Role of Precision Agriculture in the BMP

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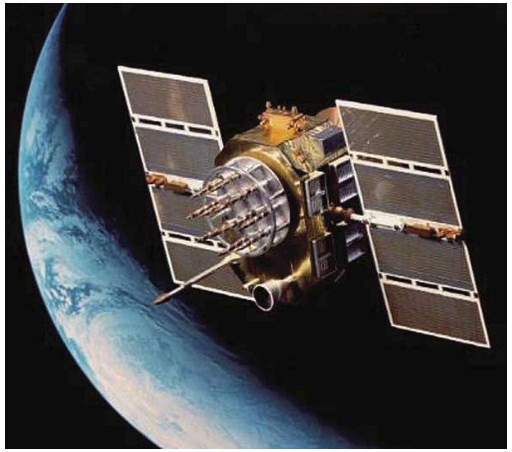
State BMP Coordinator

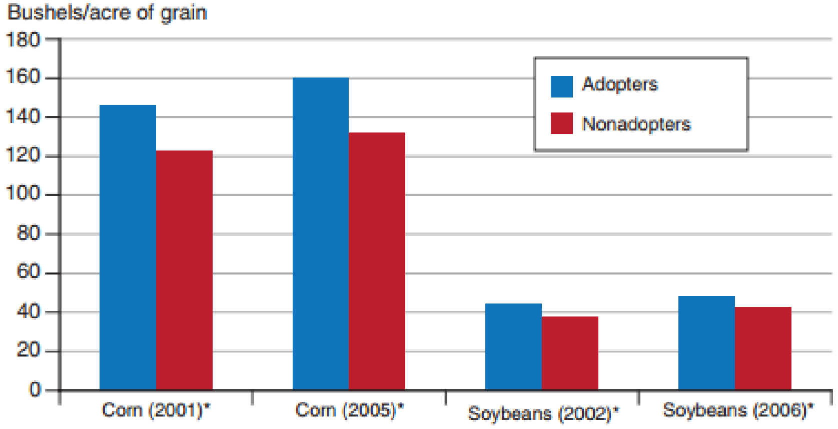
Technology use in agriculture



Global Positioning Satellite. (U.S. Air Force image)

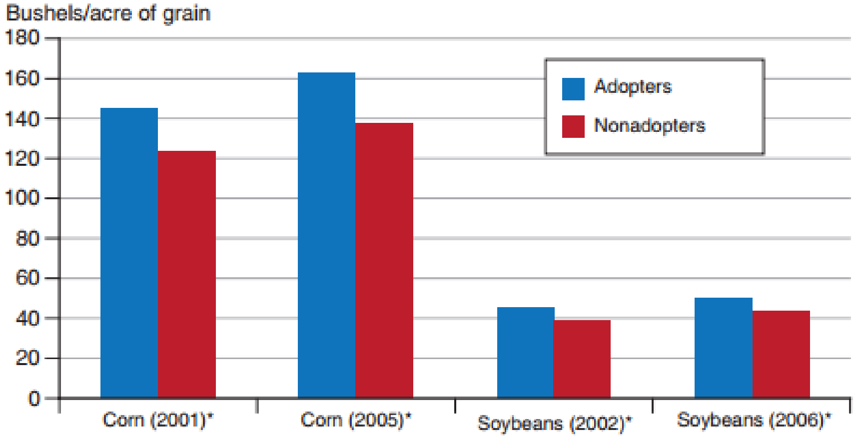
RTK (real-time kinetic) GPS base tower. (Photo courtesy of Rural Tower Network)

Comparison of yields among yield monitor adopters and nonadopters



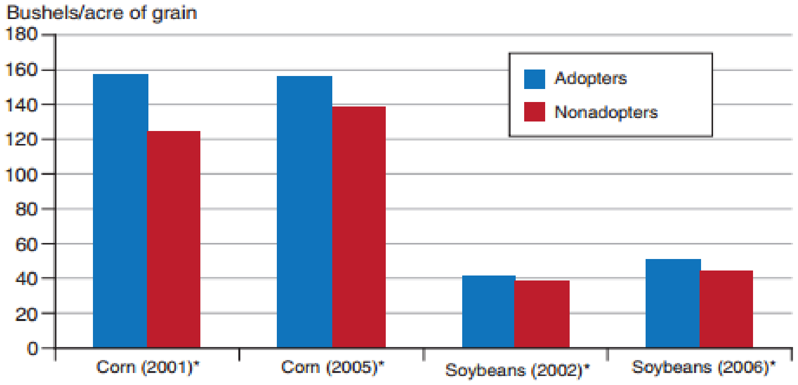
*indicates statistically significant difference of ratios, at 10% levels.
Source: Agricultural Resource Management Survey, USDA, ERS/NASS.

Comparison of yields among Global Positioning System mapping adopters and nonadopters

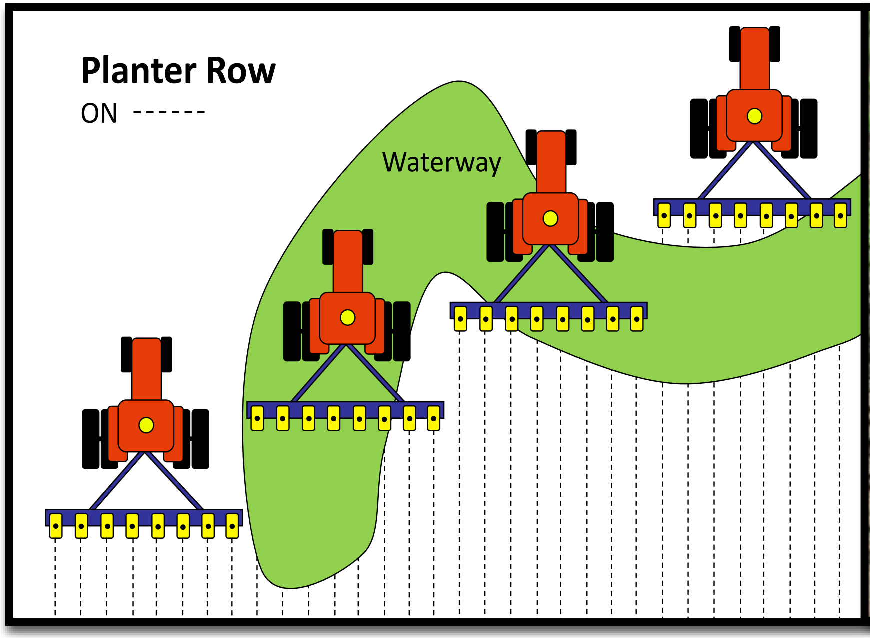


*indicates statistically significant difference of ratios, at 10% levels.
Source: Agricultural Resource Management Survey, USDA, ERS/NASS.

Comparison of yields among VRT-fertilizer adopters and nonadopters



*indicates statistically significant difference of ratios, at 10% levels.
VRT= variable-rate technology.
Source: Agricultural Resource Management Survey, USDA, ERS/NASS.



Variable Rate Fertilization

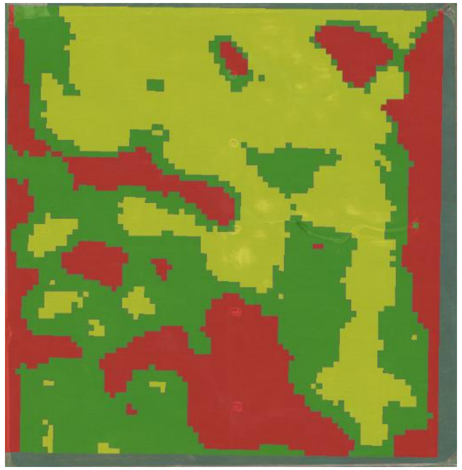
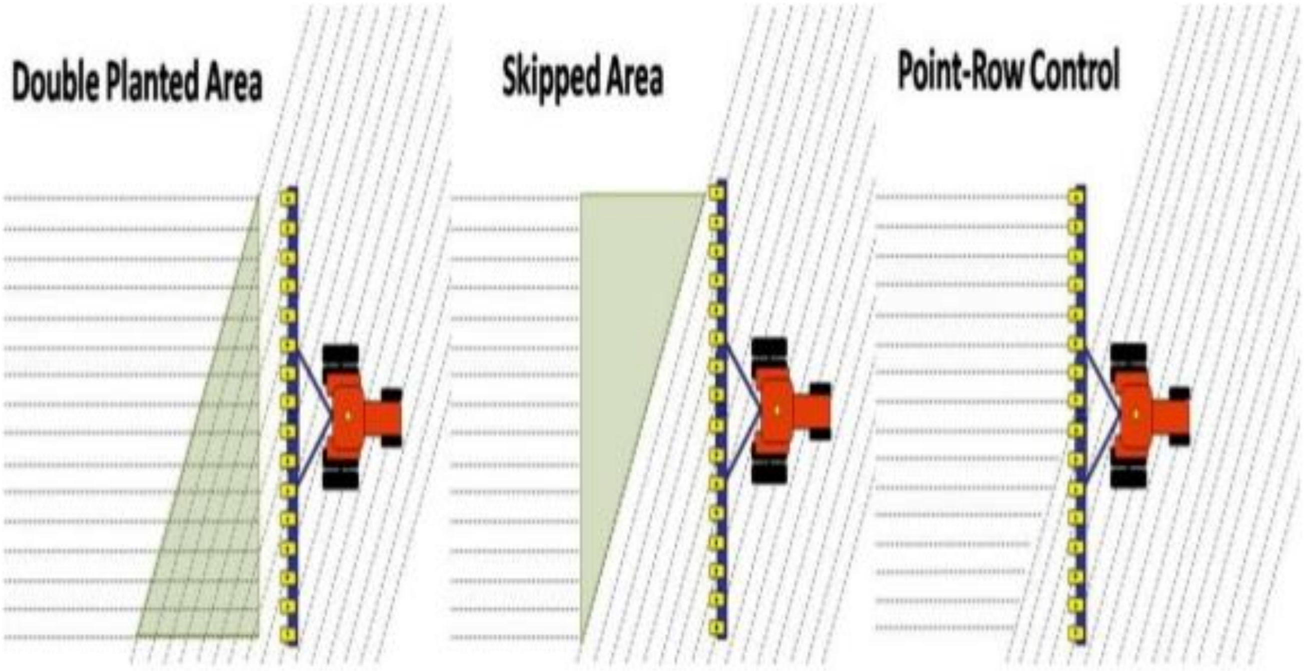


Illustration of individual row control for a planter to reduce overlap and skipped areas. The technology improves planting efficiency while reducing the amount of planted seed



http://www.slideshare.net/shrinivascs/svs-ii-semi

Economics

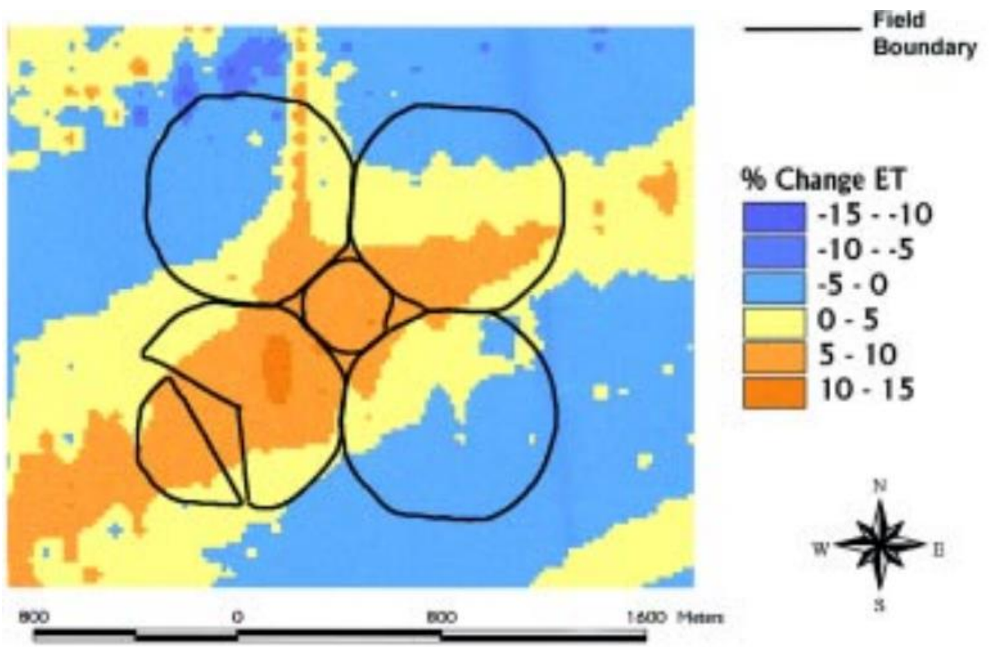
Cost saving in number of passes
Saving by GPS guided tractor per care= 5 x 1000 = $5000
Possible saving by GPS guided tractor = 20 x 1000 =$20000

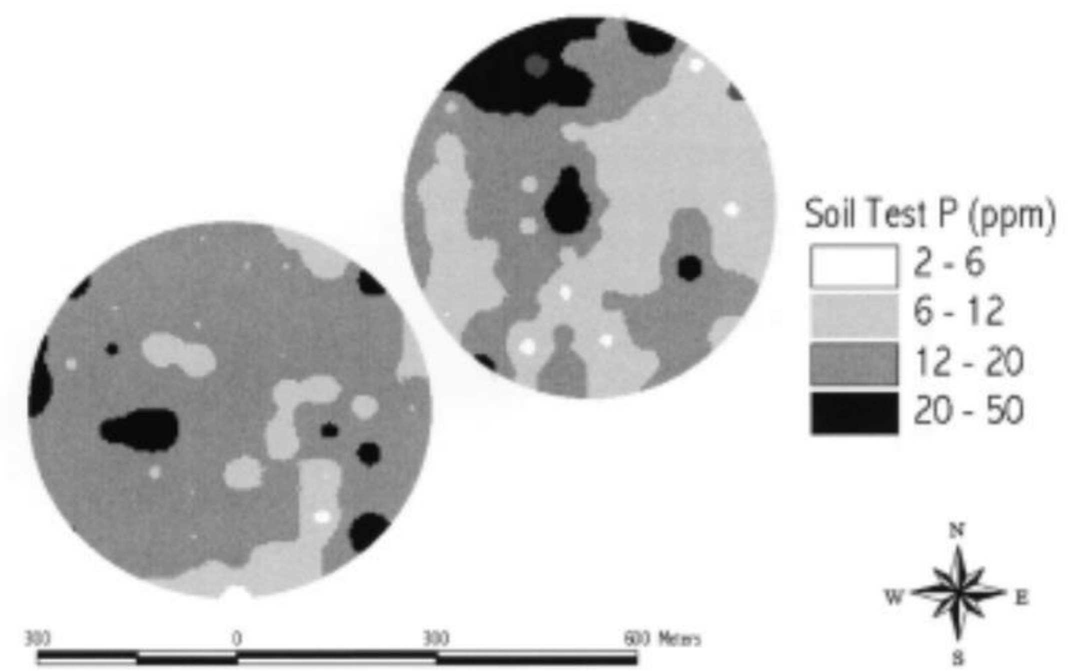
Cost saving in fertilizer application
Individual nozzle shut off saving in corn – $32/acre
In potato total saving= 1000 x 35 = $35000

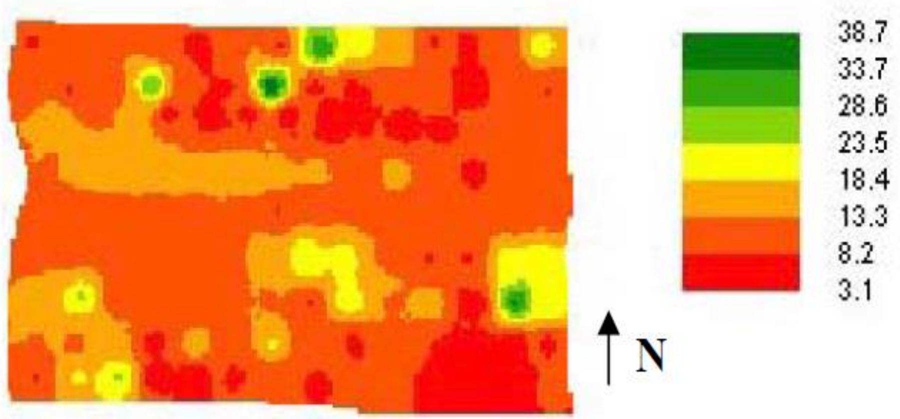
- More efficiency
- Less environmental pollution
- More energy efficient

Source: http://coststudyfiles.ucdavis.edu/uploads/cs_public/d6/fd/d6fd5258-9608-4df4-8d23-0c29634cddfa/potatoesir1_08.pdf
https://www.extension.iastate.edu/agdm/crops/pdf/a1-20.pdf

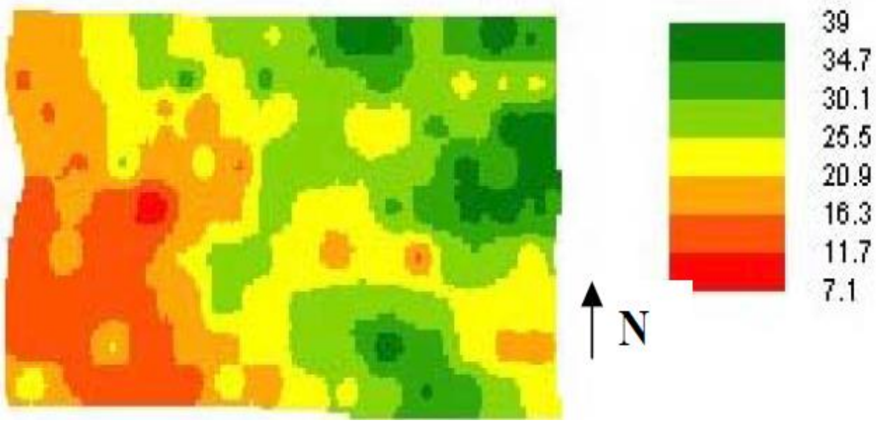
Gird/Zone Sampling



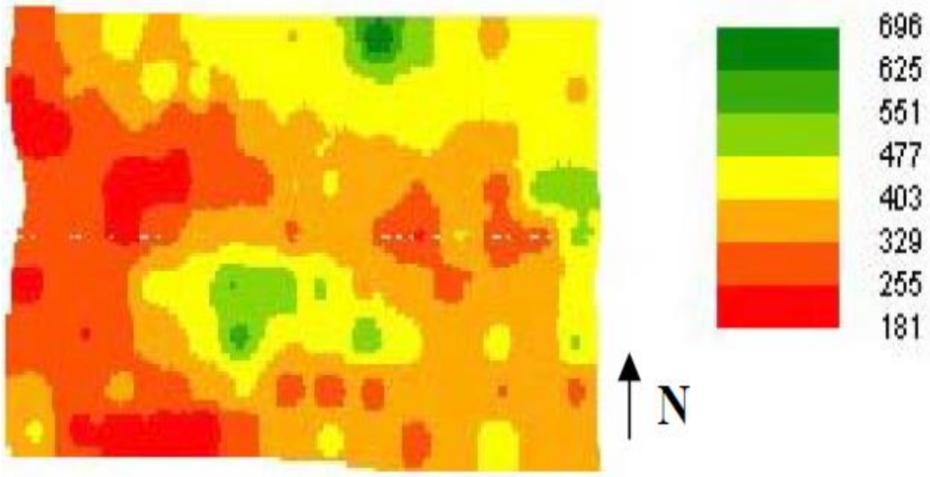




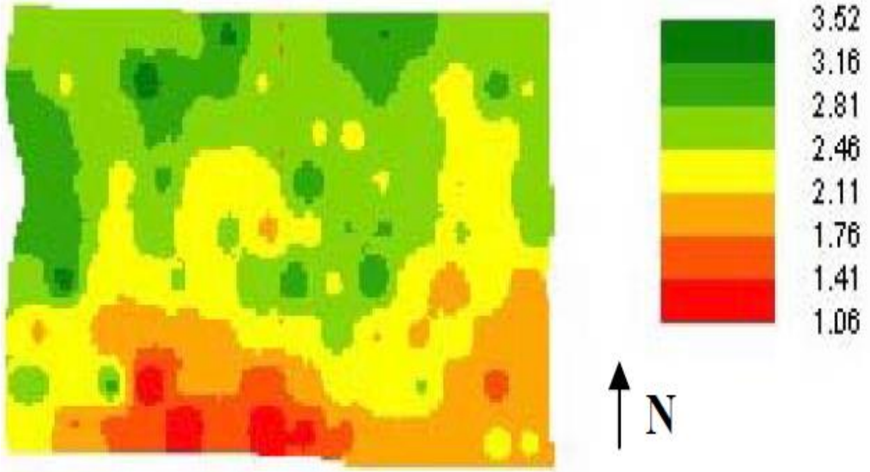
Distribution of inorganic Nitrogen



Distribution of Phosphorous



Distribution of Potassium



Distribution of SOM

http://people.oregonstate.edu/~machados/Agronomy/Working%20folder/MachadoFinalReport.pdf

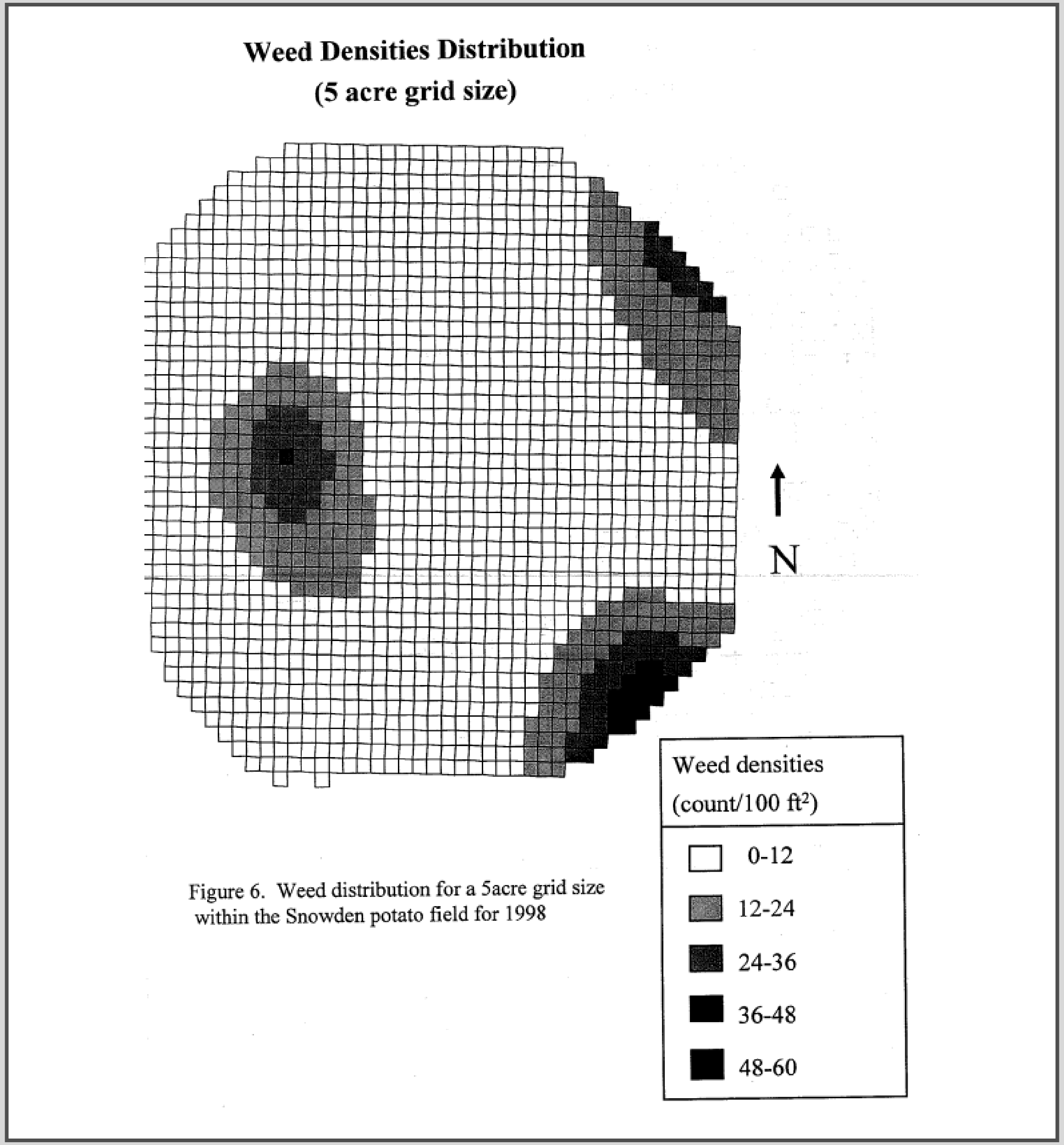
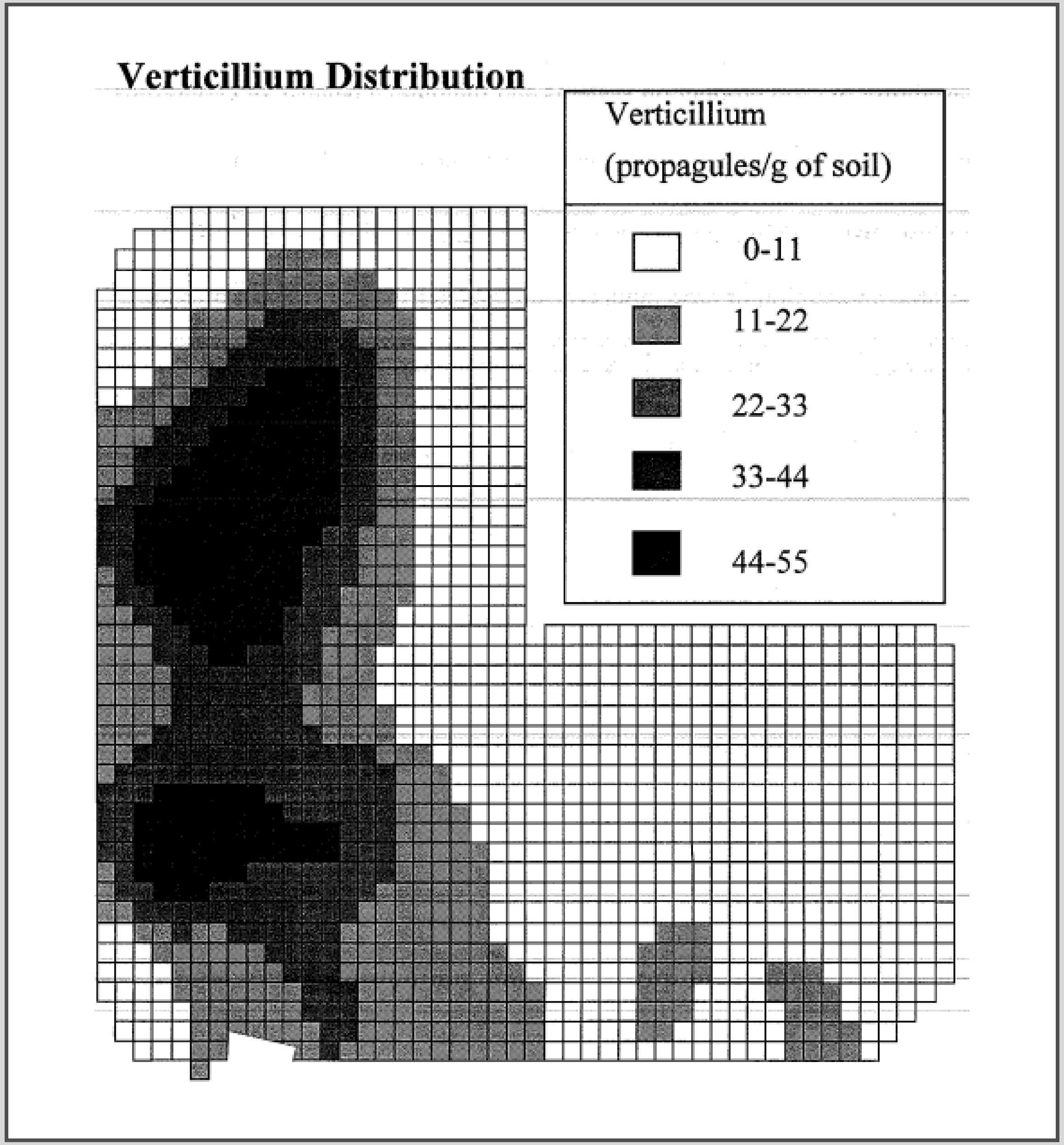
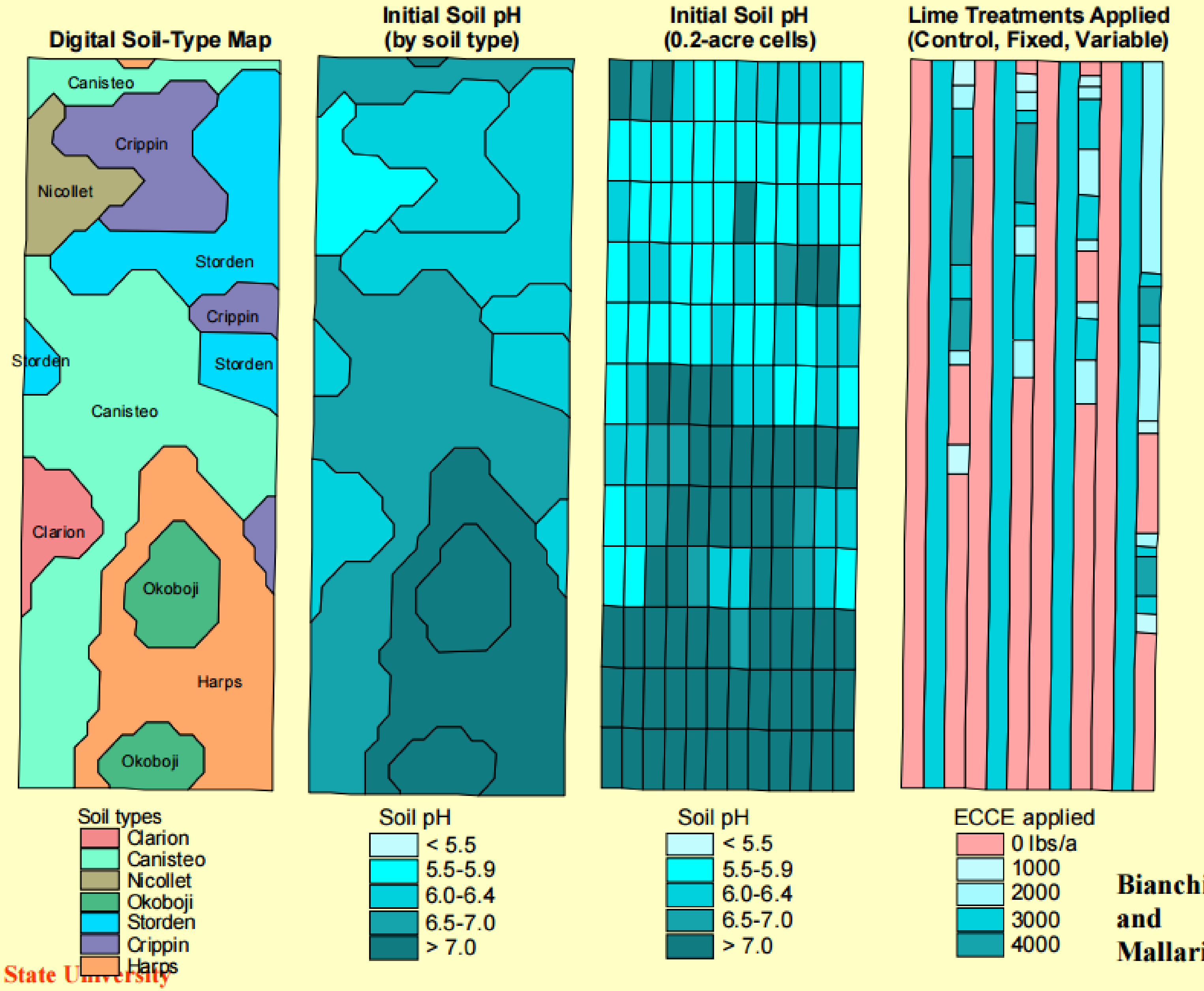


Figure 6. Weed distribution for a 5acre grid size within the Snowden potato field for 1998



http://vegetables.wisc.edu/download/archives/potatoes/Precision-Agriculture-in-Potato-Production-GD-Morgan-TR-Connell-AE-MacGuidwin-WG-Schmitt.pdf

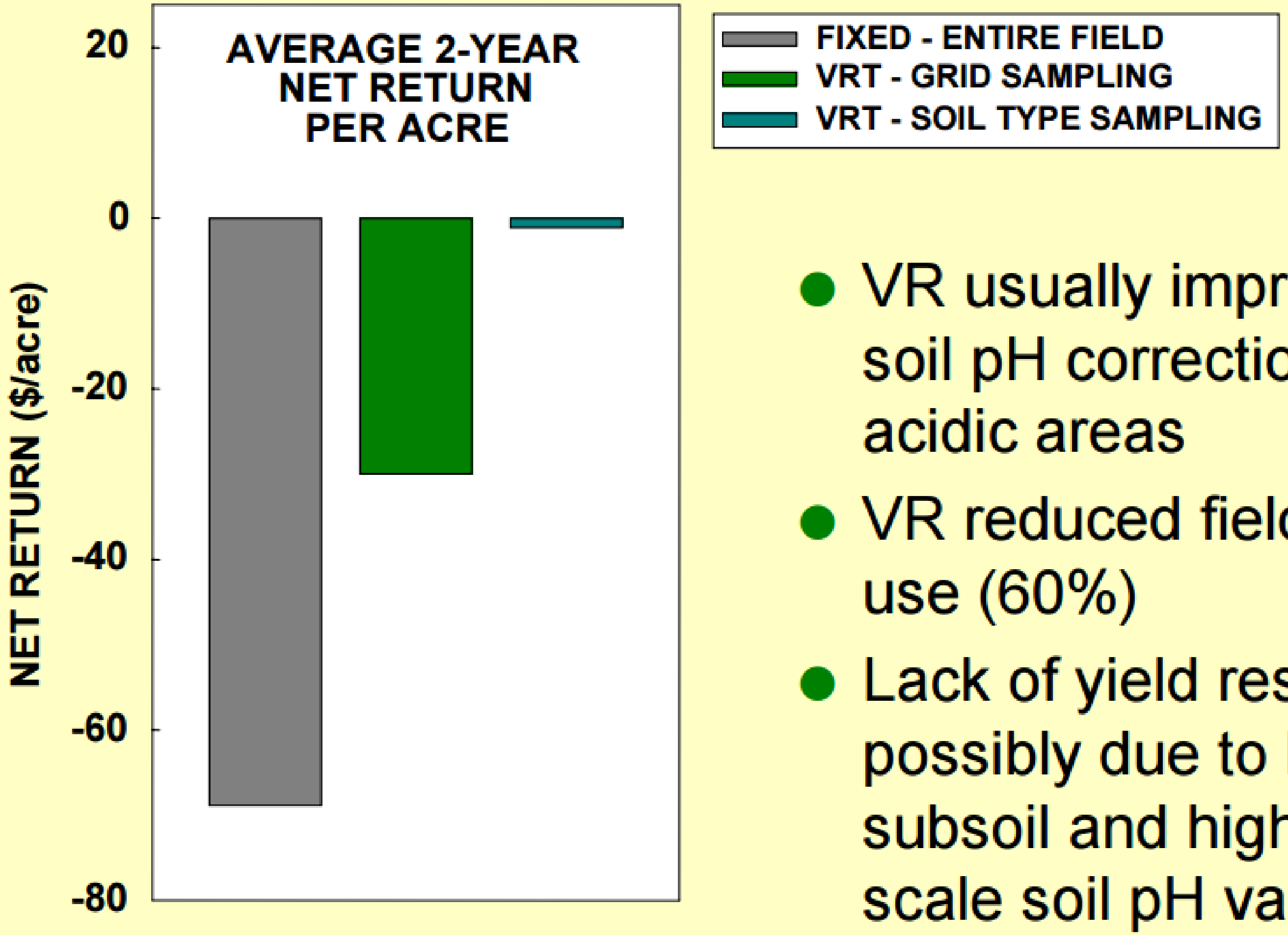
Lime Variable-Rate vs. Fixed-Rate Experiment - Heck Farm



Bianchini and Mallarino , 2002

Iowa State University

VRT LIME - HECK HOME 1998 & 1999

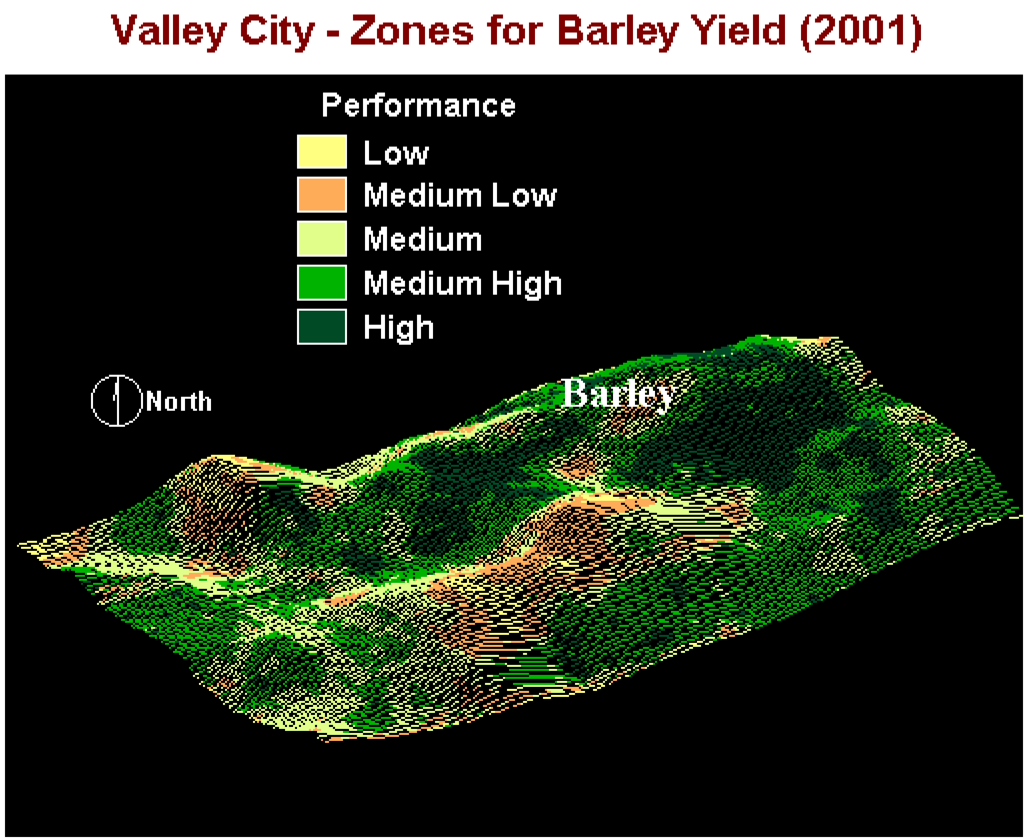


- VR usually improved soil pH correction of acidic areas
- VR reduced field lime use (60%)
- Lack of yield response possibly due to high pH subsoil and high small-scale soil pH variability

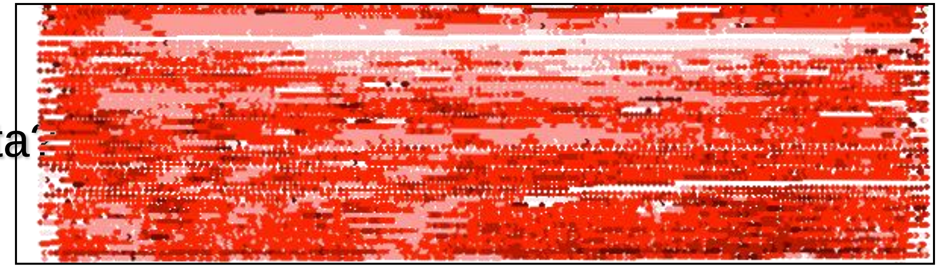
Bianchini and Mallarino , 2002
Iowa State University

http://www.agronext.iastate.edu/soilfertility/presentations/soilphliming04.pdf

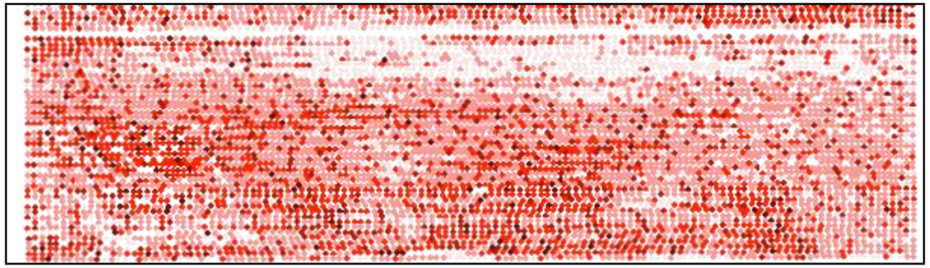
Yield


Valley City - Zones for Barley Yield (2001)
Performance
Low
Medium Low
Medium
Medium High
High
North
Barley

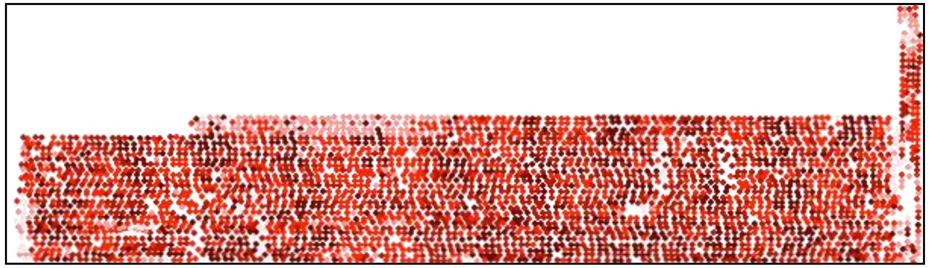
How do you manage multiple years of yield data?



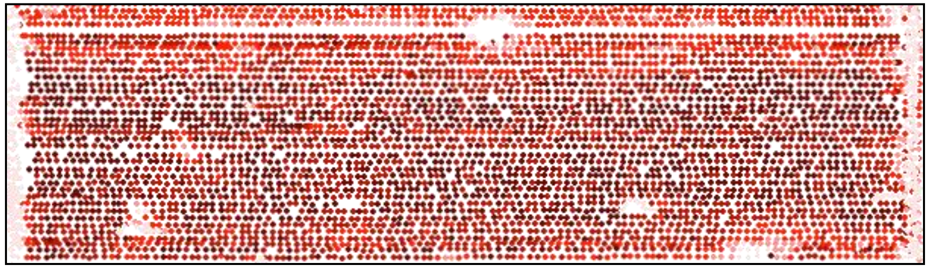
1994 Yield



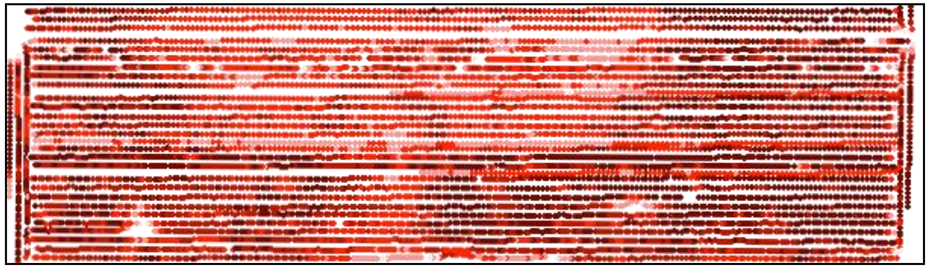
1995 Yield



1997 Yield

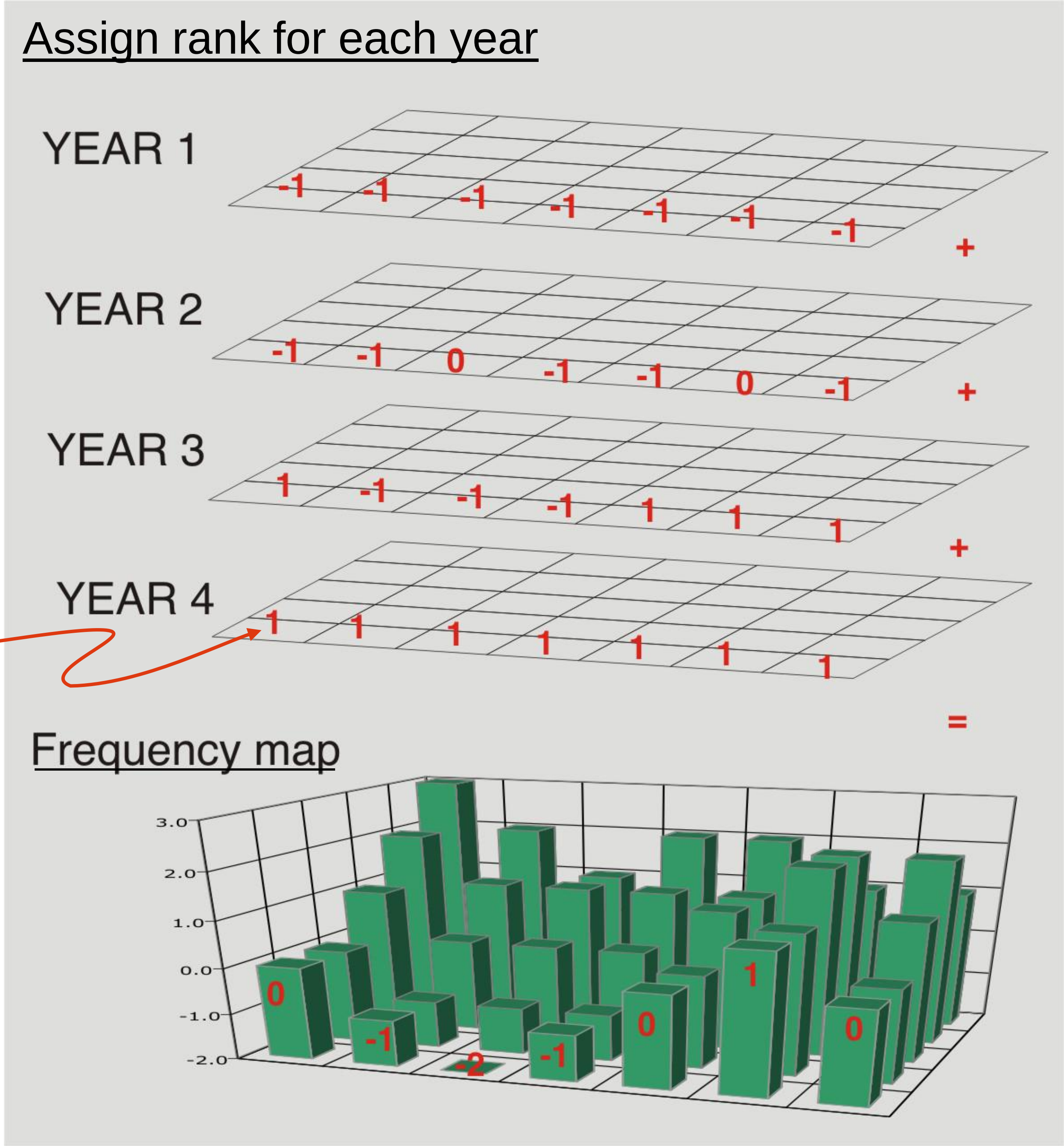


1998 Yield



2000 Yield

Managing multiple yield data using rank & frequency



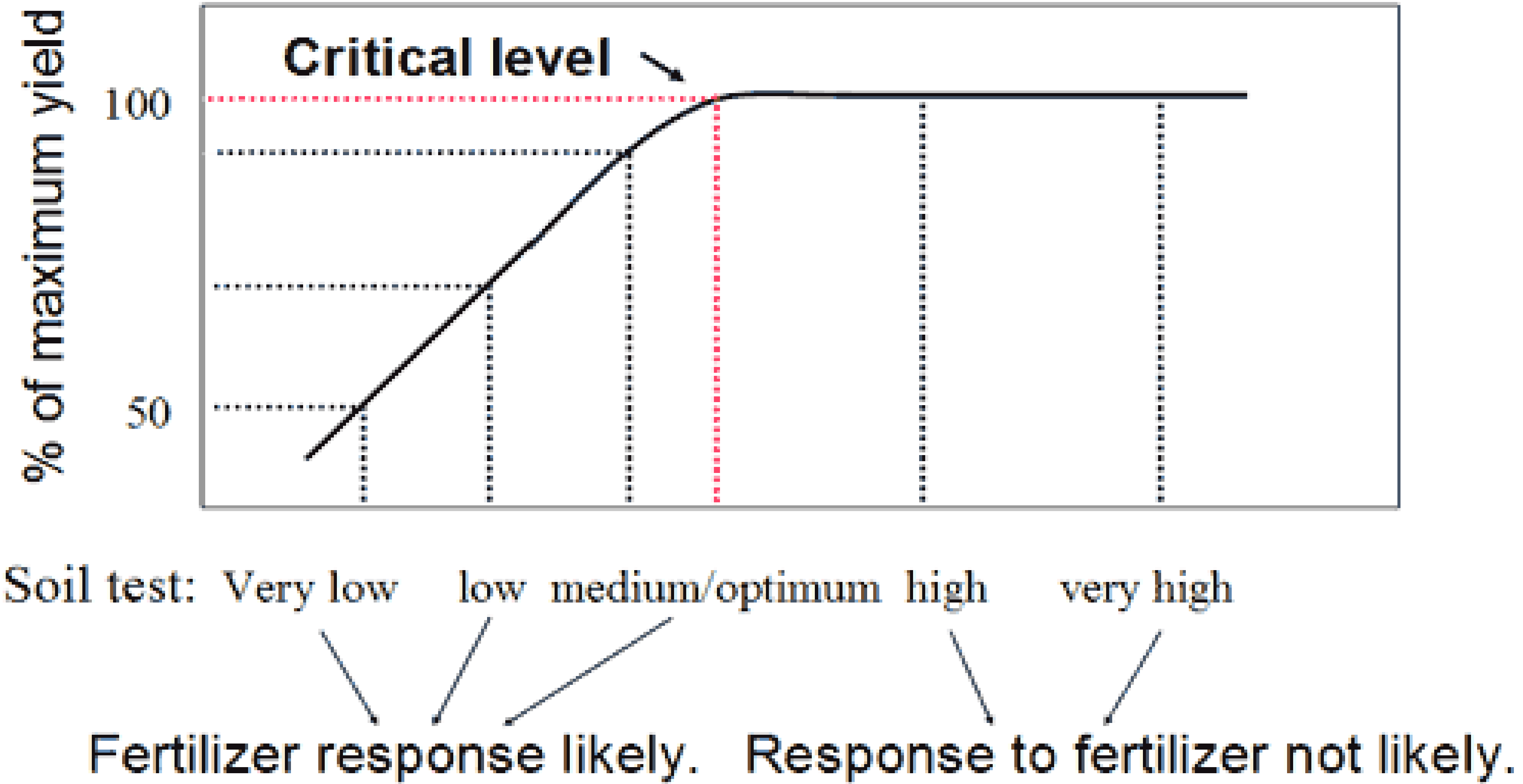
Assign rank:

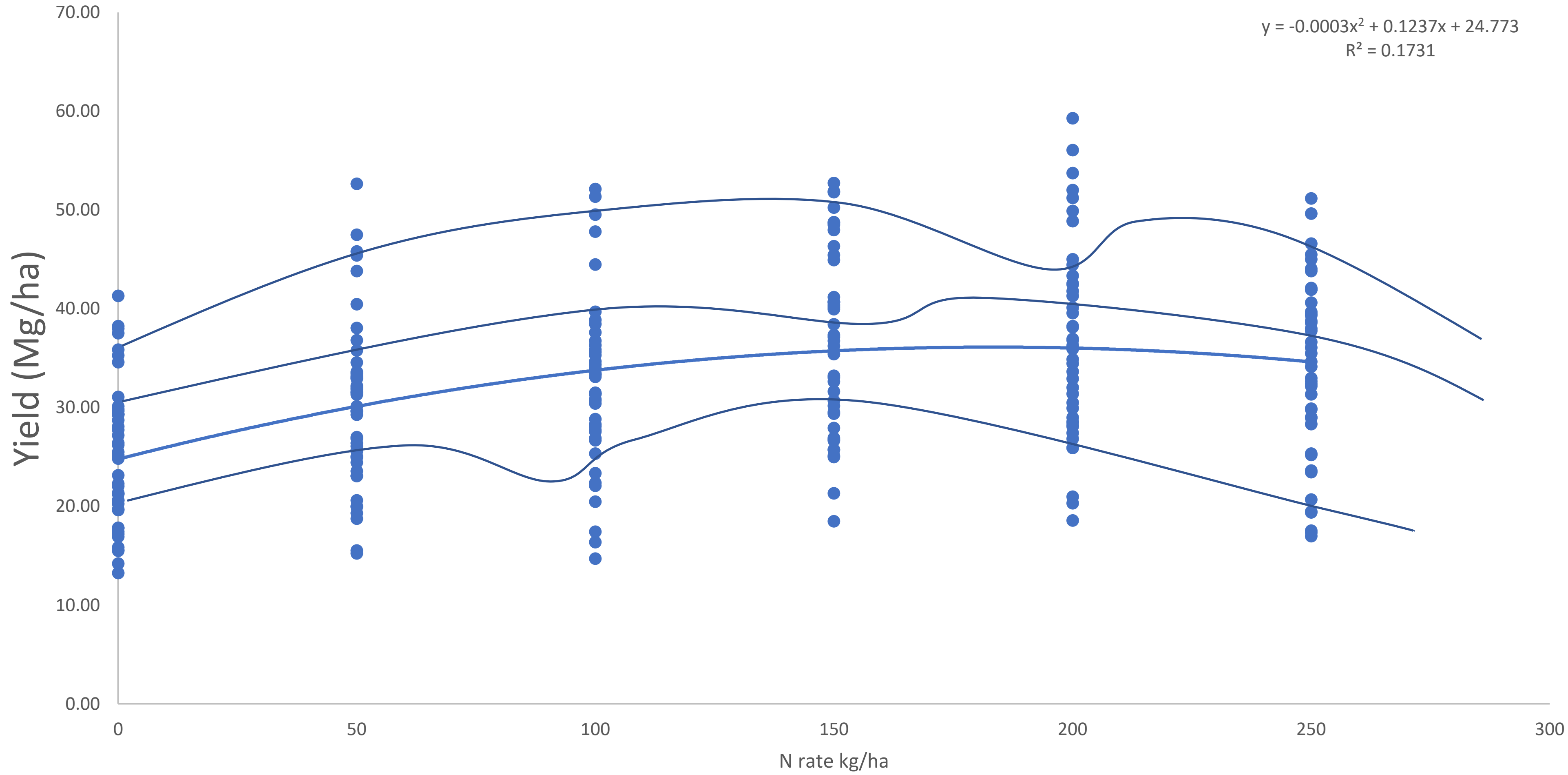
1 if > average yield

0 if = average yield

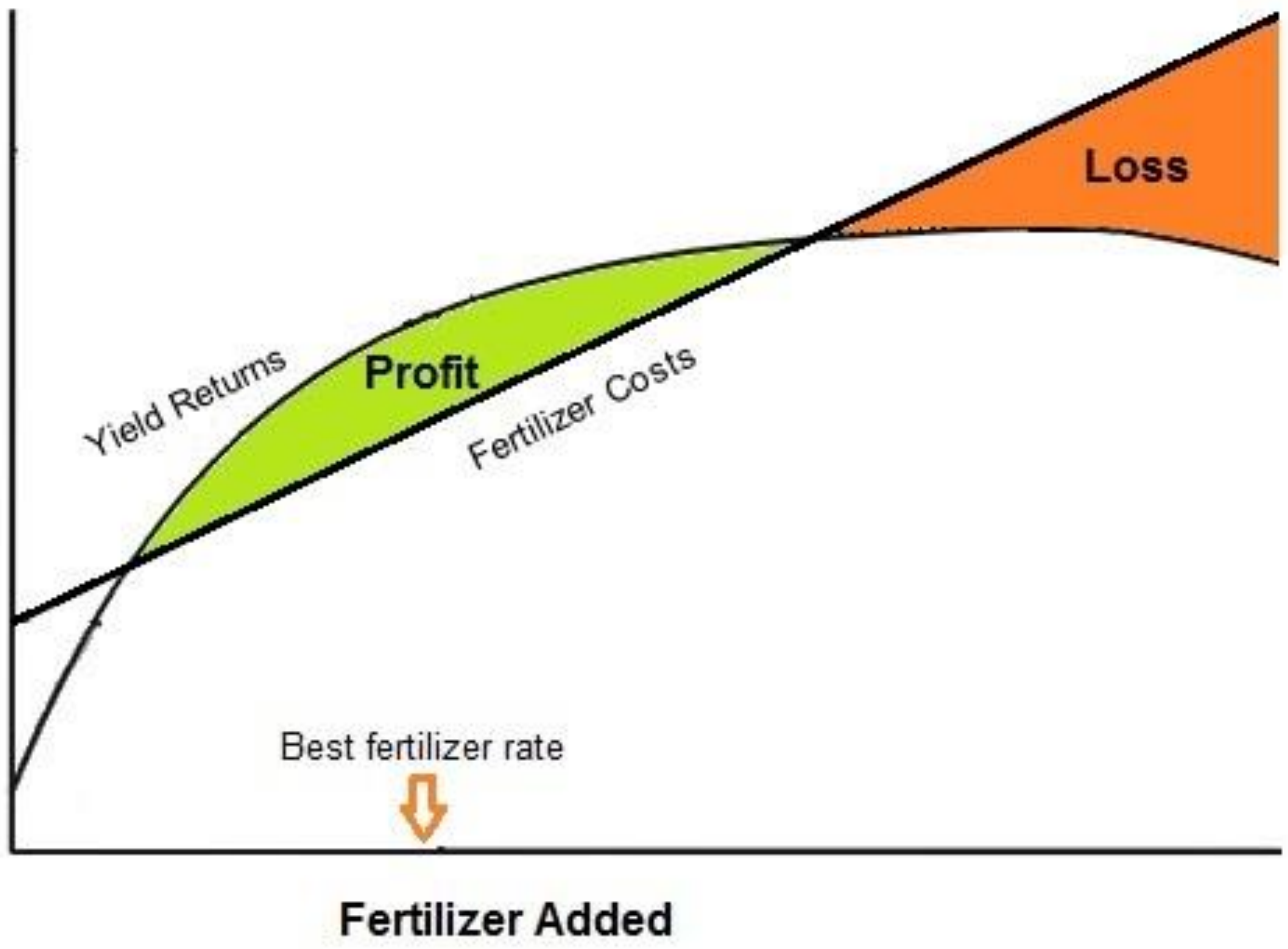
-1 if < average yield

Soil test classifications indicate whether or not adding a nutrient is likely to result in a yield increase.

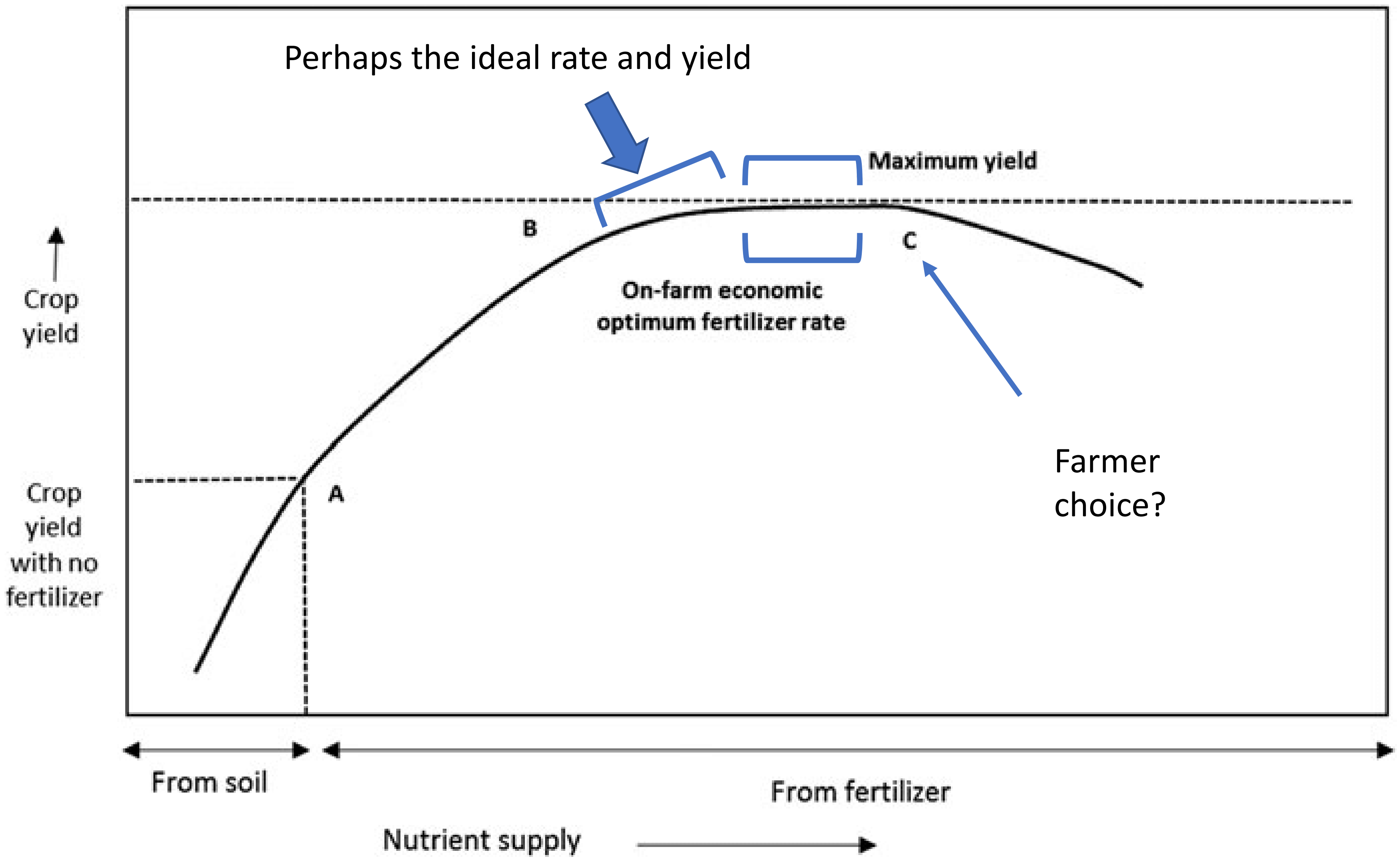




y = -0.0003x² + 0.1237x + 24.773
R² = 0.1731
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Yield (Mg/ha)
0
50
100
150
200
250
300
N rate kg/ha



Loss
Profit
Yield Returns
Fertilizer Costs
Best fertilizer rate
Fertilizer Added



Perhaps the ideal rate and yield
Maximum yield
B
C
On-farm economic
optimum fertilizer rate
Crop
yield
Crop
yield
with no
fertilizer
A
Farmer
choice?
From soil
From fertilizer
Nutrient supply

N Rate Calculator

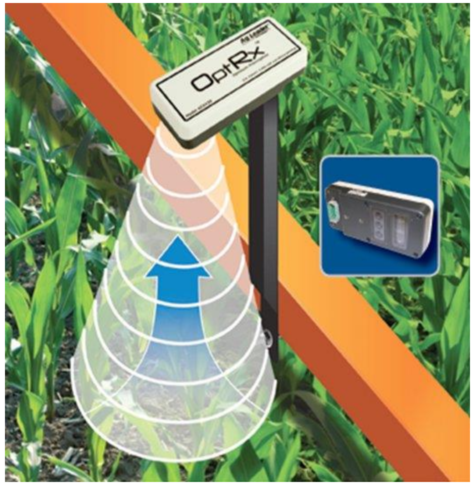
Select Region	Central Aroostook	North Aroostook	
Organic Matter	Below 2	Between 2 and 4 (inclusive)	Above 4
Cover Crop	Yes	No	
Potato Price ($/cwt)	2.2		
Nitrogen Cost ($/lbs)	0.22		

N Rate 174

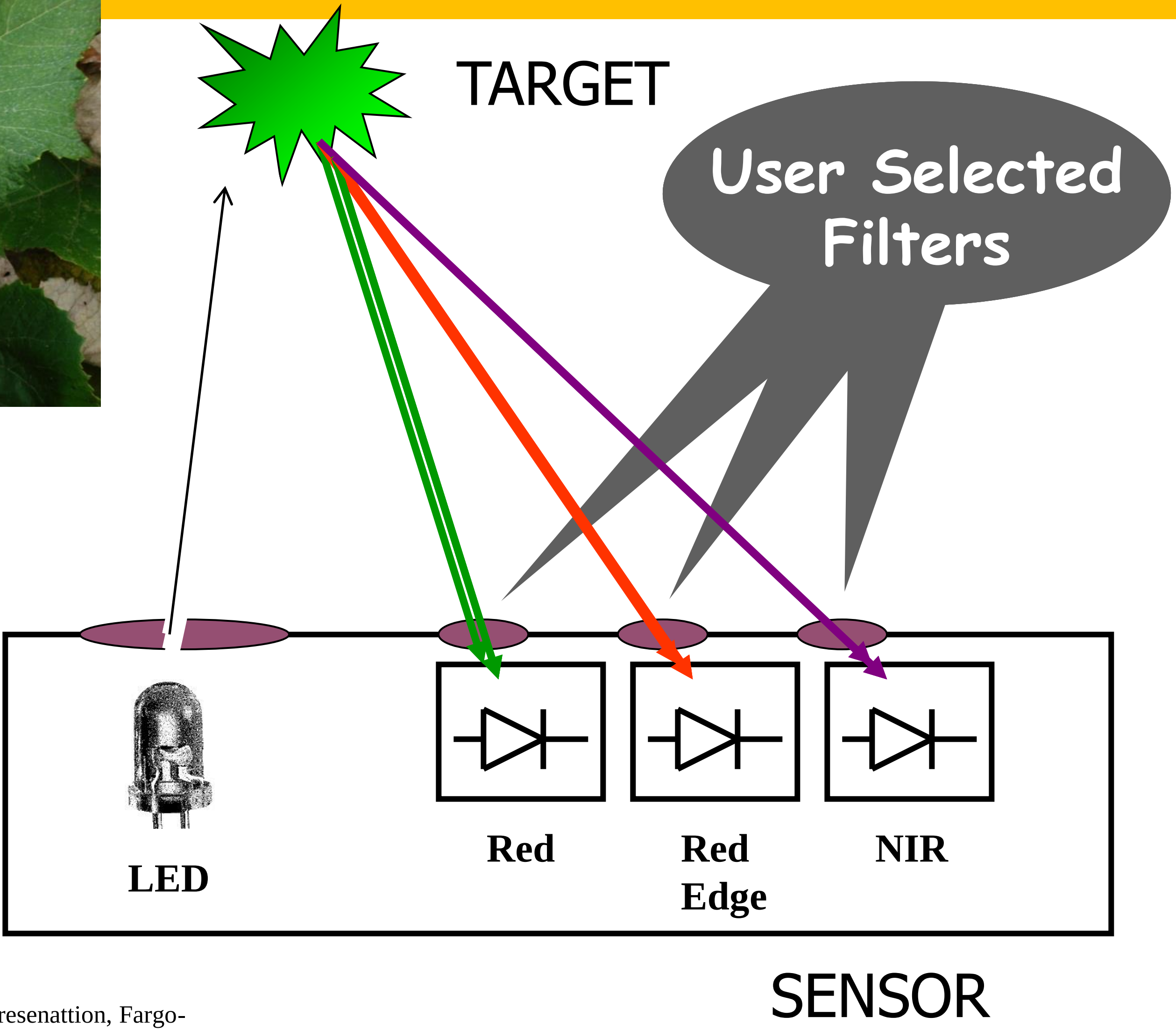
Calculate Reset

https://rishabhrrk.github.io/nrate/

Holland Crop Circle-470

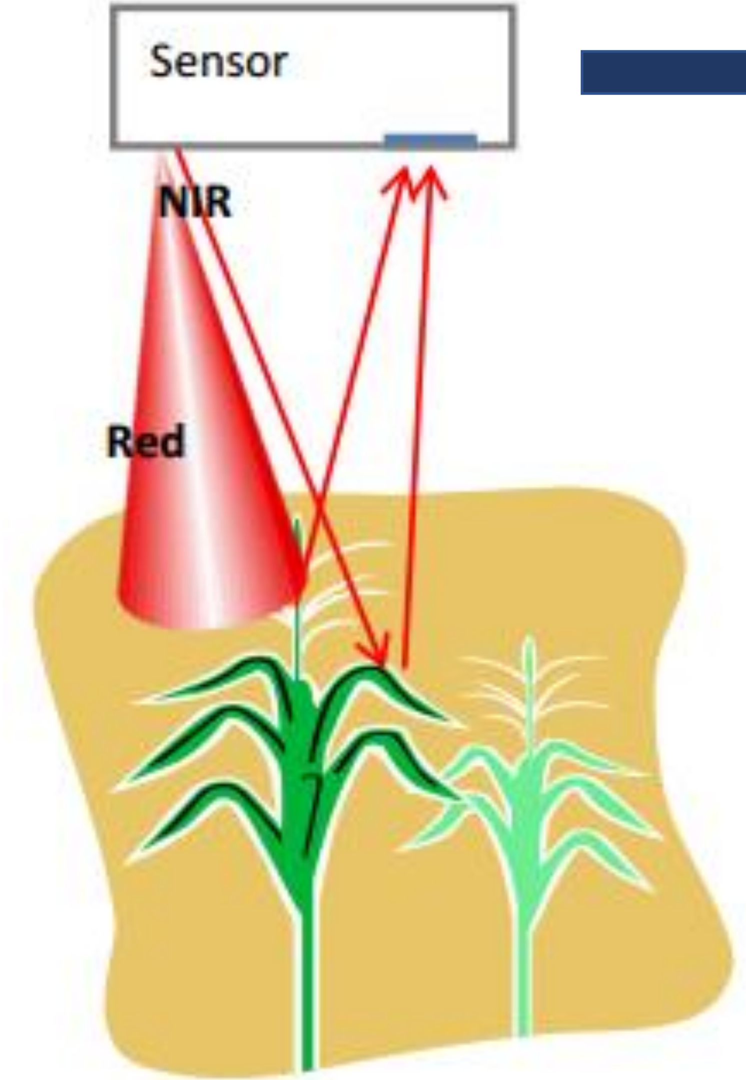


ACS-470

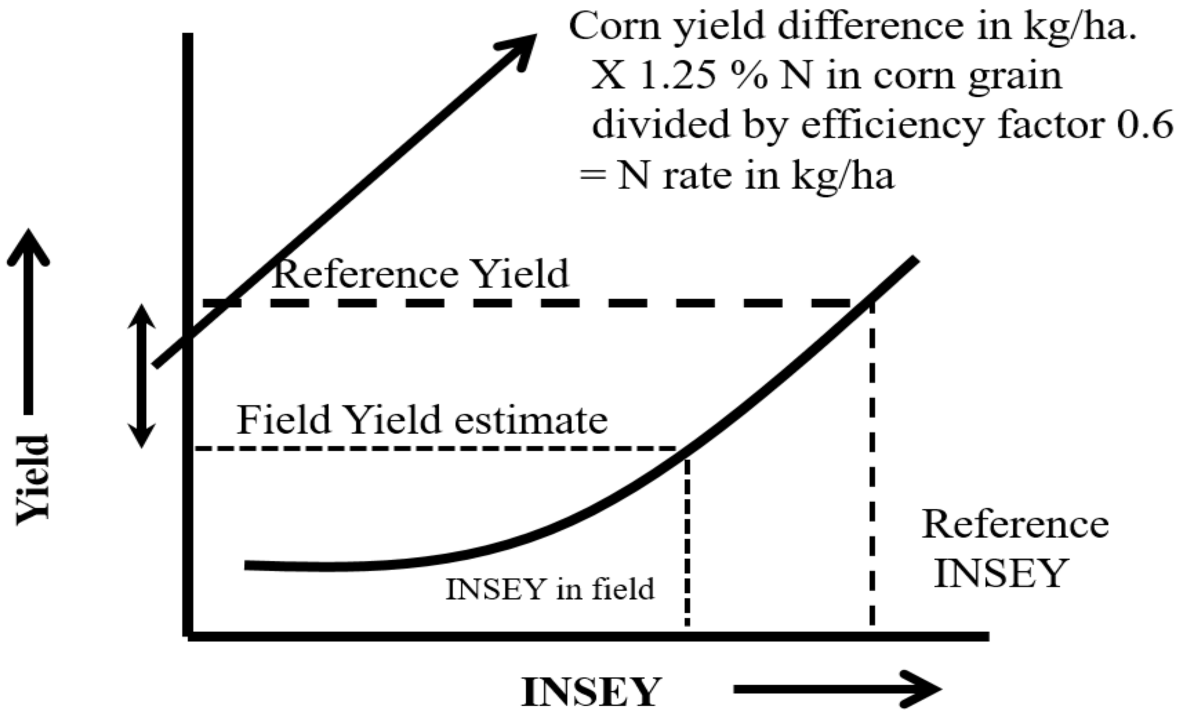


Source: Dr. Jim Schepers, NUE conference presenattion, Fargo-
http://nue.okstate.edu/Nitrogen_Conference2012/North_Dakota.htm

Optical remote Sensing?



$$NDVI = \frac{NIR-RED}{NIR+RED}$$



Optical remote Sensing?

http://cdn.intechopen.com/pdfs-wm/46140.pdf

CIMMYT
International Maize and Wheat Improvement Center

Capstan nozzle controller hooked to a
Trimble or Raven rate controller

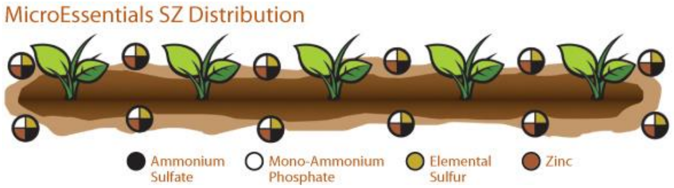
NTech
Industries, Inc.

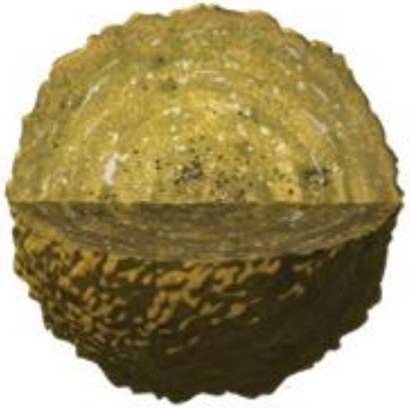
Dollar Benefit Involved!

In Soybean farm in Iowa, "NDVI Satellite" images used to find weeds problem. After analyzing the images through a decision support system 50% of the field found weed affected. However, the remaining 50% the field did not contain any weeds issue or did not contain enough weed density to be worth spraying (Shaw, 2005).

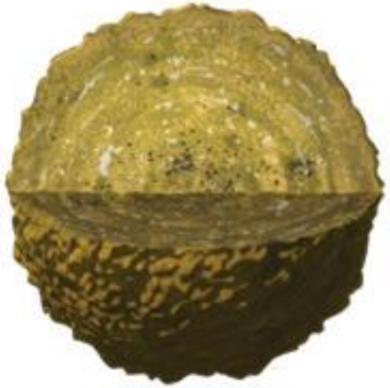
"Calculated cost savings was in range of $92.24 per hectare to $104.76 per hectare in soybean.

DESIGNER FERTILIZERS- Microessentials

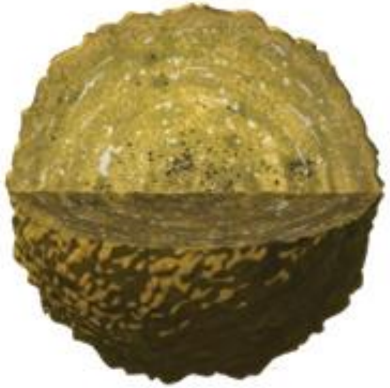




12-40-0-10S-1Zn
Detail of MicroEssentials SZ Granule; Sulfur & Zinc Distributed Throughout



13-33-0-15S
Detail of MicroEssentials S15 Granule; Nitrogen, Phosphorus & Sulfur Distributed Throughout

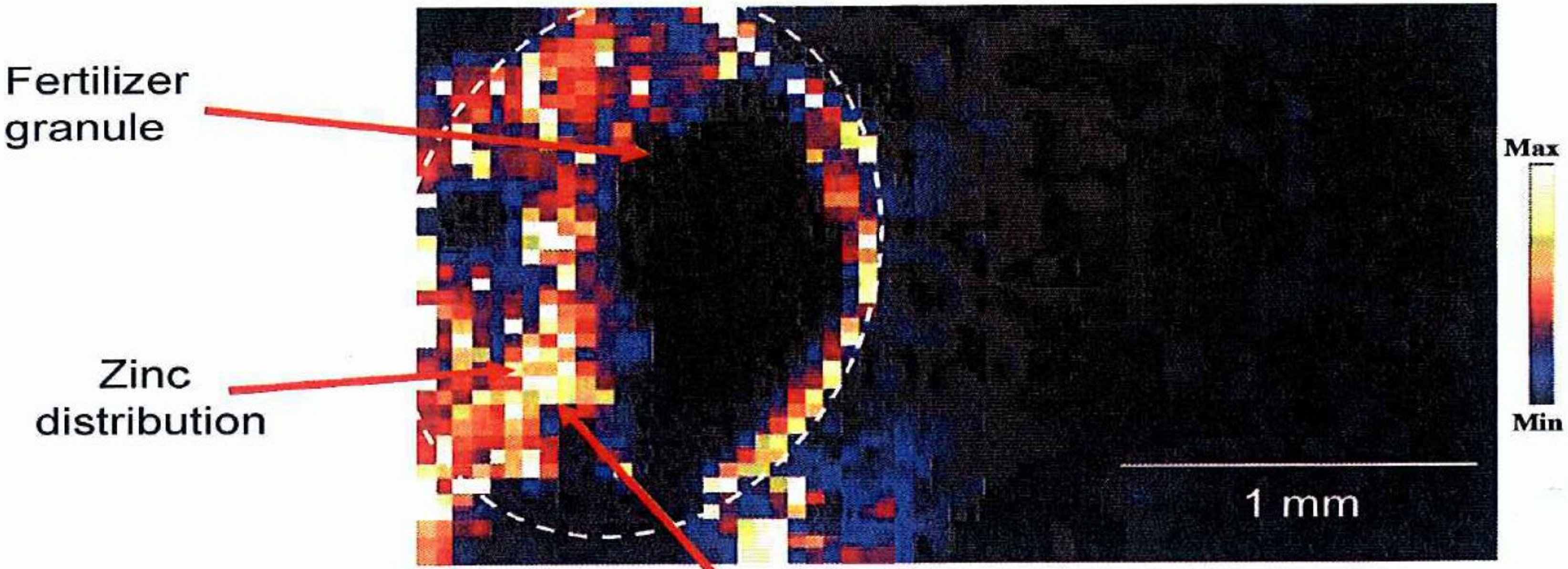


12-40-0-10S
Detail of MicroEssentials S10 Granule; Nitrogen, Phosphorus & Sulfur Distributed Throughout

MES concept was developed by a team of researchers at University of Adelaide in Australia led by Dr. Mike McLaughlin.

They made Zn maps of fertilizer granules and concluded that diffusion from the granule would often be inadequate to support efficient plant nutrition at low practical rates.

"Zn map" of fertilizer granule



$$ZnO + H_2PO_4^- \Leftrightarrow ZnPO_4 + H_2O$$

Comparison of ME products and blends at two locations in IA. (Sawyer, 2010).
P was all the same, except for SP control where no P was applied

Treatment	Leaf S%	Leaf P %	Corn Yield, bu/acre
O S	0.16	0.33	239
MES-10	0.16	0.33	244
AMS-10	0.16	0.32	241
SP control	0.14	0.29	224
MES-30	0.17	0.32	225
AMS-30	0.17	0.32	244
MAP-30	0.17	0.32	229

Effect of P source on total marketable potatoes, MN
Rosen, McNearney and Bierman

Treatment	P205 rate, lb/acre	Total marketable potato cwt/acre
Control	0	510
MAP	60	532
MAP	120	563
MES-15	60	567
MES-15	120	572
MESZ	60	579
MESZ	120	562
LSD 5%		NS

Questions

Contact information

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