(C)	30	0	0	240
15	210 SuperU	30	0	0	240

[1]ESN = Environmentally Smart Nitrogen 44-0-0, Agrium Inc; (C) = control: dealer grade; (A) = airboom; UAN = a combination of granular urea and ammonium nitrate.

[2]Post-hilling N was applied 4 times (2 times at 20 lb N/A and 2 times at 30 lb N/A) at approximately 2-wk intervals.

Preplant fertilizers were broadcast applied 6 days before planting on April 9 and incorporated with a field cultivator. At the same time, 150 lb K_2O/A as potassium chloride was applied and incorporated on all plots. A starter fertilizer containing 30 lb N/A, 130 lb P_2O_5/A, 181 lb K_2O/A, 20 lb Mg/A, and 46 lb S/A as a blend of ammonium phosphate (MAP), potassium chloride, potassium magnesium sulfate, and ammonium sulfate were applied to all plots at planting.

Plant emergence N applications were sidedressed as urea, ESN, SuperU, or Agrotain Plus on May 10 and mechanically incorporated into the hill. Post-hilling N was applied by hand over the plots as 50% granular urea and 50% granular ammonium nitrate and watered-in with overhead irrigation to simulate fertigation with 28% N. The four post-hilling applications took place on June 3, June 16, June 30, and July 19.

Plant stands were measured on June 2 and the number of stems per plant was counted on June 9. Petiole samples were collected from the 4th leaf from the terminal on June 7, June 22, July 8, July 27, and Aug 12. Petioles were analyzed for nitrate-N on a dry weight basis. Vines were harvested from two, 10-ft sections of row on September 10, followed by mechanically beating the vines over the entire plot area. On September 22, plots were machine-harvested and total tuber yield, graded yield, tuber specific gravity, and the incidence of scab, hollow heart, and brown center were measured.

Measured amounts of ESN fertilizer were placed in plastic mesh bags and buried at the depth of fertilizer placement when both the preplant and emergence applications were made. Bags were removed on April 21, May 4, May 18, June 2, June 14, June 28, July 19, Aug 17, Sept 10, and Oct 5 for preplant applied, and May 18, June 2, June 14, June 28, July 12, July 27, Aug 12, Aug 25, Sept 10, and Oct 5 for emergence applied fertilizer to track N release over time. Soil samples from the 0-2 ft depth were collected on Oct 13 & 14 to measure residual inorganic N levels. Each sample consisted of four soil cores that were composited, oven dried at 90° F, extracted with 2M KCl, and analyzed for nitrate-N and ammonium-N. A WatchDog weather station from Spectrum Technologies was used to monitor air temperature, soil temperature, and soil moisture (utilizing Watermark soil moisture sensors). Soil temperature and soil moisture were measured at about 4 inches below the top of the hill and 2 inches in from the side of the hill.

The experiment was statistically analyzed using ANOVA procedures on SAS and means were separated using a Waller-Duncan LSD test at P=0.10

Results

Weather and Environmental: Rainfall and irrigation amounts are shown in Fig. 1 and air temperature, soil temperature, and soil moisture in Fig. 2. From April 15 to September 12 (planting to vine kill), approximately 33.2 inches of rainfall was supplemented with 11.8 inches of irrigation for a total of 45.0 inches of water. Significant leaching occurred in May and June. Vine die-off began early in this study, with noticeable decline occurring by the 2nd week in August. The causes of the decline are likely to have been disease (potentially black dot), exacerbated by high N leaching in June.

Nitrogen release from ESN: Release curves for the various grades and application timings of ESN controlled release fertilizer are presented in Fig. 1. Despite application dates a month apart, preplant and emergence applications of the control (dealer grade) ESN(C) had similar release rates early on as shown by nearly parallel release curves. In both cases, 40% of the N was released after about 20 days. Release from the airboom emergence ESN(A) was much faster with over 60% released after only 8 days, while only 12% was released from ESN(C). At about 20 days post application, release from the preplant ESN(C) and the emergence ESN(A) began to slow until percent N released for all three treatments converged at 74 DAP and 92%. From then on, ESN release rates for all treatments were approximately equal. At the last measurement at 173 DAP, totals were between 98 and 100% N released, suggesting low to no risk of significant post-season N release.

ESN release rates in all three treatments matched the N uptake pattern of Russet Burbank potatoes fairly consistently. Russet Burbank takes up the majority of its N between 40 and 80 days after planting. ESN had released 78, 87, and 91% of its N by 60 days after planting for the emergence ESN(C), preplant ESN(C), and emergence ESN(A) treatments, respectively. When compared to past years, the ESN(C) preplant application released N at a rate comparable to similar treatments in 2008 and 2009 with a release of approximately 45% by 25 DAP. The quicker release of ESN(A), however, may result in early season N losses if leaching rainfall occurs.

Tuber Yield: Total yields were greatest for the emergence applied dealer grade control - ESN(C) - and SuperU (trmts 7 and 9, respectively), although they were only significantly greater than the control and the emergence applied urea/ESN(C) blended treatment (trmt 5; Table 2). Significantly lower yields were also realized from the 110 lb N/A UAN + Agrotain Plus applied at emergence with 100 lb N/A UAN applied in 4 split post-hilling applications (trmt 4) when compared with the emergence SuperU treatment (trmt 9). As expected, all treatments receiving N fertilizer had significantly greater total yields than the control. There were no significant differences in yields among preplant treatments. The mean yield from ESN(A) was numerically lower than that of ESN(C) by nearly 45 cwt/A (8.5%). However, this was not found to be a significant difference, so the effect of the potential damage to the polymer coating from airboom application on total yield is not conclusive.

Three of the 5 treatments with top marketable yields were those with 210 lb/A fertilizer applied at emergence (ESN(C), SuperU, and urea; trmts 7, 9, and 6, respectively). The other two were ESN(C) applied at preplant (trmt 14) and treatment 12, which combined SuperU applied at preplant with emergence applied UAN + Agrotain Plus. The conventional treatment of emergence applied urea with UAN split applied post emergence did, however, produce significantly lower yields than both the emergence applied ESN(C) and SuperU treatments (trmts 7 & 9, respectively). There were no significant differences in marketable yields between the comparable preplant vs. postplant applications of urea and none between the ESN(C) preplant/postplant treatments. The emergence applied SuperU yield, however, was significantly higher than the preplant. Significantly lower marketable yields were harvested from the preplant urea (trmt 13) when compared with emergence applied ESN(C) (trmt 7). Emergence applied ESN(C) also produced significantly higher marketable yields than the emergence ESN(C)/urea blend (trmt 5). The addition of Agrotain Plus to UAN (trmt 4) did not significantly affect yields when compared to straight UAN (trmt 3). The yield from the control was again significantly lower than any of the fertilized treatments.

Emergence applied ESN(C) (trmt 7) had a significantly higher percentage of large tubers (>10 oz) than half of the fertilized treatments, but was not different from the ESN(A). Two urea treatments, 210 lb/A applied at preplant (trmt 13) and split between preplant and emergence (trmt 10), did not produce significantly more tubers >10 oz than the control. Treatment 10 was also not significantly different to the control with respect to the number of tubers >6 oz.

Stand Count, Stems per Plant, and Tuber Quality: Plant stands ranged from about 98 to 100% and there were no significant differences among treatments with respect to plant stand (Table 3). There were also no significant differences among treatments with respect to the number of stems per plant with a study average of 3.6. The emergence applied ESN(C)/Urea blend (trmt 5) resulted in the highest tuber specific gravity. There were no significant differences in incidence of scab among treatments (all treatments under 25%). Both hollow heart and brown center were numerically lowest in the control, but other significant differences were not consistently associated with differences in N treatment.

Vine Dry Matter: ESN(C) applied at a rate of 210 lb N/A at emergence (trmt 7) produced the most vines, measured as dry matter (Table 3). Its production was significantly higher than that of any of the other treatments. The next two highest vine dry matter producing treatments were those that included Agrotain Plus (trmts 4 and 12). However, these were not significantly higher than the production of any of the other remaining fertilized treatments. Vine dry matter from the control was the lowest by a significant amount.

Petiole Nitrate-N Concentrations: June 7 mean nitrate concentrations were highest in petioles collected from the preplant SuperU treatment (trmt 15; Table 4). However, these concentrations were only significantly higher than those of the 50/50 preplant/emergence urea and ESN(C) treatments (trmts 10 & 11, respectively), the emergence only ESN(C) (trmt 7), and the control. On that date, petioles from the emergence only ESN(C) were also lower in NO_3^- than the preplant ESN(C) and urea treatments (trmts 14 & 13, respectively), the emergence applied ESN(A) treatment (trmt 8), and the emergence urea with post hilling split applied UAN treatment (trmt 2). On June 22, petioles from the emergence applied control grade ESN(C) treatment (trmt 7) contained mean concentrations of NO_3^- significantly higher than those of any of the other treatments. On July 8, petiole N concentrations in the emergence and post hilling UAN with Agrotain Plus treatment (trmt 4) were the highest among treatments, although not significantly different than the N concentrations from emergence only ESN(C) petioles. The remainder of the treatments produced petioles on July 8 that were significantly lower in N, and were in fact deficient in N for the tuber bulking growth stage. On July 27, petiole samples from the emergence applied urea + post hilling UAN (trmt 2) and UAN with Agrotain Plus (trmt 4) were significantly higher in NO_3^- than all other treatments but not different from each other, while samples collected on Aug 12 from the urea + post hilling UAN (trmt 2) were numerically higher in nitrate than all other samples collected on that date, but not significantly different from petioles collected from treatments the emergence only ESN(C) (trmt 7), the emergence and post hilling UAN with and without Agrotain Plus treatment (trmts 4 & 3, respectively), or the 50/50 preplant/emergence ESN(C) (trmt 7). The emergence only ESN(C) treatment did, however, produce petioles with significantly higher nitrate content than the emergence applied SuperU treatment (trmt 9).

When tracking emergence applied ESN(C), ASN(A) and SuperU though the season, the ESN(A) treatment resulted in highest readings on the first date followed by Super(U), and then ESN(C). After that date, ESN(C) resulted in the highest readings followed by ESN(A) and then Super U. These results point to a slower release nature of ESN when it is not damaged. The results also suggest when applied at equivalent rates and timing, the undamaged ESN has the potential to release N through the season longer than SuperU and damaged ESN.

Mean concentrations of NO_3^- in the petiole samples were numerically lowest for the control (trmt 1) on all dates except Aug 12 and significantly lower than those of all treatments on June 7 and June 22. On July 8 the control produced significantly lower petiole nitrate levels than all other treatments except the preplant + emergence urea (trmt 10) and the preplant urea (trmt 13). On Aug 12, the preplant urea treatment (trmt 13) produced the lowest petiole N levels, but not significantly different than preplant + emergence urea, urea or SuperU applied only at emergence, or SuperU applied at preplant with emergence applied UAN + Agrotain Plus (trmts 10, 6, 9, & 12, respectively).

Residual soil N: There were no significant differences among individual treatments with respect to post-harvest residual soil N (Table 5). Mean soil N levels were the equivalent of between 0.8 and 4.8 lb/A N for ammonium and 22.2 and 27.9 lb/A N for nitrate. Contrast analysis suggests no significant difference between the control (trmt 1) and the fertilized treatments with respect to residual nitrate or ammonium. These results suggest significant leaching during the season

Conclusions

Nitrogen release from the air boom ESN(A) was found to be much more rapid than release from a comparable application of dealer grade product – ESN(C) - which released N at a rate consistent with what was seen in previous years. Tuber yields with ESN(C) were numerically higher than with ESN(A), but these differences were not statistically significant. In a leaching year early in the growing season, risk of losses would be minimized by using undamaged ESN. Marketable yield was significantly higher from plants fertilized at emergence solely with ESN(C) or SuperU treatments when compared with urea + ESN(C) and urea + split applied UAN treatments. Results indicate that the use of emergence applied ESN, SuperU, or adding Agrotain Plus to a UAN treatment can produce marketable yield and tuber quality comparable to or higher than conventional fertilizer treatments. However, yields in all treatments in this study were somewhat compromised as a result of early vine death in August due to unknown causes.

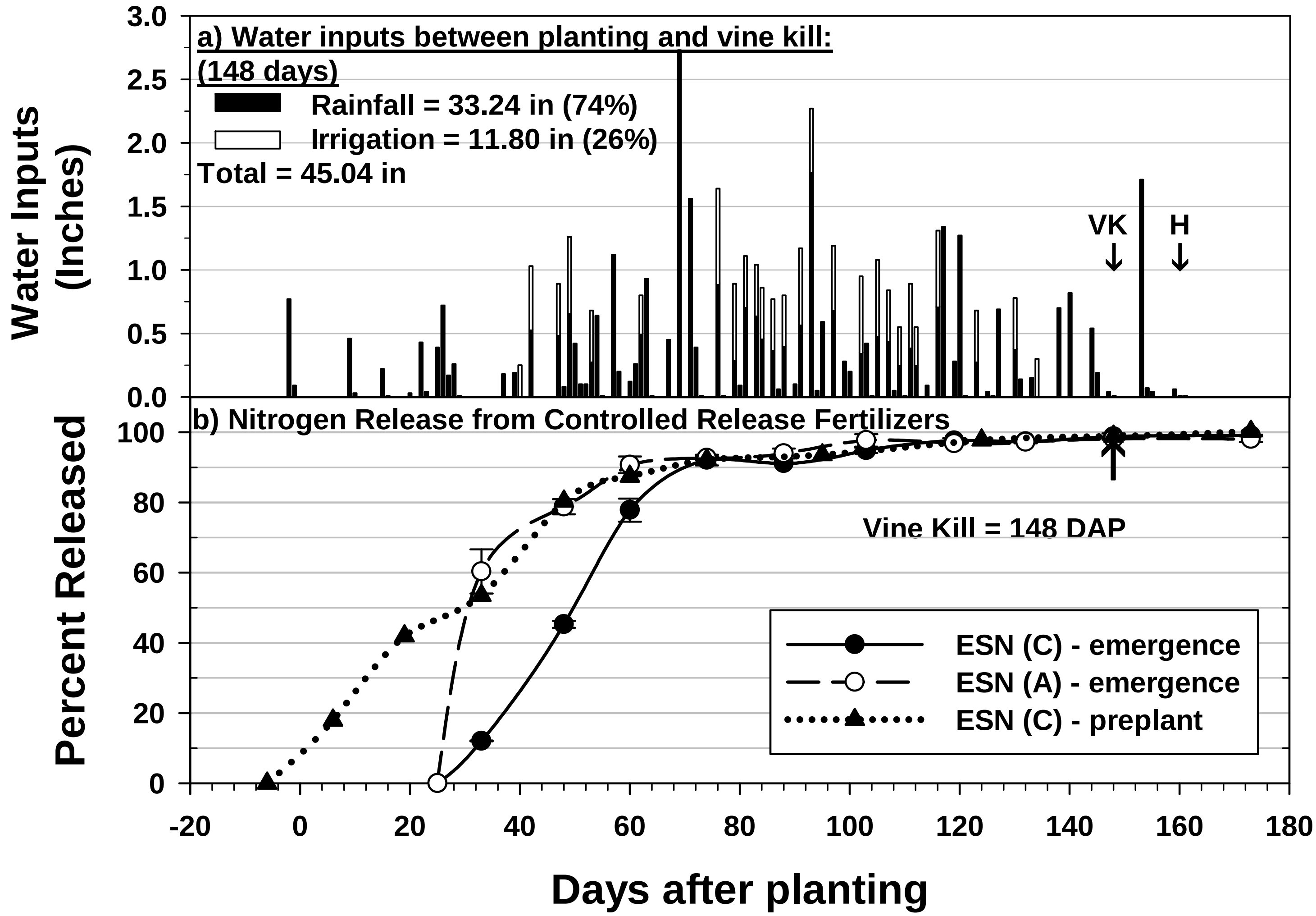

Figure 1. a) Rainfall and irrigation amounts and; b) nitrogen release from controlled release fertilizers during the 2010 growing season. ESN(C) = Control: Dealer grade ESN; ESN(A) = Airboom ESN. Planting (April 15); VK = Vine Kill (Sept 10); H = Harvest (Sept 22)

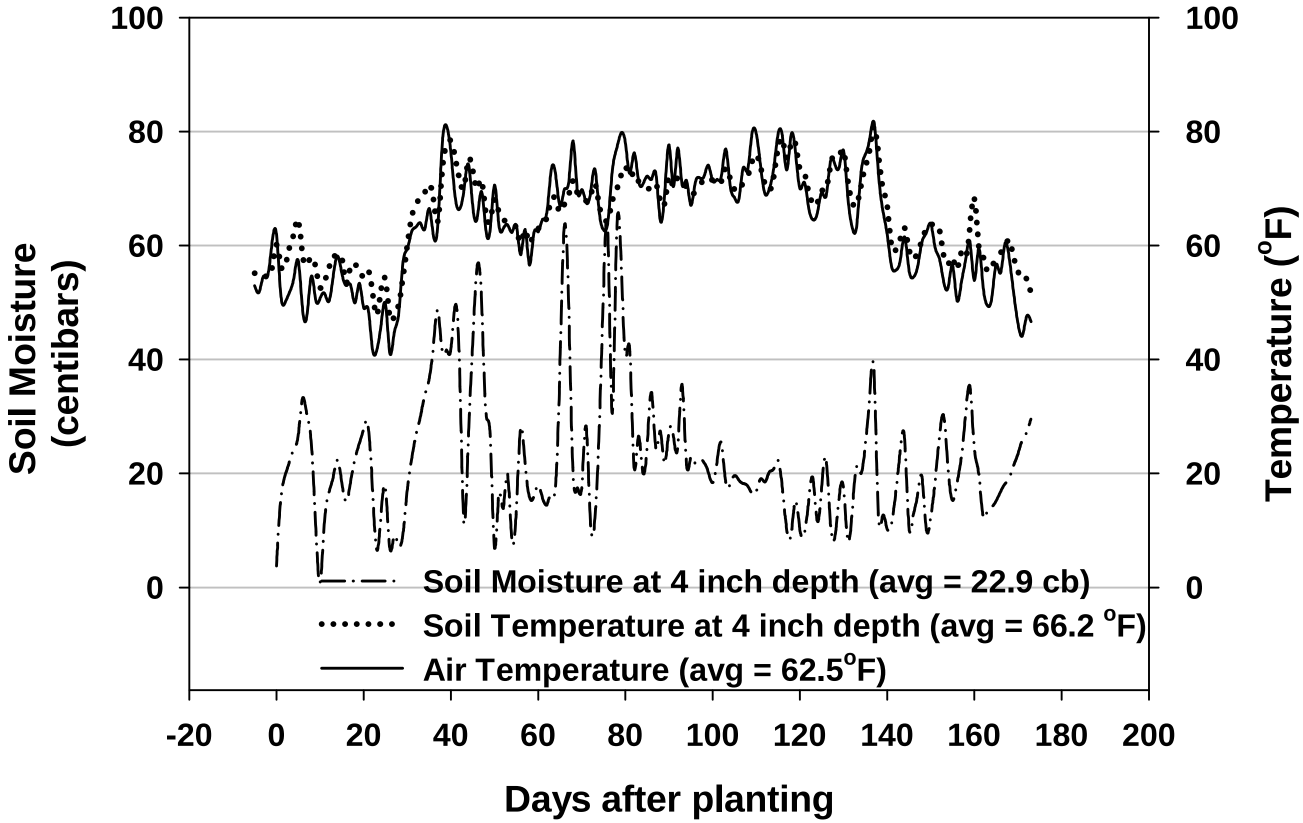

Figure 2. Soil moisture and soil & air temperatures during the 2010 growing season.

Table 2. Effects of N source, quality, and timing on Russet Burbank tuber yield and size distribution.

Nitrogen Treatments				Tuber Yield											Vines
Trtmt #	N Source[1]	N Rate	N Timing[2]	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6 oz	> 10 oz	DM
		lb N / A	PP, P, E, PH	cwt / A									%		ton / A
1	Control	30	0, 30, 0, 0	120.3	210.2	51.1	1.9	0.0	383.5	208.1	55.1	263.2	13.38	0.44	0.27
2	Urea / UAN	240	0, 30, 110, 100	110.2	206.4	127.8	32.9	5.6	482.8	326.7	45.9	372.6	34.30	7.91	0.59
3	UAN	240	0, 30, 110, 100	105.8	198.3	136.5	38.1	18.6	497.4	328.3	63.2	391.5	38.75	11.29	0.79
4	UAN / Agrotain Plus	240	0, 30, 110, 100	79.0	182.7	151.4	36.8	18.1	467.8	323.1	65.7	388.9	43.90	11.90	0.87
5	Urea / ESN(C)	240	0, 30, 210, 0	89.6	198.4	132.9	34.3	6.1	461.4	349.2	22.5	371.8	37.49	8.79	0.72
6	Urea	240	0, 30, 210, 0	90.9	214.3	144.0	41.4	5.1	495.7	374.7	30.0	404.8	38.17	9.27	0.65
7	ESN(C)	240	0, 30, 210, 0	72.8	208.0	164.4	44.2	27.8	517.2	370.1	74.4	444.4	45.31	13.81	1.32
8	ESN(A)	240	0, 30, 210, 0	78.2	190.9	144.2	51.3	8.7	473.3	371.4	23.7	395.1	43.17	12.71	0.71
9	SU	240	0, 30, 210, 0	78.6	217.1	172.8	36.9	13.7	519.0	390.1	50.4	440.4	43.12	9.79	0.64
10	Urea	240	100, 30, 110, 0	134.4	254.4	88.4	10.1	0.9	488.2	328.9	25.0	353.8	20.36	2.27	0.63
11	ESN(C)	240	100, 30, 110, 0	85.4	202.2	137.9	44.6	9.8	479.9	352.6	41.8	394.5	39.97	11.33	0.74
12	SU / UAN / Agrotain Plus	240	100, 30, 110, 0	95.0	226.4	144.6	28.8	3.5	498.3	356.5	46.8	403.3	35.50	6.56	0.81
13	Urea	240	210, 30, 0, 0	116.0	251.5	116.3	21.2	1.6	506.6	355.7	34.9	390.6	27.48	4.52	0.66
14	ESN(C)	240	210, 30, 0, 0	85.2	225.8	144.7	32.4	5.2	493.4	383.5	24.8	408.2	36.58	7.54	0.67
15	SU	240	210, 30, 0, 0	96.6	224.2	123.9	26.2	8.1	479.1	327.9	54.5	382.4	32.89	7.08	0.58
			Significance[3]	**	**	**	**	**	**	**	NS	**	**	**	**
			LSD (0.10)	14.8	47.4	30.5	20.6	9.7	50.1	43.8	--	53.0	6.95	4.62	0.31

[1]ESN(C) = Control: Dealer grade ESN; ESN(A) = Airboom ESN; SU = Super U.

[2]PP, P, E, PH = Preplant, Planting, Emergence, and Post-Hilling, respectively; 4 post-hilling applications were as follows: 20%, 20%, 30%, 30%.

[3]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 3. Effects of N source, quality, and timing on Russet Burbank tuber quality, plant stand, number of stems per plant, and vine dry matter.

Trtmt #	N Source[1]	N Rate	N Timing[2]	Specific Gravity	Tuber Quality[3] HH	BC	Scab	Plant Stand	# Stems per Plant	Vine DM[4]
		lb N / A	PP, P, E, PH		%					ton / A
1	Control	30	0, 30, 0, 0	1.0742	0.0	1.0	20.3	100.0	3.5	0.27
2	Urea / UAN	240	0, 30, 110, 100	1.0697	11.0	12.3	21.3	99.3	3.8	0.59
3	UAN	240	0, 30, 110, 100	1.0712	9.8	9.8	23.8	100.0	3.6	0.79
4	UAN / Agrotain Plus	240	0, 30, 110, 100	1.0712	14.8	14.8	18.3	100.0	3.7	0.87
5	Urea / ESN(C)	240	0, 30, 210, 0	1.0756	7.0	7.0	16.0	100.0	3.5	0.72
6	Urea	240	0, 30, 210, 0	1.0720	14.0	14.0	20.0	97.9	3.4	0.65
7	ESN(C)	240	0, 30, 210, 0	1.0720	11.0	11.0	23.0	100.0	3.5	1.32
8	ESN(A)	240	0, 30, 210, 0	1.0701	12.3	12.3	15.3	99.3	3.3	0.71
9	SU	240	0, 30, 210, 0	1.0741	16.0	16.0	22.3	100.0	3.3	0.64
10	Urea	240	100, 30, 110, 0	1.0749	4.0	4.0	23.3	100.0	3.9	0.63
11	ESN(C)	240	100, 30, 110, 0	1.0712	16.5	16.5	20.3	99.3	3.6	0.74
12	SU / UAN / Agrotain Plus	240	100, 30, 110, 0	1.0723	6.0	6.0	25.0	97.9	3.6	0.81
13	Urea	240	210, 30, 0, 0	1.0744	7.0	7.0	16.0	99.3	3.7	0.66
14	ESN(C)	240	210, 30, 0, 0	1.0727	7.3	7.3	12.3	98.6	3.6	0.67
15	SU	240	210, 30, 0, 0	1.0725	11.3	11.3	22.3	98.6	3.5	0.58
			Significance[5]	++	**	**	NS	NS	NS	**
			LSD (0.1)	0.0045	7.4	7.7	--	--	--	0.31

[1]ESN(C) = Control: Dealer grade ESN; ESN(A) = Airboom ESN; SU = Super U.

[2]PP, P, E, PH = Preplant, Planting, Emergence, and Post-Hilling, respectively; 4 post-hilling app. as: 20%, 20%, 30%, 30%.

[3]HH = Hollow Heart; BC = Brown Center

[4]DM = Dry Matter

[5]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 4. Effects of N source, rate, and timing on nitrate-N concentrations in petioles from Russet Burbank potato on five sampling dates.

Trtmt #	N Source[1]	N Timing[2] PP, P, E, PH	N Rate lb N / A	NO_3^- concentration (mg/kg) by sampling date June 7	June 22	July 8	July 27	August 12
1	Control	0, 30, 0, 0	30	6097	215	342	692	1568
2	Urea / UAN	0, 30, 110, 100	240	21447	5755	8480	10266	6349
3	UAN	0, 30, 110, 100	240	20732	7586	10191	5518	6206
4	UAN / Agrotain Plus	0, 30, 110, 100	240	19276	8787	13317	8476	6238
5	Urea / ESN(C)	0, 30, 210, 0	240	19845	9081	6060	2745	4933
6	Urea	0, 30, 210, 0	240	19222	8186	2917	741	1703
7	ESN(C)	0, 30, 210, 0	240	17277	12007	11691	4036	6333
8	ESN(A)	0, 30, 210, 0	240	21013	9275	7537	3475	4723
9	SU	0, 30, 210, 0	240	19611	9204	3479	1152	2856
10	Urea	100, 30, 110, 0	240	19011	3520	939	709	2111
11	ESN(C)	100, 30, 110, 0	240	18888	9505	8350	3101	5332
12	SU/UAN/Agrotain Plus	100, 30, 110, 0	240	20712	7514	4033	1380	1877
13	Urea	210, 30, 0, 0	240	21397	5757	1478	860	1675
14	ESN(C)	210, 30, 0, 0	240	22147	7091	3414	1733	3812
15	SU	210, 30, 0, 0	240	22590	6841	2488	2768	3339
			Significance[3]	**	**	**	**	**
			LSD (0.1)	3514	2103	1829	1948	1381

[1]ESN(C) = Control: Dealer grade ESN; ESN(A) = Airboom ESN; SU = Super U.
[2]PP, P, E, PH = Preplant, Planting, Emergence, and Post-Hilling, respectively;
4 post-hilling applications as: 20%, 20%, 30%, 30%.
[3]NS = Not significant, * Significant at 1%, ** Significant at 5%, ++ Significant at 10%

Table 5. Effects of N source, rate, and timing on residual inorganic soil N after harvest of Russet Burbank potato.

Trtmt #	N Source[1]	N Rate	N Timing[2]	Residual Soil N		
				NO_3	NH_4	Total
		lb N / A	PP, P, E, PH	lb N/A		
1	Control	30	0, 30, 0, 0	22.2	1.2	23.5
2	Urea / UAN	240	0, 30, 110, 100	26.0	2.7	28.7
3	UAN	240	0, 30, 110, 100	26.5	3.1	29.6
4	UAN / Agrotain Plus	240	0, 30, 110, 100	27.4	3.5	30.9
5	Urea / ESN(C)	240	0, 30, 210, 0	27.9	4.8	32.7
6	Urea	240	0, 30, 210, 0	24.7	1.4	26.1
7	ESN(C)	240	0, 30, 210, 0	26.3	2.3	28.6
8	ESN(A)	240	0, 30, 210, 0	25.9	1.4	27.2
9	SU	240	0, 30, 210, 0	23.2	0.8	24.1
10	Urea	240	100, 30, 110, 0	26.0	3.8	29.8
11	ESN(C)	240	100, 30, 110, 0	26.5	1.6	28.0
12	SU/UAN/Agrotain Plus	240	100, 30, 110, 0	22.8	4.8	27.6
13	Urea	240	210, 30, 0, 0	23.3	1.7	24.9
14	ESN(C)	240	210, 30, 0, 0	26.8	1.7	28.6
15	SU	240	210, 30, 0, 0	23.5	1.8	25.3
			Significance[3]	NS	NS	NS
			LSD (0.1)	--	--	--
Contrasts						
			Control vs. Rest (1 vs. 2-15)	NS	NS	NS

[1]ESN(C) = Control: Dealer grade ESN; ESN(A) = Airboom ESN; SU = Super U.
[2]PP, P, E, PH = Preplant, Planting, Emergence, and Post-Hilling, respectively;
4 post-hilling applications as: 20%, 20%, 30%, 30%.
[3]NS = Not significant, * Significant at 1%, ** Significant at 5%, ++ Significant at 10%

Effects of Phosphorus and Calcium on Tuber Set, Yield, and Quality in Goldrush Potato

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Summary: A field experiment at the Sand Plain Research Farm in Becker, MN was conducted in 2010 to evaluate the effects of phosphorus and calcium nutrient based management practices on Goldrush potato tuber yield and set. Seed planting depth was also examined for its effect on tuber greening. A comparison was made between a standard practices control and treatments that included 0 vs. 150 lb P/A, and/or the addition of 0 vs. 200 lb Ca/A as either gypsum or calcium chloride. Additionally, a 'deep seed' treatment was included which increased the seeding depth by 4 in. The P fertilizer treatments at planting did not significantly affect tuber size or set. The addition of supplemental Ca also did not have a significant effect on tuber size or set as shown by the lack of significant difference in either category. There was no evidence of any combined effect due to P removal and supplemental Ca on tuber set. Gypsum with P or without P tended to result in lower total tuber yield than the other treatments tested. The result of deep seeding on tuber greening was inconclusive due to a general lack of tuber greening in any of the treatments. At equivalent fertilizer rates, deep seeding did not significantly affect tuber yield.

Background: Goldrush potato is a fresh market russet that has a high yield potential but is less susceptible to producing misshapen tubers than other cultivars, such as Russet Burbank. Goldrush does, however, have a tendency to produce a second tuber set and also to initiate tubers near the surface of the hill. These problems can result in large numbers of undersized or green tubers. Previous work with Russet Burbank has shown that eliminating phosphorus fertilizer at planting can increase tuber size by reducing tuber set. Research conducted in Wisconsin has shown that calcium application at early hilling can have the same effect. However, no studies have been done to examine tuber set where these two management practices have been combined – i.e. the elimination of P fertilizer application at planting and the subsequent application of a calcium source at hilling. In this study, we compared a conventional P application strategy with treatments that included Ca, removed P, or both. Additionally a treatment to evaluate the practice of 'deep seeding' on tuber greening was also included.

The objectives of this study were, under field conditions, to 1) evaluate the effect of P and Ca management on tuber set in Goldrush potato, and 2) determine if a greater seeding depth can reduce tuber greening.

Materials and Methods

The study was conducted at the Sand Plain Research Farm in Becker, Minnesota on a Hubbard loamy sand using the potato cultivar Goldrush. The previous crop was rye. Selected soil chemical properties before planting were as follows (0-6"): water pH, 6.2; organic matter, 1.9%; Bray P1, 24 ppm; ammonium acetate extractable K, Ca, and Mg, 113, 835, and 156 ppm, respectively; Ca-phosphate extractable SO_4-S, 2 ppm; and DTPA extractable Zn, Cu, Fe, and Mn, 0.7, 0.3, 26.5, and 6.7 ppm, respectively. Extractable nitrate-N in the top 2 ft prior to planting was equivalent to 10.8 lb/A.

Whole “B” seed was hand planted in furrows on April 22, 2010 at a 6-8 in depth, except for the deep seeded treatment, which was planted at a 10-12 in depth. Four, 20 ft rows were planted for each plot with 18 ft of each of the middle two rows used for sampling and harvest. Spacing was 36 inches between rows and 12 inches within each row. Each treatment was replicated four times in a randomized complete block design. Weeds, diseases, and insects were controlled using standard practices. Rainfall was supplemented with sprinkler irrigation using the checkbook method of irrigation scheduling.

Treatments included a conventional management practice control, a deep seeded treatment, and various combinations of reduced P and supplemental Ca as either gypsum or calcium chloride. Six treatments were tested and are listed below (Table 1).

Table 1. Phosphorus and Calcium treatments tested in the Goldrush tuber set study.

Treatment #	N	P_2O_5	K_2O	Ca	
	lb / A				
1	240	150	300	0	None
2	240	150	300	200	Gypsum
3	240	0	300	0	None
4	240	0	300	200	Gypsum
5	240	0	300	200	Calcium Chloride
6	240	150	300	0	None (Deep Seed)

A starter fertilizer containing 60 lb N/A and 150 lb P_2O_5/A as diammonium phosphate (DAP), and 300 lb K_2O/A and 30 lb S/A as potassium sulfate were applied to treatments 1, 2, and 6 at planting, while treatments 3, 4, and 5 received 60 lb N/A as ammonium nitrate and 300 lb K_2O/A and 30 lb S/A as a blend of potassium sulfate and potassium chloride. The remaining 180 lb N/A was sidedressed as urea and mechanically incorporated - half at emergence on May 25 and half at hilling on June 2. Calcium treatments of 200 lb Ca/A as calcium chloride or gypsum were sidedressed at hilling on June 2.

Plant stands were measured on June 2 and the number of stems per plant was counted on June 9. Tuber numbers were measured by hand-digging five plants before machine harvest on Sept. 7 and separating them into size categories before counting. On Sept. 8, vines were killed via mechanical beating. Plots were machine-harvested on Sept. 14 and total tuber yield, graded yield, tuber specific gravity, and the incidence of scab, hollow heart, and brown center were measured. Tuber greening was also examined at this time through a visual inspection process whereby any noticeable greening on a given tuber from each plot was considered a positive indication of greening.

All trials of the experiment were statistically analyzed using ANOVA procedures on SAS and means were separated using a Waller-Duncan LSD test at P = 0.10.

Results

Rainfall and irrigation amounts are presented in Figure 1.

Tuber Set and Yield: Total yields were greatest with the control (150 lb P/A and no supplemental Ca), which resulted in higher yields than either of the gypsum treatments, either with or without P (Table 1). With respect to marketable yield, the control again resulted in the numerically highest yields, although differences were not significant. There were no statistically significant differences among treatments in the numbers of small tubers produced (< 3 oz) or in the number of tubers > 6 oz or > 10 oz, although the deep-seeded treatment produced the numerically highest yields for the last two categories. Though not significant, the trend was for treatments with P additions to have yields with higher percentages of large tubers. There were no significant differences among treatments with respect to the specific gravity of tubers or number of tubers per plant.

Tuber Quality: Incidences of hollow heart and brown center were significantly higher in the standard practices control (trmt 1) than in other treatments (Table 2). Scab levels were not significantly different among treatments with means that ranged from 17 (deep seed trmt 6) to 31% (no P trmt 3). There were no significant differences in tuber greening among treatments as the number of green tubers was generally very low (< 2 tubers per 36 ft of harvested row) or zero in all treatments.

Conclusions

Phosphorus fertilizer at planting did not significantly affect tuber size or change in set. The addition of supplemental Ca also did not have a significant effect on tuber size or set as shown by the lack of significant difference in either category. There was no evidence of any combined effect due to P removal and supplemental Ca on tuber set. Gypsum with P or without P tended to result in lower total tuber yield that the other treatments tested. The result of deep seeding on tuber greening was inconclusive due to a general lack of tuber greening in any of the treatments. At equivalent fertilizer rates, deep seeding did not significantly affect tuber yield.

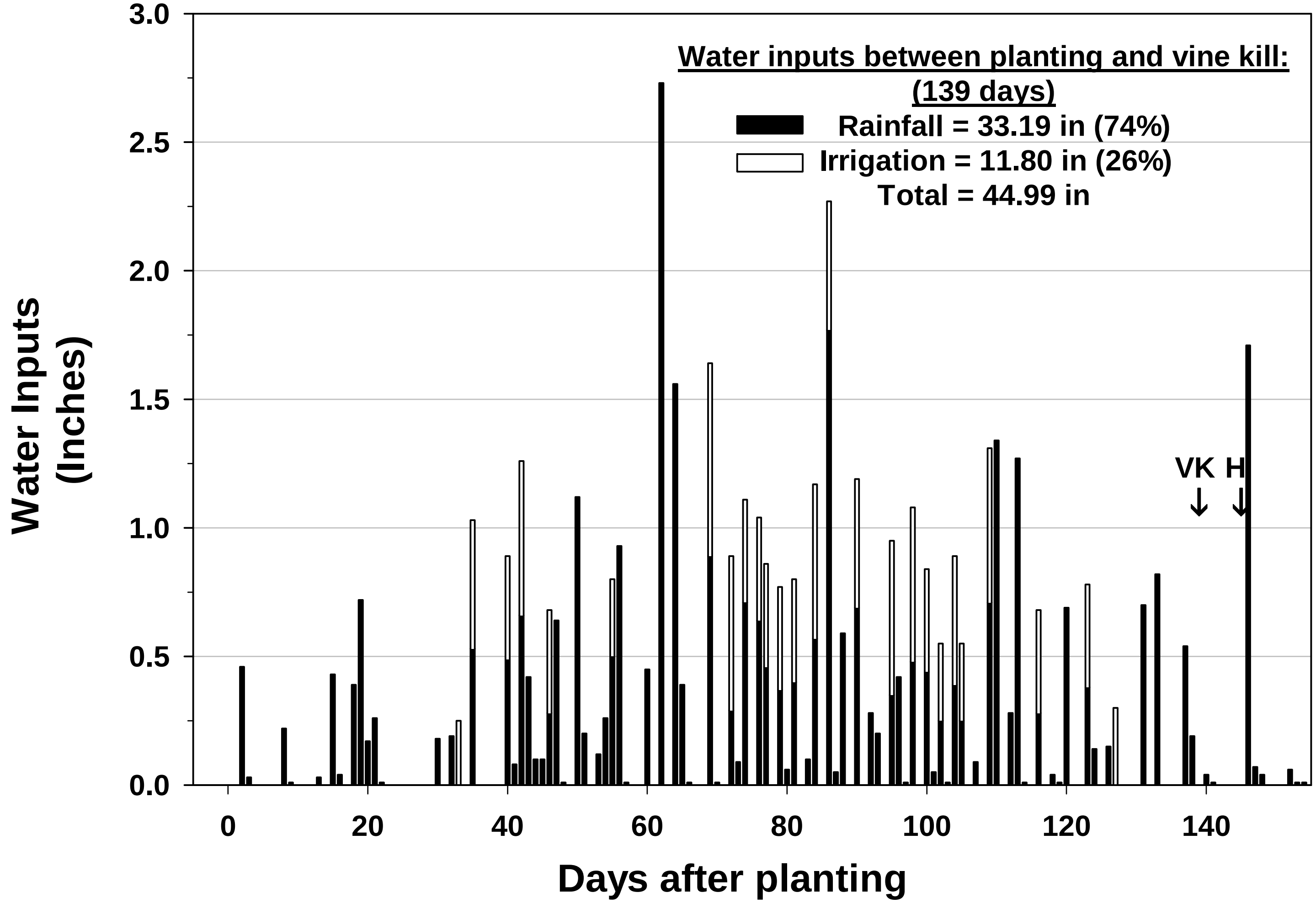

Figure 1. Rainfall and irrigation amounts during the 2010 growing season.
Planting (April 22); VK = Vine Kill (Sept 8); H = Harvest (Sept 14)

Table 1. Effects of reduced P, supplemental Ca, and Ca source on Goldrush tuber yield and size distribution.

Calcium and Phosphorus Treatments				Tuber Yield										
Trtmt #	Ca Source	Ca Rate	P Rate	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	# 2 > 3 oz	Total Marketable	> 6oz	> 10 oz
		lb Ca / A	lb / A	cwt / A									%	
1	None	0	150	26.2	97.1	157.3	118.2	79.3	478.0	415.4	36.4	451.8	74.1	41.1
2	Gypsum	200	150	27.2	87.7	142.0	106.9	74.8	438.6	379.4	32.0	411.4	73.7	41.3
3	None	0	0	29.1	103.9	172.3	99.4	58.0	462.7	413.3	20.3	433.6	71.3	34.0
4	Gypsum	200	0	25.0	107.5	145.1	96.3	63.8	437.6	385.7	26.9	412.7	69.5	36.3
5	Calcium Chloride	200	0	23.1	104.6	160.2	104.3	71.3	463.4	408.9	31.5	440.3	72.4	37.9
6	None (Deep Seed)	0	150	25.6	79.7	141.0	114.5	92.0	452.7	384.8	42.4	427.1	76.6	45.3
Significance[1]				NS	NS	NS	NS	NS	++	NS	NS	NS	NS	NS
LSD (0.10)				--	--	--	--	--	26.7	--	--	--	--	--

[1]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 2. Effects of reduced P, supplemental Ca, and Ca source on Goldrush tuber quality and tuber count (i.e. tubers per plant).

Calcium and Phosphorus Treatments				**Tuber Quality**[1]					**Tuber Count**				
Trtmt #	**Ca Source**	**Ca Rate**	**P Rate**	**Specific Gravity**	**HH**	**BC**	**Scab**	**Greening**	**0-3 oz**	**3-6 oz**	**6-10 oz**	**>10 oz**	**Total**
		lb Ca /A	**lb /A**		**%**			**# of Tubers**					
1	None	0	150	1.0667	1.5	1.5	27.0	0.5	3.8	3.1	2.5	1.5	10.8
2	Gypsum	200	150	1.0665	0.0	0.0	22.8	0.8	4.6	3.4	1.5	1.3	10.8
3	None	0	0	1.0674	0.0	0.0	30.5	0.0	2.5	2.3	3.3	1.1	9.2
4	Gypsum	200	0	1.0668	0.0	0.0	23.0	0.0	3.5	3.4	2.1	1.0	10.0
5	Calcium Chloride	200	0	1.0665	0.0	0.0	29.0	1.8	3.3	2.7	1.9	1.8	9.6
6	None (Deep Seed)	0	150	1.0653	0.0	0.0	17.0	0.0	3.1	2.4	2.8	1.8	10.0
			Significance[2]	NS	*	*	NS	NS	NS	NS	NS	NS	NS
			LSD (0.1)	--	1.0	1.0	--	--	--	--	--	--	--

[1]HH = Hollow Heart; BC = Brown Center

[2]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively

Russet Burbank Response to OceanGrown Fertilization System

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Summary: A field experiment at the Sand Plain Research Farm in Becker, MN was conducted in 2010 to evaluate the effects of the OceanGrown Fertilization System on Russet Burbank potato tuber yield and quality. A comparison was made between a standard practices control (240 lb N/A) and treatments that included a reduced N control (135 lb N/A), a starter only treatment (30 lb N/A), and treatments that included reduced N and OG foliar feeding, OG soil supplements, or a combination of the two. Only the standard practices (high N) control consistently produced significantly higher total yields. Results showed that the use of the OG foliar feed, OG soil amendments, or a combination regimen did not result in any significant advantageous or adverse effects with respect to total tuber yield and quality when compared to a comparable N only control. Based on petiole analysis, all treatments at the reduced nitrogen rate with or without OG supplements were N deficient.

Background: OceanSolution is a proprietary nutrient blend for foliar feeding produced by OceanGrown (OG) Canada, LTD. OG Carbon Four Component is a liquid supplement that can be added to a foliar feeding regimen. OG Humic Acid Component and OG Calcium Component are additional liquid soil supplements aimed at providing various agronomic benefits such as improved plant health and increased yields. In this study, we compared a conventional fertilizer control and a reduced N treatment with comparable reduced N treatments that included OG foliar feeding, OG soil amendments, and a combination of the two strategies.

The objective of this study was, under field conditions, to 1) evaluate the effect of OG foliar feeding and/or soil supplements on yield and quality of Russet Burbank potato.

Materials and Methods

The study was conducted at the Sand Plain Research Farm in Becker, Minnesota on a Hubbard loamy sand using the potato cultivar Russet Burbank. The previous crop was rye. Selected soil chemical properties before planting were as follows (0-6"): water pH, 6.6; organic matter, 1.7%; Bray P1, 42 ppm; ammonium acetate extractable K, Ca, and Mg, 131, 854, and 173 ppm, respectively; Ca-phosphate extractable SO_4-S, 8 ppm; and DTPA extractable Zn, Cu, Fe, and Mn, 0.6, 0.3, 18.3, and 4.7 ppm, respectively. Extractable nitrate-N in the top 2 ft prior to planting was 16 lb/A.

Whole “B” seed was hand planted in furrows on April 23, 2010. Four, 20 ft rows were planted for each plot with 18 ft of each of the middle two rows used for sampling and harvest. Spacing was 36 inches between rows and 12 inches within each row. Each treatment was replicated four times in a randomized complete block design. Weeds, diseases, and insects were controlled using standard practices. Rainfall was supplemented with sprinkler irrigation using the checkbook method of irrigation scheduling.

Six treatments were tested and are listed below (Table 1).

Table 1. OceanGrown treatments tested in the Russet Burbank yield and quality study.

Trmt #	OceanGrown Treatment[1]	Nitrogen Treatment	N Rate	
			Planting	Emergence
			lb N / A	
1	None	Conventional Fertilizer	30	210
2	None	Conventional Fertilizer	30	105
3	OG-HA + OG-Ca	Conventional Fertilizer	30	105
4	3 OG Foliar Treatments	Conventional Fertilizer	30	105
5	OG-HA + OG-Ca + 3 OG Foliar	Conventional Fertilizer	30	105
6	None	Starter Fertilizer Only	30	0

[1]OG = OceanGrown; HA = Humic Acid; Ca = Calcium; Foliar = Mixture of OceanSolution and OG Carbon Four. See text below for actual rates applied.

A starter fertilizer containing 30 lb N/A, 130 lb P_2O_5/A, 181 lb K_2O/A, 20 lb Mg/A, and 46 lb S/A as a blend of ammonium phosphate (MAP), potassium chloride, potassium magnesium sulfate, and ammonium sulfate were applied to all plots at planting. In addition, the OG Humic Acid component and OG Calcium component were applied at planting at a rate of 2 gal and 5 gal per acre, respectively, to treatments 3 and 5 in the furrow. The remaining 210 lb N/A (in trmt 1) or 105 lb N/A was sidedressed as polymer coated urea (ESN, Agrium Inc.) and mechanically incorporated at emergence on May 10. Foliar applications for treatments 4 and 5 occurred on May 28, June 26, and July 28 as 32 oz of OceanSolution and 16 oz OG Carbon per acre per application. All OG applications were made with a backpack sprayer.

Plant stands were measured on June 2 and the number of stems per plant was counted on June 9. Petiole samples were collected from the 4th leaf from the terminal on June 15, July 1, and July 12. Petioles were analyzed for nitrate-N on a dry weight basis. On Sept. 8, vines were killed via mechanical beating. Plots were machine-harvested on Sept. 14 and total tuber yield, graded yield, tuber specific gravity, and the incidence of scab, hollow heart, and brown center were measured.

All trials of the experiment were statistically analyzed using ANOVA procedures on SAS and means were separated using a Waller-Duncan LSD test at P = 0.10.

Results

Rainfall and irrigation amounts are presented in Figure 1. The 2010 growing season was wet with numerous leaching events.

Tuber Yield: Total yields were greatest for the full N control treatment 1 with 240 lb N/A and lowest for the 30 lb N/A starter only treatment 6 (Table 1). There was no significant difference among the remaining treatments, all at 135 lb N/A. With respect to marketable yield, treatment 1 again resulted in significantly higher yields while yields from treatment 6 were significantly lower. Treatment 2 (the low N control) also resulted in a significantly higher marketable yield than the combined foliar/soil OG treatment (trmt 5). The percent of tubers > 6 oz followed the same pattern as total yield, while the percent > 10 oz were highest in treatment 1 with no significant difference among the remainder of the treatments including the starter only treatment (trmt 6). There were no significant differences in the stands among treatments (98.6 to 100%) and none in stems per plant with a mean of 3.7 (Table 2).

Tuber Quality: Incidences of hollow heart and brown center were significantly higher in the high N standard practices control (trmt 1) than in other treatments (Table 2). However, scab levels were not significantly affected by treatment with means that ranged from 13 (trmt 1) to 20% (OG soil amendments trmt 3).

Petiole Nitrate-N Concentrations: On June 15, petioles from plants grown under treatment 1 (the full N control) contained mean concentrations of nitrate significantly higher than petioles from any of the other treatments; while petioles collected from treatment 6 (the starter only control) contained the lowest nitrate concentrations on average by a significant amount (table 3). Petioles collected from plants grown under treatment 5 were also significantly higher in nitrate than those from treatment 3, but there were no other significant differences among treatments. On July 1, petiole nitrate concentrations from plants grown under treatment 1 were again significantly higher than those from the remainder of treatments and samples collected from treatment 6 were significantly lower in nitrate than the remaining treatments, but there were no other significant differences among any of the other treatments. Treatment 1 produced plants with significantly higher petiole nitrate on July 12 and treatment 6 plants contained significantly lower amounts of petiole nitrate. On that date, petiole samples collected from treatment 5 were also significantly higher in nitrate than those from treatment 4, but there were no other statistical differences among the treatments. In general, petiole nitrate concentrations in plants grown at the reduced nitrogen rate (tmts 2-5) with or without OG supplements were at levels considered to be deficient at all dates.

Conclusions

At equivalent N rates, the use of the OG foliar feed, OG soil amendments, or a combination regimen did not significantly affect total tuber yield and quality. Marketable yield was slightly lower with the combination regimen compared with the conventional treatment, but reasons for this response are not known.

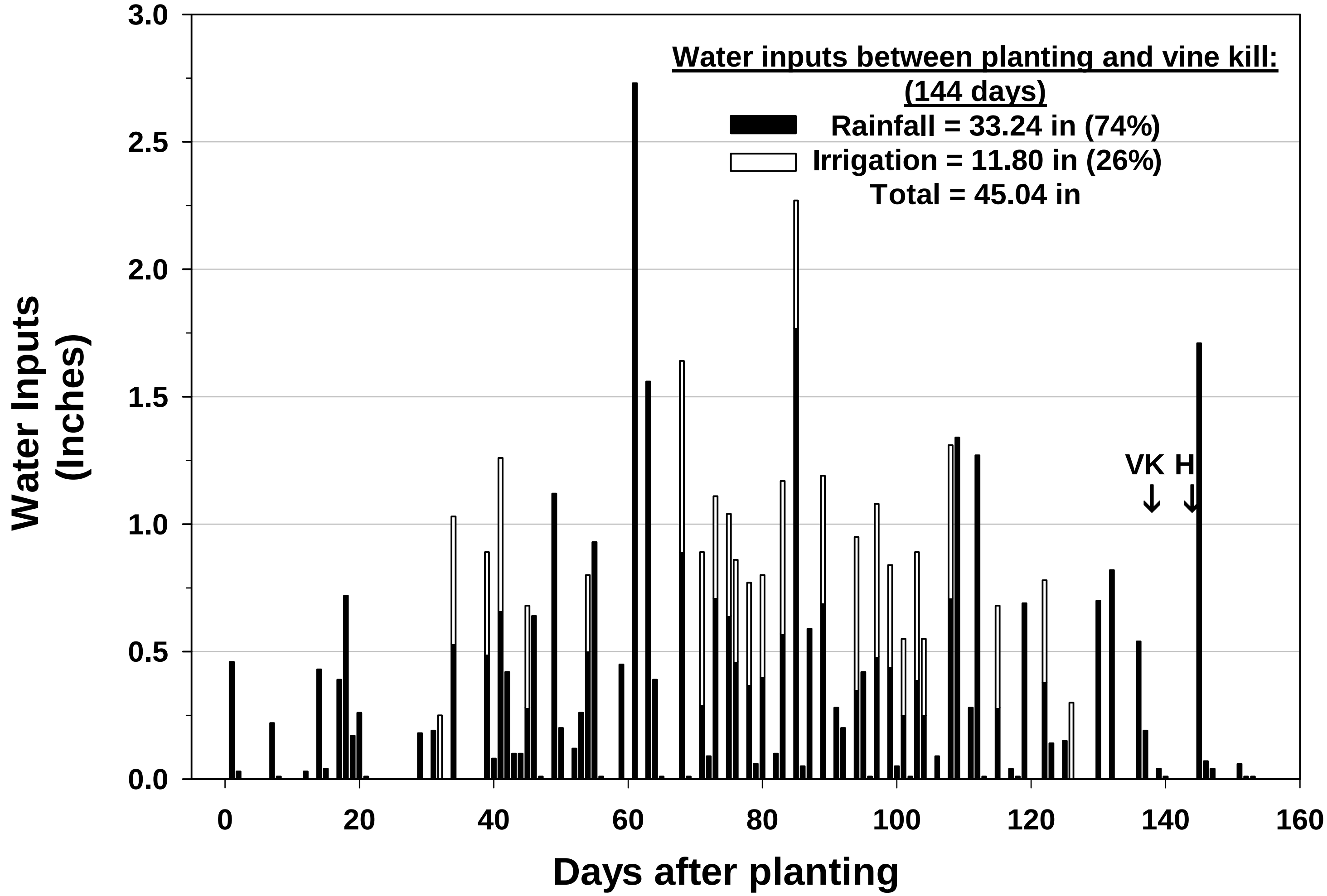

Figure 1. Rainfall and irrigation amounts during the 2010 growing season.
Planting (April 23); VK = Vine Kill (Sept 8); H = Harvest (Sept 14)

Table 1. Effects of OceanGrown System on Russet Burbank tuber yield and size distribution.

Trtmt #	Ocean Grown Treatments	N Treatment: Nitrogen Treatments	N Treatment: N Rate	Tuber Yield: 0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz
			lb N / A	cwt / A									%	
1	None	Conv.	240	94.2	275.8	138.9	36.8	20.3	565.9	426.9	44.8	471.7	34.6	10.1
2	None	Conv.	135	120.7	271.6	105.3	20.4	2.6	520.7	364.5	35.5	400.0	24.5	4.4
3	O.G. Humic Acid + Ca	Conv.	135	132.9	263.8	104.6	14.5	8.6	524.4	371.0	20.6	391.5	23.9	4.2
4	3 Foliar Treatments	Conv.	135	134.3	263.4	106.1	19.6	3.6	526.9	364.1	28.5	392.6	24.5	4.4
5	Humic + Ca + 3 Foliar	Conv.	135	133.4	257.1	102.2	10.2	4.1	507.0	353.2	20.4	373.6	22.9	2.8
6	None	Starter Only	30	168.3	183.2	24.4	4.5	0.0	380.4	178.1	34.0	212.1	7.6	1.2
			Significance[1]	**	**	**	**	++	**	**	NS	**	**	**
			LSD (0.1)	18.0	33.5	20.3	9.3	13.5	25.6	23.4	--	25.0	5.9	3.4

[1]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 2. Effects of OceanGrown System on Russet Burbank stems plant per plant and tuber quality.

Trtmt #	Ocean Grown Treatments	N Treatment: Nitrogen Treatments	N Treatment: N Rate	Plants: Stand	Plants: Stems per Plant	Tuber Quality[1]: Specific Gravity	HH	BC	Scab
			lb N / A	%			%		
1	None	Conv.	240	99.3	3.5	1.070	9.0	9.0	13.3
2	None	Conv.	135	99.3	3.8	1.072	1.8	1.8	17.0
3	O.G. Humic Acid + Ca	Conv.	135	99.3	3.7	1.072	1.5	1.5	20.3
4	3 Foliar Treatments	Conv.	135	98.6	3.8	1.071	1.5	1.5	17.5
5	Humic + Ca + 3 Foliar	Conv.	135	100.0	4.0	1.071	1.5	1.5	16.5
6	None	Starter Only	30	100.0	3.8	1.070	0.0	0.0	15.8
			Significance[2]	NS	NS	NS	**	**	NS
			LSD (0.1)	--	--	--	3.8	3.8	--

[1]HH = Hollow Heart; BC = Brown Center

[2]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 3. Effects of OceanGrown System on nitrate-N concentrations in petioles of Russet Burbank potato on three sampling dates.

Trtmt #	Ocean Grown Treatments	N Treatments	N Rate	NO_3^- concentration (ppm) by sampling date		
			lb N / A	June 15	July 1	July 12
1	None	Conv.	240	16009	9443	8337
2	None	Conv.	135	11216	4125	1365
3	OG-HA + OG-Ca	Conv.	135	10648	4013	1907
4	3 OG Foliar Treatments	Conv.	135	10935	4208	1231
5	OG-HA + OG-Ca + 3 OG Foliar	Conv.	135	12952	4390	2118
6	None	Starter Only	30	2782	253	299
			Significance[1]	**	**	**
			LSD (0.1)	2037	1060	797

[1]NS = Not significant, * Significant at 1%, ** Significant at 5%, ++ Significant at 10%

Use of Remote Sensing Techniques to Evaluate Water and Nitrogen Stress in Irrigated Russet Burbank and Alpine Russet Potato

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Summary: A field experiment at the Sand Plain Research Farm in Becker, MN was conducted in 2010 to evaluate the use of remotely sensed aerial imagery to aid in water and nitrogen fertilizer management. Additionally, the effects of surfactant (IrrigAid Gold®) application and N rate and timing variations on two potato varieties were examined. A comparison was made between Russet Burbank and Alpine Russet potatoes using five N treatments: (1) a starter only control, (2) a medium N treatment with 4 post-hilling split applications, (3) a high N treatment with 4 post-hilling split applications, (4) a high N treatment with 4 post-hilling split applications with the addition of a soil surfactant, and (5) a high N treatment with a single post-hilling application. In addition, each N treatment/variety combination was examined under both conventional and water stressed irrigation regimes. Early indications suggest that remotely sensed imagery has the potential to aid in both water and N management strategies. However, more analysis needs to be completed before definite conclusions can be made. The use of a soil surfactant produced the highest tuber yields numerically. However, yields were not statistically different than those from a comparable non-surfactant treatment. Any differences may better reflect variations in rate and timing of N application. The trend toward a positive yield effect from the surfactant was most pronounced under water stressed conditions. The starter only control produced the lowest yields. Marketable yield was found to be higher with Alpine Russet than Russet Burbank when averaged across all treatments, but plant stand and stem counts were slightly lower in Alpine plots. The 2010 growing season had above normal rainfall and therefore the irrigation effect on yield and quality were not that pronounced; although numerically higher yields were found in the well irrigated treatments. In general, glucose stem end concentrations were higher in Russet Burbank tubers than in Alpine Russet tubers. While sucrose concentrations in both stem and bud end Alpine Russet tubers were higher than those in Russet Burbank tubers. AGT scores were higher in Alpine Russet tubers than in Russet Burbank tubers. The starter only control treatment resulted in the highest tuber sucrose and glucose levels, darkest chip color, and lowest AGT score. Petiole nitrate concentrations varied with N rate and timing. Russet Burbank petioles had higher nitrate concentrations than those of Alpine Russet. Chlorphyll meter readings on leaf tissue followed an opposite trend with higher readings in Alpine Russet leaves than Russet Burbank leaves. Irrigation treatment resulted in higher petiole nitrate on the first sampling date, but then did not consistently affect petiole nitrate concentrations on subsequent sampling dates.

Background: Potato yield and quality are highly dependent on an adequate supply of water and nitrogen (N). The relatively shallow root system of the potato crop coupled with a high N requirement and sensitivity to water stress on coarse-textured soils increases the risk for nitrate leaching. Therefore, water and N management for potato is important both from production and environmental standpoints.

Applying the right amount of N and water in the right place at the right physiological stage is a challenge for potato growers. Matching irrigation and fertilization management to the demand of the crop requires an adequate assessment of water and N status in agricultural landscapes, especially early in the season when management decisions can impact yield and quality. Opportunities also exist to use airborne hyperspectral (HS) and narrow-band multispectral (MS) remote sensing for the detection of spatial variation in N status of the crop to allow more targeted N applications. Thermal remote sensing has the potential to identify spatial variations in crop water status.

Additionally, a soil surfactant at emergence might be applied in order to allow better and more uniform water infiltration to the hill. This may enable growers to be more efficient with their watering, potentially reducing nitrate leaching. Alpine Russet is a new potato variety out of the Northwest breeding program with high yield potential and uniformity. Controlled studies are needed to indentify Alpine Russet response to N and water management under Minnesota conditions. The objectives of this study were twofold: under field conditions, (i) to examine the ability of HS and thermal imagery to determine N and water status in two potato varieties (Russet Burbank and Alpine Russet), and (ii) to determine how yield and quality of the two potato varieties are affected by the use of a soil surfactant under two watering regimes.

Materials and Methods

The study was conducted at the Sand Plain Research Farm in Becker, Minnesota on a Hubbard loamy sand using the potato cultivars Russet Burbank and Alpine Russet. The previous crop was rye. Selected soil chemical properties before planting were as follows (0-6"): water pH, 6.8; organic matter, 1.5%; Bray P1, 30 ppm; ammonium acetate extractable K, Ca, and Mg, 101, 847, and 166 ppm, respectively; Ca-phosphate extractable SO_4-S, 6 ppm; and DTPA extractable Zn, Cu, Fe, and Mn, 0.9, 0.4, 15.0, and 4.0 ppm, respectively. Extractable nitrate-N in the top 2 ft prior to planting was equivalent to 12.8 lb/A.

Whole "B" seed was hand planted in furrows on April 16, 2010. Four, 20 ft rows were planted for each plot with 18 ft of each of the middle two rows used for sampling and harvest. Spacing was 36 inches between rows and 12 inches within each row. Each treatment was replicated four times in a randomized complete block design. Weeds, diseases, and insects were controlled using standard practices. Rainfall was supplemented with sprinkler irrigation using the checkbook method of irrigation scheduling. Treatments included a low N (starter only) control, a medium N treatment, and three high N treatments, two with split applied post-emergence applications (one also with surfactant), and a high N treatment where all post-emergence fertilizer was applied in one application. Five treatments were tested and are listed in Table 1.

Table 1. Nitrogen treatments tested in the water and nitrogen management study.

Treatment			N Timing			Total
			Planting	Emergence	Post-Emergence[1]	
			lb N/A			
1	Low N	Starter Only	30	0	0	30
2	Medium N	160 N Conv.	30	70	60 in 4 apps	160
3	High N metered	240 N Conv.	30	110	100 in 4 apps	240
4	High N metered + Surfactant	240 N + Surfactant	30	110	100 in 4 apps	240
5	High N early	240 N Early	30	110	100	240

[1]Post-emergence N was applied as UAN 4 times, twice at 12 and twice at 18 lb N/A for medium N or twice at 20 and twice at 30 lb N/A for high N (except early), at approximately 2-wk intervals. The entire 100 lb/A high N early post emergence fertilizer was applied in a single application.

A starter fertilizer containing 30 lb N/A, 130 lb P_2O_5/A, 181 lb K_2O/A, 20 lb Mg/A, and 46 lb S/A as a blend of ammonium phosphate (MAP), potassium chloride, potassium magnesium sulfate, and ammonium sulfate were applied to all plots at planting.

Plant emergence N applications were sidedressed as urea on May 17 and mechanically incorporated. Soil surfactant (IrrigAid Gold®) was applied on May 24 with a backpack sprayer at the recommended minimum rate of 4 qt/A according to the manufacturer's instructions. Post-emergence N was applied by hand as 50% granular urea and 50% granular ammonium nitrate and watered-in with overhead irrigation to simulate fertigation with 28% N. The four post-emergence split applications took place on June 3, June 16, July 7, and July 19. The high N early post-emergence application occurred on June 3.

Plant stands were measured on June 2 and the number of stems per plant was counted on June 9. Relative chlorophyll content readings were taken on 20 plants per plot and averaged four times during the season with a Minolta SPAD-502 chlorophyll meter. The measurements were taken on June 15, July 1, July 13, and August 5 on randomly selected plants at the terminal leaflet of the fourth leaf from the apex of the shoot. Both the leaflets and the petioles of these leaflets were collected at the time of measurement and analyzed separately for nitrate-N on a dry weight basis.

Leaf area index (LAI) was also measured on those four dates in late morning or early afternoon with a LAI-2000 plant canopy analyzer. On each date, two replications, each which included one above-canopy reading and four below-canopy readings, were done for each plot. The four below canopy readings for each replication followed diagonal transects spaced 0%, 25%, 50%, and 75% of the distance across the row to improve the spatial coverage.

Ground measurements for reflectance were measured with an MSR16R Cropscan on the same day or within two days of the SPAD readings for a total of five dates. Scans were taken approximately three feet above the canopy on June 4 (before full cover), to minimize the effect soil had on the readings. For the remainder of the measurements when little or no soil was exposed, scans were taken approximately 6 feet above the canopy to give an approximate field-of-view diameter of three feet. Additionally, 13 point measurements were taken on both July 1 and August 6 in order to match the Cropscan readings to specific pixels of the imagery.

Ground measurements for leaf canopy temperature were measured with infrared radiometers (Apogee Model SI-111) which were installed on July 13. Probes were installed approximately six feet high and were aimed at a 45° angle. Radiometers measured the temperature of the target leaves that represented the top portion of the plant canopy every second. Data from each radiometer was averaged and recorded every half hour.

Aerial imagery was acquired by the Center for Advanced Land Management Information Technologies (CALMIT) at the University of Nebraska-Lincoln, USA with an AISA Eagle VNIR hyperspectral imaging sensor with a spatial resolution of 1.0 m and 0.75 m for the July 1 and August 6 imagery, respectfully and a FLIR Systems ThermaCam SC640 infrared camera in the spectral range from 7.5 to 13 μm with a spatial resolution of 0.75 m.

Soil matric potential for both irrigation treatments, both varieties, and the high N treatments with and without surfactant was measured with Watermark sensors installed 6 inches below and at seed tuber depth. Average temperature of the top portion of the leaf canopy was measured starting July 13 with infrared radiometers installed about 6 ft above the soil surface.

Vines were harvested from two, 10-ft sections of row on September 10, followed on the same day by mechanically beating the vines over the entire plot area. On September 28, plots were machine-harvested in order to determine total tuber yield, graded yield, tuber specific gravity, and the incidence of scab, hollow heart, and brown center were measured. Subsamples of vines and tubers were collected to determine moisture percentage and N concentrations, which were then used to calculate N uptake and distribution

Soil samples from the 0-2 ft depth were collected on Oct 14 to measure residual inorganic N levels. Each sample consisted of four soil cores that were composited, oven dried at 90° F, extracted with 2M KCl, and analyzed for nitrate-N and ammonium-N.

The experiment was statistically analyzed using ANOVA procedures on SAS and means were separated using a Waller-Duncan LSD test at P=0.10. Radiometric image correction and rectification was completed using the CaliGeo software package by CALMIT. Further geo-rectification on the imagery will be done "in house" to obtain a better degree of accuracy.

Results

Weather and Environmental: Rainfall and irrigation amounts are presented in Figure 1. From April 16 to September 10 (planting to vine kill), approximately 33.2 inches of rainfall was supplemented with 12.6 and 8.8 inches of irrigation for a total of 45.8 and 42.0 inches of water in the conventionally irrigated and water stressed treatments, respectively.

Seasonal soil matric tension differentials between the conventional and water stressed 240 lb N/A conventional treatments (Ntrmt 3) are shown in Figure 2 for both Russet Burbank and Alpine Russet potato varieties. The largest differences can be observed where irrigation water was withheld in the stressed treatments in preparation for remote imaging (e.g. July 1 and August 6).

Imaging: Leaf canopy temperature as measured by the Apogee Radiometer for the August 6 imaging date is presented in Figure 3. By the imaging time (approximately 1:00 PM), reduced water availability caused stomatal closure (and therefore less transpirational cooling). This is reflected by the increased canopy temperatures around midday of August 6 for both varieties. The thermal image (which was taken near the peak of the temperature differential period between the two water treatments) provides a field-scale view of the effects of irrigation treatment on leaf canopy temperature (Figure 4). Differences are particularly noticeable in inter-plot aisle areas. However, image results have not yet been fully analyzed with respect to their direct relationship to field level temperature sensor results.

SPAD chlorophyll readings are presented in Figure 5. Statistical differences in SPAD readings were significant among treatments on both July 1 and August 5 with plants from the starter only control treatment (Ntrmt 1) displaying significantly lower chlorophyll than any of the other treatments. Additionally, the medium N treatment (Ntrmt 2) resulted in significantly lower chlorophyll readings than either of high N split application treatments (Ntrmts 3 & 4) – which were not significantly different from each other. On the earlier date (July 1), the early high N treatment (Ntrmt 5) resulted in the highest SPAD readings, by a significant amount. However, by the later August 5 date, readings from the early N treatment had dropped, still significantly higher than the starter only control, but lower than the remaining treatments. There were only significant differences among varieties with respect to SPAD readings on July 1 when they were significantly lower in the leaves of the Russet Burbank variety. This variety effect was also evident in the aerial image taken on July 1 (Figure 6.). By August, this difference had disappeared. There were no significant differences in SPAD readings between water stressed and conventionally irrigated treatments on either date.

At this time, reflectance imaging is only available for July 1, which is shown in Figure 6. The image has not yet been analyzed for significant differences or quantified, but visual differences are apparent among N treatments (e.g. starter only control; Ntrmt 1) and varieties, with Russet Burbank producing consistently lighter (higher reflectance) plots than Alpine Russet. This is consistent with the results of the SPAD readings for July 1 and the aerial image shown in Figure 6.

Tuber Yield: When potato varieties and irrigation strategies were combined, there were no significant differences in total yield due to variety. There were also no significant differences due to water management strategies (i.e. conventional vs. stressed). Mean total yields were greatest for the high N + surfactant treatment (Ntrmt 4; Table 2). This was significantly higher than yields from any of the other treatments except the equivalent treatment that did not include surfactant (Ntrmt 3). When potato varieties were looked at individually, the high N + surfactant treatment resulted in the highest numerical yields only under water stressed conditions and yields were significantly higher only when comparing the Russet Burbank plots (Table 3). Under conventional irrigation, the high N no surfactant treatment (Ntrmt 3) produced the numerically highest total Russet Burbank yields. However, when under conventional irrigation, there were no significant differences in yields among the high N treatments (surfactant or no surfactant) with either potato variety. The starter only control (Ntrmt 1) consistently resulted in the lowest total yields by a significant amount.

Total marketable yield was also highest with the high N + surfactant treatment (Ntrmt 4) in the combined analysis, although only significantly higher than the yields of the medium N treatment (Ntrmt 2) and the starter only control (Ntrmt 1; Table 2). Marketable yield also followed the same pattern as total yield when separated by variety (Table 3). Once again the high N + surfactant treatment (Ntrmt 4) resulted in the highest numerical yields under water stressed conditions but not with conventional irrigation. The high N no surfactant treatment (Ntrmt 3) produced the numerically highest total yields in both Russet Burbank and Alpine under conventional water management, but not by a significant amount. Yield from the starter only control (Ntrmt 1) was again significantly lower than those of any of the other treatments. Unlike with total yield, marketable yield was significantly higher with the Alpine compared to Russet Burbank across all treatments, and there was also a significant interaction effect between N treatment and variety. Water management produced no significant differences in marketable yield.

The starter only control (Ntrmt 1) produced a significantly lower percentage of large tubers (>6 oz and >10 oz) than any of the other treatments and a smaller number of tubers 10-14 oz and >14 oz (Table 2). There was also a significant interaction effect between irrigation and variety with respect to the percent of large tubers. There were no significant differences in treatments in the number of tubers between 3 and 6 oz, but the control produced the highest number of <3 oz tubers.

Stand Count, Stems per Plant, and Tuber Quality: Plant stands ranged from about 90 to 100% (Table 4). There were no significant differences in stand between N treatments, but there was a difference between varieties with Russet Burbank producing a significantly higher percent stand than Alpine. This difference was also mirrored in the number of stems per plant. Water management did not produce any significant difference in stand or stem counts. The high N early treatment (Ntrmt 5; Single post-hilling N application) resulted in the highest mean tuber specific gravity numerically (1.075), but this was not significantly different than those of any of the other treatments. Incidence of hollow heart paralleled N rate and the starter only control (Ntrmt 1) and middle N rate treatment (Ntrmt 2) resulted in significantly lower hollow heart than the 3 high N treatments (Ntrmts 3, 4, & 5). On average, specific gravity was lower in Alpine Russet tubers than Russet Burbank tubers.

Tuber Frying Quality/Processing: When all treatments were combined, Russet Burbank tubers, when compared with Alpine, contained significantly lower sucrose and glucose in the bud end of the tuber and sucrose in the stem end, but significantly higher glucose in the stem end (Table 4). Chip color was slightly (0.20) but significantly lower (lighter) in the stem end of Alpine tubers compared with the Russet Burbank tubers, but not in the bud end where differences were not significant. AGT scores were significantly lower in the stem end of Russet Burbank tubers when compared to Alpine. However, both varieties produced scores lower than 50. In the bud end, differences in AGT score were not significant but consistently higher than 50. The starter only control treatment (Ntrmt 1) resulted in tubers with significantly higher sucrose and glucose in both the stem and bud ends of the tuber with only the bud end glucose levels not significantly different from medium N treatment (Ntrmt 2). Chip color was significantly higher (darker) in the bud end of the tubers from the control than from those grown under any of the other treatments. The control also resulted in tubers with the numerically highest chip color in the stem end, although this was only significantly higher than found in tubers from the medium N and no surfactant high N treatments (Ntrmts 2 and 3, respectively). However, AGT score was significantly lower in both the bud and stem ends of the tubers grown under the control when compared to those from all other treatments.

Petiole Nitrate-N Concentrations: On June 15 and July 1, nitrate concentrations were significantly higher, on average, in petioles collected from plants grown under the high N early treatment (Ntrmt 5; Table 5). Additionally, the starter only control resulted in the lowest petiole N concentrations by a significant amount. There were no other statistical differences among treatments on June 15 with respect to petiole nitrate, but on July 1 the medium N treatment (Ntrmt 2) resulted in significantly lower petiole nitrate than either of the high N metered treatments (Ntrmt 3 & 4). On July 1, Petiole nitrate levels were higher in Russet Burbank than in Alpine. Leaf SPAD meter readings on this date followed an opposite trend with higher readings in Alpine Russet leaves than Russet Burbank leaves. On July 13 and August 5, there were again no significant differences in petiole N concentrations as the result of either of the high N metered treatments. However, the medium N treatment (Ntrmt 2) resulted in petiole N concentrations significantly lower than those of the high N metered treatments. Also on July 13 and August 5, the high N early treatment (Ntrmt 5) produced petiole N concentrations significantly lower than all other treatments except the starter only control (Ntrmt 1), which resulted in the lowest concentrations by a significant amount. On July 1, the high N early treatment resulted in petiole nitrate concentrations significantly higher than the starter only control, whereas on August 5 there was no significant difference between the high N early and control treatment petiole nitrate concentrations. The numerical trends in petiole N concentration on August 5 roughly parallel the SPAD chlorophyll results from that date and visual trends in the hyperspectral imaging, although comparative analysis has not yet taken place.

Significant differences in petiole N concentration were pronounced between varieties on the last three sampling dates with petioles from the Alpine Russet plants consistently having lower nitrate levels than those from the Russet Burbank plants. There were no significant differences in N concentrations between petioles grown under the two different irrigation systems, except on June 15, where the petioles from the water stressed plants contained more nitrate (significant at 5%) than those from the plants grown under conventional irrigation.

Residual soil N: Results of residual soil N analysis were not yet available at the time of this report's publication.

Conclusions

Early indications suggest that remotely sensed imagery has the potential to aid in both water and N management strategies. However, more analysis needs to be completed before definite conclusions can be made. The 2010 growing season had above normal rainfall and therefore irrigation effect on yield and quality were not that pronounced; although numerically higher yields were found in the well irrigated treatments. The use of a soil surfactant produced the highest tuber yields numerically. However, yields were not statistically different than those from a comparable non-surfactant treatment. Any differences may better reflect variations in rate and timing of N application. If a positive effect on yield from the surfactant was present, it was most pronounced under water stressed conditions. The starter only control produced the lowest yields. Marketable yield was found to be higher with Alpine Russet than Russet Burbank when averaged across all treatments, but plant stand and stem counts were lower in Alpine plots. In general, Russet Burbank tubers also contained lower concentrations of sucrose and glucose than Alpine in the stem end but higher levels of glucose in the bud end. The starter only control treatment resulted in the highest tuber sucrose and glucose levels, darkest chip color, and a lowest AGT score. AGT scores tended to be higher in Alpine Russet tubers than in Russet Burbank tubers. Russet Burbank petioles contained more nitrate than those of Alpine Russet Burbank on three of four sampling dates, but irrigation strategy did not consistently affect petiole nitrate concentrations after the first sampling date.

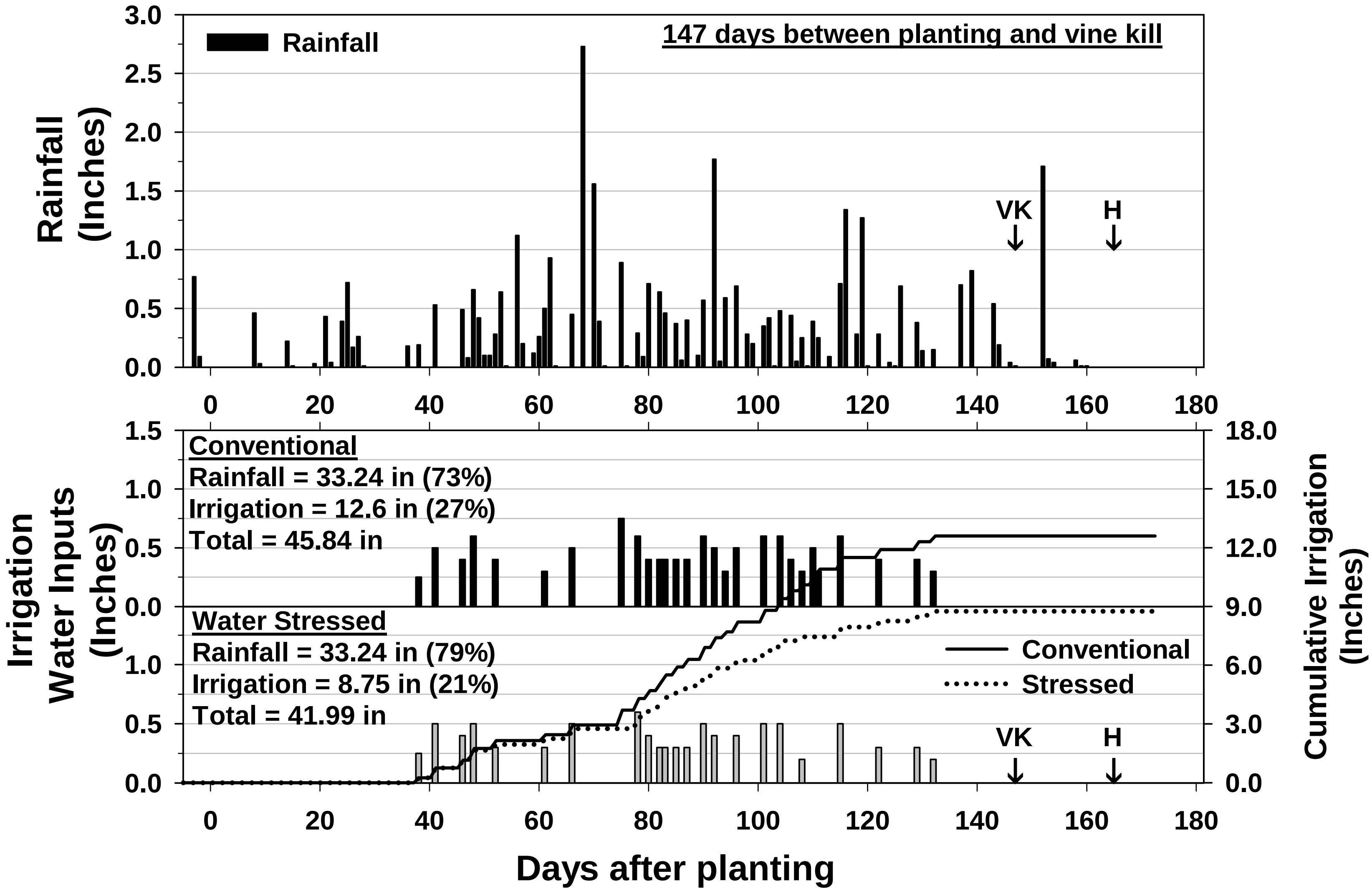

Figure 1. Rainfall and irrigation amounts during the 2010 growing season.
Planting (April 16); VK = Vine Kill (Sept 10); H = Harvest (Sept 28)

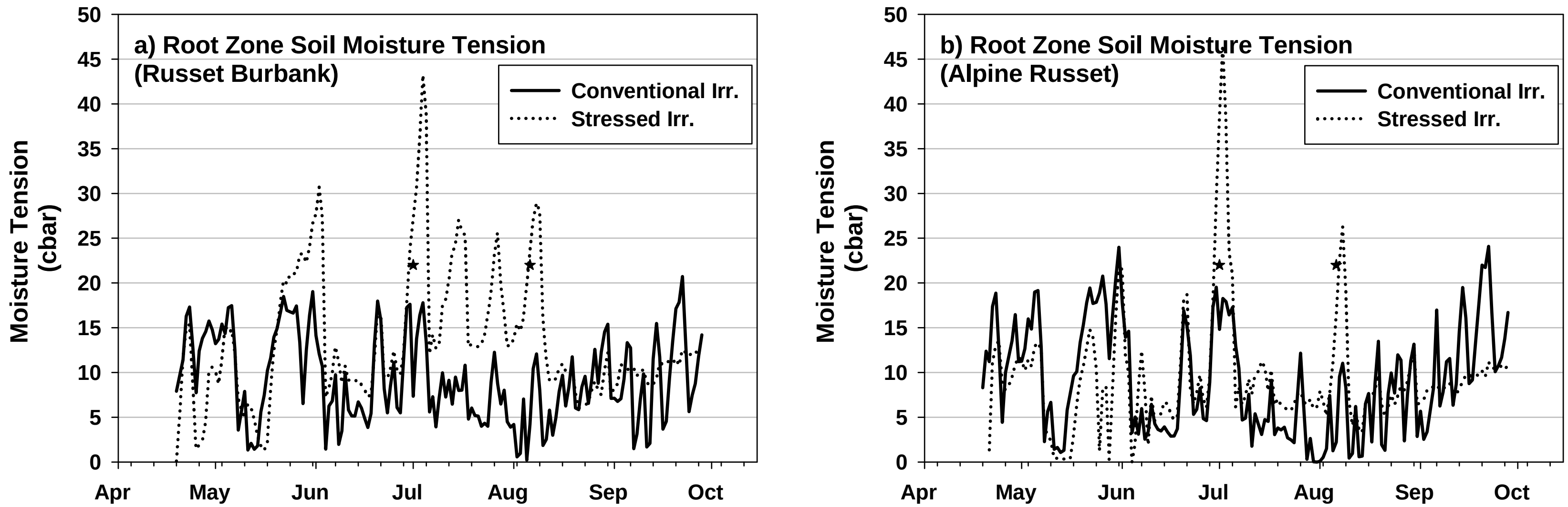

Figure 2. Effect of irrigation treatment on soil matric tension in the root zone throughout the 2010 growing season for a) Russet Burbank and b) Alpine Russet potato varieties under 240 lb N/A (trmt 3). Stars indicate imaging dates (July 1 and August 6, respectively).

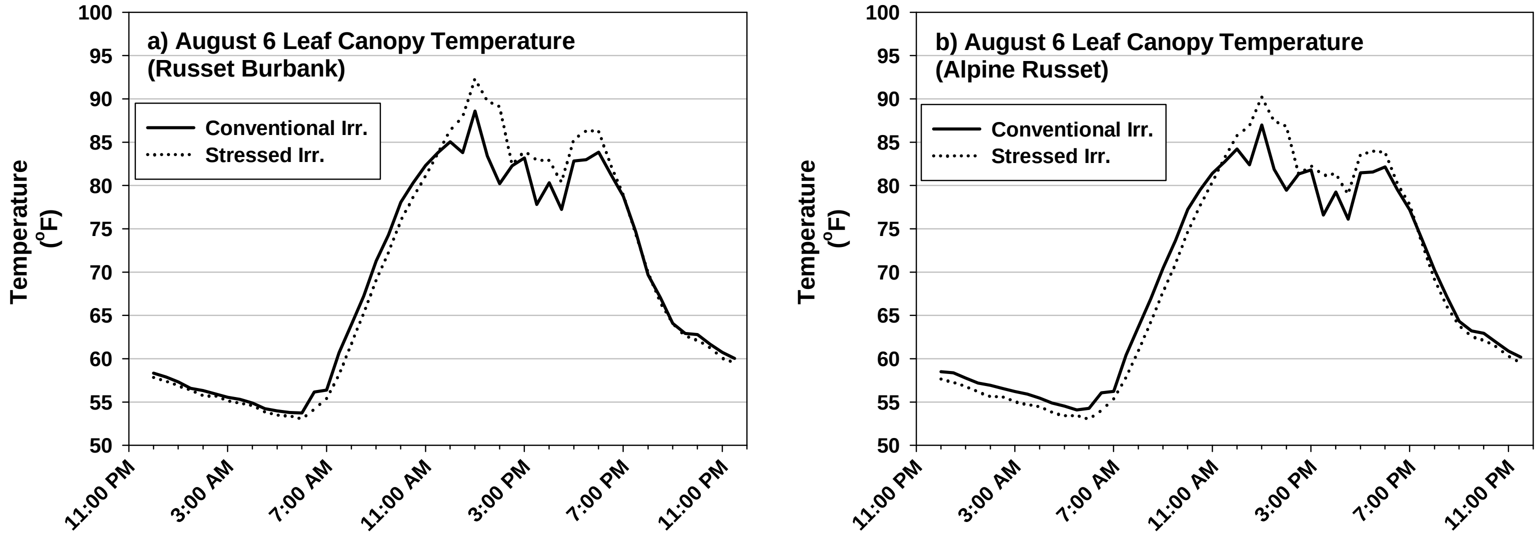

Figure 3. Effect of irrigation treatment on leaf canopy temperature throughout the day of August 6, 2010 for a) Russet Burbank and b) Alpine Russet potato varieties under 240 lb N/A (trmt 3).

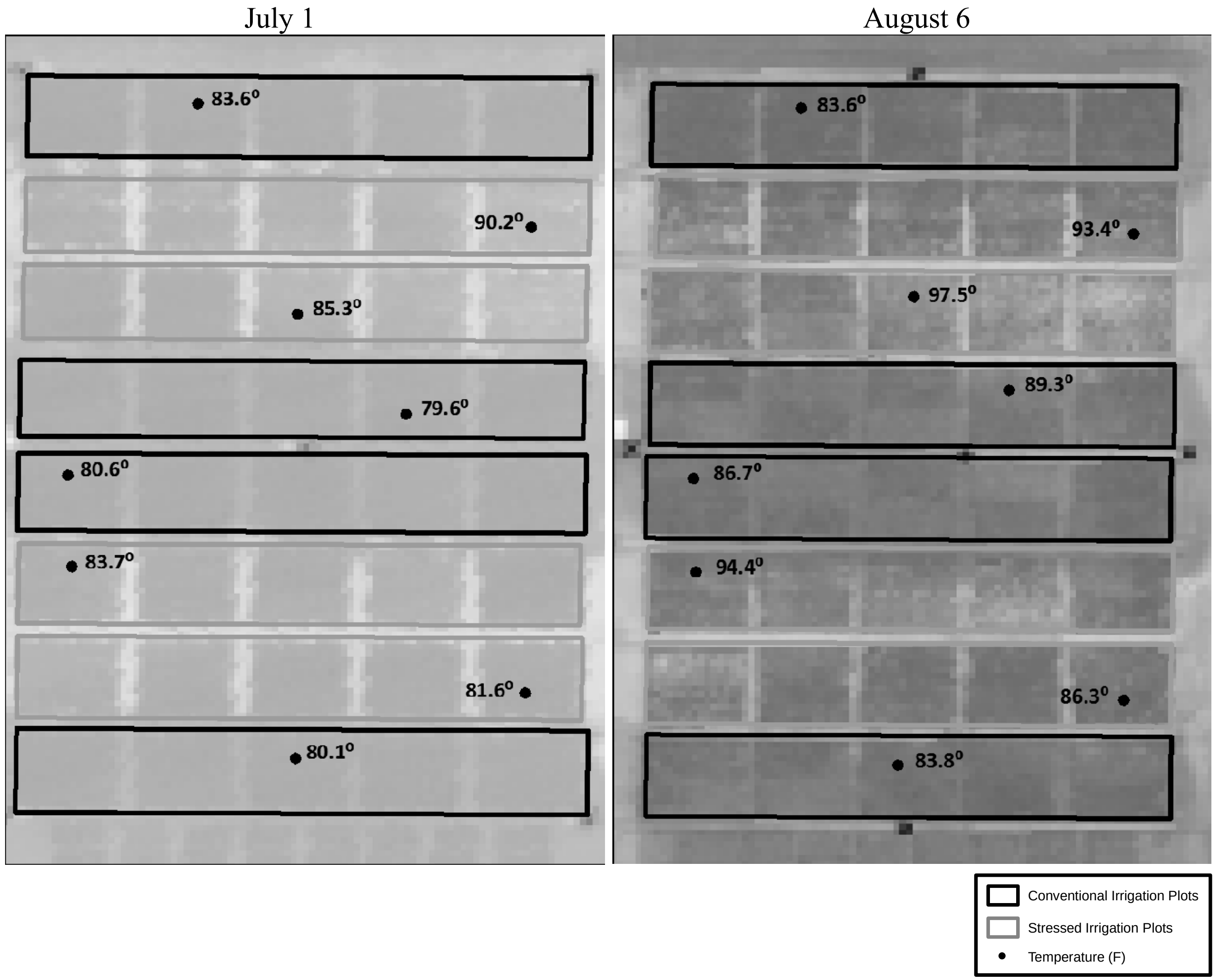

Figure 4. Thermal images indicating the effect of irrigation treatment on leaf canopy temperature. Images were taken at approximately 1:00 PM on July 1 and August 6, 2010. Temperatures are point measurements (at dots) and are in degrees F. Higher temperatures suggest reduced transpirational cooling due to stomatal closure.

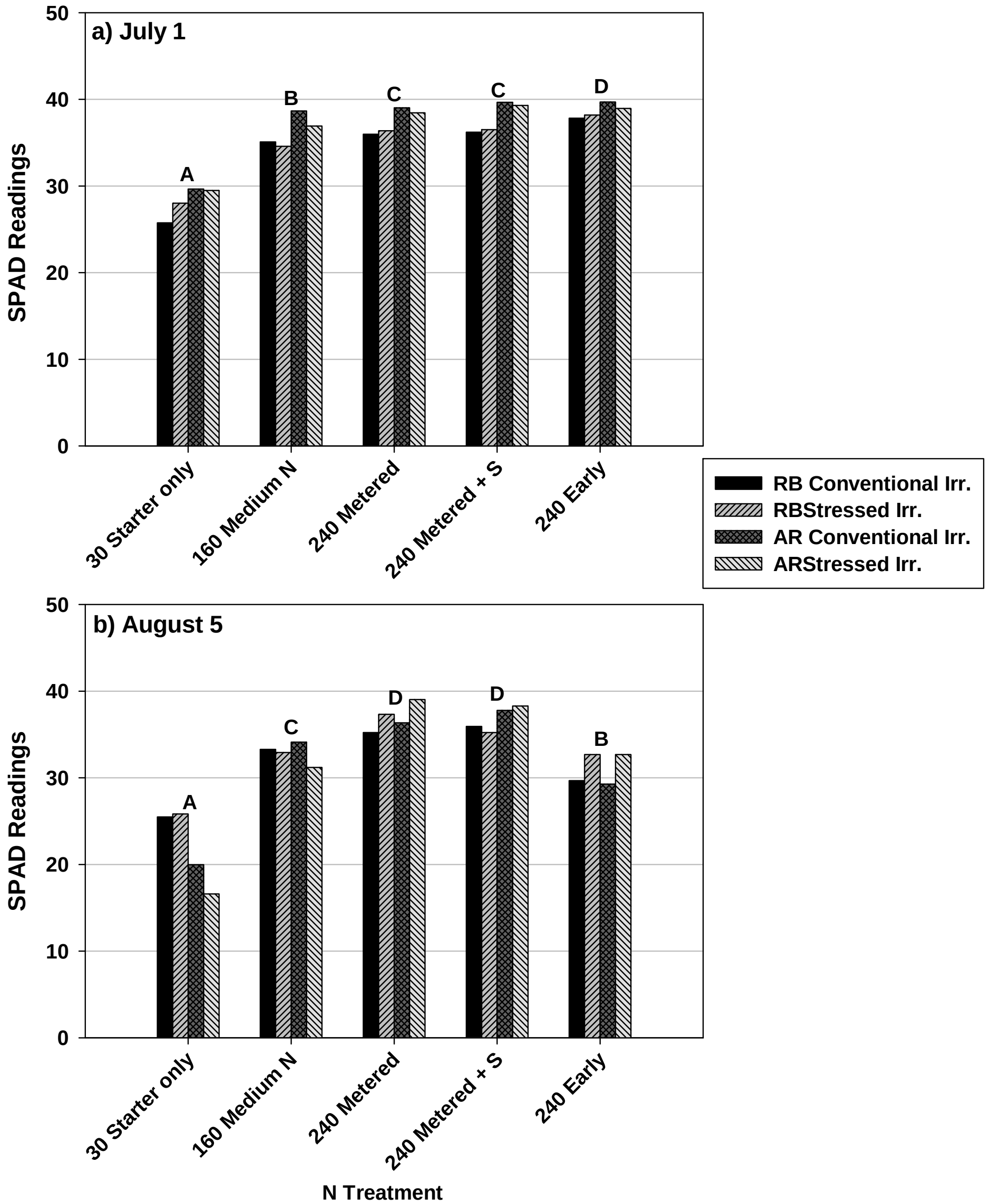

Figure 5. SPAD chlorophyll results for a) July 1 and b) August 5. Results separated by N treatment for Russet Burbank (RB) and Alpine Russet (AR) potato varieties under both conventional and water stressed irrigation schemes. Treatments are: starter only (30 lb/A); medium N (160 lb/A); high N metered (conventional 240 lb/A); high N metered w/ soil surfactant; and high N early. Statistical differences were significant among treatments on both dates (A<B<C<D at 10%), but only among varieties on July 1 when chlorophyll was significantly higher in the leaf canopy of the AR treatments. There were no significant differences in % chlorophyll between water stressed and conventionally irrigated treatments.

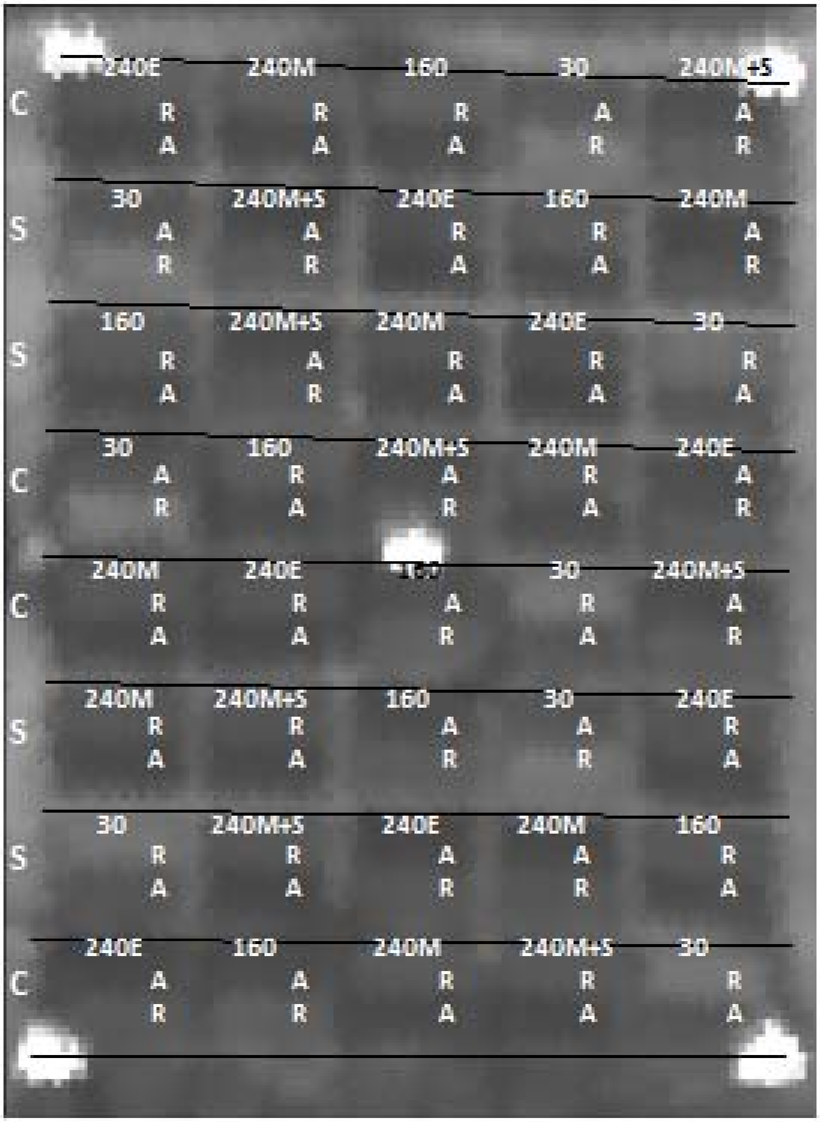

Figure 6. Hyperspectral image indicating the effect N treatment and potato variety (Russet Burbank = R; Alpine Russet = A) on leaf canopy reflectance. Treatments are: starter only (30 lb/A); medium N (160 lb/A); high N metered (conventional 240 lb/A); high N metered w/ soil surfactant; and high N early. Irrigation is indicated on the left (conventional = C; water stressed = S). Image was taken at approximately 1:00 PM on July 1, 2010. Lighter areas indicate higher reflectance suggesting greater leaf yellowing due to lower plant N uptake. N treatment and variety appeared to have the greatest effect on canopy reflectance in this imagery. This image was generated from three band combinations: 454 nm, 554 nm, and 657 nm and then converted to a black and white image for this report. Distinct pixel values have not yet been extracted to make statistical comparisons between treatments. White blotches at the corners and center are calibration and field locating points.

Table 2. Effect of N treatment, water management, and variety on tuber yield and size distribution.

Nitrogen Treatments					Tuber Yield										
Trtmt #	N Rate	N Timing[1]	Irrigation	Variety[2]	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz
	lb N / A	P, E, PH			cwt / A									%	
1	30	30, 0, 0	Conv.	RB	119.9	233.9	72.5	3.5	1.1	430.9	245.3	65.6	311.0	17.7	1.0
2	160	30, 70, 15*4	Conv.	RB	80.1	178.7	234.5	28.5	5.2	526.9	361.7	85.2	446.9	50.4	6.3
3	240	30, 110, 25*4	Conv.	RB	71.5	221.1	211.0	59.5	15.6	578.8	362.2	145.1	507.3	49.0	12.9
4	240	30, 110, 25*4 + S	Conv.	RB	69.6	206.6	218.9	53.1	15.3	563.5	363.4	130.5	493.9	50.8	12.0
5	240	30, 110, 100	Conv.	RB	68.7	223.5	196.9	49.4	9.0	547.6	401.3	77.6	478.9	46.5	10.7
6	30	30, 0, 0	Conv.	Alpine	39.2	145.1	183.4	77.0	13.2	458.0	330.6	88.2	418.7	59.6	19.7
7	160	30, 70, 15*4	Conv.	Alpine	32.6	109.7	214.2	137.5	64.6	558.6	451.6	74.4	526.0	74.4	36.1
8	240	30, 110, 25*4	Conv.	Alpine	26.9	104.8	204.4	133.0	99.0	568.2	461.9	79.4	541.3	76.7	40.7
9	240	30, 110, 25*4 + S	Conv.	Alpine	30.8	121.8	233.8	116.2	65.6	568.2	450.5	86.9	537.4	72.9	31.7
10	240	30, 110, 100	Conv.	Alpine	28.6	105.1	220.3	121.8	53.6	529.5	434.0	66.9	500.9	74.6	32.9
11	30	30, 0, 0	Stressed	RB	127.5	184.1	91.5	3.8	0.0	407.0	235.8	43.7	279.5	23.5	0.9
12	160	30, 70, 15*4	Stressed	RB	82.2	235.4	161.2	33.2	5.3	517.2	359.3	75.7	435.1	38.5	7.3
13	240	30, 110, 25*4	Stressed	RB	76.2	200.6	179.6	48.7	20.6	525.7	316.7	132.9	449.6	46.8	12.8
14	240	30, 110, 25*4 + S	Stressed	RB	64.9	225.8	189.8	63.7	16.1	560.2	371.0	124.3	495.3	48.0	14.2
15	240	30, 110, 100	Stressed	RB	58.8	195.9	199.6	52.3	20.7	527.3	415.1	53.4	468.5	51.0	13.5
16	30	30, 0, 0	Stressed	Alpine	43.2	181.6	166.3	30.5	2.6	424.2	301.7	79.4	381.1	46.1	7.5
17	160	30, 70, 15*4	Stressed	Alpine	27.1	122.4	219.2	104.3	46.4	519.5	431.0	61.4	492.4	71.1	28.8
18	240	30, 110, 25*4	Stressed	Alpine	30.0	133.7	226.6	100.3	45.7	536.2	456.0	50.1	506.2	68.9	26.6
19	240	30, 110, 25*4 + S	Stressed	Alpine	34.1	111.2	219.5	120.1	70.0	554.9	456.2	64.6	520.8	73.6	33.9
20	240	30, 110, 100	Stressed	Alpine	32.2	135.1	228.6	110.1	39.2	545.1	476.5	36.4	512.9	68.2	26.2
				Significance[3]	**	NS	**	**	**	**	**	**	**	**	**
Main Effects															
Variety	Russet Burbank				81.9	210.6	175.6	39.6	10.9	518.5	343.2	93.4	436.6	42.2	9.2
	Alpine				32.5	127.0	211.6	105.1	50.0	526.2	425.0	68.8	493.8	68.6	28.4
				Significance[3]	**	**	**	**	**	NS	**	**	**	**	**
Irrigation	Conventional				56.8	165.0	199.0	77.9	34.2	533.0	386.3	90.0	476.2	57.3	20.4
	Stressed				57.6	172.6	188.2	66.7	26.6	511.7	381.9	72.2	454.1	53.6	17.2
				Significance[3]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N Treatment	30	30, 0, 0			82.5	186.2	128.4	28.7	4.2	430.0	278.4	69.2	347.6	36.7	7.3
	160	30, 70, 15*4			55.5	161.6	207.3	75.8	30.4	530.6	400.9	74.2	475.1	58.6	19.6
	240	30, 110, 25*4			51.2	165.1	205.4	85.4	45.2	552.2	399.2	101.9	501.1	60.4	23.2
	240	30, 110, 25*4 + Surfactant			49.8	166.3	215.5	88.3	41.7	561.7	410.3	101.6	511.9	61.4	23.0
	240	30, 110, 100			47.1	164.9	211.4	83.4	30.6	537.4	431.7	58.6	490.3	60.1	20.8
				Significance[3]	**	NS	**	**	**	**	**	**	**	**	**
				LSD (0.1)	7.3	29.2	18.4	15.3	11.2	17.7	19.9	15.5	22.4	4.9	4.0
Interactions	Irrigation x Variety				NS	++	++	**	**	NS	NS	NS	NS	++	**
	N Treatment x Irrigation				NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	N Treatment x Variety				**	NS	**	++	**	NS	++	**	**	NS	*
	N Treatment x Irrigation x Variety				NS	*	*	NS	NS	NS	NS	NS	NS	*	NS

[1]P, E, PH = Planting, Emergence, and Post-Hilling, respectively; S = Surfactant.

[2]RB = Russet Burbank

[3]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 3. Effect of N treatment on Russet Burbank and Alpine Russet tuber yield and size distribution under conventional and stressed water management systems.

Russet Burbank		Irrigation																							
		Conventional												Stressed											
N Rate	N Timing[1]	Trtmt #	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz	Trtmt #	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz
lb N / A	P, E, PH		cwt / A									%			cwt / A									%	
30	30, 0, 0	1	119.9	233.9	72.5	3.5	1.1	430.9	245.3	65.6	311.0	17.7	1.0	11	127.5	184.1	91.5	3.8	0.0	407.0	235.8	43.7	279.5	23.5	0.9
160	30, 70, 15*4	2	80.1	178.7	234.5	28.5	5.2	526.9	361.7	85.2	446.9	50.4	6.3	12	82.2	235.4	161.2	33.2	5.3	517.2	359.3	75.7	435.1	38.5	7.3
240	30, 110, 25*4	3	71.5	221.1	211.0	59.5	15.6	578.8	362.2	145.1	507.3	49.0	12.9	13	76.2	200.6	179.6	48.7	20.6	525.7	316.7	132.9	449.6	46.8	12.8
240	30, 110, 25*4 + S	4	69.6	206.6	218.9	53.1	15.3	563.5	363.4	130.5	493.9	50.8	12.0	14	64.9	225.8	189.8	63.7	16.1	560.2	371.0	124.3	495.3	48.0	14.2
240	30, 110, 100	5	68.7	223.5	196.9	49.4	9.0	547.6	401.3	77.6	478.9	46.5	10.7	15	58.8	195.9	199.6	52.3	20.7	527.3	415.1	53.4	468.5	51.0	13.5
		Significance[2]	**	*	**	**	*	**	**	*	**	**	**		**	NS	**	**	++	**	**	**	**	*	*
		LSD (0.1)	10.8	29.1	40.6	15.3	9.7	36.7	34.0	43.8	42.6	6.2	3.4		27.0	--	43.0	22.9	16.4	22.7	51.5	40.8	43.1	14.0	7.0

Alpine Russet		Irrigation																							
		Conventional												Stressed											
N Rate	N Timing[1]	Trtmt #	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz	Trtmt #	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz
lb N / A	P, E, PH		cwt / A									%			cwt / A									%	
30	30, 0, 0	6	39.2	145.1	183.4	77.0	13.2	458.0	330.6	88.2	418.7	59.6	19.7	16	43.2	181.6	166.3	30.5	2.6	424.2	301.7	79.4	381.1	46.1	7.5
160	30, 70, 15*4	7	32.6	109.7	214.2	137.5	64.6	558.6	451.6	74.4	526.0	74.4	36.1	17	27.1	122.4	219.2	104.3	46.4	519.5	431.0	61.4	492.4	71.1	28.8
240	30, 110, 25*4	8	26.9	104.8	204.4	133.0	99.0	568.2	461.9	79.4	541.3	76.7	40.7	18	30.0	133.7	226.6	100.3	45.7	536.2	456.0	50.1	506.2	68.9	26.6
240	30, 110, 25*4 + S	9	30.8	121.8	233.8	116.2	65.6	568.2	450.5	86.9	537.4	72.9	31.7	19	34.1	111.2	219.5	120.1	70.0	554.9	456.2	64.6	520.8	73.6	33.9
240	30, 110, 100	10	28.6	105.1	220.3	121.8	53.6	529.5	434.0	66.9	500.9	74.6	32.9	20	32.2	135.1	228.6	110.1	39.2	545.1	476.5	36.4	512.9	68.2	26.2
		Significance[2]	++	NS	++	NS	**	**	**	NS	**	*	*		*	**	*	**	*	**	**	++	**	**	**
		LSD (0.1)	7.7	--	33.6	--	26.2	38.9	37.6	--	43.6	8.1	11.2		8.4	29.4	33.8	29.2	28.9	34.8	40.1	26.5	37.7	8.0	7.8

[1]P, E, PH = Planting, Emergence, and Post-Hilling, respectively; S = Surfactant.

[2]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 4. Effect of N treatment, water management, and potato variety on tuber quality and processing.

Nitrogen Treatments					Tuber Quality		Frying Quality									
							Stem				Bud				Stand	# Stems per Plant
Trtmt #	N Rate	N Timing[1]	Irrigation	Variety[2]	Hollow Heart	Specific Gravity	Sucrose	Glucose	Chip Color	AGT Score	Sucrose	Glucose	Chip Color	AGT Score		
	lb N / A	P, E, PH			%	(H)									%	
1	30	30, 0, 0	Conv.	RB	0.0	1.077	0.876	4.487	3.75	45.50	1.817	0.357	2.75	51.75	98.5	3.7
2	160	30, 70, 15*4	Conv.	RB	0.0	1.073	1.501	3.148	3.25	47.00	2.107	0.318	2.25	56.25	99.7	3.8
3	240	30, 110, 25*4	Conv.	RB	7.0	1.076	1.160	3.583	3.25	48.50	1.974	0.167	2.75	54.25	99.7	3.6
4	240	30, 110, 25*4 + S	Conv.	RB	7.0	1.076	0.897	3.750	3.25	45.50	1.913	0.238	2.50	56.00	98.3	3.5
5	240	30, 110, 100	Conv.	RB	4.0	1.078	1.232	3.119	3.50	44.00	1.817	0.306	2.50	54.00	98.6	3.8
6	30	30, 0, 0	Conv.	Alpine	0.0	1.069	2.274	3.608	3.50	44.25	4.160	0.690	3.00	50.50	95.7	3.0
7	160	30, 70, 15*4	Conv.	Alpine	0.0	1.070	1.482	2.108	3.00	48.75	3.106	0.693	2.50	55.75	92.7	2.6
8	240	30, 110, 25*4	Conv.	Alpine	0.0	1.069	1.764	1.615	3.00	49.25	2.790	0.292	2.25	56.25	95.3	2.5
9	240	30, 110, 25*4 + S	Conv.	Alpine	0.0	1.073	1.432	2.130	3.25	48.75	3.042	0.197	2.50	55.25	93.6	2.7
10	240	30, 110, 100	Conv.	Alpine	0.0	1.071	1.781	2.243	3.25	47.75	3.258	0.420	2.25	55.75	93.0	2.6
11	30	30, 0, 0	Stressed	RB	0.0	1.074	1.735	4.313	3.50	41.75	2.130	0.338	3.25	49.00	98.8	4.0
12	160	30, 70, 15*4	Stressed	RB	0.0	1.075	1.135	3.100	3.25	48.00	1.871	0.678	2.00	57.00	96.5	3.4
13	240	30, 110, 25*4	Stressed	RB	2.0	1.075	0.669	3.672	3.25	46.00	1.954	0.101	2.00	56.50	98.0	3.7
14	240	30, 110, 25*4 + S	Stressed	RB	2.0	1.073	0.911	3.342	3.25	48.75	1.659	0.211	2.00	57.25	98.8	3.8
15	240	30, 110, 100	Stressed	RB	6.0	1.077	1.262	3.132	3.25	47.25	2.127	0.314	2.25	55.25	99.7	3.7
16	30	30, 0, 0	Stressed	Alpine	0.0	1.071	3.116	4.105	3.25	44.75	4.768	1.035	2.75	52.50	94.2	2.4
17	160	30, 70, 15*4	Stressed	Alpine	0.0	1.071	1.895	2.172	3.00	50.25	2.855	0.286	2.00	57.00	95.4	3.0
18	240	30, 110, 25*4	Stressed	Alpine	0.0	1.071	1.553	2.161	3.00	50.25	3.083	0.303	2.50	55.25	91.0	2.5
19	240	30, 110, 25*4 + S	Stressed	Alpine	0.0	1.070	1.620	2.115	3.25	50.25	2.620	0.213	2.00	57.50	90.1	2.5
20	240	30, 110, 100	Stressed	Alpine	0.0	1.074	2.018	1.918	3.00	52.50	3.285	0.304	2.25	55.75	96.2	2.4
Main Effects																
Variety	Russet Burbank				2.8	1.075	1.138	3.565	3.35	46.23	1.937	0.303	2.43	54.73	98.7	3.7
	Alpine				0.0	1.071	1.893	2.417	3.15	48.68	3.297	0.443	2.40	55.15	93.7	2.6
				Significance[5]	**	**	**	**	*	**	**	*	NS	NS	**	**
Irrigation	Conventional				1.8	1.073	1.440	2.979	3.30	46.93	2.598	0.368	2.53	54.58	96.5	3.2
	Stressed				1.0	1.073	1.591	3.003	3.20	47.98	2.635	0.378	2.30	53.30	95.9	3.1
				Significance[5]	NS	NS	NS	NS	NS	NS	NS	NS	**	NS	NS	NS
N Treatment	30	30, 0, 0	Ntrmt1		0.0	1.073	2.000	4.128	3.50	44.06	3.219	0.605	2.94	50.94	96.8	3.3
	160	30, 70, 15*4	Ntrmt2		0.0	1.072	1.503	2.632	3.13	48.50	2.485	0.494	2.92	56.50	96.1	3.2
	240	30, 110, 25*4	Ntrmt3		2.3	1.073	1.286	2.758	3.13	48.50	2.450	0.216	2.38	55.56	96.0	3.1
	240	30, 110, 25*4 + S	Ntrmt4		2.3	1.073	1.215	2.834	3.25	48.31	2.308	0.215	2.25	56.50	95.2	3.1
	240	30, 110, 100	Ntrmt5		2.3	1.075	1.573	2.060	3.25	47.88	2.622	0.336	2.31	55.19	96.9	3.1
				Significance[5]	**	NS	**	**	*	**	**	**	**	**	NS	NS
				LSD (0.1)	1.4	--	0.423	0.773	0.36	3.07	0.541	0.165	0.29	2.06	--	--
Interactions	Irrigation x Variety				NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	N Treatment x Irrigation				NS	NS	*	NS	NS	*	NS	NS	NS	NS	NS	NS
	N Treatment x Variety				**	NS	++	NS	NS	NS	**	NS	NS	NS	NS	NS
	N Treatment x Irrigation x Variety				NS	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	*

[1]P, E, PH = Planting, Emergence, and Post-Hilling, respectively; S = Surfactant.
[2]RB = Russet Burbank
[3]HH = Hollow Heart; DQ = Disqualified (i.e > 3/4" in diam); BC = Brown Center
[4]DM = Dry Matter
[5]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 5. Effect of N treatment, water management, and potato variety on nitrate-N concentrations in petioles on four sampling dates.

Nitrogen Treatments			Irrigation	Variety[2]	Petiole Nitrate-N			
					Sampling Date			
Trtmt #	N Rate	N Timing[1]			June 15	July 1	July 13	August 5
	lb N / A	P, E, PH			ppm			
1	30	30, 0, 0	Conv.	RB	1248	332	354	493
2	160	30, 70, 15*4	Conv.	RB	12559	2518	2753	2354
3	240	30, 110, 25*4	Conv.	RB	11842	3806	3554	3746
4	240	30, 110, 25*4 + S	Conv.	RB	13265	3939	3283	2906
5	240	30, 110, 100	Conv.	RB	15076	6265	1441	872
6	30	30, 0, 0	Conv.	Alpine	1138	300	117	93
7	160	30, 70, 15*4	Conv.	Alpine	10933	1887	1293	1281
8	240	30, 110, 25*4	Conv.	Alpine	12931	2023	3277	1715
9	240	30, 110, 25*4 + S	Conv.	Alpine	10813	2090	2302	1901
10	240	30, 110, 100	Conv.	Alpine	15997	2941	657	125
11	30	30, 0, 0	Stressed	RB	1453	393	292	156
12	160	30, 70, 15*4	Stressed	RB	12617	2633	2164	2226
13	240	30, 110, 25*4	Stressed	RB	13960	4459	3862	4858
14	240	30, 110, 25*4 + S	Stressed	RB	13636	3768	4712	4044
15	240	30, 110, 100	Stressed	RB	15480	5797	1937	478
16	30	30, 0, 0	Stressed	Alpine	3501	385	267	49
17	160	30, 70, 15*4	Stressed	Alpine	14799	1183	2147	338
18	240	30, 110, 25*4	Stressed	Alpine	13901	1675	3142	1534
19	240	30, 110, 25*4 + S	Stressed	Alpine	12853	1951	2862	1705
20	240	30, 110, 100	Stressed	Alpine	15574	3712	681	230
Main Effects								
Variety	Russet Burbank				10812	3391	2435	2213
	Alpine				11195	1815	1675	897
				Significance[3]	NS	**	**	**
Irrigation	Conventional				10511	2610	1903	1549
	Stressed				11585	2596	2207	1562
				Significance[3]	*	NS	NS	NS
N Treatment	30	30, 0, 0			1724	352	258	198
	160	30, 70, 15*4			12587	2055	2089	1550
	240	30, 110, 25*4			13105	2991	3459	2963
	240	30, 110, 25*4 + Surfactant			12582	2937	3290	2639
	240	30, 110, 100			15533	4679	1179	426
				Significance[3]	**	**	**	**
				LSD (0.1)	1633	629	665	383
Interactions	Irrigation x Variety				NS	NS	NS	++
	N Treatment x Irrigation				NS	NS	NS	NS
	N Treatment x Variety				NS	**	NS	**
	N Treatment x Irrigation x Variety				NS	NS	NS	NS

[1]P, E, PH = Planting, Emergence, and Post-Hilling, respectively; S = Surfactant.

[2]RB = Russet Burbank

[3]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Russet Burbank Response to Foliar Applied Calcium

Carl Rosen, Charles Hyatt, and Matt McNearney
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crosen@umn.edu

Summary: A field experiment at the Sand Plain Research Farm in Becker, MN was conducted in 2010 to evaluate the effects of calcium (Ca) foliar feeding strategies on Russet Burbank potato tuber size and potato plant Ca uptake. A comparison was made between a non-foliar fed control, and treatments that included foliar fed 6% Ca as calcium nitrate or Carbomin calcium. In addition, strontium (Sr) nitrate and Carbomin Sr treatments that used 12% Sr as a tracer were examined to evaluate potential Ca uptake in potato plants. The use of Carbomin Ca produced tuber yields consistent with the use of Ca nitrate in a foliar feeding regimen. However, foliar feeding with Carbomin Ca can potentially reduce incidences of disqualifying brown center or hollow heart when compared with a Ca nitrate treatment. There were also no significant differences in yields between the two Sr treatments, but the yield of large tubers (> 14 oz) was lower in the Sr treatments when compared to the no foliar control. Incidence of tuber hollow heart and brown center was significantly lower with Carbomin Ca than with Ca nitrate and numerically lower than the control and the surfactant only treatments. Nutrient analysis of plant matter showed no significant differences among any treatment with respect to Ca concentration. However, Sr concentrations were significantly higher under a foliar feeding regimen, suggesting uptake. Very little significant difference was seen between Carbomin and the respective nitrate salts of either Ca or Sr, except in the early leaf samples where the Carbomin Sr treatment contained higher Sr than the Sr nitrate treatment. Foliar strontium application from either source did not increase strontium concentrations in the tuber peel or flesh. This indicates that little if any Sr is transported from the leaves to tubers following a foliar application.

Background: Calcium deficiency can occur in acidic, highly leached soils. In potato, deficiencies can result in poor tuber quality and storability, and reduced tuber size. Foliar feeding of Ca is one strategy used to overcome mild Ca deficiencies. Calcium nitrate has been used in foliar feeding regimens, but recently a new product, Carbomin Ca, has been introduced as an alternative. In this study we compared a no foliar application control with treatments that included a surfactant and 6% Ca nitrate or 6% Carbomin Ca. A surfactant only control was also examined. In addition, treatments that included 12% Sr nitrate or a Sr analog of Carbomin (12% Carbomin Sr) were included. The Sr is taken up and metabolized by the plant as if it was Ca and can be used as a tracer to determine Ca uptake efficacy. Soils generally have very low Sr, so native Sr will have little effect on Sr concentrations in plant tissue.

The objectives of this study were, under field conditions, to 1) compare the effects of Ca foliar feeding as Ca nitrate or Carbomin Ca on tuber yield and quality in Russet Burbank potato, 2) determine differences in potential Ca uptake between potato plants foliar fed with Ca nitrate and Carbomin Ca, and 3) Use Sr as a tracer for foliar Ca application.

Materials and Methods

The study was conducted at the Sand Plain Research Farm in Becker, Minnesota on a Hubbard loamy sand using the potato cultivar Russet Burbank. The previous crop was rye. Selected soil chemical properties before planting were as follows (0-6"): water pH, 6.1; organic matter, 1.9%; Bray P1, 46 ppm; ammonium acetate extractable K, Ca, Mg, and Sr, 81, 842, 160, and 4.3 ppm, respectively; Ca-phosphate extractable SO_4-S, 4 ppm; DTPA extractable Zn, Cu, Fe, and Mn, 1.1, 0.7, 34.0, and 7.4 ppm, respectively.

Whole “B” seed was hand planted in furrows on April 28, 2010. Four, 20 ft rows were planted for each plot with 18 ft of each of the middle two rows used for sampling and harvest. Spacing was 36 inches between rows and 12 inches within each row. Each treatment was replicated four times in a randomized complete block design. Weeds, diseases, and insects were controlled using standard practices. Rainfall was supplemented with sprinkler irrigation using the checkbook method of irrigation scheduling.

Treatments included a no foliar application control, a surfactant only control, two 6% Ca treatments and two 12% Sr treatments. Six treatments were tested and are listed below (Table 1).

Table 1. Calcium treatments tested in the Russet Burbank Ca foliar feeding study.

Treatment #	Treatment
1	Control
2	Carbomin Ca (6%) + Surfactant
3	Calcium Nitrate (6%) + Surfactant
4	Carbomin Sr (12%) + Surfactant
5	Strontium Nitrate (12%) + Surfactant
6	Surfactant Only

A starter fertilizer containing 30 lb N/A, 130 lb P_2O_5/A, 181 lb K_2O/A, 20 lb Mg/A, and 46 lb S/A as a blend of ammonium phosphate (MAP), potassium chloride, potassium magnesium sulfate, and ammonium sulfate were applied to all plots at planting. The remaining 210 lb N/A was sidedressed as ESN and mechanically incorporated at emergence on May 25. Calcium and Sr foliar treatment solutions were mixed with LI 700 surfactant according to manufacturer’s directions and applied six times at a rate of 1 gal/A of either 6% (by weight) Ca nitrate or Carbomin Ca, or 1.09 gal/A of either 12% Sr nitrate or Carbomin Sr. Solutions were diluted to 25 gal in water prior to application. Foliar application was made with a CO_2 sprayer on June 16, June 28, July 7, July 19, August 2, and Sept. 1.

Plant stands were measured on June 2 and the number of stems per plant was counted on June 9. Whole leaf samples were collected on July 9 and August 5. Four whole plants were collected by hand-digging on Sept. 17. Shortly after on the same day vines were killed via mechanical beating. Plots were machine-harvested on Sept. 22 and total tuber yield, graded yield, tuber specific gravity, and the incidence of scab, hollow heart, and brown center were measured.

Tuber peels, whole tubers, the two whole leaf samples, and vines were analyzed for Ca and Sr content, along with Al, B, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, P, Pb, and Zn, via a multi-element, ICP-dry ash method.

All trials of the experiment were statistically analyzed using ANOVA procedures on SAS and means were separated using a Waller-Duncan LSD test at P = 0.10.

Results

Rainfall and irrigation amounts are presented in Figure 1.

Tuber Yield: There were no significant differences in total tuber yield or marketable yield among any of the treatments. Only the category of tubers > 14 oz showed any significant difference. In this category, the no foliar control produced a significantly higher number of large tubers (> 14oz) than either of the Sr treatments or the 6% Carbomin Ca treatment. However, there were no significant treatment differences in the percent of tubers produced that were > 6 oz or > 10 oz.

Tuber Quality: The Ca nitrate treatment (trmt 3) produced significantly more tubers with brown center and hollow heart that were disqualified than any of the other treatments except the no foliar control (1). There was no significant difference among the remaining treatments. However, scab levels were low and not significantly different with means that ranged from 6.7 (Carbomin Sr trmt 4) down to 0.8% (no foliar trmt 1). There were no significant treatment differences with respect to tuber specific gravity.

Plant Matter Nutrient Concentration: Ca concentrations were not significantly affected by treatment in any part of the plant or tuber (Table 3). There were also no consistent numerical trends with respect to Ca. In the leaf samples and vines, Sr content was significantly higher in the treatments where Sr was applied as a foliar feed. However, only one of the leaf sample sets displayed a significant difference between the Sr nitrate and Carbomin Sr treatments. The July 9 leaf samples had significantly higher Sr concentrations in the Carbomin Sr (trmt 4) than the Sr nitrate (trmt 5). The vine samples (although not significant) trended the other way numerically (trmt 5 > 4) while the August 5 leaf samples contained nearly identical Sr concentrations in trmts 4 and 5. Foliar Sr application from either source did not increase Sr concentrations in the tuber peel or flesh. This indicates that little if any Sr is transported from the leaves to tubers following a foliar application.

Conclusions

The use of Carbomin Ca produced tuber yields consistent with the use of Ca nitrate in a foliar feeding regimen. However, foliar feeding with Carbomin Ca can potentially reduce incidences of disqualifying brown center or hollow heart when compared with a Ca nitrate treatment. There were also no significant differences in yields between the two Sr treatments, but the yield of large tubers (> 14 oz) was lower in the Sr treatments when compared to the no foliar control. Nutrient analysis of leaf, vine and tuber tissue showed no significant differences among any treatment with respect to Ca concentration. However, Sr concentrations were significantly higher under a foliar feeding regimen for leaves and vines, suggesting uptake. Very little significant difference was seen between Carbomin and the respective nitrate salts of either Ca or Sr, except in the early leaf samples where the Carbomin Sr treatment contained higher Sr than the Sr nitrate treatment. Foliar Sr application from either source did not increase Sr concentrations in the tuber peel or flesh. This indicates that little if any Sr is transported from the leaves to tubers following a foliar application.

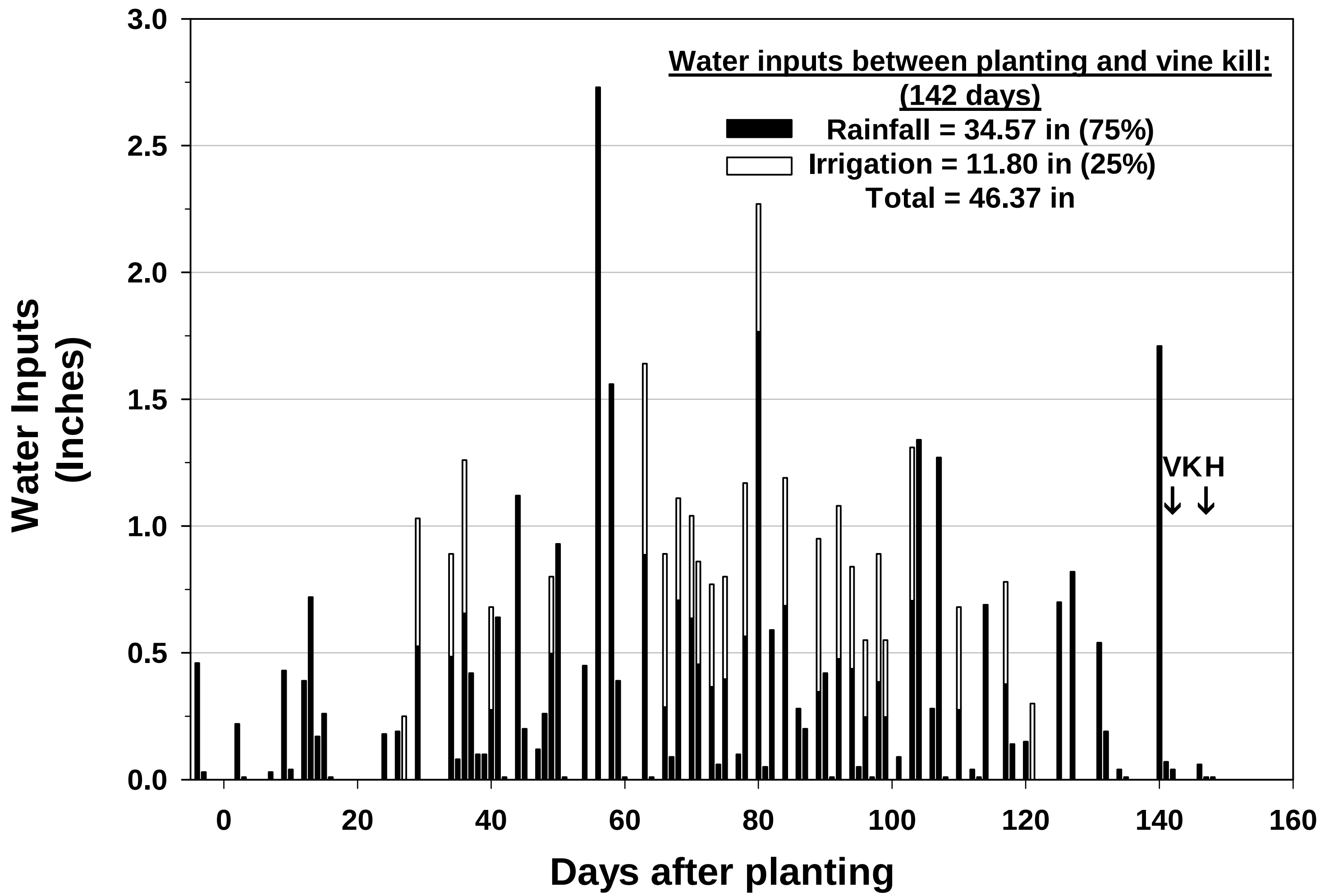


Figure 1. Rainfall and irrigation amounts during the 2010 growing season.
Planting (April 28); VK = Vine Kill (Sept 17); H = Harvest (Sept 22)

Table 1. Effect of Ca foliar feeding strategies on Russet Burbank tuber yield and size distribution.

Calcium Treatments		N Treatment	Tuber Yield										
Trmt #	Foliar Treatment	N Rate	0-3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1 > 3 oz	#2 > 3 oz	Total Marketable	> 6oz	> 10 oz
		lb N / A	cwt / A									%	
1	None	240	67.9	263.6	220.2	71.0	56.1	678.8	415.3	195.6	610.9	51.2	18.8
2	Carbomin Ca (6%) + Surfactant	240	75.6	298.3	215.4	77.0	30.3	696.6	435.5	185.5	621.0	46.4	15.4
3	Calcium Nitrate (6%) + Surfactant	240	79.9	299.1	208.6	59.2	38.4	685.3	430.3	175.1	605.4	44.6	14.2
4	Carbomin Sr (12%) + Surfactant	240	78.9	274.0	212.3	57.3	19.6	642.0	432.7	130.5	563.2	45.0	12.0
5	Strontium Nitrate (12%) + Surfactant	240	76.7	309.9	203.8	66.6	25.4	682.4	419.9	185.8	605.7	43.3	13.4
6	Surfactant Only	240	68.4	290.7	218.9	81.4	42.8	702.2	415.1	218.7	633.7	48.6	17.5
		Significance[1]	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS
		LSD (0.1)	--	--	--	--	22.1	--	--	--	--	--	--

[1]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 2. Effect of Ca foliar feeding strategies on Russet Burbank tuber quality.

Calcium Treatments		N Treatment	Tuber Quality[1]					
Trmt #	Foliar Treatment	N Rate	Specific Gravity	HH	HH DQ	BC	BC DQ	Scab
		lb N / A		%				
1	None	240	1.0777	4.15	3.30	4.15	3.30	0.83
2	Carbomin Ca (6%) + Surfactant	240	1.0790	1.65	1.65	1.65	1.65	5.00
3	Calcium Nitrate (6%) + Surfactant	240	1.0787	6.65	5.00	8.33	5.00	2.50
4	Carbomin Sr (12%) + Surfactant	240	1.0754	0.83	0.00	1.65	0.00	6.68
5	Strontium Nitrate (12%) + Surfactant	240	1.0768	2.48	0.83	4.15	0.83	2.50
6	Surfactant Only	240	1.0788	4.15	0.83	5.00	0.83	5.83
		Significance[2]	NS	**	*	*	*	NS
		LSD (0.1)	--	3.74	2.85	3.65	2.85	--

[1]HH = Hollow Heart; DQ = Disqualified (i.e > 3/4" in diam); BC = Brown Center

[2]NS = Non-significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

Table 3. Effect of foliar feeding strategies on nutrient concentration and uptake in Russet Burbank potato plants.

Treatment #	Foliar Treatment	Ca					Sr				
		Tuber		Above Ground[1]			Tuber		Above Ground[1]		
		Peel	Flesh	Leaf #1	Leaf #2	Vine	Peel	Flesh	Leaf #1	Leaf #2	Vine
		----------------- ppm ---------------									
1	None	966	225	13574	12589	9789	4.74	1.17	39.6	30.8	42.8
2	Carbomin Ca(6%)+Surfactant	1149	233	11830	11383	9745	6.07	1.39	34.4	27.0	46.1
3	Calcium Nitrate(6%)+Surfactant	1032	232	12498	12343	9730	5.70	1.34	37.0	32.9	46.5
4	Carbomin Sr(12%)+Surfactant	1095	232	13731	11406	10436	5.86	1.25	1427.5	1194.2	165.3
5	Strontium Nitrate(12%)+Surfactant	1101	242	12201	10845	10723	6.21	1.36	1076.6	1194.3	183.0
6	Surfactant Only	1078	219	11665	11232	9590	6.21	1.06	34.0	26.4	41.8
Significance[2]		NS	NS	NS	NS	NS	NS	NS	**	**	**
LSD (0.1)		--	--	--	--	--	--	--	**237.9**	**144.7**	**64.2**

[1]Leaf #1 samples collected on July 9 2010; Leaf #2 collected on August 5, 2010; Vines harvested on Sept 17, 2010.

[2]NS = Non significant; ++, *, ** = Significant at 10%, 5%, and 1%, respectively.

2010 North Central Region Potato Variety Trial

Best Western - O'Hare

Chicago, IL

December 13 – 14, 2010

Prepared By: Mr. Jeff Miller

Dr. Christian Thill

Department of Horticultural Sciences

University of Minnesota

Table of Contents

2010 North Central Regional Potato Variety Trial Cooperators

State or Province	Cooperator	Seed Shipping Address
MICHIGAN	**Dr. Dave Douches** Michigan State University Dept. of Crop & Soil Sci. 486 Plant & Soil Sci. Bldg. East Lansing, MI 48824-1325 VOICE: 517-355-0271 x1194, x1198, x1199 FAX: 517-353-5174 douchesd@msu.edu	**Mr. Joe Coombs** Michigan State University Crop Science Field Lab 4450 Beaumont Rd. East Lansing, MI 48824 VOICE: 517-355-2287 coombs@msu.edu **Receive by: 01 April**
MINNESOTA	**Dr. Christian Thill** University of Minnesota Dept. of Horticultural Science 1970 Folwell Ave. St. Paul, MN 55108 VOICE: 612-624-9737 FAX: 612-624-4941 thill005@umn.edu	**Mr. Jeff Miller** USDA/ARS Potato Research Worksite 311 5th Ave. Northeast East Grand Forks, MN 56721 VOICE: 218-773-2473 FAX: 701-795-8348 mille603@umn.edu **Receive by: 01 April**
NORTH DAKOTA	**Dr. Asunta (Susie) Thompson** North Dakota State University Dept. of Plant Sciences NDSU 7670; P.O. Box 6050 Fargo, ND 58108-6050 VOICE: 701-231-8160 FAX: 701-231-8474 CELL: 701-799-8536 asunta.thompson@ndsu.edu	**Mr. Bryce Farnsworth/Mr. Richard Nilles** North Dakota State University Potato Science Building 1220 16th St. North Fargo, ND 58108 VOICE: 701-231-1051 CELL: 701-793-8812/701-730-0429 **receive by: 01 April** bryce.farnsworth@ndsu.edu richard.nilles@ndsu.edu
WISCONSIN	**Dr. Jiwan Palta** University of Wisconsin Dept of Horticulture 1575 Linden Drive Madison, WI 53706 VOICE: 608.262.5782 FAX: 608-262-4743 jppalta@wisc.edu	**Bryan Bowen** UW Lelah Starks Potato Breeding Farm 4181 Camp Bryn Afon Road Rhinelander, WI 54501 VOICE: 715-369-0619 (farm) FAX: 715-369-4562 (farm) bdbowen@wisc.edu **Receive by: 15 April**
MANITOBA[1] * Phytosanitary is required.	**Dr. Benoit Bizimungu** Agriculture and Agri-Foods Canada Lethbridge Research Center Hyw. 3, East Lethbridge P.O. 3000, Main Lethbridge, Alberta T1J 4B1 , Canada VOICE: 403-317-2276 FAX: 403-382-3156 bbizimungu@AGR.GC.CA	**1. Marty Glynn** USDA / ARS Potato Research Worksite **Receive by: 15 April** **2. Re-ship by Bizimungu to:** Morden, Manitoba

(Harvest Samples ONLY) and (Seed Shipments for CANADA)

1) ALB & Ont did not participate in 2010.

USDA / ARS *** Harvest samples only**	**Mr. Marty Glynn** USDA/ARS Potato Research Worksite 311 5th Ave. Northeast East Grand Forks, MN 56721 VOICE: 218-773-2473 FAX: 701-795-8348 GLYNNM@fargo.ars.usda.gov

North Central Regional Potato Variety Trial-2010

TABLE 1. Clonal entries, parentage, market use, and characteristics.

Entry No.	Clone	Entered by	Market Use	Unique features	Pedigree: Female	Pedigree: Male	Characteristics: Skin Type	Characteristics: Flesh Color	Characteristics: Shape
	RED								
1	ND8314-1R	ND	FM				Red	W	Rnd-Oval
2	ND8555-8R	ND	FM				Red	Cream	Rnd-Oval
3	W2609-1R	WI	FM				Red	Cream	Rnd-Oval
4	**Red Norland**	Chk	FM		RedKote	ND626	Red	W	Rnd-Oval
5	**Red Pontiac**	Chk	FM				Red	Cream	Oval-Oblong
	RUSSET / LONG								
6	CV00047-3	AB	FF				Rus	Cream	Oval-Oblong
7	CV99222-2	AB	FF				Rus	Cream	Oval-Oblong
8	ND8229-3	ND	FF/FM				Rus	Cream	Blocky, Long
9	W8946-1rus	WI	FF				Rus	Cream	Oval-Oblong
10	**R. Burbank**	Chk	FF		Chimera of Burbank		Rus	Cream	Oblong
11	**R. Norkotah**	Chk	FM		ND9526-4RUSS	ND9687-5RUSS	Rus	Cream	Oblong
	ROUND WHITE								
12	MSL211-3	MI	C	Late Blight Resistant	MSG301-9	Jacqueline Lee	W	Cream	Rnd-Oval
13	MSL268-D	MI	C	Late Blight Resistant	NY103	Jacqueline Lee	W	Cream	Rnd-Oval
14	MSM182-1	MI	C	Late Blight Resistant	Stirling	NY121	W	Cream	Rnd
15	MSQ176-5	MI	C	Late Blight Resistant	MSI152-A	Missaukee	W	Cream	Rnd-Oval
16	ND8307C-3	ND	C				W	Cream	Rnd-Oval
17	W2717-5	WI	C	Long storage-cold chipping	S440	ND3828-15	W	Cream	Rnd-Oval
18	W2978-3	WI	C	Long storage, chip and tablestock	Monticello	Dakota Pearl	W	Cream	Rnd-Oval
19	W5015-12	WI	C	Long storage, high yield	Brodick	White Pearl	W	Cream	Rnd-Oval
20	**Atlantic**	Chk	C				W	Cream	Rnd-Oval
21	**NorValley**	Chk	C	Storage chip	Norchip	ND860-2	W	Cream	Rnd-Oval
22	**Snowden**	Chk	C				W	W	Rnd-Oval

North Central Regional Potato Variety Trial-2010

TABLE 2. Locations, Cooperators, and Cultural Information.

Site No.	Locations	Cooperators	Soil Type	Irrigation	Dates: Planting	Dates: Harvest	Days to Vine Kill	Days to Harvest
1	**MICHIGAN (MI)** Montcalm Research Farm Entrican, MI	Dr. Dave Douches Joe Coombs VOICE: 517-353-3145	McBride sandy loam	Overhead pivot as needed	4-May-10	27-Sep-10	114	126
2	**MINNESOTA (MN)** UM-Sand Plain Res Farm Becker, MN	Dr. Christian Thill Jeff Miller VOICE: 612-624-9737	Hubbard Loamy Sand	Soild Set Sprinkler	5-May-10	21-Sep-10	123	139
3	**NORTH DAKOTA (ND)** Oberg Farms Hoople, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160	sandy loam	dryland				
4	**NORTH DAKOTA (ND)** Forrest River Site Inkster, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160	sandy loam	Linear				
5	**WISCONSIN (WI)** UW-Hancock Res. Farm Hancock, WI	Dr. Jiwan Palta Dr. Felix Navarro VOICE: 608-262-1878	Plainfield loamy sand	Linear System 12.38" irrigation 28.8" rain	28-Apr-10	7-Sep-10	117	132
6	**MANITOBA (MB)** Morden, MB, Canada	Dr. Benoit Bizimungu VOICE: 506-452-4880	Hochfeld fine sandy loam	pivot	19-May-10	15-Sep-10		120

North Central Regional Potato Variety Trial-2010

TABLE 2. Locations, Cooperators, and Cultural Information.

Site No.	Locations	Cooperators	Cultural Information: N - P - K Fertilizer (lbs./A)	Cultural Information: Herbicides
1	**MICHIGAN (MI)** Montcalm Research Farm Entrican, MI	Dr. Dave Douches Joe Coombs VOICE: 517-353-3145	286N-50P-42K from 4 applications + 2 t/a chicken manure pre-plant	Dual/Lorox (cracking) Sencor/Matrix (post)
2	**MINNESOTA (MN)** UM-Sand Plain Res Farm Becker, MN	Dr. Christian Thill Jeff Miller VOICE: 612-624-9737	250 lbs/ac 0-0-60 --- broadcast 250 lbs/ac 0-0-22 --- broadcast 300 lbs/ac 18-46-0 --- broadcast 440 lbs/ac 46-0-0 --- banded --split application	Sencor DF + Dual II Mag. Preemerge
3	**NORTH DAKOTA (ND)** Oberg Farms Hoople, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160		
4	**NORTH DAKOTA (ND)** NPPGA Research Farm Tappen, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160		
5	**WISCONSIN (WI)** UW-Hancock Res. Farm Hancock, WI	Dr. Jiwan Palta Dr. Felix Navarro VOICE: 608-262-1878	3/31/2010: 500 lbs/acre 0-0-0-17S-21Ca, Calcium Sulfate 3/31/2010: 385 lbs/acre 0-0-60 Potash 4/28/2010: 550 lbs/acre 6-30-22-4S+micros with Platinum 5/14/2010: 360 lbs/acre 21-0-0-24S (IrrigAid Gold) 6/01/2010 350 lbs/acre 34-0-0 Ammonium Nitrate 6/24/2010 150 lbs/acre 34-0-0 Ammonium Nitrate 7/02/2010 100 lbs/acre 34-0-0 Ammonium Nitrate 7/16/2010 104 lbs/acre 32-0-0 UAN	5/15: 0.5 lb/a Metribuzin 5/15: 1pt/a Paralell 6/17: 1.5 oz/a Matrix 8/23: 1.5 pt/a Diquat E 8/30: 1.5 pt/a Diquat E
6	**MANITOBA (MB)** Morden, MB, Canada	Dr. Benoit Bizimungu VOICE: 506-452-4880	N = 174lbs/A, P = 95lbs/A, K = 50lbs/A	Prism Sencor

North Central Regional Potato Variety Trial-2010
TABLE 2. Locations, Cooperators, and Cultural Information.

Site No.	Locations	Cooperators	Cultural Information: Insecticides	Cultural Information: Fungicides
1	**MICHIGAN (MI)** Montcalm Research Farm Entrican, MI	Dr. Dave Douches Joe Coombs VOICE: 517-353-3145	Admire at planting	Weekly fungicides
2	**MINNESOTA (MN)** UM-Sand Plain Res Farm Becker, MN	Dr. Christian Thill Jeff Miller VOICE: 612-624-9737	Admire Pro, Radiant, BayThroid, Dimethoate Thionex, Coragen, Permethrin, Rimon	Quadris, Ultra-Flourish Bravo, PolyRam, Previcur Endura, Kocide, Curzate Tanos
3	**NORTH DAKOTA (ND)** Oberg Farms Hoople, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160		
4	**NORTH DAKOTA (ND)** NPPGA Research Farm Tappen, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160		
5	**WISCONSIN (WI)** UW-Hancock Res. Farm Hancock, WI	Dr. Jiwan Palta Dr. Felix Navarro VOICE: 608-262-1878	7/23: 5 fl oz Coragen	6/10: 2.125 pt/a Bravo Zn + 2 pt/a Champ FormulaII 6/15: 2.125 pt/a Bravo Zn + 8oz/a Tanos 6/21: 2 pt/a Bravo Zn + Headline 8 fl oz/a 6/28: 2 pt/a Bravo Zn 7/6: 3.5oz/a Endura + 2 pt/a EquusZN 7/13: 12 fl oz/a Abba 0.15 EC 7/20: 2 pt/a Bravo Zn + 3.5 oz/a Endura 7/25: 1.87 oz/a Agri-Tin 80WP + 2 lbs/a Manzate Pro-Stick
6	**MANITOBA (MB)** Morden, MB, Canada	Dr. Benoit Bizimungu VOICE: 506-452-4880	N/A	Dithane DG Bravo 500 Revus

North Central Regional Potato Variety Trial-2010

TABLE 2. Locations, Cooperators, and Cultural Information.

Site No.	Locations	Cooperators	Cultural Information: Other Information
1	**MICHIGAN (MI)** Montcalm Research Farm Entrican, MI	Dr. Dave Douches Joe Coombs VOICE: 517-353-3145	
2	**MINNESOTA (MN)** UM-Sand Plain Res Farm Becker, MN	Dr. Christian Thill Jeff Miller VOICE: 612-624-9737	
3	**NORTH DAKOTA (ND)** Oberg Farms Hoople, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160	
4	**NORTH DAKOTA (ND)** NPPGA Research Farm Tappen, ND	Dr. Susie Thompson Bryce Farnsworth VOICE: 701-231-8160	
5	**WISCONSIN (WI)** UW-Hancock Res. Farm Hancock, WI	Dr. Jiwan Palta Dr. Felix Navarro VOICE: 608-262-1878	7/30: 1.87 oz/a Agri-Tin 80WP + 2 lbs/a Manzate Pro-Stick 8/4: 2 pt/a EquusZN 8/9: 2.125 pt/a Bravo Zn + 2 lbs/a Manzate Pro-Stick 8/14: 2 pt/a EquusZN 8/19: 8oz/a Tanos + 2 lbs/a Manzate Pro-Stick 8/24: 2 pt/a EquusZN
6	**MANITOBA (MB)** Morden, MB, Canada	Dr. Benoit Bizimungu VOICE: 506-452-4880	Rainfall = 21in Irrigation = 1in

North Central Regional Potato Variety Trial - 2010 - Red Entries

Entry No. Clone

1) **ND8314-1R**

Flesh: W

2) **ND8555-8R**

Flesh: Cream

3) **W2609-1R**

Flesh: Cream

4) **Red Norland**

Flesh: W

5) **Red Pontiac**

Flesh: Cream

2010 North Central Regional Potato Variety Trial - Table 3

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Red

Entry No: **1**

Entered By: **ND**

ND8314-1R	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
			cwt/a	cwt/a	cwt/a	cwt/a					
Program											
MAN	3.5	1.081	296	59	230	0	20	-	1	1	
MI	1.0	1.063	365	193	161	4	55	3.0	3	-	
MN	1.3	1.065	621	282	335	4	45	8.0	3	3	9
ND - Inkster*	1.5	1.075	218	26	193	0	12	-	1	T	
WI	2.3	1.063	296	216	54	26	69	-	1.8	-	
Avg.	**1.8**	**1.069**	**359**	**155**	**195**	**7**	**40**	-	**2.0**	**2.0**	**9**
ND - Crystal*	2.3	1.094	248	57	191	0	24	-	1	T	
Red Norland	**1.6**	**1.060**	**388**	**297**	**51**	**7**	**77**	-	**1.3**	**1.5**	**9**
Red Pontiac	**3.4**	**1.062**	**465**	**341**	**25**	**39**	**65**	-	**2.7**	**3.0**	**9**

	External Defects (%) Scab	GC	2^0 Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	33	0	0	0	1	66	0	0	0	0	100
MI	-	-	-	-	-	-	5	0	5	0	90
MN	0	0	-	0	-	100	0	0	0	0	100
ND - Inkster*	1	0	4	0	0	95	0	0	0	0	100
WI	0	0.9	0.5	1.3	0	96.9	0.4	0.0	0.3	0.0	99.2
Avg.	**8.5**	**0.2**	**1.5**	**0.3**	**0.5**	**89.5**	**1.1**	**0.0**	**1.1**	**0.0**	**97.8**
ND - Crystal*	5	0	2	0	0	93	0	0	17	0	83
Red Norland	**18.7**	**4.7**	**0.5**	**1.0**	**0.5**	**75.3**	**1.0**	**0.0**	**4.0**	**0.0**	**95.5**
Red Pontiac	**18.1**	**0.6**	**1.8**	**2.0**	**0.5**	**77.7**	**1.2**	**0.0**	**5.5**	**0.0**	**93.3**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 4

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Red

Entry No: **2**

Entered By: **ND**

ND8555-8R	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
			cwt/a								
Program											
MAN	3.8	1.080	410	203	190	0	47	-	1	T	
MI	1.0	1.067	509	382	117	0	77	1.5	2	-	
MN	2.8	1.068	488	326	159	2	67	5.5	2	2.5	9
ND*	2.5	1.076	357	195	158	0	55	-	1	T	
WI	2.0	1.063	402	357	26	19	84	-	1.1	-	
Avg.	**2.5**	**1.071**	**433**	**293**	**130**	**4**	**66**	**-**	**1.4**	**2.5**	**9**
ND*	2.6	1.100	296	126	170	0	42	-	1	T	
Red Norland	**1.6**	**1.060**	**388**	**297**	**51**	**7**	**77**	**-**	**1.3**	**1.5**	**9**
Red Pontiac	**3.4**	**1.062**	**465**	**341**	**25**	**39**	**65**	**-**	**2.7**	**3.0**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	37	4	0	0	4	55	0	0	0	1	99
MI	-	-	-	-	-	-	3	3	0	0	94
MN	0	0	-	0	-	100	0	0	0	0	100
ND*	1	0	1	0	0	98	0	0	5	0	95
WI	0.0	0.6	0.0	2.5	0.2	96.6	0.4	0.2	0.3	0.0	99.1
Avg.	**9.5**	**1.2**	**0.3**	**0.6**	**1.4**	**87.4**	**0.7**	**0.6**	**1.1**	**0.2**	**97.4**
ND*	0	1	1	0	0	98	0.0	0.0	22.0	0.0	78.0
Red Norland	**18.7**	**4.7**	**0.5**	**1.0**	**0.5**	**75.3**	**1.0**	**0.0**	**4.0**	**0.0**	**95.5**
Red Pontiac	**18.1**	**0.6**	**1.8**	**2.0**	**0.5**	**77.7**	**1.2**	**0.0**	**5.5**	**0.0**	**93.3**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 5

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Red

Entry No: **3**

Entered By: **WI**

Program	Mat[1]	SpGr[2]	Total Yld (cwt/a)	A's (cwt/a)	B's (cwt/a)	Culls (cwt/a)	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
	W2609-1R										
MAN	2.5	1.072	377	286	73	7	76	-	1	T	
MI	1.3	1.058	328	259	56	3	82	2.5	1	-	
MN	2.0	1.064	498	377	121	0	76	7.0	1.5	2	9
ND*	1.0	1.057	267	190	45	0	72	-	1	T	
WI	2.6	1.057	290	284	5	1	95	-	1.1	-	
Avg.	**1.7**	**1.062**	**352**	**279**	**60**	**2**	**80**	**-**	**1.1**	**2.0**	**9**
ND*	2.0	1.098	212	130	75	1	60		1	T	
Red Norland	**1.6**	**1.060**	**388**	**297**	**51**	**7**	**77**	**-**	**1.3**	**1.5**	**9**
Red Pontiac	**3.4**	**1.062**	**465**	**341**	**25**	**39**	**65**	**-**	**2.7**	**3.0**	**9**

Program	External Defects (%) Scab	GC	2^0 Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	33	0	0	0	3	64	0	2	5	0	93
MI	-	-	-	-	-	-	0	3	0	0	97
MN	0	0	-	0	-	100	0	0	0	0	100
ND*	2	0	2	0	0	96	0	0	7	0	93
WI	0.0	0.9	0.0	0.5	0.1	98.5	0.4	0.0	1.3	0.0	98.2
Avg.	**8.8**	**0.2**	**0.7**	**0.1**	**1.0**	**89.6**	**0.1**	**1.0**	**2.7**	**0.0**	**96.2**
ND*	10	3	0	0	0	87	0	0	27	0	73
Red Norland	**18.7**	**4.7**	**0.5**	**1.0**	**0.5**	**75.3**	**1.0**	**0.0**	**4.0**	**0.0**	**95.5**
Red Pontiac	**18.1**	**0.6**	**1.8**	**2.0**	**0.5**	**77.7**	**1.2**	**0.0**	**5.5**	**0.0**	**93.3**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 6

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Red

Entry No: **4**

Entered By: **Chk**

Program	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
			cwt/a								
MAN	2.0	1.065	367	297	52	19	81	-	1	T	
MI	1.5	1.055	287	241	37	0	87	2.0	2	-	
MN	1.5	1.059	517	429	83	5	83	8.0	1	1.5	9
ND*	1.3	1.060	382	220	31	2	58	-	1	T	
WI	2.0	1.053	405	336	12	58	70	-	2.5	-	
ND*	2.0	1.080	294	214	43	1	73	-	1	T	
Red Norland	**1.6**	**1.060**	**388**	**297**	**51**	**7**	**77**	**-**	**1.3**	**1.5**	**9**
Red Pontiac	-	-	-	-	-	-	-	-	-	-	-

	External Defects (%)						Internal Defects (%)				
Program	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	44	12	0	3	1	41	1	0	4	0	95
MI	-	-	-	-	-	-	3	0	3	0	96
MN	0	0	-	0	-	100	0	0	0	0	100
ND*	12	2	1	0	0	85	0	0	9	0	91
WI	0.6	1.3	0.1	9.3	0.3	88.4	0.4	0.0	0.3	0.0	99.2
ND*	7	6	0	5	0	90	0	0	18	0	82
Red Norland	**18.7**	**4.7**	**0.5**	**1.0**	**0.5**	**75.3**	**1.0**	**0.0**	**4.0**	**0.0**	**95.5**
Red Pontiac	-	-	-	-	-	-	-	-	-	-	-

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 7

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Red

Entry No: **5**

Entered By: **Chk**

Program	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
			cwt/a								
Red Pontiac											
MAN	5.0	1.073	538	431	31	75	80	-	1	1	
MI	2.1	1.061	421	303	42	13	87	3.5	4.5	-	
MN	3.5	1.059	616	574	35	7	93	9.0	3	5	9
ND*	3.0	1.064	323	77	10	1	25	-	1	T	
WI	2.0	1.051	427	322	8	97	41	-	3.8	-	
ND*	3.5	1.087	334	198	32	9	59	-	1	T	
Red Norland	-	-	-	-	-	-	-	-	-	-	-
Red Pontiac	**3.4**	**1.062**	**465**	**341**	**25**	**39**	**65**	-	**2.7**	**3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	33	0	0	0	1	66	0	0	0	0	100
MI	-	-	-	-	-	-	5	0	5	0	90
MN	0	0	-	0	-	100	0	0	0	0	100
ND*	25	0	4	0	0	71	0	0	16	0	84
WI	14.3	2.5	1.3	7.9	0.4	73.7	0.9	0.2	6.4	0.0	92.4
ND*	9	2	0	0	0	85	1	0	16	0	84
Red Norland	-	-	-	-	-	-	-	-	-	-	-
Red Pontiac	**18.1**	**0.6**	**1.8**	**2.0**	**0.5**	**77.7**	**1.2**	**0.0**	**5.5**	**0.0**	**93.3**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

North Central Regional Potato Variety Trial in 2010 - Red Comments

Sort 2	Clone		Rep	Comments/Notes	K/D
1	ND8314-1R	BL	1	Red, Rnd-oval, Ex. Color, yld	K
2	ND8314-1R	BL	2	Red, Rnd-oval, Good color/skin, Some off-types, Knobs, Flattened, Ex. Yld	K-
3	ND8314-1R	BL	3	Red, Some off-types	K-
4	ND8314-1R	BL	4	Red, Rnd-oval, Stolons, Some off types, Ex. Yld	K-
5	ND8314-1R	WI		somewhat flat, round oval, excellent skin texture and color, good internal and external quality, small tuber size	
6	ND8555-8R	BL	1	Red, Rnd, Good color, Skins, Unif. Shape/ size, Med size, Ex. Yld	K
7	ND8555-8R	BL	2	Red, Rnd-oval, Ex. Color, Skins, Unif. shape/size, Ex-yld, Med-lge size	K
8	ND8555-8R	BL	3	Red, Rnd-ovl, Ex. Color, Skins, Pitted Scab, Unif. Shape/size Few dumbbells	D
9	ND8555-8R	BL	4	Red, Rnd-oval. Ex. Color, Skins, Unif. Shpe/size, Ex. yld, Attractive	K
10	ND8555-8R	WI		Excellent color off the field, some netting and silver scurf	
11	W2609-1R	BL	1	Red, Rnd-oval, Ex. Color, skins, Unif. Shape/size, Med-lge. Ex. Yld	K
12	W2609-1R	BL	2	Red, Rnd Ex. Color, Few off-types, Ex. Yld	K
13	W2609-1R	BL	3	Red, Rnd-oval, Ex. Color/skin, Ex. Yld	K
14	W2609-1R	BL	4	Red, Rnd-oval, Good color, Skins, Unif. Size, Med-lge, Ex-yld	K-
15	W2609-1R	WI		silver scurf, mid red color, very nice size, some skinning, excellent internal/external appearance, high %US#1	
16	**Red Norland**	BL	1	Red, Rnd-oval, Good color, Ex. Skin, Scurf, Med-lge, Ex. Yld	K
17	**Red Norland**	BL	2	Red, Rnd-oval, Good color, Ex. Skin, Ex-yld, GC, Lge	K
18	**Red Norland**	BL	3	Red, Rnd-oval, Good color, Ex. yld	K
19	**Red Norland**	BL	4	Red, Rnd-oval, Good color/skin, Med-lge size	K
20	**Red Norland**	WI		Greening, light color, surface scab, netting, light color and silver scurf	
21	**Red Pontiac**	BL	1	Red, Oval-oblong, Knobs, GC, Pale, Huge, Ex-yld, Skins	D
22	**Red Pontiac**	BL	2	Red, Oval-oblong, Deep eyes, Huge, Pale color, Ex. yld	D
23	**Red Pontiac**	BL	3	Red, Oval-oblong, Deep eyes, Pale color, Huge, Ex. Yld	D
24	**Red Pontiac**	BL	4	Red, Pale color, Lge size, Deep eyes	D
25	**Red Pontiac**	WI		Scab, rough, deep eyes, light color	

North Central Regional Potato Variety Trial - 2010 - Russet Entries

Entry
No. Clone

6) **CV00047-3**

Flesh: Cream

7) **CV99222-2**

Flesh: Cream

8) **ND8229-3**

Flesh: Cream

9) **W8946-1rus**

Flesh: Cream

North Central Regional Potato Variety Trial - 2010 - Russet Entries

Entry
No. Clone

10) **Russet Burbank**

Flesh: Cream

11) **Russet Norkotah**

Flesh: Cream

2010 North Central Regional Potato Variety Trial - Table 8

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Russet

Entry No: **6**

Entered By: **CAN**

CV00047-3

Program	Mat[1]	SpGr[2]	Total Yld (cwt/a)	A's (cwt/a)	B's (cwt/a)	Culls (cwt/a)	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
MAN	3.3	1.091	340	258	64	19	76	55.4	0	0	
MI	-	-	-	-	-	-	-	-	-	-	
MN	3.0	1.080	518	394	116	8	76	0	1	1	9
ND - Inkster*	3.0	1.083	295	203	63	4	77	-	0	0	
ND - Larimore*	1.1	1.096	298	202	56	12	76	-	0	0	
WI	-	-	-	-	-	-	-	-	-	-	
Avg.	**2.6**	**1.088**	**363**	**264**	**75**	**11**	**76**	**-**	**0.3**	**0.3**	**9**
Russet Burbank	**3.1**	**1.078**	**443**	**298**	**64**	**36**	**75**	**-**	**0.5**	**0.0**	**9**
Russet Norkotah	**2.1**	**1.075**	**379**	**243**	**51**	**25**	**77**	**-**	**1.1**	**0.8**	**9**

Program	External Defects (%) Scab	GC	2[0] Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	0	0	5	6	0	89	6	0	1	0	93
MI	-	-	-	-	-	-	-	-	-	-	-
MN	0	0	-	4	-	96	0	8	0	0	92
ND - Inkster*	0	0	2	0	0	98	0	0	8	0	92
ND - Larimore*	0	2	8	0	0	90	6	0	10	0	84
WI	-	-	-	-	-	-	-	-	-	-	-
Avg.	**0**	**1**	**5**	**3**	**0**	**93**	**3**	**2**	**5**	**0**	**90**
Russet Burbank	**2.1**	**2.0**	**25.3**	**0.3**	**0.3**	**76.5**	**15.5**	**0.0**	**2.2**	**0.4**	**81.9**
Russet Norkotah	**0.0**	**1**	**3**	**0**	**1**	**96**	**11**	**0.2**	**5.2**	**0.4**	**84**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 9

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Russet

Entry No: **7**

Entered By: **CAN**

CV99222-2

Program	Mat[1]	SpGr[2]	Total Yld (cwt/a)	A's (cwt/a)	B's (cwt/a)	Culls (cwt/a)	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
MAN	3.5	1.083	390	294	71	26	75	32.9	1	T	
MI	-	-	-	-	-	-	-	-	-	-	
MN	3.3	1.078	582	450	122	10	77	0	3	4	9
ND - Inkster*	3.0	1.080	413	289	37	6	89	-	0	0	
ND - Larimore*	2.0	1.101	340	202	32	33	79	-	0	0	
WI	-	-	-	-	-	-	-	-	-	-	
Avg.	**3.0**	**1.085**	**431**	**309**	**66**	**19**	**80**	**-**	**1.0**	**1.3**	**9**
Russet Burbank	**3.1**	**1.078**	**443**	**298**	**64**	**36**	**75**	**-**	**0.5**	**0.0**	**9**
Russet Norkotah	**2.1**	**1.075**	**379**	**243**	**51**	**25**	**77**	**-**	**1.1**	**0.8**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	4	0	2	6	0	88	0	0	5	0	95
MI	-	-	-	-	-	-	-	-	-	-	-
MN	0	0	-	0	-	100	0	0	4	0	96
ND - Inkster*	0	5	2	0	0	93	0	0	9	0	91
ND - Larimore*	0	1	33	0	0	66	3	0	5	0	92
WI	-	-	-	-	-	-	-	-	-	-	-
Avg.	**1.0**	**1.5**	**12.3**	**1.5**	**0.0**	**86.8**	**0.8**	**0.0**	**5.8**	**0.0**	**93.5**
Russet Burbank	**2.1**	**2.0**	**25.3**	**0.3**	**0.3**	**76.5**	**15.5**	**0.0**	**2.2**	**0.4**	**81.9**
Russet Norkotah	**0.0**	**1**	**3**	**0**	**1**	**96**	**11**	**0.2**	**5.2**	**0.4**	**84**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 10

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Russet

Entry No: **8**

Entered By: **ND**

	ND8229-3										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	5.0	1.091	438	340	41	50	78	45.6	0	0	
MI	2.3	1.076	331	248	53	3	83	1.0	1	-	
MN	3.0	1.082	433	375	58	0	87	0	3	2	9
ND - Inkster*	3.3	1.080	447	346	29	3	92	-	0	0	
ND - Larimore*	2.8	1.106	381	288	34	1	91	-	0	0	
WI	2.5	1.075	364	314	25	25	74	-	1.5	-	
Avg.	**3.3**	**1.085**	**399**	**319**	**40**	**14**	**84**	**-**	**0.8**	**0.4**	**9**
Russet Burbank	**3.1**	**1.078**	**443**	**298**	**64**	**36**	**75**	**-**	**0.5**	**0.0**	**9**
Russet Norkotah	**2.1**	**1.075**	**379**	**243**	**51**	**25**	**77**	**-**	**1.1**	**0.8**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	0	0	5	5	1	89	5	1	1	2	91
MI	-	-	-	-	-	-	3	0	0	0	97
MN	0	0	-	0	-		8	0	0	0	92
ND - Inkster*	0	0	4	0	0	96	0	0	4	0	96
ND - Larimore*	0	0	0	0	0	100	29	0	2	0	68
WI	2.2	0.7	0.0	6.6	0.1	90.5	1.5	0.7	0.0	0.0	97.8
Avg.	**0.4**	**0.1**	**2.3**	**2.3**	**0.3**	**93.9**	**7.7**	**0.3**	**1.2**	**0.3**	**90.2**
Russet Burbank	**2.1**	**2.0**	**25.3**	**0.3**	**0.3**	**76.5**	**15.5**	**0.0**	**2.2**	**0.4**	**81.9**
Russet Norkotah	**0.0**	**1**	**3**	**0**	**1**	**96**	**11**	**0.2**	**5.2**	**0.4**	**84**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 11

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Russet

Entry No: **9**

Entered By: **WI**

	W8946-1rus										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	5.0	1.101	395	282	113	0	71	45.1	0	0	
MI	3.8	1.091	391	223	141	20	58	-	1.3	-	
MN	4.0	1.091	546	298	237	12	55	0	1.5	1	7
ND - Inkster*	3.3	1.091	481	366	87	7	80	-	0	0	
ND - Larimore*	1.9	1.116	285	193	74	7	70	-	0	0	
WI	2.3	1.085	415	356	45	14	81	-	1.1	-	
Avg.	**3.6**	**1.096**	**419**	**286**	**116**	**10**	**69**	**-**	**0.6**	**0.3**	**7**
Russet Burbank	**3.1**	**1.078**	**443**	**298**	**64**	**36**	**75**	**-**	**0.5**	**0.0**	**9**
Russet Norkotah	**2.1**	**1.075**	**379**	**243**	**51**	**25**	**77**	**-**	**1.1**	**0.8**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	0	0	0	0	0	100	0	0	1	0	99
MI	-	-	-	-	-	-	0	3	8	0	89
MN	4	0	-	4	-	92	0	0	0	0	100
ND - Inkster*	0	1	7	0	0	92	0	0	10	0	90
ND - Larimore*	4	4	0	0	0	92	0	0	1	0	99
WI	0.0	0.6	0.4	1.0	0.1	98.0	0.4	0.0	2.58	0.0	97.0
Avg.	**1.6**	**1.1**	**1.8**	**1.0**	**0.0**	**94.8**	**0.1**	**0.4**	**3.7**	**0.0**	**95.7**
Russet Burbank	**2.1**	**2.0**	**25.3**	**0.3**	**0.3**	**76.5**	**15.5**	**0.0**	**2.2**	**0.4**	**81.9**
Russet Norkotah	**0.0**	**1**	**3**	**0**	**1**	**96**	**11**	**0.2**	**5.2**	**0.4**	**84**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 12

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Russet

Entry No: **10**

Entered By: **Chk**

	Russet Burbank										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	4.5	1.080	402	305	69	23	76	38.7	0	0	
MI	1.4	1.064	252	151	93	3	62	-	2.3	-	
MN	4.0	1.074	674	562	89	23	83	2.3	0	0	9
ND - Inkster*	3.5	1.077	495	281	42	89	73	-	0	0	
ND - Larimore*	2.0	1.095	391	191	24	45	82	-	0	0	
WI	2.1	1.073	504	390	62	52	64	-	1.1	-	
Russet Burbank	**3.1**	**1.078**	**443**	**298**	**64**	**36**	**75**	**-**	**0.5**	**0.0**	**9**
Russet Norkotah	-	-	-	-	-	-	-	-	-	-	-

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	0	2	11	0	1	86	27	0	0	2	71
MI	-	-	-	-	-	-	0	0	5	0	95
MN	8	0	-	0	-	92	13	0	0	0	88
ND - Inkster*	0	4	41	1	0	54	1	0	6	0	93
ND - Larimore*	0	2	24	0	0	74	37	0	0	0	63
WI	0.0	1.2	1.2	1.7	0.3	95.6	2.0	5.1	0.3	1.2	91.3
Russet Burbank	**2.1**	**2.0**	**25.3**	**0.3**	**0.3**	**76.5**	**15.5**	**0.0**	**2.2**	**0.4**	**81.9**
Russet Norkotah	-	-	-	-	-	-	-	-	-	-	-

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 13

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

Russet

Entry No: **11**

Entered By: **Chk**

	Russet Norkotah										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	2.3	1.076	311	230	62	8	74	30.8	0	0	
MI	2.0	1.073	293	114	73	97	42	-	2	-	
MN	3.0	1.070	550	487	60	3	89	1	2.5	2.5	9
ND - Inkster*	2.3	1.069	412	199	32	18	89	-	0	0	
ND - Larimore*	1.0	1.085	330	185	27	1	91	-	-	-	
WI	2.5	1.065	486	442	30	14	86	-	1.1	-	
Russet Burbank	-	-	-	-	-	-	-	-	-	-	-
Russet Norkotah	**2.1**	**1.075**	**379**	**243**	**51**	**25**	**77**	**-**	**1.1**	**0.8**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	0	0	0	0	4	96	13	1	9	2	75
MI	-	-	-	-	-	-	5	0	10	0	85
MN	0	3	-	0	-	97	0	0	0	0	100
ND - Inkster*	0	2	3	0	0	95	4	0	3	0	93
ND - Larimore*	0	0	5	0	0	95	33	0	4	0	68
WI	0.0	0.5	0.0	2.0	0.2	97.2	2.0	0.2	0.3	0.0	97.4
Russet Burbank	-	-	-	-	-	-	-	-	-	-	-
Russet Norkotah	**0.0**	**1**	**3**	**0**	**1**	**96**	**11**	**0.2**	**5.2**	**0.4**	**84**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

North Central Regional Potato Variety Trial in 2010 - Russet Comments

Sort 2	Clone		Rep	Comments/Notes	K/D
26	CV00047-3	BL	1	Rus, Oblong, Good length, Unif. Shape, Ex. Yld	K
27	CV00047-3	BL	2	Rus, Oval-oblong, Too many small, More oval, Good yld	D
28	CV00047-3	BL	3	Rus, GC, Oval-oblong, V's, Short-med lngth, Good size	K
29	CV00047-3	BL	4	Rus, Ex. Yld, Unif. Shape/size, Med lugth, Blocky types	K
30	CV00047-3	WI		Not received	
31	CV99222-2	BL	1	Rus, Oblong, Crescents, knobs, Short-med length, Pitted Scab, Ex. Yld	D
32	CV99222-2	BL	2	Rus, Good yld, Oval-oblong, Too small, short, Too many oval	D
33	CV99222-2	BL	3	Rus, Pitted scab, Too many small, Ex. Yld, Too short overall	D
34	CV99222-2	BL	4	Rus, Oval-oblong, V's, Crescents, Unif. Shape/size, Superb yld	K
35	CV99222-2	WI		Not received	
36	ND8229-3	BL	1	Rus, Unif. Shape/size, Good length, Ex-yld, Attractive	K
37	ND8229-3	BL	2	Rus, Oblong, Unif. Shape/size, Ex. Yld, Attractive, 2 w/elephant hide	K
38	ND8229-3	BL	3	Rus, Shallow eyes, Oblong, Good length, Attractive	K
39	ND8229-3	BL	4	Rus, Oblong, Good length, size, Attractive	K
40	ND8229-3	WI		Nice type, size, blocky, smooth, uniform	
41	W8946-1rus	BL	1	Rus, Ex. Yld, Too small/short	D
42	W8946-1rus	BL	2	Rus, Ex. Yld, Oval-oblong, Too many small/short	D
43	W8946-1rus	BL	3	Rus, Ex. Yld, Oval-oblong, Too short/small, (FM?)	D
44	W8946-1rus	BL	4	Rus, Knobs GC, Oval-oblong, Short, Too short, Small FM?	D
45	W8946-1rus	WI		Maybe too small, uniform	
46	**Russet Burbank**	BL	1	Rus, Oblong-long, Knobs, Hooks, Superior yld	D
47	**Russet Burbank**	BL	2	Rus, Ex. Ingth, Knobs, Crescents, Ex-yld	D
48	**Russet Burbank**	BL	3	Rus, Ex.lngth, Knobs, Dumbbells, Superb yld	K-
49	**Russet Burbank**	BL	4	Rus, Oblong, Crescents, Points, Long, Superb yld	K
50	**R. Burbank**	WI		Very long & narrow &variable shape	
51	**Russet Norkotah**	BL	1	Rus, Oblong, Unif. Shape/size, Ex-yld	K+
52	**Russet Norkotah**	BL	2	Rus, oblong, Ex. Skin, Unif. Shape, Attractive	K+
53	**Russet Norkotah**	BL	3	Rus, Oblong, Unif. Shape/size, Ex. Yld	K+
54	**Russet Norkotah**	BL	4	Rus, Unif. Shpe/size, Ex. Yld, Lge size, Attractive	K+
55	**R. Norkotah**	WI		Very uniform, blocky, net is set	

North Central Regional Potato Variety Trial - 2010 - White Entries

Entry
No. Clone

12) **MSL211-3**

Flesh: Cream

13) **MSL268-D**

Flesh: Cream

14) **MSM182-1**

Flesh: Cream

15) **MSQ176-5**

Flesh: Cream

16) **ND8307C-3**

Flesh: Cream

17) **W2717-5**

Flesh: Cream

18) **W2978-3**

Flesh: Cream

19) **W5015-12**

Flesh: Cream

20) **Atlantic**

Flesh: Cream

21) **NorValley**

Flesh: Cream

22) **Snowden**

Flesh: W

2010 North Central Regional Potato Variety Trial - Table 14

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **12**

Entered By: **MI**

	MSL211-3										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	-	-	-	-	-	-	-	-	-	-	
MI	1.3	1.068	458	371	46	9	89	2.5	2.2	-	
MN	3.0	1.069	678	538	135	5	79	8.0	2.5	2	**9**
ND - Inkster*	3.5	1.072	215	134	41	3	78	7.3	1	T	
WI	2.0	1.064	433	354	21	58	69	-	1.1	-	
Avg.	**2.6**	**1.068**	**446**	**349**	**61**	**19**	**79**	-	**1.7**	**2.0**	**9**
ND - Hoople*	2.3	1.074	143	77	59	0	58	5.5	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	-	-	-	-	-	-	-	-	-	-	-
MI	-	-	-	-	-	-	0	0	3	0	97
MN	0	0	-	0	-	100	0	0	0	0	100
ND - Inkster*	13	3	1	1	0	82	0	0	2	0	98
WI	0.1	2.0	0.1	9.4	0.4	88.0	0.9	0.2	0.0	0.0	98.8
Avg.	**4.4**	**1.7**	**0.6**	**3.5**	**0.2**	**90.0**	**0.2**	**0.0**	**1.1**	**0.0**	**98.5**
ND - Hoople*	6	0	0	0	0	94	0	0	20	0	80
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 15

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **13**

Entered By: **MI**

	MSL268-D										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	-	-	-	-	-	-	-	-	-	-	
MI	1.8	1.081	419	339	67	8	82	1.0	3	-	
MN	4.0	1.083	739	562	146	31	76	6.0	3	3	9
ND - Inkster*	3.3	1.082	333	203	90	5	71	4.3	1	T	
WI	2.5	1.076	447	383	12	52	76	-	2.1	-	
Avg.	**3.0**	**1.081**	**485**	**372**	**79**	**24**	**76**	**-**	**2.3**	**3.0**	**9**
ND - Hoople*	3	1.098	244	121	112	0	56	4.0	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	-	-	-	-	-	-	-	-	-	-	-
MI	-	-	-	-	-	-	0	0	10	0	90
MN	4	4	-	0	-	92	4	0	0	0	96
ND - Inkster*	12	0	7	0	0	82	0	0	7	0	90
WI	0.0	4.0	0.6	2.5	0.7	92.2	0.9	1.3	0.0	0.0	97.7
Avg.	**5.3**	**2.7**	**3.8**	**0.8**	**0.4**	**88.7**	**1.3**	**0.3**	**4.3**	**0.0**	**93.4**
ND - Hoople*	3	0	1	0	0	96	1	0	32	0	68
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 16

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **14**

Entered By: **MI**

	MSM182-1										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	-	-	-	-	-	-	-	-	-	-	
MI	2.0	1.068	382	298	57	4	84	2.5	3.0	-	
MN	3.5	1.065	595	406	189	0	68	8.0	2.5	3.5	9
ND - Inkster*	3.0	1.075	307	193	58	0	80	7.0	1	T	
WI	2.1	1.066	405	379	9	17	83	-	1.5	-	
Avg.	**2.8**	**1.069**	**422**	**319**	**78**	**5**	**79**	**-**	**2.0**	**3.5**	**9**
ND - Hoople*	2.8	1.088	119	69	29	0	73	5.8	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	-	-	-	-	-	-	-	-	-	-	-
MI	-	-	-	-	-	-	5	13	3	0	79
MN	0	0	-	0	-	100	0	13	0	0	88
ND - Inkster*	36	0	0	0	0	64	0	0	8	0	92
WI	1.2	0.6	0.3	1.4	0.1	96.3	1.5	5.1	0.0	0.0	93.3
Avg.	**12.4**	**0.2**	**0.2**	**0.5**	**0.0**	**86.8**	**1.6**	**7.5**	**2.6**	**0.0**	**88.0**
ND - Hoople*	13	0	1	0	0	86	0	0	22	0	75
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 17

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **15**

Entered By: **MI**

MSQ176-5	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
			cwt/a	cwt/a	cwt/a	cwt/a					
Program											
MAN	-	-	-	-	-	-	-	-	-	-	
MI	2.0	1.066	411	271	41	4	89	1.0	3.0	-	
MN	3.8	1.069	537	426	111	0	79	7.0	2.0	5	8.5
ND - Inkster*	3.8	1.073	358	226	24	0	94	5.8	1	T	
WI	3.0	1.062	460	383	5	72	56	-	1.8	-	
Avg.	**3.2**	**1.068**	**441**	**326**	**45**	**19**	**79**	**-**	**1.9**	**5.0**	**9**
ND - Hoople*	3.8	1.081	168	93	35	0	79	4.3	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	-	-	-	-	-	-	-	-	-	-	-
MI	-	-	-	-	-	-	23	5	3	0	69
MN	25	0	-	0	-	75	0	0	0	0	100
ND - Inkster*	21	1	0	1	0	77	1	0	4	1	95
WI	6.0	1.6	0.3	10.0	0.4	81.7	6.5	0.0	1.4	1.4	90.7
Avg.	**17.3**	**0.9**	**0.1**	**3.7**	**0.2**	**77.9**	**7.5**	**1.3**	**2.0**	**0.6**	**88.7**
ND - Hoople*	0	0	0	0	0	100	1	0	8	0	91
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 18

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **16**

Entered By: **ND**

	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
ND8307C-3			cwt/a						Severity	Coverage	Score
Program											
MAN	3.8	1.097	230	45	168	0	19	59.0	0	0	
MI	1.6	1.087	370	285	78	4	78	1.0	1.5	-	
MN	2.3	1.087	408	226	179	3	55	4.0	2.0	1.5	9
ND - Inkster*	3.0	1.087	183	92	59	7	64	4.3	1	T	
WI	2.1	1.088	313	280	22	11	85	-	1.5	-	
Avg.	**2.7**	**1.089**	**301**	**186**	**101**	**5**	**60**	**-**	**1.2**	**0.8**	**9**
ND - Hoople*	2.1	1.108	66	17	47	0	23	2.3	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	0	0	0	0	5	95	0	0	1	0	99
MI	-	-	-	-	-	-	5	0	3	0	92
MN	4	0	-	0	-	96	4	0	0	0	96
ND - Inkster*	19	1	0	0	0	80	2	0	4	1	96
WI	0.2	0.9	0.1	1.6	0.2	97.0	0.4	0.0	0.6	0.6	98.4
Avg.	**5.8**	**0.5**	**0.0**	**0.4**	**1.7**	**92.0**	**2.3**	**0.0**	**1.6**	**0.3**	**96.2**
ND - Hoople*	0	1	0	0	0	99	0	0	13	0	92
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 19

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **17**

Entered By: **WI**

	W2717-5										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	3.5	1.095	284	191	65	3	66	56.9	1	T	
MI	1.1	1.088	282	231	45	3	82	1.5	3.0	-	
MN	3.0	1.087	477	343	127	6	72	5.0	3.0	1.5	9
ND - Inkster*	2.9	1.091	331	198	68	1	78	3.3	1	T	
WI	2.1	1.080	347	307	24	16	76	-	1.8	-	
Avg.	**2.6**	**1.088**	**344**	**254**	**66**	**6**	**75**	**-**	**2.0**	**1.5**	**9**
ND - Hoople*	2.0	1.097	182	96	42	6	72	3.3	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	24	0	0	0	7	69	5	1	30	0	64
MI	-	-	-	-	-	-	5	3	10	3	79
MN	0	0	-	0	-	100	8	0	0	4	88
ND - Inkster*	7	1	0	0	0	83	0	0	5	1	94
WI	0.2	1.5	0.0	4.6	0.1	93.6	1.5	2.4	1.1	1.1	93.9
Avg.	**7.8**	**0.6**	**0.0**	**1.2**	**2.4**	**86.4**	**4.0**	**1.2**	**9.2**	**1.8**	**83.7**
ND - Hoople*	0	0	6	0	0	94	3	0	32	0	65
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 20

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **18**

Entered By: **WI**

Program	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
	W2978-3										
			cwt/a								
MAN	3.0	1.083	367	265	100	2	72	53.6	1	T	
MI	1.1	1.072	322	238	74	0	77	1.0	3.5	-	
MN	3.0	1.081	593	448	145	0	76	5.5	3.0	4.0	9
ND - Inkster*	3.0	1.072	324	193	82	0	74	2.5	1	T	
WI	2.3	1.068	314	282	13	19	85	-	1.1	-	
Avg.	**2.5**	**1.075**	**384**	**285**	**83**	**4**	**77**	**-**	**1.9**	**4.0**	**9**
ND - Hoople*	2.3	1.093	121	45	74	0	48	3.5	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

Program	External Defects (%) Scab	GC	2^0 Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	20	0	0	1	0	79	0	0	1	0	99
MI	-	-	-	-	-	-	0	0	0	0	100
MN	0	0	-	0	-	100	0	0	0	0	100
ND - Inkster*	6	1	0	1	0	92	0	0	3	0	97
WI	0.0	1.4	0.0	2.4	0.1	96.1	0.4	0.0	0.0	0.0	99.5
Avg.	**6.5**	**0.6**	**0.0**	**1.1**	**0.0**	**91.8**	**0.1**	**0.0**	**0.8**	**0.0**	**99.1**
ND - Hoople*	0	0	2	0	0	95	0	0	18	1	76
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 21

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **19**

Entered By: **WI**

W5015-12

Program	Mat[1]	SpGr[2]	Total Yld (cwt/a)	A's (cwt/a)	B's (cwt/a)	Culls (cwt/a)	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
MAN	4.8	1.094	344	138	206	0	40	62.0	1	T	
MI	2.3	1.085	451	347	77	5	83	1.0	3.0	-	
MN	4.0	1.087	534	365	170	0	68	4.5	3.0	5	9
ND - Inkster*	3.5	1.083	402	256	102	4	72	2.9	1	T	
WI	2.3	1.083	441	393	19	28	79	-	1.1	-	
Avg.	**3.6**	**1.086**	**434**	**300**	**115**	**7**	**69**	**-**	**1.8**	**5.0**	**9**
ND - Hoople*	3.3	1.094	201	75	123	0	39	2.5	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**		**1.9**	**4**	**9**
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**		**2.0**	**1.5**	**9**
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**		**1.7**	**2.3**	**9**

Program	External Defects (%) Scab	GC	2^0 Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	4	0	0	0	0	96	2	0	1	1	96
MI	-	-	-	-	-	-	28	10	0	0	62
MN	0	0	-	0	-		13	17	0	0	71
ND - Inkster*	23	1	3	1	0	72	0	0	7	0	93
WI	0.0	0.6	0.1	5.8	0.1	93.5	0.4	1.8	0.6	0.6	96.6
Avg.	**6.8**	**0.4**	**1.0**	**1.7**	**0.0**	**87.2**	**8.5**	**5.7**	**1.7**	**0.3**	**83.7**
ND - Hoople*	8	0	2	0	0	87	1	0	21	0	78
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 22

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **20**

Entered By: **Chk**

	Atlantic										
	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4]		LB[5]
			cwt/a						Severity	Coverage	Score
Program											
MAN	4.3	1.098	441	343	82	15	78	47.6	1	T	
MI	1.8	1.086	420	315	38	8	89	1.5	2.9	-	
MN	3.5	1.088	597	495	94	9	83	6.0	3	4	9
ND - Inkster*	3.0	1.089	309	258	30	2	89	4.3	1	T	
WI	2.1	1.088	445	390	12	42	53	-	1.5	-	
ND - Hoople*	2.1	1.107	177	115	31	1	81	3.3	1	T	
Atlantic	**3.1**	**1.090**	**443**	**360**	**51**	**15**	**78**	**-**	**1.9**	**4.0**	**9**
NorValley	-	-	-	-	-	-	-	-	-	-	
Snowden	-	-	-	-	-	-	-	-	-	-	

	External Defects (%)						Internal Defects (%)				
	Scab	GC	2^0 Gr.	Grn	Rot	Free	HH	IN	VD	BC	Free
MAN	9	0	0	0	0	91	8	1	2	0	89
MI	-	-	-	-	-	-	53	13	13	0	21
MN	8	0	-	0	-	92	25	17	0	0	58
ND - Inkster*	9	2	3	0	0	86	1	0	16	0	96
WI	0.3	1.4	0.5	5.2	0.1	92.6	8.1	11.8	3.4	3.4	73.3
ND - Hoople*	3	0	2	0	0	93	1	0	19	0	77
Atlantic	**6.7**	**0.8**	**1.2**	**1.3**	**0.0**	**90.4**	**18.9**	**8.4**	**6.8**	**0.7**	**67.5**
NorValley	-	-	-	-	-	-	-	-	-	-	-
Snowden	-	-	-	-	-	-	-	-	-	-	-

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 23

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **21**

Entered By: **Chk**

Program	Mat[1]	SpGr[2]	Total Yld (cwt/a)	A's (cwt/a)	B's (cwt/a)	Culls (cwt/a)	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
	NorValley										
MAN	-	-	-	-	-	-	-	-	-	-	
MI	1.4	1.072	416	321	62	0	85	1.0	2.3	-	
MN	3.5	1.078	551	476	69	6	86	5.5	3	1.5	9
ND - Inkster*	3.3	1.075	274	231	45	1	86	3.5	1	T	
WI	2.0	1.072	473	403	13	57	71	-	1.8	-	
ND - Hoople*	1.9	1.092	213	111	77	3	62	2.8	1	T	
Atlantic	-	-	-	-	-	-	-	-	-	-	-
NorValley	**2.7**	**1.074**	**429**	**358**	**47**	**16**	**82**	-	**2.0**	**1.5**	**9**
Snowden	-	-	-	-	-	-	-	-	-	-	-

Program	External Defects (%) Scab	GC	2^0 Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	-	-	-	-	-	-	-	-	-	-	-
MI	-	-	-	-	-	-	0	0	0	0	100
MN	0	0	-	0	-	100	0	0	0	0	100
ND - Inkster*	7	0	6	0	0	88	0	0	0	0	100
WI	1.6	0.8	0.1	9.3	0.1	88.1	0.4	0	1.1	1.1	97.3
ND - Hoople*	0	0	13	0	0	87	0	0	10	0	90
Atlantic	-	-	-	-	-	-	-	-	-	-	-
NorValley	**2.9**	**0.3**	**3.1**	**3.1**	**0.1**	**92.0**	**0.1**	**0**	**0.3**	**0.3**	**99.3**
Snowden	-	-	-	-	-	-	-	-	-	-	-

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

2010 North Central Regional Potato Variety Trial - Table 24

Summary Table: Maturity, Ylds (cwt/a), Gravity, Scab, External/Internal Defects

White

Entry No: **21**

Entered By: **Chk**

	Mat[1]	SpGr[2]	Total Yld	A's	B's	Culls	% US # 1	Chip[3]	Scab[4] Severity	Scab[4] Coverage	LB[5] Score
			cwt/a								
Program											
MAN	4.5	1.091	411	291	120	0	70	56.7	0	0	
MI	1.6	1.081	433	355	48	4	88	1.0	2.9	-	
MN	3.0	1.090	639	514	125	0	80	5.0	3.0	4.5	9
ND - Inkster*	3.0	1.090	403	296	86	2	78	3.3	1	T	
WI	2.1	1.078	519	481	2	37	83	-	1.8	-	
ND - Hoople*	2.3	1.100	176	87	84	0	47	2.5	1	T	
Atlantic	-	-	-	-	-	-	-	-	-	-	-
NorValley	-	-	-	-	-	-	-	-	-	-	-
Snowden	**3.0**	**1.086**	**481**	**387**	**76**	**9**	**80**	**-**	**1.7**	**2.3**	**9**

	External Defects (%) Scab	GC	2^0 Gr.	Grn	Rot	Free	Internal Defects (%) HH	IN	VD	BC	Free
MAN	0	0	0	0	0	100	4	0	0	2	94
MI	-	-	-	-	-	-	18	0	10	0	72
MN	17	0	-	0	-	83	0	0	0	0	100
ND - Inkster*	4	0	0	0	0	86	0	0	7	0	89
WI	2.3	0.5	0.1	5.5	0	91.5	0.9	0	0	0	99.0
ND - Hoople*	7	0	2	0	0	91	0	0	36	0	64
Atlantic	-	-	-	-	-	-	-	-	-	-	-
NorValley	-	-	-	-	-	-	-	-	-	-	-
Snowden	**5.8**	**0.1**	**0.0**	**1.4**	**0.0**	**90.1**	**4.5**	**0.0**	**3.4**	**0.4**	**90.8**

1) MN maturity rating = 1 Early, 2 Medium-early, 3 Medium, 4 Meduim-late, 5 Late
1) ND maturity scale: 1=very early, 5=very late
1) WI readings = Plant Vigor (Not included in average)
2) MN Specific gravity determination: **[weight in air/(weight in air - weight in water)]**
3) MI Chip = 1 - 5; 2.5 = Unacceptable
3) MN Chip = 2 - 10; 5 = Unacceptable
3) ND chip score reported as USDA color chart values 1=white, 10=unacceptably dark.
4) MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted)
4) MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%
4) ND Scab rating…0 equals no infection, other scores per Severity/Coverage footnote description.
5) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100
* ND non-irrigated sites at Hoople (chip) and Crystal (red fresh), irrigated sites at Larimore (proc only) and Inkster (fresh, chip and processing)

North Central Regional Potato Variety Trial in 2010 - White Comments

Sort 2	Clone		Rep	Comments/Notes	K/D
56	MSL211-3	BL	1	W, Oval, Flattened, Large size, Ex. Yld	K
57	MSL211-3	BL	2	W, Rnd-oval, Flattened, Large size, Ex. Yld	K
58	MSL211-3	BL	3	W, Rnd-oval, Large size, Ex. Yld, Sprouts	K
59	MSL211-3	BL	4	W, Rnd-oval, Flattened, Large size, Ex-yld	K
60	MSL211-3	WI		Low gravity, full shape to ~flat oval, greening	
61	MSL268-D	BL	1	W, Rnd-oval, Med-lge size, Ex. Yld	K
62	MSL268-D	BL	2	W, Rnd-oval, Lumps, Knobs, Unif. Shape, Ex. Yld, Pitted Scab	K-
63	MSL268-D	BL	3	W. Oval-oblong, Knobs, Huge, Ex. Yld	D
64	MSL268-D	BL	4	W, Rnd-oval, Ex-yld, Med-lge size, Few off-types, Pitted Scab	K-
65	MSL268-D	WI		Nice, except scab, protuberant eyes-oval,	
66	MSM182-1	BL	1	W, Rnd, Shallow eyes, Lumps, Unif. Shape/size, Ex. Yld	K
67	MSM182-1	BL	2	W, Rnd, Netted, Med size, Unif. Shape/size, Ex-yld	K
68	MSM182-1	BL	3	W, Rnd Shallow eyes, Lt-net, Ex. Yld, Unif. Shape	K
69	MSM182-1	BL	4	W, Rnd-oval, Netted, Ex. Yld, Tapered/points	K-
70	MSM182-1	WI		Low gravity, alligator skin	
71	MSQ176-5	BL	1	W, Rnd, Large size, Pitted Scab/ Scabby, Ex. Yld	D
72	MSQ176-5	BL	2	W, Rnd-oval, Lt-net, Scabby, Large size, Ex-yld, shallow eyes	D
73	MSQ176-5	BL	3	W, Rnd-oval, Lt. net, Large size, Ex. Yld, Pitted Scab	K-
74	MSQ176-5	BL	4	W. Rnd-oval, Lt-net, Mel-large size, Ex-yld, Pitted Scab & Scabby!	D
75	MSQ176-5	WI		Low gravity, hollow heart, eyes, lenticels, surface scab, alligator skin	
76	ND8307C-3	BL	1	W, Rnd-oval, Flattened, GC, Med. Large size	K
77	ND8307C-3	BL	2	W, Rnd-oval-oblong, Med size, Ex. Yld	K
78	ND8307C-3	BL	3	W, Rnd, Fattened, Small-med size, Unif. Shape/size, Ex. Yld	K
79	ND8307C-3	BL	4	W, Rnd-oval, Flattened, Med-large size	K
80	ND8307C-3	WI		High gravity, heavy net, lenticels, ~flat	
81	W2717-5	BL	1	W. Rnd-oval, Flattened, Stolons, Small-med size, Good yld	K-
82	W2717-5	BL	2	W. Rnd-oval, Unif. Shape/size, Med, Flattened	K
83	W2717-5	BL	3	W, Rnd-oval, Large size, Ex-yld	K
84	W2717-5	BL	4	W, Rnd, Med-lge. Size, Ex. Yld	K-
85	W2717-5	WI		Good gravity, nice, some sticking stolons, very uniform,	

North Central Regional Potato Variety Trial in 2010 - White Comments

Sort 2	Clone		Rep	Comments/Notes	K/D
86	W2978-3	BL	1	W, Rnd-oval, Large size, Ex-yld, Shallow eyes, Lt. net, DEEP Pitted Scab	D
87	W2978-3	BL	2	W, Rnd-oval, Ex. Yld, shallow eyes, Pitted Scab	D
88	W2978-3	BL	3	W, Rnd-oval, Ex-yld, Large size, Pitted Scab	D
89	W2978-3	BL	4	W, Rnd-oval, Med-large size, Lt. net, Ex. Yld	K
90	W2978-3	WI		Low gravity, very uniform, nice tubers, yield?	
91	W5015-12	BL	1	W, Rnd-oval, Flattened,Unif. shape/size, Ex-yld, Pitted Scab	K-
92	W5015-12	BL	2	W, Rnd-oval, Med eyes, Flattened, Stolons, Dumbbells, Med. Large size, Ex. Yld	K
93	W5015-12	BL	3	W, Rnd, PPE, Med-large size, Slightly flattened	K
94	W5015-12	BL	4	W, Rnd-oval, Flattened, Med-lge size, Ex. yld	K
95	W5015-12	WI		Good gravity, ~flat, otherwise uniform, ~deep eyes	
96	**Atlantic**	BL	1	W, Rnd-oval, Netted, Lumps, Lge size, Ex. Yld	K
97	**Atlantic**	BL	2	W, Rnd-oval, Large Size, Ex. Yld, Med-deep eyes, Deep end folds, Rot	D
98	**Atlantic**	BL	3	W, Rnd-oval, Large-Jumbo size, Knobs, Pitted Scab	D
99	**Atlantic**	BL	4	W. Rnd-oval, Med-large size, Netted, Luisa, Knobs, Ex. Yld	K-
100	**Atlantic**	WI		High gravity, hollow heart, ibs, vd. Otherwise large size, nice tubers	
101	**NorValley**	BL	1	W, Rnd-oval, Lge size, GC, Ex. Yld	K
102	**NorValley**	BL	2	W, Rnd-oval, Lumps, Large size, Ex. yld	K
103	**NorValley**	BL	3	W, Rnd-oval, Large size, Lumps, Ex. Yld	K
104	**NorValley**	BL	4	W, Rnd-oval, Large size	K
105	**NorValley**	WI		Very nice, uniform full shape	
106	**Snowden**	BL	1	W, Rnd-oval, Med-deep eyes, Netted, Eyed, Med. Lge	K
107	**Snowden**	BL	2	W, Rnd-oval, Netted, Large size, Ex-yld, Lumps, Med-deep eyes	K
108	**Snowden**	BL	3	W, Rnd, Med-deep eyes, Netted, Med-lge size, Ex. Yld	K
109	**Snowden**			Deep eyes & uniform	

North Central Regional Potato Variety Trial - 2010

TABLE 25. Other Disease Rxns.

Entry No.	Clone	Irrigated: MAN Rot cwt/a	MI Blackspot Bruise	MN[1] LB Final	WI[2] Vert %	WI[2] Vert Sev	WI[2] EB Sev
	RED						
1	ND8314-1R	7	1.0	9	94.4	4.6	5.0
2	ND8555-8R	15	1.1	9	47.7	3.3	4.3
3	W2609-1R	10	0.4	9	86.0	4.3	4.8
4	**Red Norland**	0	0.2	9	89.4	4.6	4.8
5	**Red Pontiac**	0	0.7	9	12.7	1.6	3.4
	RUSSET / LONG						
6	CV00047-3	0	-	9	-	-	-
7	CV99222-2	0	-	9	-	-	-
8	ND8229-3	7	2.0	9	11.0	1.6	2.1
9	W8946-1rus	0	1.5	7	0.0	1.1	2.3
10	**R. Burbank**	5	0.1	9	27.7	2.8	2.8
11	**R. Norkotah**	12	0.8	9	42.7	3.3	3.8
	ROUND WHITE						
12	MSL211-3	-	1.0	9	41.0	3.3	3.8
13	MSL268-D	-	1.5	9	16.0	2.0	3.4
14	MSM182-1	-	1.2	9	24.4	2.1	2.9
15	MSQ176-5	-	0.6	8.5	16.0	2.0	3.1
16	ND8307C-3	18	0.8	9	31.0	2.8	4.3
17	W2717-5	25	1.2	9	51.0	3.3	3.6
18	W2978-3	0	0.5	9	41.0	3.3	3.9
19	W5015-12	0	2.4	9	7.7	1.3	3.6
20	**Atlantic**	0	1.4	9	19.4	2.3	3.4
21	**NorValley**	-	1.2	9	15.5	2.6	3.9
22	**Snowden**	0	1.4	9	16.0	1.8	3.1

1) MN LB Scale: (% defoliation) 1=0, 2=0<5, 3=5<15, 4=15<35, 5=35<65, 6=65<85, 7=85<95, 8=95<100, 9 = 100

2) WI = % Verticillium Wilt

2) WI Verticillium Wilt Severity: (1= No symptom, 5= 100% branches); ≤ 2.5 = Acceptable.

2) WI Early Blight Severity: (1= No symptom, 5= 100% branches); ≤ 2.5 = Acceptable.

North Central Regional Potato Variety Trial - 2010

Common Scab; Becker, MN; Red Entries

Entry No.	Clone	Flesh	Type	I/C R1	I/C R2	Area
1)	ND8314-1R	W	3	C	C	3
2)	ND8555-8R	Cream	2	I	C	2.5
3)	W2609-1R	Cream	1.5	I	C	2
4)	Red Norland	W	1	I	I	1.5
5)	Red Pontiac	Cream	3	C	C	5

1) ND8314-1R

2) ND8555-8R

3) W2609-1R

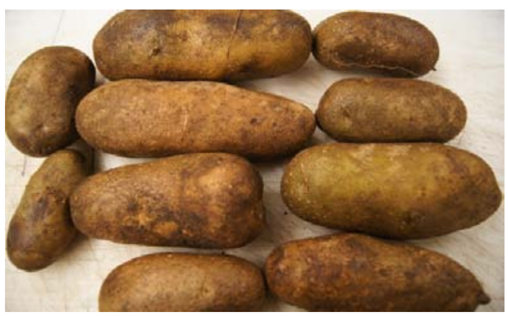
4) Red Norland

5) Red Pontiac

MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted); I = Isolated, C = Coalesced
MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%

North Central Regional Potato Variety Trial - 2010

Common Scab; Becker, MN; Russet Entries

Entry No.	Clone	Flesh	Photo	Type	I/C R1	I/C R2	Area
6)	CV00047-3	Cream		1	0	C	1
7)	CV99222-2	Cream		3	C	C	4
8)	ND8229-3	Cream		2.5	I	I	1.5
9)	W8946-1rus	Cream		1.5	I	I	1

MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted); I = Isolated, C = Coalesced
MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%

North Central Regional Potato Variety Trial - 2010

Common Scab; Becker, MN; Russet Entries

Entry No.	Clone	Flesh	Photo	Type	I/C R1	I/C R2	Area
10)	**Russet Burbank**	Cream		0	0	0	0
11)	**Russet Norkotah**	Cream		2.5	C	C	2.5

MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted); I = Isolated, C = Coalesced
MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%

North Central Regional Potato Variety Trial - 2010

Common Scab; Becker, MN; White Entries

Entry No.	Clone	Flesh	Photo	Type	I/C R1	I/C R2	Area
12)	MSL211-3	Cream		2.5	I	I	2
13)	MSL268-D	Cream		3	I	I	3
14)	MSM182-1	Cream		2.5	C	C	3.5
15)	MSQ176-5	Cream		2	C	C	5

MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted); I = Isolated, C = Coalesced

MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%

North Central Regional Potato Variety Trial - 2010

Common Scab; Becker, MN; White Entries

Entry No.	Clone	Flesh	Photo	Type	I/C R1	I/C R2	Area
16)	ND8307C-3	Cream		2	I	I	1.5
17)	W2717-5	Cream		3	I	I	1.5
18)	W2978-3	Cream		3	C	I	4
19)	W5015-12	Cream		3	C	C	5

MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted); I = Isolated, C = Coalesced

MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%

North Central Regional Potato Variety Trial - 2010

Common Scab; Becker, MN; White Entries

Entry No.	Clone		Type	I/C R1	I/C R2	Area
20)	**Atlantic** Flesh: Cream		3	C	C	4
21)	**NorValley** Flesh: Cream		3	C	I	1.5
22)	**Snowden** Flesh: W		3	C	C	4.5

MN Scab Severity: 1 (Small, Surface) - 3 (Very large pustules, Pitted); I = Isolated, C = Coalesced
MN Scab Coverage: 1=< 2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6>50%

2010 University of Minnesota Potato Breeding & Genetics

NPPGA Reporting Conference, Grand Forks, ND

February 15, 2011

Prepared By: Mr. Jeff Miller

Dr. Christian Thill

Department of Horticultural Sciences

University of Minnesota

Project Title:	Potato Breeding and Genetics
Project leader:	Dr. Christian A. Thill University of Minnesota College of Food, Agricultural, & Natural Resource Sciences Department of Horticultural Sciences
Scientist:	Jeff Miller
Assistant Scientist:	Kristen John
Re:	2010 Potato Breeding Research Summary

This research emphasizes the development, evaluation, and distribution of potato cultivars and germplasm with improved yield, quality, and resistance to biotic and abiotic stress. The overall goal is to improve the productivity, value, and use of the potato vegetable crop by the release of improved varieties adapted to the upper Midwest. In 2010 the following research was conducted:

MN ADVANCED BREEDING LINES

MN15620	Red/pink skin, yellow flesh, oval shape FF processing line with CIS resistance
MN02419	Lt Russet skin, white flesh, long shape FF processing line from 45F
MN02467	Russet skin, yellow flesh, long shape FF processing line from 45F
MN18747	Long white, white skin, blocky shape, FF field processing, Fresh, 90day
AOMN03178-2	Blocky russet, white flesh, FF processing
MN96072-4R	Red skin, white flesh, Fresh market
MN99460-14R	Red skin, white flesh, Fresh market
ATMN03505-3R	Red skin, white flesh, Fresh market; storage red
COMN03021-1R	Red skin, white flesh, Fresh market; storage red
COMN03027-1R	Red skin, white flesh, Fresh market; storage red
WIMN06030-1R	Red skin, white flesh, Fresh market; small uniform size, large B market
MN02616R	Red skin, yellow flesh, Fresh market
MN96013-1R	Red skin, yellow flesh, Fresh market
MN19298R	Red skin, lt. yellow flesh, Fresh market
MN99380-1	White skin, yellow flesh, Chip potato with CIS resistance from 45F
MN02696	White skin, white flesh, Chip potato with CIS resistance from 42F

BREEDING YIELD & QUALITY TRIALS

Objective of Study: *Potato breeding Minnesota; Thill/ Miller*
Develop new hybrid progeny in French fry processing, Fresh, and Chip Potato and determine yield, grade and quality of potato breeding lines grown under irrigated and non-irrigated conditions.

Crosses made: 433
Crosses with viable seed and sown 2010: 146
Single Hill Population: 18,000 @ Becker, 17,000 @ Nesson Valley, 8,000 @ Pine Lake Wild Rice
First Year (G1) Selections: 24 @ Becker, 76 @ Nesson Valley
Second Year (G2) Selections: 145 @Becker, 145 @ Nesson Valley, All 3 Disease Trials
Third year (G3) Selections: 166 @ Becker, and 166 @ Nesson Valley, All 3 Disease Trials
Fourth Year (G4) selections: 33 @ Becker and 33 @ Nesson Valley, All 3 Disease Trials
Fifth Year and greater Selections: 50 @ Becker, 50 @ Nesson Valley, All 3 Disease Trials

Advanced Early Red Trials: 75 Clones @ 2 Locations Becker and Nesson Valley
Advanced Late Red Trials: 25 Clones @ 2 Locations Becker and Nesson Valley
Advanced French fry Processing Trials: 55 clones @ 2 Locations Becker and Nesson Valley
Advanced Chipping Potato Trials: 65 Clones @ 2 Locations Becker and Nesson Valley

DISEASE RESISTANCE BREEDING

Objective of Study: *Late blight resistance, Thill/ Miller*
The primary focus of this research is to develop new potato varieties and parental germplasm resistant to late blight. Breeding lines were evaluated 3x for % late blight infection after inoculation. Selections were made advancing the most resistant lines. This work is done at UMORE Park, Rosemount, MN. Lines evaluated include: MN Breeding lines, NCR lines, National L. blight lines, US Potato Board Chip Breeders Trial lines, and SolCap Trial lines for a total of 540 potato clones evaluated.

Objective of Study: *Common scab resistance, Thill/ Miller*
The primary focus of this research is to develop new potato varieties and parental germplasm resistant to common scab. Common scab is a soil-borne disease, which causes significant economic loss by adversely affecting tuber quality with lesions on the tuber periderm. Breeding lines are evaluated for disease incidence (% coverage) and disease severity (surface, raised, and pitted scab; individual or coalesced lesions). This work is done at the Sand Plains Research Farm in Becker, MN. Lines evaluated include: MN Breeding lines, NCR lines, National C. Scab lines, US Potato Board Chip Breeders Trial lines, and SolCap Trial lines for a total of 757 potato clones evaluated.

Objective of Study: *PVY resistance and PVY symptom expression, Thill/ Miller/ John*
The primary focus of this research is to develop new potato varieties and parental germplasm resistant to PVY. Additionally this research explores the symptom expression of PVY and its relationship to variety. PVY is a viral plant disease that reduces potato plant productivity, marketability, and seed quality. This work is done at UMORE Park, Rosemount, MN. Lines evaluated include: MN Breeding lines, NCR lines, National breeding lines, US Potato Board Chip Breeders Trial lines, SolCap, and Flynn MS. Research Trial lines for a total of 2145 potato clones evaluated.

PRODUCTION

Objective of Study: *Developing cultural management information for advanced MN breeding selections, Thill/ Miller; David; Glynn*

Promising advanced selections from the MN breeding program were evaluated for production and quality characteristics from 4 MN and ND locations. Our role in this research, conducted by N. David, was to provide seed, technical support, and bi-weekly reports on field observations and sampling.

Lines evaluated include:
Perham French fry Processing Trial: MN15620, MN02419, MN02467, AOMN03178-2
Larimore French fry Processing Trial: MN15620, MN02467, MN02419, & AOMN03178-2
Hoople Fresh Red Trial: ATMN03505-3R, COMN03021-1R, COMN03027-1R, MN02616R, MN96013-1R, MN15620, WIMN06030-1R, and MN99460-14R
Crystal Chip Potato Trial: MN99380-1 & MN02696

Objective of Study: *Semi-commercial testing of MN15620 variety, Thill/ Miller; Bergman*

MN 15620 variety was grown in a 1.5 acre semi-commercial test plot at the Nesson Valley, ND to determine its response to commercial handling. The harvest is currently stored at Ryan Potato Co., and being evaluated for quality and commercial potential.

Objective of Study: *Strip-trial evaluation of 12 MN and ND breeding lines, Thill/ Miller; Bergman*

Twelve breeding lines were grown in 800-hill, 4-row strip plots at the Nesson Valley, ND to determine their response to commercial handling and quality through storage. Processing lines are being evaluated bi-monthly by Ag World Support Systems for grade and quality. Red lines are stored at Ryan Potato Co. and are being evaluated monthly for storage quality.

The MN lines include:
French fry lines: MN15620, MN02467, MN02419; and
Red lines: MN02616R, MN96013-1R, MN96072-4R, and MN19298R.

Objective of Study: *Spacing x Gibberellic acid treatment of MN15620 variety, Thill/ Miller; Bergman*

The MN15620 variety was grown under 4 spacing x 4 *GA* treatments to determine size profile and quality relationships. This is being done to have greater understanding of how changes in production parameters change MN15620.

SEED

Objective of Study: *Pre nuclear and Nuclear seed production; Thill/ Miller/ John; MDA; Pine Lake Wild Rice Seed Farm*

In these studies we produced both pre nuclear and nuclear seed of MN lines. Pre nuclear seed of 12 MN lines was produced in isolated UM greenhouses under MDA seed certification guidelines. Lines were grown in 5 pot sizes to determine production efficiency. Additionally, nuclear seed of 10 MN lines was produced at PLWR. Up to 200 tissue culture transplant seedlings from each of 10 lines was planted at PLWR. At harvest 'Nuclear Class' seed was harvested.

Lines produced and certified seed class application:

FF Processing

MN15620	N	P N
MN02419	N	PN
MN02467	N	PN
MN18747	N	
MN00467-4	N	PN

Fresh Red

MN02616R	N	PN
MN19298R	N	PN

Chip Potato

MN99380-1	N	PN
NDMN03339-4	N	PN
MN02574	N	PN
MN02586	N	
MN02588	N	PN

Objective of Study: *Red Family selection at Pine Lake Wild Rice Seed Farm; Thill/ Miller; Pine Lake Wild Rice Seed Farm*
Among our winter 2010 crosses we selected and planted 40 red families to select for early season reds with bright red color skin. Up to 200 single-hill transplant seedlings from each of 40 red families was planted at PLWR. At harvest we selected 105 clones to advance. These clones will be eligible as 'Experimental Class' nuclear seed.

Objective of Study: *Potato virus eradication strategies to advance MN breeding lines; Thill/ John*
The primary focus of this laboratory research is to develop and advance strategies for eradicating virus from potato breeding lines.

RESEARCH PRESENTATIONS / FIELD TOURS

MN Area II:	1 presentation @ reporting conference, 3 field @ Becker
NPPGA:	3 presentations @ Expo, 3 field/shed @ Twilight tour
MONDAK Ag Open:	1 presentation @ Nesson Valley field
N. David, Perham Chip Tour:	Participant, MN variety discussion
N. David, Perham Fry Tour:	Participant, MN variety discussion

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Emerg		Final[3]		Harvest Internal Defects (%)						
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
1	**Red Norland**	BE	**Chk**	FM	Red	W	56	98	79	2.3	0	0	0	0	0	1.0	1.053
2		BL					33	98	103	1.5	0	0	0	0	0	0.8	1.059
3		W					62	95			0	0	0	0	0	1.0	1.064
4																	
5	**Red Pontiac**	BE	**Chk**	FM	Red	Cream	56	95	79	5.0	0	0	0	0	0	3.0	1.048
6		BL					33	84	103	3.5	0	0	3	0	0	1.5	1.059
7		W					62	85			0	0	0	0	0	1.0	1.065
8																	
9	**Yukon Gold**	BE	**Chk**	FM	W	Yel	56	100	79	2.8	0	0	0	5	0	1.0	1.067
10		BL					33	98	103	2.0	13	0	0	0	0	0.0	1.078
11		W					62	95			13	0	0	0	0	0.5	1.084
12																	
13	MN 96013-1	BE	G14	FM	Red	Yel-dk	56	85	79	3.5	0	0	0	0	0	1.0	1.056
14		BL					33	23	103	2.5	0	0	0	0	0	1.0	1.068
15		W					62	85			0	0	0	0	0	1.0	1.074
16																	
17	MN 96072-4	BE	G14	FM	Red	W	56	93	79	1.8	0	0	0	0	0	1.5	1.054
18		BL					33	98	103	1.5	0	0	0	0	0	0.5	1.057
19		W					62	93			0	0	0	0	0	1.0	1.059
20																	
21	MN 99380-1	BE	G11	C/FM	W	Yel-dk	56	72.5	79	2.5	0	0	0	0	0	1.0	1.065
22																	
23	MN 99460-14	BE	G11	FM	Red	W	56	83	79	2.0	0	0	0	0	0	1.0	1.059
24		BL					33	93	103	1.0	0	0	0	0	0	1.0	1.062
25		W					62	95			0	0	0	0	0	1.0	1.070
26																	
27	MN 02 586	BE	G8	C/FM	W	Yel-lt	56	60	79	4.8	0	0	0	0	0	1.0	1.055

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

													Harvest						
			2010		Color		Emerg		Final[3]		Internal Defects (%)								
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
28																	
29	MN 02 598	BE	G8	C/FM	W	Yel-lt	56	93	79	5.0	0	0	0	0	0	1.0	1.063
30																	
31	MN 02 616	BE	G8	FM	Red	Yel-dk	56	85	79	1.8	0	0	0	0	0	0.5	1.061
32		BL					33	93	103	1.5	0	0	0	0	0	0.5	1.073
33		W					62	93			0	0	0	0	0	1.0	1.072
34																	
35	ATMN 03505-3	BE	G7	FM	Red	Cream	56	80	79	3.0	0	0	0	0	0	2.5	1.048
36		BL					33	68	103	2.0	0	0	0	0	0	3.0	1.063
37		W					62	88	119	2	0	0	0	0	0	2.5	1.070
38																	
39	COMN 03021-1	BE	G7	FM	Red	Cream	56	90	79	2.5	0	0	0	0	0	1.0	1.049
40		BL					33	88	103	1.0	0	0	0	0	0	1.0	1.058
41		W					62	98			0	0	0	0	0	1.0	1.055
42																	
43	COMN 03027-1	BE	G7	FM	Red	Cream	56	78	79	4.0	0	0	0	0	0	1.0	1.054
44		BL					33	45	103	3.0	0	0	0	0	6	0.0	1.064
45		W					62	100			0	0	0	0	0	1.0	1.070
46																	
47	NDMN 03376-1	BE	G7	FM	Red	Cream	56	60	79	2.8	0	0	0	0	0	1.5	1.044
48		W					62	80			0	0	0	0	0	1.0	1.069
49																	
50	WIMN 06030-01	BE	G4	FM	Red	W	56	98	79	2.0	0	0	0	0	0	0.5	1.060
51		BL					33	100	103	1.5	0	0	0	0	0	1.0	1.065
52		W					62	100			0	0	0	0	0	1.0	1.072
53																	
54	COMN07-B182WG1	BE	G3	FM	Red	W	56	88	79	2.0	0	0	0	0	0	1.5	1.052

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Emerg		Final[3]		Harvest: Internal Defects (%)						
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
55																	
56	COMN07-B196BG1	BE	G3	FM	Red	Cream	56	65	79	3.3	0	0	0	0	0	2.5	1.058
57		W					62	68			0	0	0	0	0	3.0	1.077
58																	
59	COMN07-B198BG1	BE	G3	FM	Red	Cream	56	93	79	2.5	0	0	0	6	0	2.5	1.046
60		W					62	100			0	0	0	0	0	1.0	1.068
61																	
62	COMN07-B217BG1	BE	G3	FM	Red	W	56	93	79	2.3	0	0	0	0	0	1.0	1.052
63		BL					33	83	103	1.5	0	0	0	0	0	3.5	1.062
64																	
65	COMN07-B219WG1	BE	G3	FM	Red	W	56	85	79	3.0	0	0	0	0	0	1.0	1.046
66		W					62	98			0	0	0	0	0	1.0	1.067
67																	
68	COMN07-B229BG1	BE	G3	FM	Red	Cream	56	75	79	2.3	0	0	0	0	0	2.5	1.050
69		W					62	68	119	3	6	0	0	0	0	3.0	1.075
70																	
71	COMN07-B229WG1	BE	G3	FM	Red	Cream	56	80	79	2.8	0	0	0	0	0	2.0	1.053
72		W					62	95			0	0	0	0	0	2.0	1.075
73																	
74	COMN07-B248WG1	BE	G3	FM	Red	Yel	56	58	79	3.3	0	0	0	0	0	2.0	1.045
75		BL					33	53	103	3.0	0	0	6	0	0	5.0	1.062
76		W					62	73			0	0	0	0	0	4.5	1.062
77																	
78	COMN07-GF286BG1	BE	G3	FM	Red	Yel	56	73	79	2.8	5	0	0	0	0	0.5	1.053
79		BL					33	63	103	2.5	0	0	0	0	0	0.5	1.059
80		W					62	85			0	0	0	0	0	1.0	1.066
81																	

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

													Harvest					
			2010		Color		Emerg		Final[3]		Internal Defects (%)							
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
82	COMN07-W073BG1	BE	G3	FM	Red	Cream	56	75	79	2.8	0	0	0	0	0	0.5	1.036
83		BL					33	20	103	3.0	0	0	0	0	0	1.5	1.054
84		W					62	60			0	0	0	0	0	1.0	1.059
85																	
86	COMN07-W090BG1	BE	G3	FM	Red	W	56	98	79	2.0	0	0	0	0	0	3.0	1.060
87		BL					33	68	103	2.0	0	0	0	0	0	3.0	1.064
88		W					62	90			0	0	0	0	0	3.5	1.079
89																	
90	COMN07-W106BG1	BE	G3	FM	Red	Cream	56	75	79	1.0	0	0	0	0	0	2.0	1.059
91																	
92	COMN07-W109BG1	BE	G3	FM	Red	Cream	56	93	79	2.5	0	0	0	0	0	1.0	1.058
93		BL					33	95	103	1.0	0	0	0	6	0	2.0	1.069
94		W					62	93	119	1	0	0	0	0	0	1.5	1.074
95																	
96	COMN07-W112BG1	BE	G3	FM	W/Purple	Purple/W	56	93	79	4.0	0	0	0	0	0	0.0	1.048
97		BL					33	45	103	3.5	0	0	0	0	0	0.0	1.067
98		W					62	90			0	0	0	0	0	0.0	1.073
99																	
100	NDMN07-GF040BG1	BE	G3	FM	Red	Cream	56	80	79	2.3	0	20	0	0	0	3.0	1.054
101		BL					33	80	103	1.5	0	0	0	0	0	4.0	1.057
102		W					62	95			0	0	0	0	0	4.0	1.059
103																	
104	NDMN07-W138BG1	BE	G3	FM	Red	W	56	100	79	1.5	0	0	0	0	0	2.0	1.054
105																	
106	COMN08-B001BG1	BE	G2	FM	Red	W	56	95	79	4.5	0	0	0	0	0	1.0	1.051
107																	
108	COMN08-B006BG1	BE	G2	FM	Red	Cream	56	55	79	2.0	0	0	0	0	0	1.0	1.057

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

											Harvest						
			2010		Color		Emerg		Final[3]		Internal Defects (%)						
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
109																	
110	COMN08-B008BG1	BE	G2	FM	Red	Cream	56	80	79	2.0	0	0	0	0	0	2.0	1.056
111																	
112	COMN08-B011BG1	BE	G2	FM	Red	Cream	56	90	79	2.0	0	0	0	0	0	2.0	1.046
113																	
114	COMN08-B011WG1	BE	G2	FM	Red	Cream	56	70	79	2.0	0	0	0	0	0	1.0	1.047
115																	
116	COMN08-B015BG1	BE	G2	FM	Red	Yel-lt	56	50	79	4.5	0	0	0	10	0	3.0	1.044
117																	
118	COMN08-B018GFG1	BE	G2	FM	Red	W	56	70	79	3.0	0	0	0	0	0	1.0	1.044
119																	
120	COMN08-B019BG1	BE	G2	FM	Red	W	56	60	79	4.0	0	0	0	0	0	2.0	1.048
121																	
122	COMN08-B024BG1	BE	G2	FM	Red	W	56	70	79	2.0	0	0	0	0	0	2.0	1.054
123																	
124	COMN08-B121WG1	BE	G2	FM	Red	Cream	56	85	79	3.0	0	0	0	0	0	1.0	1.049
125																	
126	COMN08-B122BG1	BE	G2	FM	Red	Cream	56	35	79	5.0	0	0	0	0	0	2.0	1.042
127																	
128	COMN08-B122WG1	BE	G2	FM	Red	Cream	56	95	79	4.0	0	0	0	0	0	2.0	1.046
129																	
130	COMN08-B126WG1TJ	BE	G2	FM	Red	Yel	56	60	79	5.0	0	0	0	0	0	1.0	1.040
131																	
132	COMN08-B128BG1	BE	G2	FM	Red	W	56	70	79	4.5	0	0	0	0	0	1.0	1.055
133																	
134	COMN08-B128WG1	BE	G2	FM	Red	W	56	80	79	5.0	0	0	0	0	0	1.0	1.050
135																	

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

												Harvest						
			2010		Color		Emerg		Final[3]		Internal Defects (%)						
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
136	COMN08-B180WG1	BE	G2	FM	Rus	W	56	80	79	2.0	0	0	0	0	0	2.0	1.062
137																	
138	COMN08-W001WG1TJ	BE	G2	FM	Red	Cream	56	85	79	2.0	10	0	0	0	0	1.0	1.057
139																	
140	COMN08-W006BG1	BE	G2	FM	Red	W	56	70	79	3.5	0	0	0	0	0	1.0	1.052
141																	
142	COMN08-W009WG1	BE	G2	FM	Red	Cream	56	55	79	2.0	0	0	0	0	0	2.0	1.042
143																	
144	COMN08-W015WG1TJ	BE	G2	FM	Red	Cream	56	90	79	5.0	0	0	0	90	0	0.0	1.034
145																	
146	COMN08-W018BG1	BE	G2	FM	Red	Yel	56	50	79	2.0	0	0	0	0	0	3.0	1.045
147																	
148	COMN08-W020WG1	BE	G2	FM	Red	Yel	56	55	79	2.0	0	0	0	0	0	1.0	1.044
149																	
150	COMN08-W025WG1	BE	G2	FM	Red	Cream	56	75	79	4.5	0	0	0	0	0	3.0	1.038
151																	
152	COMN08-W027BG1	BE	G2	FM	Red	W	56	60	79	2.5	0	0	0	0	0	1.0	1.047
153																	
154	COMN08-W031BG1	BE	G2	FM	Red	W	56	95	79	4.0	0	0	0	0	0	1.0	1.059
155																	
156	COMN08-W031WG1	BE	G2	FM	Red	W	56	75	79	2.5	0	0	0	0	0	1.0	1.057
157																	
158	COMN08-W034WG1TJ	BE	G2	FM	Red	W	56	80	79	3.5	0	0	0	0	0	3.0	1.048
159																	
160	COMN08-W036BG1	BE	G2	FM	Red	Cream	56	45	79	2.0	0	0	0	0	0	1.0	1.041
161																	
162	COMN08-W036WG1	BE	G2	FM	Red	Cream	56	85	79	2.0	0	0	0	0	0	2.0	1.050

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

											Harvest							
			2010		Color		Emerg		Final[3]		Internal Defects (%)							
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
163																	
164	COMN08-W040WG1	BE	G2	FM	Red	W	56	100	79	2.5	0	0	0	0	0	4.0	1.058
165																	
166	COMN08-W048GFG1	BE	G2	FM	Red	W	56	85	79	2.0	0	0	0	0	0	3.0	1.043
167																	
168	COMN08-W052GFG1	BE	G2	FM	Red	Cream	56	100	79	2.0	0	0	0	0	0	1.0	1.053
169																	
170	COMN08-W055GFG1	BE	G2	FM	Red	Cream	56	50	79	3.0	0	0	0	0	0	3.0	1.043
171																	
172	COMN08-W056GFG1	BE	G2	FM	Red	W	56	70	79	3.0	0	0	0	0	0	2.0	1.053
173																	
174	COMN08-W057WG1	BE	G2	FM	Red	W	56	70	79	3.0	0	0	0	0	0	3.0	1.051
175																	
176	COMN08-W058WG1	BE	G2	FM	Red	Cream	56	80	79	2.5	0	0	0	0	0	3.0	1.049
177																	
178	COMN08-W059BG1	BE	G2	FM	W	Cream	56	45	79	5.0	0	0	0	0	0	2.0	1.057
179																	
180	COMN08-W059WG1TJ	BE	G2	FM	W	Cream	56	55	79	2.5	0	0	0	0	0	3.0	1.055
181																	
182	COMN08-W060BG1	BE	G2	FM	W	W	56	70	79	3.0	40	0	0	20	0	1.0	1.052
183																	
184	COMN08-W061BG1	BE	G2	FM	W	Cream	56	55	79	2.0	0	0	0	0	0	1.0	1.043
185																	
186	ORMN08-W072GFG1	BE	G2	C/FM	W	Yel-lt	56	85	79	4.0	0	0	0	0	0	1.0	1.051
187																	
188	ORMN08-W072WG1	BE	G2	C/FM	W	Yel	56	80	79	3.5	0	0	0	0	0	0.0	1.046
189																	

Table 1. FM trials at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Emerg		Final[3]		Harvest: Internal Defects (%)						
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Skin[4]	Sp Gr
190	ND8314-1R	BL	NCR	FM	Red	W	33	95	103	1.3	0	0	0	0	0	2.0	1.065
191																	
192	ND8555-8R	BL	NCR	FM	Red	Cream	33	86	103	2.8	0	0	0	0	0	3.5	1.068
193																	
194	W2609-1R	BL	NCR	FM	Red	Cream	33	96	103	2.0	0	0	0	0	0	2.5	1.064

1) BE Reds planted: 12.April.2010; Vine Killed: 2.July.2010 @ 81 DAP; Harvested; 21.July.2010
1) BL Reds planted: 5.May.2010; Vine killed:18.August.2010; Harvested; 9.September.2010
2) W Reds planted: 22.April.2010; Vine killed: 5.August.2010; Harvested: 31.August.2010
3) Final Maturity Ratings: 0 = dead, 5 = Late Season
4) Skin = Skinning: 0 = none, 5 = severe
5) Type of Common Scab lesion: 1=Surface, 2=raised, 3=pitted

Table 2. FM yields at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's	% B's	A's	% A's	US #1
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	< 4 oz	Cwtyld	> 4 oz	%
1	**Red Norland**	BE	**Chk**	FM	Red	W	6	233.7	0.0	0.0	233.7	69.3	29.7	164.4	70.3	70.3
2		BL					10	511.9	5.3	1.0	517.2	82.9	16.0	429.1	83.0	83.0
3		W					5	277.8	4.5	1.6	282.4	32.9	11.7	244.9	86.7	86.7
4																
5	**Red Pontiac**	BE	**Chk**	FM	Red	Cream	5	116.3	0.0	0.0	116.3	85.1	73.2	31.1	26.8	26.8
6		BL					9	609.4	6.6	1.1	616.0	35.1	5.7	574.3	93.2	93.2
7		W					6	352.7	27.6	7.3	380.4	42.6	11.2	310.2	81.5	81.5
8																
9	**Yukon Gold**	BE	**Chk**	FM	W	Yel	6	232.0	0.0	0.0	232.0	71.4	30.8	160.6	69.2	69.2
10		BL					9	535.3	6.2	1.1	541.5	66.1	12.2	469.2	86.7	86.7
11		W					5	305.0	21.2	6.5	326.2	25.0	7.7	280.0	85.8	85.8
12																
13	MN 96013-1	BE	G14	FM	Red	Yel-dk	4	103.2	0.0	0.0	103.2	57.1	55.4	46.0	44.6	44.6
14		BL					6	258.6	6.3	2.4	264.9	65.5	24.7	193.1	72.9	72.9
15		W					5	193.9	25.2	11.5	219.1	39.0	17.8	154.8	70.7	70.7
16																
17	MN 96072-4	BE	G14	FM	Red	W	6	142.1	0.0	0.0	142.1	108.4	76.3	33.7	23.7	23.7
18		BL					13	318.2	3.5	1.1	321.8	211.7	65.8	106.6	33.1	33.1
19		W					7	192.3	0.0	0.0	192.3	116.0	60.3	76.3	39.7	39.7
20																
21	MN 99380-1	BE	G11	C/FM	W	Yel-dk	4	138.1	0.0	0.0	138.1	42.0	30.4	96.1	69.6	69.6
22																
23	MN 99460-14	BE	G11	FM	Red	W	4	95.1	0.0	0.0	95.1	67.8	71.3	27.3	28.7	28.7
24		BL					7	255.5	0	0.0	255.5	77.8	30.4	177.7	69.6	69.6
25		W					5	171.1	6.2	3.5	177.3	51.6	29.1	119.5	67.4	67.4
26																
27	MN 02 586	BE	G8	C/FM	W	Yel-lt	5	74.3	0.0	0.0	74.3	70.2	94.5	4.1	5.5	5.5
28																
29	MN 02 598	BE	G8	C/FM	W	Yel-lt	7	130.7	0.0	0.0	130.7	108.9	83.3	21.9	16.7	16.7
30																
31	MN 02 616	BE	G8	FM	Red	Yel-dk	7	172.6	0.0	0.0	172.6	120.8	70.0	51.8	30.0	30.0
32		BL					12	528.2	3.7	0.7	531.9	115.8	21.8	412.4	77.5	77.5
33		W					7	215.0	0.0	0.0	215.0	100.3	46.7	114.6	53.3	53.3

Table 2. FM yields at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's	% B's	A's	% A's	US #1
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	< 4 oz	Cwtyld	> 4 oz	%
34																
35	ATMN 03505-3	BE	G7	FM	Red	Cream	6	115.9	0.0	0.0	115.9	98.4	84.9	17.5	15.1	15.1
36		BL					7	328.4	0	0.0	328.4	73.0	22.2	255.5	77.8	77.8
37		W					5	169.9	13.8	7.5	183.8	59.8	32.6	110.1	59.9	59.9
38																
39	COMN 03021-1	BE	G7	FM	Red	Cream	6	133.5	0.0	0.0	133.5	94.6	70.9	38.8	29.1	29.1
40		BL					9	288.2	2.7	0.9	291.0	131.6	45.2	156.7	53.9	53.9
41		W					7	207.7	7.4	3.4	215.2	82.2	38.2	125.6	58.4	58.4
42																
43	COMN 03027-1	BE	G7	FM	Red	Cream	5	75.4	0.0	0.0	75.4	68.1	90.4	7.3	9.6	9.6
44		BL					9	239.2	3.4	1.4	242.5	131.7	54.3	107.5	44.3	44.3
45		W					7	126.9	0.6	0.5	127.5	92.8	72.8	34.1	26.8	26.8
46																
47	NDMN 03376-1	BE	G7	FM	Red	Cream	4	51.5	0.0	0.0	51.5	49.5	96.3	1.9	3.7	3.7
48		W					6	167.0	12.0	6.7	179.0	80.0	44.7	87.0	48.6	48.6
49																
50	WIMN 06030-01	BE	G4	FM	Red	W	11	146.4	0.0	0.0	146.4	144.3	98.6	2.0	1.4	1.4
51		BL					11	256.4	0	0.0	256.4	189.7	74.0	66.7	26.0	26.0
52		W					6	109.9	2.9	2.6	112.8	90.0	79.8	19.9	17.6	17.6
53																
54	COMN07-B182WG1	BE	G3	FM	Red	W	3	47.5	0.0	0.0	47.5	45.4	95.6	2.1	4.4	4.4
55																
56	COMN07-B196BG1	BE	G3	FM	Red	Cream	5	67.7	0.0	0.0	67.7	67.7	100.0	0.0	0.0	0.0
57		W					6	178.0	6.3	3.4	184.4	74.1	40.2	103.9	56.4	56.4
58																
59	COMN07-B198BG1	BE	G3	FM	Red	Cream	5	62.9	0.0	0.0	62.9	58.1	92.4	4.8	7.6	7.6
60		W					8	271.2	7.4	2.7	278.6	87.2	31.3	184.0	66.0	66.0
61																
62	COMN07-B217BG1	BE	G3	FM	Red	W	6	97.0	0.0	0.0	97.0	97.0	100.0	0.0	0.0	0.0
63		BL					10	336.4	3.5	1.0	339.9	145.1	42.7	191.3	56.3	56.3
64																
65	COMN07-B219WG1	BE	G3	FM	Red	W	2	30.8	0.0	0.0	30.8	30.8	100.0	0.0	0.0	0.0
66		W					3	67.7	8.6	11.3	76.3	41.5	54.4	26.2	34.3	34.3

Table 2. FM yields at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's	% B's	A's	% A's	US #1
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	< 4 oz	Cwtyld	> 4 oz	%
67																
68	COMN07-B229BG1	BE	G3	FM	Red	Cream	4	52.6	0.0	0.0	52.6	52.6	100.0	0.0	0.0	0.0
69		W					8	223.4	9.4	4.0	232.8	109.7	47.1	113.8	48.9	48.9
70																
71	COMN07-B229WG1	BE	G3	FM	Red	Cream	4	50.2	0.0	0.0	50.2	50.2	100.0	0.0	0.0	0.0
72		W					7	177.4	6.1	3.3	183.5	109.0	59.4	68.3	37.2	37.2
73																
74	COMN07-B248WG1	BE	G3	FM	Red	Yel	2	38.2	0.0	0.0	38.2	32.0	83.6	6.3	16.4	16.4
75		BL					4	228.1	7.0	3.0	235.0	31.6	13.4	196.5	83.6	83.6
76		W					2	119.8	12.0	9.1	131.7	16.2	12.3	103.6	78.6	78.6
77																
78	COMN07-GF286BG1	BE	G3	FM	Red	Yel	6	117.6	0.0	0.0	117.6	75.1	63.9	42.5	36.1	36.1
79		BL					11	433.1	0	0.0	433.1	128.8	29.7	304.2	70.3	70.3
80		W					7	263.7	8.6	3.2	272.3	76.6	28.1	187.1	68.7	68.7
81																
82	COMN07-W073BG1	BE	G3	FM	Red	Cream	3	25.7	0.0	0.0	25.7	25.7	100.0	0.0	0.0	0.0
83		BL					6	128.7	0	0.0	128.7	101.1	78.6	27.6	21.4	21.4
84		W					5	122.9	0.0	0.0	122.9	75.0	61.1	47.8	38.9	38.9
85																
86	COMN07-W090BG1	BE	G3	FM	Red	W	6	92.1	0.0	0.0	92.1	90.1	97.8	2.0	2.2	2.2
87		BL					11	256.3	0	0.0	256.3	203.9	79.5	52.5	20.5	20.5
88		W					8	212.0	8.2	3.7	220.2	102.3	46.4	109.8	49.8	49.8
89																
90	COMN07-W106BG1	BE	G3	FM	Red	Cream	3	51.2	0.0	0.0	51.2	46.5	90.8	4.7	9.2	9.2
91																
92	COMN07-W109BG1	BE	G3	FM	Red	Cream	7	81.7	0.0	0.0	81.7	81.7	100.0	0.0	0.0	0.0
93		BL					16	270.6	0	0.0	270.6	249.7	92.3	20.9	7.7	7.7
94		W					11	173.7	0.0	0.0	173.7	157.0	90.4	16.7	9.6	9.6
95																
96	COMN07-W112BG1	BE	G3	FM	W/Purple	Purple/W	3	33.8	0.0	0.0	33.8	33.8	100.0	0.0	0.0	0.0
97		BL					15	342.9	0	0.0	342.9	254.1	74.1	88.8	25.9	25.9
98		W					9	238.7	1.6	0.7	240.3	132.6	55.2	106.1	44.1	44.1
99																

Table 2. FM yields at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's	% B's	A's	% A's	US #1
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	< 4 oz	Cwtyld	> 4 oz	%
100	NDMN07-GF040BG1	BE	G3	FM	Red	Cream	5	111.4	0.0	0.0	111.4	94.7	85.0	16.7	15.0	15.0
101		BL					9	303.6	4.3	1.4	307.9	106.7	34.6	196.9	63.9	63.9
102		W					7	206.2	16.2	7.3	222.4	75.3	33.9	130.9	58.8	58.8
103																
104	NDMN07-W138BG1	BE	G3	FM	Red	W	7	150.4	0.0	0.0	150.4	129.0	85.8	21.4	14.2	14.2
105																
106	COMN08-B001BG1	BE	G2	FM	Red	W	8	124.2	0.0	0.0	124.2	122.0	98.3	2.1	1.7	1.7
107																
108	COMN08-B006BG1	BE	G2	FM	Red	Cream	3	55.4	0.0	0.0	55.4	47.2	85.1	8.3	14.9	14.9
109																
110	COMN08-B008BG1	BE	G2	FM	Red	Cream	4	80.5	0.0	0.0	80.5	58.5	72.7	22.0	27.3	27.3
111																
112	COMN08-B011BG1	BE	G2	FM	Red	Cream	6	122.9	0.0	0.0	122.9	105.8	86.1	17.1	13.9	13.9
113																
114	COMN08-B011WG1	BE	G2	FM	Red	Cream	3	41.1	0.0	0.0	41.1	41.1	100.0	0.0	0.0	0.0
115																
116	COMN08-B015BG1	BE	G2	FM	Red	Yel-lt	2	40.5	0.0	0.0	40.5	28.3	69.9	12.2	30.1	30.1
117																
118	COMN08-B018GFG1	BE	G2	FM	Red	W	2	33.8	0.0	0.0	33.8	33.8	100.0	0.0	0.0	0.0
119																
120	COMN08-B019BG1	BE	G2	FM	Red	W	3	44.7	0.0	0.0	44.7	40.5	90.7	4.1	9.3	9.3
121																
122	COMN08-B024BG1	BE	G2	FM	Red	W	5	105.1	0.0	0.0	105.1	85.2	81.1	19.9	18.9	18.9
123																
124	COMN08-B121WG1	BE	G2	FM	Red	Cream	5	63.2	0.0	0.0	63.2	63.2	100.0	0.0	0.0	0.0
125																
126	COMN08-B122BG1	BE	G2	FM	Red	Cream	1	13.6	0.0	0.0	13.6	13.6	100.0	0.0	0.0	0.0
127																
128	COMN08-B122WG1	BE	G2	FM	Red	Cream	5	57.7	0.0	0.0	57.7	57.7	100.0	0.0	0.0	0.0
129																
130	COMN08-B126WG1TJ	BE	G2	FM	Red	Yel	2	49.3	0.0	0.0	49.3	45.2	91.7	4.1	8.3	8.3
131																
132	COMN08-B128BG1	BE	G2	FM	Red	W	3	38.4	0.0	0.0	38.4	38.4	100.0	0.0	0.0	0.0

Table 2. FM yields at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

												Size Distribution				
			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	B's	% B's	A's	% A's	US #1
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	< 4 oz	Cwtyld	> 4 oz	%
133																
134	COMN08-B128WG1	BE	G2	FM	Red	W	3	41.8	0.0	0.0	41.8	41.8	100.0	0.0	0.0	0.0
135																
136	COMN08-B180WG1	BE	G2	FM	Rus	W	6	108.0	0.0	0.0	108.0	101.0	93.5	7.0	6.5	6.5
137																
138	COMN08-W001WG1TJ	BE	G2	FM	Red	Cream	6	201.1	0.0	0.0	201.1	82.2	40.9	119.0	59.1	59.1
139																
140	COMN08-W006BG1	BE	G2	FM	Red	W	5	125.0	0.0	0.0	125.0	99.0	79.2	26.0	20.8	20.8
141																
142	COMN08-W009WG1	BE	G2	FM	Red	Cream	4	74.6	0.0	0.0	74.6	68.5	91.8	6.1	8.2	8.2
143																
144	COMN08-W015WG1TJ	BE	G2	FM	Red	Cream	5	50.4	0.0	0.0	50.4	50.4	100.0	0.0	0.0	0.0
145																
146	COMN08-W018BG1	BE	G2	FM	Red	Yel	3	75.7	0.0	0.0	75.7	48.6	64.2	27.1	35.8	35.8
147																
148	COMN08-W020WG1	BE	G2	FM	Red	Yel	3	39.3	0.0	0.0	39.3	39.3	100.0	0.0	0.0	0.0
149																
150	COMN08-W025WG1	BE	G2	FM	Red	Cream	2	30.2	0.0	0.0	30.2	30.2	100.0	0.0	0.0	0.0
151																
152	COMN08-W027BG1	BE	G2	FM	Red	W	3	40.4	0.0	0.0	40.4	40.4	100.0	0.0	0.0	0.0
153																
154	COMN08-W031BG1	BE	G2	FM	Red	W	9	133.1	0.0	0.0	133.1	131.1	98.5	2.0	1.5	1.5
155																
156	COMN08-W031WG1	BE	G2	FM	Red	W	6	78.9	0.0	0.0	78.9	77.1	97.7	1.8	2.3	2.3
157																
158	COMN08-W034WG1TJ	BE	G2	FM	Red	W	4	75.2	0.0	0.0	75.2	64.0	85.0	11.3	15.0	15.0
159																
160	COMN08-W036BG1	BE	G2	FM	Red	Cream	2	42.4	0.0	0.0	42.4	40.4	95.3	2.0	4.7	4.7
161																
162	COMN08-W036WG1	BE	G2	FM	Red	Cream	8	122.1	0.0	0.0	122.1	114.0	93.3	8.2	6.7	6.7
163																
164	COMN08-W040WG1	BE	G2	FM	Red	W	9	143.9	0.0	0.0	143.9	139.6	97.0	4.3	3.0	3.0
165																

Table 2. FM yields at 2 irrigated locations; Becker, MN (Early & Late)[1] & Williston, ND (Late)[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's	% B's	A's	% A's	US #1
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	< 4 oz	Cwtyld	> 4 oz	%
166	COMN08-W048GFG1	BE	G2	FM	Red	W	2	38.8	0.0	0.0	38.8	34.4	88.6	4.4	11.4	11.4
167																
168	COMN08-W052GFG1	BE	G2	FM	Red	Cream	4	63.4	0.0	0.0	63.4	63.4	100.0	0.0	0.0	0.0
169																
170	COMN08-W055GFG1	BE	G2	FM	Red	Cream	2	46.4	0.0	0.0	46.4	40.6	87.6	5.8	12.4	12.4
171																
172	COMN08-W056GFG1	BE	G2	FM	Red	W	3	44.2	0.0	0.0	44.2	38.6	87.4	5.6	12.6	12.6
173																
174	COMN08-W057WG1	BE	G2	FM	Red	W	6	99.4	0.0	0.0	99.4	88.3	88.8	11.1	11.2	11.2
175																
176	COMN08-W058WG1	BE	G2	FM	Red	Cream	5	132.2	0.0	0.0	132.2	78.4	59.3	53.8	40.7	40.7
177																
178	COMN08-W059BG1	BE	G2	FM	W	Cream	1	25.6	0.0	0.0	25.6	18.4	71.9	7.2	28.1	28.1
179																
180	COMN08-W059WG1TJ	BE	G2	FM	W	Cream	2	46.9	0.0	0.0	46.9	28.4	60.5	18.5	39.5	39.5
181																
182	COMN08-W060BG1	BE	G2	FM	W	W	5	79.0	0.0	0.0	79.0	70.5	89.2	8.5	10.8	10.8
183																
184	COMN08-W061BG1	BE	G2	FM	W	Cream	2	21.7	0.0	0.0	21.7	21.7	100.0	0.0	0.0	0.0
185																
186	ORMN08-W072GFG1	BE	G2	C/FM	W	Yel-lt	8	123.2	0.0	0.0	123.2	110.5	89.7	12.7	10.3	10.3
187																
188	ORMN08-W072WG1	BE	G2	C/FM	W	Yel	6	91.5	0.0	0.0	91.5	81.7	89.4	9.7	10.6	10.6
189																
190	ND8314-1R	BL	NCR	FM	Red	W	21	617.1	3.9	0.6	621.0	335.2	54.0	281.8	45.4	45.4
191																
192	ND8555-8R	BL	NCR	FM	Red	Cream	13	485.5	2.5	0.5	488.0	159.1	32.6	326.4	66.9	66.9
193																
194	W2609-1R	BL	NCR	FM	Red	Cream	12	498.2	0	0.0	498.2	121.0	24.3	377.2	75.7	75.7

1) BE Reds planted: 12.April.2010; Vine Killed: 2.July.2010 @ 81 DAP; Harvested; 21.July.2010
1) BL Reds planted: 5.May.2010; Vine killed:18.August.2010; Harvested; 9.September.2010
2) W Reds planted: 22.April.2010; Vine killed: 5.August.2010; Harvested: 31.August.2010

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest							3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)								
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]	FF[4]	FF[4]
1	**Russet Burbank**	BL	**Chk**	FF	Rus	Cream	33	96.3	103	4.0	13	0	0	0	0	1.074	2	4	4
2		W					62	100	119	2.5	8	0	0	0	0	1.078	1	4	2
3																			
4	**Russet Norkotah**	BL	**Chk**	FM	Rus	Cream	33	92.5	103	3.0	0	0	0	0	0	1.070	0		
5		W					62	92.5			21	0	0	0	0	1.077	1		
6																			
7	**Shepody**	BL	**Chk**	FF	LW	W	33	95.0	103	3.5	0	0	0	0	0	1.078	1	4	3
8		W					62	97.5	119	3	0	0	0	0	0	1.082	0	4	3
9																			
10	MN 15620	BL	G17	FF/FM	Red	Yel	33	80.0	103	3.5	0	0	0	0	8	1.069	0	2	2
11		W					62	100	119	4	0	0	0	0	0	1.083	0 0	1	0
12																			
13	MN 02 419	BL	G8	FF	LW	Cream	33	100.0	103	2.5	8	0	0	0	0	1.079	1	4	4
14		W					62	95	119	2	0	0	0	0	0	1.083	0	4	3
15																			
16	MN 02 467	BL	G8	FF/FM	Rus	Yel-lt	33	70.0	103	4.0	17	0	0	0	0	1.079	0	3	1
17		W					62	97.5	119	3	8	0	0	0	0	1.084	0	3	1
18																			
19	AOMN 03178-2	BL	G7	FF	Rus lt.	W	33	87.5	103	3.5	17	0	0	0	0	1.077	1	3	1
20		W					62	97.5	119	1	8	0	0	0	0	1.079	0	2	1
21																			
22	AOMN 041101-01	BL	G6	FF	LW	W	33	67.5	103	4.0	0	0	0	0	0	1.064	1	3	3
23		W					62	100	119	4	0	0	0	0	0	1.066	0	2	2
24																			
25	COMN 04692-10	W	G6	FF	Rus	Cream	62	100	119	2	0	0	0	0	0	1.056	0 0	2	1
26																			
27	COMN 04702-03	BL	G6	FF	Rus	Cream	33	72.5	103	3.0	0	0	0	0	8	1.070	2	4	4
28		W					62	92.5	119	1	0	0	0	0	0	1.066	1	4	3
29																			
30	AOMN 06077-01	BL	G4	FF	Rus	Cream	33	82.5	103	3.5	8	0	0	0	8	1.076	1	4	3
31		W					62	90	119	2	0	0	0	0	0	1.083	0	4	2

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

																			Harvest	3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)										
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]		FF[4]	FF[4]
32																				
33	AOMN 06107-01	BL	G4	FF	Rus	Cream	33	57.5	103	3.0	33	0	0	0	0	1.065	1		2	3
34																				
35	AOMN 06118-01	BL	G4	FF	Rus	Cream	33	70.0	103	3.5	25	0	8	0	0	1.057	3		4	3
36		W					62	72.5	119	3	0	0	0	0	0	1.079	0		4	3
37																				
38	AOMN 06126-02	BL	G4	FF	Rus	Cream	33	87.5	103	3.5	0	0	0	0	0	1.083	2		4	3
39		W					62	92.5	119	2	0	0	0	0	0	1.079	2		4	2
40																				
41	AOMN 06131-01	BL	G4	FF	Rus	W	33	90.0	103	2.5	0	0	0	0	0	1.066	1		4	3
42		W					62	95	119	1	0	0	0	0	0	1.078	0 0		2	2
43																				
44	AOMN 06147-05	BL	G4	FF	Rus	Cream	33	27.5	103	4.0	25	0	0	0	0	1.082	0		3	2
45		W					62	95	119	4	0	0	0	0	0	1.091	0		2	2
46																				
47	AOMN 06153-01 S.D.	BL	G4	FF	Rus	W	33	97.5	103	3.0	0	0	0	0	8	1.066	1		4	4
48		W					62	100	119	1.5	0	0	0	0	0	1.067	0		4	3
49																				
50	AOMN 06174-01 S.D.	BL	G4	FF	Rus	Cream	33	15.0	103	4.0	0	0	0	0	0	1.091	0		3	1
51		W					62	75	119	4	0	0	0	0	0	1.087	0		3	2
52																				
53	COMN 06332-01	BL	G4	FF	Rus	W	33	92.5	103	3.5	0	0	0	0	0	1.088	0		2	1
54		W					62	95	119	2	0	0	0	0	0	1.081	0		2	1
55																				
56	COMN 06363-01	BL	G4	FF	Rus	Cream	33	70.0	103	4.0	0	0	8	0	25	1.066	3		4	4
57		W					62	95	119	2	0	0	0	0	0	1.069	0 0		2	2
58																				
59	COMN 06379-02	BL	G4	FF	Rus	W	33	87.5	103	3.0	8	0	0	0	0	1.095	1		3	3
60		W					62	100	119	3	0	0	0	0	0	1.088	0		3	2
61																				

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Emerg		Final[3]		Harvest: Internal Defects (%)							3/40/D	3/45/D
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]	FF[4]	FF[4]
62	COMN 06392-01	BL	G4	FF	Rus	W	33	95.0	103	4.0	8	0	0	0	8	1.077	1	3	3
63		W					62	97.5	119	2.5	0	0	0	0	0	1.075	0	3	2
64																			
65	COMN07-B023BG1	BL	G3	FF	Rus	Cream	33	87.5	103	3.5	0	0	0	0	17	1.064	1	4	3
66		W					62	100	119	2.5	0	0	0	0	0	1.070	0	3	1
67																			
68	COMN07-B028BG1	BL	G3	FF	Rus	Cream	33	100.0	103	2.5	0	0	0	0	0	1.076	0 0	2	1
69		W					62	97.5	119	1	0	0	0	0	0	1.069	0 0	2	1
70																			
71	COMN07-B041BG1	BL	G3	FF	Rus	W	33	100.0	103	4.0	0	0	8	0	8	1.075	3	4	2
72		W					62	97.5	119	3.5	0	0	0	0	0	1.072	1	4	4
73																			
74	COMN07-B050BG1	BL	G3	FF	Rus	Cream	33	92.5	103	4.0	33	0	0	0	0	1.084	3	4	3
75		W					62	85	119	4	8	0	0	0	0	1.092	3	4	2
76																			
77	COMN07-B051BG1	BL	G3	FF	Rus	Cream	33	75.0	103	2.0	0	0	0	0	0	1.070	1	3	2
78		W					62	97.5	119	1	0	0	0	0	0	1.073	1	3	2
79																			
80	COMN07-B061BG1	BL	G3	FF	Rus	Cream	33	87.5	103	3.5	0	0	0	0	0	1.069	0	2	1
81		W					62	77.5	119	2.5	0	0	0	0	0	1.075	0	4	1
82																			
83	COMN07-B095BG1	BL	G3	FF	Rus	Cream	33	95.0	103	3.0	0	0	0	0	8	1.083	0	2	2
84		W					62	100	119	1	0	0	0	0	0		1	2	1
85																			
86	COMN07-B132BG1	BL	G3	FF	Rus	Cream	33	95.0	103	3.5	25	0	0	0	0	1.087	0	0	1
87		W					62	80	119	3	0	0	0	0	0	1.082	0	1	1
88																			
89	COMN07-B134BG1	BL	G3	FF	Rus	Cream	33	80.0	103	3.0	0	0	0	0	0	1.087	0	4	2
90		W					62	100	119	2	0	0	0	0	0	1.081	0	3	1
91																			

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

																			3/40/D	3/45/D
											Harvest								3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)									
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]		FF[4]	FF[4]
92	COMN07-B139BG1	BL	G3	FF	Rus	Cream	33	7.5	103	3.5	8	0	0	0	0	1.065	2		4	3
93		W					62	85	119	3	0	0	0	0	0	1.073	2		4	2
94																				
95	COMN07-B141BG1	BL	G3	FF	Rus	W	33	97.5	103	3.5	0	0	0	0	0	1.079	0		4	3
96		W					62	95	119	3	0	0	0	0	0	1.077	1		4	2
97																				
98	COMN07-B144BG1	BL	G3	FF	Rus	Cream	33	45.0	103	3.5	17	0	0	0	8	1.065	1		4	1
99		W					62	87.5	119	3	8	0	0	0	0	1.076	0 0		3	1
100																				
101	COMN07-GF174WG1	BL	G3	FF	Rus	Cream	33	95.0	103	3.5	0	0	0	0	0	1.076	1		3	3
102		W					62	100	119	2	0	0	0	0	0	1.076	0		4	2
103																				
104	COMN07-GF179BG1	BL	G3	FF	Rus	W	33	15.0	103	4.0	0	0	0	0	0	1.075	1		3	3
105		W					62	80	119	3.5	0	0	0	0	0	1.076	1		1	1
106																				
107	COMN07-GF188BG1	BL	G3	FF	Rus	Cream	33	90.0	103	4.0	0	0	0	0	0	1.078	3		4	3
108		W					62	92.5	119	1.5	0	0	0	0	0	1.074	1		3	4
109																				
110	COMN07-GF198BG1	BL	G3	FF	Rus	Cream	33	95.0	103	3.5	0	0	0	0	0	1.067	3		5	5
111		W					62	92.5	119	2	0	0	0	0	0	1.068	2		4	4
112																				
113	COMN07-GF206BG1	BL	G3	FF	Rus	Cream	33	62.5	103	4.0	0	0	0	0	0	1.086	2		3	3
114		W					62	90	119	4	0	0	0	0	0	1.080	1		3	2
115																				
116	COMN07-GF222WG1	BL	G3	FF	Rus	Cream	33	35.0	103	3.5	8	0	0	0	0	1.076	1		4	3
117		W					62	95	119	2	0	0	0	0	0	1.080	1		3	3
118																				
119	COMN07-W034WG1	BL	G3	FF	Rus	W	33	100.0	103	4.0	8	0	0	0	0	1.084	3		4	4
120		W					62	92.5	119	2.5	0	0	0	0	0	1.085	1		4	4
121																				

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

												Harvest							3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)									
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]	FF[4]	FF[4]
122	COMN07-W067BG1	BL	G3	FF	Rus It	Cream	33	92.5	103	4.0	0	0	0	0	8	1.079	1	3	2
123		W					62	97.5	119	3	0	0	0	0	0	1.079	1	3	2
124																			
125	COMN07-W199BG1	BL	G3	FF	Rus	Cream	33	92.5	103	2.0	0	8	0	0	0	1.062	2	4	5
126		W					62	97.5	119	1.5	0	0	0	0	0	1.061	2	10	9
127																			
128	COMN07-W203BG1	BL	G3	FF	LW	Cream	33	90.0	103	2.5	0	0	0	0	17	1.074	1	4	3
129																			
130	NDMN07-B272BG1	BL	G3	FF	LW	Cream	33	97.5	103	2.0	0	0	0	0	8	1.070	4	4	3
131		W					62	92.5	119	1	8	0	0	0	0	1.071	7	6	8
132																			
133	NDMN07-W146BG1	BL	G3	FF	Rus	Cream	33	100.0	103	3.0	0	0	0	0	0	1.073	1	3	3
134		W					62	87.5	119	2	0	0	0	0	0	1.071	0	3	2
135																			
136	NDMN07-W153BG1	BL	G3	FF	Rus	Cream	33	92.5	103	4.0	33	0	0	0	0	1.071	6	4	2
137		W					62	87.5	119	3.5	33	0	0	0	0	1.073	4	7	5
138																			
139	NDMN07-W173BG1	BL	G3	FF	LW	Cream	33	90.0	103	3.5	0	0	0	0	0	1.066	4	4	4
140		W					62	97.5	119	2	0	0	0	0	0	1.068	3	6	6
141																			
142	ORMN07-B257BG1	BL	G3	FF	Rus	Cream	33	67.5	103	3.5	8	0	0	0	0	1.085	1	4	4
143		W					62	92.5	119	3	0	0	0	0	0	1.093	1	4	3
144																			
145	ORMN07-GF011BG1	BL	G3	FF	Rus	Cream	33	95.0	103	4.0	8	0	8	0	0	1.083	1	3	3
146		W					62	92.5	119	4	0	0	0	0	0	1.094	0	2	1
147																			
148	ORMN07-GF014BG1	BL	G3	FF	LW	W	33	92.5	103	3.0	0	0	8	0	17	1.075	2	4	3
149		W					62	97.5	119	1.5	0	0	0	0	0	1.083	1	4	2
150																			
151	ORMN07-W127WG1	BL	G3	FF	Rus	Cream	33	85.0	103	3.5	0	0	0	0	0	1.079	2	4	3
152		W					62	100	119	3	0	0	0	0	0	1.078	0	3	1

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest								3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)									
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]		FF[4]	FF[4]
153																				
154	ORMN07-W129WG1	BL	G3	FF	Rus	xW	33	100.0	103	3.0	0	0	17	0	0	1.085	1		2	3
155		W					62	95	119	3	0	0	0	0	0	1.096	0		1	1
156																				
157	COMN08-B140WG1	W	G2	FF	Rus	Cream	62	100	119	3	17	0	0	0	0	1.087	0 0		1	0
158																				
159	COMN08-B147BG1	BL	G2	FF	Rus	Yel	33	50.0	103	3.0	0	0	0	0	0	1.066	0		4	3
160																				
161	COMN08-B155WG1	W	G2	FF	Rus	Cream	62	100	119	3	0	0	0	0	0	1.081	1		4	2
162																				
163	COMN08-B158BG1	BL	G2	FF	Rus	Cream	33	25.0	103	3.0	0	0	0	0	0	1.066	1		4	4
164																				
165	COMN08-B160BG1	BL	G2	FF	Rus	W	33	90.0	103	3.0	0	0	0	0	0	1.071	2		4	2
166																				
167	COMN08-B166BG1CT	BL	G2	FF	Rus	Cream	33	55.0	103	3.0	0	17	0	0	0	1.069	1		4	4
168																				
169	COMN08-B173WG1	W	G2	FF	Rus	Cream	62	100	119	3	0	0	0	0	0	1.076	1		3	2
170																				
171	COMN08-B175WG1	W	G2	FF	Rus	Cream	62	95	119	5	17	0	0	0	0	1.085	1		4	2
172																				
173	COMN08-B177BG1	BL	G2	FF	Rus	Cream	33	40.0	103	4.0	17	0	0	0	0	1.072	1		2	1
174																				
175	COMN08-B178BG1	BL	G2	FF	Rus	W	33	55.0	103	2.0	0	0	0	0	0	1.075	0		4	4
176																				
177	COMN08-B224WG1	W	G2	FF	LW	Cream	62	85	119	5	0	0	0	0	0	1.074	2		3	3
178																				
179	COMN08-B225WG1	W	G2	FF	LW	W	62	95	119	2	0	0	0	0	0	1.080	3		4	3
180																				
181	COMN08-W054BG1	BL	G2	FM/FF	Red	Yel	33	70.0	103	2.0	33	0	0	0	0	1.067	0		4	2
182																				
183	COMN08-W063WG1OM	W	G2	FF	LW	Yel	62	90	119	2	17	0	0	0	0	1.068	0 0		3	1

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest							3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)								
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]	FF[4]	FF[4]
184																			
185	COMN08-W112WG1	W	G2	FF	Rus	Cream	62	95	119	3	0	0	0	0	0	1.072	1	4	1
186																			
187	COMN08-W113WG1	W	G2	FF	Rus	W	62	65	119	3	17	0	0	0	0	1.038	3	4	3
188																			
189	COMN08-W114WG1	W	G2	FF	Rus	Cream	62	75	119	3	0	0	0	0	0	1.080	0	1	1
190																			
191	COMN08-W115WG1	W	G2	FF	Rus	Yel	62	100	119	3	0	0	0	0	0	1.085	0	1	0
192																			
193	COMN08-W116WG1	W	G2	FF	Rus	W	62	95	119	4	0	0	0	0	0	1.076	1	3	3
194																			
195	COMN08-W117WG1	W	G2	FF	Rus	Cream	62	95	119	3	33	0	0	0	0	1.085	0	4	2
196																			
197	COMN08-W118WG1	W	G2	FF	Rus	W	62	90	119	2	0	0	0	0	0	1.083	0	3	1
198																			
199	COMN08-W126WG1	W	G2	FF	Rus	W	62	90	119	5	0	0	0	0	0	1.094	2	2	2
200																			
201	NDMN08-B133WG1	W	G2	FF	LW	Yel-lt	62	95	119	3	0	0	0	0	0	1.068	2	9	3
202																			
203	ORMN08-B198WG1	W	G2	FF	Rus	Cream	62	100	119	3	0	0	0	0	0	1.082	0	2	2
204																			
205	ORMN08-B203WG1	W	G2	FF	Rus	Cream	62	95	119	3	0	0	0	0	0	1.077	1	3	2
206																			
207	ORMN08-B204WG1	W	G2	FF	Rus	W	62	95	119	4	0	0	0	0	0	1.082	1	4	3
208																			
209	ORMN08-B206WG1	W	G2	FF	Rus	W	62	100	119	1	0	0	0	0	0	1.070	0	3	2
210																			
211	ORMN08-B207WG1	W	G2	FF	Rus	Cream	62	85	119	4	0	0	0	0	0	1.071	0 0	2	1
212																			
213	ORMN08-B213WG1	W	G2	FF	Rus	W	62	95	119	3	0	0	0	0	0	1.082	0	1	0
214																			

Table 3. Processor trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest							3/40/D	3/45/D
			2010		Color		Emerg		Final[3]		Internal Defects (%)								
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	FF[4]	FF[4]	FF[4]
215	ORMN08-B221BG1	BL	G2	FF	Rus	Cream	33	70.0	103	2.0	0	0	0	0	0	1.063	3	4	3
216																			
217	CV00047-3	BL	NCR	FF	Rus	Cream	33	92.5	103	3.0	0	8	0	0	8	1.080	0		
218																			
219	CV99222-2	BL	NCR	FF	Rus	Cream	33	91.3	103	3.3	0	0	4	0	0	1.078	0		
220																			
221	ND8229-3	BL	NCR	FF	Rus	Cream	33	92.5	103	3.0	8	0	0	0	0	1.082	0		
222																			
223	W8946-1rus	BL	NCR	FF	Rus	Cream	33	100.0	103	4.0	0	0	0	0	8	1.091	0		

1) BL processors planted: 5.May.2010; Vine killed:18.August.2010; Harvested; 9.September.2010

2) W processors planted: 22.April.2010; Vine killed: 5.August.2010; Harvested: 31.August.2010

3) Final Maturity Ratings: 0 = dead, 5 = Late Season

4) FF scores: Fry time = 3 minutes @ 375 F, Unblanced

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

														Size Distribution					
			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	< 4 oz		4 - 10 oz		> 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
1	**Russet Burbank**	BL	**Chk**	FF	Rus	Cream	12	651.7	22.6	3.3	674.3	89.4	13.3	389.6	57.8	172.8	25.6	83.4
2		W					8	386.0	22.7	5.6	408.7	56.7	13.9	247.5	60.6	81.8	20.0	80.6
3																		
4	**Russet Norkotah**	BL	**Chk**	FM	Rus	Cream	9	546.3	3.5	0.6	549.7	59.6	10.8	267.0	48.6	219.6	40.0	88.5
5		W					6	251.2	3.7	1.4	254.8	46.0	18.0	154.9	60.8	50.3	19.7	80.5
6																		
7	**Shepody**	BL	**Chk**	FF	LW	W	8	508.4	25.2	4.7	533.6	54.7	10.2	281.7	52.8	172.0	32.2	85.0
8		W					6	300.1	36.2	10.8	336.3	30.5	9.1	155.2	46.1	114.4	34.0	80.2
9																		
10	MN 15620	BL	G17	FF/FM	Red	Yel	11	421.1	26.7	6.0	447.9	127.6	28.5	268.2	59.9	25.4	5.7	65.5
11		W					9	417.2	29.3	6.6	446.5	62.9	14.1	276.9	62.0	77.4	17.3	79.3
12																		
13	MN 02 419	BL	G8	FF	LW	Cream	7	292.1	8.8	2.9	300.9	79.1	26.3	197.8	65.7	15.2	5.1	70.8
14		W					7	300.1	6.6	2.1	306.7	56.5	18.4	216.6	70.6	27.1	8.8	79.5
15																		
16	MN 02 467	BL	G8	FM/FF	Rus	Yel-lt	8	445.9	20.8	4.5	466.8	74.1	15.9	239.5	51.3	132.4	28.4	79.7
17		W					5	300.4	7.4	2.4	307.8	30.8	10.0	175.1	56.9	94.5	30.7	87.6
18																		
19	AOMN 03178-2	BL	G7	FF	Rus lt.	W	7	283.0	2.8	1.0	285.9	86.6	30.3	165.6	57.9	30.8	10.8	68.7
20		W					6	246.8	11.3	4.4	258.2	55.3	21.4	153.5	59.4	38.0	14.7	74.2
21																		
22	AOMN 041101-01	BL	G6	FF	LW	W	9	445.0	8.5	1.9	453.5	76.2	16.8	301.6	66.5	67.2	14.8	81.3
23		W					6	376.8	7.9	2.1	384.7	27.4	7.1	193.7	50.4	155.7	40.5	90.8
24																		
25	COMN 04692-10	W	G6	FF	Rus	Cream	6	249.1	3.7	1.5	252.7	43.0	17.0	187.4	74.2	18.6	7.4	81.5
26																		
27	COMN 04702-03	BL	G6	FF	Rus	Cream	7	382.0	16.5	4.2	398.6	61.1	15.3	222.0	55.7	98.9	24.8	80.5
28		W					4	242.9	14.4	5.6	257.2	19.8	7.7	149.5	58.1	73.5	28.6	86.7
29																		
30	AOMN 06077-01	BL	G4	FF	Rus	Cream	11	396.1	9.8	2.4	406.0	141.1	34.8	215.7	53.1	39.3	9.7	62.8
31		W					7	295.1	14.4	4.7	309.6	77.1	24.9	183.0	59.1	35.1	11.3	70.4
32																		
33	AOMN 06107-01	BL	G4	FF	Rus	Cream	8	428.3	19.5	4.4	447.9	46.8	10.4	273.6	61.1	108.0	24.1	85.2
34																		

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

												Size Distribution						
			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	< 4 oz		4 - 10 oz		> 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
35	AOMN 06118-01	BL	G4	FF	Rus	Cream	4	292.5	25.0	7.9	317.6	23.5	7.4	145.4	45.8	123.7	38.9	84.7
36		W					3	195.8	25.5	11.5	221.3	17.0	7.7	78.1	35.3	100.8	45.5	80.8
37																		
38	AOMN 06126-02	BL	G4	FF	Rus	Cream	8	407.2	6.6	1.6	413.9	60.7	14.7	235.2	56.8	111.3	26.9	83.7
39		W					5	326.2	4.1	1.2	330.3	33.6	10.2	161.5	48.9	131.1	39.7	88.6
40																		
41	AOMN 06131-01	BL	G4	FF	Rus	W	7	359.1	12.8	3.4	371.9	47.6	12.8	248.6	66.8	62.9	16.9	83.8
42		W					6	315.6	48.3	13.3	363.9	28.7	7.9	204.3	56.1	82.5	22.7	78.8
43																		
44	AOMN 06147-05	BL	G4	FF	Rus	Cream	5	352.5	35.0	9.0	387.6	19.8	5.1	178.3	46.0	154.4	39.8	85.8
45		W					5	290.8	18.0	5.8	308.8	12.6	4.1	170.5	55.2	107.7	34.9	90.1
46																		
47	AOMN 06153-01 S.D.	BL	G4	FF	Rus	W	10	458.4	10.9	2.3	469.3	100.4	21.4	283.4	60.4	74.6	15.9	76.3
48		W					5	257.8	2.8	1.1	260.5	39.1	15.0	178.8	68.6	39.9	15.3	84.0
49																		
50	AOMN 06174-01 S.D.	BL	G4	FF	Rus	Cream	5	295.4	10.8	3.5	306.2	31.0	10.1	196.3	64.1	68.0	22.2	86.3
51		W					4	208.9	0.0	0.0	208.9	26.6	12.7	134.5	64.4	47.8	22.9	87.3
52																		
53	COMN 06332-01	BL	G4	FF	Rus	W	8	436.3	13.4	3.0	449.7	63.5	14.1	291.0	64.7	81.8	18.2	82.9
54		W					5	257.5	21.3	7.7	278.8	27.2	9.8	174.9	62.7	55.4	19.9	82.6
55																		
56	COMN 06363-01	BL	G4	FF	Rus	Cream	6	338.7	24.7	6.8	363.4	30.8	8.5	219.8	60.5	88.2	24.3	84.7
57		W					4	311.5	10.3	3.2	321.9	16.8	5.2	133.1	41.3	161.7	50.2	91.6
58																		
59	COMN 06379-02	BL	G4	FF	Rus	W	6	338.4	14.8	4.2	353.2	47.4	13.4	220.9	62.5	70.2	19.9	82.4
60		W					5	278.7	21.7	7.2	300.4	23.4	7.8	184.6	61.5	70.6	23.5	85.0
61																		
62	COMN 06392-01	BL	G4	FF	Rus	W	12	499.8	50.8	9.2	550.6	101.4	18.4	348.8	63.3	49.6	9.0	72.4
63		W					7	301.1	52.2	14.8	353.3	38.3	10.8	219.0	62.0	43.8	12.4	74.4
64																		
65	COMN07-B023BG1	BL	G3	FF	Rus	Cream	10	460.5	13.1	2.8	473.6	98.9	20.9	288.8	61.0	72.8	15.4	76.4
66		W					7	336.8	17.9	5.0	354.7	54.0	15.2	225.7	63.6	57.1	16.1	79.7
67																		

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution < 4 oz		Size Distribution 4 - 10 oz		Size Distribution > 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
68	COMN07-B028BG1	BL	G3	FF	Rus	Cream	9	392.5	6.7	1.7	399.2	87.8	22.0	263.3	66.0	41.4	10.4	76.3
69		W					5	215.2	8.3	3.7	223.5	45.3	20.3	159.7	71.5	10.2	4.6	76.0
70																		
71	COMN07-B041BG1	BL	G3	FF	Rus	W	17	731.3	13.7	1.8	745.1	187.9	25.2	462.1	62.0	81.3	10.9	72.9
72		W					8	378.1	5.5	1.4	383.6	65.8	17.1	219.3	57.2	93.0	24.2	81.4
73																		
74	COMN07-B050BG1	BL	G3	FF	Rus	Cream	8	496.9	26.0	5.0	522.9	38.8	7.4	269.8	51.6	188.3	36.0	87.6
75		W					5	383.6	83.9	18.0	467.5	21.5	4.6	85.0	18.2	277.1	59.3	77.4
76																		
77	COMN07-B051BG1	BL	G3	FF	Rus	Cream	8	372.2	11.0	2.9	383.2	70.0	18.3	206.8	54.0	95.4	24.9	78.9
78		W					6	299.3	22.6	7.0	321.9	36.7	11.4	183.7	57.1	78.9	24.5	81.6
79																		
80	COMN07-B061BG1	BL	G3	FF	Rus	Cream	9	503.9	16.5	3.2	520.4	71.8	13.8	311.2	59.8	120.9	23.2	83.0
81		W					5	313.0	12.7	3.9	325.7	31.9	9.8	161.3	49.5	119.9	36.8	86.3
82																		
83	COMN07-B095BG1	BL	G3	FF	Rus	Cream	13	527.3	20.1	3.7	547.4	141.1	25.8	354.4	64.7	31.8	5.8	70.6
84		W					9	381.4	19.3	4.8	400.7	91.8	22.9	252.9	63.1	36.7	9.2	72.3
85																		
86	COMN07-B132BG1	BL	G3	FF	Rus	Cream	9	387.6	15.8	3.9	403.4	91.5	22.7	251.6	62.4	44.5	11.0	73.4
87		W					5	260.9	19.5	7.0	280.4	40.8	14.6	159.1	56.7	61.0	21.8	78.5
88																		
89	COMN07-B134BG1	BL	G3	FF	Rus	Cream	11	391.7	0.0	0.0	391.7	147.1	37.6	229.6	58.6	14.9	3.8	62.4
90		W					8	294.3	2.0	0.7	296.4	87.6	29.6	175.1	59.1	31.7	10.7	69.8
91																		
92	COMN07-B139BG1	BL	G3	FF	Rus	Cream	9	369.9	0.0	0.0	369.9	103.9	28.1	228.8	61.9	37.2	10.0	71.9
93		W					7	290.1	0.0	0.0	290.1	75.2	25.9	180.8	62.3	34.1	11.7	74.1
94																		
95	COMN07-B141BG1	BL	G3	FF	Rus	W	8	468.4	14.0	2.9	482.4	60.3	12.5	275.8	57.2	132.3	27.4	84.6
96		W					6	333.1	31.2	8.6	364.4	30.9	8.5	179.3	49.2	122.9	33.7	82.9
97																		
98	COMN07-B144BG1	BL	G3	FF	Rus	Cream	6	353.8	41.6	10.5	395.4	43.7	11.1	152.7	38.6	157.4	39.8	78.4
99		W					5	326.4	20.8	6.0	347.2	20.1	5.8	131.7	37.9	174.6	50.3	88.2
100																		

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution < 4 oz		4 - 10 oz		> 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
101	COMN07-GF174WG1	BL	G3	FF	Rus	Cream	9	498.1	53.1	9.6	551.2	61.0	11.1	298.6	54.2	138.5	25.1	79.3
102		W					7	369.4	34.9	8.6	404.4	46.1	11.4	170.7	42.2	152.7	37.8	80.0
103																		
104	COMN07-GF179BG1	BL	G3	FF	Rus	W	6	292.2	3.5	1.2	295.7	43.7	14.8	212.8	72.0	35.7	12.1	84.0
105		W					4	225.4	27.7	10.9	253.1	20.2	8.0	148.7	58.8	56.5	22.3	81.1
106																		
107	COMN07-GF188BG1	BL	G3	FF	Rus	Cream	11	516.3	7.6	1.4	523.9	95.0	18.1	347.8	66.4	73.5	14.0	80.4
108		W					6	286.5	1.8	0.6	288.3	33.3	11.5	202.8	70.3	50.4	17.5	87.8
109																		
110	COMN07-GF198BG1	BL	G3	FF	Rus	Cream	10	454.5	5.3	1.1	459.7	82.7	18.0	316.5	68.8	55.3	12.0	80.9
111		W					6	270.6	11.2	4.0	281.9	63.3	22.4	169.0	60.0	38.4	13.6	73.6
112																		
113	COMN07-GF206BG1	BL	G3	FF	Rus	Cream	9	380.7	7.4	1.9	388.1	81.9	21.1	263.0	67.8	35.8	9.2	77.0
114		W					8	338.1	8.9	2.6	346.9	73.4	21.1	231.5	66.7	33.1	9.6	76.3
115																		
116	COMN07-GF222WG1	BL	G3	FF	Rus	Cream	7	334.3	5.3	1.6	339.6	83.1	24.5	195.7	57.6	55.4	16.3	73.9
117		W					6	211.6	15.4	6.8	227.0	67.0	29.5	132.6	58.4	12.0	5.3	63.7
118																		
119	COMN07-W034WG1	BL	G3	FF	Rus	W	7	310.0	23.8	7.1	333.8	69.3	20.8	188.1	56.4	52.6	15.8	72.1
120		W					5	251.2	37.1	12.9	288.4	42.7	14.8	110.5	38.3	98.0	34.0	72.3
121																		
122	COMN07-W067BG1	BL	G3	FF	Rus It	Cream	10	511.3	13.9	2.6	525.2	91.3	17.4	316.5	60.3	103.5	19.7	80.0
123		W					7	347.6	8.1	2.3	355.7	53.0	14.9	224.0	63.0	70.6	19.8	82.8
124																		
125	COMN07-W199BG1	BL	G3	FF	Rus	Cream	8	402.9	5.5	1.4	408.4	75.5	18.5	254.4	62.3	72.9	17.9	80.1
126		W					4	183.2	4.5	2.4	187.7	52.3	27.9	91.1	48.5	39.9	21.2	69.7
127																		
128	COMN07-W203BG1	BL	G3	FF	LW	Cream	9	518.9	7.4	1.4	526.3	51.7	9.8	313.1	59.5	154.2	29.3	88.8
129																		
130	NDMN07-B272BG1	BL	G3	FF	LW	Cream	9	378.6	2.9	0.8	381.5	86.7	22.7	248.9	65.3	42.9	11.3	76.5
131		W					7	305.4	10.1	3.2	315.5	86.7	27.5	149.6	47.4	69.1	21.9	69.3
132																		
133	NDMN07-W146BG1	BL	G3	FF	Rus	Cream	14	566.9	4.6	0.8	571.5	160.0	28.0	303.4	53.1	103.4	18.1	71.2
134		W					6	268.1	0.0	0.0	268.1	45.2	16.9	159.6	59.5	63.4	23.6	83.1

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

													Size Distribution						
			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	< 4 oz		4 - 10 oz		> 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
135																		
136	NDMN07-W153BG1	BL	G3	FF	Rus	Cream	9	382.3	0.0	0.0	382.3	87.8	23.0	257.8	67.4	36.7	9.6	77.0
137		W					7	350.6	17.3	4.7	367.9	40.7	11.1	232.8	63.3	77.1	21.0	84.2
138																		
139	NDMN07-W173BG1	BL	G3	FF	LW	Cream	9	383.1	75.8	16.5	458.9	99.3	21.6	196.3	42.8	87.5	19.1	61.8
140		W					5	260.9	22.7	8.0	283.6	36.2	12.8	143.1	50.4	81.7	28.8	79.2
141																		
142	ORMN07-B257BG1	BL	G3	FF	Rus	Cream	10	421.1	0	0.0	421.1	112.2	26.6	283.2	67.2	25.8	6.1	73.4
143		W					6	319.6	3.7	1.2	323.3	31.4	9.7	230.5	71.3	57.6	17.8	89.1
144																		
145	ORMN07-GF011BG1	BL	G3	FF	Rus	Cream	11	548.2	9.4	1.7	557.6	102.4	18.4	347.3	62.3	98.5	17.7	80.0
146		W					7	396.1	5.0	1.2	401.1	38.4	9.6	231.2	57.6	126.5	31.5	89.2
147																		
148	ORMN07-GF014BG1	BL	G3	FF	LW	W	9	390.4	11.6	2.9	401.9	95.5	23.8	258.9	64.4	35.9	8.9	73.4
149		W					6	339.3	10.1	2.9	349.5	32.2	9.2	193.5	55.4	113.7	32.5	87.9
150																		
151	ORMN07-W127WG1	BL	G3	FF	Rus	Cream	10	442.2	8.8	2.0	451.0	97.6	21.6	277.8	61.6	66.8	14.8	76.4
152		W					6	340.2	17.0	4.8	357.2	31.3	8.8	180.7	50.6	128.2	35.9	86.5
153																		
154	ORMN07-W129WG1	BL	G3	FF	Rus	xW	9	427.0	13.2	3.0	440.2	90.0	20.5	284.1	64.5	52.8	12.0	76.5
155		W					4	256.6	55.3	17.7	312.0	17.4	5.6	132.0	42.3	107.2	34.4	76.7
156																		
157	COMN08-B140WG1	W	G2	FF	Rus	Cream	6	328.9	13.7	4.0	342.6	40.2	11.7	217.5	63.5	71.1	20.8	84.3
158																		
159	COMN08-B147BG1	BL	G2	FF	Rus	Yel	8	340.3	0.0	0.0	340.3	97.1	28.5	188.0	55.2	55.2	16.2	71.5
160																		
161	COMN08-B155WG1	W	G2	FF	Rus	Cream	6	343.2	9.5	2.7	352.7	29.8	8.5	234.8	66.6	78.6	22.3	88.8
162																		
163	COMN08-B158BG1	BL	G2	FF	Rus	Cream	9	217.0	0.0	0.0	217.0	156.4	72.1	56.1	25.8	4.5	2.1	27.9
164																		
165	COMN08-B160BG1	BL	G2	FF	Rus	W	8	355.4	7.8	2.1	363.2	91.1	25.1	194.6	53.6	69.7	19.2	72.8
166																		
167	COMN08-B166BG1CT	BL	G2	FF	Rus	Cream	5	357.3	50.1	12.3	407.4	20.2	5.0	157.8	38.7	179.3	44.0	82.8
168																		

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution < 4 oz		4 - 10 oz		> 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
169	COMN08-B173WG1	W	G2	FF	Rus	Cream	6	383.7	8.8	2.2	392.5	22.0	5.6	196.4	50.0	165.3	42.1	92.1
170																		
171	COMN08-B175WG1	W	G2	FF	Rus	Cream	6	269.8	16.9	5.9	286.6	48.0	16.8	165.6	57.8	56.2	19.6	77.4
172																		
173	COMN08-B177BG1	BL	G2	FF	Rus	Cream	7	350.7	9.5	2.6	360.2	52.4	14.5	239.2	66.4	59.1	16.4	82.8
174																		
175	COMN08-B178BG1	BL	G2	FF	Rus	W	10	327.9	13.3	3.9	341.2	145.2	42.5	169.9	49.8	12.8	3.8	53.6
176																		
177	COMN08-B224WG1	W	G2	FF	LW	Cream	5	290.1	3.0	1.0	293.1	28.8	9.8	173.5	59.2	87.8	30.0	89.2
178																		
179	COMN08-B225WG1	W	G2	FF	LW	W	5	277.9	61.4	18.1	339.3	23.5	6.9	97.6	28.8	156.8	46.2	75.0
180																		
181	COMN08-W054BG1	BL	G2	FM/FF	Red	Yel	9	262.9	3.9	1.5	266.9	146.2	54.8	116.7	43.7	0.0	0.0	43.7
182																		
183	COMN08-W063WG1ON	W	G2	FF	LW	Yel	6	177.7	18.5	9.4	196.2	74.6	38.0	103.2	52.6	0.0	0.0	52.6
184																		
185	COMN08-W112WG1	W	G2	FF	Rus	Cream	7	298.0	26.4	8.1	324.3	46.7	14.4	164.5	50.7	86.8	26.8	77.5
186																		
187	COMN08-W113WG1	W	G2	FF	Rus	W	2	114.9	55.5	32.6	170.4	11.0	6.4	31.8	18.7	72.1	42.3	61.0
188																		
189	COMN08-W114WG1	W	G2	FF	Rus	Cream	4	180.6	10.8	5.6	191.4	39.9	20.8	94.3	49.2	46.5	24.3	73.5
190																		
191	COMN08-W115WG1	W	G2	FF	Rus	Yel	8	379.0	13.0	3.3	391.9	75.5	19.3	257.8	65.8	45.7	11.7	77.4
192																		
193	COMN08-W116WG1	W	G2	FF	Rus	W	6	399.2	12.2	3.0	411.4	20.2	4.9	242.1	58.8	136.9	33.3	92.1
194																		
195	COMN08-W117WG1	W	G2	FF	Rus	Cream	5	276.1	23.3	7.8	299.4	23.0	7.7	173.4	57.9	79.8	26.7	84.6
196																		
197	COMN08-W118WG1	W	G2	FF	Rus	W	7	308.3	7.3	2.3	315.6	59.5	18.9	192.6	61.0	56.1	17.8	78.8
198																		
199	COMN08-W126WG1	W	G2	FF	Rus	W	6	316.3	21.6	6.4	338.0	28.9	8.5	186.7	55.2	100.8	29.8	85.1
200																		
201	NDMN08-B133WG1	W	G2	FF	LW	Yel-lt	5	230.7	1.0	0.4	231.7	37.1	16.0	144.3	62.3	49.3	21.3	83.6
202																		

Table 4. Processor yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution: < 4 oz		Size Distribution: 4 - 10 oz		Size Distribution: > 10 oz		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	Cwtyld	%	%
203	ORMN08-B198WG1	W	G2	FF	Rus	Cream	6	341.3	4.3	1.2	345.5	24.6	7.1	210.5	60.9	106.2	30.7	91.6
204																		
205	ORMN08-B203WG1	W	G2	FF	Rus	Cream	4	219.6	13.9	5.9	233.5	15.6	6.7	144.1	61.7	59.9	25.6	87.4
206																		
207	ORMN08-B204WG1	W	G2	FF	Rus	W	3	205.1	3.6	1.7	208.7	16.9	8.1	116.8	56.0	71.4	34.2	90.2
208																		
209	ORMN08-B206WG1	W	G2	FF	Rus	W	5	189.4	7.2	3.7	196.6	56.3	28.6	133.1	67.7	0.0	0.0	67.7
210																		
211	ORMN08-B207WG1	W	G2	FF	Rus	Cream	6	237.0	12.5	5.0	249.6	56.7	22.7	159.3	63.8	21.0	8.4	72.2
212																		
213	ORMN08-B213WG1	W	G2	FF	Rus	W	5	271.8	42.7	13.6	314.5	29.4	9.4	169.0	53.7	73.3	23.3	77.0
214																		
215	ORMN08-B221BG1	BL	G2	FF	Rus	Cream	7	274.9	16.3	5.6	291.2	76.9	26.4	182.2	62.6	15.7	5.4	68.0
216																		
217	CV00047-3	BL	NCR	FF	Rus	Cream	11	509.9	7.8	1.5	517.7	116.1	22.4	315.6	61.0	78.2	15.1	76.1
218																		
219	CV99222-2	BL	NCR	FF	Rus	Cream	12	572.0	10.1	1.7	582.1	122.5	21.0	363.6	62.5	85.9	14.8	77.2
220																		
221	ND8229-3	BL	NCR	FF	Rus	Cream	8	433.0	0.0	0.0	433.0	57.5	13.3	287.0	66.3	88.4	20.4	86.7
222																		
223	W8946-1rus	BL	NCR	FF	Rus	Cream	16	534.4	11.7	2.1	546.1	236.8	43.4	280.7	51.4	16.9	3.1	54.5

1) BL processors planted: 5.May.2010; Vine killed:18.August.2010; Harvested; 9.September.2010
2) W processors planted: 22.April.2010; Vine killed: 5.August.2010; Harvested: 31.August.2010

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest								
			2010		Color		Emerg		Final[3]		Internal Defects (%)							3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]	Chip[4]	Chip[4]
1	**Atlantic**	BL	**Chk**	C	W	Cream	33	96.3	103	3.5	25.0	16.7	0.0	0.0	0.0	1.088	6.9	8.3	7.3
2		W					62	95	119	3.5	8.3	0.0	0.0	0.0	0.0	1.094	5.8	8.0	7.0
3																			
4	**NorValley**	BL	**Chk**	C	W	Cream	33	82.5	103	3.5	0.0	0.0	0.0	0.0	8.3	1.078	5.6	6.8	5.8
5		W					62	97.5	119	2.5	0.0	0.0	0.0	0.0	0.0	1.076	4.0	5.8	4.8
6																			
7	**Snowden**	BL	**Chk**	C	W	W	33	98.3	103	3.0	0.0	0.0	0.0	0.0	16.7	1.090	4.5	8.3	6.0
8		W					62	95	119	4	0.0	0.0	0.0	0.0	0.0	1.090	2.5	8.0	5.8
9																			
10	MN 00467-4	BL	G10	C	W	W	33	87.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.081	4.8	8.0	7.5
11		W					62	85	119	2.5	0.0	0.0	0.0	0.0	0.0	1.086	4.5	7.5	7.0
12																			
13	MN 02 598	BL	G8	C/FM	W	Yel-lt	33	67.5	103	4.0	16.7	0.0	0.0	0.0	0.0	1.077	4.0	7.5	6.0
14		W					62	95	119	3	0.0	0.0	0.0	0.0	0.0	1.079	4.8	6.3	5.5
15																			
16	MN 02 588	BL	G8	C	W	W	33	80.0	103	3.5	0.0	0.0	0.0	0.0	0.0	1.077	3.3	8.0	6.8
17		W					62	85	119	2.5	0.0	0.0	0.0	0.0	0.0	1.080	2.5	7.3	6.5
18																			
19	MN 02 696	BL	G8	C	W	W	33	47.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.079	2.5	3.5	2.3
20																			
21	NDMN 03324-4	BL	G7	C	W	Cream	33	67.5	103	4.0	0.0	8.3	0.0	0.0	0.0	1.083	4.0	6.8	4.8
22		W					62	97.5	119	4	0.0	0.0	0.0	0.0	0.0	1.087	2.5	5.3	3.8
23																			
24	NDMN 04910-01	BL	G6	C	W	Cream	33	90.0	103	4.0	0.0	0.0	0.0	0.0	0.0	1.078	4.8	7.5	5.8
25		W					62	95	119	3.5	0.0	0.0	0.0	0.0	0.0	1.087	2.8	6.3	5.0
26																			
27	NDMN 04911-01	BL	G6	C	W	W	33	90.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.071	3.8	7.0	5.0
28		W					62	92.5	119	1.5	0.0	0.0	0.0	0.0	0.0	1.072	3.0	6.3	3.8
29																			
30	AOMN 06150-02	BL	G4	C	W	Cream	33	92.5	103	4.0	8.3	16.7	0.0	0.0	8.3	1.073	5.8	8.5	6.8
31		W					62	97.5	119	3.5	8.3	0.0	0.0	0.0	0.0	1.071	5.5	8.3	6.3
32																			
33	COMN07-GF310BG1	BL	G3	C	W	W	33	47.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.061	4.5	6.5	6.5
34		W					62	97.5	119	2	0.0	0.0	0.0	0.0	0.0	1.063	3.5	6.5	5.3
35																			

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest								
			2010		Color		Emerg		Final[3]		Internal Defects (%)							3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]	Chip[4]	Chip[4]
36	COMN07-GF315BG1	BL	G3	C	W/W	Cream	33	90.0	103	2.5	0.0	0.0	0.0	0.0	0.0	1.067	6.5	9.5	8.5
37		W					62	92.5	119	1	0.0	0.0	0.0	0.0	0.0	1.067	7.0	9.3	8.5
38																			
39	COMN07-W201BG1	BL	G3	C	W	W	33	97.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.073	6.0	8.0	7.5
40		W					62	95	119	2	0.0	0.0	0.0	0.0	0.0	1.071	5.8	9.0	7.5
41																			
42	COMN07-W203BG1	W	G3	C	W	Cream	62	100	119	2	0.0	0.0	0.0	0.0	0.0	1.070	6.8	5.5	8.0
43																			
44	NDMN07-B266BG1	BL	G3	C	W	Cream	33	80.0	103	2.5	0.0	25.0	0.0	33.3	0.0	1.069	7.0	9.0	7.5
45		W					62	97.5	119	2	0.0	0.0	0.0	0.0	0.0	1.068	5.8	8.5	7.3
46																			
47	NDMN07-B269BG1	BL	G3	C	W	Cream	33	100.0	103	4.0	0.0	0.0	0.0	8.3	0.0	1.079	7.0	9.0	8.0
48		W					62	95	119	2.5	0.0	0.0	0.0	0.0	0.0	1.078	7.0	8.0	7.0
49																			
50	NDMN07-B289BG1	BL	G3	C	W	Cream/ purple	33	92.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.092	4.5	7.0	3.5
51		W					62	92.5	119	3	0.0	0.0	0.0	0.0	0.0	1.094	3.5	5.5	2.8
52																			
53	NDMN07-B299BG1	W	G3	C	W	Cream	62	92.5	119	1.5	0.0	0.0	0.0	0.0	0.0	1.084	5.8	7.8	4.0
54																			
55	NDMN07-B302BG1	BL	G3	C	W	W	33	95.0	103	4.0	25.0	0.0	0.0	0.0	0.0	1.091	4.3	7.5	6.0
56		W					62	97.5	119	3	0.0	0.0	0.0	0.0	0.0	1.074	3.8	7.0	4.8
57																			
58	NDMN07-B309BG1	BL	G3	C	W	W	33	57.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.084	4.0	7.0	6.5
59		W					62	92.5	119	2	0.0	0.0	0.0	0.0	0.0	1.084	2.5	7.0	5.5
60																			
61	NDMN07-B311BG1	BL	G3	C	W	Cream	33	90.0	103	3.0	8.3	0.0	0.0	8.3	0.0	1.070	5.3	9.0	8.0
62		W					62	90	119	2.5	16.7	0.0	0.0	0.0	0.0	1.064	4.8	7.5	6.0
63																			
64	NDMN07-B312BG1	BL	G3	C	W	W	33	90.0	103	2.5	0.0	0.0	0.0	0.0	0.0	1.070	4.0	7.0	4.8
65		W					62	100	119	2.5	0.0	0.0	0.0	0.0	0.0	1.072	2.3	5.8	3.5
66																			
67	NDMN07-B316WG1	W	G3	C	W/Red splash	Cream	62	87.5	119	2.5	0.0	0.0	0.0	0.0	0.0	1.068	2.8	6.8	5.5
68																			
69	NDMN07-B322BG1	BL	G3	C	W	Cream	33	100.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.081	4.0	4.5	2.0
70		W					62	100	119	2.5	0.0	0.0	0.0	0.0	0.0	1.078	3.3	3.5	2.0
71																			

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest								
			2010		Color		Emerg		Final[3]		Internal Defects (%)							3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]	Chip[4]	Chip[4]
72	NDMN07-B326BG1	BL	G3	C	W	YeI-lt.	33	97.5	103	3.0	41.7	0.0	0.0	0.0	0.0	1.074	4.5	7.5	5.5
73		W					62	97.5	119	1.5	0.0	0.0	0.0	0.0	0.0	1.081	3.0	7.0	5.3
74																			
75	NDMN07-B330BG1	BL	G3	C	W/Red splash	Cream/red splash	33	87.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.075	4.5	8.0	7.3
76		W					62	90	119	3	0.0	0.0	0.0	0.0	0.0	1.079	3.8	8.3	6.5
77																			
78	NDMN07-GF045BG1	BL	G3	C	W	Cream	33	77.5	103	2.5	33.3	0.0	0.0	8.3	0.0	1.072	5.5	8.5	7.5
79		W					62	87.5	119	2	16.7	0.0	0.0	0.0	0.0	1.076	5.3	8.0	7.5
80																			
81	NDMN07-GF056BG1	BL	G3	C	W	YeI-lt.	33	92.5	103	1.0	0.0	0.0	0.0	0.0	0.0	1.070	3.0	6.8	5.8
82		W					62	92.5	119	0	0.0	0.0	0.0	0.0	0.0	1.066	2.5	6.3	4.3
83																			
84	NDMN07-GF066BG1	BL	G3	C	W	W	33	95.0	103	2.0	0.0	0.0	0.0	0.0	0.0	1.083	4.0	8.0	6.5
85		W					62	90	119	2	8.3	0.0	0.0	0.0	0.0	1.066	3.5	8.0	7.0
86																			
87	NDMN07-GF106BG1	BL	G3	C	W	Cream	33	85.0	103	3.0	0.0	0.0	0.0	8.3	0.0	1.067	3.0	6.0	3.3
88		W					62	92.5	119	2.5	0.0	0.0	0.0	0.0	0.0	1.070	2.3	4.8	2.0
89																			
90	NDMN07-W150BG1	BL	G3	C	W	W	33	87.5	103	2.5	0.0	0.0	0.0	0.0	0.0	1.075	5.0	7.0	5.0
91		W					62	82.5	119	3	0.0	0.0	0.0	0.0	0.0	1.069	5.5	7.3	8.5
92																			
93	NDMN07-W151BG1	BL	G3	C	W	W	33	70.0	103	2.5	16.7	0.0	0.0	0.0	0.0	1.083	3.0	6.0	2.8
94		W					62	85	119	3	25.0	0.0	0.0	0.0	0.0	1.076	2.0	3.0	2.8
95																			
96	NDMN07-W152BG1	BL	G3	C	W	W	33	97.5	103	3.0	0.0	0.0	0.0	16.7	0.0	1.079	4.5	7.0	5.5
97		W					62	95	119	3.5	0.0	0.0	0.0	0.0	0.0	1.076	2.8	6.5	5.5
98																			
99	NDMN07-W159BG1	BL	G3	C	W	Cream	33	97.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.079	3.8	7.5	6.0
100		W					62	90	119	3	0.0	0.0	0.0	0.0	0.0	1.077	2.5	6.5	5.8
101																			
102	NDMN07-W160BG1	BL	G3	C	W	Cream	33	92.5	103	3.5	0.0	0.0	0.0	25.0	0.0	1.084	2.5	7.5	6.0
103		W					62	97.5	119	2.5	0.0	0.0	0.0	0.0	0.0	1.079	2.5	7.5	3.8
104																			
105	NDMN07-W161BG1	BL	G3	C	W	Cream	33	62.5	103	2.5	16.7	0.0	0.0	0.0	16.7	1.076	4.3	6.3	4.5
106		W					62	72.5	119	2	0.0	0.0	0.0	0.0	0.0	1.069	3.0	5.0	2.8
107																			

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest								
			2010		Color		Emerg		Final[3]		Internal Defects (%)							3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]	Chip[4]	Chip[4]
108	NDMN07-W162BG1	BL	G3	C	W	Cream	33	65.0	103	2.0	0.0	0.0	0.0	0.0	0.0	1.063	4.0	6.0	5.8
109		W					62	97.5	119	2.5	0.0	0.0	0.0	0.0	0.0	1.074	3.0	4.8	2.5
110																			
111	NDMN07-W162WG1	BL	G3	C	W	Cream	33	67.5	103	2.5	0.0	0.0	0.0	0.0	0.0	1.069	3.5	6.0	5.0
112		W					62	82.5	119	2.5	8.3	0.0	0.0	0.0	0.0	1.073	2.8	5.5	3.5
113																			
114	NDMN07-W169BG1	BL	G3	C	W	W	33	85.0	103	2.0	0.0	0.0	0.0	0.0	0.0	1.072	6.8	8.5	8.0
115		W					62	92.5	119	2	0.0	0.0	0.0	0.0	0.0	1.071	4.5	8.0	7.5
116																			
117	COMN08-W041WG1	W	G2	C	W	Cream	62	40	119	5	0.0	0.0	0.0	0.0	0.0	1.081	5.0	8.5	6.0
118																			
119	COMN08-W132WG1	W	G2	C	W	Cream	62	90	119	3	16.7	0.0	0.0	0.0	0.0	1.091	3.0	7.0	4.5
120																			
121	COMN08-W135WG1	W	G2	C	W	Cream	62	70	119	3	33.3	0.0	0.0	0.0	0.0	1.078	4.5	7.0	6.0
122																			
123	COMN08-W145WG1	W	G2	C	W	W	62	85	119	2	0.0	0.0	0.0	0.0	0.0	1.078	1.0	4.0	3.0
124																			
125	COMN08-W147WG1'	W	G2	C	W	W	62	95	119	2	0.0	0.0	0.0	0.0	0.0	1.083	6.0	9.0	8.0
126																			
127	COMN08-W150WG1	W	G2	C	W	W	62	85	119	2	0.0	0.0	0.0	0.0	0.0	1.081	8.0	9.0	8.0
128																			
129	NDMN08-B025WG1	W	G2	C	W	W	62	90	119	3	0.0	0.0	0.0	0.0	0.0	1.081	2.5	4.0	3.0
130																			
131	NDMN08-B026BG1	BL	G2	C	W	Cream	33	80.0	103	4.0	33.3	0.0	0.0	0.0	0.0	1.071	7.0	8.0	8.0
132																			
133	NDMN08-B026WG1	W	G2	C	W	Cream	62	90	119	3	0.0	0.0	0.0	0.0	0.0	1.063	6.5	8.0	7.0
134																			
135	NDMN08-B032BG1	BL	G2	C	W	Cream	33	60.0	103	2.0	0.0	0.0	0.0	0.0	0.0	1.066	6.0	9.0	8.0
136																			
137	NDMN08-B035BG1	BL	G2	C	W	Cream	33	35.0	103	3.0	0.0	33.3	0.0	0.0	0.0	1.074	6.0	8.0	6.5
138																			
139	NDMN08-B035WG1	W	G2	C	W	Cream	62	95	119	2	0.0	0.0	0.0	0.0	0.0	1.075	3.5	8.0	7.0
140																			
141	NDMN08-B036BG1	BL	G2	C	W	Cream	33	35.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.080	5.5	8.0	7.0
142																			
143	NDMN08-B037BG1	BL	G2	C	W	W	33	45.0	103	3.0	16.7	0.0	0.0	0.0	0.0	1.064	5.5	7.5	6.0

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

												Harvest							
			2010		Color		Emerg		Final[3]		Internal Defects (%)							3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]	Chip[4]	Chip[4]
144																			
145	NDMN08-B039WG1	W	G2	C	W	W	62	100	119	3	0.0	0.0	0.0	0.0	0.0	1.072	3.5	6.5	6.0
146																			
147	NDMN08-B046BG1	BL	G2	C	W	Cream	33	40.0	103	3.0	50.0	0.0	0.0	0.0	0.0	1.077	6.0	8.0	7.0
148																			
149	NDMN08-B046WG1	W	G2	C	W	Cream	62	85	119	2	0.0	0.0	0.0	0.0	0.0	1.086	6.0	8.0	7.0
150																			
151	NDMN08-B050WG1	W	G2	C	W	Cream	62	90	119	4	0.0	0.0	0.0	0.0	0.0	1.068	5.5	8.5	6.0
152																			
153	NDMN08-B062WG1	W	G2	C	W	W	62	90	119	3	0.0	0.0	0.0	0.0	0.0	1.082	3.0	8.0	6.0
154																			
155	NDMN08-B072WG1	W	G2	C	W	Cream	62	95	119	3	16.7	0.0	0.0	0.0	0.0	1.073	5.0	7.0	6.0
156																			
157	NDMN08-B074WG1	W	G2	C	W	W	62	65	119	2	50.0	0.0	0.0	0.0	0.0	1.083	6.0	7.0	6.0
158																			
159	NDMN08-B083WG1	W	G2	C	W	Cream/Purple	62	60	119	3	0.0	0.0	0.0	0.0	0.0	1.086	3.0	6.0	2.0
160																			
161	NDMN08-B084WG1	W	G2	C	W	Cream	62	85	119	2	0.0	0.0	0.0	0.0	0.0	1.074	7.5	9.0	8.0
162																			
163	NDMN08-B085WG1	W	G2	C	W	Cream	62	65	119	3	0.0	0.0	0.0	0.0	0.0	1.076	#DIV/0!	6.0	5.0
164																			
165	NDMN08-B086BG1	BL	G2	C	W	Cream	33	80.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.077	5.5	8.0	8.0
166																			
167	NDMN08-B094BG1	BL	G2	C	W	Cream	33	15.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.075	8.0	7.0	8.0
168																			
169	NDMN08-B095BG1	BL	G2	C	W	Cream	33	50.0	103	3.0	16.7	0.0	0.0	0.0	0.0	1.080	5.5	8.0	6.0
170																			
171	NDMN08-B097BG1	BL	G2	C	W	Cream	33	40.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.072	7.0	9.0	9.0
172																			
173	NDMN08-B097WG1	W	G2	C	W	Cream	62	90	119	2	0.0	0.0	0.0	0.0	0.0	1.071	6.0	9.0	8.0
174																			
175	NDMN08-B098BG1	BL	G2	C	W	Cream	33	10.0	103	3.0	16.7	0.0	0.0	0.0	0.0	1.072	3.5	7.0	5.0
176																			
177	NDMN08-B101BG1	BL	G2	C	W	W	33	45.0	103	4.0	0.0	0.0	0.0	0.0	33.3	1.081	5.0	7.0	6.5
178																			
179	NDMN08-B101WG1	W	G2	C	W	W	62	100	119	3	0.0	0.0	0.0	0.0	0.0	1.086	3.0	7.0	3.5

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

											Harvest									
			2010		Color		Emerg		Final[3]		Internal Defects (%)								3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]		Chip[4]	Chip[4]
180																				
181	NDMN08-B102WG1	W	G2	C	W	W	62	100	119	3	0.0	0.0	0.0	0.0	0.0	1.082	2.5		7.5	4.5
182																				
183	NDMN08-B107BG1	BL	G2	C	W	W	33	90.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.081	5.5		M	7.0
184																				
185	NDMN08-B110WG1	W	G2	C	W	W	62	90	119	3	0.0	0.0	0.0	0.0	0.0	1.059	6.0		8.0	8.0
186																				
187	NDMN08-B113WG1	W	G2	C	W	Cream	62	95	119	4	33.3	0.0	0.0	0.0	0.0	1.079	4.5		7.0	5.5
188																				
189	NDMN08-B114BG1	BL	G2	C	W	Cream	33	50.0	103	3.0	0.0	66.7	0.0	0.0	0.0	1.062	6.5		8.0	8.0
190																				
191	NDMN08-B117WG1	W	G2	C	W	W	62	85	119	2	0.0	0.0	0.0	0.0	0.0	1.083	4.0		8.5	7.0
192																				
193	NDMN08-B118BG1	BL	G2	C	W	Cream	33	85.0	103	3.0	0.0	0.0	0.0	0.0	0.0	1.083	8.0		9.0	8.0
194																				
195	NDMN08-B130WG1	W	G2	C	W	Cream	62	85	119	3	0.0	0.0	0.0	0.0	0.0	1.061	7.0		9.0	8.0
196																				
197	NDMN08-B137BG1	BL	G2	C	W	Cream	33	60.0	103	4.0	0.0	0.0	0.0	0.0	83.3	1.076	5.5		7.0	4.0
198																				
199	NDMN08-B137WG1	W	G2	C	W	Cream	62	95	119	3	16.7	0.0	0.0	0.0	0.0	1.085	4.5		6.5	4.5
200																				
201	NDMN08-B183WG1	W	G2	C	W	W	62	95	119	3	0.0	0.0	0.0	0.0	0.0	1.071	7.0		9.0	8.0
202																				
203	NDMN08-B184WG1	W	G2	C	W	W	62	85	119	1	0.0	0.0	0.0	0.0	0.0	1.083	3.0		7.0	5.5
204																				
205	NDMN08-B187WG1	W	G2	C	W	W	62	80	119	3	0.0	0.0	0.0	0.0	0.0	1.074	5.5		8.0	7.0
206																				
207	NDMN08-B189BG1	BL	G2	C	W	Cream	33	40.0	103	3.0	16.7	0.0	0.0	0.0	0.0	1.077	6.5		9.0	8.0
208																				
209	NDMN08-B189WG1	W	G2	C	W	W	62	100	119	3	0.0	0.0	0.0	0.0	0.0	1.077	7.0		8.0	7.0
210																				
211	NDMN08-W102WG1	W	G2	C	W	W	62	85	119	3	0.0	0.0	0.0	0.0	0.0	1.081	4.5		8.5	7.0
212																				
213	MSL211-3	BL	NCR	C	W	Cream	33	97.5	103	3.0	0.0	0.0	0.0	0.0	0.0	1.069	7.6			
214																				
215	MSL268-D	BL	NCR	C	W	Cream	33	95.0	103	4.0	4.2	0.0	0.0	0.0	0.0	1.083	6.0			

Table 5. Chip trials at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

												Harvest								
			2010		Color		Emerg		Final[3]		Internal Defects (%)								3/40/D	3/45/D
Sort 4	Clone	Loc	Trial	Mkt	Skin	Flesh	DAP	%	DAP	Mat.	HH	IN	VD	BC	Bruise	Sp Gr	Chip[4]		Chip[4]	Chip[4]
216																				
217	MSM182-1	BL	NCR	C	W	Cream	33	96.3	103	3.5	0.0	12.5	0.0	0.0	0.0	1.065	7.5			
218																				
219	MSQ176-5	BL	NCR	C	W	Cream	33	86.3	103	3.8	0.0	0.0	0.0	0.0	0.0	1.069	7.0			
220																				
221	ND8307C-3	BL	NCR	C	W	Cream	33	91.3	103	2.3	4.2	0.0	0.0	0.0	0.0	1.087	4.9			
222																				
223	W2717-5	BL	NCR	C	W	Cream	33	82.5	103	3.0	8.3	0.0	0.0	4.2	0.0	1.087	4.1			
224																				
225	W2978-3	BL	NCR	C	W	Cream	33	98.8	103	3.0	0.0	0.0	0.0	0.0	0.0	1.081	5.6			
226																				
227	W5015-12	BL	NCR	C	W	Cream	33	78.8	103	4.0	12.5	16.7	0.0	0.0	0.0	1.087	4.0			

1) BL chips planted: 5.May.2010; Vine killed:18.August.2010; Harvested; 9.September.2010
2) W chips planted: 22.April.2010; Vine killed: 5.August.2010; Harvested: 31.August.2010
3) Final Maturity Ratings: 0 = dead, 5 = Late Season
4) Chip scores: Fry time = 1.5 minutes @ 375 F

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

					Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution				US #1
			2010									B's		A's		
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	%
1	**Atlantic**	BL	**Chk**	C	W	Cream	11	588.4	8.9	1.5	597.3	93.8	15.7	494.6	82.8	82.8
2		W					7	376.0	6.5	1.7	382.5	39.1	10.2	337.0	88.1	88.1
3																
4	**NorValley**	BL	**Chk**	C	W	Cream	10	545.4	5.7	1.0	551.2	69.2	12.6	476.2	86.4	86.4
5		W					8	424.0	12.1	2.8	436.1	62.8	14.4	361.2	82.8	82.8
6																
7	**Snowden**	BL	**Chk**	C	W	W	14	638.6	0.0	0.0	638.6	124.7	19.5	513.9	80.5	80.5
8		W					8	451.2	0.0	0.0	451.2	46.5	10.3	404.7	89.7	89.7
9																
10	MN 00467-4	BL	G10	C	W	W	10	405.9	0.0	0.0	405.9	120.4	29.7	285.5	70.3	70.3
11		W					6	294.6	3.3	1.1	297.9	38.9	13.0	255.8	85.9	85.9
12																
13	MN 02 598	BL	G8	C/FM	W	Yel-lt	11	460.3	5.1	1.1	465.4	138.5	29.8	321.7	69.1	69.1
14		W					8	323.4	8.5	2.6	331.8	88.3	26.6	235.0	70.8	70.8
15																
16	MN 02 588	BL	G8	C	W	W	11	399.4	6.7	1.6	406.1	130.2	32.1	269.3	66.3	66.3
17		W					9	319.0	0.0	0.0	319.0	109.5	34.3	209.5	65.7	65.7
18																
19	MN 02 696	BL	G8	C	W	W	10	345.1	4.1	1.2	349.2	144.4	41.3	200.8	57.5	57.5
20																
21	NDMN 03324-4	BL	G7	C	W	Cream	11	345.9	7.5	2.1	353.5	159.7	45.2	186.2	52.7	52.7
22		W					8	323.6	17.1	5.0	340.7	82.1	24.1	241.5	70.9	70.9
23																
24	NDMN 04910-01	BL	G6	C	W	Cream	15	590.2	12.6	2.1	602.8	174.0	28.9	416.1	69.0	69.0
25		W					9	399.3	3.7	0.9	403.0	92.1	22.8	307.3	76.2	76.2
26																
27	NDMN 04911-01	BL	G6	C	W	W	11	418.8	0.0	0.0	418.8	145.6	34.8	273.3	65.2	65.2
28		W					7	254.4	6.5	2.5	260.9	91.9	35.2	162.5	62.3	62.3
29																
30	AOMN 06150-02	BL	G4	C	W	Cream	14	438.0	0.0	0.0	438.0	235.8	53.8	202.3	46.2	46.2
31		W					8	298.6	0.0	0.0	298.6	95.8	32.1	202.8	67.9	67.9
32																
33	COMN07-GF310BG1	BL	G3	C	W	W	6	283.8	6.4	2.2	290.2	52.4	18.1	231.4	79.7	79.7
34		W					4	230.0	2.7	1.2	232.7	28.1	12.1	201.9	86.8	86.8

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's		A's		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	%
35																
36	COMN07-GF315BG1	BL	G3	C	W/W	Cream	9	292.5	0.0	0.0	292.5	128.2	43.8	164.2	56.2	56.2
37		W					6	210.3	15.0	6.7	225.3	79.5	35.3	130.7	58.0	58.0
38																
39	COMN07-W201BG1	BL	G3	C	W	W	10	435.2	3.5	0.8	438.7	107.3	24.5	327.9	74.7	74.7
40		W					7	294.4	5.4	1.8	299.7	62.5	20.9	231.8	77.3	77.3
41																
42	COMN07-W203BG1	W	G3	C	W	Cream	8	388.5	3.9	1.0	392.4	67.2	17.1	321.3	81.9	81.9
43																
44	NDMN07-B266BG1	BL	G3	C	W	Cream	12	281.2	0.0	0.0	281.2	208.3	74.1	72.9	25.9	25.9
45		W					9	279.0	0.0	0.0	279.0	114.6	41.1	164.4	58.9	58.9
46																
47	NDMN07-B269BG1	BL	G3	C	W	Cream	11	371.1	9.7	2.5	380.8	155.2	40.8	215.9	56.7	56.7
48		W					7	302.1	0.0	0.0	302.1	68.5	22.7	233.6	77.3	77.3
49																
50	NDMN07-B289BG1	BL	G3	C	W	Cream/ purple	13	408.2	0.0	0.0	408.2	211.8	51.9	196.3	48.1	48.1
51		W					8	252.8	11.6	4.4	264.4	101.4	38.4	151.3	57.3	57.3
52																
53	NDMN07-B299BG1	W	G3	C	W	Cream	7	159.2	0.0	0.0	159.2	104.3	65.5	54.9	34.5	34.5
54																
55	NDMN07-B302BG1	BL	G3	C	W	W	11	421.7	0.0	0.0	421.7	131.4	31.2	290.2	68.8	68.8
56		W					11	335.6	0.0	0.0	335.6	151.8	45.2	183.8	54.8	54.8
57																
58	NDMN07-B309BG1	BL	G3	C	W	W	9	286.3	0.0	0.0	286.3	134.0	46.8	152.3	53.2	53.2
59		W					8	238.4	0.0	0.0	238.4	123.8	51.9	114.5	48.1	48.1
60																
61	NDMN07-B311BG1	BL	G3	C	W	Cream	10	409.6	6.2	1.5	415.8	125.5	30.2	284.1	68.3	68.3
62		W					8	331.7	14.3	4.1	346.1	79.7	23.0	252.0	72.8	72.8
63																
64	NDMN07-B312BG1	BL	G3	C	W	W	11	481.7	5.8	1.2	487.4	126.1	25.9	355.6	73.0	73.0
65		W					8	370.3	0.0	0.0	370.3	58.0	15.7	312.3	84.3	84.3
66																
67	NDMN07-B316WG1	W	G3	C	W/Red splash	Cream	5	291.2	34.2	10.5	325.3	33.7	10.4	257.4	79.1	79.1
68																

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

												Size Distribution					
			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	B's		A's		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	%
69	NDMN07-B322BG1	BL	G3	C	W	Cream	19	500.0	0.0	0.0	500.0	324.0	64.8	176.1	35.2	35.2
70		W					11	327.8	2.4	0.7	330.1	145.7	44.1	182.1	55.1	55.1
71																
72	NDMN07-B326BG1	BL	G3	C	W	Yel-lt.	16	461.3	5.3	1.1	466.6	285.3	61.1	176.0	37.7	37.7
73		W					11	310.5	0.0	0.0	310.5	165.2	53.2	145.2	46.8	46.8
74																
75	NDMN07-B330BG1	BL	G3	C	W/Red splash	Cream/red splash	10	426.1	0.0	0.0	426.1	110.9	26.0	315.2	74.0	74.0
76		W					9	363.2	5.1	1.4	368.3	81.9	22.2	281.3	76.4	76.4
77																
78	NDMN07-GF045BG1	BL	G3	C	W	Cream	7	356.8	29.1	7.6	385.9	56.4	14.6	300.3	77.8	77.8
79		W					4	219.6	16.6	7.0	236.3	24.3	10.3	195.3	82.7	82.7
80																
81	NDMN07-GF056BG1	BL	G3	C	W	Yel-lt.	9	321.0	0.0	0.0	321.0	116.7	36.4	204.3	63.6	63.6
82		W					5	194.0	2.4	1.2	196.4	61.4	31.3	132.5	67.5	67.5
83																
84	NDMN07-GF066BG1	BL	G3	C	W	W	11	322.8	14.0	4.2	336.8	162.7	48.3	160.1	47.5	47.5
85		W					8	258.5	17.1	6.2	275.7	103.8	37.7	154.7	56.1	56.1
86																
87	NDMN07-GF106BG1	BL	G3	C	W	Cream	8	368.6	6.0	1.6	374.6	83.0	22.2	285.5	76.2	76.2
88		W					8	325.8	8.6	2.6	334.4	69.7	20.8	256.1	76.6	76.6
89																
90	NDMN07-W150BG1	BL	G3	C	W	W	11	465.6	4.7	1.0	470.3	109.8	23.4	355.7	75.6	75.6
91		W					8	372.5	5.7	1.5	378.2	75.0	19.8	297.5	78.7	78.7
92																
93	NDMN07-W151BG1	BL	G3	C	W	W	9	253.7	0.0	0.0	253.7	134.9	53.2	118.8	46.8	46.8
94		W					6	246.6	0.0	0.0	246.6	71.3	28.9	175.3	71.1	71.1
95																
96	NDMN07-W152BG1	BL	G3	C	W	W	10	577.3	8.7	1.5	586.0	73.3	12.5	504.1	86.0	86.0
97		W					8	397.1	0.0	0.0	397.1	61.1	15.4	336.0	84.6	84.6
98																
99	NDMN07-W159BG1	BL	G3	C	W	Cream	16	495.6	0.0	0.0	495.6	263.3	53.1	232.3	46.9	46.9
100		W					9	407.3	0.0	0.0	407.3	84.2	20.7	323.1	79.3	79.3
101																

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

					Size Distribution												
			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	B's		A's		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	%
102	NDMN07-W160BG1	BL	G3	C	W	Cream	15	501.8	0.0	0.0	501.8	236.4	47.1	265.4	52.9	52.9
103		W					10	368.2	4.7	1.3	372.9	116.6	31.3	251.6	67.5	67.5
104																
105	NDMN07-W161BG1	BL	G3	C	W	Cream	10	269.8	2.9	1.1	272.7	161.0	59.0	108.8	39.9	39.9
106		W					6	191.5	0.0	0.0	191.5	77.9	40.7	113.6	59.3	59.3
107																
108	NDMN07-W162BG1	BL	G3	C	W	Cream	7	180.0	0.0	0.0	180.0	109.1	60.6	70.9	39.4	39.4
109		W					8	328.9	0.0	0.0	328.9	81.6	24.8	247.3	75.2	75.2
110																
111	NDMN07-W162WG1	BL	G3	C	W	Cream	9	262.3	0.0	0.0	262.3	122.3	46.6	140.1	53.4	53.4
112		W					6	281.1	0.0	0.0	281.1	49.1	17.5	232.0	82.5	82.5
113																
114	NDMN07-W169BG1	BL	G3	C	W	W	11	386.2	7.3	1.8	393.4	144.1	36.6	242.0	61.5	61.5
115		W					8	288.8	3.7	1.3	292.6	94.8	32.4	194.0	66.3	66.3
116																
117	COMN08-W041WG1	W	G2	C	W	Cream	5	178.8	2.1	1.2	180.9	54.8	30.3	124.0	68.5	68.5
118																
119	COMN08-W132WG1	W	G2	C	W	Cream	6	248.3	0.0	0.0	248.3	52.5	21.1	195.8	78.9	78.9
120																
121	COMN08-W135WG1	W	G2	C	W	Cream	5	268.2	7.6	2.8	275.8	30.1	10.9	238.1	86.3	86.3
122																
123	COMN08-W145WG1	W	G2	C	W	W	4	266.2	6.3	2.3	272.5	19.3	7.1	246.9	90.6	90.6
124																
125	COMN08-W147WG1TJ	W	G2	C	W	W	7	265.8	0.0	0.0	265.8	81.6	30.7	184.2	69.3	69.3
126																
127	COMN08-W150WG1	W	G2	C	W	W	8	268.3	0.0	0.0	268.3	93.8	35.0	174.5	65.0	65.0
128																
129	NDMN08-B025WG1	W	G2	C	W	W	8	407.7	0.0	0.0	407.7	62.2	15.3	345.5	84.7	84.7
130																
131	NDMN08-B026BG1	BL	G2	C	W	Cream	12	489.4	2.8	0.6	492.2	137.4	27.9	352.0	71.5	71.5
132																
133	NDMN08-B026WG1	W	G2	C	W	Cream	7	217.1	4.8	2.2	221.9	91.7	41.3	125.4	56.5	56.5
134																
135	NDMN08-B032BG1	BL	G2	C	W	Cream	8	224.4	0	0.0	224.4	116.2	51.8	108.3	48.2	48.2

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's		A's		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	%
136																
137	NDMN08-B035BG1	BL	G2	C	W	Cream	5	194.5	0	0.0	194.5	42.5	21.8	152.0	78.2	78.2
138																
139	NDMN08-B035WG1	W	G2	C	W	Cream	7	317.7	10.8	3.3	328.5	55.2	16.8	262.5	79.9	79.9
140																
141	NDMN08-B036BG1	BL	G2	C	W	Cream	11	347.7	0	0.0	347.7	148.3	42.7	199.4	57.3	57.3
142																
143	NDMN08-B037BG1	BL	G2	C	W	W	11	369.0	5.2	1.4	374.2	135.5	36.2	233.5	62.4	62.4
144																
145	NDMN08-B039WG1	W	G2	C	W	W	7	266.4	0.0	0.0	266.4	68.6	25.7	197.9	74.3	74.3
146																
147	NDMN08-B046BG1	BL	G2	C	W	Cream	6	221.6	0	0.0	221.6	65.7	29.6	156.0	70.4	70.4
148																
149	NDMN08-B046WG1	W	G2	C	W	Cream	13	346.9	12.5	3.5	359.4	186.7	51.9	160.2	44.6	44.6
150																
151	NDMN08-B050WG1	W	G2	C	W	Cream	6	288.8	7.0	2.4	295.9	58.9	19.9	229.9	77.7	77.7
152																
153	NDMN08-B062WG1	W	G2	C	W	W	6	276.6	33.4	10.8	310.1	45.5	14.7	231.1	74.5	74.5
154																
155	NDMN08-B072WG1	W	G2	C	W	Cream	8	343.0	0.0	0.0	343.0	64.8	18.9	278.1	81.1	81.1
156																
157	NDMN08-B074WG1	W	G2	C	W	W	6	146.8	8.3	5.3	155.1	86.5	55.8	60.3	38.9	38.9
158																
159	NDMN08-B083WG1	W	G2	C	W	Cream/Purple	9	297.1	0.0	0.0	297.1	135.8	45.7	161.4	54.3	54.3
160																
161	NDMN08-B084WG1	W	G2	C	W	Cream	7	253.1	0.0	0.0	253.1	96.4	38.1	156.7	61.9	61.9
162																
163	NDMN08-B085WG1	W	G2	C	W	Cream	10	381.7	4.8	1.2	386.6	109.3	28.3	272.5	70.5	70.5
164																
165	NDMN08-B086BG1	BL	G2	C	W	Cream	13	315.6	0	0.0	315.6	221.3	70.1	94.3	29.9	29.9
166																
167	NDMN08-B094BG1	BL	G2	C	W	Cream	11	294.5	0	0.0	294.5	192.7	65.5	101.7	34.5	34.5
168																
169	NDMN08-B095BG1	BL	G2	C	W	Cream	6	222.0	0	0.0	222.0	97.2	43.8	124.7	56.2	56.2

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

Sort 1	Clone	Loc	2010 Trial	Mkt	Color Skin	Color Flesh	Tubers #/plant	Mkt Yld Cwtyld	Culls Cwtyld	Culls %	Total Yld Cwtyld	Size Distribution B's Cwtyld	B's %	A's Cwtyld	A's %	US #1 %
170																
171	NDMN08-B097BG1	BL	G2	C	W	Cream	11	379.9	1.7	0.5	381.6	145.6	38.1	234.3	61.4	61.4
172																
173	NDMN08-B097WG1	W	G2	C	W	Cream	9	329.6	12.4	3.6	341.9	109.0	31.9	220.5	64.5	64.5
174																
175	NDMN08-B098BG1	BL	G2	C	W	Cream	5	173.9	3.1	1.8	177.0	67.0	37.9	106.9	60.4	60.4
176																
177	NDMN08-B101BG1	BL	G2	C	W	W	9	358.6	8.2	2.2	366.8	111.8	30.5	246.8	67.3	67.3
178																
179	NDMN08-B101WG1	W	G2	C	W	W	8	319.7	5.6	1.7	325.3	67.8	20.9	251.9	77.4	77.4
180																
181	NDMN08-B102WG1	W	G2	C	W	W	7	325.6	1.3	0.4	326.9	56.5	17.3	269.1	82.3	82.3
182																
183	NDMN08-B107BG1	BL	G2	C	W	W	11	361.8	15.0	4.0	376.9	146.1	38.8	215.7	57.2	57.2
184																
185	NDMN08-B110WG1	W	G2	C	W	W	5	328.9	0.0	0.0	328.9	31.3	9.5	297.6	90.5	90.5
186																
187	NDMN08-B113WG1	W	G2	C	W	Cream	7	328.2	21.1	6.0	349.3	46.3	13.3	281.9	80.7	80.7
188																
189	NDMN08-B114BG1	BL	G2	C	W	Cream	10	351.1	0	0.0	351.1	129.6	36.9	221.5	63.1	63.1
190																
191	NDMN08-B117WG1	W	G2	C	W	W	8	360.6	0.0	0.0	360.6	69.2	19.2	291.4	80.8	80.8
192																
193	NDMN08-B118BG1	BL	G2	C	W	Cream	8	364.6	18.0	4.7	382.6	75.0	19.6	289.6	75.7	75.7
194																
195	NDMN08-B130WG1	W	G2	C	W	Cream	7	264.9	22.4	7.8	287.3	63.4	22.1	201.5	70.1	70.1
196																
197	NDMN08-B137BG1	BL	G2	C	W	Cream	6	207.4	0	0.0	207.4	64.0	30.8	143.5	69.2	69.2
198																
199	NDMN08-B137WG1	W	G2	C	W	Cream	8	321.6	10.0	3.0	331.6	70.0	21.1	251.7	75.9	75.9
200																
201	NDMN08-B183WG1	W	G2	C	W	W	10	400.2	76.8	16.1	477.0	65.9	13.8	334.3	70.1	70.1
202																
203	NDMN08-B184WG1	W	G2	C	W	W	6	235.8	3.8	1.6	239.6	46.3	19.3	189.5	79.1	79.1

Table 6. Chip yields at 2 irrigated locations; Becker, MN[1] & Williston, ND[2].2010

			2010		Color		Tubers	Mkt Yld	Culls		Total Yld	Size Distribution B's		Size Distribution A's		US #1
Sort 1	Clone	Loc	Trial	Mkt	Skin	Flesh	#/plant	Cwtyld	Cwtyld	%	Cwtyld	Cwtyld	%	Cwtyld	%	%
204																
205	NDMN08-B187WG1	W	G2	C	W	W	7	377.2	18.3	4.6	395.5	58.4	14.8	318.8	80.6	80.6
206																
207	NDMN08-B189BG1	BL	G2	C	W	Cream	9	387.5	28.0	6.7	415.5	114.8	27.6	272.7	65.6	65.6
208																
209	NDMN08-B189WG1	W	G2	C	W	W	7	297.8	11.9	3.9	309.7	73.2	23.6	224.6	72.5	72.5
210																
211	NDMN08-W102WG1	W	G2	C	W	W	9	409.6	2.8	0.7	412.4	77.6	18.8	332.0	80.5	80.5
212																
213	MSL211-3	BL	NCR	C	W	Cream	14	673.5	4.9	0.7	678.4	135.1	19.9	538.4	79.4	79.4
214																
215	MSL268-D	BL	NCR	C	W	Cream	15	707.9	31.5	4.3	739.4	145.7	19.7	562.3	76.0	76.0
216																
217	MSM182-1	BL	NCR	C	W	Cream	15	595.0	0.0	0.0	595.0	189.2	31.8	405.8	68.2	68.2
218																
219	MSQ176-5	BL	NCR	C	W	Cream	12	537.3	0.0	0.0	537.3	110.9	20.6	426.4	79.4	79.4
220																
221	ND8307C-3	BL	NCR	C	W	Cream	12	405.4	2.7	0.7	408.2	179.3	43.9	226.1	55.4	55.4
222																
223	W2717-5	BL	NCR	C	W	Cream	12	470.6	6.3	1.3	476.9	127.4	26.7	343.2	72.0	72.0
224																
225	W2978-3	BL	NCR	C	W	Cream	14	593.1	0.0	0.0	593.1	145.0	24.5	448.0	75.5	75.5
226																
227	W5015-12	BL	NCR	C	W	Cream	14	534.5	0.0	0.0	534.5	169.7	31.8	364.7	68.2	68.2

Table 7. Common Scab trials at Becker, MN[1.] 2010

			2010		Color			I/C[3]			
Sort	**Loc**	**Clone**	**Trial**	**Mkt**	**Skin**	**Flesh**	**Type[2]**	R1	R2	R3	**Area[4]**
1	Bscab	**Atlantic**	Nscab	C	W	W	3	C	3	3	4
2	Bscab	**NorValley**	**Chk**	C	W	Cream	3	C	3		1.5
3	Bscab	**Red Norland**	**Chk**	FM	Red	W	1	I	1		1.5
4	Bscab	**Red Pontiac**	**Chk**	FM	Red	Cream	3	C	3		5
5	Bscab	**Russet Norkotah**	**Chk**	FM	Rus	Cream	2.5	C	2		2.5
6	Bscab	**Shepody**	**Chk**	FF	LW	W	3	C	3		5
7	Bscab	**Snowden**	**Chk**	C	W	W	3	C	3		4.5
8	Bscab	**Y. Gold**	**Chk**	FM	W	Yel	3	C	3		3.5
9	Bscab	MN 15620	G17	FF	Red	Yel	3	I	3		2.5
10	Bscab	MN 96013-1	G14	FM	Red	Yel-dk	3	C	3		2
11	Bscab	MN 96072-4	G14	FM	Red	W	3	C	3		3.5
12	Bscab	MN 99460-14	G11	FM	Red	W	2.5	C	2		2
13	Bscab	MN 00467-4	G10	C	W	W	1.5	I	2		1
14	Bscab	MN 02 419	G8	FF	LW	Cream	2.5	C	2		4
15	Bscab	MN 02 467	G8	FM/FF	Rus	Yel-lt	2.5	I	3		1
16	Bscab	MN 02 588	G8	C	W	W	2.5	I	2		2.5
17	Bscab	MN 02 598	G8	C/FM	W	Yel-lt	3	C	3		4
18	Bscab	MN 02 616	G8	FM	Red	Yel-dk	3	I	3		2
19	Bscab	MN 02 696	G8	C	W	W	2.5	C	2		2
20	Bscab	AOMN 03178-2	G7	FF	Rus lt.	W	1	0	2		0.5
21	Bscab	ATMN 03505-3	G7	FM	Red	Cream	2	I	3		2
22	Bscab	COMN 03021-1	G7	FM	Red	Cream	2	C	2		2
23	Bscab	COMN 03027-1	G7	FM	Red	Cream	2.5	C	2		3.5
24	Bscab	NDMN 03324-4	G7	C	W	Cream	2	I	2		2.5
25	Bscab	AOMN 041101-01	G6	FF	LW	W	1.5	I	1		1.5
26	Bscab	COMN 04702-03	G6	FF	Rus	Cream	2	I	3		1.5
27	Bscab	NDMN 04910-01	G6	C	W	Cream	2.5	C	2		3
28	Bscab	NDMN 04911-01	G6	C	W	W	2	C	2		4
29	Bscab	AOMN 06077-01	G4	FF	Rus	Cream	2	I	2		2
30	Bscab	AOMN 06107-01	G4	FF	Rus	Cream	0	0	0		0
31	Bscab	AOMN 06118-01	G4	FF	Rus	Cream	0.5	0	1		0.5
32	Bscab	AOMN 06126-02	G4	FF	Rus	Cream	3	C	3		4
33	Bscab	AOMN 06131-01	G4	FF	Rus	W	3	I	3		2
34	Bscab	AOMN 06147-05	G4	FF	Rus	Cream	1.5	I	2		2.5
35	Bscab	AOMN 06150-02	G4	C	W	Cream	3	C	3		2.5
36	Bscab	AOMN 06153-01 S.D.	G4	FF	Rus	W	3	I	3		3
37	Bscab	AOMN 06174-01 S.D.	G4	FF	Rus	Cream	3	C	3		3.5
38	Bscab	COMN 06332-01	G4	FF	Rus	W	2	I	1		1
39	Bscab	COMN 06363-01	G4	FF	Rus	Cream	3	I	3		2.5
40	Bscab	COMN 06379-02	G4	FF	Rus	W	1.5	I	0		0.5
41	Bscab	COMN 06392-01	G4	FF	Rus	W	1.5	I	1		2
42	Bscab	WIMN 06030-01	G4	FM	Red	W	2	C	2		3.5
43	Bscab	COMN07-B023BG1	G3	FF	Rus	Cream	2	C	2		2.5
44	Bscab	COMN07-B028BG1	G3	FF	Rus	Cream	3	C	3		3
45	Bscab	COMN07-B041BG1	G3	FF	Rus	W	3	C	3		5
46	Bscab	COMN07-B050BG1	G3	FF	Rus	Cream	2	I	2		1.5
47	Bscab	COMN07-B051BG1	G3	FF	Rus	Cream	1.5	I	1		1
48	Bscab	COMN07-B061BG1	G3	FF	Rus	Cream	2.5	I	3		2
49	Bscab	COMN07-B095BG1	G3	FF	Rus	Cream	2	C	2		2.5
50	Bscab	COMN07-B132BG1	G3	FF	Rus	Cream	1	I	1		1
51	Bscab	COMN07-B134BG1	G3	FF	Rus	Cream	3	C	3		3
52	Bscab	COMN07-B139BG1	G3	FF	Rus	Cream	3	C	3		2.5
53	Bscab	COMN07-B141BG1	G3	FF	Rus	W	3	C	3		4.5
54	Bscab	COMN07-B144BG1	G3	FF	Rus	Cream	0	0	0		0
55	Bscab	COMN07-B217BG1	G3	FM	Red	W	3	C	3		4
56	Bscab	COMN07-B248WG1	G3	FM	Red	Yel	2.5	C	2		3.5
57	Bscab	COMN07-GF174WG1	G3	FF	Rus	Cream	3	C	3		5.5
58	Bscab	COMN07-GF179BG1	G3	FF	Rus	W	2	I	1		1
59	Bscab	COMN07-GF188BG1	G3	FF	Rus	Cream	3	C	3		4.5
60	Bscab	COMN07-GF198BG1	G3	FF	Rus	Cream	3	I	3		3
61	Bscab	COMN07-GF206BG1	G3	FF	Rus	Cream	0.5	0	1		0.5
62	Bscab	COMN07-GF222WG1	G3	FF	Rus	Cream	1.5	I	2		1
63	Bscab	COMN07-GF286BG1	G3	FM	Red	Yel	2.5	C	2		2
64	Bscab	COMN07-GF310BG1	G3	C	W	W	2.5	C	2		2.5
65	Bscab	COMN07-GF315BG1	G3	C	W/W	XX	2	I	2		2
66	Bscab	COMN07-W034WG1	G3	FF	Rus	W	1	C	1		1.5

Table 7. Common Scab trials at Becker, MN[1,] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
67	Bscab	COMN07-W067BG1	G3	FF	Rus It	Cream	1.5	I	1		1.5
68	Bscab	COMN07-W073BG1	G3	FM	Red	Cream	1.5	I	1		1.5
69	Bscab	COMN07-W090BG1	G3	FM	Red/Red	XX	3	C	3		3.5
70	Bscab	COMN07-W109BG1	G3	FM	Red	Cream	2.5	C	3		5
71	Bscab	COMN07-W112BG1	G3	FM	W/Purple	Purple/W	3	I	3		2
72	Bscab	COMN07-W199BG1	G3	FF	W/Rus	XX	3	I	3		3
73	Bscab	COMN07-W201BG1	G3	C	W/W	XX	2	C	3		4
74	Bscab	COMN07-W203BG1	G3	C	W	Cream	3	I	3		3
75	Bscab	NDMN07-B266BG1	G3	C	Rus/W	XX	2.5	C	2		3
76	Bscab	NDMN07-B269BG1	G3	C	Rus/W	XX	3	C	3		5
77	Bscab	NDMN07-B272BG1	G3	C	Rus/W	XX	3	I	3		3
78	Bscab	NDMN07-B289BG1	G3	C	Rus/W	XX	2.5	C	2		1.5
79	Bscab	NDMN07-B302BG1	G3	C	W	W	3	C	3		4.5
80	Bscab	NDMN07-B309BG1	G3	C	W	W	3	I	3		3
81	Bscab	NDMN07-B311BG1	G3	C	W	Cream	3	C	3		4.5
82	Bscab	NDMN07-B312BG1	G3	C	W	W	1.5	C	1		1.5
83	Bscab	NDMN07-B322BG1	G3	C	W	Cream	3	C	3		3.5
84	Bscab	NDMN07-B326BG1	G3	C	W	Yel-lt.	3	I	3		3.5
85	Bscab	NDMN07-B330BG1	G3	C	W/Red splash	Cream/red splash	2	C	1		1.5
86	Bscab	NDMN07-GF040BG1	G3	FM	Red/Red	XX	2	I	2		1.5
87	Bscab	NDMN07-GF045BG1	G3	C	W/W	XX	3	C	3		6
88	Bscab	NDMN07-GF056BG1	G3	C	W	Yel-lt.	1.5	0	3		2
89	Bscab	NDMN07-GF066BG1	G3	C	W	W	1.5	0	3		2
90	Bscab	NDMN07-GF106BG1	G3	C	W	Cream	2	C	2		3.5
91	Bscab	NDMN07-W146BG1	G3	FF	Rus	Cream	3	C	3		4
92	Bscab	NDMN07-W150BG1	G3	C	W/W / red	XX	1.5	C	2		2.5
93	Bscab	NDMN07-W151BG1	G3	C	W/W	XX	1.5	C	1		3
94	Bscab	NDMN07-W152BG1	G3	C	W	W	3	C	3		3.5
95	Bscab	NDMN07-W153BG1	G3	C	W	Cream	3	C	3		3
96	Bscab	NDMN07-W159BG1	G3	C	W	Cream	3	C	3		4
97	Bscab	NDMN07-W160BG1	G3	C	W/W	XX	2.5	C	3		5.5
98	Bscab	NDMN07-W161BG1	G3	C	W	W	2.5	I	3		4
99	Bscab	NDMN07-W162BG1	G3	C	W/W	XX	1.5	I	1		2
100	Bscab	NDMN07-W162WG1	G3	C	W	Cream	1.5	I	1		1
101	Bscab	NDMN07-W169BG1	G3	C	W/W	XX	2.5	C	2		4
102	Bscab	NDMN07-W173BG1	G3	C	W/W	XX	3	C	3		4.5
103	Bscab	ORMN07-B257BG1	G3	FF	Rus	Cream	2	I	2		2
104	Bscab	ORMN07-GF011BG1	G3	FF	Rus	Cream	3	C	3		4
105	Bscab	ORMN07-GF014BG1	G3	FF	Rus	W	2.5	C	2		4
106	Bscab	ORMN07-W127WG1	G3	FF	Rus	Cream	3	C	3		3.5
107	Bscab	ORMN07-W129WG1	G3	FF	Rus	xW	2.5	C	3		4
108	Bscab	COMN08-B001BG1	G2	FM	Red	x	0	0			0
109	Bscab	COMN08-B006BG1	G2	FM	Red	x	NA	X			NA
110	Bscab	COMN08-B008BG1	G2	FM	Red	x	1	I			1
111	Bscab	COMN08-B011WG1	G2	FM	Red	x	2	C			5
112	Bscab	COMN08-B015BG1	G2	FM	Red	x	3	I			2
113	Bscab	COMN08-B019BG1	G2	FM	Red	x	2	I			1
114	Bscab	COMN08-B024BG1	G2	FM	Red	x	2	I			2
115	Bscab	COMN08-B122BG1	G2	FM	Red	x	0	0			0
116	Bscab	COMN08-B126WG1TJ	G2	FM	Red	x	1	I			1
117	Bscab	COMN08-B128BG1	G2	FM	Red	x	2	I			1
118	Bscab	COMN08-B128WG1	G2	FM	Red	x	2	I			1
119	Bscab	COMN08-B140WG1	G2	FF	Rus	x	3	C			4
120	Bscab	COMN08-B147BG1	G2	FF	Rus	x	2	C			3
121	Bscab	COMN08-B155WG1	G2	FF	Rus	x	NA	X			NA
122	Bscab	COMN08-B158BG1	G2	FF	Rus	x	1	I			1
123	Bscab	COMN08-B160BG1	G2	FF	Rus	x	3	C			2
124	Bscab	COMN08-B166BG1CT	G2	FF	Rus	x	0	0			0
125	Bscab	COMN08-B173WG1	G2	FF	Rus	x	0	0			0
126	Bscab	COMN08-B175WG1	G2	FF	Rus	x	3	C			4
127	Bscab	COMN08-B177BG1	G2	FF	Rus	x	3	C			4
128	Bscab	COMN08-B178BG1	G2	FF	Rus	x	2	I			2
129	Bscab	COMN08-B180WG1	G2	FM	Rus	x	3	C			4
130	Bscab	COMN08-B224WG1	G2	C	W	x	3	C			6
131	Bscab	COMN08-B225WG1	G2	C	W	x	3	C			3
132	Bscab	COMN08-W001WG1TJ	G2	FM	Red	x	1	C			3

Table 7. Common Scab trials at Becker, MN[1.]2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
133	Bscab	COMN08-W006BG1	G2	FM	Red	x	0	0			0
134	Bscab	COMN08-W009WG1	G2	FM	Red	x	2	I			2
135	Bscab	COMN08-W015WG1TJ	G2	FM	Red	x	1	C			2
136	Bscab	COMN08-W018BG1	G2	FM	Red	x	2	C			2
137	Bscab	COMN08-W020WG1	G2	FM	Red	x	2	C			3
138	Bscab	COMN08-W025WG1	G2	FM	Red	x	3	C			2
139	Bscab	COMN08-W027BG1	G2	FM	Red	x	2	I			1
140	Bscab	COMN08-W031BG1	G2	FM	Red	x	2	I			1
141	Bscab	COMN08-W031WG1	G2	FM	Red	x	2	I			2
142	Bscab	COMN08-W034WG1TJ	G2	FM	Red	x	3	I			2
143	Bscab	COMN08-W036BG1	G2	FM	Red	x	3	I			2
144	Bscab	COMN08-W040WG1	G2	FM	Red	x	3	C			4
145	Bscab	COMN08-W041WG1	G2	C	Red	x	3	C			3
146	Bscab	COMN08-W054BG1	G2	FF	Red	x	3	I			1
147	Bscab	COMN08-W055BG1	G2	FM	Red	x	3	C			3
148	Bscab	COMN08-W057WG1	G2	FM	Red	x	3	C			4
149	Bscab	COMN08-W058WG1	G2	FM	Red	x	NA	X			NA
150	Bscab	COMN08-W059BG1	G2	FM	W	x	3	C			4
151	Bscab	COMN08-W059WG1TJ	G2	FM	W	x	2	C			3
152	Bscab	COMN08-W060BG1	G2	FM	W	x	2	C			1
153	Bscab	COMN08-W063WG1OM	G2	FF	W	x	3	C			3
154	Bscab	COMN08-W112WG1	G2	FF	Rus	x	0	0			0
155	Bscab	COMN08-W113WG1	G2	FF	Rus	x	1	I			1
156	Bscab	COMN08-W114WG1	G2	FF	Rus	x	3	I			2
157	Bscab	COMN08-W115WG1	G2	FF	Rus	x	3	I			1
158	Bscab	COMN08-W116WG1	G2	FF	Rus	x	3	C			3
159	Bscab	COMN08-W117WG1	G2	FF	Rus	x	NA	C			2
160	Bscab	COMN08-W118WG1	G2	FF	Rus	x	3	C			6
161	Bscab	COMN08-W126WG1	G2	FF	Rus	x	2	I			1
162	Bscab	COMN08-W132WG1	G2	C	W	x	3	I			2
163	Bscab	COMN08-W135WG1	G2	C	W	x	3	I			1
164	Bscab	COMN08-W145WG1	G2	C	W	x	2	C			3
165	Bscab	COMN08-W147WG1TJ	G2	C	W	x	3	C			3
166	Bscab	COMN08-W150WG1	G2	C	W	x	3	C			3
167	Bscab	NDMN08-B025WG1	G2	C	W	x	3				3
168	Bscab	NDMN08-B026BG1	G2	C	W	x	2	C			5
169	Bscab	NDMN08-B026WG1	G2	C	W	x	0	0			0
170	Bscab	NDMN08-B032BG1	G2	C	W	x	3	I			2
171	Bscab	NDMN08-B035BG1	G2	C	W	x	0	0			0
172	Bscab	NDMN08-B035WG1	G2	C	W	x	3	C			3
173	Bscab	NDMN08-B036BG1	G2	C	W	x	3	C			3
174	Bscab	NDMN08-B037BG1	G2	C	W	x	1	I			1
175	Bscab	NDMN08-B039WG1	G2	C	W	x	1	I			1
176	Bscab	NDMN08-B046BG1	G2	C	W	x	NA	X			NA
177	Bscab	NDMN08-B046WG1	G2	C	W	x	3	I			2
178	Bscab	NDMN08-B050WG1	G2	C	W	x	3	C			4
179	Bscab	NDMN08-B062WG1	G2	C	W	x	3	C			5
180	Bscab	NDMN08-B072WG1	G2	C	W	x	2	I			2
181	Bscab	NDMN08-B074WG1	G2	C	W	x	2	I			1
182	Bscab	NDMN08-B083WG1	G2	C	W	x	3	I			2
183	Bscab	NDMN08-B084GFG1	G2	C	W	x	2	C			4
184	Bscab	NDMN08-B085WG1	G2	C	W	x	NA	X			NA
185	Bscab	NDMN08-B086BG1	G2	C	W	x	3	C			2
186	Bscab	NDMN08-B094BG1	G2	C	W	x	2	C			4
187	Bscab	NDMN08-B095BG1	G2	C	W	x	3	C			3
188	Bscab	NDMN08-B097BG1	G2	C	W	x	3	C			4
189	Bscab	NDMN08-B097WG1	G2	C	W	x	3	C			4
190	Bscab	NDMN08-B098BG1	G2	C	W	x	2	I			1
191	Bscab	NDMN08-B101BG1	G2	C	W	x	3	C			4
192	Bscab	NDMN08-B101WG1	G2	C	W	x	2	C			4
193	Bscab	NDMN08-B102WG1	G2	C	W	x	2	C			3
194	Bscab	NDMN08-B107BG1	G2	C	W	x	3	I			1
195	Bscab	NDMN08-B110GFG1	G2	C	W	x	NA	X			NA
196	Bscab	NDMN08-B110WG1	G2	C	W	x	1	I			1
197	Bscab	NDMN08-B113WG1	G2	C	W	x	3	C			4
198	Bscab	NDMN08-B114BG1	G2	C	W	x	2	I			1

Table 7. Common Scab trials at Becker, MN[1.] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
199	Bscab	NDMN08-B117WG1	G2	C	W	x	3	C			6
200	Bscab	NDMN08-B118BG1	G2	C	W	x	3	C			4
201	Bscab	NDMN08-B130WG1	G2	C	W	x	3	C			4
202	Bscab	NDMN08-B133WG1	G2	C	W	x	0	0			0
203	Bscab	NDMN08-B137BG1	G2	C	W	x	1	I			1
204	Bscab	NDMN08-B137WG1	G2	C	W	x	3	C			4
205	Bscab	NDMN08-B183WG1	G2	C	W	x	3	I			2
206	Bscab	NDMN08-B184WG1	G2	C	W	x	3	C			4
207	Bscab	NDMN08-B187WG1	G2	C	W	x	3	I			2
208	Bscab	NDMN08-B188GFG1	G2	C	W	x	NA	X			NA
209	Bscab	NDMN08-B189BG1	G2	C	W	x	3	I			2
210	Bscab	NDMN08-B189WG1	G2	C	W	x	2	I			1
211	Bscab	NDMN08-W102WG1	G2	C	W	x	2	C			3
212	Bscab	ORMN08-B198WG1	G2	FF	Mix	x	2	I			2
213	Bscab	ORMN08-B203WG1	G2	FF	Mix	x	1	I			1
214	Bscab	ORMN08-B204WG1	G2	FF	Mix	x	0	0			0
215	Bscab	ORMN08-B206WG1	G2	C/FM	Mix	x	1	I			1
216	Bscab	ORMN08-B207WG1	G2	FF	Mix	x	0	0			0
217	Bscab	ORMN08-B213WG1	G2	FF	Mix	x	3	C			4
218	Bscab	ORMN08-B221BG1	G2	FF	Mix	x	3	C			2
219	Bscab	ORMN08-W072WG1	G2	C/FM	Mix	x	3	I			2
220	Bscab	CV00047-3	NCR	FF	Rus	x	2	X	2		2
221	Bscab	CV99222-2	NCR	FF	Rus	x	3	C	3		4
222	Bscab	MSL211-3	NCR	C	W	x	2.5	I	2		2
223	Bscab	MSL268-D	NCR	C	W	x	3	I	3		3
224	Bscab	MSM182-1	NCR	C	W	x	2.5	C	2		3.5
225	Bscab	MSQ176-5	NCR	C	W	x	2	C	2		5
226	Bscab	ND8229-3	NCR	C	W	x	2.5	I	2		1.5
227	Bscab	ND8307C-3	NCR	C	W	x	2	I	2		1.5
228	Bscab	ND8314-1R	NCR	FM	Red	x	3	C	3		3
229	Bscab	ND8555-8R	NCR	FM	Red	x	2	I	2		2.5
230	Bscab	W2609-1R	NCR	FM	Red	x	1.5	I	1		2
231	Bscab	W2717-5	NCR	C	W	x	3	I	3		1.5
232	Bscab	W2978-3	NCR	C	W	x	3	C	3		4
233	Bscab	W5015-12	NCR	C	W	x	3	C	3		5
234	Bscab	W8946-1rus	NCR	FF	Rus	x	1.5	I	1		1
235	Bscab	A-32	NCBT	C	W	x	3	I			1
236	Bscab	A91814-5	NCBT	C	W	x	3	C			6
237	Bscab	AC00206-2W	NCBT	C	W	x	3	C			6
238	Bscab	AC01151-5W	NCBT	C	W	x	3	C			6
239	Bscab	AC03433-1W	NCBT	C	W	x	3	C			4
240	Bscab	AC03452-2W	NCBT	C	W	x	2	I			3
241	Bscab	AF4139-1	NCBT	C	W	x	3	I			1
242	Bscab	AF4147-1	NCBT	C	W	x	2	I			2
243	Bscab	AF4148-1	NCBT	C	W	x	3	C			3
244	Bscab	AF4149-1	NCBT	C	W	x	2	I			1
245	Bscab	AF4157-6	NCBT	C	W	x	3	C			6
246	Bscab	AF4240-3	NCBT	C	W	x	3	I			4
247	Bscab	AF4240-5	NCBT	C	W	x	2	C			3
248	Bscab	AF4240-6	NCBT	C	W	x	3	C			6
249	Bscab	AF4252-1	NCBT	C	W	x	2	C			4
250	Bscab	AF4252-3	NCBT	C	W	x	2	I			2
251	Bscab	AF4254-2	NCBT	C	W	x	3	C			4
252	Bscab	AF4307-1	NCBT	C	W	x	3	C			4
253	Bscab	AF4363-2	NCBT	C	W	x	3	C			4
254	Bscab	AF4363-5	NCBT	C	W	x	3	I			3
255	Bscab	AF4369-2	NCBT	C	W	x	3	C			6
256	Bscab	AO0188-3C	NCBT	C	W	x	1	I			2
257	Bscab	AO0206-1C	NCBT	C	W	x	3	C			4
258	Bscab	AO0466-1LBC	NCBT	C	W	x	1	I			2
259	Bscab	AO1143-3C	NCBT	C	W	x	1	I			2
260	Bscab	AO2515-2	NCBT	C	W	x	3	C			5
261	Bscab	AO3471-7C	NCBT	C	W	x	3	C			3
262	Bscab	AO3913-101LBY	NCBT	C	W	x	2	C			3
263	Bscab	AO5463-5C	NCBT	C	W	x	3	I			2
264	Bscab	AOMN 06150-02	NCBT	C	W	Cream	3	C			4

Table 7. Common Scab trials at Becker, MN[1.] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
265	Bscab	AOTX95295-1W	NCBT	C	W	x	2	I			1
266	Bscab	AOTX95309-3W	NCBT	C	W	x	3	I			3
267	Bscab	**Atlantic**	NCBT	C	W	x	3	C			4
268	Bscab	ATX85404-8W	NCBT	C	W	x	3	I			3
269	Bscab	B-166	NCBT	C	W	x	3	I			3
270	Bscab	B-190	NCBT	C	W	x	3	C			4
271	Bscab	B-191	NCBT	C	W	x	3	C			3
272	Bscab	B2721-1	NCBT	C	W	x	3	C			6
273	Bscab	B2721-10	NCBT	C	W	x	3	C			6
274	Bscab	B2721-101	NCBT	C	W	x	3	I			2
275	Bscab	B2721-105	NCBT	C	W	x	3	C			4
276	Bscab	B2721-121	NCBT	C	W	x	3	I			2
277	Bscab	B2721-123	NCBT	C	W	x	3	C			4
278	Bscab	B2721-13	NCBT	C	W	x	3	C			6
279	Bscab	B2721-141	NCBT	C	W	x	3	C			3
280	Bscab	B2721-15	NCBT	C	W	x	3	I			3
281	Bscab	B2721-159	NCBT	C	W	x	2	I			2
282	Bscab	B2721-18	NCBT	C	W	x	3	I			3
283	Bscab	B2721-22	NCBT	C	W	x	3	C			4
284	Bscab	B2721-40	NCBT	C	W	x	3	C			4
285	Bscab	B2721-42	NCBT	C	W	x	3	C			4
286	Bscab	B2721-47	NCBT	C	W	x	3	C			5
287	Bscab	B2721-63	NCBT	C	W	x	3	C			5
288	Bscab	B2721-64	NCBT	C	W	x	3	I			3
289	Bscab	B2721-67	NCBT	C	W	x	2	I			1
290	Bscab	B2721-73	NCBT	C	W	x	3	C			5
291	Bscab	B2721-78	NCBT	C	W	x	3	C			6
292	Bscab	B2721-93	NCBT	C	W	x	3	C			5
293	Bscab	B2721-96	NCBT	C	W	x	3	I			1
294	Bscab	B-70	NCBT	C	W	x	3	I			1
295	Bscab	B-94	NCBT	C	W	x	0	0			0
296	Bscab	**Beacon Chipper**	NCBT	C	W	x	2	I			2
297	Bscab	**Boulder**	NCBT	C	W	x	2	C			5
298	Bscab	C-118	NCBT	C	W	x	2	I			1
299	Bscab	C-172	NCBT	C	W	x	1	I			1
300	Bscab	CO00188-4W	NCBT	C	W	x	2	C			3
301	Bscab	CO00197-3W	NCBT	C	W	x	3	C			4
302	Bscab	CO00270-7W	NCBT	C	W	x	3	C			4
303	Bscab	CO02024-9W	NCBT	C	W	x	3	C			5
304	Bscab	CO02033-1W	NCBT	C	W	x	3	C			6
305	Bscab	CO02321-4W	NCBT	C	W	x	3	C			6
306	Bscab	CO03243-3W	NCBT	C	W	x	3	C			5
307	Bscab	CO03273-7W	NCBT	C	W	x	3	I			3
308	Bscab	COMN07-W112BG1	NCBT	FM	W/Purple	Purple/W	3	C			6
309	Bscab	COMN07-W203BG1	NCBT	C	W	Cream	3	I			4
310	Bscab	COTX02377-1W	NCBT	C	W	x	2	I			2
311	Bscab	COTX03270-1W	NCBT	C	W	x	3	C			4
312	Bscab	E106-4	NCBT	C	W	x	2	I			1
313	Bscab	E50-8	NCBT	C	W	x	2	C			3
314	Bscab	F47-3	NCBT	C	W	x	3	I			1
315	Bscab	F47-5	NCBT	C	W	x	3	C			3
316	Bscab	F48-4	NCBT	C	W	x	2	C			2
317	Bscab	F57-3	NCBT	C	W	x	3	C			3
318	Bscab	G20-12	NCBT	C	W	x	1	C			3
319	Bscab	G20-13	NCBT	C	W	x	3	C			3
320	Bscab	G20-30	NCBT	C	W	x	3	C			3
321	Bscab	G20-31	NCBT	C	W	x	3	C			4
322	Bscab	G20-33	NCBT	C	W	x	2	I			2
323	Bscab	G20-4	NCBT	C	W	x	3	C			6
324	Bscab	G20-41	NCBT	C	W	x	3	C			6
325	Bscab	G20-44	NCBT	C	W	x	2	I			1
326	Bscab	G20-5? (AB in Place)	NCBT				NA	x			NA
327	Bscab	G20-5? (found)	NCBT				2	C			4
328	Bscab	G20-55	NCBT	C	W	x	2	C			3
329	Bscab	G20-56	NCBT	C	W	x	2	I			3
330	Bscab	G20-58	NCBT	C	W	x	2	C			4

Table 7. Common Scab trials at Becker, MN[1.] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
331	Bscab	G20-63	NCBT	C	W	x	2	C			4
332	Bscab	G86-1	NCBT	C	W	x	2	C			4
333	Bscab	G87-3	NCBT	C	W	x	2	I			2
334	Bscab	G89-2	NCBT	C	W	x	3	C			3
335	Bscab	**Megachip**	NCBT	C	W	x	3	C			3
336	Bscab	MN 02 586	NCBT	C/FM	W	Yel-lt	3	C			4
337	Bscab	MN 99380-1	NCBT	C/FM	W	Yel-dk	2	C			2
338	Bscab	MSH228-6	NCBT	C	W	x	1	I			1
339	Bscab	MSJ126-9Y	NCBT	C	W	Y	1	I			1
340	Bscab	MSJ147-1	NCBT	C	W	x	2	I			2
341	Bscab	MSK061-4	NCBT	C	W	x	1	I			1
342	Bscab	MSK409-1	NCBT	C	W	x	2	C			3
343	Bscab	MSL007-B	NCBT	C	W	x	2	C			3
344	Bscab	MSL106-AY	NCBT	C	W	Y	3	C			5
345	Bscab	MSL292-A	NCBT	C	W	x	3	C			3
346	Bscab	MSM246-B	NCBT	C	W	x	2	C			4
347	Bscab	MSN148-A	NCBT	C	W	x	1	I			1
348	Bscab	MSN170-A	NCBT	C	W	x	2	I			1
349	Bscab	MSP270-1	NCBT	C	W	x	1	I			1
350	Bscab	MSP368-1	NCBT	C	W	x	2	I			2
351	Bscab	MSP459-5	NCBT	C	W	x	3	I			1
352	Bscab	MSP515-2	NCBT	C	W	x	1	I			2
353	Bscab	MSQ029-1	NCBT	C	W	x	2	C			4
354	Bscab	MSQ035-3	NCBT	C	W	x	1	I			1
355	Bscab	MSQ070-1	NCBT	C	W	x	2	I			2
356	Bscab	MSQ089-1	NCBT	C	W	x	2	C			4
357	Bscab	MSQ130-4	NCBT	C	W	x	3	I			3
358	Bscab	MSQ279-1	NCBT	C	W	x	1	I			1
359	Bscab	MSR036-5	NCBT	C	W	x	1	I			1
360	Bscab	MSR041-3	NCBT	C	W	x	2	I			3
361	Bscab	MSR058-1	NCBT	C	W	x	1	I			2
362	Bscab	MSR061-1	NCBT	C	W	x	2	I			1
363	Bscab	MSR089-9Y	NCBT	C	W	Y	2	I			1
364	Bscab	MSR093-4	NCBT	C	W	x	2	I			2
365	Bscab	MSR128-4Y	NCBT	C	W	Y	2	C			3
366	Bscab	MSR131-2	NCBT	C	W	x	0	0			0
367	Bscab	MSR148-4	NCBT	C	W	x	2	C			3
368	Bscab	MSR161-2	NCBT	C	W	x	2	I			2
369	Bscab	MSR169-8Y	NCBT	C	W	Y	0	0			0
370	Bscab	MSS026-2	NCBT	C	W	x	3	C			4
371	Bscab	MSS165-2Y	NCBT	C	W	x	1	I			2
372	Bscab	MSS927-1	NCBT	C	W	x	1	I			2
373	Bscab	ND7192-1	NCBT	C	W	x	3	C			5
374	Bscab	ND7799c-1	NCBT	C	W	x	3	C			4
375	Bscab	ND8304-2	NCBT	C	W	x	3	C			4
376	Bscab	ND8307C-3	NCBT	C	W	x	2	I			2
377	Bscab	ND8331Cb-2	NCBT	C	W	x	3	I			2
378	Bscab	ND8331Cb-3	NCBT	C	W	x	2	I			3
379	Bscab	ND8456-1	NCBT	C	W	x	3	C			5
380	Bscab	ND8559-20	NCBT	C	W	x	1	I			1
381	Bscab	NDA060396AB-1C	NCBT	C	W	x	3	I			2
382	Bscab	NDMN07-B318WG1	NCBT	C	W	Cream	3	I			2
383	Bscab	NDMN07-GF059WG1	NCBT	C	W	W	2	C			4
384	Bscab	NDTX059632-1W	NCBT	C	W	x	3	I			2
385	Bscab	NDTX059828-2W	NCBT	C	W	x	2	C			4
386	Bscab	NDTX059979-1W	NCBT	C	W	x	3	C			4
387	Bscab	NDTX059997-2W	NCBT	C	W	x	3	C			4
388	Bscab	NDTX059997-6W	NCBT	C	W	x	3	C			4
389	Bscab	NY 145 (D40-35)	NCBT	C	W	x	3	I			3
390	Bscab	NY 146 (D40-50)	NCBT	C	W	x	3	C			5
391	Bscab	**Snowden**	NCBT	C	W	x	3	C			4
392	Bscab	**Superior**	NCBT	C	W	x	0	0	N/A	N/A	0
393	Bscab	TX03196-1W	NCBT	C	W	x	3	C			4
394	Bscab	TX05240-10W	NCBT	C	W	x	3	C			3
395	Bscab	TX05249-5W	NCBT	C	W	x	3	I			2
396	Bscab	TX1673-1W	NCBT	C	W	x	3	C			3

Table 7. Common Scab trials at Becker, MN[1,] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
397	Bscab	W2133-1	NCBT	C	W	x	3	I			1
398	Bscab	W2324-1	NCBT	C	W	x	3	C			3
399	Bscab	W2717-5	NCBT	C	W	x	1	I			1
400	Bscab	W2978-3	NCBT	C	W	x	3	I			2
401	Bscab	W4980-1	NCBT	C	W	x	3	C			4
402	Bscab	W5015-19	NCBT	C	W	x	3	C			6
403	Bscab	W5285-9	NCBT	C	W	x	3	C			4
404	Bscab	W5955-1	NCBT	C	W	x	3	I			2
405	Bscab	W6483-5	NCBT	C	W	x	3	C			3
406	Bscab	W6609-3	NCBT	C	W	x	0	0			0
407	Bscab	W6803-3	NCBT	C	W	x	3	I			2
408	Bscab	W6822-3	NCBT	C	W	x	3	I			1
409	Bscab	W7918-8	NCBT	C	W	x	0	0			0
410	Bscab	W8010-1	NCBT	C	W	x	3	I			2
411	Bscab	W8441-2	NCBT	C	W	x	3	C			3
412	Bscab	W8486-6	NCBT	C	W	x	2	I			1
413	Bscab	W8539-2	NCBT	C	W	x	2	I			1
414	Bscab	W8586-8	NCBT	C	W	x	1	I			1
415	Bscab	W8587-4	NCBT	C	W	x	3	I			2
416	Bscab	W8603-1	NCBT	C	W	x	3	C			3
417	Bscab	W8615-11	NCBT	C	W	x	3	I			2
418	Bscab	W8615-5	NCBT	C	W	x	2	C			2
419	Bscab	W8639-3	NCBT	C	W	x	2	I			1
420	Bscab	W8639-5	NCBT	C	W	x	3	I			2
421	Bscab	W8641-4	NCBT	C	W	x	2	C			3
422	Bscab	WIMN 04855-02	NCBT	C	W	Cream	3	I			2
423	Bscab	A98345-1	Nscab	x	x	x	3	C	3	3	5.7
424	Bscab	A99326-1PY	Nscab	x	x	x	2	I	N/A	2	1
425	Bscab	AC99329-7PW/Y	Nscab	x	x	x	3	C	3	3	6
426	Bscab	AC99330-1P/Y	Nscab	x	x	x	NA	N/A	N/A	N/A	NA
427	Bscab	AF0338-17	Nscab	x	x	x	3	C	3	3	6
428	Bscab	AF3001-6	Nscab	x	x	x	2	C	2	2	5.7
429	Bscab	AF3317-15	Nscab	x	x	x	2	I	N/A	2	2
430	Bscab	AF3362-1	Nscab	x	x	x	2	I	2	2	1.7
431	Bscab	AO008-1TE	Nscab	x	x	x	2	N/A	N/A	2	2
432	Bscab	AO0286-3Y	Nscab	x	x	x	1.5	N/A	2	1	1
433	Bscab	B1992-106	Nscab	x	x	x	2.3	I	2	2	2
434	Bscab	B2492-7	Nscab	x	x	x	2	C	2	2	3.3
435	Bscab	B2628-4	Nscab	x	x	x	3	C	3	3	5.3
436	Bscab	B2724-18	Nscab	x	x	x	3	C	3	3	5.7
437	Bscab	B2725-8	Nscab	x	x	x	2	C	2	2	5
438	Bscab	B2731-13	Nscab	x	x	x	2.3	C	2	3	4.7
439	Bscab	B2731-3	Nscab	x	x	x	2.7	I	3	3	4.3
440	Bscab	B2735-12	Nscab	x	x	x	2.7	I	3	3	4
441	Bscab	B2738-3	Nscab	x	x	x	2.3	C	3	2	4.7
442	Bscab	B2746-1	Nscab	x	x	x	2.7	C	3	3	4
443	Bscab	B2747-10	Nscab	x	x	x	3	C	3	3	6
444	Bscab	B2747-5	Nscab	x	x	x	3	C	3	3	6
445	Bscab	B2776-1	Nscab	x	x	x	3	I	3	3	4.7
446	Bscab	BNC202-7	Nscab	x	x	x	3	C	3	3	4.3
447	Bscab	BNC202-8	Nscab	x	x	x	3	C	3	3	5.3
448	Bscab	CO99045-1W/Y	Nscab	x	x	x	2.3	I	2	3	2.7
449	Bscab	CO99076-6R	Nscab	x	x	x	3	C	3	3	5.3
450	Bscab	Dakota TrailBlazer (AOND95249-1Russ)	Nscab	FF	Rus	W	2.3	C	2	3	6
451	Bscab	MSH228-6	Nscab	x	x	x	2.3	I	3	1	1.7
452	Bscab	MSJ126-9Y	Nscab	x	x	x	2	N/A	2	N/A	1
453	Bscab	MSL0007-B	Nscab	x	x	x	2	C	2	2	2.3
454	Bscab	MSP270-1	Nscab	x	x	x	1	N/A	N/A	1	1
455	Bscab	MSQ070-1	Nscab	x	x	x	1.7	I	1	2	2.7
456	Bscab	MSR061-1	Nscab	x	x	x	3	N/A	3	3	3
457	Bscab	ND8229-3	Nscab	FF	Rus	W	1.7	I	1	2	2
458	Bscab	NY138	Nscab	C	W	x	1.7	I	3	1	1
459	Bscab	NY139	Nscab	C	W	x	1.7	I	1	2	1
460	Bscab	NY141	Nscab	C	W	x	2.7	C	3	2	4.3
461	Bscab	NY144	Nscab	C	W	x	3	C	3	3	3
462	Bscab	**Ranger Russet**	Nscab	FF	Rus	W	2	C	2	2	5

Table 7. Common Scab trials at Becker, MN[1.] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
463	Bscab	**Russet Burbank**	Nscab	FF	Rus	Cream	3	N/A	3	3	2.5
464	Bscab	**Superior**	Nscab	C	W	W	NA	N/A			NA
465	Bscab	Clone 201	Sol-Cap	FF	Rus	x	0	0			0
466	Bscab	Clone 202	Sol-Cap	FF	Rus	x	0	0			0
467	Bscab	Clone 203	Sol-Cap	FF	Rus	x	0	0			0
468	Bscab	Clone 204	Sol-Cap	FF	Rus	x	0	0			0
469	Bscab	Clone 205	Sol-Cap	FF	Rus	x	2	I			1
470	Bscab	Clone 206	Sol-Cap	FF	Rus	x	2	I			3
471	Bscab	Clone 207	Sol-Cap	FF	Rus	x	0	0			0
472	Bscab	Clone 208	Sol-Cap	FF	Rus	x	0	0			0
473	Bscab	Clone 209	Sol-Cap	FF	Rus	x	3	I			1
474	Bscab	Clone 210	Sol-Cap	FF	Rus	x	0	0			0
475	Bscab	Clone 211	Sol-Cap	FF	Rus	x	0	0			0
476	Bscab	Clone 212	Sol-Cap	FF	Rus	x	0	0			0
477	Bscab	Clone 213	Sol-Cap	FF	Rus	x	3	C			4
478	Bscab	Clone 214	Sol-Cap	FF	Rus	x	3	C			4
479	Bscab	Clone 215	Sol-Cap	FF	Rus	x	2	I			1
480	Bscab	Clone 216	Sol-Cap	FF	Rus	x	2	C			3
481	Bscab	Clone 217	Sol-Cap	FF	Rus	x	0	0			0
482	Bscab	Clone 218	Sol-Cap	FF	Rus	x	3	C			3
483	Bscab	Clone 219	Sol-Cap	FF	Rus	x	0	0			0
484	Bscab	Clone 220	Sol-Cap	FF	Rus	x	2	I			2
485	Bscab	Clone 221	Sol-Cap	FF	Rus	x	0	0			0
486	Bscab	Clone 222	Sol-Cap	FF	Rus	x	3	I			1
487	Bscab	Clone 223	Sol-Cap	FF	Rus	x	0	0			0
488	Bscab	Clone 224	Sol-Cap	FF	Rus	x	1	I			1
489	Bscab	Clone 225	Sol-Cap	FF	Rus	x	3	I			1
490	Bscab	Clone 226	Sol-Cap	FF	Rus	x	0	0			0
491	Bscab	Clone 227	Sol-Cap	FF	Rus	x	0	0			0
492	Bscab	Clone 228	Sol-Cap	FF	Rus	x	2	I			2
493	Bscab	Clone 229	Sol-Cap	FF	Rus	x	3	C			4
494	Bscab	Clone 230	Sol-Cap	FF	Rus	x	2	I			3
495	Bscab	Clone 231	Sol-Cap	FF	Rus	x	2	I			1
496	Bscab	Clone 232	Sol-Cap	FF	Rus	x	0	0			0
497	Bscab	Clone 233	Sol-Cap	FF	Rus	x	2	I			1
498	Bscab	Clone 234	Sol-Cap	FF	Rus	x	0	0			0
499	Bscab	Clone 235	Sol-Cap	FF	Rus	x	2	I			1
500	Bscab	Clone 236	Sol-Cap	FF	Rus	x	0	0			0
501	Bscab	Clone 237	Sol-Cap	FF	Rus	x	2	I			2
502	Bscab	Clone 238	Sol-Cap	FF	Rus	x	2	I			2
503	Bscab	Clone 239	Sol-Cap	FF	Rus	x	0	0			0
504	Bscab	Clone 240	Sol-Cap	FF	Rus	x	3	I			2
505	Bscab	Clone 241	Sol-Cap	FF	Rus	x	3	I			3
506	Bscab	Clone 242	Sol-Cap	FF	Rus	x	2	I			2
507	Bscab	Clone 243	Sol-Cap	FF	Rus	x	3	I			4
508	Bscab	Clone 244	Sol-Cap	FF	Rus	x	0	0			0
509	Bscab	Clone 245	Sol-Cap	FF	Rus	x	3	I			3
510	Bscab	Clone 246	Sol-Cap	FF	Rus	x	2	I			3
511	Bscab	Clone 247	Sol-Cap	FF	Rus	x	0	0			0
512	Bscab	Clone 248	Sol-Cap	FF	Rus	x	2	I			2
513	Bscab	Clone 249	Sol-Cap	FF	Rus	x	1	I			1
514	Bscab	Clone 250	Sol-Cap	FF	Rus	x	1	I			1
515	Bscab	Clone 251	Sol-Cap	FF	Rus	x	2	I			2
516	Bscab	Clone 252	Sol-Cap	FF	Rus	x	1	I			1
517	Bscab	Clone 253	Sol-Cap	FF	Rus	x	2	I			2
518	Bscab	Clone 254	Sol-Cap	FF	Rus	x	3	I			2
519	Bscab	Clone 255	Sol-Cap	FF	Rus	x	3	C			2
520	Bscab	Clone 256	Sol-Cap	FF	Rus	x	2	C			1
521	Bscab	Clone 257	Sol-Cap	FF	Rus	x	0	0			0
522	Bscab	Clone 258	Sol-Cap	FF	Rus	x	2	I			3
523	Bscab	Clone 259	Sol-Cap	FF	Rus	x	2	C			2
524	Bscab	Clone 260	Sol-Cap	FF	Rus	x	2	C			2
525	Bscab	Clone 261	Sol-Cap	FF	Rus	x	1	I			1
526	Bscab	Clone 262	Sol-Cap	FF	Rus	x	2	I			2
527	Bscab	Clone 263	Sol-Cap	FF	Rus	x	3	C			4
528	Bscab	Clone 264	Sol-Cap	FF	Rus	x	0	0			0

Table 7. Common Scab trials at Becker, MN[1.] 2010

			2010		Color			I/C[3]			
Sort	Loc	Clone	Trial	Mkt	Skin	Flesh	Type[2]	R1	R2	R3	Area[4]
529	Bscab	Clone 265	Sol-Cap	FF	Rus	x	0	0			0
530	Bscab	Clone 266	Sol-Cap	FF	Rus	x	0	0			0
531	Bscab	Clone 267	Sol-Cap	FF	Rus	x	3	I			1
532	Bscab	Clone 268	Sol-Cap	FF	Rus	x	3	I			2
533	Bscab	Clone 269	Sol-Cap	FF	Rus	x	0	0			0
534	Bscab	Clone 270	Sol-Cap	FF	Rus	x	0	0			0
535	Bscab	Clone 271	Sol-Cap	FF	Rus	x	3	I			2

1) Common Scab trial planted: 17.May.2010
2) Type of Common Scab lesion: 1=Surface, 2=raised, 3=pitted
3) I / C: I=Isolated Common Scab lesions, C=Coalesced Common Scab lesions
4) Area coverage of lesions: 1=<2%, 2=2-5%, 3=5-10%, 4=10-25%, 5=25-50%, 6=>50%

Table 8. Late Blight trial at Rosemount, MN[1.] 2010

				2010		Color		
Sort 3	Sort 1	Loc	Clone	Trial	Mkt	Skin	Flesh	Final LB[2]
1	A	RLB	**Atlantic**	**Chk**	C	W	Cream	9.0
2	A	RLB	**NorValley**	**Chk**	C	W	Cream	9.0
3	A	RLB	**Red Norland**	**Chk**	FM	Red	W	9.0
4	A	RLB	**Red Pontiac**	**Chk**	FM	Red	Cream	9.0
5	A	RLB	**Russet Burbank**	**Chk**	FF	Rus	Cream	9.0
6	A	RLB	**Russet Norkotah**	**Chk**	FM	Rus	Cream	9.0
7	A	RLB	**Shepody**	**Chk**	FF	LW	W	9.0
8	A	RLB	**Snowden**	**Chk**	C	W	W	9.0
9	A	RLB	**Y. Gold**	**Chk**	FM	W	Yel	9.0
10	B	RLB	MN 15620	G17	FF	Red	Yel	9.0
11	B	RLB	MN 96013-1	G14	FM	Red	Yel-dk	9.0
12	B	RLB	MN 96072-4	G14	FM	Red	W	9.0
13	B	RLB	MN 99380-1	G11	C/FM	W	Yel-dk	9.0
14	B	RLB	MN 99460-14	G11	FM	Red	W	9.0
15	B	RLB	MN 00467-4	G10	C	W	W	9.0
16	B	RLB	MN 02 419	G8	FF	LW	Cream	9.0
17	B	RLB	MN 02 467	G8	FM/FF	Rus	Yel-lt	8.5
18	B	RLB	MN 02 586	G8	C/FM	W	Yel-lt	9.0
19	B	RLB	MN 02 588	G8	C	W	W	9.0
20	B	RLB	MN 02 598	G8	C/FM	W	Yel-lt	8.5
21	B	RLB	MN 02 616	G8	FM	Red	Yel-dk	9.0
22	B	RLB	MN 02 696	G8	C	W	W	9.0
23	C	RLB	AOMN 03178-2	G7	FF	Rus lt.	W	8.5
24	C	RLB	ATMN 03505-3	G7	FM	Red	Cream	9.0
25	C	RLB	COMN 03021-1	G7	FM	Red	Cream	9.0
26	C	RLB	COMN 03027-1	G7	FM	Red	Cream	9.0
27	C	RLB	NDMN 03324-4	G7	C	W	Cream	8.0
28	C	RLB	NDMN 03376-1	G7	FM	Red	Cream	9.0
29	D	RLB	AOMN 041101-01	G6	FF	LW	W	9.0
30	D	RLB	COMN 04692-10	G6	FF	Rus	Cream	9.0
31	D	RLB	COMN 04702-03	G6	FF	Rus	Cream	9.0
32	D	RLB	NDMN 04910-01	G6	C	W	Cream	9.0
33	D	RLB	NDMN 04911-01	G6	C	W	W	9.0
34	D	RLB	WIMN 04844-03	G6	C	W	Yel	9.0
35	D	RLB	WIMN 04855-02	G6	C	W	Cream	8.5
36	F	RLB	AOMN 06077-01	G4	FF	Rus	Cream	9.0
37	F	RLB	AOMN 06107-01	G4	FF	Rus	Cream	9.0
38	F	RLB	AOMN 06118-01	G4	FF	Rus	Cream	8.0
39	F	RLB	AOMN 06126-02	G4	FF	Rus	Cream	9.0
40	F	RLB	AOMN 06131-01	G4	FF	Rus	W	9.0
41	F	RLB	AOMN 06147-05	G4	FF	Rus	Cream	9.0
42	F	RLB	AOMN 06150-02	G4	C	W	Cream	9.0
43	F	RLB	AOMN 06153-01 S.D.	G4	FF	Rus	W	9.0
44	F	RLB	AOMN 06174-01 S.D.	G4	FF	Rus	Cream	9.0
45	F	RLB	COMN 06332-01	G4	FF	Rus	W	9.0
46	F	RLB	COMN 06363-01	G4	FF	Rus	Cream	9.0
47	F	RLB	COMN 06379-02	G4	FF	Rus	W	8.5
48	F	RLB	COMN 06392-01	G4	FF	Rus	W	8.5
49	F	RLB	WIMN 06030-01	G4	FM	Red	W	9.0
50	G	RLB	COMN07-B023BG1	G3	FF	Rus	Cream	9.0
51	G	RLB	COMN07-B028BG1	G3	FF	Rus	Cream	9.0
52	G	RLB	COMN07-B041BG1	G3	FF	Rus	W	9.0
53	G	RLB	COMN07-B050BG1	G3	FF	Rus	Cream	8.0
54	G	RLB	COMN07-B051BG1	G3	FF	Rus	Cream	9.0
55	G	RLB	COMN07-B061BG1	G3	FF	Rus	Cream	9.0
56	G	RLB	COMN07-B095BG1	G3	FF	Rus	Cream	9.0
57	G	RLB	COMN07-B132BG1	G3	FF	Rus	Cream	9.0
58	G	RLB	COMN07-B134BG1	G3	FF	Rus	Cream	9.0
59	G	RLB	COMN07-B139BG1	G3	FF	Rus	Cream	9.0
60	G	RLB	COMN07-B141BG1	G3	FF	Rus	W	9.0
61	G	RLB	COMN07-B144BG1	G3	FF	Rus	Cream	9.0

Table 8. Late Blight trial at Rosemount, MN[1.] 2010

				2010		Color		
Sort 3	Sort 1	Loc	Clone	Trial	Mkt	Skin	Flesh	Final LB[2]
62	G	RLB	COMN07-B182WG1	G3	FM	Red	W	9.0
63	G	RLB	COMN07-B196BG1	G3	FM	Red	Cream	9.0
64	G	RLB	COMN07-B198BG1	G3	FM	Red	Cream	9.0
65	G	RLB	COMN07-B217BG1	G3	FM	Red	W	9.0
66	G	RLB	COMN07-B219WG1	G3	FM	Red	x	9.0
67	G	RLB	COMN07-B229BG1	G3	FM	Red	Cream	9.0
68	G	RLB	COMN07-B229WG1	G3	FM	Red	Cream	9.0
69	G	RLB	COMN07-B248WG1	G3	FM	Red	Yel	9.0
70	G	RLB	COMN07-GF174WG1	G3	FF	Rus	Cream	9.0
71	G	RLB	COMN07-GF179BG1	G3	FF	Rus	W	9.0
72	G	RLB	COMN07-GF188BG1	G3	FF	Rus	Cream	9.0
73	G	RLB	COMN07-GF198BG1	G3	FF	Rus	Cream	9.0
74	G	RLB	COMN07-GF206BG1	G3	FF	Rus	Cream	7.5
75	G	RLB	COMN07-GF222WG1	G3	FF	Rus	Cream	9.0
76	G	RLB	COMN07-GF310BG1	G3	C	W	W	9.0
77	G	RLB	COMN07-GF315BG1	G3	C	W/W	XX	9.0
78	G	RLB	COMN07-W034WG1	G3	FF	Rus	W	8.5
79	G	RLB	COMN07-W067BG1	G3	FF	Rus lt	Cream	9.0
80	G	RLB	COMN07-W073BG1	G3	FM	Red	Cream	8.5
81	G	RLB	COMN07-W090BG1	G3	FM	Red/Red	XX	9.0
82	G	RLB	COMN07-W106BG1	G3	FM	Red/Red	XX	9.0
83	G	RLB	COMN07-W109BG1	G3	FM	Red	Cream	9.0
84	G	RLB	COMN07-W112BG1	G3	FM	W/Purple	Purple/W	8.5
85	G	RLB	COMN07-W199BG1	G3	FF	W/Rus	XX	9.0
86	G	RLB	COMN07-W201BG1	G3	C	W/W	XX	9.0
87	G	RLB	COMN07-W203BG1	G3	C	W	Cream	9.0
88	G	RLB	NDMN07-B266BG1	G3	C	Rus/W	XX	9.0
89	G	RLB	NDMN07-B269BG1	G3	C	Rus/W	XX	8.5
90	G	RLB	NDMN07-B272BG1	G3	C	Rus/W	XX	9.0
91	G	RLB	NDMN07-B289BG1	G3	C	Rus/W	XX	9.0
92	G	RLB	NDMN07-B299BG1	G3	C	W/W	XX	9.0
93	G	RLB	NDMN07-B302BG1	G3	C	W	W	9.0
94	G	RLB	NDMN07-B309BG1	G3	C	W	W	9.0
95	G	RLB	NDMN07-B311BG1	G3	C	W	Cream	9.0
96	G	RLB	NDMN07-B312BG1	G3	C	W	W	9.0
97	G	RLB	NDMN07-B316WG1	G3	C	W/Red splash	Cream	9.0
98	G	RLB	NDMN07-B318WG1	G3	C	W	Cream	9.0
99	G	RLB	NDMN07-B322BG1	G3	C	W	Cream	9.0
100	G	RLB	NDMN07-B326BG1	G3	C	W	Yel-lt.	9.0
101	G	RLB	NDMN07-B330BG1	G3	C	W/Red splash	Cream/red splash	9.0
102	G	RLB	NDMN07-GF040BG1	G3	FM	Red/Red	XX	9.0
103	G	RLB	NDMN07-GF045BG1	G3	C	W/W	XX	9.0
104	G	RLB	NDMN07-GF056BG1	G3	C	W	Yel-lt.	9.0
105	G	RLB	NDMN07-GF059WG1	G3	C	W	W	8.5
106	G	RLB	NDMN07-GF066BG1	G3	C	W	W	9.0
107	G	RLB	NDMN07-GF106BG1	G3	C	W	Cream	9.0
108	G	RLB	NDMN07-W138BG1	G3	FM	Red/Red	XX	9.0
109	G	RLB	NDMN07-W146BG1	G3	FF	Rus	Cream	9.0
110	G	RLB	NDMN07-W150BG1	G3	C	W/W / red	XX	9.0
111	G	RLB	NDMN07-W151BG1	G3	C	W/W	XX	9.0
112	G	RLB	NDMN07-W152BG1	G3	C	W	W	9.0
113	G	RLB	NDMN07-W153BG1	G3	C	W	Cream	9.0
114	G	RLB	NDMN07-W159BG1	G3	C	W	Cream	8.5
115	G	RLB	NDMN07-W160BG1	G3	C	W/W	XX	9.0
116	G	RLB	NDMN07-W161BG1	G3	C	W	W	9.0
117	G	RLB	NDMN07-W162BG1	G3	C	W/W	XX	9.0
118	G	RLB	NDMN07-W162WG1	G3	C	W	Cream	9.0
119	G	RLB	NDMN07-W169BG1	G3	C	W/W	XX	9.0
120	G	RLB	NDMN07-W173BG1	G3	C	W/W	XX	9.0
121	G	RLB	NDMN07-W182BG1	G3	C	W/W	XX	9.0
122	G	RLB	ORMN07-B257BG1	G3	FF	Rus	Cream	9.0

Table 8. Late Blight trial at Rosemount, MN[1.] 2010

				2010		Color		
Sort 3	Sort 1	Loc	Clone	Trial	Mkt	Skin	Flesh	Final LB[2]
123	G	RLB	ORMN07-GF011BG1	G3	FF	Rus	Cream	9.0
124	G	RLB	ORMN07-GF014BG1	G3	FF	Rus	W	9.0
125	G	RLB	ORMN07-W127WG1	G3	FF	Rus	Cream	9.0
126	G	RLB	ORMN07-W129WG1	G3	FF	Rus	xW	9.0
127	H	RLB	COMN08-B001BG1	G2	FM	Red	x	9.0
128	H	RLB	COMN08-B006BG1	G2	FM	Red	x	5.0
129	H	RLB	COMN08-B008BG1	G2	FM	Red	x	9.0
130	H	RLB	COMN08-B011BG1	G2	FM	Red	x	9.0
131	H	RLB	COMN08-B011WG1	G2	FM	Red	x	9.0
132	H	RLB	COMN08-B015BG1	G2	FM	Red	x	9.0
133	H	RLB	COMN08-B019BG1	G2	FM	Red	x	9.0
134	H	RLB	COMN08-B024BG1	G2	FM	Red	x	9.0
135	H	RLB	COMN08-B121WG1	G2	FM	Red	x	9.0
136	H	RLB	COMN08-B122BG1	G2	FM	Red	x	#DIV/0!
137	H	RLB	COMN08-B122WG1	G2	FM	Red	x	9.0
138	H	RLB	COMN08-B126WG1TJ	G2	FM	Red	x	8.0
139	H	RLB	COMN08-B128BG1	G2	FM	Red	x	9.0
140	H	RLB	COMN08-B128WG1	G2	FM	Red	x	9.0
141	H	RLB	COMN08-B140WG1	G2		Rus	x	9.0
142	H	RLB	COMN08-B147BG1	G2		Rus	x	#DIV/0!
143	H	RLB	COMN08-B155WG1	G2		Rus	x	9.0
144	H	RLB	COMN08-B158BG1	G2		Rus	x	9.0
145	H	RLB	COMN08-B160BG1	G2		Rus	x	9.0
146	H	RLB	COMN08-B166BG1CT	G2		Rus	x	9.0
147	H	RLB	COMN08-B173GFG1	G2		Rus	x	9.0
148	H	RLB	COMN08-B173WG1	G2		Rus	x	8.0
149	H	RLB	COMN08-B174GFG1	G2		Rus	x	9.0
150	H	RLB	COMN08-B175WG1	G2		Rus	x	5.0
151	H	RLB	COMN08-B177BG1	G2		Rus	x	9.0
152	H	RLB	COMN08-B178BG1	G2		Rus	x	9.0
153	H	RLB	COMN08-B180WG1	G2	FM	Rus	x	9.0
154	H	RLB	COMN08-B223GFG1	G2		W	x	9.0
155	H	RLB	COMN08-B224WG1	G2		W	x	7.0
156	H	RLB	COMN08-B225WG1	G2		W	x	9.0
157	H	RLB	COMN08-W001WG1TJ	G2	FM	Red	x	9.0
158	H	RLB	COMN08-W006BG1	G2	FM	Red	x	9.0
159	H	RLB	COMN08-W009WG1	G2	FM	Red	x	9.0
160	H	RLB	COMN08-W015WG1TJ	G2	FM	Red	x	5.0
161	H	RLB	COMN08-W018BG1	G2	FM	Red	x	9.0
162	H	RLB	COMN08-W020WG1	G2	FM	Red	x	9.0
163	H	RLB	COMN08-W025WG1	G2	FM	Red	x	9.0
164	H	RLB	COMN08-W027BG1	G2	FM	Red	x	9.0
165	H	RLB	COMN08-W031BG1	G2	FM	Red	x	9.0
166	H	RLB	COMN08-W031WG1	G2	FM	Red	x	9.0
167	H	RLB	COMN08-W034WG1TJ	G2	FM	Red	x	9.0
168	H	RLB	COMN08-W036BG1	G2	FM	Red	x	9.0
169	H	RLB	COMN08-W036WG1 (AB Filler)	G2	FM	Red	x	9.0
170	H	RLB	COMN08-W040WG1	G2	FM	Red	x	9.0
171	H	RLB	COMN08-W041WG1	G2	C	Red	x	7.0
172	H	RLB	COMN08-W048GFG1	G2	FM	Red	x	9.0
173	H	RLB	COMN08-W052GFG1	G2	FM	Red	x	9.0
174	H	RLB	COMN08-W054BG1	G2		Red	x	9.0
175	H	RLB	COMN08-W054GFG1	G2		Red	x	9.0
176	H	RLB	COMN08-W055GFG1	G2	FM	Red	x	9.0
177	H	RLB	COMN08-W056GFG1	G2	FM	Red	x	9.0
178	H	RLB	COMN08-W057WG1	G2	FM	Red	x	9.0
179	H	RLB	COMN08-W059BG1	G2	FM	W	x	9.0
180	H	RLB	COMN08-W059WG1TJ	G2	FM	W	x	9.0
181	H	RLB	COMN08-W060BG1	G2	FM	W	x	9.0
182	H	RLB	COMN08-W061BG1	G2	FM	W	x	9.0
183	H	RLB	COMN08-W063WG1OM	G2		W	x	9.0

Table 8. Late Blight trial at Rosemount, MN[1.] 2010

				2010		Color		
Sort 3	Sort 1	Loc	Clone	Trial	Mkt	Skin	Flesh	Final LB[2]
184	H	RLB	COMN08-W112WG1	G2		Rus	x	9.0
185	H	RLB	COMN08-W113WG1	G2		Rus	x	9.0
186	H	RLB	COMN08-W114WG1	G2		Rus	x	8.0
187	H	RLB	COMN08-W115WG1	G2		Rus	x	8.0
188	H	RLB	COMN08-W116WG1	G2		Rus	x	7.0
189	H	RLB	COMN08-W117WG1	G2		Rus	x	8.0
190	H	RLB	COMN08-W118WG1	G2		Rus	x	9.0
191	H	RLB	COMN08-W126WG1	G2		Rus	x	5.0
192	H	RLB	COMN08-W132WG1	G2		W	x	9.0
193	H	RLB	COMN08-W135WG1	G2		W	x	9.0
194	H	RLB	COMN08-W142GFG1	G2		W	x	8.0
195	H	RLB	COMN08-W145WG1	G2		W	x	9.0
196	H	RLB	COMN08-W147WG1TJ	G2		W	x	9.0
197	H	RLB	COMN08-W150WG1	G2		W	x	9.0
198	H	RLB	NDMN08-B025WG1	G2		W	x	9.0
199	H	RLB	NDMN08-B026BG1	G2		W	x	9.0
200	H	RLB	NDMN08-B026WG1	G2		W	x	9.0
201	H	RLB	NDMN08-B028GFG1	G2		W	x	9.0
202	H	RLB	NDMN08-B032BG1	G2		W	x	9.0
203	H	RLB	NDMN08-B035BG1	G2		W	x	9.0
204	H	RLB	NDMN08-B035WG1	G2		W	x	9.0
205	H	RLB	NDMN08-B036BG1	G2		W	x	9.0
206	H	RLB	NDMN08-B037BG1	G2		W	x	9.0
207	H	RLB	NDMN08-B039WG1	G2		W	x	9.0
208	H	RLB	NDMN08-B046BG1	G2		W	x	9.0
209	H	RLB	NDMN08-B046WG1	G2		W	x	9.0
210	H	RLB	NDMN08-B050WG1	G2		W	x	7.0
211	H	RLB	NDMN08-B059GFG1	G2		W	x	9.0
212	H	RLB	NDMN08-B062WG1	G2		W	x	9.0
213	H	RLB	NDMN08-B072WG1	G2		W	x	9.0
214	H	RLB	NDMN08-B074WG1	G2		W	x	9.0
215	H	RLB	NDMN08-B083WG1	G2		W	x	9.0
216	H	RLB	NDMN08-B084GFG1	G2		W	x	9.0
217	H	RLB	NDMN08-B084WG1	G2		W	x	9.0
218	H	RLB	NDMN08-B085WG1	G2		W	x	9.0
219	H	RLB	NDMN08-B086BG1	G2		W	x	9.0
220	H	RLB	NDMN08-B094BG1	G2		W	x	9.0
221	H	RLB	NDMN08-B094GFG1	G2		W	x	9.0
222	H	RLB	NDMN08-B095BG1	G2		W	x	9.0
223	H	RLB	NDMN08-B097BG1	G2		W	x	9.0
224	H	RLB	NDMN08-B097GFG1	G2		W	x	9.0
225	H	RLB	NDMN08-B097WG1	G2		W	x	9.0
226	H	RLB	NDMN08-B098BG1	G2		W	x	9.0
227	H	RLB	NDMN08-B101BG1	G2		W	x	9.0
228	H	RLB	NDMN08-B101WG1	G2		W	x	9.0
229	H	RLB	NDMN08-B102WG1	G2		W	x	8.0
230	H	RLB	NDMN08-B103GFG1	G2		W	x	9.0
231	H	RLB	NDMN08-B107BG1	G2		W	x	9.0
232	H	RLB	NDMN08-B110GFG1	G2		W	x	9.0
233	H	RLB	NDMN08-B110WG1	G2		W	x	9.0
234	H	RLB	NDMN08-B112GFG1	G2		W	x	9.0
235	H	RLB	NDMN08-B113WG1	G2		W	x	5.0
236	H	RLB	NDMN08-B114BG1	G2		W	x	9.0
237	H	RLB	NDMN08-B117WG1	G2		W	x	9.0
238	H	RLB	NDMN08-B118BG1	G2		W	x	9.0
239	H	RLB	NDMN08-B130WG1	G2		W	x	9.0
240	H	RLB	NDMN08-B133WG1	G2		W	x	8.0
241	H	RLB	NDMN08-B137BG1	G2		W	x	9.0
242	H	RLB	NDMN08-B137WG1	G2		W	x	9.0
243	H	RLB	NDMN08-B183GFG1	G2		W	x	9.0
244	H	RLB	NDMN08-B183WG1	G2		W	x	9.0

Table 8. Late Blight trial at Rosemount, MN[1.] 2010

				2010		Color		
Sort 3	Sort 1	Loc	Clone	Trial	Mkt	Skin	Flesh	Final LB[2]
245	H	RLB	NDMN08-B184WG1	G2		W	x	9.0
246	H	RLB	NDMN08-B187WG1	G2		W	x	9.0
247	H	RLB	NDMN08-B188GFG1	G2		W	x	9.0
248	H	RLB	NDMN08-B189BG1	G2		W	x	9.0
249	H	RLB	NDMN08-B189GFG1	G2		W	x	9.0
250	H	RLB	NDMN08-B189WG1	G2		W	x	9.0
251	H	RLB	NDMN08-W102WG1	G2		W	x	9.0
252	H	RLB	ORMN08-B197GFG1	G2		Mix	x	9.0
253	H	RLB	ORMN08-B198GFG1	G2		Mix	x	9.0
254	H	RLB	ORMN08-B198WG1	G2		Mix	x	9.0
255	H	RLB	ORMN08-B199GFG1	G2		Mix	x	9.0
256	H	RLB	ORMN08-B203WG1	G2		Mix	x	9.0
257	H	RLB	ORMN08-B204GFG1	G2		Mix	x	9.0
258	H	RLB	ORMN08-B206WG1	G2		Mix	x	9.0
259	H	RLB	ORMN08-B207WG1	G2		Mix	x	9.0
260	H	RLB	ORMN08-B213WG1	G2		Mix	x	9.0
261	H	RLB	ORMN08-B221BG1	G2		Mix	x	9.0
262	H	RLB	ORMN08-W067GFG1	G2		Mix	x	9.0
263	H	RLB	ORMN08-W072GFG1	G2	C/FM	Mix	x	6.0
264	H	RLB	ORMN08-W072WG1	G2	C/FM	Mix	x	9.0
265	I	RLB	CV00047-3	NCR	FF	Rus	x	9.0
266	I	RLB	CV99222-2	NCR	FF	Rus	x	9.0
267	I	RLB	MSL211-3	NCR	C	W	x	9.0
268	I	RLB	MSL268-D	NCR	C	W	x	9.0
269	I	RLB	MSM182-1	NCR	C	W	x	9.0
270	I	RLB	MSQ176-5	NCR	C	W	x	8.5
271	I	RLB	ND8229-3	NCR	C	W	x	9.0
272	I	RLB	ND8307C-3	NCR	C	W	x	9.0
273	I	RLB	ND8314-1R	NCR	FM	Red	x	9.0
274	I	RLB	ND8555-8R	NCR	FM	Red	x	9.0
275	I	RLB	W2609-1R	NCR	FM	Red	x	9.0
276	I	RLB	W2717-5	NCR	C	W	x	9.0
277	I	RLB	W2978-3	NCR	C	W	x	9.0
278	I	RLB	W5015-12	NCR	C	W	x	9.0
279	I	RLB	W8946-1rus	NCR	FF	Rus	x	7.0
280	K	RLB	A0008-1TE	NLB				9.0
281	K	RLB	A00286-3Y	NLB				8.3
282	K	RLB	A00293-2Y	NLB				9.0
283	K	RLB	A00324-1	NLB				8.3
284	K	RLB	A01010-1	NLB				8.7
285	K	RLB	A98345-1	NLB				8.0
286	K	RLB	A99326-1PY	NLB				9.0
287	K	RLB	A99331-2RY	NLB				8.3
288	K	RLB	AC99329-7PW/Y	NLB				9.0
289	K	RLB	AC99375-1RU	NLB				8.0
290	K	RLB	AF0338-17	LB				9.0
291	K	RLB	AF2291-10	NLB				9.0
292	K	RLB	AF2574-1	NLB				9.0
293	K	RLB	AF3001-6	LB				9.0
294	K	RLB	AF3317-15	NLB				8.4
295	K	RLB	AF3362-1	NLB				9.0
296	K	RLB	AF4121-3	NLB				7.3
297	K	RLB	AF4122-3	NLB				9.0
298	K	RLB	AF4191-2	NLB				7.7
299	K	RLB	Alpine Russet (A9305-10)	NLB	FF			8.7
300	K	RLB	AO96141-3	NLB				8.3
301	K	RLB	AO96305-3	NLB				9.0
302	K	RLB	AWN86514-2	NLB				6.3
303	K	RLB	B0692-4	NLB				8.3
304	K	RLB	B0718-3	NLB				5.3
305	K	RLB	B2731-3	NLB				9.0

Table 8. Late Blight trial at Rosemount, MN[1.] 2010

				2010		Color		
Sort 3	Sort 1	Loc	Clone	Trial	Mkt	Skin	Flesh	Final LB[2]
306	K	RLB	B2738-3	NLB				9.0
307	K	RLB	B2746-1	NLB				9.0
308	K	RLB	B2747-15	NLB				9.0
309	K	RLB	BNC202-3	NLB	C			8.3
310	K	RLB	Clearwater Russet (AOA95154-1)	NLB				8.7
311	K	RLB	CO00412-5W/Y	NLB				9.0
312	K	RLB	CO99053-3RU	NLB				8.7
313	K	RLB	Dakota TrailBlazer (AOND95249-1Russ)	NLB				8.0
314	K	RLB	LBR1R2R3R4	NLB				8.7
315	K	RLB	LBR5	NLB				8.7
316	K	RLB	LBR7	NLB				9.0
317	K	RLB	LBR9	NLB				9.0
318	K	RLB	MSM182-1	NLB				8.7
319	K	RLB	MSQ070-1	NLB				8.7
320	K	RLB	MSQ176-5	NLB				8.3
321	K	RLB	MSQ86-3	NLB				9.0
322	K	RLB	MSR061-1	NLB				9.0
323	K	RLB	ND039036B-2R	NLB				8.0
324	K	RLB	ND050174B-5R	NLB				9.0
325	K	RLB	ND8229-3	NLB				9.0
326	K	RLB	NY140	NLB				8.7
327	K	RLB	OR03029-2	NLB				8.3

1) Planted: 1,3 June.2010
2) Final LB reading taken; 1.October.2010

Potato Breeding and Cultivar Development for the Northern Plains
North Dakota State University
2010 Summary

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Potato continues to be the most important vegetable and horticultural crop grown in North Dakota and the Northern Plains. Traditionally, North Dakota State University (NDSU) potato cultivar releases have been widely adapted and accepted, thus significantly impacting production in North Dakota, Minnesota, the Northern Plains, and often throughout North America.

Potato research has been conducted at NDSU since the late 1800s. Early work was mainly in regard to production practices such as plant population and planting depth. The potato breeding program was initiated in 1930 by the North Dakota Agricultural Experiment Station (NDAES). Potato breeders have included Dr. A. F. Yaeger, Mr. H. Mattson, Dr. Robert H. Johansen (1948), Dr. Rich Novy (1995), and Dr. Asunta (Susie) Thompson (2001). Recent interim breeders (circa 1998-2001) included Dr. Gary Secor (Department of Plant Pathology, NDSU) and Dr. Jim Lorenzen (University of Idaho). Potato breeding is a long, arduous process, partly due to the complex genetic nature of the highly heterozygous and tetraploid *Solanum tuberosum* L., but also because producers, industry, and consumers are very discerning, and in order to remain economically sustainable must know information about a myriad of traits including agronomic characteristics, yield and grade, cultivar specific management information, resistances to pests and stress, and processing and culinary qualities. Our basic breeding schematic is presented in Table 1.

Since 1930, 24 cultivars have been named and released by the NDAES, in cooperation with the USDA-ARS, and others (please see Table 2). Many additional collaborative releases with state Agricultural Experiment Stations, the USDA-ARS, and Agriculture Canada have also occurred. As a leader in potato breeding, selection, and cultivar development, our goal is to identify and release superior, multi-purpose cultivars that are high yielding, possess multiple resistances to diseases, insect pests, and environmental stresses, have excellent processing and/or culinary quality, and that are adapted to production in North Dakota, Minnesota, and the Northern Plains.

Our program emphasizes late blight, cold-sweetening, Colorado potato beetle, pink rot and *Pythium* leak, silver scurf, sugar end, and aphid and virus resistance breeding. In order to develop durable and long-term resistance to pests and stresses, breeding efforts continue to include germplasm enhancement to incorporate important pest resistances and improved quality traits via exploitation of wild species and wild species hybrids, in addition to the use of released cultivars and advanced germplasm from around the globe. Breeding, evaluation, and screening efforts are successful because of the cooperative and interdisciplinary efforts amongst the NDSU potato improvement team, the North Dakota State Seed Department (NDSSD), Minnesota Department of Agriculture, and with potato producers, research and industry personnel in North Dakota, Minnesota, the Northern Plains, and beyond.

In order to meet the needs of producers and industry, we have established the following research objectives:
1) Develop potato (*Solanum tuberosum* Group Tuberosum L.) cultivars for North Dakota, Minnesota, the Northern Plains, and beyond, using traditional hybridization that are genetically superior for yield, market-limiting traits, and processing quality.

2) Identify and introgress into adapted potato germplasm, genetic resistance to major disease, insect, and nematode pests causing economic losses in potato production in North Dakota and the Northern Plains.

3) Identify and develop enhanced germplasm with resistance to environmental stresses and improved quality characteristics for adoption by consumers and the potato industry.

Potato Breeding, Selection, Cultivar Development, and Germplasm Enhancement

The NDSU potato improvement team concentrates on breeding and evaluation for important traits to our industry, including cold processing ability (both chip and frozen products), late blight, Colorado potato beetle, sugar end, *Verticillium* wilt, pink rot and *Pythium* leak, aphid, and *Fusarium* dry rot resistance. In hybridizing, the breeding program utilizes germplasm enhancement in an effort to develop durable and long-term resistance to pests and stresses and to improve quality attributes, exploiting wild species, wild species hybrids, and cultivars and advanced selections from cooperators around the globe. In 2010, 626 new families were created in the greenhouse using 174 parental genotypes. Of these families, 417 (67%) included late blight resistance breeding, 289 (46%) Colorado potato beetle (CPB) resistance breeding, 129 (21%) aphid resistance breeding, 46 (7%) *Verticillium* wilt resistance breeding, and 213 (34%) chip selections with cold sweetening resistance breeding. In the summer and fall greenhouse crops, 530 families from (true) botanical seed were grown; of these families, 340 (64%) included late blight resistance breeding, 248 (47%) CPB resistance breeding, 190 (36%) aphid resistance breeding, 22 (4%) *Verticillium* wilt resistance breeding, 192 (36%) chip selections with cold sweetening resistance breeding, 19 (4%) corky ringspot resistance breeding, and 20 (4%) tuber moth resistance breeding. Harvest both crops are complete.

At Langdon, 78,020 North Dakota (ND) seedlings, representing 565 families, were evaluated; 770 selections were retained. Unselected seedling tubers from cooperating programs in Idaho, Texas and Maine were grown at Larimore, Hoople and Crystal, ND. Unselected seedlings (totaling 45,702 tubers) were shared with breeding programs in Idaho (18, 569), Maine (6,820), Colorado (8,697), and Texas (11,616). In 2010, 757 second, 158 third year, and 302 fourth year and older selections, were produced in seed maintenance and increase lots at Absaraka and Wyndmere; 176, 81, and 240 second, third, and fourth year and older selections were retained, respectively. Additional selections with late blight resistance and for several genetic studies were also maintained and/or increased at Wyndmere.

Yield and evaluation trials were grown at six locations in North Dakota, four irrigated (Larimore, Oakes, Inkster and Williston) and two non-irrigated locations (Hoople and Crystal). Twenty-six entries were grown in the chip trial at Hoople, including 15 advancing selections from the NDSU program, four lines from Frito-Lay, and seven named cultivars. A new trial in 2010 was the National Chip Breeders Trial, initiated by the USPB and regional chip processors; 219 entries were included in the unreplicated trial. The goals are to rapidly identify and develop clones to replace Atlantic for southern production areas, and Snowden from storage. At Crystal, 20 entries were grown in the fresh market trial, including 13 advancing selections and seven named cultivars. In the preliminary fresh market trial, 31 entries were evaluated, including 27 advanced selections and four named cultivars. The purpose of the preliminary fresh market trial is to help us discard lines that do not have commercial potential and to more quickly identify those that should be increased and moved to the fresh market trial. Twenty selections and commercially acceptable cultivars were grown in the Oakes processing trial, 20 in the Larimore processing trial, and 16 in the Williston processing trial. A new trial in 2010 at Larimore was a trial aimed at identifying suitable genotypes for dehydration; in this initial year, 20 entries including four check genotypes (Alturas, Ranger Russet, Russet Burbank and Dakota Trailblazer) were evaluated. Additionally at Larimore, the NDSU potato breeding program cooperated with Simplot Plant Sciences, Boise, ID, in conducting three trials evaluating improved lines of Ranger Russet, Russet Burbank and Atlantic. Trials at Inkster ranged from the chip processing yield trial with 21 entries, evaluation of genotypes for resistance to Verticillium wilt, Fusarium sp., sugar end/anti-sweetening, and cultural management trials including work with 2,4-D and metribuzin sensitivity. The trials were in collaboration with Drs. Nick David, Neil Gudmestad, Harlene Hatterman-Valenti, Gary Secor and Joe Sowokinos.

Four entries from NDSU were evaluated in the North Central Regional Potato Variety Trial (NCRPVT), including ND8314-1R and ND8555-8R, bright red skinned selections suitable for the fresh market, ND8307C-3 a chip processing selection, and ND8229-3 a dual-purpose russet. NCRPVT locations are Crystal (fresh market), Hoople (chip processing), Larimore (processing), and Inkster (fresh market, chip and processing).

Our efforts continue to identify processing (both chip and frozen) germplasm that will reliably and consistently process from long-term cold storage. As we grade, chip processing selections are sampled, and stored at 42F and 38F (5.5C and 3.3C) for eight weeks; a second set is evaluated the following June. French fry/fozen processing selections are evaluated predominantly from 45F (7.2C) storage after eight weeks storage and again the following June. All trial entries are evaluated for blackspot and shatter bruise potential.

In 2010, Dr. Gary Secor’s program evaluated seedling families using a detached leaf assay in the greenhouse. Resistant selections were retained for field evaluation in 2011. Collaborative field trials included late blight foliar and tuber evaluation trials with Dr. Secor, in addition to evaluation for resistance to tuber blemish diseases. Bacterial ring rot expression and resistance to Verticillium wilt, pink rot and Pythium leak is a collaborative effort with Dr. Neil Gudmestad’s program. Dr. Deirdre Prischmann-Voldseth’s program conducted Colorado potato beetle resistance screening. Sucrose rating, invertase/ugpase analysis, and serial chipping of chip and French fry/frozen processing selections is conducted by Marty Glynn (USDA-ARS), and Drs. Joseph Sowokinos (UMN) and Sonu at the USDA-ARS Potato Worksite in East Grand Forks, MN. We also submitted entries in many cooperative trials with various producers, industry, and research groups around North America.

The most promising advancing red fresh market selections include ND4659-5R, ND8555-8R, AND00272-1R, ND6002-1R, and ND7132-1R. All are beautiful, bright red skinned, white fleshed selections. Release committee meetings may convene for ND8555-8R and ND4659-5R in 2011. Dual-purpose russet selections, ND8229-3, ND8068-5Russ and several hybrids between Dakota Trialblazer and ND8229-3, possess excellent appearance, yield and grade, and processing qualities. ND8068-5Russ has early maturity, about seven days earlier than Russet Norkotah. Unlike Russet Norkotah, it processes from the field and 45F storage. ND7519-1 and ND8304-2, advancing chip processing selections, possess excellent appearance and cold sweetening resistance. Characteristics of Dakota Trailblazer and superior advancing selections for all market types including three specialty types are summarized in the pages following Table 2.

A highlight for 2010 was being the first project to move into the new NDSU greenhouse complex. In our first crop, several families of seedlings were grown, in addition to several advancing clones for minituber production. This crop was tremendous in terms of size of tubers and number of tubers per pot. We currently have two additional crops for minituber production in two separate pods (chambers). This state-of-art facility is allowing the potato breeding program to produce seedlings and minitubers with reduced fear of insect pests that vector diseases such as tomato spotted wilt and impatiens necrotic spot viruses, which are present in other ranges on campus. The precise environmental controls allow us to define strict production parameters, which were evident in the high yield and quality of our first crop.

Goals for 2011 continue to include developing improved potato cultivars for ND, MN, the Northern Plains, and beyond, using traditional hybridization, and utilizing early generation selection techniques such as marker assisted selection and greenhouse screening procedures when possible for rapid identification of genetically superior germplasm. Our objectives for identifying and developing resistance to major insect, disease and nematode pests, and to environmental stresses, with an emphasis on improved quality characteristics will continue as major concentrations. Finally, working with the North Dakota State Seed Department and the Minnesota Department of Agriculture, we will strive to streamline and improve our seed maintenance and increase efforts in order to produce high quality certified seed. New efforts in participatory plant breeding and sustainable production practices will also be initiated.

We are grateful for the opportunity to conduct cooperative and interdisciplinary research with members of the NDSU potato improvement team, the USDA-ARS programs in Fargo and East Grand Forks, the North Central group and other research programs across the globe. Our sincere thanks to our many grower, industry, and research cooperators in North Dakota, Minnesota, and beyond. Your support of our research program is amazing, making our work exciting and a joy.

Table 1. Potato Breeding and Cultivar Development Breeding, Selection and Development Schematic, North Dakota State University

Year	Procedure
1	Parental selection, crossing and true seed production in the greenhouse. Produce seedling tubers from true seed in the greenhouse. Initiate late blight screening of seedling families in the greenhouse using a detached leaf assay.
2	About 100,000 North Dakota seedlings are planted in the field (Langdon, ND) as single hills. Up to 50,000 from out-of state programs are also planted at ND locations. Initial selection takes place at harvest; 1,000-1,500 genotypes are typically retained. This is the first cycle of field selection. Decisions regarding seed increase are initiated.
3	Two-four hill units are planted at Absaraka for seed maintenance. Typically 200-250 selections are retained at harvest based primarily on phenotypic selection. This is the second cycle of field selection. Colorado potato beetle (CPB) resistant (potential) selections are entered into replicated trials and evaluated for defoliation. Selections are evaluated for specific gravity and internal defects. Chipping and processing russet selections are evaluated for sucrose rating and are chipped from storage (5.5 and 7.2 C). Replicated late blight resistance screening field evaluations begin. Preliminary yield trials begin. Cleanup and micropropagation are initiated for exceptional genotypes.
4 and/or 5	Two-four hill units are planted at Absaraka and 10 hills are planted at Wyndmere for seed maintenance. Decisions regarding increase are made at harvest and following quality evaluations during the winter. This is the third cycle of field selection. Selections are evaluated for specific gravity and internal defects. Chipping evaluations, late blight and CPB resistance screenings continue. Selected lines are increased for trial seed. Additional selections may be entered into micropropagation. Entry into state yield trials for up to three years may occur. Sensory evaluations are initiated. Decision is made following grading, or during the winter evaluations, determining which selections to continue with.
6	Second year of state trials. Promising selections continue to be increased. Cultural management and disease/pest (field and post-harvest reaction) evaluation trials begin. Promising selections continue to be increased. To growers for evaluation and increase.
7	Third year in state trials or exceptional selections to North Central Regional Potato Variety Trial. Cultural management and disease/pest evaluation trials continue. Processing selections are evaluated for flake production.
8-11	Enter in North Central Regional Trial for up to 3 years and USPB/Snack Food Association Trial if it is a chipper. Grower evaluation and increase continue. Cultural management and disease/pest reaction evaluations continue.
10-15+	Consider for release as a named cultivar.

February 2011

Table 2. Cultivar releases from the North Dakota State University Potato Breeding Program, as part of the North Dakota Agricultural Experiment Station, from its inception in 1930 through 2010.

Cultivar	Year	Type	Seed Acreage 2010[1]
Nordak	1957	Tablestock, round-oval white	
Norgleam	1957	Tablestock, round-oval white	
Norland	1957	Tablestock, round-oval red	3021.36[2]
Snowflake	1961	Tablestock, round-oval white	
Viking	1963	Tablestock, oblong-round red	125.40
Norgold Russet	1964	Tablestock, russet	
Norchip	1968	Chip processing, round white	
Norchief	1968	Tablestock, round-oblong red	
Bison	1974	Tablestock, round-oblong red	
Dakchip	1979	Chip processing, round-oval white	
Crystal	1980	Chip processing, oval	
Redsen	1983	Tablestock, round-oval red	
NorKing Russet	1985	Tablestock, russet	
Russet Norkotah	1987	Tablestock, russet	397.26[3]
Goldrush	1992	Tablestock, russet	149.40
Norqueen Russet	1992	Tablestock, russet	
NorDonna	1995	Tablestock, round-oval red	
NorValley	1997	Chip processing, round-oval white	92.40
Dakota Pearl	1999	Chip processing, round white	1,196.14
Dakota Rose	2000	Tablestock, round-oblong red	23.21
Dakota Jewel	2004	Tablestock, round-oblong red	36.00
Dakota Crisp	2005	Chip processing, round white	270.11
Dakota Diamond	2005	Chip processing, round white	3.50
Dakota Trailblazer	2009	Dual-purpose[4], russet	19.00

[1] North Dakota Certified Seed Potato Acreage Summary, acreage eligible.
[2] Includes all selections
[3] Standard Russet Norkotah, does not include lines, strains or selections from CO, TX, or NE
[4] Dual-purpose – suitable for French fry processing and tablestock. Evaluated (also listed in seed directory) as AOND95249-1Russ.

Dakota Trailblazer

- A89163-3LS x A8914-4
- Medium-late maturity
- High yield potential
- Good storability and low sugar accumulation in storage.
- High specific gravity
- Resistance to *Vertillium* wilt, pink rot, sugar ends, and late blight (foliar) in field evaluations. Hollow heart and blackspot bruise are occasionally noted.
- Tolerant of metribuzin applications. Requires reduced applications of nitrogen.

ND8229-3

- Marcy x AH66-4
- Medium maturity
- Medium vine size
- High yield potential
- Good storability and excellent fry color from 45F storage
- High specific gravity
- Resistance to sugar ends
- Tolerant of metribuzin applications

ND8068-5Russ

- ND2667-9Russ x ND4233-1Russ
- Medium vine size
- Early vine maturity
- Medium to high yield potential
- Dual-purpose
- High specific gravity
- Good storability with low sugar accumulation

ND4659-5R

- NorDonna x ND2842-3R
- Suited for the fresh market
- Medium vine with red-purple flowers
- Medium maturity
- Medium yield potential
- Bright red, round, smooth tubers with white flesh and shallow eyes
- Medium specific gravity
- No outstanding disease or pest susceptibilities
- Stores well

ND8555-8R

- ND7188-4R x ND5256-7R
- Suited for the fresh market
- Medium maturity
- Medium-large vine size
- High yield potential
- Bright red, round, smooth tubers with white flesh and shallow eyes
- Very uniform tuber size profile
- Medium specific gravity
- Stores well

AND00272-1R

- MN17922 x A92653-6R
- Suited for the fresh market
- Medium vine with red-purple flowers
- Medium-late maturity
- Medium yield potential
- Bright red, round to oval, tubers with white flesh, shallow eyes and smooth tuber type.
- Low to medium specific gravity
- No outstanding disease or pest susceptibilities
- Stores well

ND6002-1R

- NorDonna x Bison
- Medium sized vine
- Medium-late vine maturity
- Medium yield potential
- Round, smooth, bright red tubers with smooth eyes and bright white flesh
- Low to medium specific gravity
- Early in evaluation process

ND7132-1R

- ND5002-3R x ND5438-1R
- Medium maturity
- Medium yield potential
- Bright red skinned, oval to oblong tubers with white flesh
- Early in evaluation process

ND8314-1R

- Dakota Jewel x ND5261-3R
- Medium vine size
- Medium maturity
- High yield potential
- Bright red skin, oval to oblong tubers with white flesh
- Early in evaluation process

ND7519-1

- ND3828-15 x W1353
- Medium sized vine
- Medium-late maturity
- High yield potential
- High specific gravity (+1.090 average in ND)
- Chips from 42F storage

ND8304-2

- ND860-2 x ND7083-1
- Medium early maturity
- Small to medium sized vine
- Medium yield potential
  - Nice tuber type, smaller size profile
- High specific gravity
- Chips from 42F storage
  - Excellent cold chipping selection

ND7799c-1

- Dakota Pearl x Dakota Diamond
- Medium vine size
- Medium-late maturity
- High yield potential
  - Nice tuber type and tuber size profile
- Medium to high specific gravity (1.086 average)
- Chips from 42F storage

ATND98459-1RY

- ATD252-5R x T4845
- Medium to large vine size
- Medium maturity
- High yield potential
- Round, smooth, red tubers with shallow eyes and yellow flesh
- Medium to high specific gravity

ND7834-2P

- NorDonna x ND5554-1R
- Medium vine size
- Medium maturity
- Medium to high yield potential
- Oval and blocky tubers, smooth, dark purple (blue) color, with very shallow eyes and marbled flesh
- Medium to high specific gravity

ND7818-1Y

- Morene x Marcy
- Medium vine size
- Medium maturity
- Medium to high yield potential
- Oval, smooth, yellow skinned tubers with yellow flesh
- Medium to high specific gravity
- Excellent cold chipping selection
- ‘European’ type