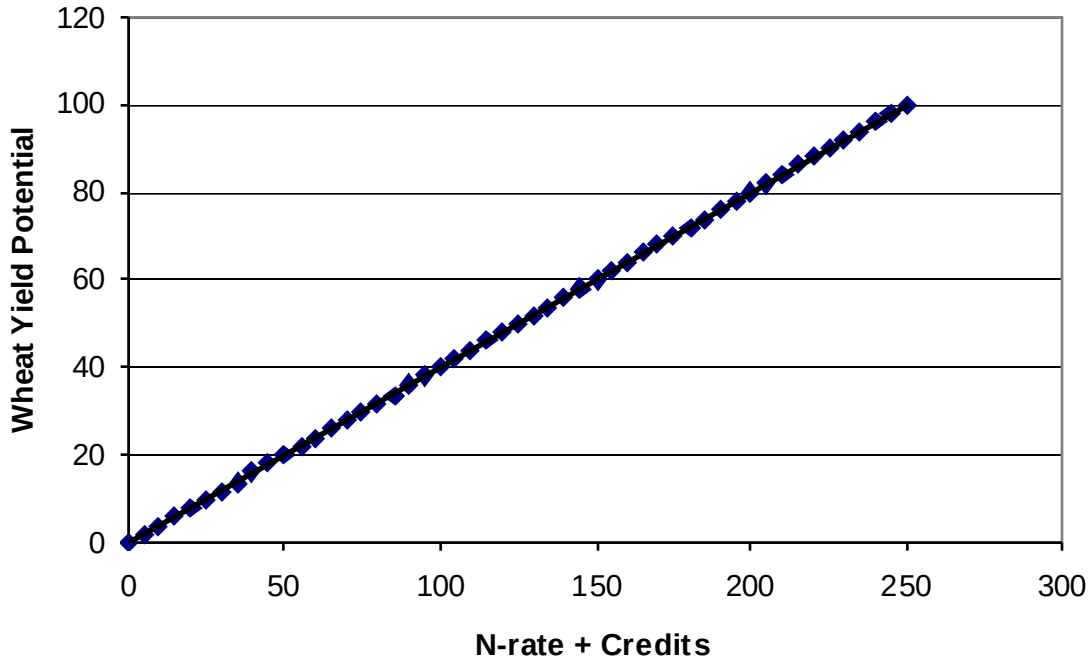
N Use in Wheat- Strategies for Improving Efficiencies and/or Reducing Costs

Dr. Dave Franzen

NDSU Extension Soil Specialist

Present recommendations for spring wheat/durum in North Dakota-

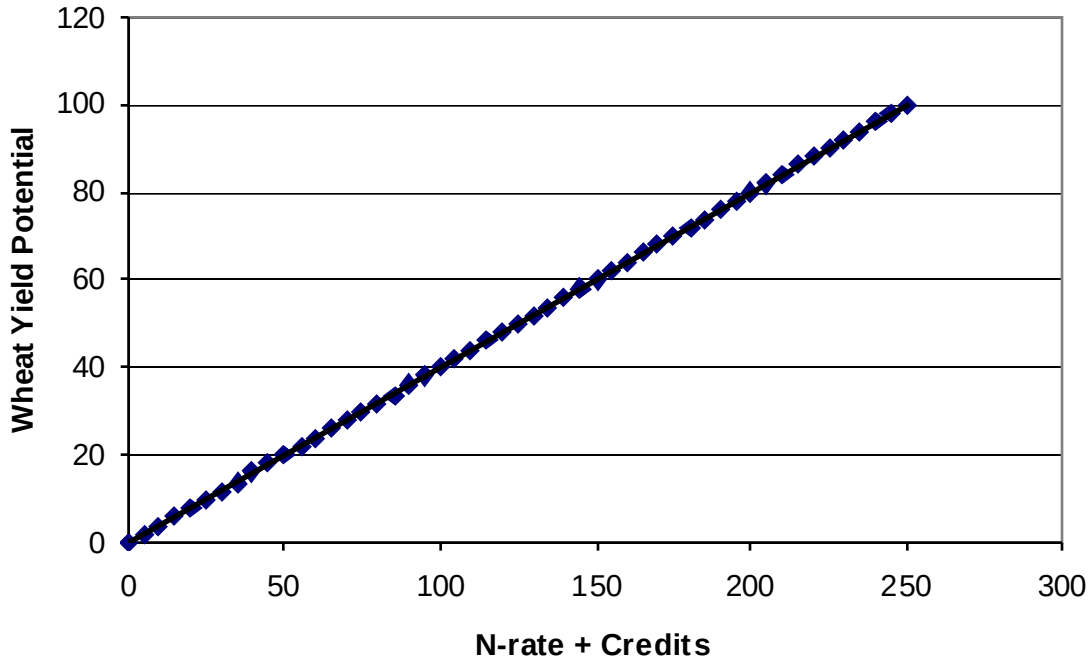
N Recommendation = ((Yield Potential) X 2.5) less credits



The formula does not contain a contemporary economic component.

-no allowance for soil mineralization differences

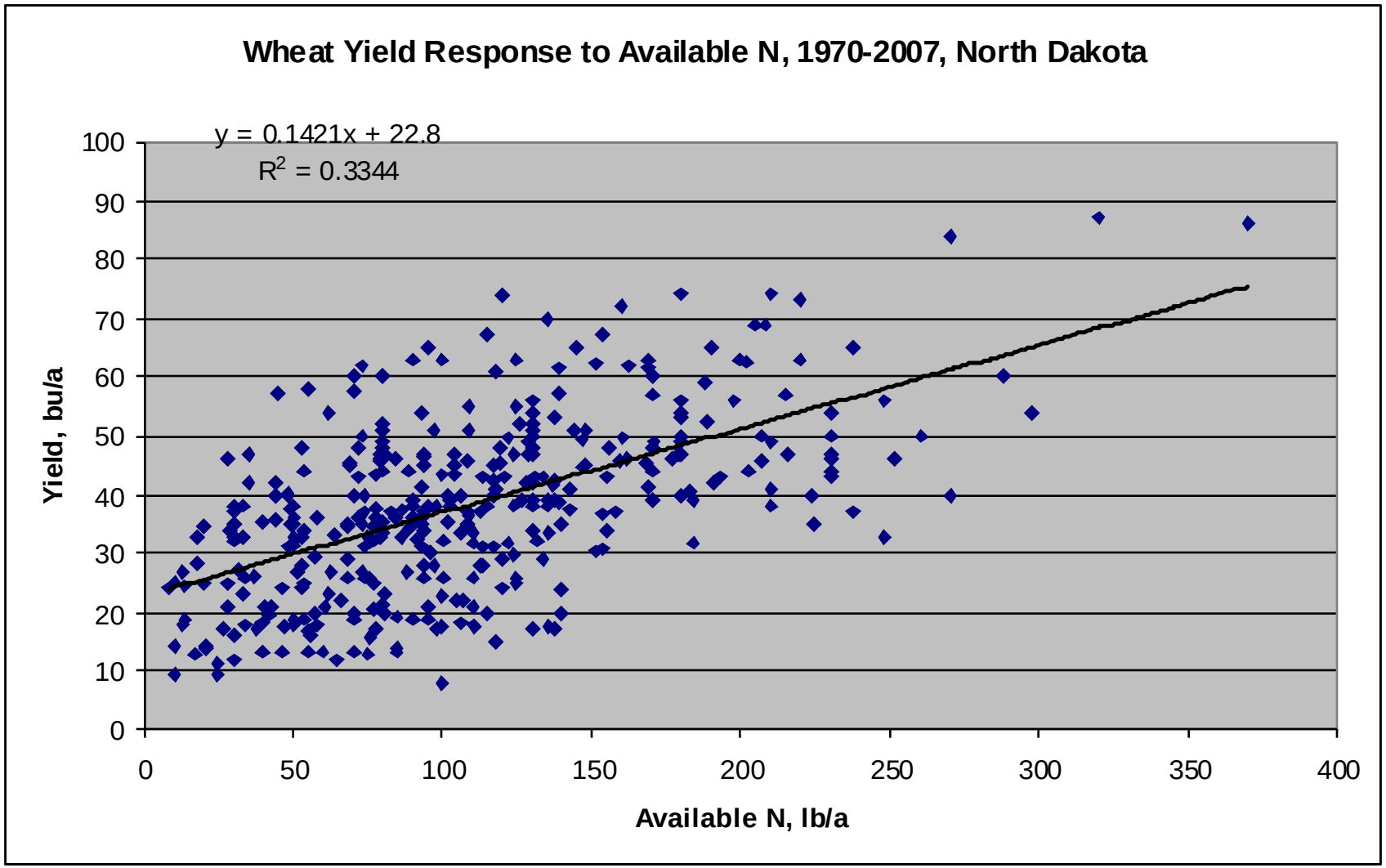
-no allowance for agri-climatology differences



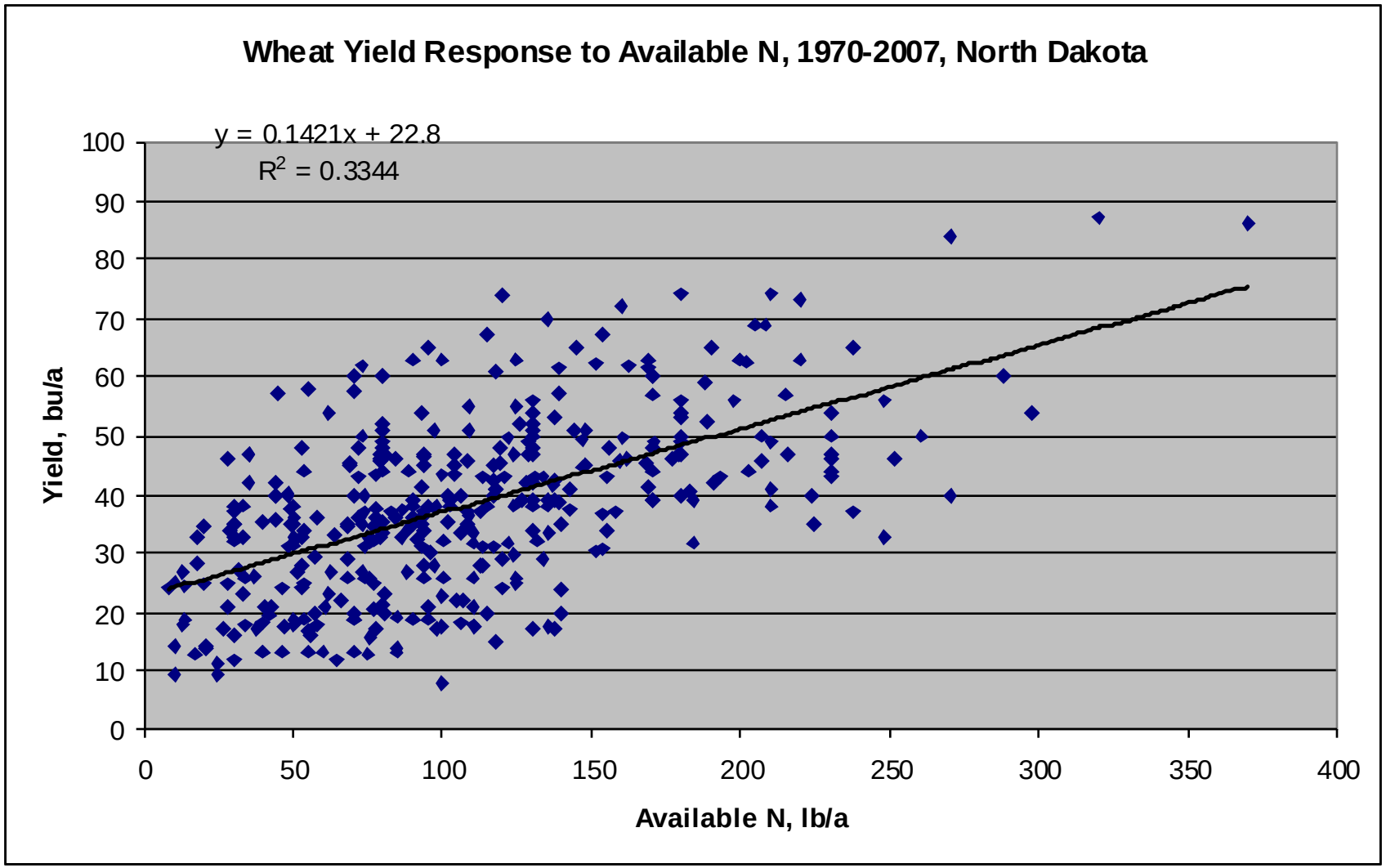
-Search archives and obscure drawers and files for recently historic (from ~1970) N calibration data.

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

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

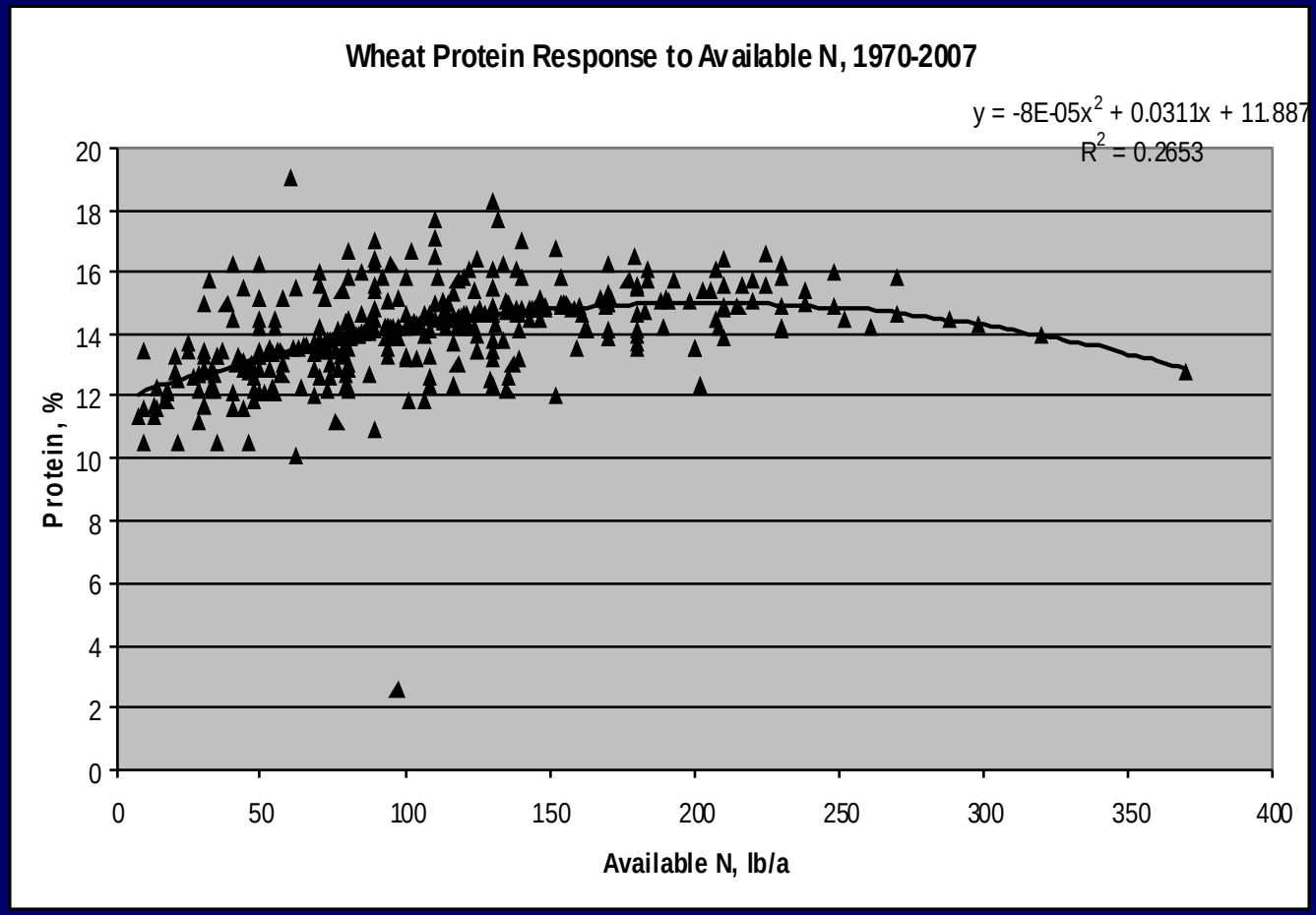


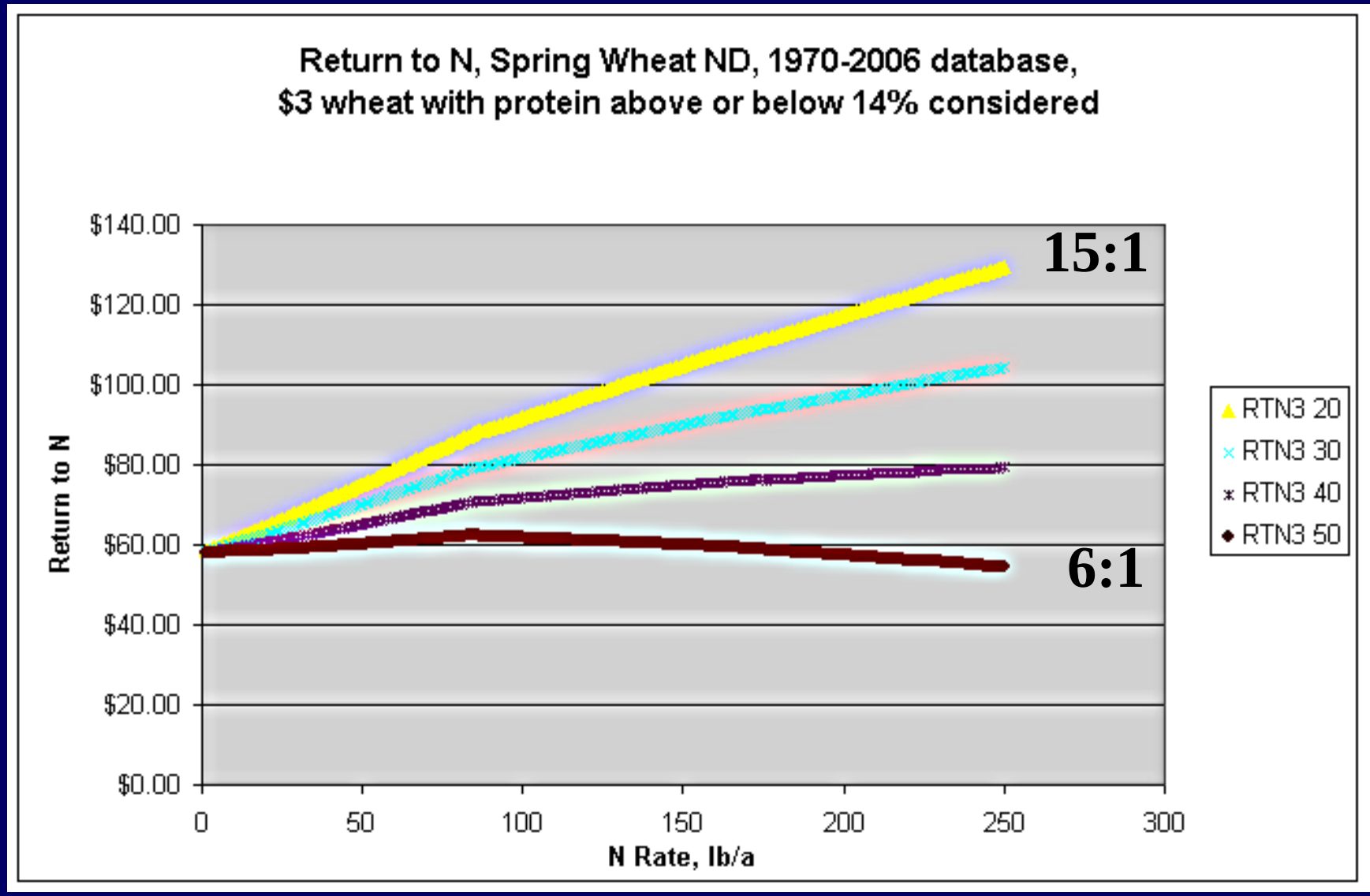
N-rate includes 2-ft nitrate-N and any previous crop credit estimate.

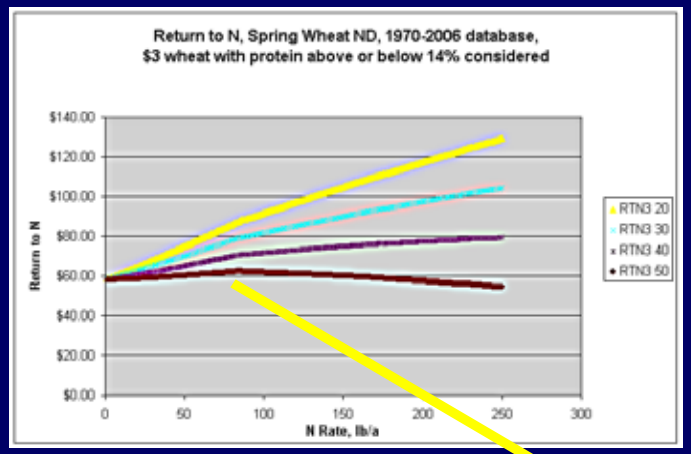


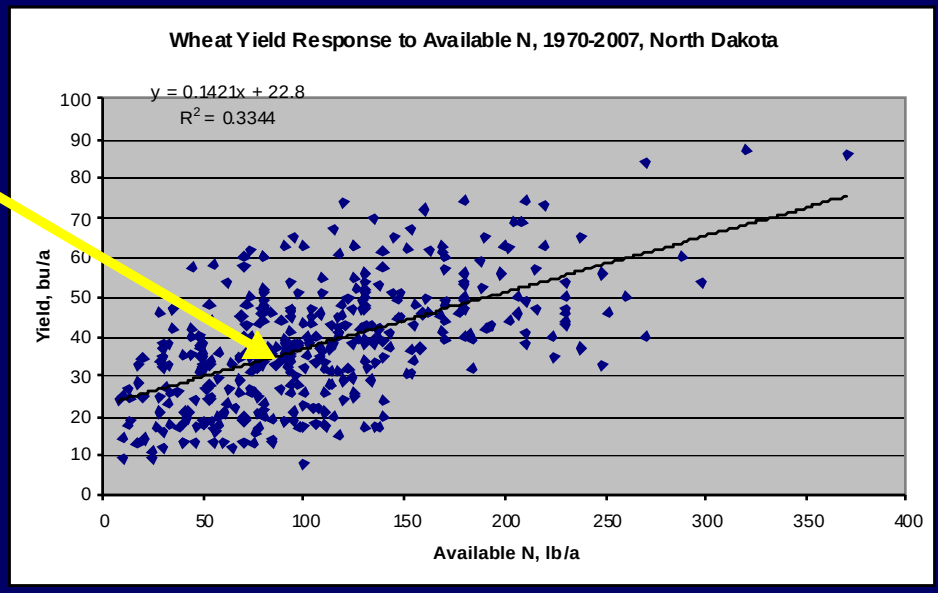
Taken at face value, this line is
N Recommendation = 7 X YP – 160 less credits

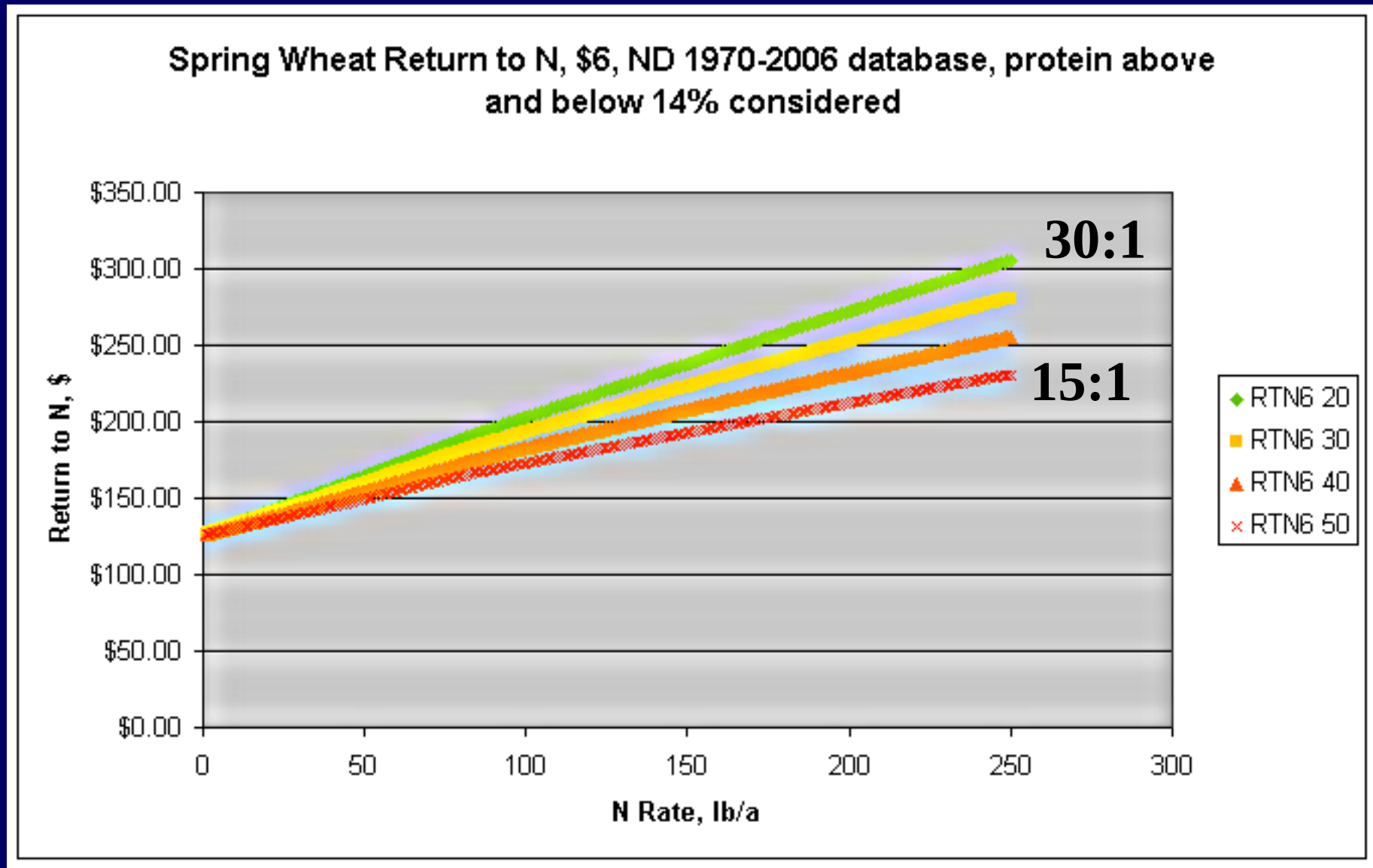
Protein in ND is an economic quality component.
Below 14%, elevators subtract a dock.
From 14 to about 15% elevators provide a $ premium.
Above 15%, no additional premium.

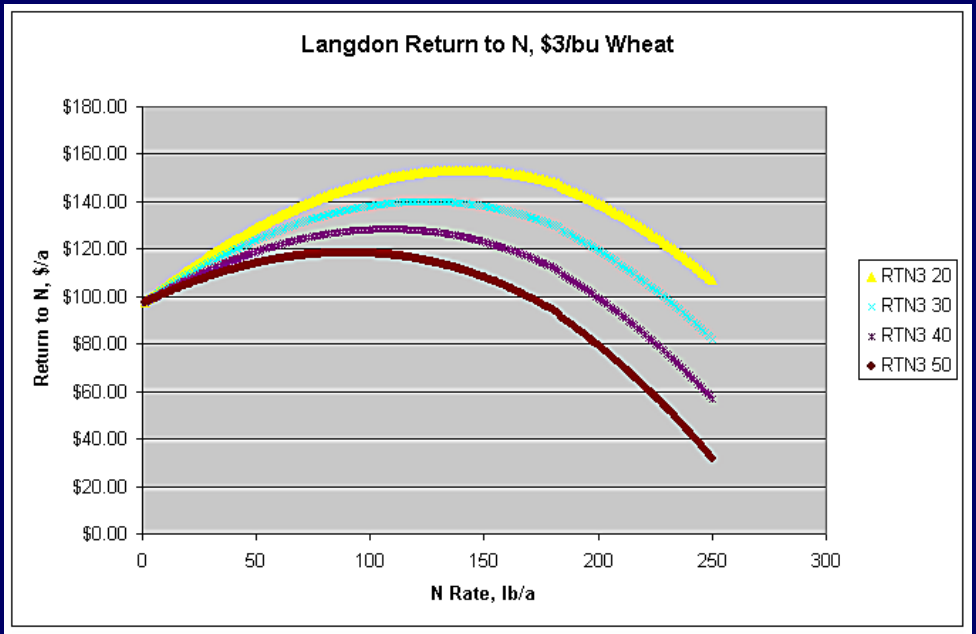


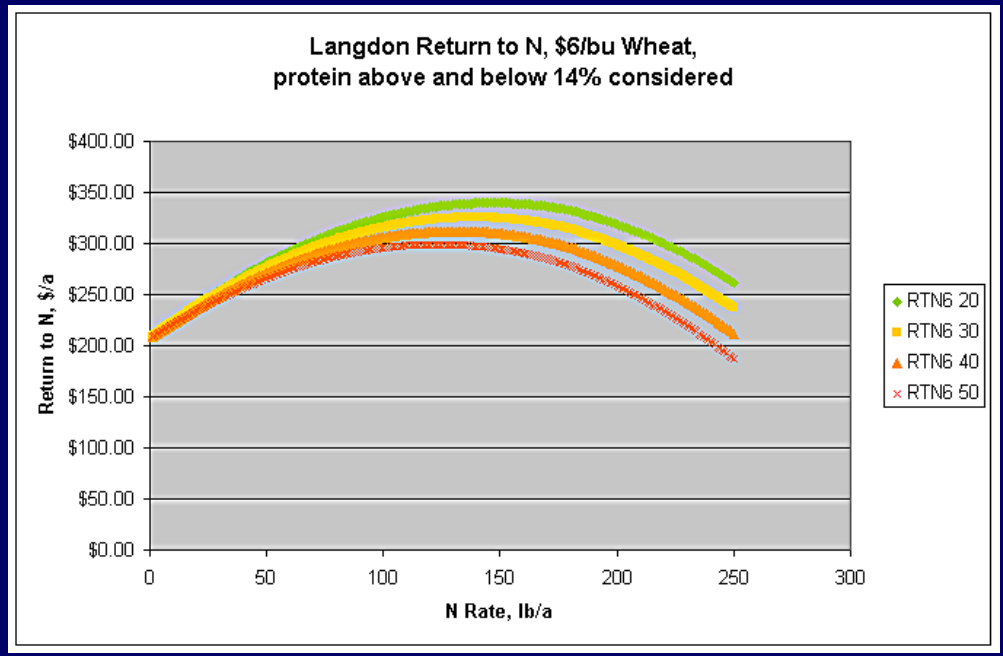

Return to N, Spring Wheat ND, 1970-2006 database,
$3 wheat with protein above or below 14% considered
Return to N
$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
0
50
100
150
200
250
300
N Rate, lb/a
15:1
6:1
RTN3 20
RTN3 30
RTN3 40
RTN3 50


Return to N, Spring Wheat ND, 1970-2006 database,
$3 wheat with protein above or below 14% considered
$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
Return to N
0
50
100
150
200
250
300
N Rate, lb/a
RTN3 20
RTN3 30
RTN3 40
RTN3 50

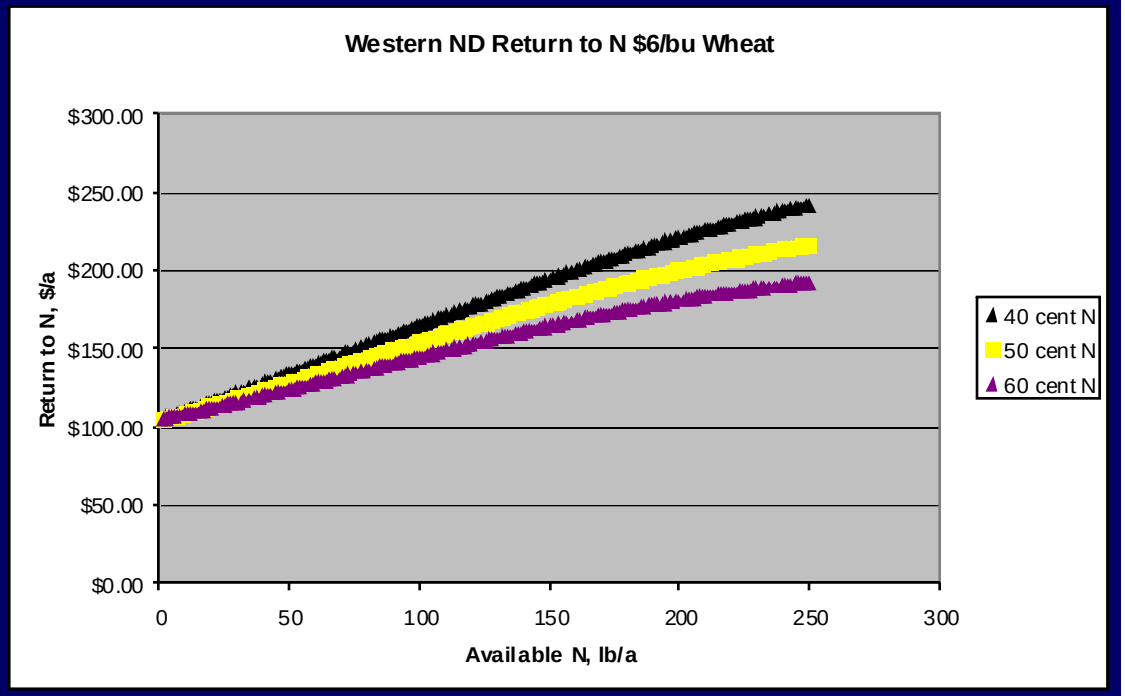

Wheat Yield Response to Available N, 1970-2007, North Dakota
y = 0.1421x + 22.8
R2 = 0.3344
100
90
80
70
60
50
40
30
20
10
0
Yield, bu/a
0
50
100
150
200
250
300
350
400
Available N, lb/a


Spring Wheat Return to N, $6, ND 1970-2006 database, protein above and below 14% considered
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Return to N, $
0
50
100
150
200
250
300
N Rate, lb/a
30:1
15:1
RTN6 20
RTN6 30
RTN6 40
RTN6 50


Langdon Return to N, $3/bu Wheat
$180.00
$160.00
$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
Return to N, $/a
0
50
100
150
200
250
300
N Rate, lb/a
RTN3 20
RTN3 30
RTN3 40
RTN3 50


Langdon Return to N, $6/bu Wheat,
protein above and below 14% considered
$400.00
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Return to N, $/a
0
50
100
150
200
250
300
N Rate, lb/a
RTN6 20
RTN6 30
RTN6 40
RTN6 50


Western ND Return to N, $3/bu Wheat
$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
Return to N, $/a
0
50
100
150
200
250
300
N Rate, lb/a
RTN3 20
RTN3 30
RTN3 40
RTN3 50


Western ND Return to N $6/bu Wheat
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Return to N, $/a
0
50
100
150
200
250
300
Available N, lb/a
40 cent N
50 cent N
60 cent N

So how high in N should you go with $9 wheat and $12 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.

Management Strategies-

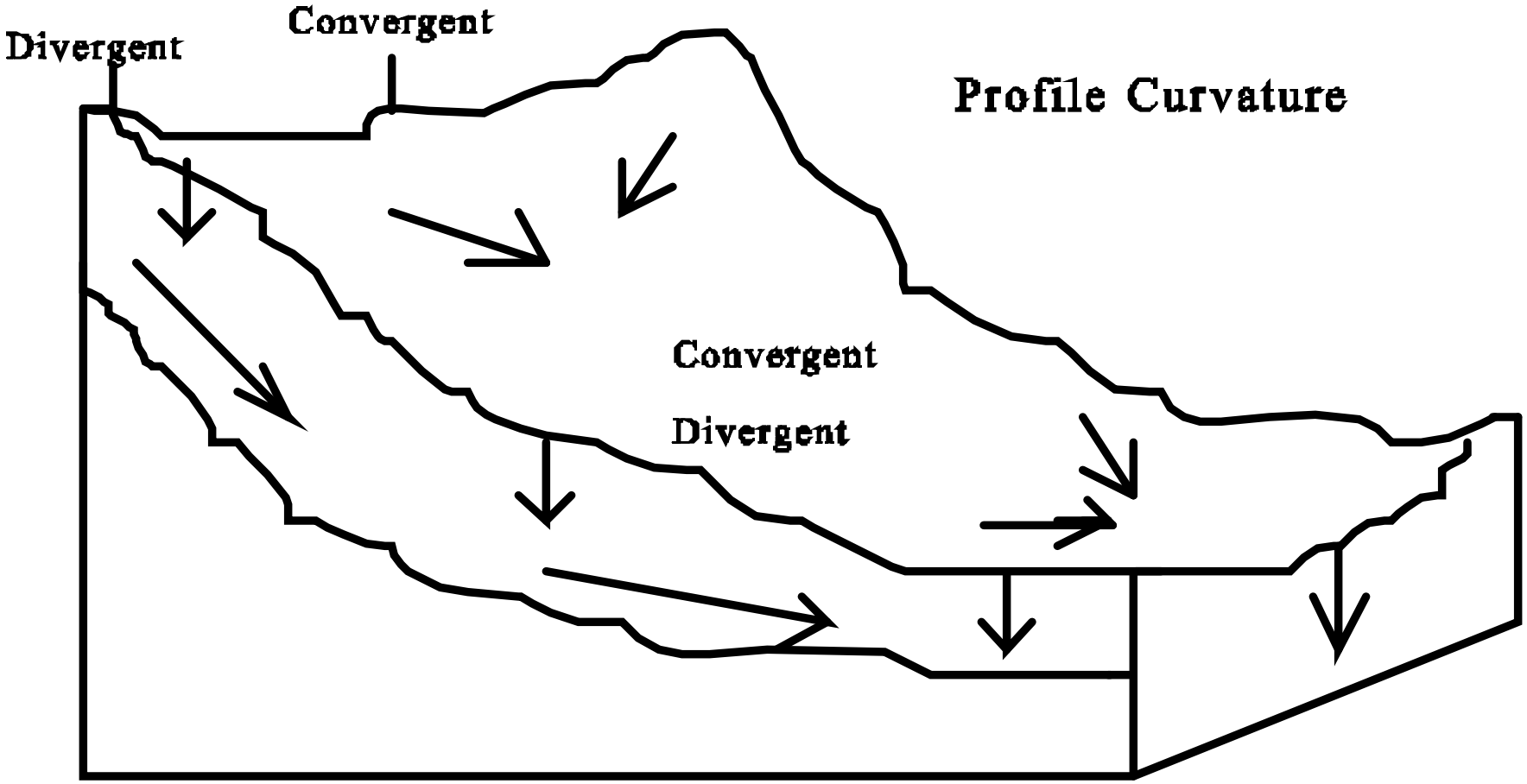
Use of soil testing to identify residual N.

Sampling by zone will result in more confidence in the number.

Tools that we found to be helpful in zone delineation were-
topography, yield frequency maps, soil EC, aerial/satellite imagery

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


Divergent
Convergent
Profile Curvature
Convergent
Divergent

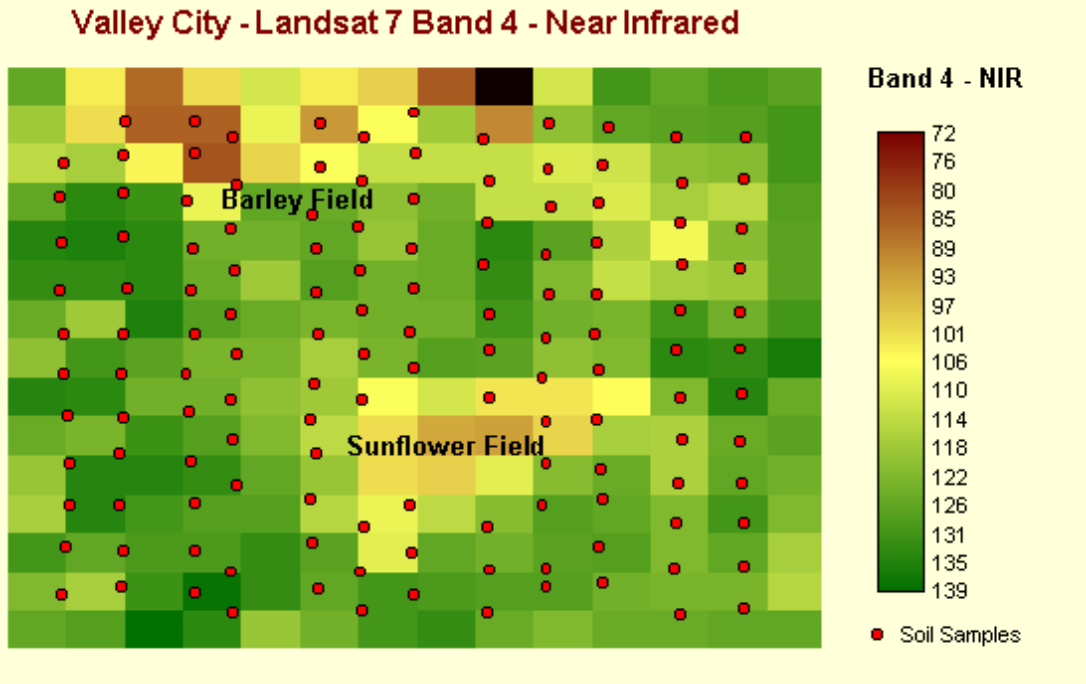
Electrical conductivity

Electrical conductivity, EM-38

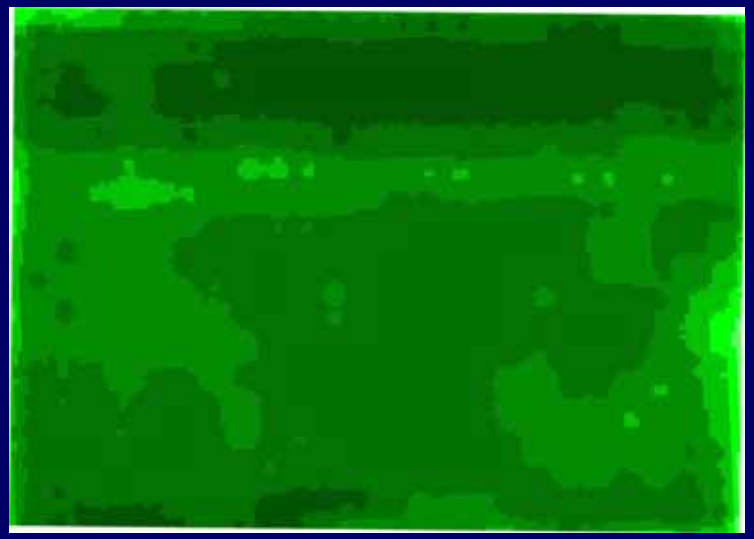
Geonics, Inc., Mississauga, ON

Remotely Sensed Images (RSI)

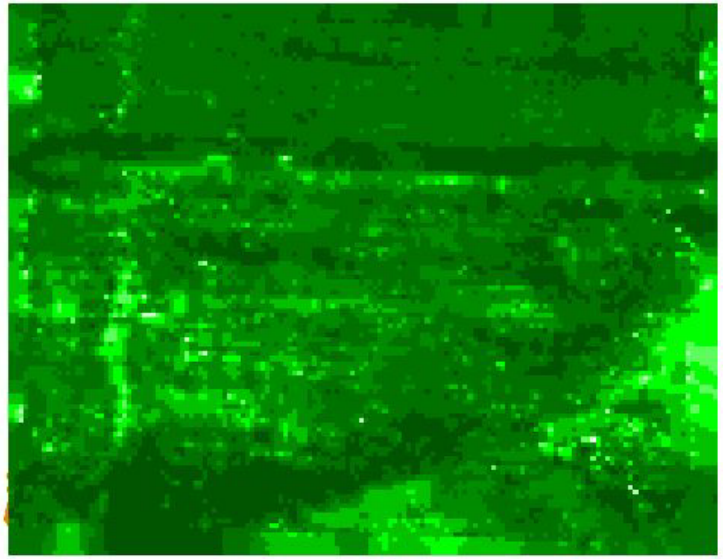
- Landsat 7 satellite pictures
- Aerial photos: Ektochrome color film.



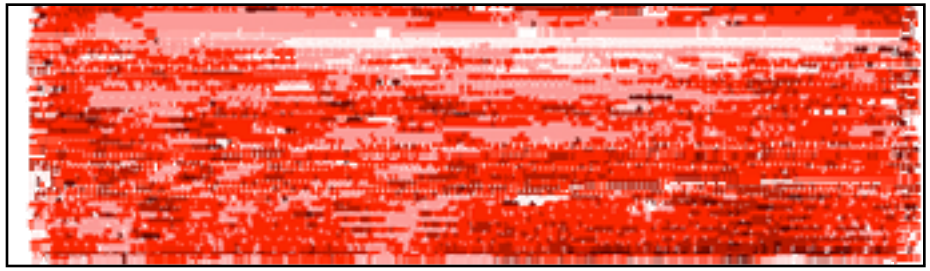
Satellite



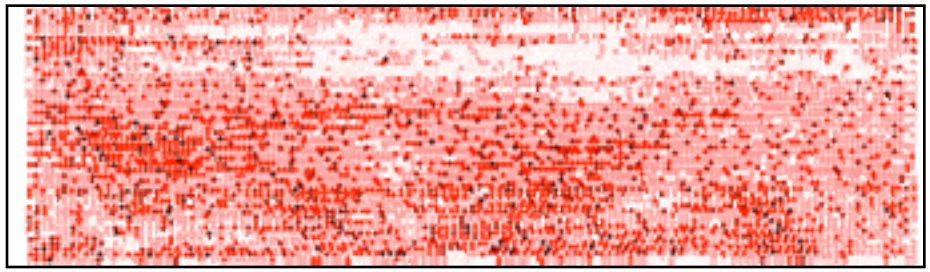
Greenseeker sensor



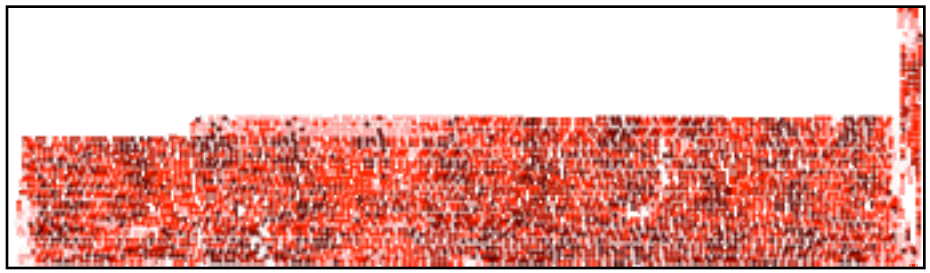
How do you manage multiple years of yield data?



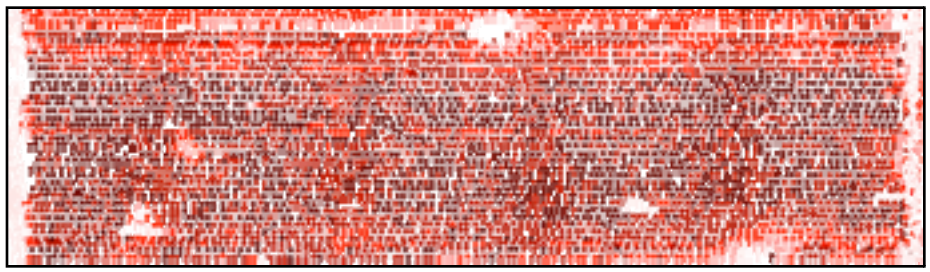
1994 Yield



1995 Yield



1997 Yield



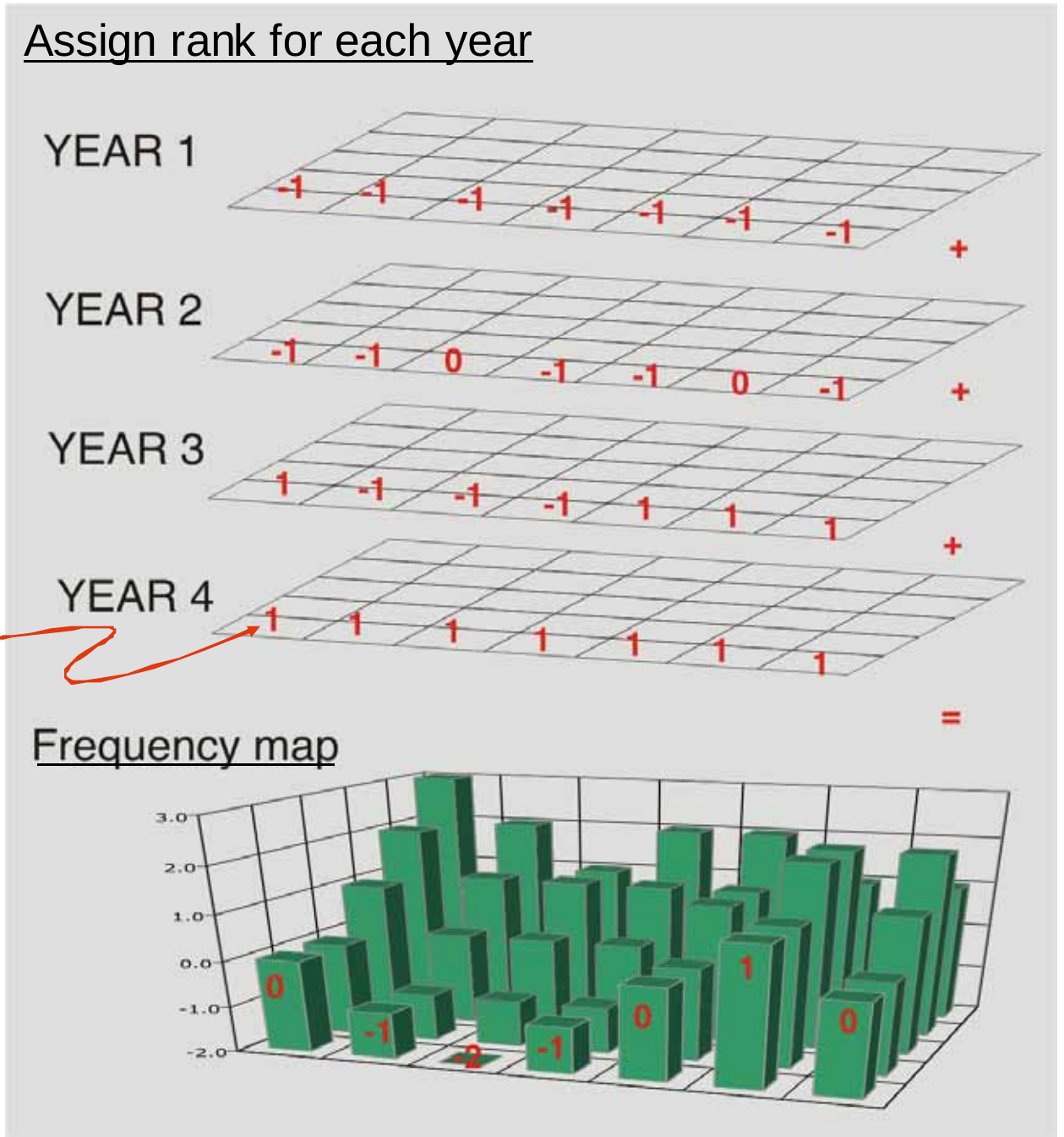
1998 Yield

2000 Yield

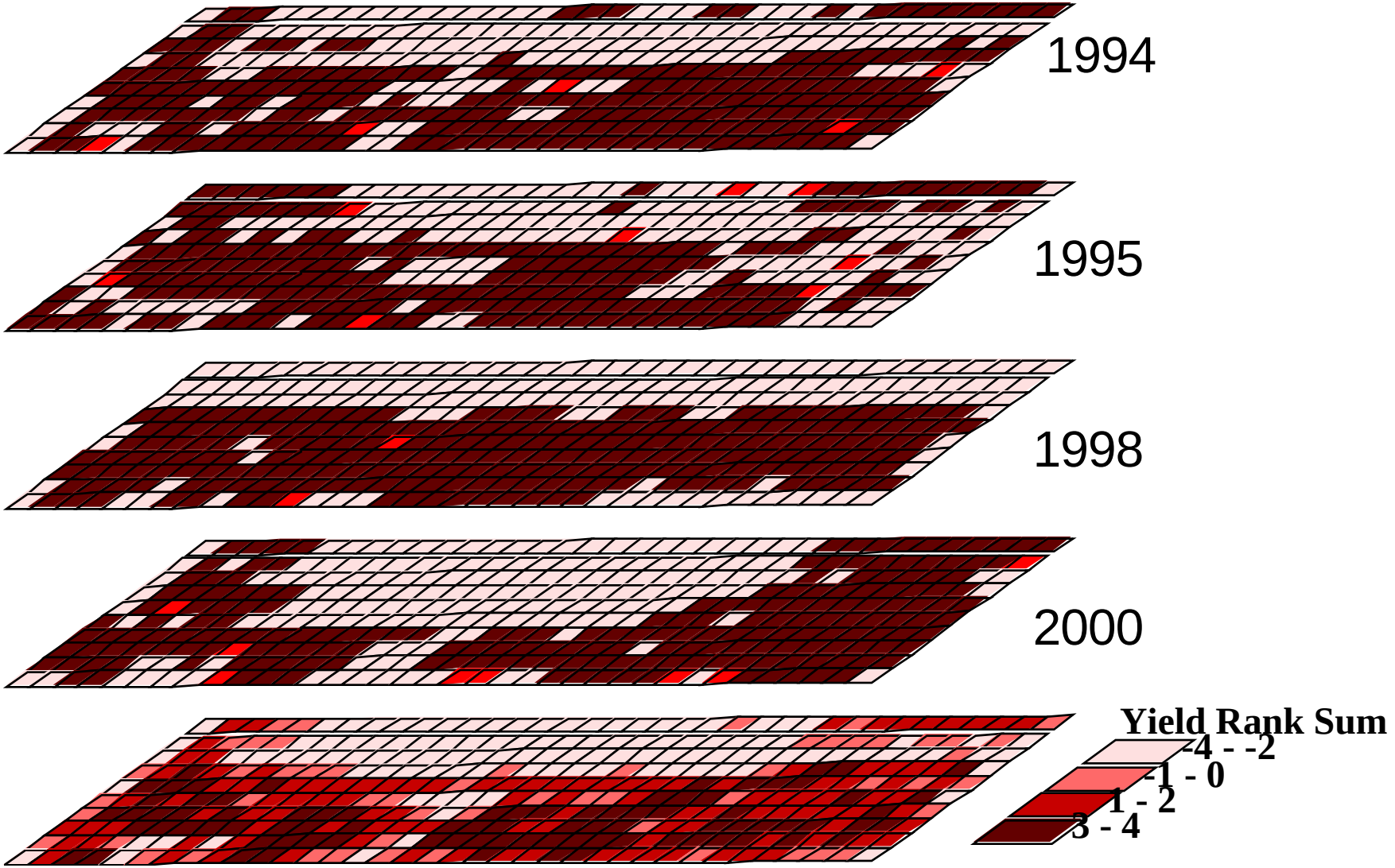
Managing multiple yield data using rank & frequency

Assign rank:
1 if > average yield
0 if = average yield
-1 if < average yield

Assign rank for each year

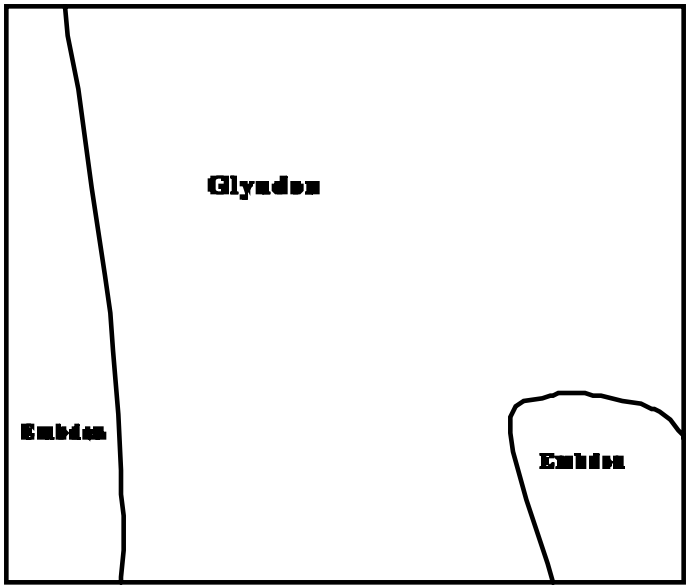


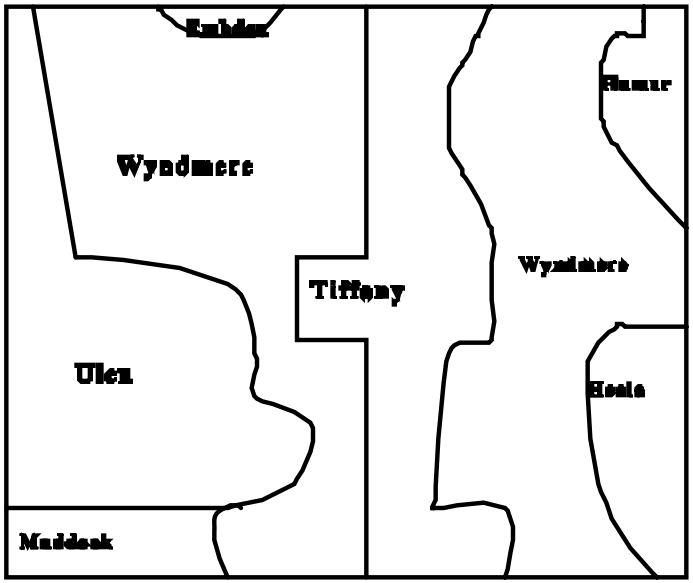
Developing Frequency Map



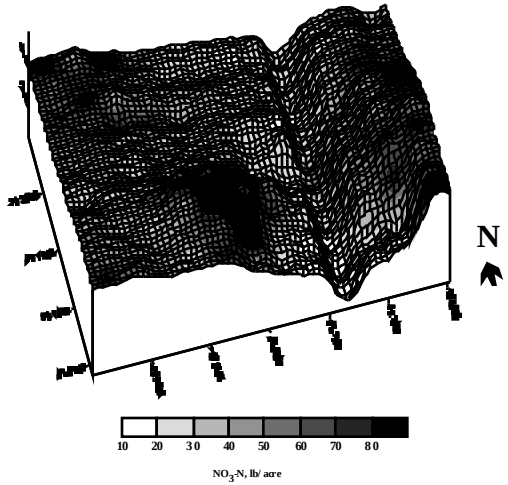
Soil survey

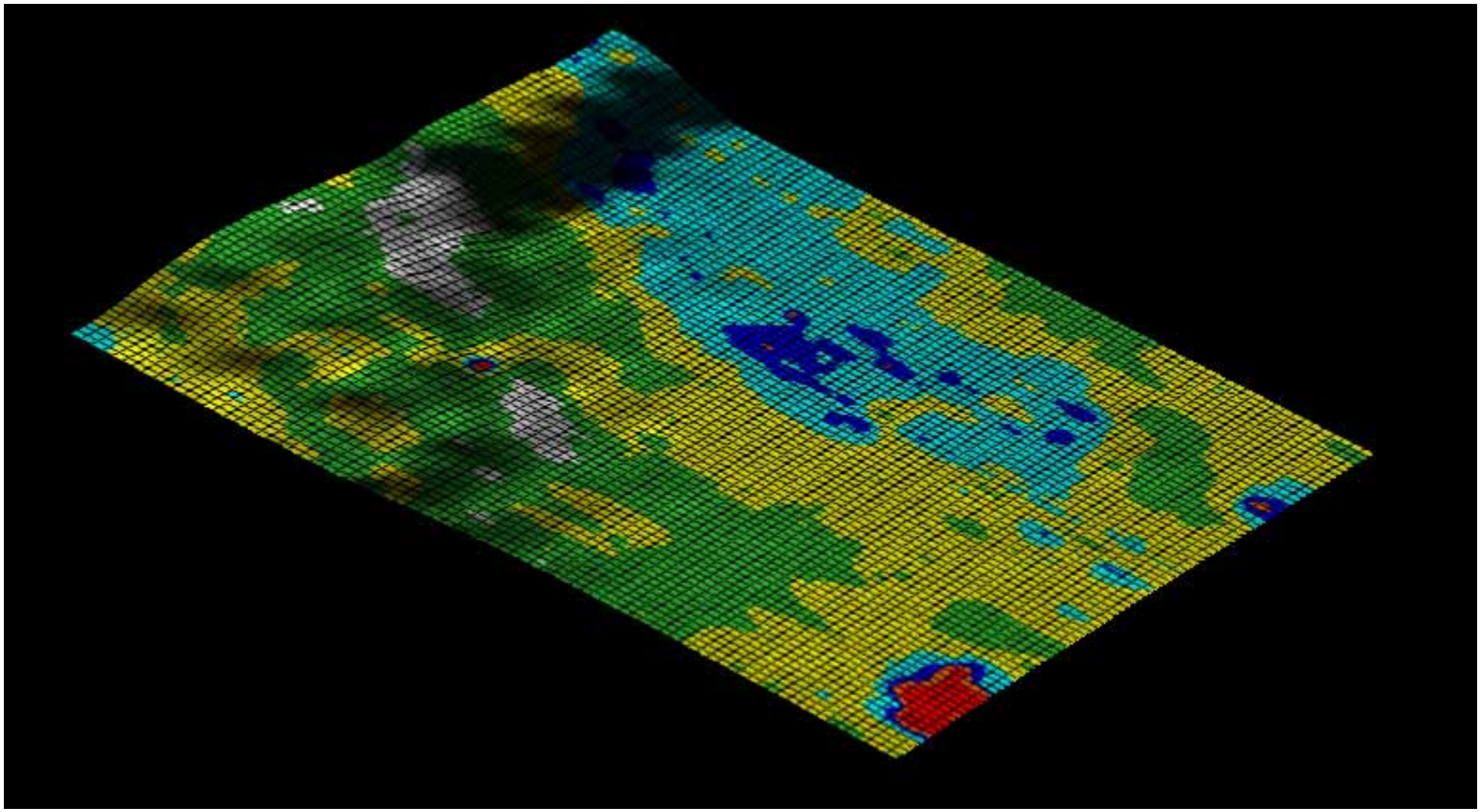
Order 1 1:8,000



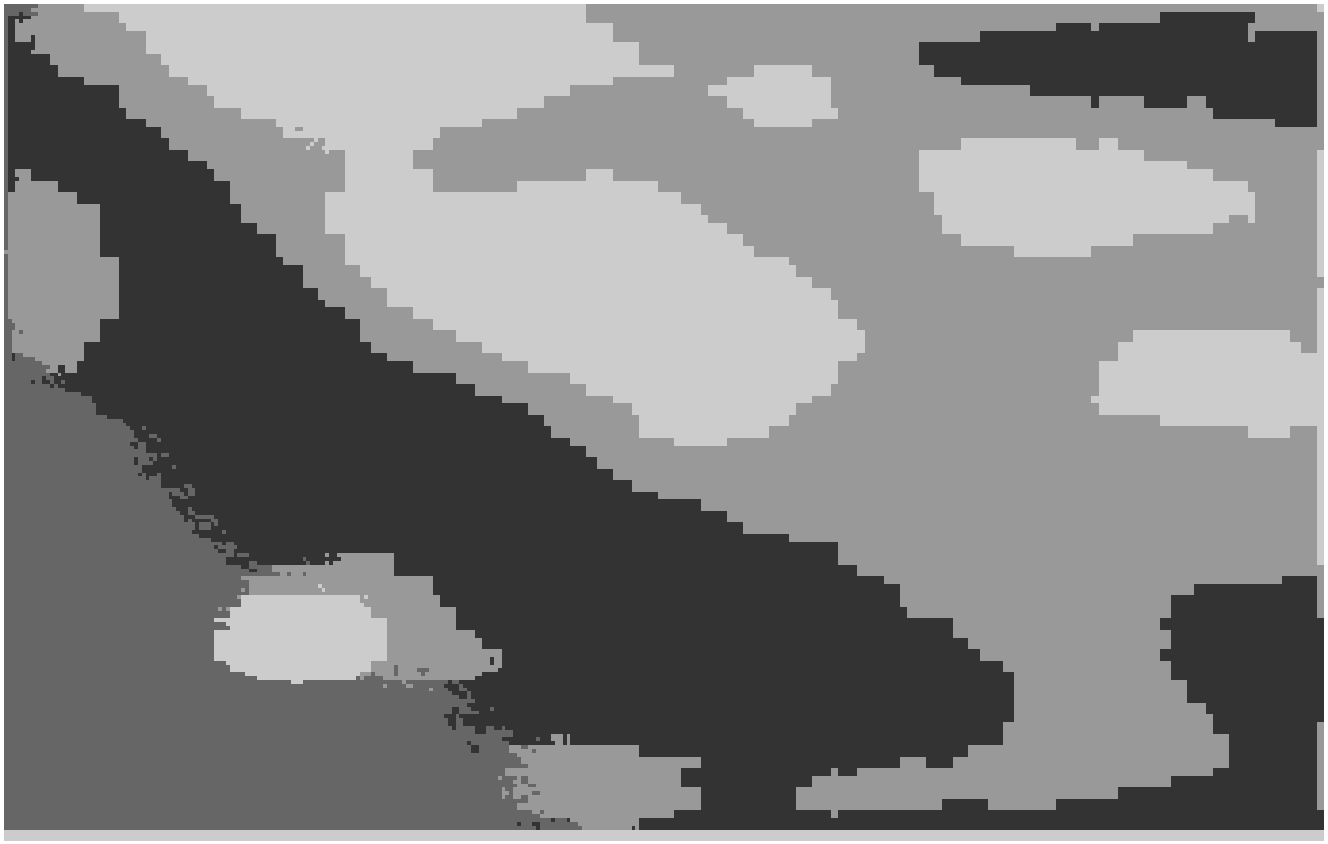


Order 2 1:20,000




28
24
20
16
12
8
4
Apparent EC mmohs/cm

Beach site zones using satellite NDVI imagery, soil EC and topography patterns.



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 ½ 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.

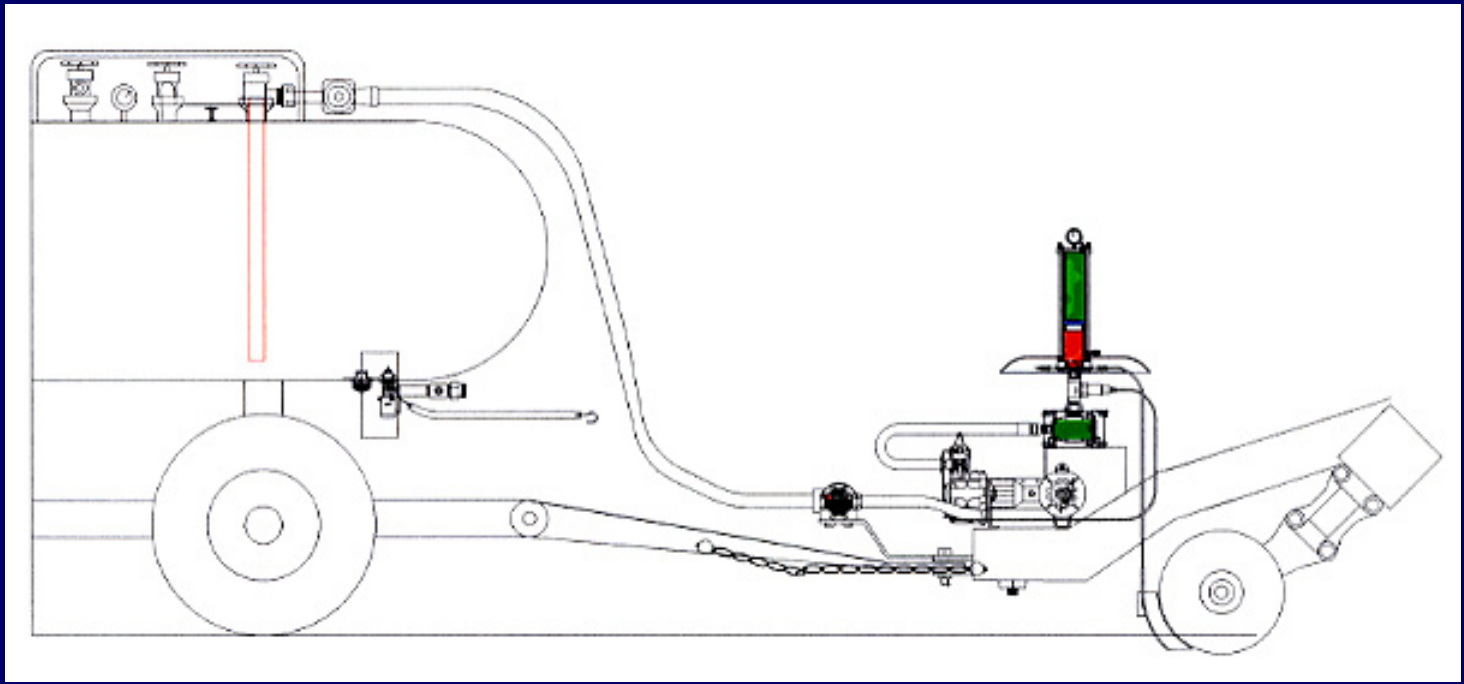
I consider 2-3 inch deep application 90% efficient.

Banding N DOES NOT increase N efficiency!

Exactrix?

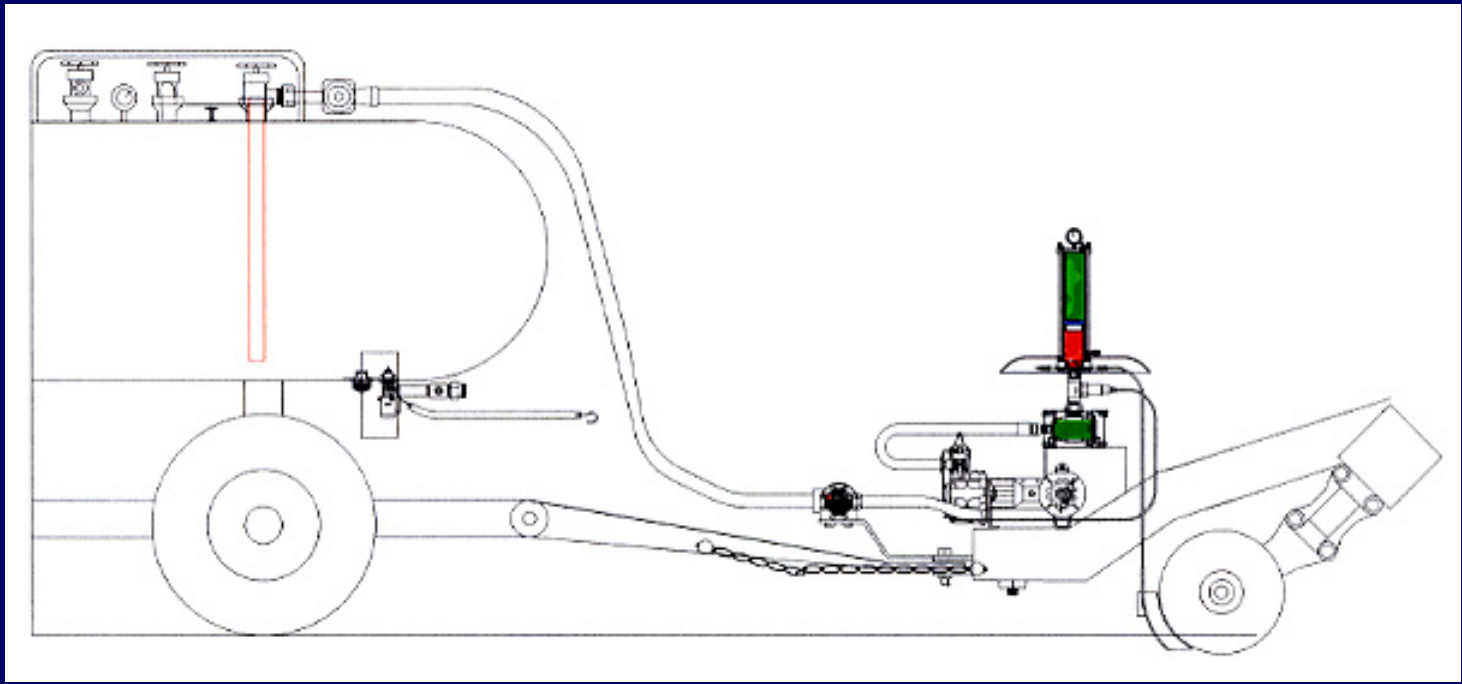
Benefits- very low “footprint” in no-till

most even application of any method



Exactrix?

Drawbacks- difficult and expensive to maintain
no added efficiency benefit

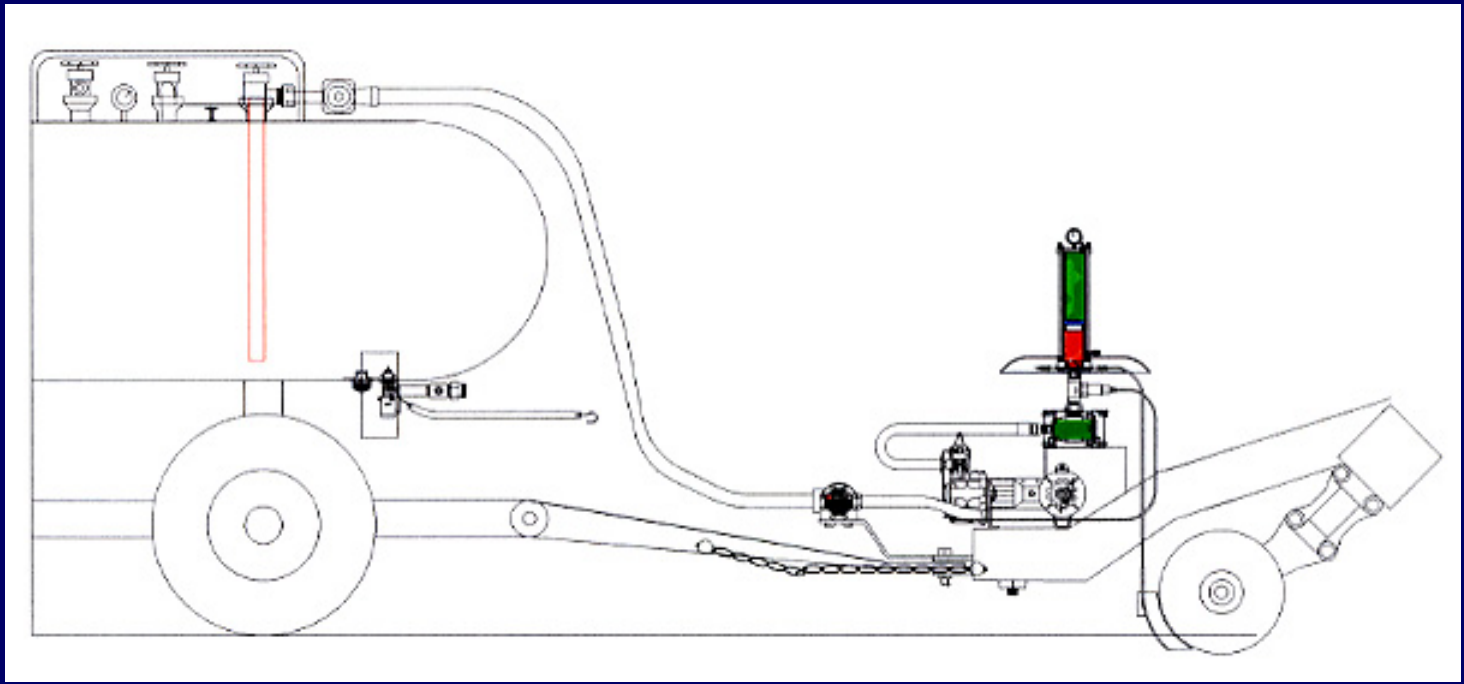


Exactrix?

Concerns- ammonia application should still-

-not be directly below the seed

-should be at least 2 inches off to the side



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.

QUESTIONS?