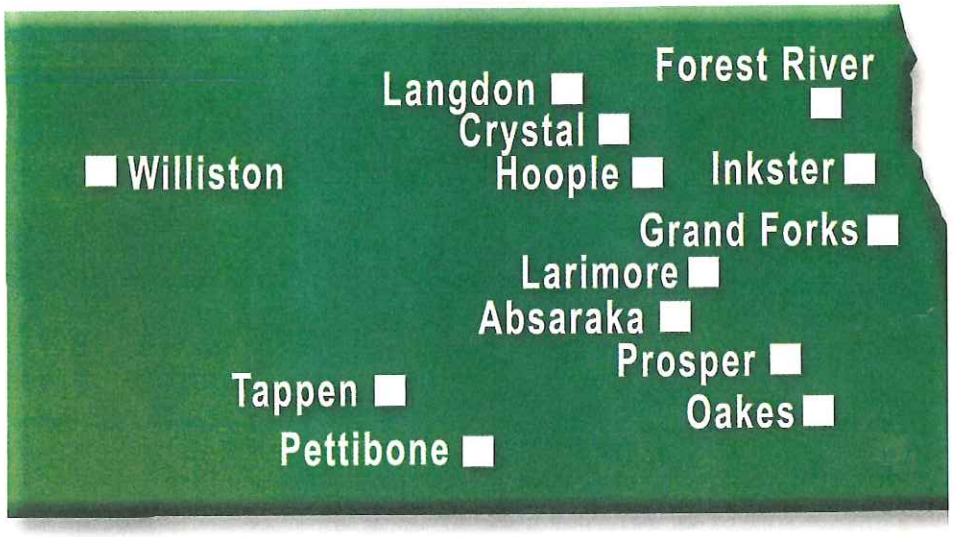
2013 Potato Field Research In

The 2013 Potato growing season has been the opposite of last year. The area was inundated with rain and cold weather, making planting difficult for growers and researchers.



As in previous years, the potato research and extension activities are occurring throughout North Dakota and Minnesota. The work addresses potato breeding; nutrient management; and disease, insect, and weed pests. The efforts are focused on improving potato production for the North Dakota and Minnesota growers, but also effect production practices throughout the United State and world. Many of the projects are funded by the Northern Plain Potato Growers Association, Minnesota Area II Research and Promotion Council, industry partners, and other funding organizations. The following pages provide a brief summary of the major field research activities underway by the potato programs at North Dakota State University, University of Minnesota, and the North Dakota State Seed Department. We hope you find the information useful and we look forward to seeing you at the Northern Plains Potato Grower Association Field Days at Larimore, Inkster, and Hoople, North Dakota on Thursday, August 22, 2013. The Minnesota Area II Field Day will be held on July 16th at the Sand Plains Research Farm in Becker, Minnesota. It will start at 5:00 PM and we will tour fields until 7:30 PM, then dinner will be provided.

2013 Potato Agronomy Field Research Summary

Dr. Andy Robinson, Extension Potato Agronomist NDSU/U of M and Eric Brandvik, Research Specialist

Inkster Near Inkster, North Dakota is evaluating the effect of Rejuvenate on stem number and yield of Russet Burbank potatoes. The second trial is comparing different fertilizers containing potassium, magnesium, and sulfur compounds on Russet Burbank.

Grand Forks Trials at Grand Forks, North Dakota are assessing the effect of glyphosate and dicamba residues in seed and how emergence and yield are affected from these herbicides, effect of nitrogen and seed spacing on potatoes, and the effect of phosphorous acid and glyphosate applied on seed prior to storage and how this effects growth and development of the potato plant.

We are assessing 29 different red- and yellow-skinned varieties for their yield, storability, and disease resistance in storage. Varieties being tested are from Colorado, Maine, Minnesota, North Dakota, and Wisconsin.

Pettibone Arbuscular mycorrhizal fungi, a naturally occurring fungus, have been shown to increase uptake of nitrogen, phosphors, water and other plant nutrients in cropping systems. A trial was established at Pettibone, ND to evaluate mycorrhizae fungi applied to seed and the effect it has on nutrient uptake of potatoes.

Perham Three trials at Perham,

North Dakota and Minnesota

Minnesota are evaluating herbicides for weed control and injury to potato plants. One trial is assessing reduced rates of Matrix (rimsulfuron) and metribuzin on weed control and crop injury, a second trial is focused on determining the effect of various adjuvants mixed with Matrix (rimsulfuron) used postemergence to control weeds and not cause significant damage to potato plants, and a third trial is evaluating Linex (linuron) and other preemergence herbicides and their effect on weed control and crop injury.

Becker One trial in Becker, Minnesota is studying the effect of different nitrogen rates and different irrigation rates on the production of Dakota Trailblazer, Russet Burbank, and ND8068-5Russ in order to find a more sustainable way to produce processing potatoes.

Nutrient Management Research on Irrigated Potatoes

Dr. Carl Rosen, Department of Soil, Water and Climate, University of Minnesota

In 2013, five studies are being conducted at the Sand Plain Research Farm in Becker and Park Rapids, Minnesota. As in previous years, the overall goal of these studies is to improve nutrient management and potato production on irrigated sandy soils. The objectives and brief descriptions of these studies are as follows:

Agronomic Trials of Advanced Potato Cultivars to Reduce Acrylamide Levels in Processed Potato Products

This is the first year of a project being conducted in cooperation with researchers in five other states (ID, ME, OR, WI, and WA), funded by the Specialty Crops Research Initiative, U. S. Department of Agriculture. The study is being conducted in all six states using 14 recently-derived clones, with Russet Burbank as the check variety. The dates of 50% emergence, tuber initiation, tuber set, and 100% canopy closure will be determined, as will the pre-harvest stem count and any occurrence of disease. Tuber yield and quality will be measured, and samples will be analyzed for frying quality, sugar concentration, asparagine concentration, and the acrylamide concentrations of finished fried products after 0, 4, 8, and 11 months of storage.

Evaluation of Slow Release Nitrogen Sources and Improving Diagnostic Tools to Determine Nitrogen Requirements for Irrigated Potato Production

Studies with controlled release N fertilizer have been conducted for the past eight years using ESN, a polymer coated urea manufactured by Agrium, Inc. Since 2011, studies have also included Duration, also manufactured by Agrium, and have found that it can improve nitrogen nutrition in leaching years. Because of the slow release nature of this product, it needs to be applied early (e.g. preplant) or in combination with quicker release forms at emergence. We are continuing this research in 2013, with

diagnostic techniques first applied last year, such as the chlorophyll meter and whole leaf and petiole analysis to monitor nitrogen status of the crop. We are also continuing our 2012 research on a product with reported slow release properties called N-Zone (manufactured by AgXplore). This year, we are using split applications of N-Zone, similar to those typical for urea/UAN, as opposed to using a single application at emergence. The research is being conducted on small plots at Becker and on an on-farm study near Park Rapids. Specific objectives include: a) Compare the effects of ESN with Duration on potato yield and quality and b) Integrate the use of various diagnostic tools such as the chlorophyll meter, petiole nitrate analysis, and whole leaf N analysis to help identify the N status of the crop. Eighteen N treatments are being evaluated using Russet Burbank as the test cultivar. Four of the 18 treatments are conventional N sources (urea/UAN) with various times of application at 170 and 240 lb N/ac. Additional sources include N-Zone, ESN and Duration as well as various combinations and timings of these sources. At the Park Rapids site, ESN rates from 110 to 350 lb N/ac are being tested in 60 lb N/ac increments with conventional N and Duration treatments being tested at the 230 lb N/ac rate. At this site, treatment effects on an established field are being compared with those on ground with no history of previously planted potatoes. A companion study similar to the one in Park Rapids is being conducted in Tappen, North Dakota by Andy Robinson.

Optimizing Potassium Management for Irrigated Potato Production

A potassium (K) study was initiated at the Sand Plain Research Farm in Becker in 2012 to determine the extent of K movement during the season, as well as variability in soil test K during the season. Numerous questions about soil test potassium and potential leaching losses have been asked over the last few growing seasons. Agronomists noted lower petiole K levels than normal, which prompted questioning of when the soil should be tested for K. The recommended time is in the fall or early spring prior to planting. However, in some cases samples are taken in June of the previous season when soybeans are being grown. Research is needed to determine when soil test K provides a reasonable measure of K availability, how much K might be leaching, and determine how much K drops after growing a crop of potatoes at various K rates. The objectives of this study are to 1) evaluate potato response to K fertilizer rate; 2) determine the effect of timing of sampling on soil test K; 3) determine K draw down following a crop of potatoes; 4) determine the extent of K movement though the growing season (and over the winter of 2012-13). Treatments will compare the effects of pre-plant application rates of K ranging from 0 to 360 lb K2O/ac on Russet Burbank potato yield and quality in 2013 and relate the response to soil test K sampled at various times through the growing season. A concurrent study on Red Norland potatoes compares different K application rates (0, 160, or 320 lbs K2O/ac) and different application times (pre-planting, planting, emergence, and two applications split between planting and one of the other two times). Soil test K will be determined preplant, mid-season and after harvest. Petiole K is also be monitored on four occasions during the season. Effects of fall application will be evaluated for the 2014 growing season.

Evaluation of Seed Power, Nitrate Balancer, X-Cyte, STO-33, Bio-Forge, Nitro Plus 9, and Sugar Mover on Potato Yield and Quality

Stoller USA manufactures various products that have the potential to improve plant performance, but have not been field tested for potatoes under Midwest conditions. Seven products are being evaluated at the Sand Plain Research Farm at Becker in 2013. Stimulate and Seed Power are liquid seed treatments intended to promote root growth, enhancing nutrient uptake, stress resistance, and yield. STO-33 and Bio-Forge are applied around bloom and are intended to reduce drought stress and promote root development. Nitrate Balancer is intended to reduce excessive growth in plants in response to high nitrate concentrations, enhancing yield, quality, and disease resistance. Nitro Plus 9 is a liquid fertilizer formulation with nitrogen in the amine form. It also contains calcium and boron. Sugar Mover is a product intended to improve translocation of sugars from the vines to the tubers and enhance yield. Similarly, X-Cyte is being evaluated for its potential to enhance sugar transport from the vines to the tubers to enhance yield. The overall objective of this research is to evaluate these Stoller products as amendments for irrigated Russet Burbank production and compare their effectiveness with conventional practices.

Evaluation of Crystal Green as a P Source for Potatoes

Crystal Green is a slow-release P source (struvite) that also includes nitrogen and magnesium. Its slow-release characteristics are due to low water solubility. Solubility is increased by chemicals exuded by plant roots (citrates). Thus, Crystal Green is intended to enhance P fertilization efficiency by releasing P more rapidly when in proximity to plant roots. The objective of this study is to evaluate Crystal Green as a contributing P source for Russet Burbank potatoes. We will address the following questions: (1) Are there differences in marketable yield and quality when using Crystal Green as

a P source, relative to MAP? (2) How do results for blends of Crystal Green and MAP compare to those for either P source alone? (3) Can the optimum P2O5 application rate be reduced by combining Crystal Green and MAP? In 2013, treatments will compare different ratios of MAP to Crystal Green, different application methods (in-furrow at planting vs. broadcast before planting), and different application rates (75 vs. 100 lbs/ac), including a no-P check. Russet Burbank plants will be evaluated for P uptake at three times during the season, and for the yield, grade, size, and quality of their tubers at harvest.

2013 Field Research Potato Entomology

Janet Knodel, Extension Entomologist NDSU & Patrick Beauzay, Research Specialist

Colorado potato beetle is a notorious insect pest of potato. Beetles and larvae defoliate the plants and can severely reduce yields. Many populations of Colorado potato beetles have developed resistance to different insecticides. In this research, new insecticides are being screened for control of Colorado potato beetle near Glyndon, MN. Some of these tested insecticides provide alternative modes of action to help prevent the development of insecticide resistance.

2013 Potato Pathology Field Research Trials

Dr. Neil C. Gudmestad, Raymond J. Taylor, Dean Peterson and Russell Benz

Potato pathology research trials conducted this year at the Northern Plains Potato Growers Research Site at Inkster, North Dakota will be similar to those performed in past years. In collaboration with Dr. Gary Secor, we will be screening standard and experimental fungicides for efficacy in controlling foliar blight diseases including early blight (*Alternaria solani*), brown spot (*A. alternata*) and black dot (*Colletotrichum coccodes*) in three trials. Most of these will be conducted in the context of a fungicide program to determine how each fungicide performs in conjunction with other fungicide chemistries. Fungicide applications will be performed as each program specifies, typically on a weekly basis. Data from these trials will include weekly foliar disease severity made by visual estimation, intermittent evaluation of the disease complex through isolating the causal pathogen from foliar lesions present on non-treated control plants, and total yield. As plants begin to develop, one trial will be inoculated with *C. coccodes* and as senescence begins, two trials will be inoculated with *A. solani*, to enhance disease development.

In addition to our own research and screening trials, we also will assist Dr. Asunta Thompson in the development of breeding material with disease resistance. The 2013 field site is identical to the site used by NDSU in 2009. In that year we established a Verticillium wilt trial where Dr. Thompson's breeding material was screened and that site was geo-referenced so that we can plant in the same plot every four years. In addition, inoculum of *Verticillium dahliae* will be applied to the soil at planting to increase the Verticillium wilt pressure. Selections from the NDSU breeding program then will be planted into infested soil. We also will screen selections from the breeding program for resistance to pink rot and leak. This will be accomplished via post-harvest *P. erythroseptica* and *P. ultimum* tuber challenge inoculations. Tubers will be evaluated for tuber rot severity and incidence and compared to control cultivars for levels of disease resistance.

In 2011 we initiated a research program on powdery scab (*Spongospora subterranea*) in collaboration with Dr. Gary Secor, along with an additional project on *potato mop top virus* (PMTV). The importance of these two diseases has escalated over the past few growing seasons in many parts of the USA, particularly the PNW. These diseases are interrelated in that the fungus *S. subterranea* is the vector, or carrier, for PMTV. Two Ph.D. students, Francisco Bittara and Owusu Domfeh, have been conducting experiments to screen cultivars and breeding material across several market classes for resistance to each pathogen. These studies are continuing in 2013. Foliage from plants will be collected during the growing season and evaluated for the presence of the virus. Post-harvest tuber evaluations will be conducted immediately as well as throughout the storage season to determine disease incidence and severity. This research has already successfully identified potato cultivars within each market class that do not express tuber necrosis induced by PMTV and will provide disease control options for growers affected by this devastating disease.

Tuber rot diseases remain an integral part of the potato pathology program in 2013. As in the past, we will evaluate several areas to improve control of pink rot caused by *Phytophthora erythroseptica* in addition to the disease resistance screening already mentioned. Two pink rot trials will be conducted at Park Rapids, Minnesota. The objective of the first will be to evaluate various rates and application timings of traditional and alternative fungicide chemistries and programs for tuber rot control compared to standard mefenoxam (Ridomil/Ultra flourish®) and phosphorous acid (Phostrol®) treatments. Soil will be inoculated with mefenoxam sensitive isolates of *P. erythroseptica* and tubers will be evaluated for levels of rot at harvest and approxi-

mately 45 days post-harvest. We continue to screen new fungicide chemistry for activity against the pink rot and the late blight pathogens. One fungicide in particular appears to represent an entirely new class of fungicide chemistry.

Additional trials performed in Minnesota include the evaluation of the effects of chloropicrin soil fumigation on Verticillium wilt and black dot disease development. Soil was collected and tested for the quantity of *V. dahliae* microsclerotia, foliar wilt will be evaluated over the course of the growing season and tuber yield and grade will be assessed post-harvest. This trial was conducted for the first time in 2012 with very promising results. Finally, fungicides will be evaluated for the control of white mold caused by *Sclerotinia sclerotiorum*.

2013 Field Research Potato Entomology

Dr. Ian MacRae, University of Minnesota

Aphid Alert II - In cooperation with and assistance from the Area II and Northern Plains Potato Growers Assoc., we have re-established the Aphid Alert suction trap network. This network will provide near real-time distribution information on aphid species that vector virus diseases (esp. PVY) to seed potatoes. This information will assist seed potato producers in making decisions to manage these disease vectors. The weekly trap catches will be published in text format via email from the NPPGA and will be available graphically via the website, aphidalert.blogspot.com. In 2012, the network rebooted with 9 trap locations, in 2013 we plan to expand the network to 18-20 trap locations throughout Minnesota and North Dakota.

Assessing Soybean Aphid as a Vector of PVY in Minnesota Seed Potato - Funded by a Specialty Crops Block Grant from the Minnesota Dept. of Agriculture, this is a collaborative effort with Dr. Robert Koch, soybean entomologist with the UMN Dept. of Entomology. The fact that soybean aphids are capable of transmitting PVY and findings from Wisconsin on the potential impact of this aphid on PVY epidemiology raises concerns about it's role in effective vector management. We will be examining soybean aphids as a vector of PVY in Minnesota seed potato fields, and especially its movement between soybeans and potatoes, and the potential impact of this aphid on established aphid management tactics.

Monitoring Neonicotinoid Insecticide resistance in Colorado Potato Beetle - In cooperation with and assistance from the Area II and Northern Plains Potato Growers Assoc. we are establishing the susceptibility to neonicotinoid insecticides in populations of Colorado Potato Beetles (CPB) sampled from production areas across Minnesota and North Dakota. Individuals sampled in surveys and by cooperators are returned to the entomology lab at the UMN-NWROC in Crookston, Minnesota where their level of susceptibility to neonicotinoid insecticides is assessed and compared to that of a laboratory population that is known to be susceptible to these insecticides. In 2012, we confirmed decreasing levels of sensitivity to these insecticides for the first time in certain locations in the Red River Valley of the North. This suggests the geographic distribution of neonicotinoid tolerance in CPB is expanding in MN and ND. In 2013, we hope to sample 20-30 locations in potato production areas in the region.

Remote Sensing of PVY - Dr.'s Susie Thompson, Neil Gudmestad, and Ian MacRae are gathering preliminary data on the potential to use remotely sensed data to detect PVY infected plants. Light in the Near InfaRed region of the spectrum reflected by plants can be utilized to detect plant stress (e.g. from insect feeding, disease, or drought). This technique has been utilized in a number of crops to determine pest impact.

2013 Field Research Potato Pathology NDSU

Dr. Gary Secor

Seed treatment trials. We have several trials at five locations to determine the effect of seed and in-furrow treatments on management of Rhizoctonia stem canker, silver scurf and Fusarium decay.

Inkster Two trials at the NPPGA irrigated research site at Inkster, North Dakota will evaluate fungicide treatments for disease control and yield and quality of Russet Burbank potatoes. One trial will evaluate seed treatments and a second trial will evaluate will evaluate biological treatments. A third seed treatment trial is located at an irrigated site near Osage, MN will evaluate Emesto Silver with and without Serenade located near Perham, MN. These trials will evaluate the effect of treatments on stand, disease control, yield, grade and tuber quality. Diseases evaluated in these three trials will concentrate on Rhizoctonia of stems and stolons.

Becker Two trials at the Scott Hayes farm will evaluate seed and in-furrow treatments for Fusarium seed decay and silver scurf. Yukon Gold seed was inoculated with Fusarium prior to treating and planting by tumbling potatoes with crumbled potatoes diseased with dry rot. Fusarium seed decay and wilt will be assessed during the season.

A second trial will evaluate several new SDHI and biological fungicides for control of silver scurf at harvest. Seed of Yukon Gold was inoculated with H. solani, the fungus that causes silver scurf prior to treating and planting. Silver scurf will be assessed at harvest and after storage of tubers from the trial.

A silver scurf trial to determine whether H. solani, the fungus that causes silver scurf, can be soil-borne in addition to being seed-borne, was planted at the Paul Gray farm near Becker. Greenhouse produced minitubers free of H. solani produced by Valley Tissue Culture were planted in five different fields. The fields selected were 1,2,3,4 and five years since the last crop of potatoes. Tubers will be assessed for silver scurf soon after harvest to determine if H. solani can persist in Becker soils and if so, for how long.

Forest River A trial near Forest River, North Dakota will evaluate the efficacy of seed treatment and in-furrow treatments for control of common scab. Scab will be evaluated at harvest time.

Absaraka Maintenance and increase of germplasm used in the NDSU potato breeding program are planted on a farm near Absaraka, North Dakota. This repository of clean potato germplasm is free of disease and indexed for virus by greenhouse testing at NDSU and is entered for certification with the North Dakota State Seed Department. The potatoes produced at this location are certified will be used as parents and for production trials with growers. This work is a collaborative project between Susie Thompson and our project.

Prosper Four foliar late blight trials and one late blight seed treatment trial will be conducted at the NDSU Research Farm at Prosper, North Dakota. One trial will evaluate foliar fungicides for control foliar and tuber late blight disease. In collaboration with Susie Thompson, two trials will screen potato selections and germplasm for genetic resistance to late blight caused by *Phytophthora infestans*. One trial will evaluate approximately 180 early generation selections from the NDSU potato breeding program and the Chilean potato breeding program used in dedicated late blight crossing block in five hill trials for resistance to late blight. The dedicated crossing block contains late blight varieties from national and international sources. Another trial will evaluate 32 advanced selections from the NDSU potato breeding program in replicated trials for resistance to both foliar and tuber late blight. Another will evaluate resistance to late blight of cultivars and clones entered into the National Late Blight Trial coordinated by Kathy Haynes, USDA-ARS. A seed treatment trial will be conducted to determine the efficacy of seed treatment compounds for managing seed-borne late blight.

Post-harvest Fusarium dry rot resistance trials will be conducted using potatoes produced at Inkster, North Dakota. Several varieties, including many new processing selections and cultivars from NDSU, US Potato Board and other breeding programs are being grown for increase under irrigation.

Excellent technical support of these trials is provided by Dean Peterson, Russell Benz, Ariane Fricke and Viviana Rivera, as well as a number of valuable summer employees. Continuing support of the potato industry for this work is acknowledged and appreciated.

2013 Potato Breeding Program Field Research Summary

Dr. Asunta (Susie) Thompson
Jeremy Buchman and Richard Nilles

The North Dakota State University Potato Breeding Project is conducting field research and producing certified seed at locations across North Dakota and western Minnesota. An campus, seedling and minituber production is in full swing in the beautiful Agricultural Experiment Station Greenhouse complex. Field trials and seed production efforts are summarized here by location:

Absaraka This site is a collaborative effort with Dr. Gary Secor's program in Plant Pathology, with the goal of producing high quality, disease free certified seed, for use by the potato breeding program in maintenance, increase, and trials, and for sharing with cooperating research programs and potato industry collaborators at NDSU and across North America. Seed maintenance of second year material (seedlings selected at Langdon in September 2012), and third year and older advancing selections, named cultivars, and parental genotypes are grown at Absaraka. All lots are entered for certification with the North Dakota State Seed Department (NDSSD). This isolated site is rented from a farmer (corn, soybeans, wheat) south of the NDSU Dale Herman Research Arboretum.

Baker Seed maintenance and increase lots are planted at Baker, Minnesota, on the James F. Thompson Farm. The lots are entered for certification with the Minnesota Department of Agriculture. Seed produced at this site is used for trials and is shared with research collaborators at NDSU and with research and potato industry collaborators in North Dakota, Minnesota, and around North America. Additionally, selections identified as having resistance to late blight via the detached leaf assay, and those identi-

fied as possessing resistance to PVY via marker-assisted selection, are fast-tracked for agronomic evaluation at this site.

Crystal The fresh market trials are planted on the farm of Dave and Andy Moquist (O.C. Schulz). Trials include the North Central Regional Potato Variety Trial (NCRPVT) and the State Fresh Market trial. NDSU has entered ND6002-1R, ND7132-1R and ND7982-1R in the NCRPVT. The preliminary fresh market trial is also planted at this non-irrigated site.

Grand Forks We are focusing on Colorado Potato Beetle (CPB) resistance breeding efforts at this site and have four trials evaluating defoliation by this 'super' pest. One trial focuses on screening genotypes for the presence of glandular trichomes as a mechanism for CPB control, while one is evaluating genotypes for the presence of tuber and foliar glycoalkaloids, the latter an important mechanism imparting resistance to CPB. One hundred seedling families and 165 genotypes with CPB resistance breeding will be evaluated for defoliation levels. New in 2013, a trial associated with addressing vine kill options using dessicant rate and timing to achieve optimum skin set for ND8555-8R, is being conducted by Jeremy.

Hoople The focus at this location are chip trials, including the NCRPVT chip processing trial and the State chip processing trial. This non-irrigated site on the Lloyd Oberg farm includes the preliminary chip processing trial, in addition to the National Chip Processing Trials (NCPT, unreplicated and replicated). The NCPT has goals to rapidly identify replacements for Snowden with long-term chip processing potential, and Atlantic, primarily to address its susceptibility to internal heat necrosis, while providing high yield potential and high specific gravity, and that can withstand production environments in the south. ND7799c-1, a hybrid between Dakota Pearl and Dakota Diamond, is the lone NDSU entry in the NCRPVT chip trial. Additionally, Marty Glynn with the USDA-ARS Potato Worksite, has trials at this location.

Inkster This irrigated site includes the irrigated NRPVT fresh market and chip processing trials, and is a second irrigated site for the NCRPVT processing trial. NDSU entries in the NCRPVT fresh market trial include ND6002-1R, ND7132-1R and ND7982-1R. ND7799c-1 is being evaluated in the NCRPVT chip trial. The irrigated State chip trial includes advancing NDSU selections and chip industry standards. In an accelerated effort to breed and select genotypes with Verticillium wilt resistance, a replicated screening trial is planted at Inkster; this work is a collaborative effort with Dr. Neil Gudmestad's program. We are grateful to the Northern Plains Potato Growers Association, the Forest River Community, and Simplot Grower Solutions in addition to many others, for facilitating our work at this location.

Langdon NDSU potato seedlings and minituber increase lots are planted in the nursery at the Langdon Research Extension Center. The nursery is coordinated with the help and collaboration of Dr. Randy Mehloff and staff at the center. All lots are entered for certification with the North Dakota State Seed Department (NDSSD). We anticipate selection of this material after Labor Day, in early to mid September.

Larimore Irrigated trials at Larimore are at Hoverson Farms on a mini-pivot built in support of potato improvement research efforts. Trials include the State processing trial the NCRPVT processing trial, preliminary processing trial, maintenance of out-of-state selections and out-of-state seedlings. The National French Fry Processing trial (NFPT), supported by the USPB, is also being conducted at this location, with the goal of identifying russet selections with French Fry processing potential with low acrylamide levels in fried tuber tissues. The starch quality trial is in its second year in cooperation with the Potato Innovation Group, including Drs. Susan Raatz, Senay Simsek and Pushparajah Thavarajah. Two new trials in 2013 are being conducted by Jeremy. The first focuses on nitrogen fertility management of ND8555-8R, to achieve optimal skin set. The second, focuses on seed handling of Dakota Trailblazer to determine if preplant options exist to maximize marketable yield.

Oakes An irrigated processing trial is grown at the Oakes Research Extension Center. There are 24 entries in the 2013 trial including 16 advancing NDSU dual-purpose russet selections and eight industry standards.

Park Rapids In 2013, a processing trial with 18 entries and a preliminary processing trial evaluating 60 dual-purpose russets for processing potential are planted at Park Rapids, Minnesota on the RDO Farm.

Williston An irrigated processing trial is grown in cooperation with Dr. Jerry Bergman, Chuck Stadick, and Tom Rolfstad at the Nesson Valley Irrigation Research Site. There are 24 entries including, sixteen advancing NDSU dual-purpose russet selections and eight industry standards. This work is supported by the MonDak Economic Development group and the North Dakota Specialty Crops program.

Additional trials are grown at some of the sites listed above and also at Prosper,

North Dakota, by our cooperating colleagues in Plant Pathology. Dr. Gary Secor's research group conducts late blight resistance evaluations, at the NDSU Prosper site. Dr. Neil Gudmestad and Dr. Ray Taylor evaluate pink rot, Pythium leak and *Phytophthora nicotianae* resistance of advancing NDSU selections and parental genotypes from materials grown at Inkster.

Agronomic Performance Trials

UM Sand Plains Research and Outreach Center, Becker, MN

Dr. Christian Thill, Jeffrey Miller, Ron Faber

UM Agronomic Performance Trials at this irrigated location advancing potato breeding lines developed at the University of Minnesota are being evaluated. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest and from storage. Data for the following attributes are collected - US #1 marketable and size distribution yield, percentage of U.S. #1 yield and graded defect weights (malformed tubers, severe growth cracking, etc.), specific gravity, incidence and type of internal and external defects, and processing color. Red skin selections are harvested early and late to evaluate skin color retention and degree of skin sloughing at harvest and storage. Processing selections are evaluated for processing at harvest and from storage at 3, 7 & 9 months. Chip selections are evaluated for processing at harvest and from 3, 7 & 9 months.

UM Sand Plains Reearch and Outreach Station Becker, MN

Dr. Christian Thill, Jeffrey Miller, Ron Faber, NCR Potato Breeders

North Central Regional Potato Variety Trials. In this trial 4-5 advanced breeding lines developed at the University of Minnesota - Christian Thill & Jeffrey Miller, North Dakota State University - Susie Thompson, Michigan State University - David Douches, and the University of Wisconsin - Jeff Endelman, are evaluated in each cooperating state relative to standard cultivars. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest and from storage. Red skin selections are harvested early and late to evaluate skin color retention and degree of skin sloughing at harvest and storage. Processing selections are evaluated for processing at harvest and from storage at 3, 7 & 9 months. Chip selections are evaluated for processing at harvest and from 3, 7 & 9 months. Potato market types include Reds, Processing, Chip, and Fresh yellow flesh and russets.

Northern Plains Potato Growers Association, East Grand Forks, MN

Dr. Christian Thill, Jeffrey Miller, NPPGA

UM Agronomic Performance Trials at this location our focus is on selecting fresh market red and processing russet clones advancing in the University of Minnesota potato breeding program at the NPPGA Potato Research Farm. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest and from storage. Red skin selections are harvested late to evaluate skin color retention and degree of skin sloughing at harvest and storage. Processing selections are evaluated for processing at harvest and from storage at 3, 7 & 9 months.

Nesson Valley, Williston, ND

Dr. Christian Thill, Jeffrey Miller, Jerry Bergman

UM Agronomic Performance Trials at this irrigated location advancing potato breeding lines developed at the University of Minnesota are being evaluated for adaptation to this region. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest and from storage. Red skin selections are harvested early and late to evaluate skin color retention and degree of skin sloughing at harvest and storage. Processing selections are evaluated for processing at harvest and from storage at 3, 7 & 9 months. Chip selections are evaluated for processing at harvest and from 3, 7 & 9 months. Among the most advanced clones; MonDak Gold, MN18747, MN02419, MN02467Y, MN02616R/Y, MN02588, MN02586Y, MN99380-1Y are planted in strip trials expected to yield 5-10 cwt for larger scale processing and quality evaluations. In addition, many earlier generation breeding selections are being evaluated. We are also selecting among 15,000 single-hill (SH) seedlings from 168 families.

On-Farm Agronomic Performance Trials

Dechene Potato Farm, Big Lake, MN

Dr. Christian Thill, Jeffrey Miller, Jim Dechene

UM Agronomic Performance Trials at this location 24 advanced red and russet potato clones developed at the University of Minnesota are being evaluated on irrigated sandy soils. Clones are planted in 100' strip plots. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at this location is to determine adaptation of red selections, initially selected at Pine Lake Wild Rice seed potato farm, for skin color retention and degree of skin sloughing at harvest. Processing selections are being evaluated for processing from the field. Fresh russet and yellow selections are being evaluated for early and late harvest against market standards. The advanced clones MonDak Gold, MN18747, MN02419, MN02467Y, MN02616R/Y, MN02588, MN02586Y are also planted.

Peterson Potato Farm, Big Lake, MN
Dr. Christian Thill, Jeffrey Miller, Art Peterson

Agronomic Performance Trials at this location 24 advanced red and russet potato clones developed at the University of Minnesota are being evaluated on irrigated sandy soils. Clones are planted in 100' strip plots. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at this location is to determine adaptation of red selections, initially selected at Pine Lake Wild Rice seed potato farm, for skin color retention and degree of skin sloughing at harvest. Processing selections are being evaluated for processing from the field. Fresh russet and yellow selections are being evaluated for early and late harvest against market standards. The advanced clones MonDak Gold, MN18747, MN02419, MN02467Y, MN02616R/Y, MN02588, MN02586Y are also planted.

Edling Potato Farm, Clear Lake, MN
Dr. Christian Thill, Jeffrey Miller, Jerome Edling

UM Agronomic Performance Trials at this location the clone MN04844-7Y developed at the University of Minnesota is being evaluated on irrigated sandy soils. This yellow flesh clone produces uniform round tubers of marketable size and comparable yield to cultivar Yukon Gold. MN04844-07 does not have internal defects, unlike Yukon Gold. The clone is planted in 2-row strips of 500'. It will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at this location is to determine adaptation and maturity relative to the standard cultivar.

Hayes Potato Farm, Clear Lake, MN
Dr. Christian Thill, Jeffrey Miller, Scott Hayes

UM Agronomic Performance Trials at this location the clone MN18747 developed at the University of Minnesota is being evaluated on irrigated sandy soils. This white skin and white flesh processing and fresh market clone produces uniform blocky long tubers of marketable size early. MN18747 has been determined to have low acrylamide in fry processing. It also does not have internal defects. The clone is planted in 2-row strips of 300'. It will be evaluated for plant maturity, yield, grade, and quality at harvest. The clone bulks early. Our focus at this location is to determine adaptation and maturity relative to the standard cultivar Superior for early harvest.

Five Star Potato, Clear Lake, MN
Dr. Christian Thill, Jeffrey Miller, Bill Keffmeyer

UM Agronomic Performance Trials at this location the clone MN 04844-07Y, MN18747, and MN02616R/Y developed at the University of Minnesota are being evaluated on irrigated sandy soils. MN04844-07Y is a yellow flesh clone producing uniform round tubers of marketable size and comparable yield to cultivar Yukon Gold. MN04844-07 does not have internal defects, unlike Yukon Gold. MN18747 is a white skin and white flesh processing and fresh market clone producing uniform blocky long tubers of marketable size early. MN18747 has been determined to have low acrylamide in fry processing. It also does not have internal defects. MN02616R/Y is a fresh red skin yellow flesh clone that produces round tubers with excellent red color and skin retention. The flesh color is deep yellow and no internal defects have been observed. The culinary quality of MN02616R/Y is excellent. These clones are planted in multiple-row strip plots of 200-400'. They will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at this location is to determine adaptation and maturity relative to the standard cultivars.

Moquist Potato Farm, Crystal, ND
Dr. Christian Thill, Jeffrey Miller, Dave & Andy Moquist

UM Agronomic Performance Trials at this location 40 advanced red and russet potato clones developed at the University of Minnesota are being evaluated on heavy Northern RRV soils. Clones are planted in replicated plots. Clones will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at this location is to determine adaptation of red selections, initially selected at Pine Lake Wild Rice seed potato farm, for skin color retention and degree of skin sloughing at harvest and storage. Processing selections are being evaluated for processing from the field and storage. Fresh russet and yellow selections are being evaluated for early and late harvest against market standards. The advanced clones MonDak Gold, MN18747, MN02419, MN02467Y, MN02616R/Y, MN02588, MN02586Y are also planted.

Hugh's Garden Organic Potatoes, Halstad, MN
Dr. Christian Thill, Jeffrey Miller, Hugh Duffner

UM Agronomic Performance Trials at this location the clone MN02616R/Y developed at the University of Minnesota is being evaluated under Organic, northern RRV soil condition. MN02616R/Y is a fresh red skin yellow flesh clone that produces round tubers with excellent red color and skin retention. The flesh color is deep yellow and

no internal defects have been observed. The culinary quality of MN02616R/Y is excellent. It will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at this location is to determine adaptation and maturity relative to the standard cultivar grown under Organic conditions.

Organic Trials, MN

Dr. Christian Thill, Jeffrey Miller, Greg Reynolds, Riverbend Farm, Delano; Mike Lilja, Natures Folly, Dayton; Nick and Joan Olson, Prairie Drifter Farm, Litchfield; Liz Otto, Haberman's Garden, Delano; Connie Carlson, Local Roots Coop Garden, Buffalo; Cathy Rose, Natures Nest, Delano; Laura Dimler, Dilmer Farms, Watertown.

UM Agronomic Performance Trials at these 7 locations MN02616R/Y developed at the University of Minnesota is being evaluated under Organic growing conditions. MN02616R/Y is a fresh red skin yellow flesh clone that produces round tubers with excellent red color and skin retention. The flesh color is deep yellow and no internal defects have been observed. The culinary quality of MN02616R/Y is excellent. It will be evaluated for plant maturity, yield, grade, and quality at harvest. Our focus at these location is to determine adaptation and maturity relative to the standard cultivar grown under Organic conditions.

Seed Development Trials

Pine Lake Wild Rice Seed Potato Farm, Gully, MN

Dr. Christian Thill, Jeffrey Miller, Peter Imle

UM Seed Performance Trials - At this location 25 advanced red and russet breeding lines, originally selected at this location, are being grown for seed. Seed is being grown in accordance with Minnesota Seed Potato Certification guidelines. Seed harvested from this location will be used for On-Farm trials in 2014. Clones will be evaluated for plant disease, plant maturity, yield, grade, and quality at harvest. Our focus at this location is to grow seed for commercial evaluation by growers. In addition, many earlier generation breeding selections are being evaluated. We are also selecting among 35,000 single-hill (SH) seedlings from 168 families.

Disease Screening Trials

UM Sand Plains Research and Outreach Station, Becker, MN

Dr. Christian Thill, Jeffrey Miller, NCR Potato Breeders, US Potato Board NCPT and NFPT Programs

Common Scab Disease Trial at this location replicated plots of clones developed at the University of Minnesota, and by potato breeders in the North Central Region at North Dakota, Michigan, and Wisconsin, and by breeders participating in the US Potato Board NCPT and NFPT program are being evaluated for resistance to Common scab. 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).

UM Umore Park, Rosemount, MN

Dr. Christian Thill, Jeffrey Miller, NCR Potato Breeders, US Potato Board NCPT and NFPT Programs

Late Blight Disease Evaluation Trial at this location replicated plots of clones developed at the University of Minnesota, and by potato breeders in the North Central Region at North Dakota, Michigan, and Wisconsin, and by breeders participating in the US Potato Board NCPT and NFPT program are being evaluated for resistance to Late Blight. The primary focus of this research is to develop new potato varieties and parental germplasm resistant to late blight. Breeding lines are evaluated 3x for % late blight infection after inoculation.

UM Umore Park, Rosemount, MN

Dr. Christian Thill, Jeffrey Miller, NCR Potato Breeders, US Potato Board NCPT and NFPT Programs

PVY Disease Evaluation Trial at this location replicated plots of clones developed at the University of Minnesota, and by potato breeders in the North Central Region at North Dakota, Michigan, and Wisconsin, and by breeders participating in the US Potato Board NCPT and NFPT program are being evaluated for resistance to PVY resistance/ susceptibility, and PVY expression. 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.

Willem Schrage

The State Seed Department plants a plot of 16 varieties with virus diseases for observation of symptom expression of Potato Virus Y (PVY) and Potato Leaf Roll Virus (PLRV) in the different varieties. The strains of PVY are not specified. There are also 33 varieties planted for identification. The plot is a training tool. A map of the varieties is available at the State Seed Department.