

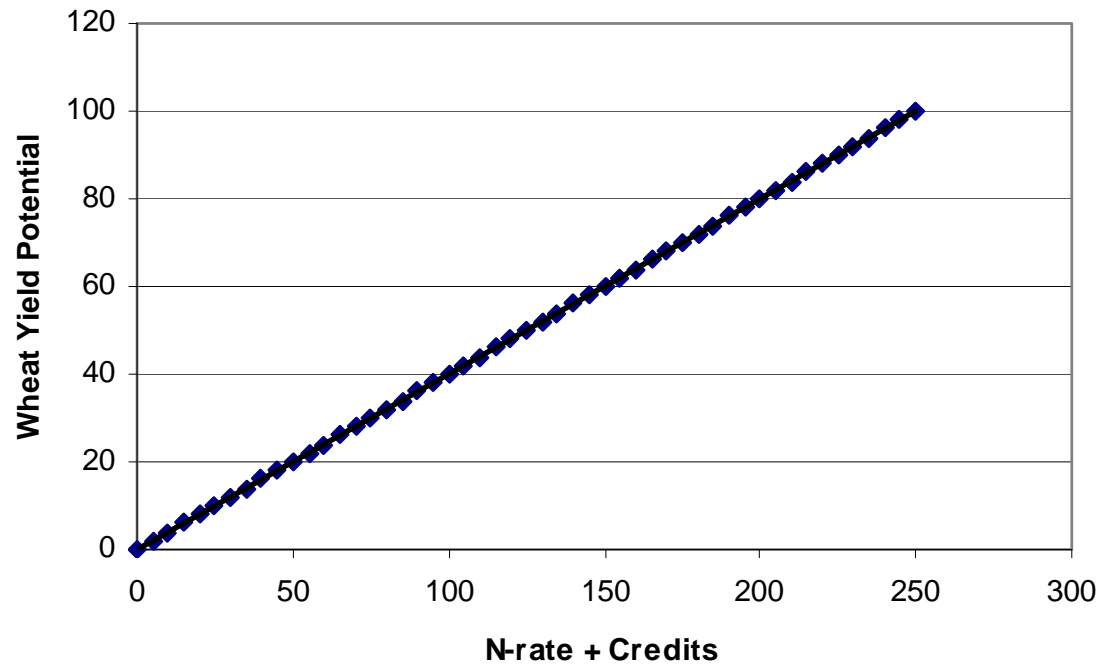
**N Use in Wheat-  
Strategies for Improving  
Efficiencies and/or Reducing Costs**

**Dr. Dave Franzen**

**NDSU Extension Soil Specialist**

# Present recommendations for spring wheat/durum in North Dakota-

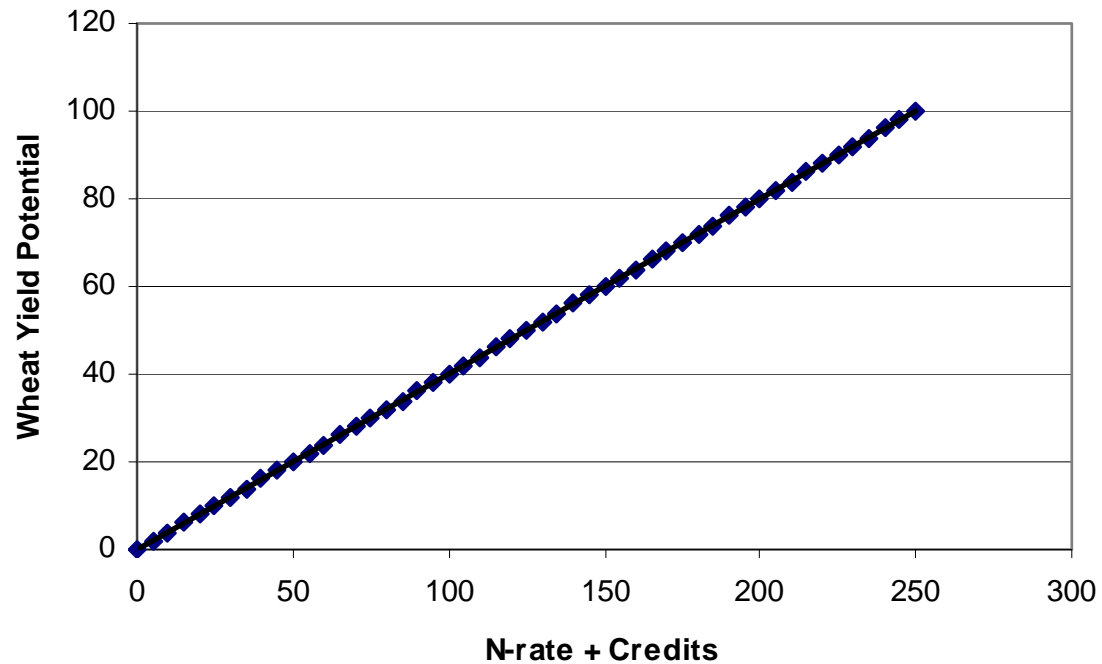
$$\text{N Recommendation} = ((\text{Yield Potential}) \times 2.5) \text{ less credits}$$



**The formula does not contain a contemporary economic component.**

**-no allowance for soil mineralization differences**

**-no allowance for agri-climatology differences**

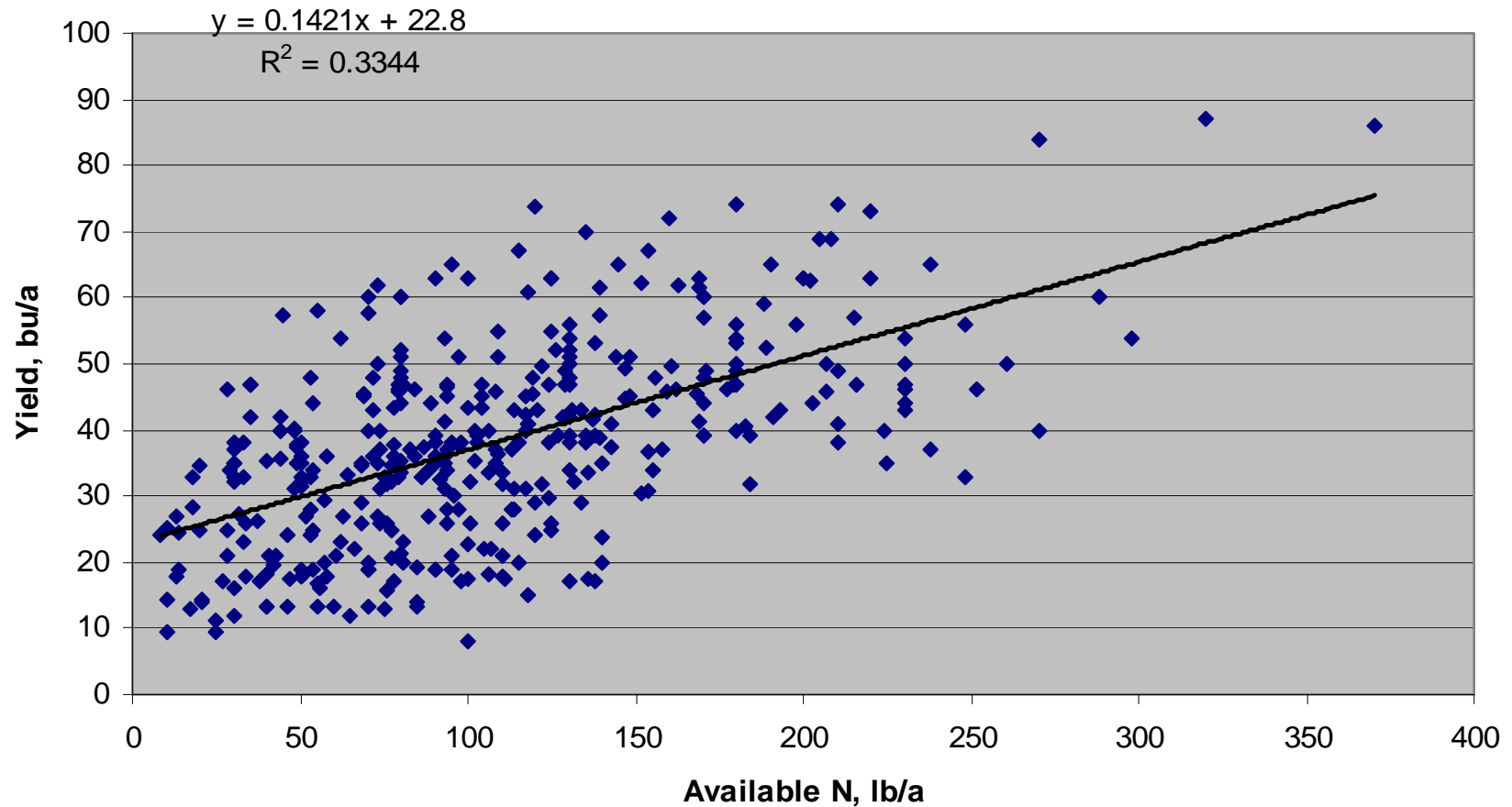


**-Search archives and obscure drawers and files for recently historic (from ~1970) N calibration data.**

**-Conduct N calibration trials to fill in gaps in geography/soils**

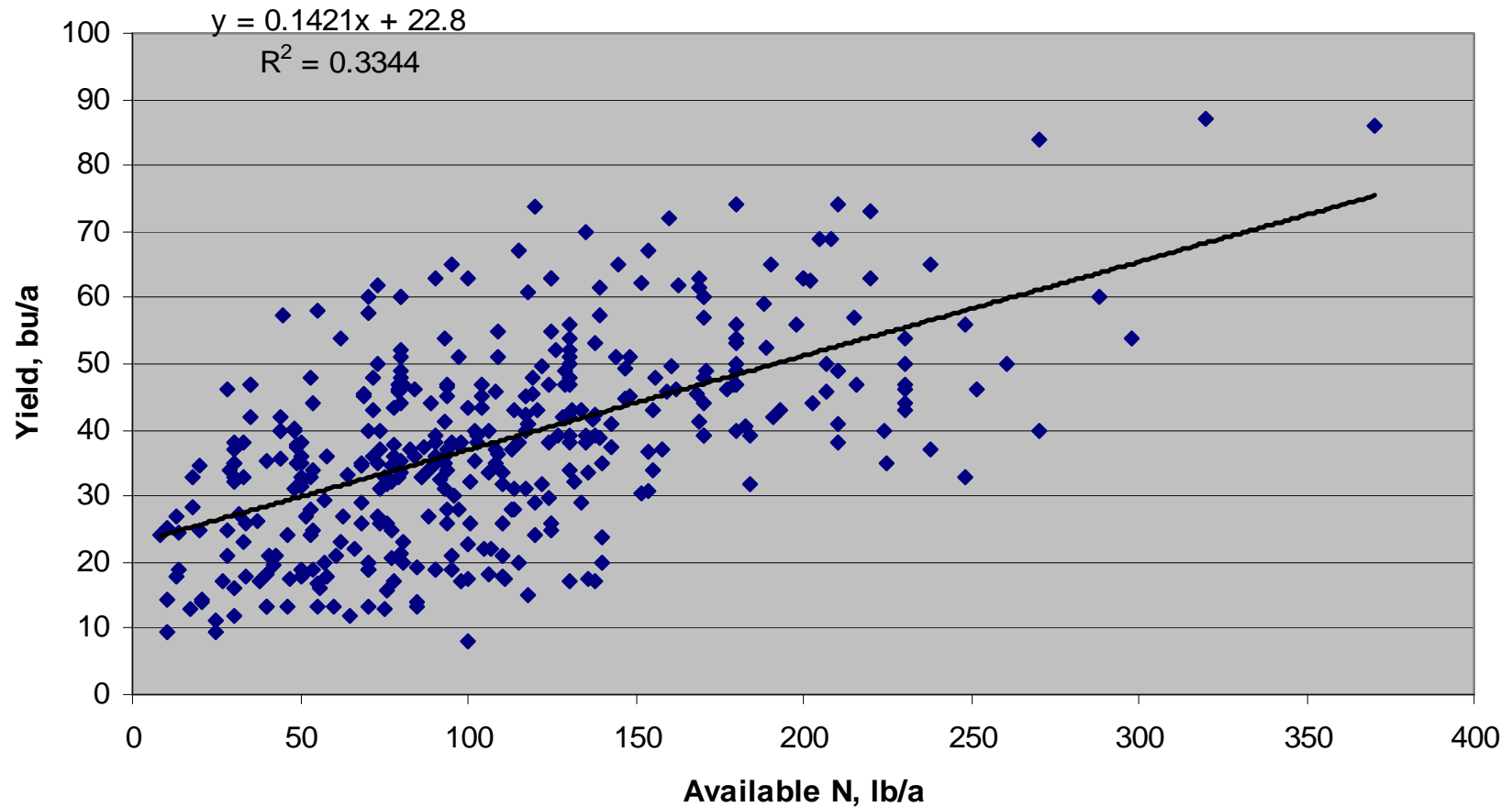
**-Include soil data including OM, soil type, soil texture and conduct ISNT.**

### Wheat Yield Response to Available N, 1970-2007, North Dakota



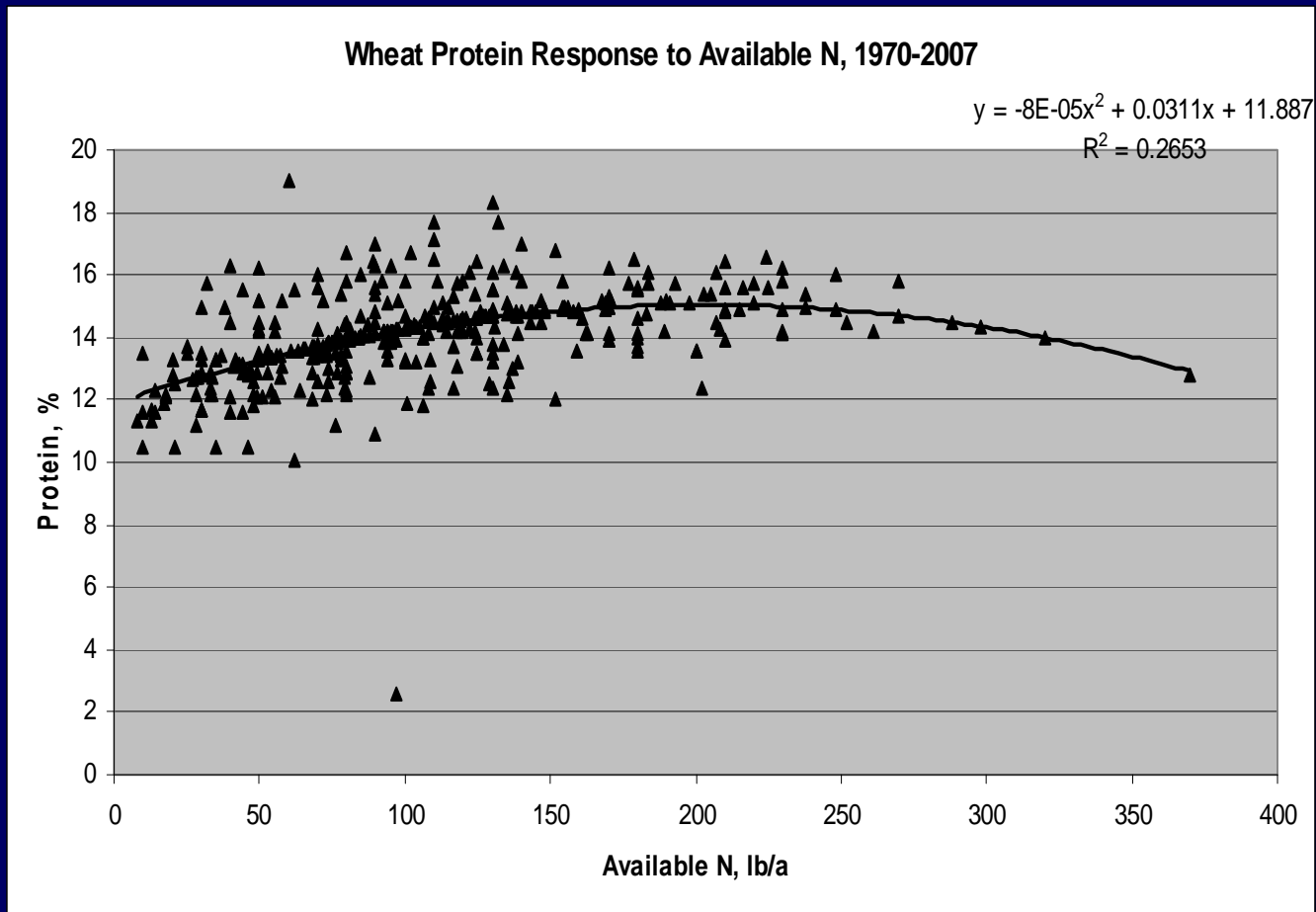
N-rate includes 2-ft nitrate-N and any previous crop credit estimate.

### Wheat Yield Response to Available N, 1970-2007, North Dakota

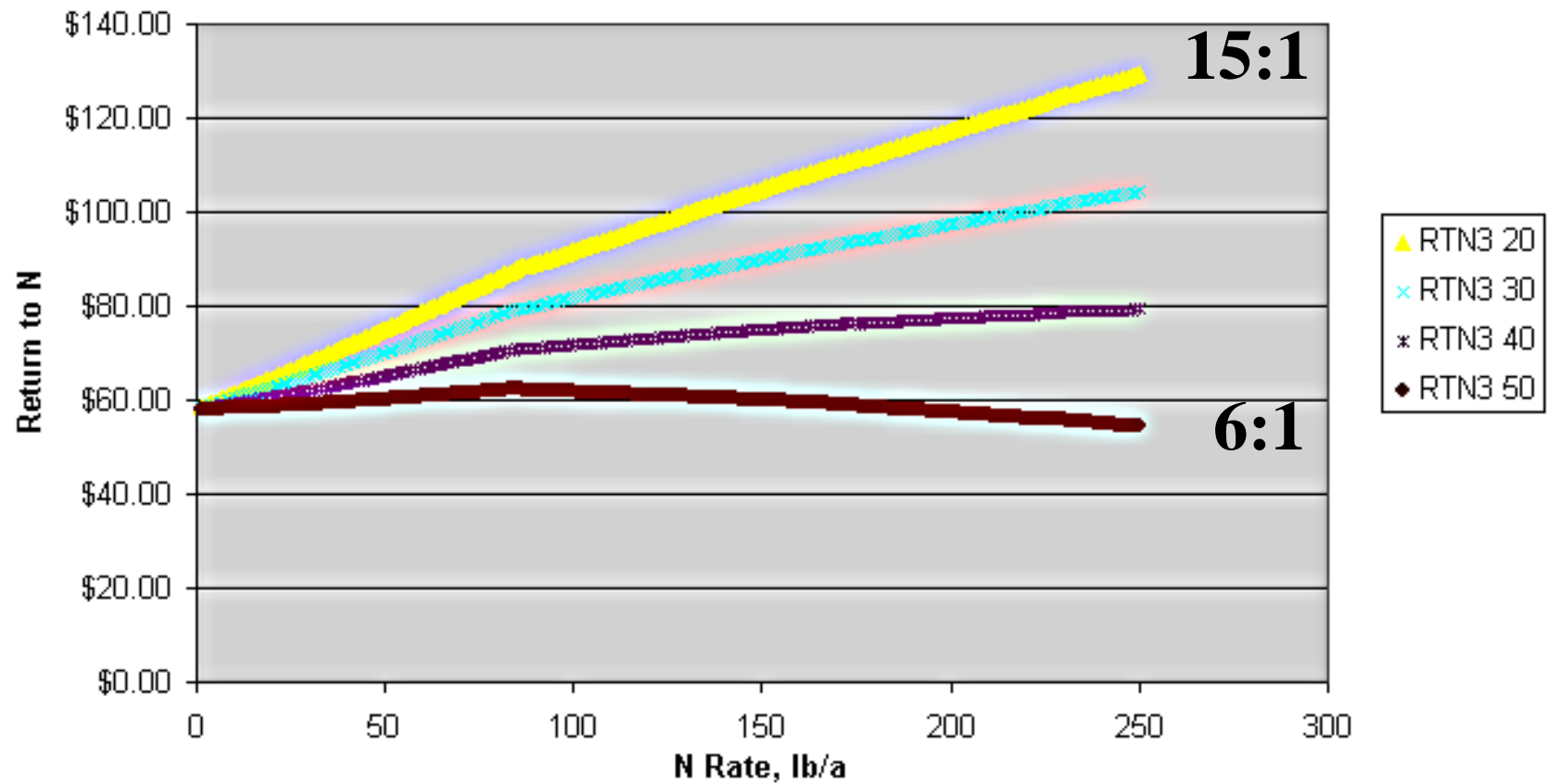


Taken at face value, this line is  
 $N \text{ Recommendation} = 7 \times YP - 160$  less credits

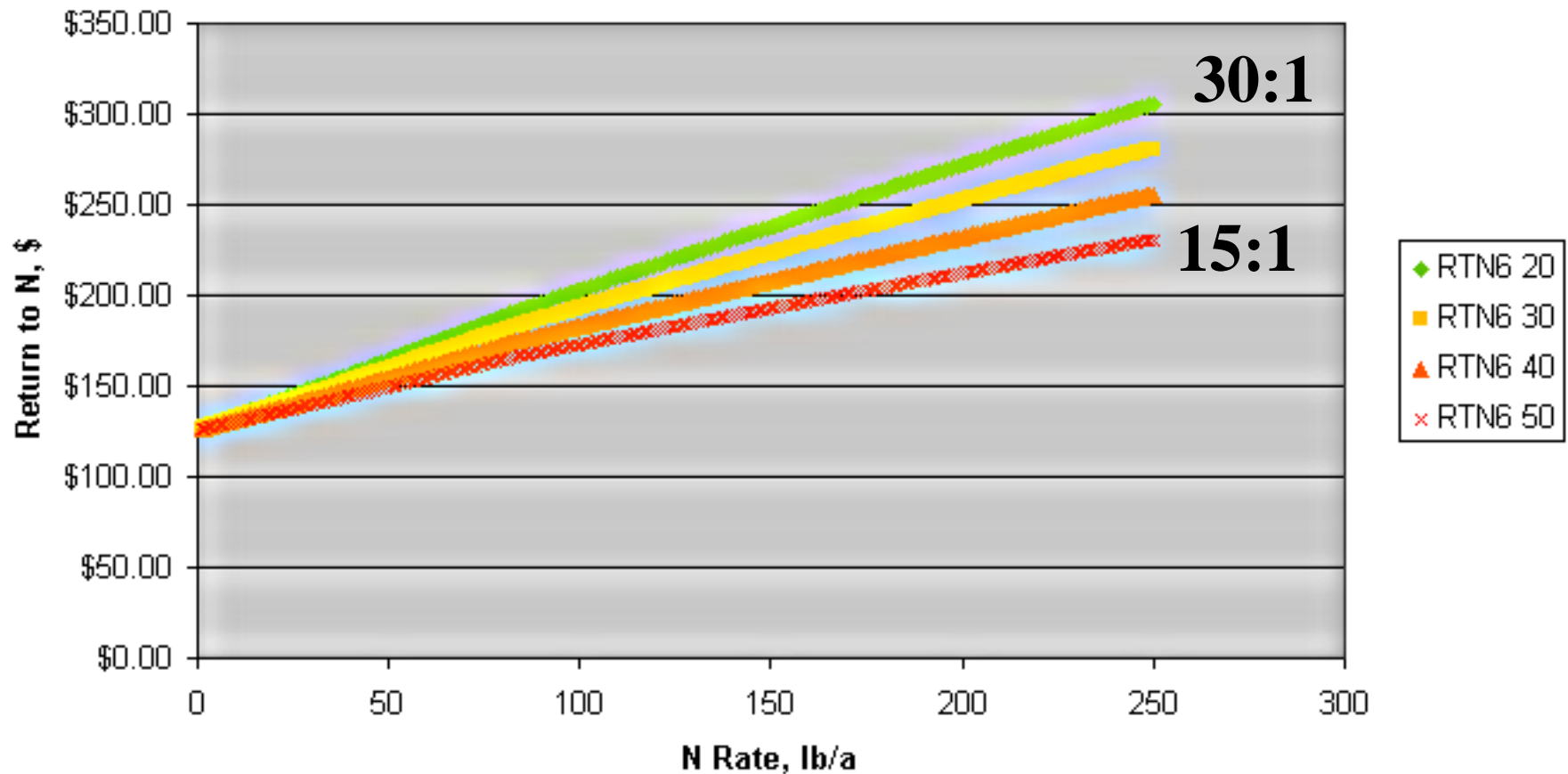
**Protein in ND is an economic quality component.**  
**Below 14%, elevators subtract a dock.**  
**From 14 to about 15% elevators provide a \$ premium.**  
**Above 15%, no additional premium.**



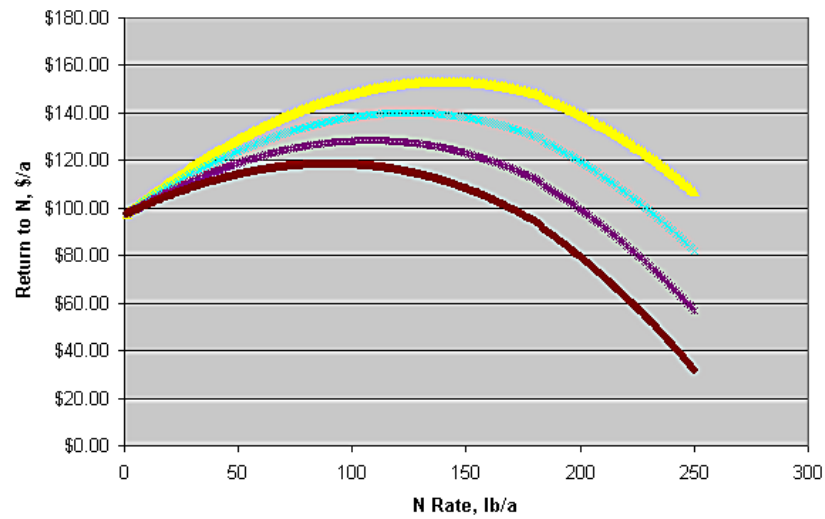
Return to N, Spring Wheat ND, 1970-2006 database,  
\$3 wheat with protein above or below 14% considered



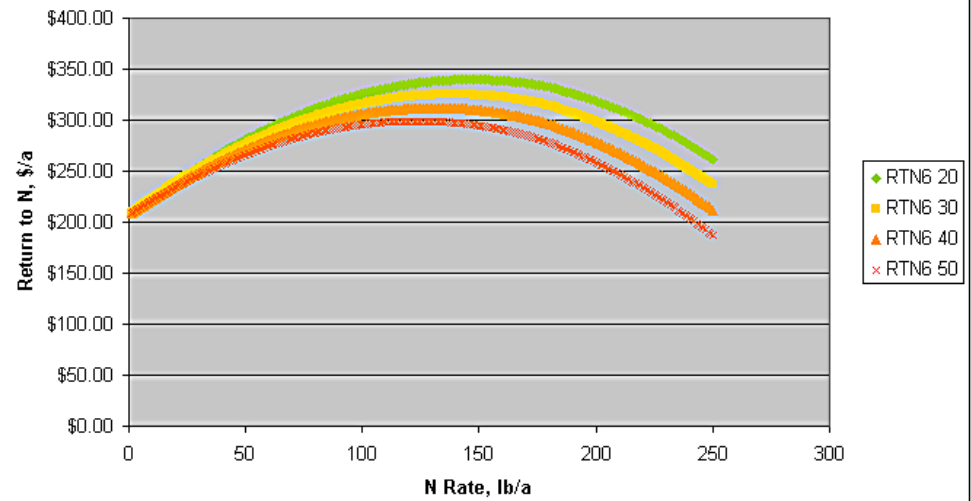
Spring Wheat Return to N, \$6, ND 1970-2006 database, protein above and below 14% considered

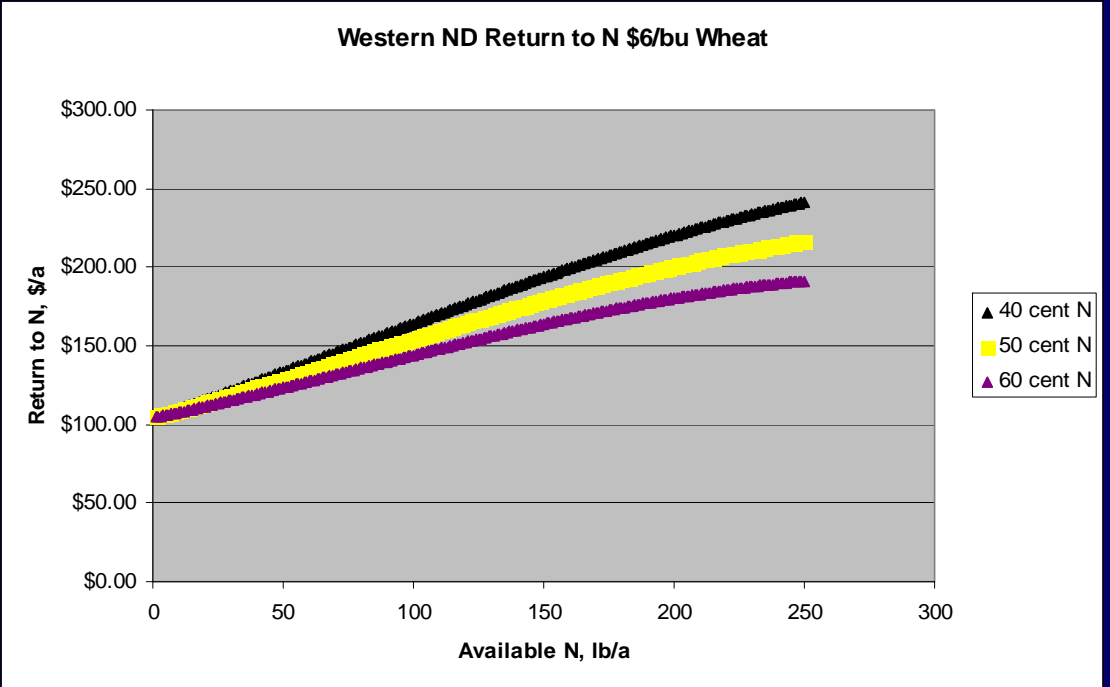
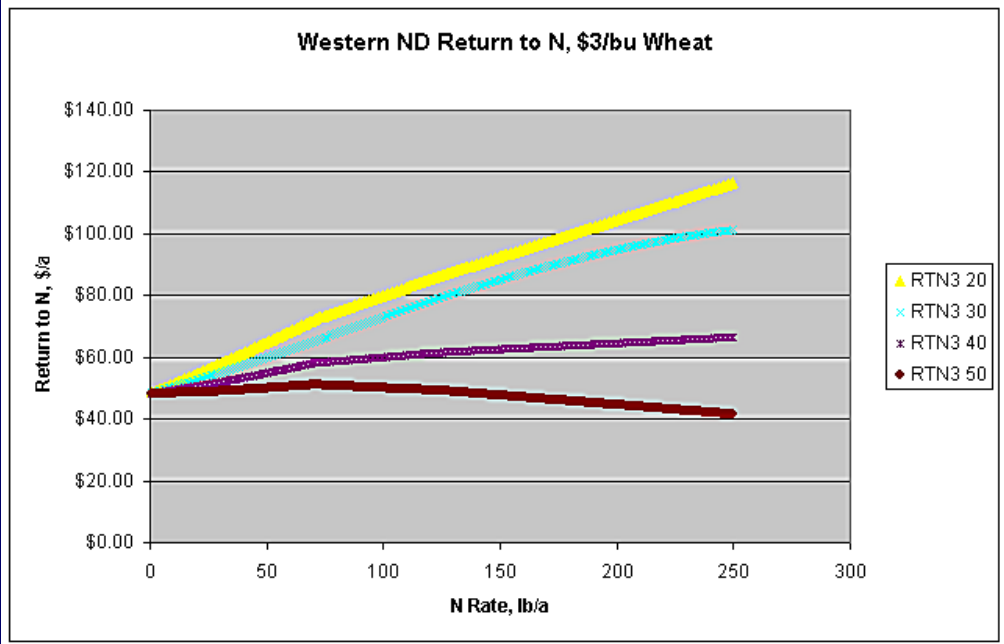


Langdon Return to N, \$3/bu Wheat



Langdon Return to N, \$6/bu Wheat, protein above and below 14% considered





**So how high in N should you go with  
\$10 wheat and \$20 durum ????**

**Remember where we are-  
Crop failures loom every year-**

**How much can you afford to lose?**

## **Example-**

**60 bu wheat- averages about 220 lb/a  
available N in our dataset  
about 150 lb N/a in our present recs**

**If soil test N is about 40 lb/a, we need  
at least 110 lb /a, or if N is \$0.55/lb N,  
\$60.50/a**

**If it doesn't rain from April 10 to July 1,  
and the wheat only makes 15 bu/a,  
can you afford to lose \$60/a?**

**If you decide to actually apply 150 lb N,  
and it costs you \$0.60/ lb N, can you  
afford \$90/a?**

**Just on N?**

**What about the cash rent, machinery  
costs, seed, everything else?**

**Growers might need to consider a modest amount of N even with high prices.**

**If the season is cool and moist, chances for above fertilizer N level yields are likely.**

**If the season is hot and dry, the modest amount should still carry the crop.**

**In the past, we thought that one of the opportunities for site-specific nutrient application was to put more on productive acres and less on more poorly productive acres.**

**Due to recent studies, we are starting to consider the opposite strategy.**

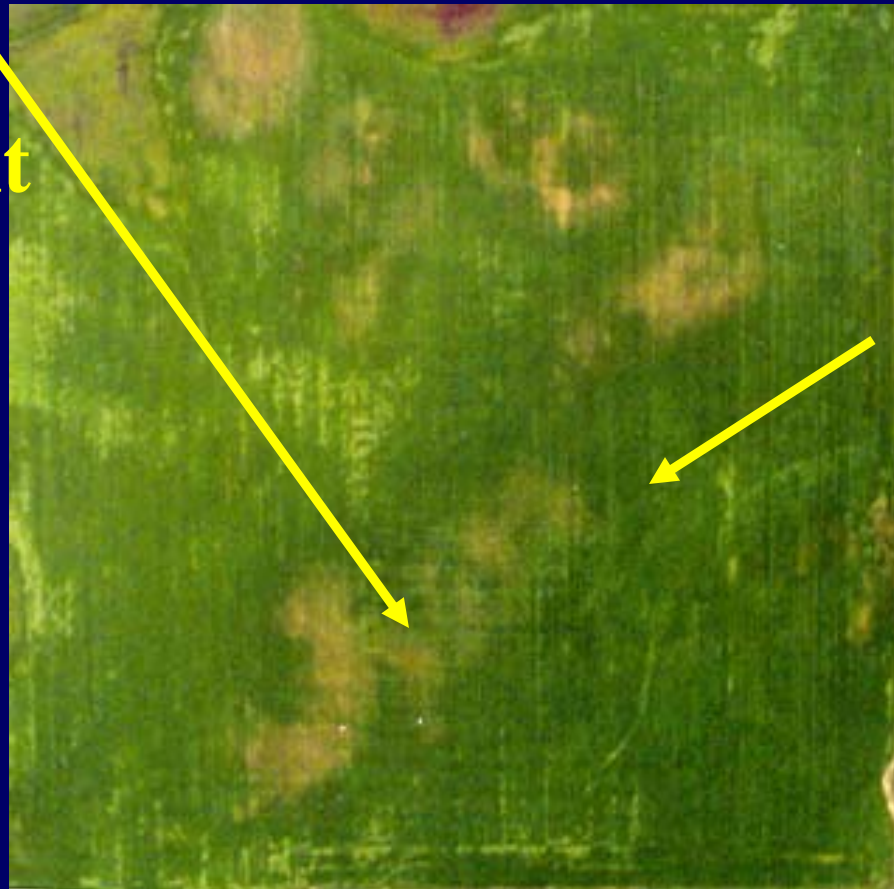
**Lo productivity**

**Low OM**

**Lo yield**

**Higher N need**

**and  
different  
mgt.**



**Hi productivity**

**Hi OM**

**Hi yield**

**Lower N need**

**In Montana, same project, using analysis on N rate study without regard to landscape showed no response to N.**

**When landscape position was considered, higher organic matter footslopes were NOT responsive, while hilltops and slopes WERE responsive.**

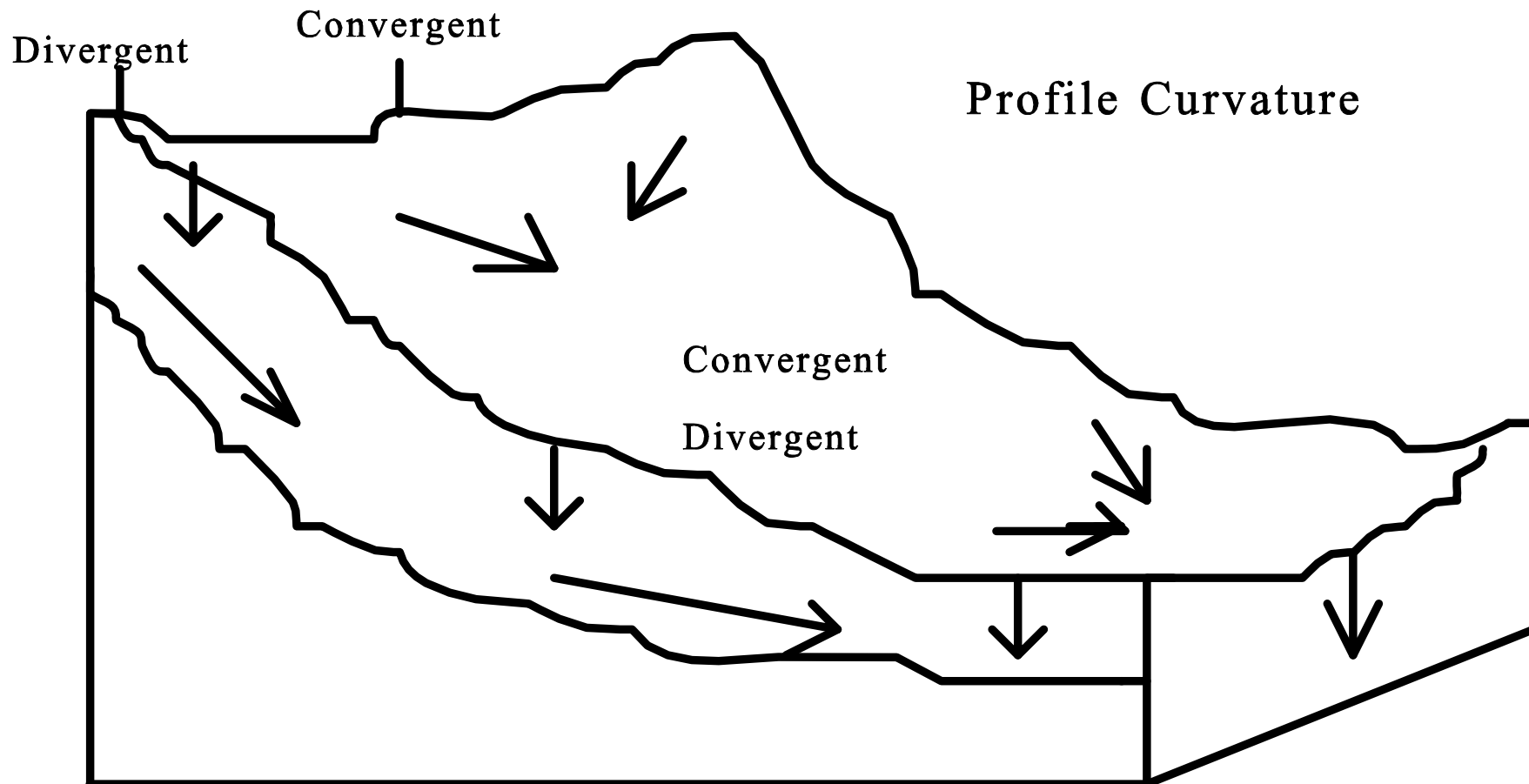
**The productive areas did not need as much N as more poorly productive areas.**

# **Management Strategies-**

**Use of soil testing to identify residual N.**

**Zone sampling is a method of investigating patterns of nutrients and other soil factors within a field based on some logical, easy to measure effect, either natural or manmade.**

# TOPOGRAPHY



# Electrical conductivity



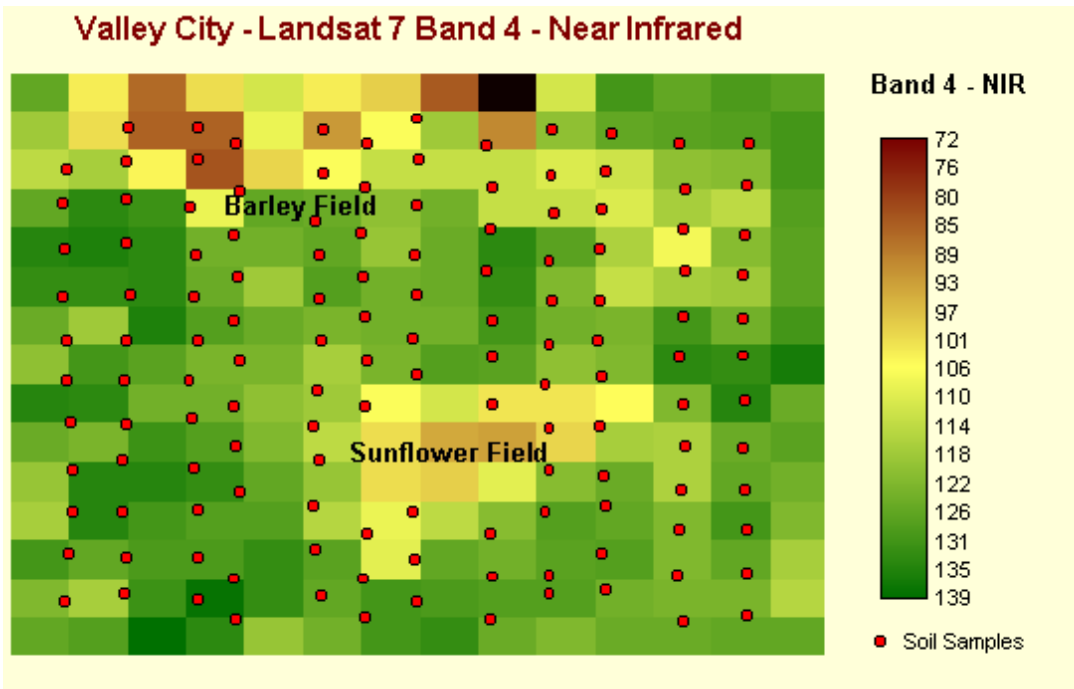
# Electrical conductivity, EM-38



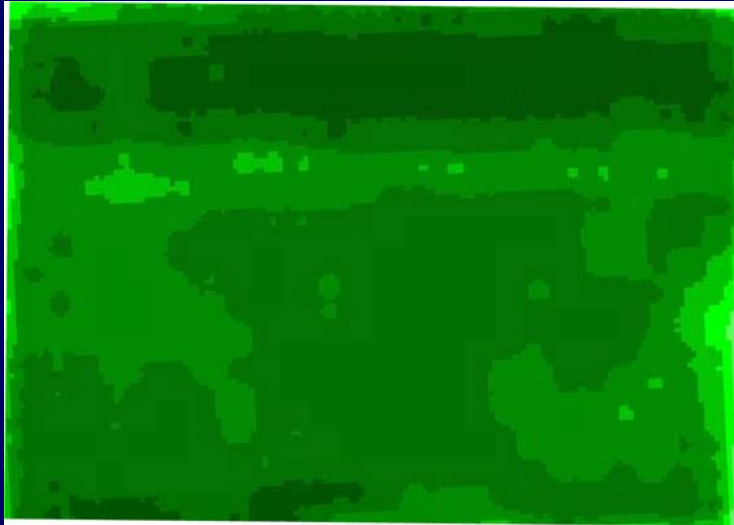
**Geonics, Inc., Mississauga, ON**

# Remotely Sensed Images (RSI)

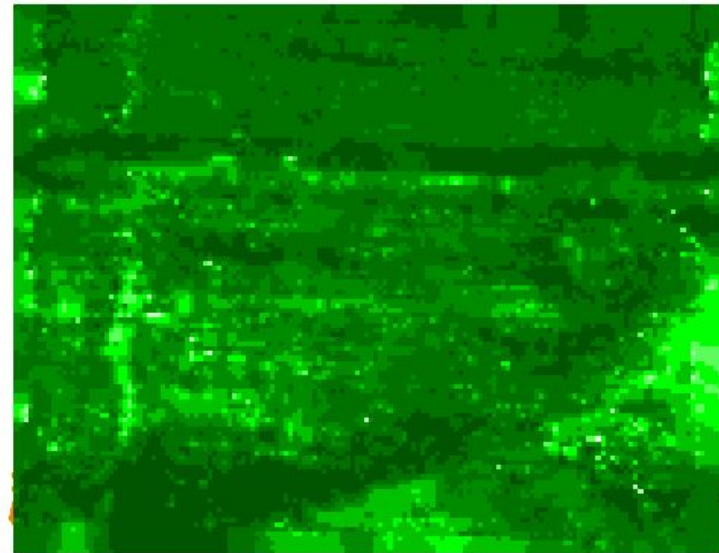
- Landsat 7 satellite pictures
- Aerial photos: Ektochrome color film.



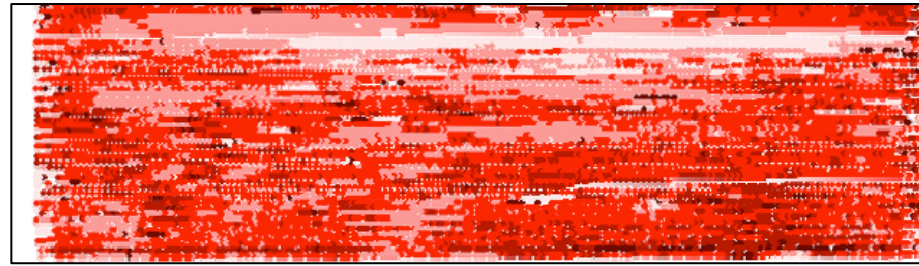
# Satellite



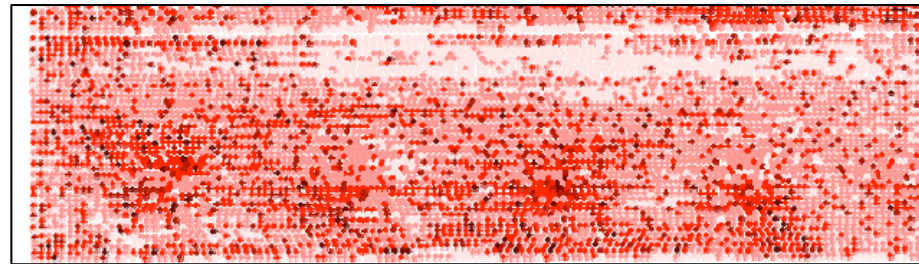
# Greenseeker sensor



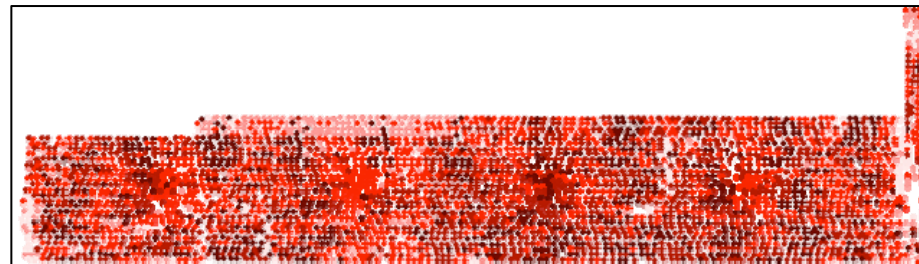
**How do you  
manage  
multiple  
years of  
yield data?**



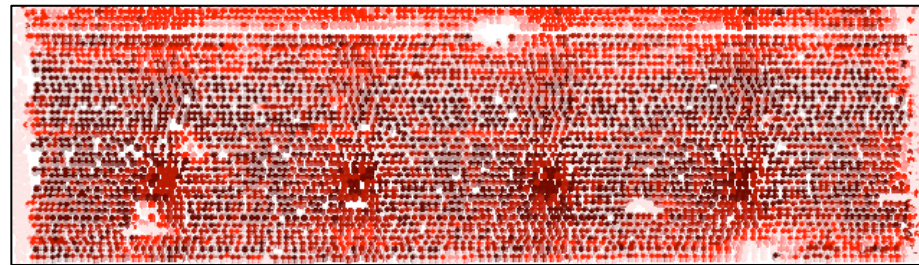
1994 Yield



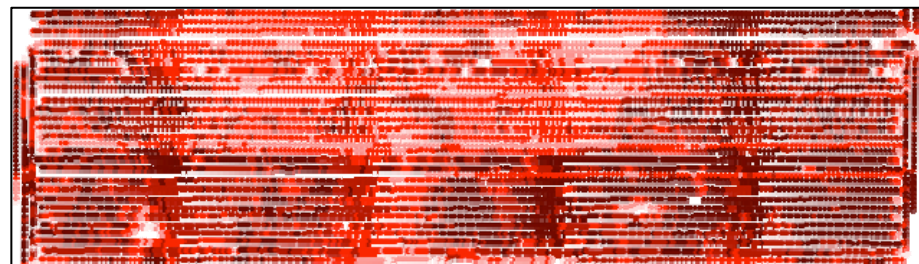
1995 Yield



1997 Yield



1998 Yield



2000 Yield

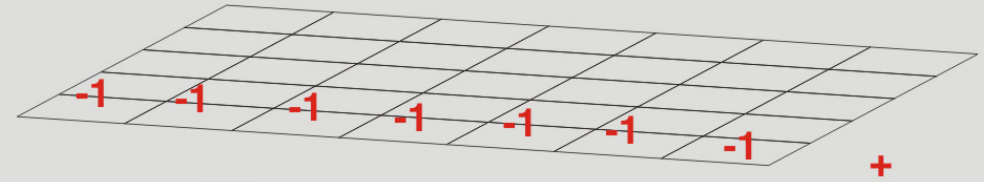
# Managing multiple yield data using rank & frequency

## Assign rank:

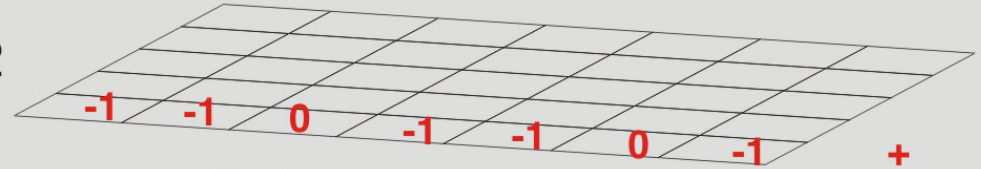
1 if > average yield  
0 if = average yield  
-1 if < average yield

## Assign rank for each year

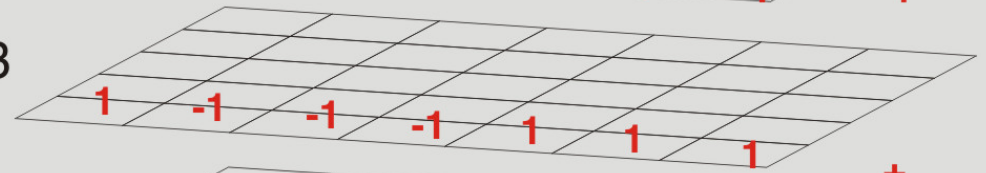
YEAR 1



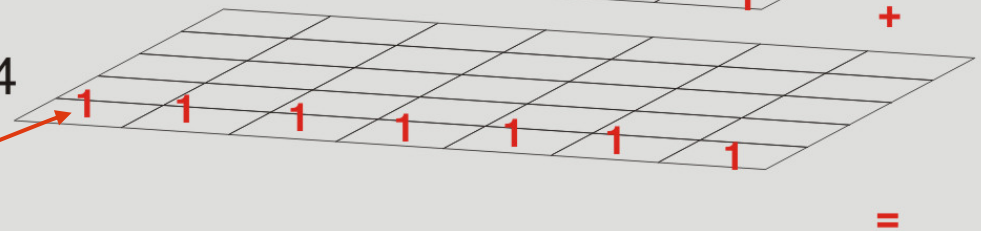
YEAR 2



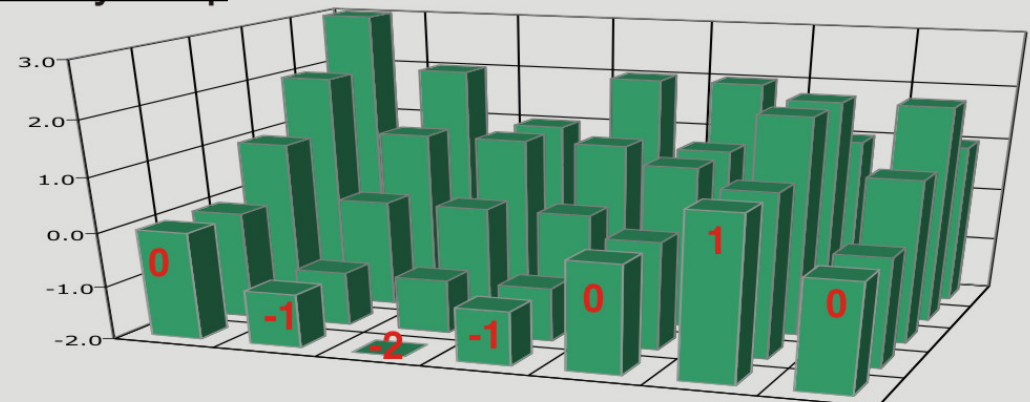
YEAR 3



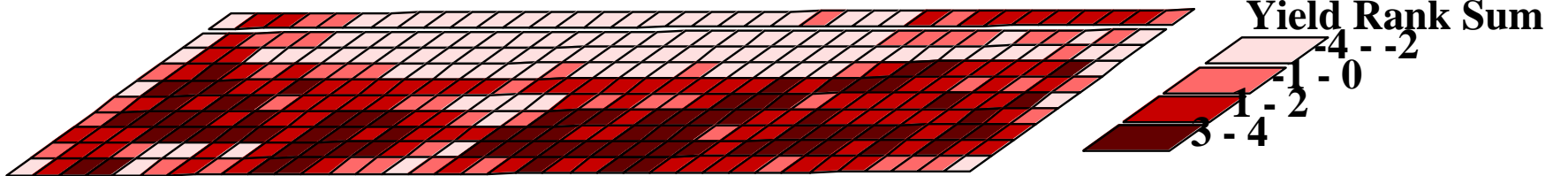
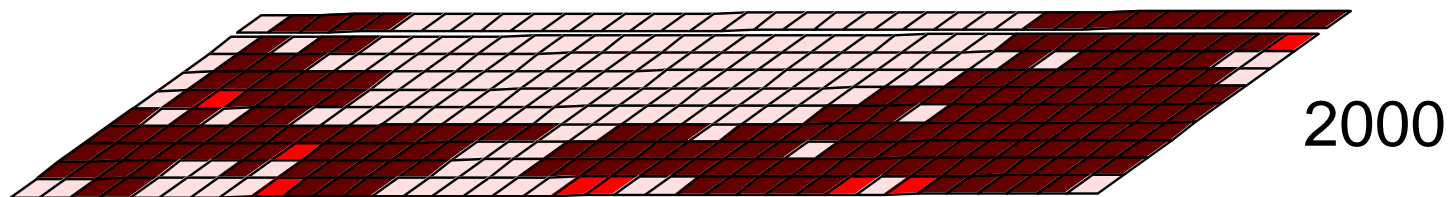
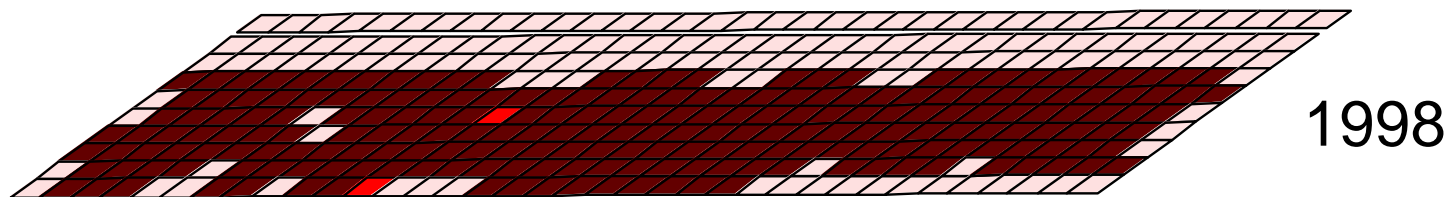
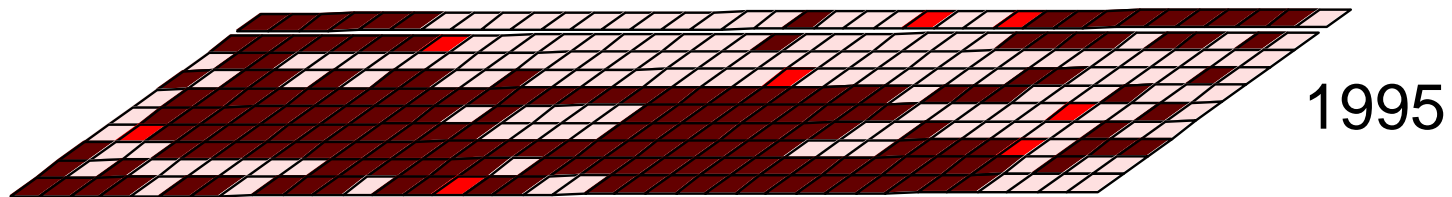
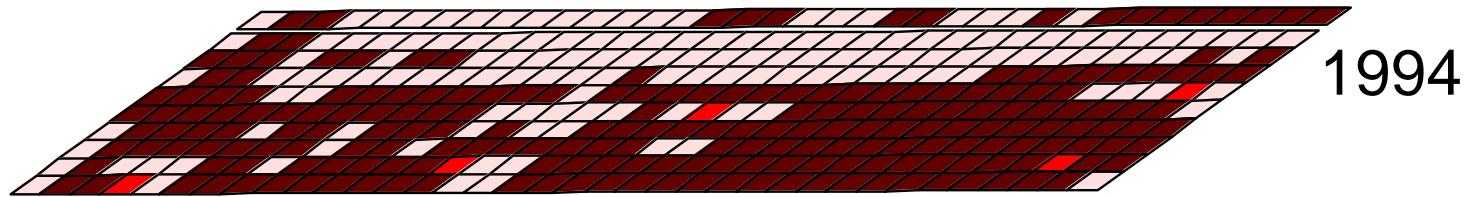
YEAR 4



## Frequency map

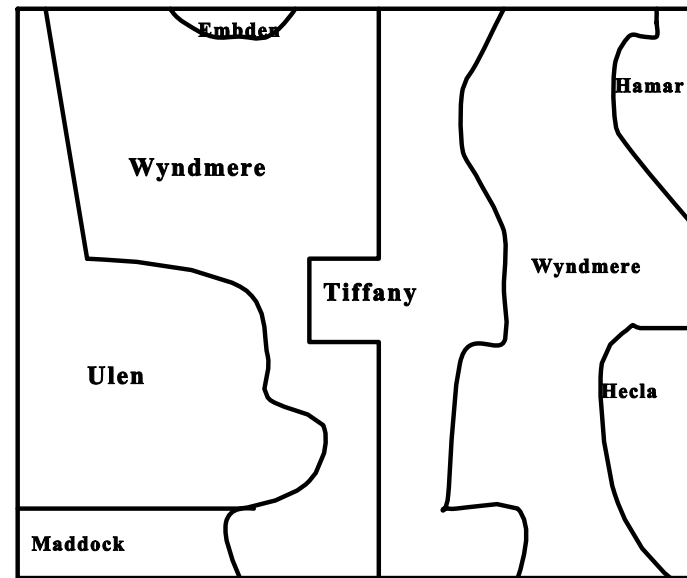
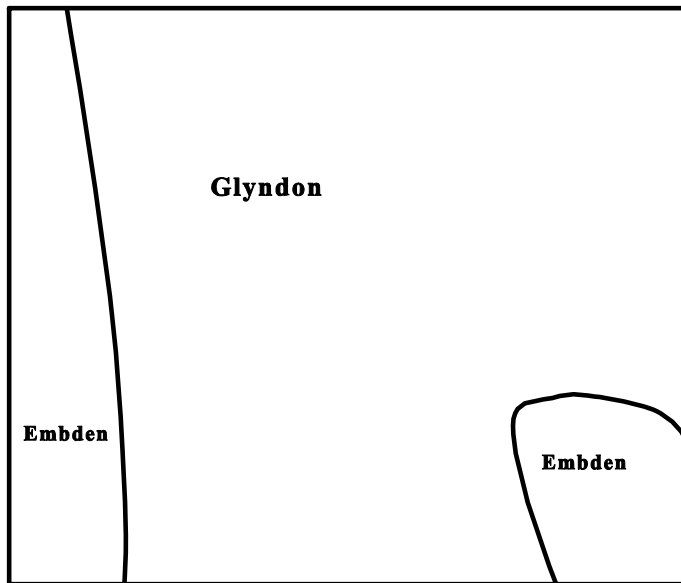


# Developing Frequency Map

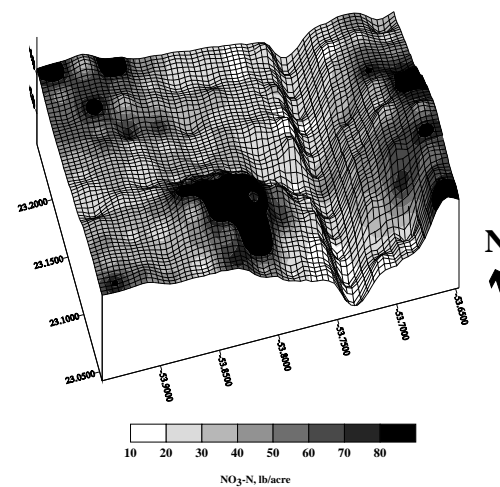


# Soil survey

Order 1 1:8,000



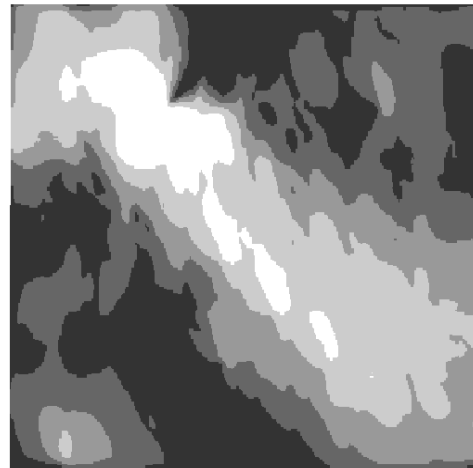
Order 2 1:20,000





**Williston 40 acres**

← **aerial image,  
elevation & satellite image**



# **Management Strategies-**

## **Alternative crops**

**-Crops that require no N**

**-Crops that require reduced N rates**

# **Crops that require no N**

## **Most legumes-**

**-Peas**

**-Lentils**

**-Alfalfa**

**-Soybean**

**Crops that require less N than wheat/corn-**

**Dry beans- 0-75 lb/a**

**Flax- N recs are capped at 80 lb N.**

**Barley- N rates should be conservative.**

**Rates in the west lower than east.**

**Canola- New recs cap max N at 120 lb in the west.**

**Sunflowers- Rooting depth can scavenge  
unaccounted for deep N.**

**Take advantage of N credits from  
previous crops and conditions-**

**Legumes-**

**-Annual legumes- 40 lb N/acre**

**-Volunteer grains present when  
fields were sampled- 20% to 50% of N  
contained in the growing cover.**

## **N application methods-**

### **Urea application-**

**Once soils are deeply frozen,  
DO NOT APPLY UREA!**

**When snow melts, soil is too cold  
to penetrate. Water stays at or near  
the surface, urea is soluble and can  
run with water.**

## **N application methods-**

### **Urea application-**

**Avoid application on the surface in no-till fields. Ammonia volatilization is a problem. Losses can be high.**

## **N application methods-**

### **Urea application-**

**In conventionally-tilled fields, till into the soil within 48 hours generally unless it is so dry that granules remain intact.**

**It takes at least 1/2 inch of rain to incorporate urea.**

**Addition of Agrotain will add about  
10 days to the safety of surface-applied  
urea.**

**It really works.**

**Lots of studies support its use.**

**ESN studies have shown that the  
product needs to be handled gently.  
In non-irrigated soils, results have  
been inconsistent.**

**We have worked with a  
Georgia-Pacific product for several  
years.**

**In dry years, the urea or liquid  
behaves similar to urea or 28%.**

**In wet springs after application on  
sandy soils, it has an advantage  
over urea or 28%.**

**This season, 30 lbs acted like 60 urea.  
60 lbs acted like 90 urea.**

# **N application methods-**

## **Ammonia-**

**Application at least 4-inches deep is considered 100% efficient.**

**I consider 2-3 inch deep application 90% efficient.**

**Banding N DOES NOT increase N efficiency!**



## **N application methods-**

### **Timing-**

**In some years, there is little difference between fall and spring application.**

**In some years, there may be as much as 20% difference.**

**Canadian recommendations consider fall about 90% efficient.**

**Summary-**

**Soil test and use zone management.**

**Apply N at right time with right method.**

**QUESTIONS?**