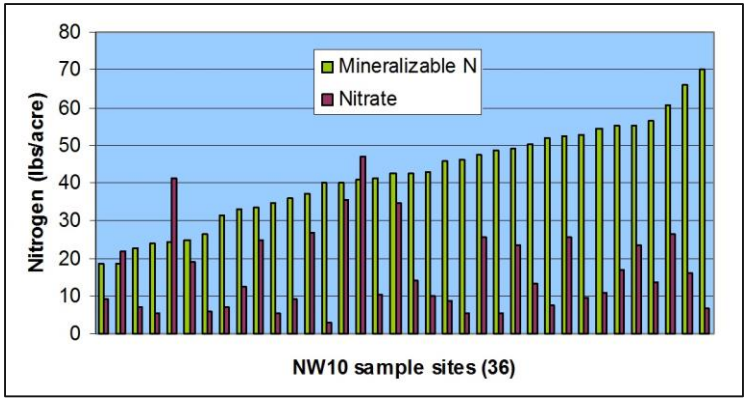
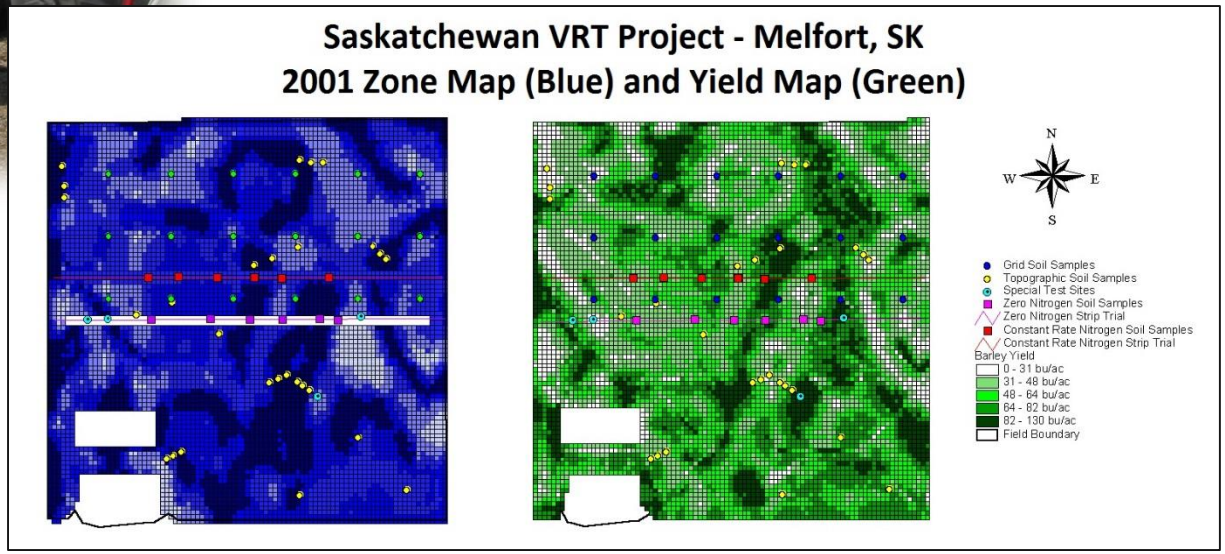
The Foundation of VR Fertility

SWAT MAPS

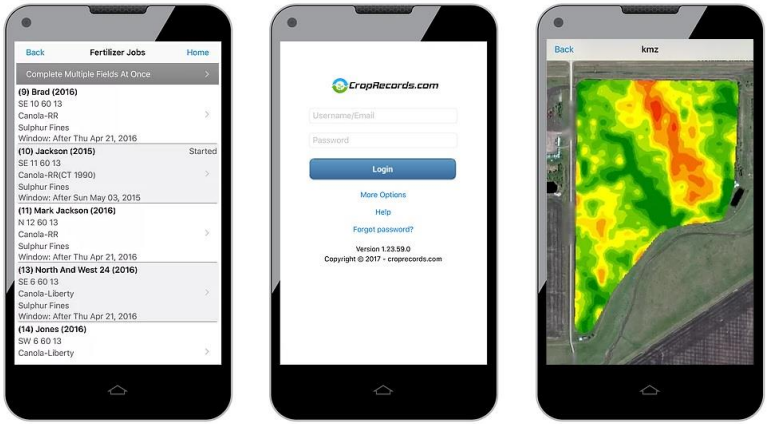
Soil, Water And Topography MAPS





CropRecords.com
where farmers and consultants sync

- Head Office in Naicam
  - Fully independent consultants since 2003
  - Team of 23 staff specialized in variable-rate fertilizer and agronomy, 5 software developers
  - CropRecords software integrates with GK ADMS



GK Technology For Agriculture

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Secure | https://www.swatmaps.com/consultants

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SWAT MAPS
Soil, Water and Topography MAPS

agronomy@croprecords.com
swatmaps.com

INDEPENDENT CONSULTANTS:

SWAT MAPS Service Fees

Variable Rate Fertilizer & Seed: Mapping, Zoning, Prescriptions

Mapping/SWAT MAPS Development of New Fields: High grade elevation/EC, zone map development, drainage files (1st year only, one-time fee - payable upon completion)

Soil Sampling & Analysis: Sampling of 5 zones, NPKS, OM, B, Cl, Zn, Cu

Mapping/ SWAT MAPS Development		Soil Sampling & Analysis
$5.00	complete farm clients > 20,000ac	$1.50
$5.50	complete farm clients	$2.00
$6.25	>1000ac booked at once	$2.25
$7.00	<1000ac booked at once	$2.50

Prescription Files for Controllers: (payable when developed, typically April invoice)
$1.00/ac (prescriptions for one application such as multi-tank air-cart seeding)
$50/field (prescription files for additional applications such as floater or fall NH3)

Agronomic Evaluations:
$0.50/ac for fertility planning & MAPS reports - two trips for plant stand counts and pre-harvest assessment included

Licensed Independent Consultants: You choose the level of service you are willing to provide for your customers.
1st Year: fields custom mapped for SWAT MAPS using one of our licensed service provider packages. Independent consultants can: ground truth, soil sample, write prescriptions, scout fields and support clients.
Subsequent Years: Independent consultants retain the client and own the data to do the service; requires ADMS and CropRecords software to conduct the service. Visit CropRecords.com to download software.

Does Nitrogen Mineralization Vary by Topography?

Or by Yield Potential?

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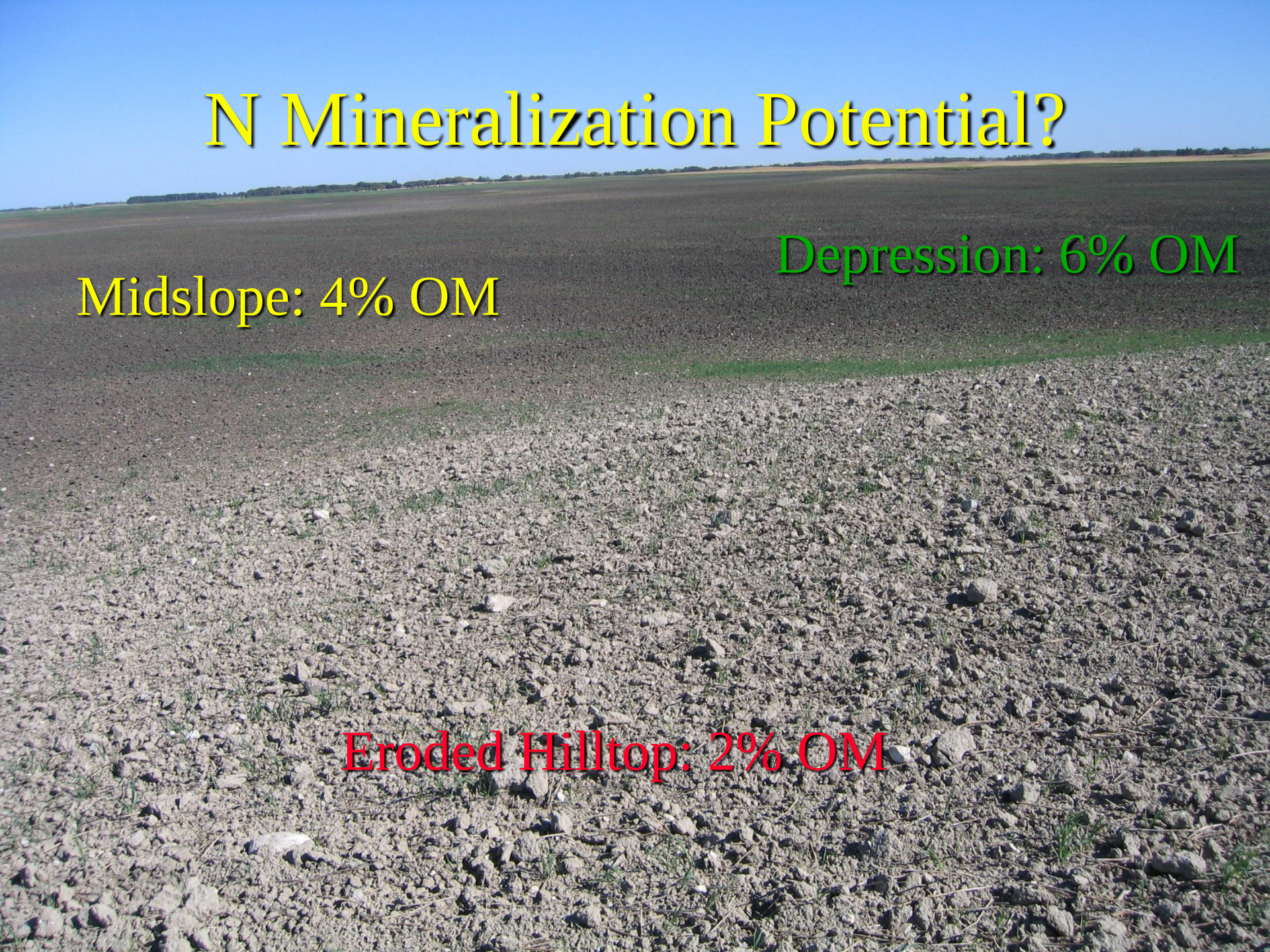

N Mineralization Potential?
Depression: 6% OM
Midslope: 4% OM
Eroded Hilltop: 2% OM

Saskatchewan VRT Project

1998 -2003 Fertility Results

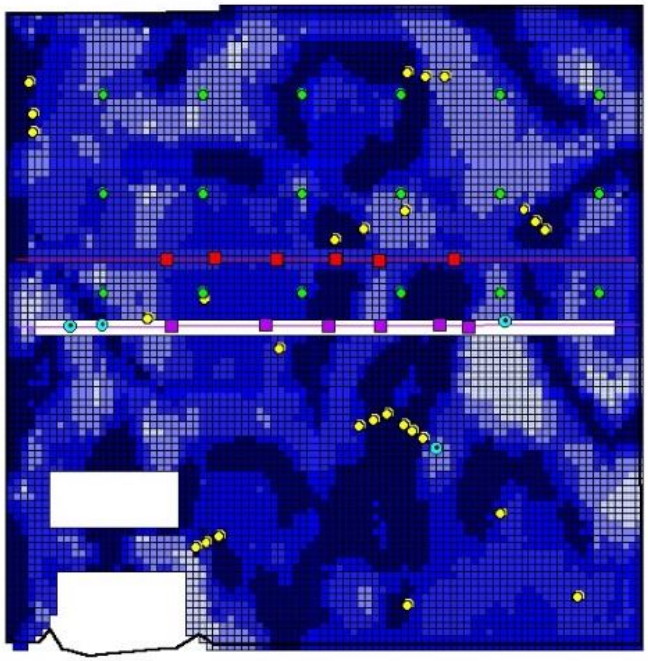
NARF / Melfort Research Farm

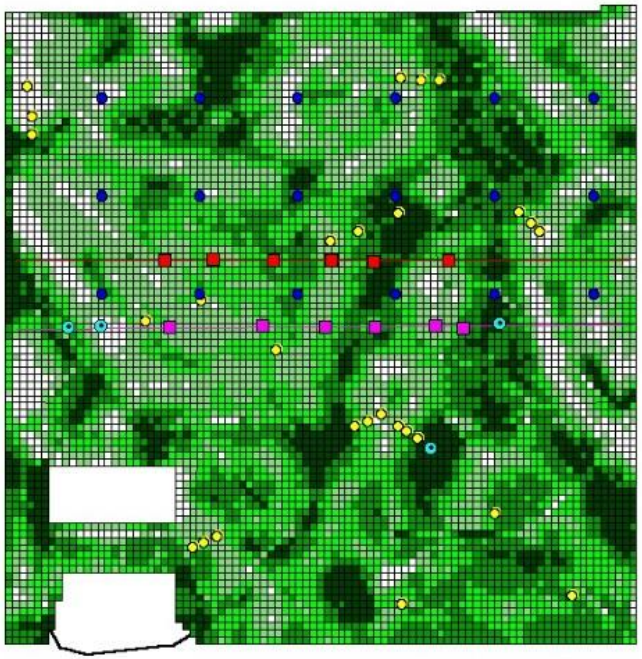
CropPro Consulting

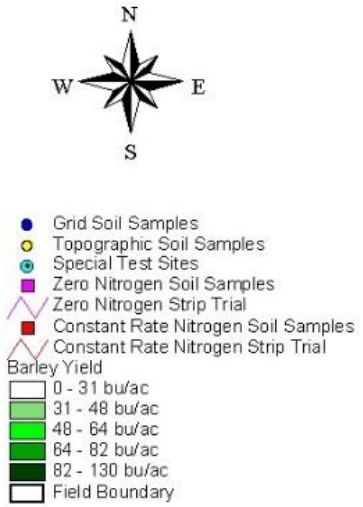
1998-03 Research Sites

- McIntosh Farms - Central Research Site
  - 3 fields with very detailed SSM investigations
  - Entire farm with VRF
- 10 Fertility Research Sites in Northeast Sask.
  - Brooksby (2), Tisdale (2), Kinistino, Zenon Park, Kelvington, Albertville, Nipawin, Naicam
- Nitrogen research only

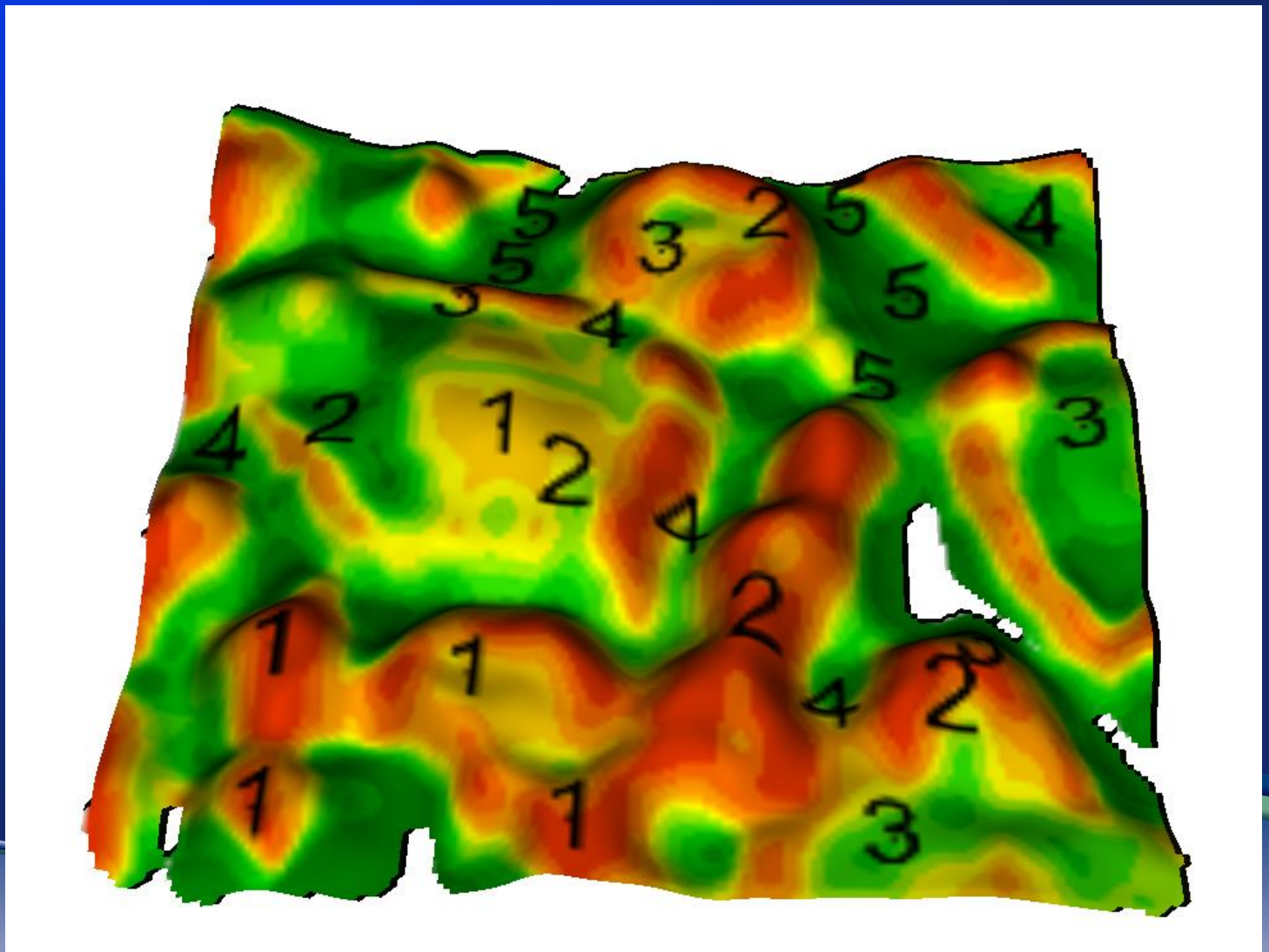
Saskatchewan VRT Project - Melfort, SK
2001 Zone Map (Blue) and Yield Map (Green)







“Seat of the Pants” Method



“Start with the End in Sight”

Build a picture in your mind of what the zone maps should like

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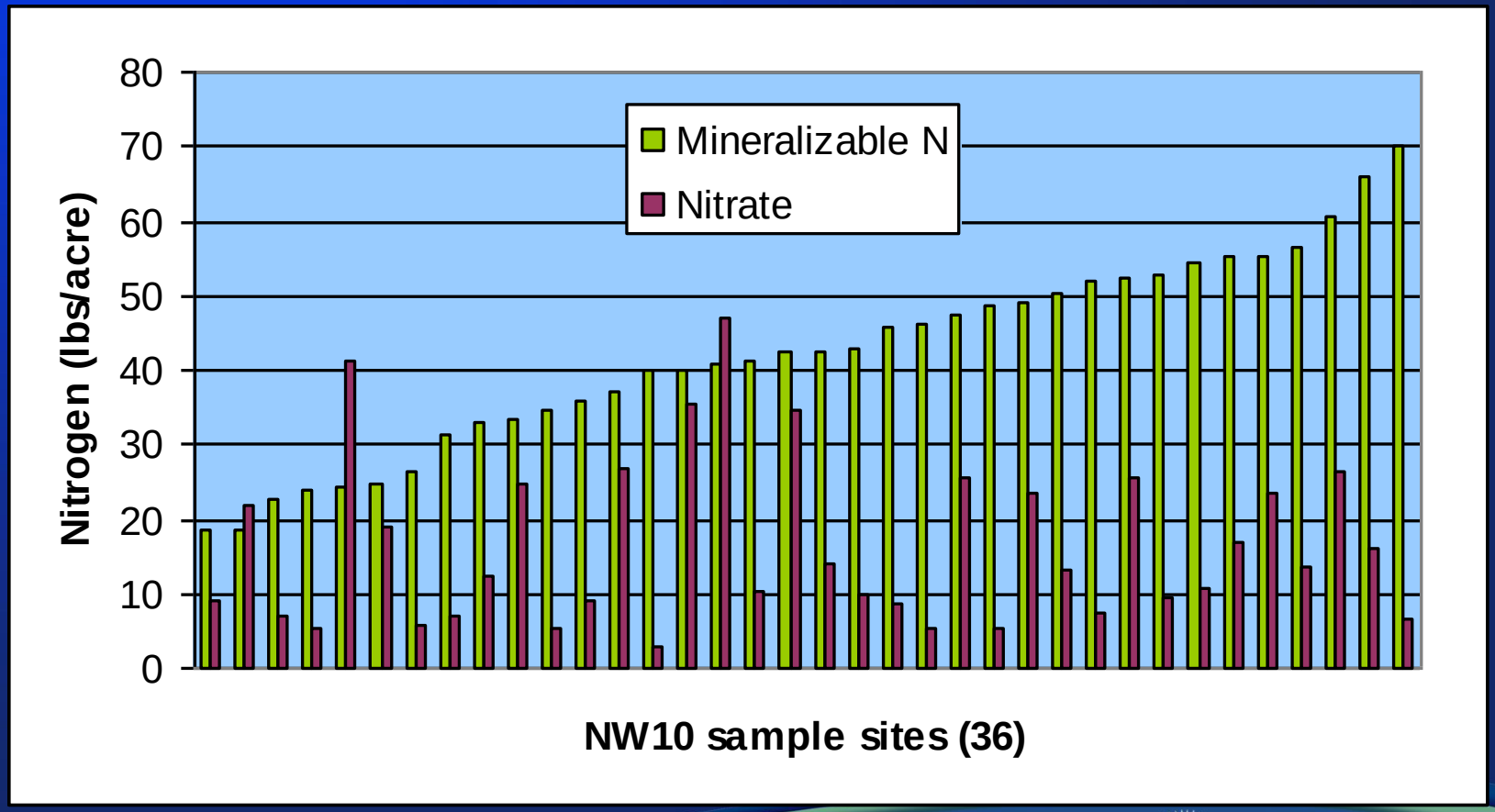
Nitrate test compared to Mineralizable N test – NW10



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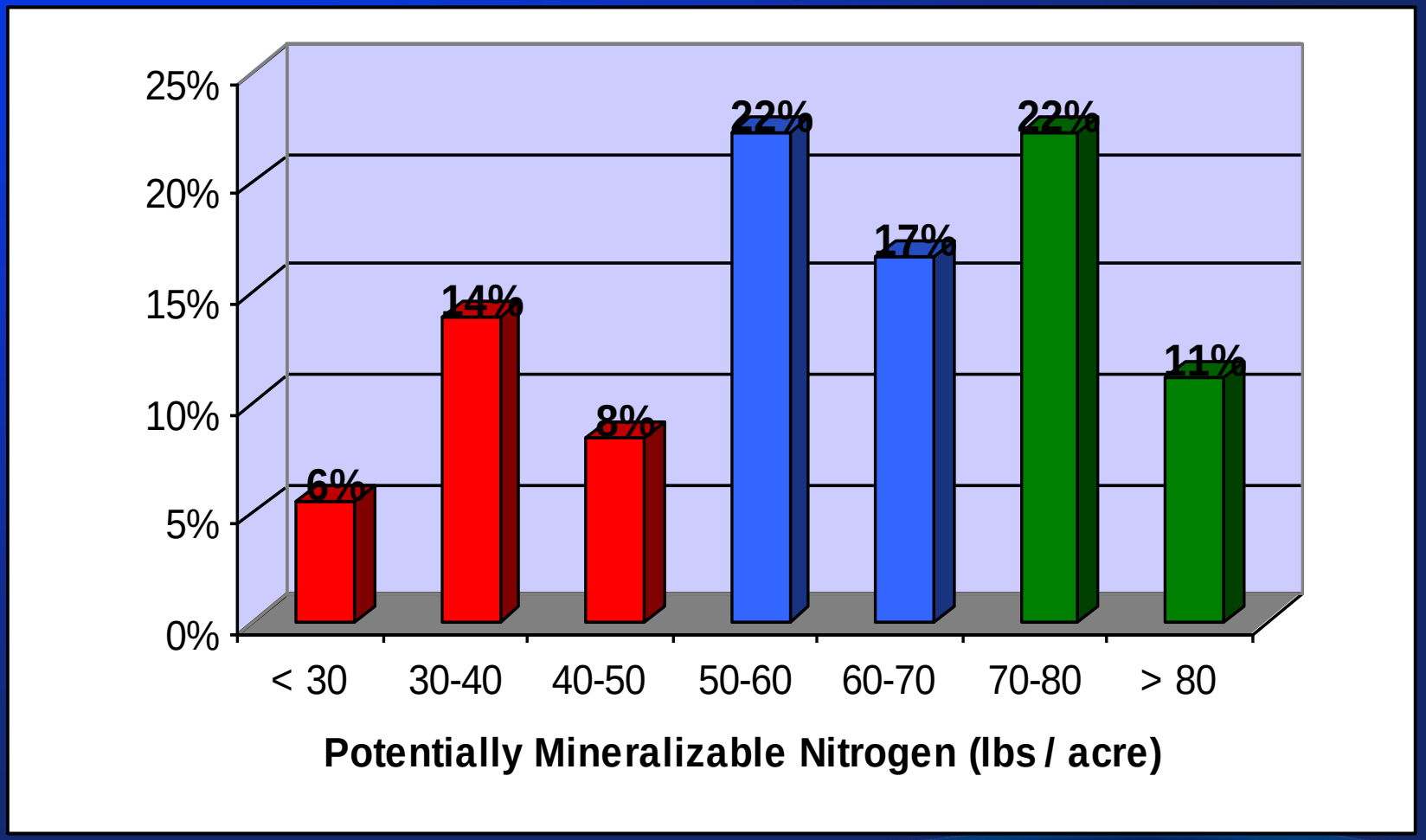
Soil Variability – NW10



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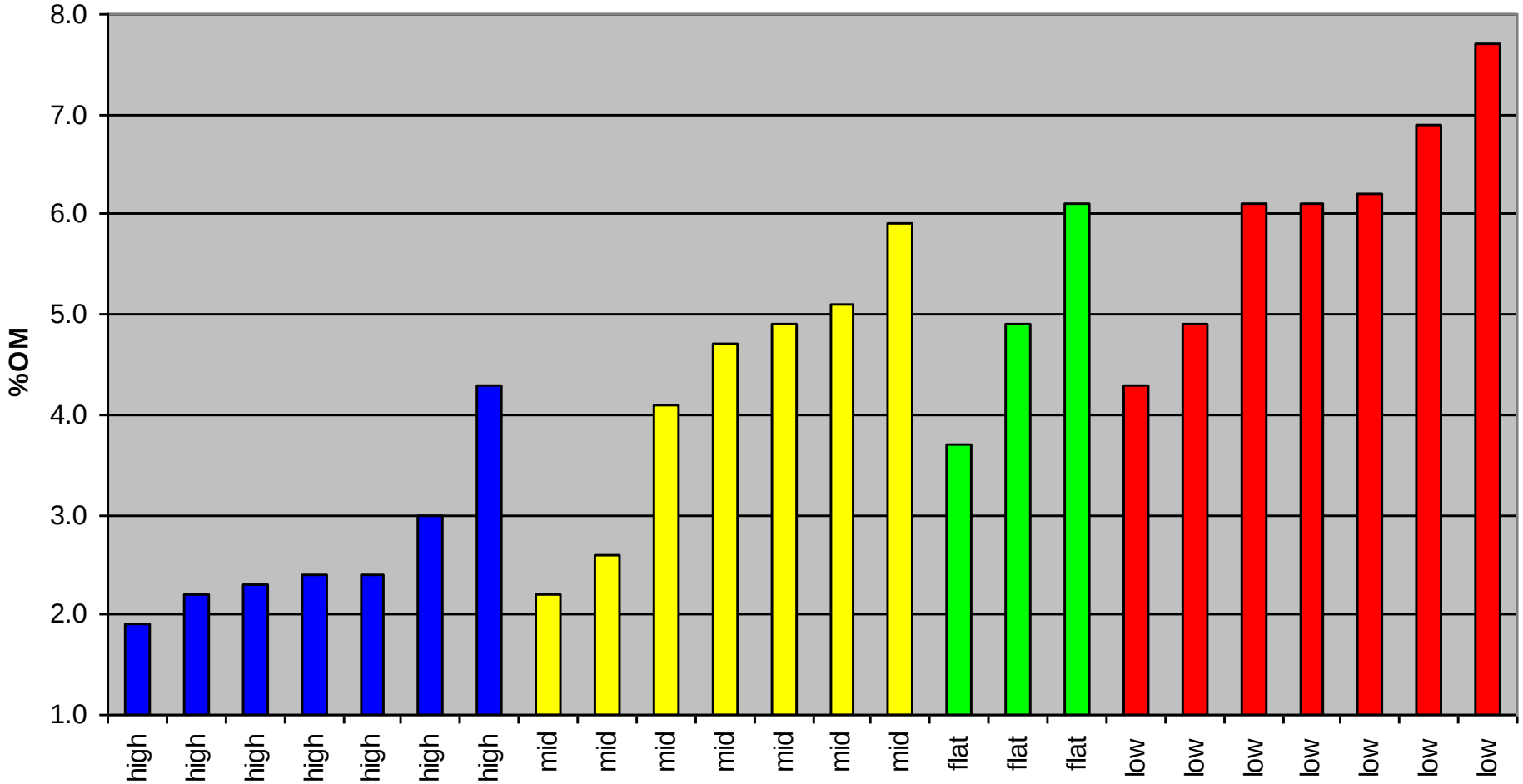
NW10 Organic Matter vs. Landscape Position



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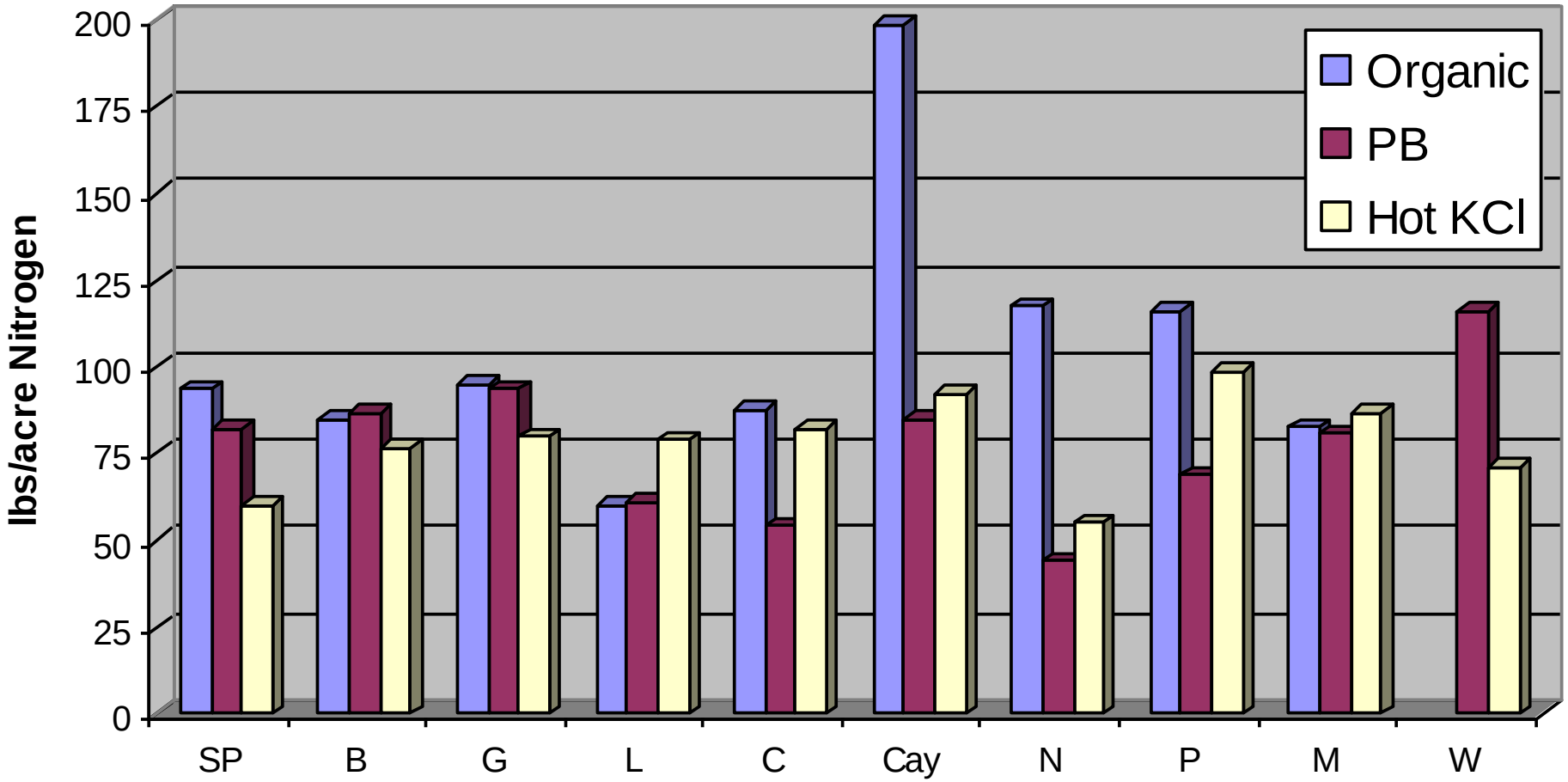
Comparison of Actual Mineralization versus Predicted



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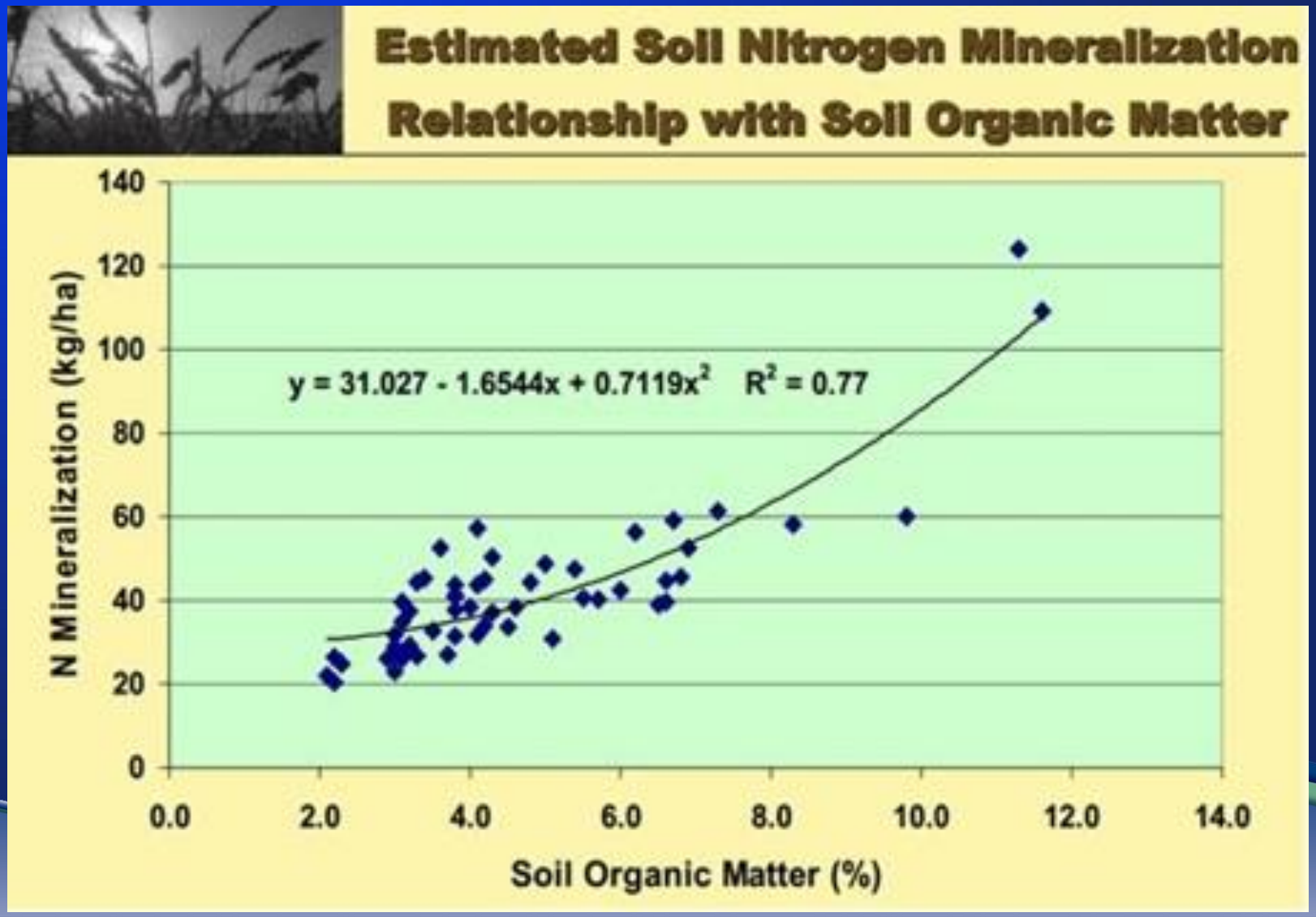
Mineralization of N from OM

Ross McKenzie, Alberta Ag



Dr. Dan Pennock (U of S)

Source: 2001 Edmonton SSM Conference Proceedings

- "A very consistent finding in the scientific literature is that variable rate fertilizer prescriptions based on standard soil test procedures have generally been unsuccessful"
- "nitrate-N procedures are a poor indicator of the amount of N that will become available from the soil organic matter over the course of the growing season"

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Summary - Mineralization

- The most important component of your nitrogen fertility program to understand
- Rates of mineralization appear to significantly exceed traditional thinking
- Mineralization is at least 5X more important than nitrates, is topography related and more efficiently used
  - Similar N03 tests mean very little if you don't get a decent Nmin estimate

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What is the starting point of creating maps for fertility?

Collect data?

Yield?

Imagery?

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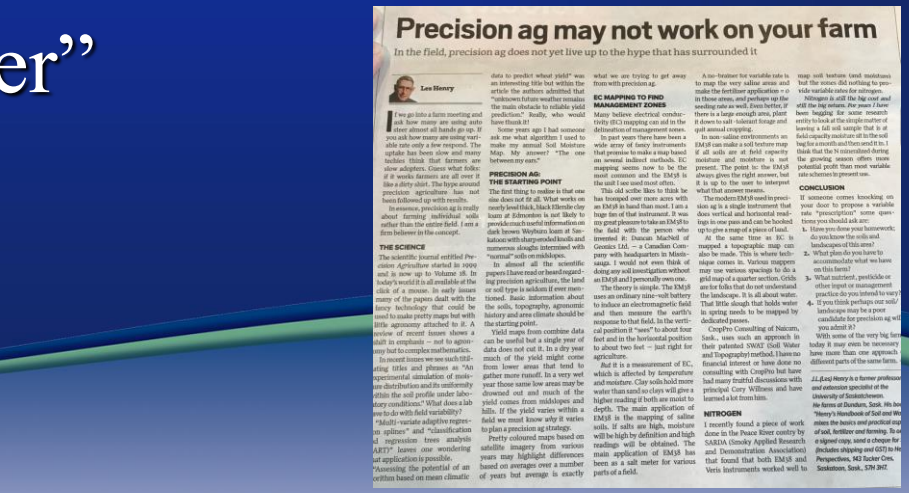
What is the Starting Point?

Les Henry

- “Basic information about the soils, topography, agronomic history and area climate should be the starting point”
- “At the same time as EC is mapped a topographic map can also be made”
- “It is all about water”



Precision ag may not work on your farm

In the field, precision ag does not yet live up to the hype that has surrounded it

Les Henry

If we go into a farm meeting and ask how many are using auto steer almost all hands go up. If you ask how many are using variable rate only a few respond. The uptake has been slow and many techies think that farmers are slow adopters. Guess what folks: if it works farmers are all over it like a dirty shirt. The hype around precision agriculture has not been followed up with results.

In essence, precision ag is really about farming individual soils rather than the entire field. I am a firm believer in the concept.

THE SCIENCE

The scientific journal entitled Precision Agriculture started in 1999 and is now up to Volume 18. In today's world it is all available at the click of a mouse. In early issues many of the papers dealt with the fancy technology that could be used to make pretty maps but with little agronomy attached to it. A review of recent issues shows a shift in emphasis – not to agronomy but to complex mathematics.

In recent issues we see such titillating titles and phrases as "An experimental simulation of moisture distribution and its uniformity within the soil profile under laboratory conditions." What does a lab have to do with field variability?

"Multi-variate adaptive regression splines" and "classification and regression trees analysis (CART)" leaves one wondering if application is possible.

"Assessing the potential of an algorithm based on mean climatic data to predict wheat yield" was an interesting title but within the article the authors admitted that "unknown future weather remains the main obstacle to reliable yield prediction." Really, who would have thunk it!

Some years ago I had someone ask me what algorithm I used to make my annual Soil Moisture Map. My answer? "The one between my ears."

PRECISION AG: THE STARTING POINT

The first thing to realize is that one size does not fit all. What works on nearly-level thick, black Ellendale clay loam at Edmonton is not likely to provide much useful information on dark brown Weyburn loam at Saskatoon with sharp eroded knolls and numerous sloughs intermixed with "normal" soils on midslopes.

In almost all the scientific papers I have read or heard regarding precision agriculture, the land or soil type is seldom if ever mentioned. Basic information about the soils, topography, agronomic history and area climate should be the starting point.

Yield maps from combine data can be useful but a single year of data does not cut it. In a dry year much of the yield might come from lower areas that tend to gather more runoff. In a very wet year those same low areas may be drowned out and much of the yield comes from midslopes and hills. If the yield varies within a field we must know why it varies to plan a precision ag strategy.

Pretty coloured maps based on satellite imagery from various years may highlight differences based on averages over a number of years but average is exactly what we are trying to get away from with precision ag.

EC MAPPING TO FIND MANAGEMENT ZONES

Many believe electrical conductivity (EC) mapping can aid in the delineation of management zones.

In past years there have been a wide array of fancy instruments that promise to make a map based on several indirect methods. EC mapping seems now to be the most common and the EM38 is the unit I see used most often.

This old scribe likes to think he has bounced over more acres with an EM38 in hand than most. I am a huge fan of that instrument. It was my great pleasure to take an EM38 to the field with the person who invented it: Duncan MacNeil of Geonics Ltd. – a Canadian Company with headquarters in Mississauga. I would not even think of doing any soil investigation without an EM38 and I personally own one.

The theory is simple. The EM38 uses an ordinary nine-volt battery to induce an electromagnetic field and then measure the earth's response to that field. In the vertical position it "sees" to about four feet and in the horizontal position to about two feet – just right for agriculture.

But it is a measurement of EC, which is affected by temperature and moisture. Clay soils hold more water than sand so clays will give a higher reading if both are moist to depth. The main application of EM38 is the mapping of saline soils. If salts are high, moisture will be high by definition and high readings will be obtained. The main application of EM38 has been as a salt meter for various parts of a field.

A no-brainer for variable rate is to map the very saline areas and make the fertilizer application = 0 in those areas, and perhaps up the seeding rate as well. Even better, if there is a large enough area, plant it down to salt-tolerant forage and quit annual cropping.

In non-saline environments an EM38 can make a soil texture map if all soils are at field capacity moisture and moisture is not present. The point is: the EM38 always gives the right answer, but it is up to the user to interpret what that answer means.

The modern EM38 used in precision ag is a single instrument that does vertical and horizontal readings in one pass and can be hooked up to give a map of a piece of land.

At the same time as EC is mapped a topographic map can also be made. This is where technique comes in. Various mappers may use various spacings to do a grid map of a quarter section. Grids are for folks that do not understand the landscape. It is all about water. That little slough that holds water in spring needs to be mapped by dedicated passes.

CropPro Consulting of Naicam, Sask., uses such an approach in their patented SWAT (Soil Water and Topography) method. I have no financial interest or have done no consulting with CropPro but have had many fruitful discussions with principal Cerry Wilhoss and have learned a lot from him.

NITROGEN

I recently found a piece of work done in the Peace River country by SARDA (Smoky Applied Research and Demonstration Association) that found that both EM38 and Veris instruments worked well to map soil texture (and moisture) but the scans did nothing to provide variable rates for nitrogen.

Nitrogen is still the big cost and still the big return. For years I have been begging for some research entity to look at the simple matter of leaving a fall soil sample that is at field-capacity moisture all in the soil bag for a month and then send it in. I think that the N mineralized during the growing season offers more potential profit than most variable rate schemes in present use.

CONCLUSION

If someone comes knocking on your door to propose a variable rate "prescription" some questions you should ask are:

1. Have you done your homework; do you know the soils and landscapes of this area?
2. What plan do you have to accommodate what we have on this farm?
3. What nutrient, pesticide or other input or management practice do you intend to vary?
4. If you think perhaps our soil/landscape may be a poor candidate for precision ag will you admit it?

With some of the very big farms today it may even be necessary to have more than one approach on different parts of the same farm.

J.L.(Les) Henry is a former professional and extension specialist at the University of Saskatchewan. He farms at Dundurn, Sask. His book "Henry's Handbook of Soil and Water" mixes the basics and practical aspects of soil, fertilizer and farming. To order a signed copy, send a cheque for (includes shipping and GST) to Heavy Perspectives, 142 Tucker Cres, Saskatoon, Sask., S7H 3H7.

Fertilizer Response Variability

- Soil
  - Topsoil depth and organic matter levels
  - salinity, sandy to heavy clay soils, peat soils, solonetzic influence yield potential and fertilizer response
- Water
  - Most profound factor on yields and fertilizer response, where is it dry (knolls) versus wet (depressions)
  - Mobile nutrients moving in water
- Topography
  - Landscape position (knoll-midslope-depression) influences moisture, erosion history, organic levels, pH, soil fertility levels

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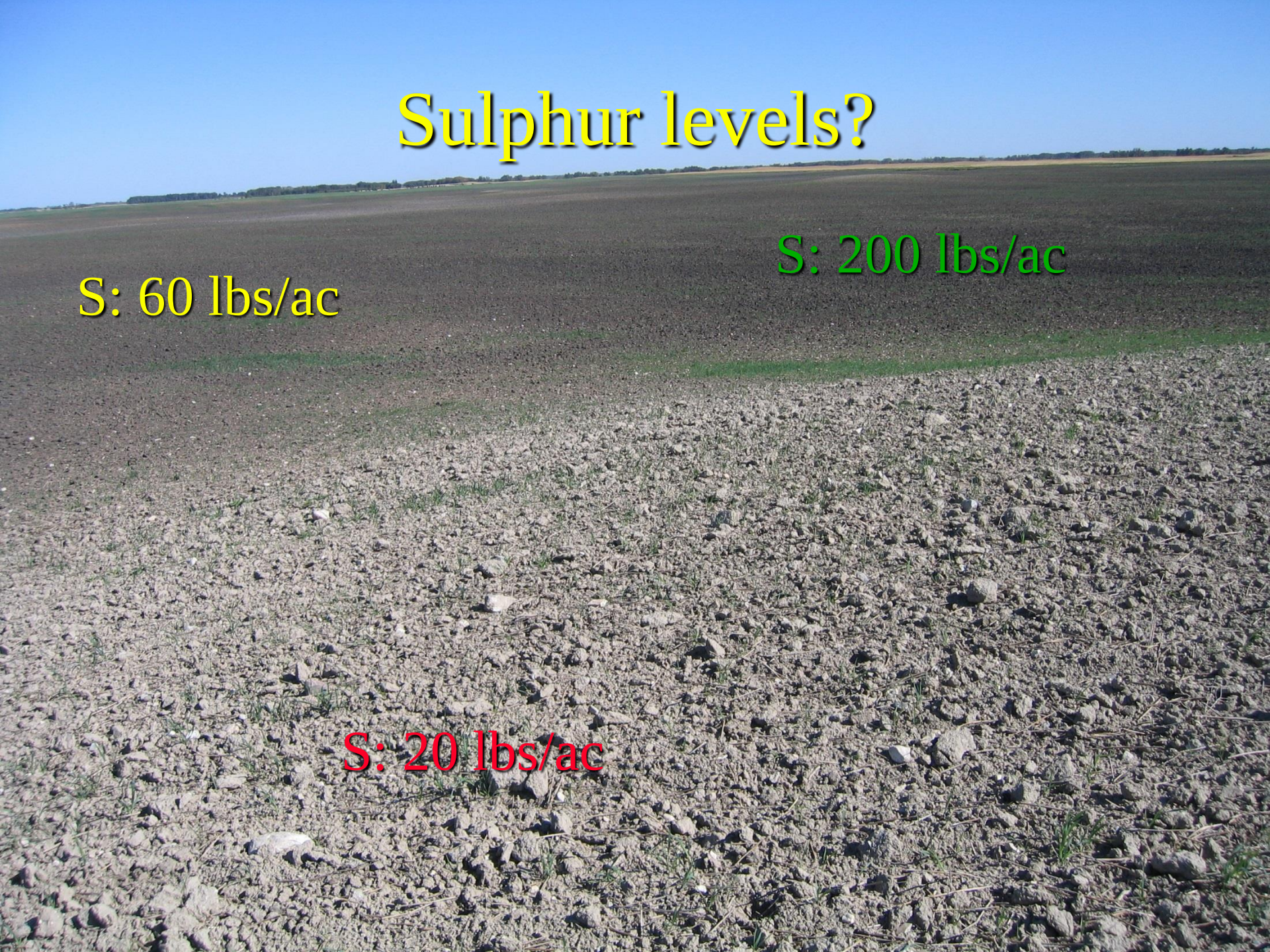
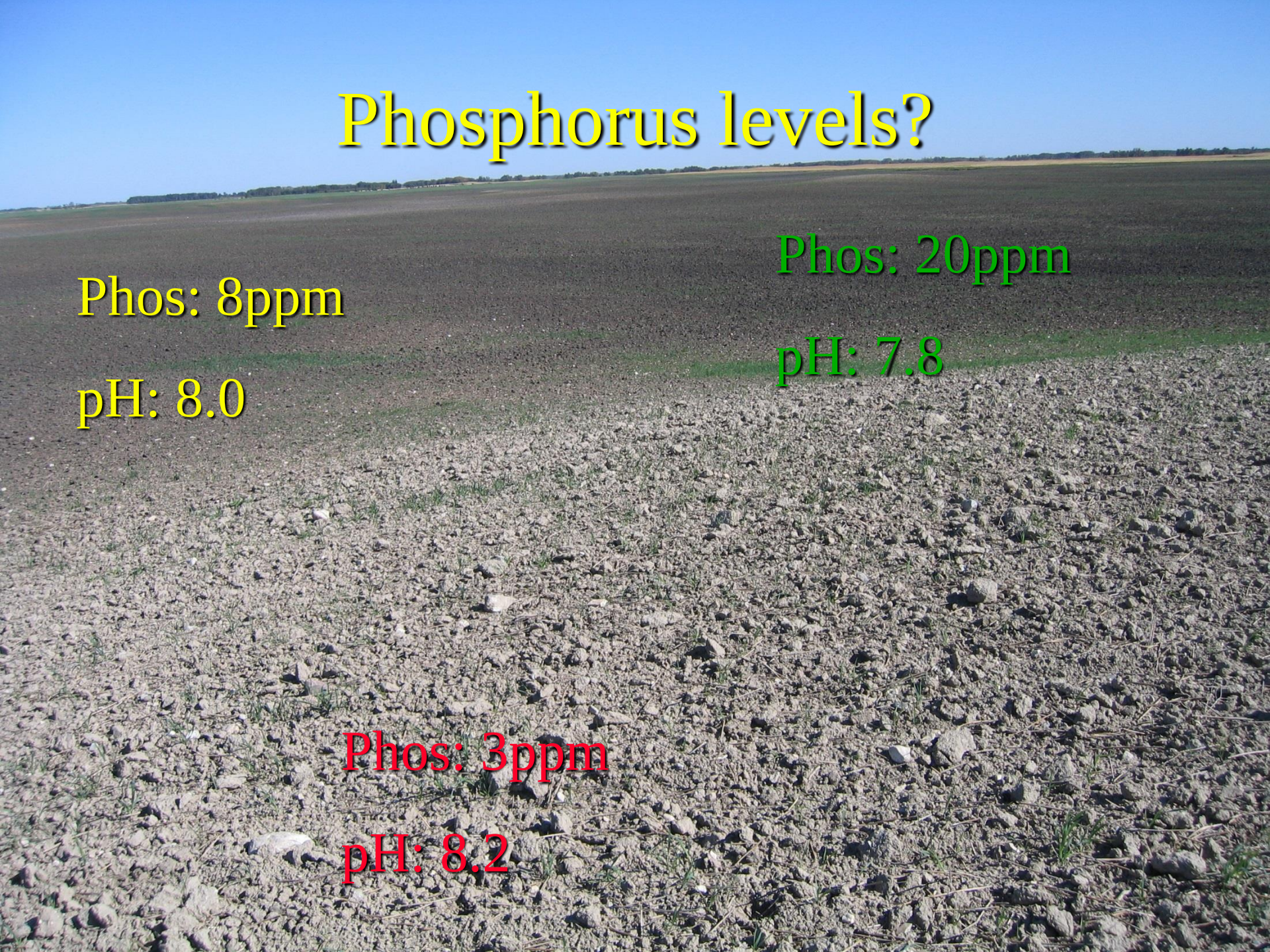

Sulphur levels?
S: 200 lbs/ac
S: 60 lbs/ac
S: 20 lbs/ac


Phosphorus levels?
Phos: 8ppm
pH: 8.0
Phos: 20ppm
pH: 7.8
Phos: 3ppm
pH: 8.2

Wheres the Water?
Water accumulation areas
High OM – more stored water
Water runoff areas, less snow
Low OM – less stored water

How Do You Make Maps that Focus on Fertility Based Variability?

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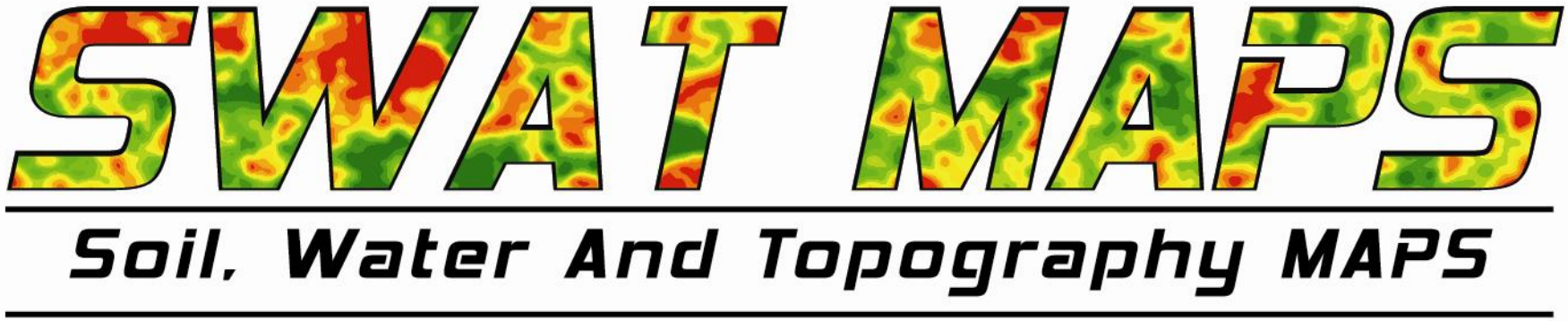

Trademarked

Patented

Think in "Cross-sections"

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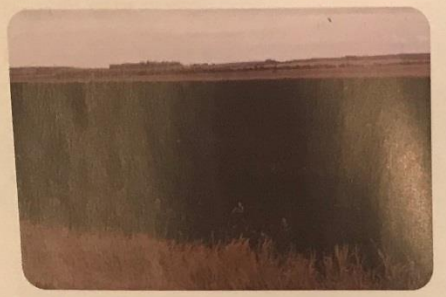
The A, B, C's of Soil



A young, rich glacial lacustrine soil near Melfort, SK.

For the majority of prairie soils, time as a soil forming factor is a non-issue. Recent events, such as river floodplains result in alluvium soils that are very, very young with so little soil development that they exhibit no well defined soil profile. Which brings us to the issue of soil profiles.

The A, B, C's of Soil – the Soil Profile

The end result of 10,000 years of soil formation is the soil profile. If we examine a soil from the surface to a depth of a meter or so, we usually see several layers with very different color, structure and chemical composition. The layers are referred to as soil horizons. The horizons from the surface to the unchanged parent material constitute the soil profile.

A Horizon: the A horizon is the topsoil which is the layer of organic matter accumulation. The color will vary from brown to black, depending upon the climate and vegetation which combine to determine the amount of organic matter that can accumulate.

An Ae (e = eluviated = washed out = leached) is a special type of A horizon that is washed out, grey in colour and has platy structure.

B Horizon: the B horizon is usually reddish brown in color and may contain accumulations of constituents washed down from the A horizon. Clay is the major accumulation product in B horizons but iron and sodium are other candidates. The B horizon can often exhibit an easily recognizable columnar or prismatic structure.

C Horizon: the C horizon is the more or less unweathered parent material – stated this way because C horizons can contain a significant accumulation of lime ($CaCO_3$) that has been washed out of the A and B horizons. Lime accumulation layers are designated Cca. The occurrence of a distinct Cca horizon is a characteristic of semi-arid soils. **The depth-of-lime accumulation represents the long-term average depth of entry of water from rain or snow melt.**

Practical Note 3.1: The Cca Horizon

The Cca horizon, or lime accumulation layer is an important concept in the understanding of prairie soils. The depth-to-lime provides a 10,000 year record of the volume of water that has passed through a soil. Distinct accumulation layers of lime occur where water rarely passes through the soil and the depth to the Cca is the average depth of penetration of rain water or snow melt.

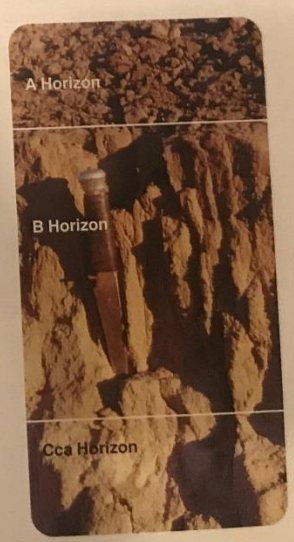
Portions of a landscape that have a distinct Cca horizon likely contribute little to groundwater recharge. Recharge occurs in sloughs where the lime layer is deep and diffuse.

Because it is an accumulation layer there is a school of thought that says the lime accumulation layer should be designated Bca. Another school of thought reserves the B horizon for accumulations of clay, iron, organic matter or sodium. When one examines a Cca, it has characteristics more like a C horizon than a B horizon. Right or wrong, the C horizon advocates won out and we refer to a lime accumulation layer as a Cca.

The average depth of the soil profile is about one meter, but it can vary from 0.5 meters to several meters in depth. Refer back to Figure 3.1 from the Redberry Lake area of Saskatchewan where the soil profile depth (depth-to-lime) in a slough is 3.5 meters.

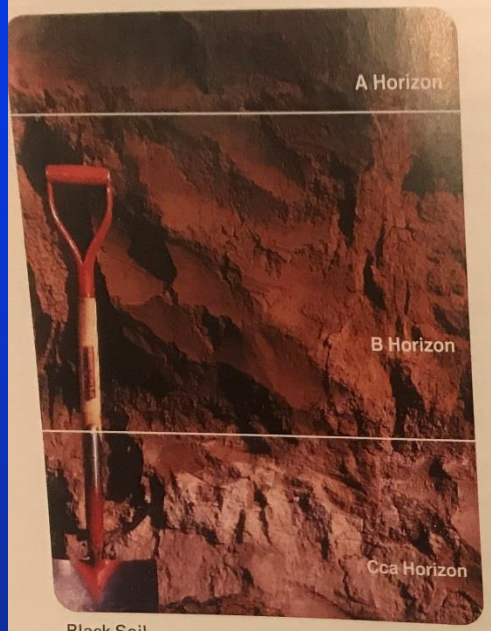
The best way to learn about soil profiles is to look at them.

Brown Soil

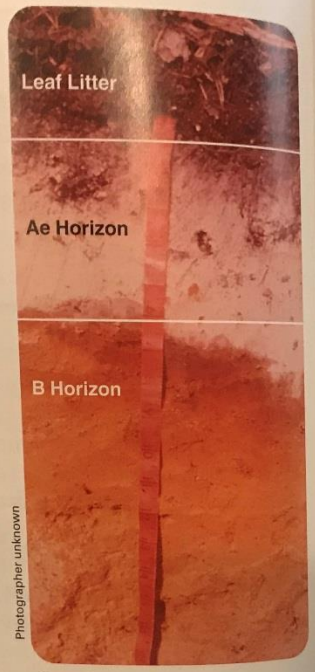


Dark Brown Soil

Cross section "single field location"



Black Soil



Photographer unknown

Grey Soil

Photographer unknown

Thick Black Soil – divisions on stick are 15 cm.

Soil Organic Matter and the Soil Zones

In the Canadian Prairies, the end result of 10,000 years of soil formation was broad Soil Zones with similar soil organic matter and soil profiles. The frontispiece map shows the soil zones. Table 3.1 provides information on the organic matter content of the A horizon in the various soil zones.

Table 3.1 Organic Matter and Nitrogen Content of Prairie Soils

Soil Zone	Native	Cultivated		
	Organic Matter of A Horizon (percentage)		A Depth (inches)	Total N** (lb/acre)
Brown	4	2.5	3	1250
Dark Brown	6	3.5	4	2333
Black	8	6.5	6	6500
Thick Black	10	7.5	12	15000
Grey-Black	8	4.5	6	4500
Grey	*	3.5	4	2333

* The organic matter content of the leaf litter of Grey soils is 30 - 40% but upon cultivation most of that is lost, leaving a cultivated A horizon low in organic matter.
** Total N data is for the A depth indicated.

The above data are approximate and are meant as a general guideline only. Considerable variation occurs around the average value. Ranges in values would be a more realistic, but more cumbersome method of expressing the data. Within one soil zone the organic matter content will increase along with the clay content. Thus, clay soils will be higher in organic matter than medium textured soils, which will be higher than sandy soils.

RULE OF THUMB

Soil Organic Matter and Nitrogen

The total N content of a soil multiplied by 20 gives an approximation of the organic matter content of a soil.

% N x 20 = % OM

or we can say % OM / 20 = % N.

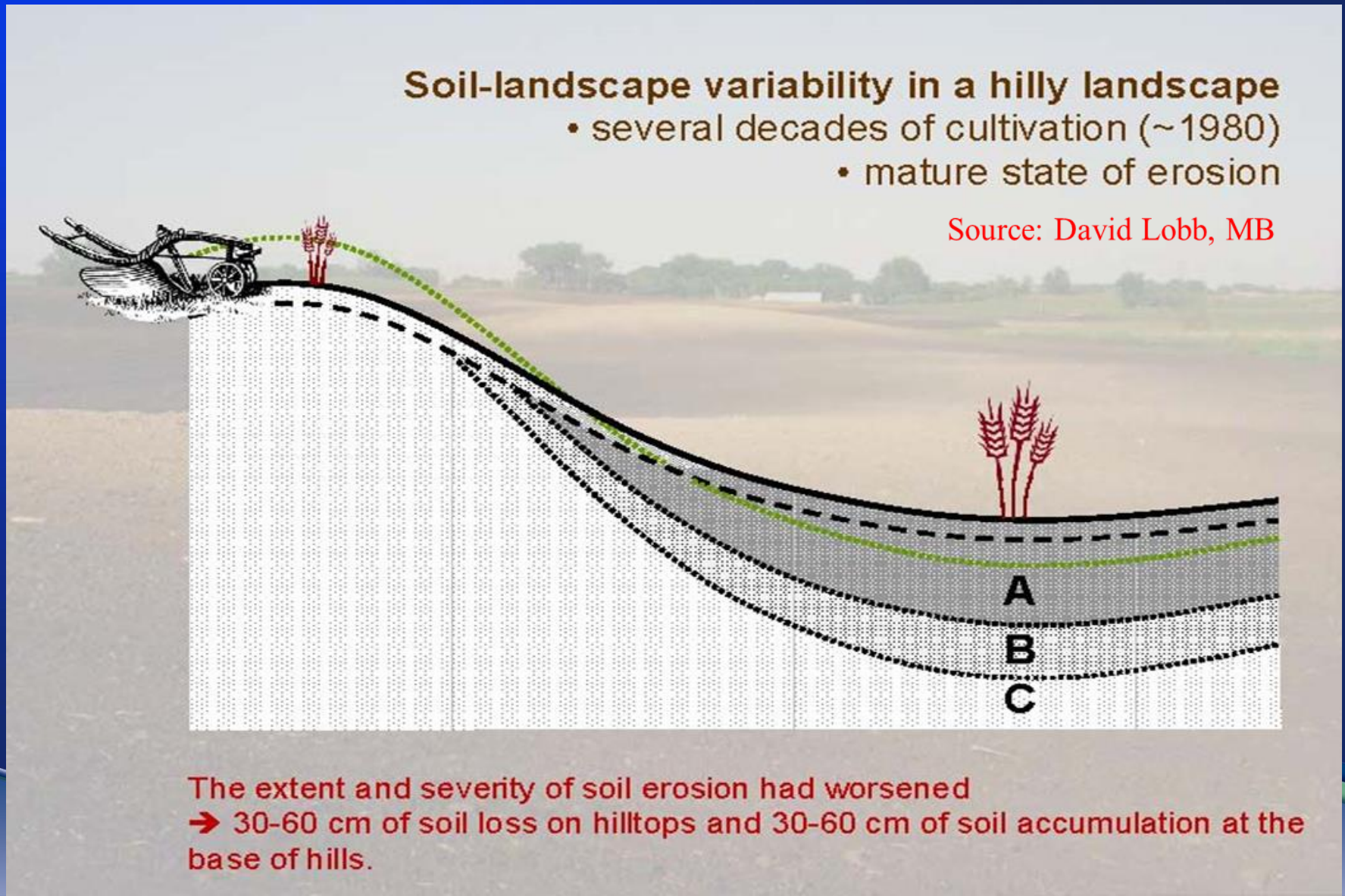
Remember that the weight of an acre to 6 inches is 2,000,000 pounds.

So, 1% OM will be 20,000 pounds of OM.

And OM/20 = N
20,000/20 = 1000

Therefore for each of 1% OM there will be 1000 lb/acre of total N to a depth of 6 inches.

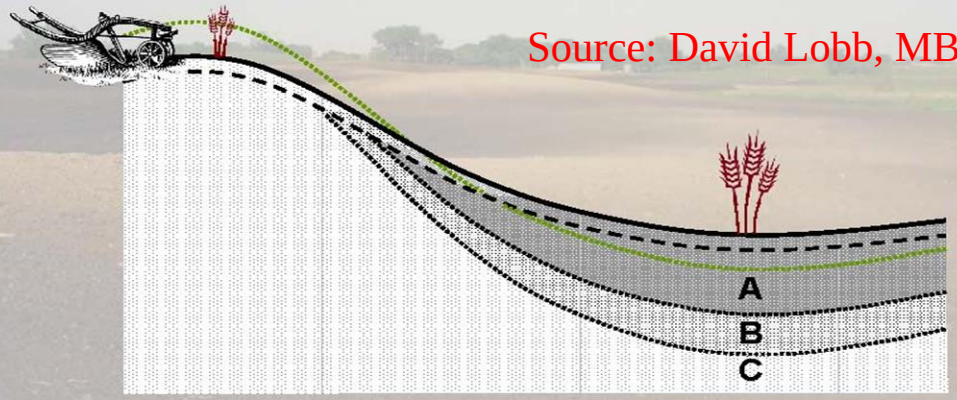
Cross section "within a field"



Soil-landscape variability in a hilly landscape

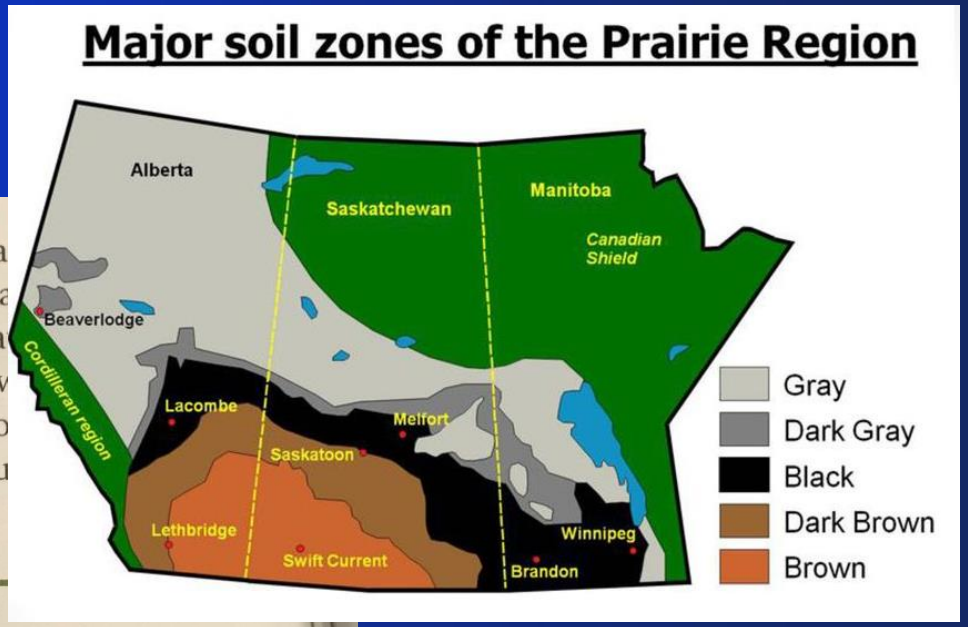
- several decades of cultivation (~1980)
- mature state of erosion

Source: David Lobb, MB



The extent and severity of soil erosion had worsened
➔ 30-60 cm of soil loss on hilltops and 30-60 cm of soil accumulation at the base of hills.

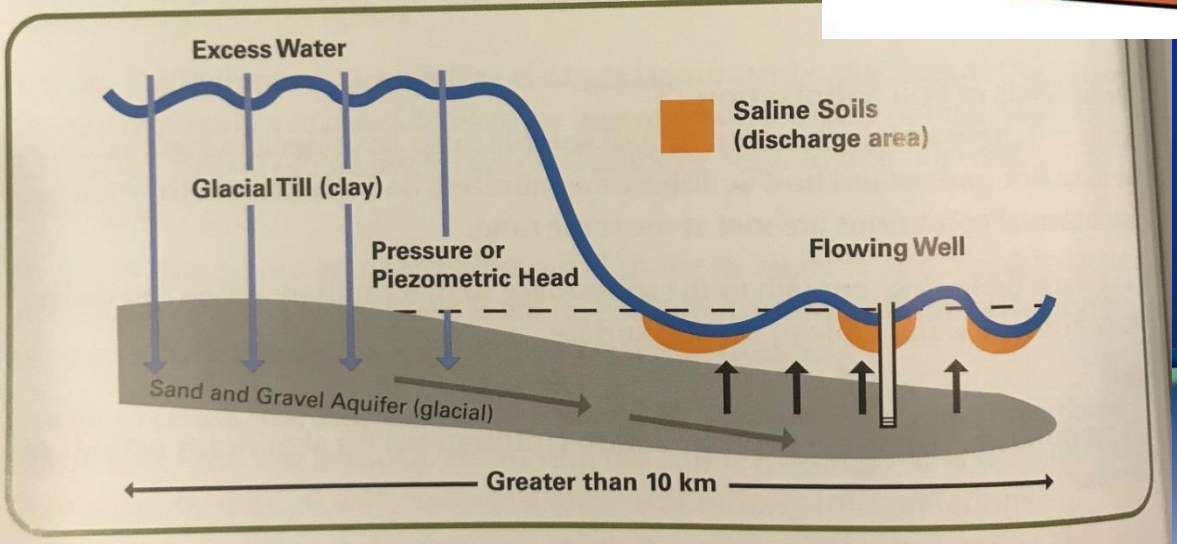
Cross section "of a region"



1. Artesian Discharge

In the artesian discharge model, groundwater flow in an a
pressure conditions where the aquifer 'pinches out'. If an a
to a valley, no pressure will build up. Where no such na
pressure from the aquifer provides a constant upward flow
tains a high water table even under dry climatic conditio
common in saline areas where artesian discharge is the cu

Figure 5.1 Artesian Discharge Mechanism of Soil Salinization



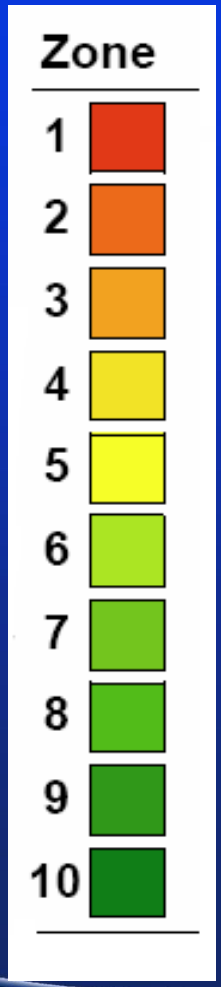
CropPro Consulting

Veris EC and OM 2008-11

EM38 and sleds 2011-2017

SWAT BOX

SWAT MAPS



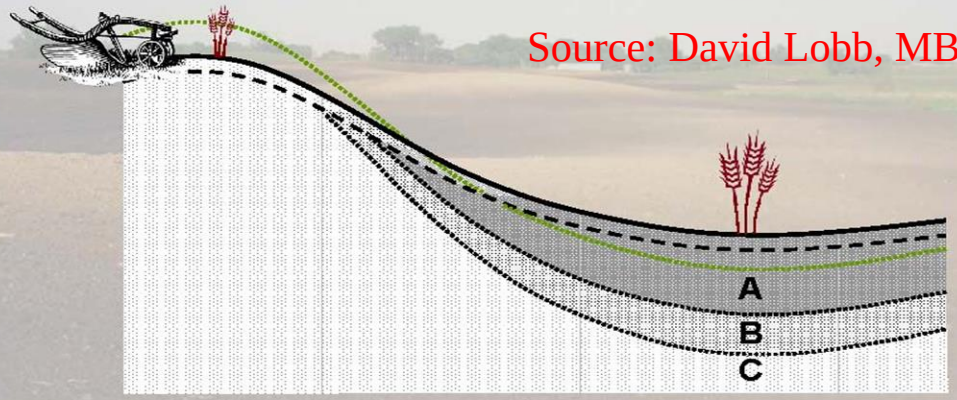
- **Zone 1,2:** eroded knolls, hills, sands, low organic, driest areas
- **Zone 3,4:** shoulder slopes, upper slopes, water runs off
- **Zone 5,6:** midslopes, flat areas, average
- **Zone 7,8:** toe slopes, lower flats
- **Zone 9,10:** depressions, saline areas, clay, water collection, peat, high organic, wet

CropPro Consulting

Soil-landscape variability in a hilly landscape

- several decades of cultivation (~1980)
- mature state of erosion

Source: David Lobb, MB



The extent and severity of soil erosion had worsened
➔ 30-60 cm of soil loss on hilltops and 30-60 cm of soil accumulation at the base of hills.

1 2 4 6 8 10

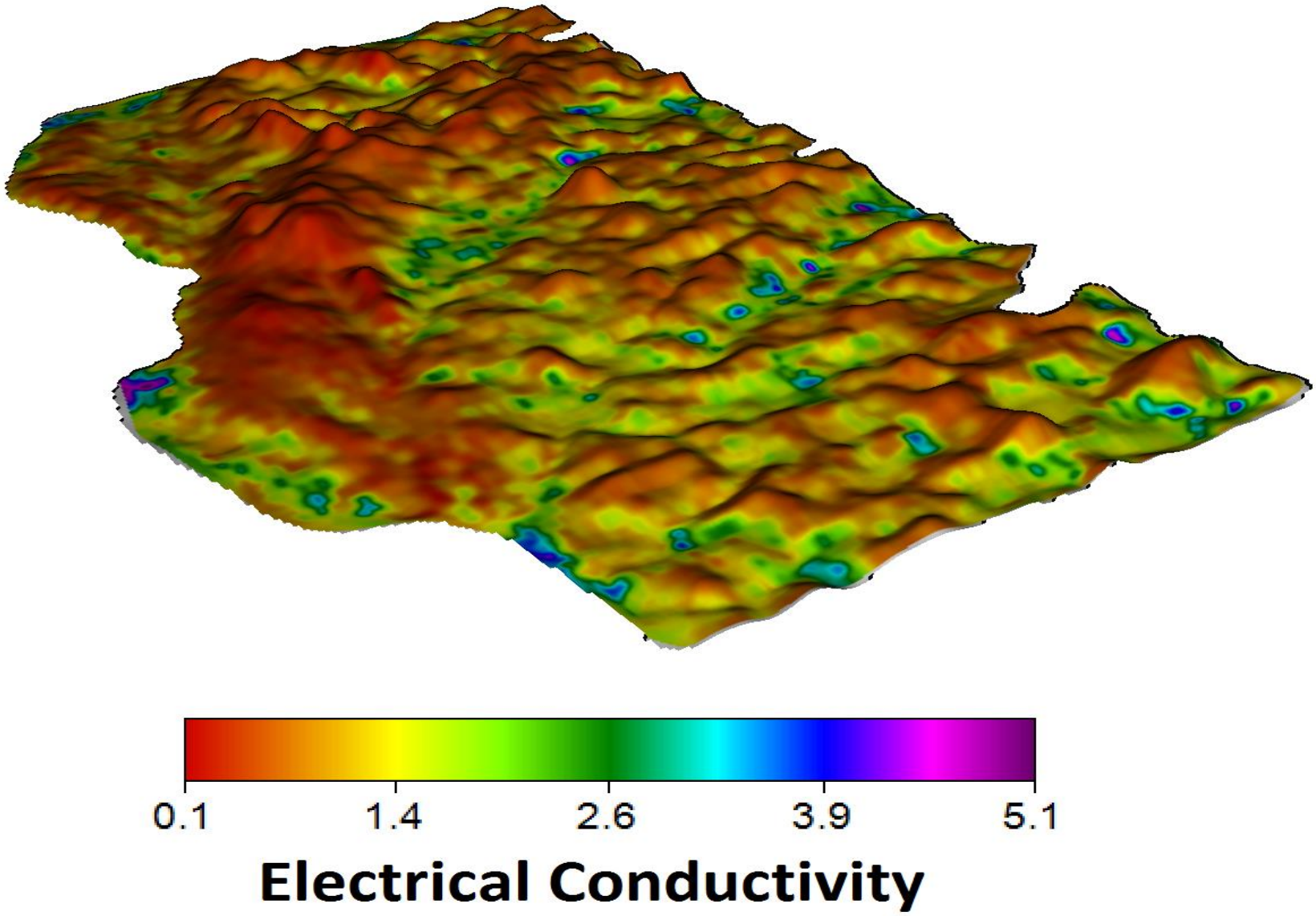
Zone

1
2
3
4
5
6
7
8
9
10

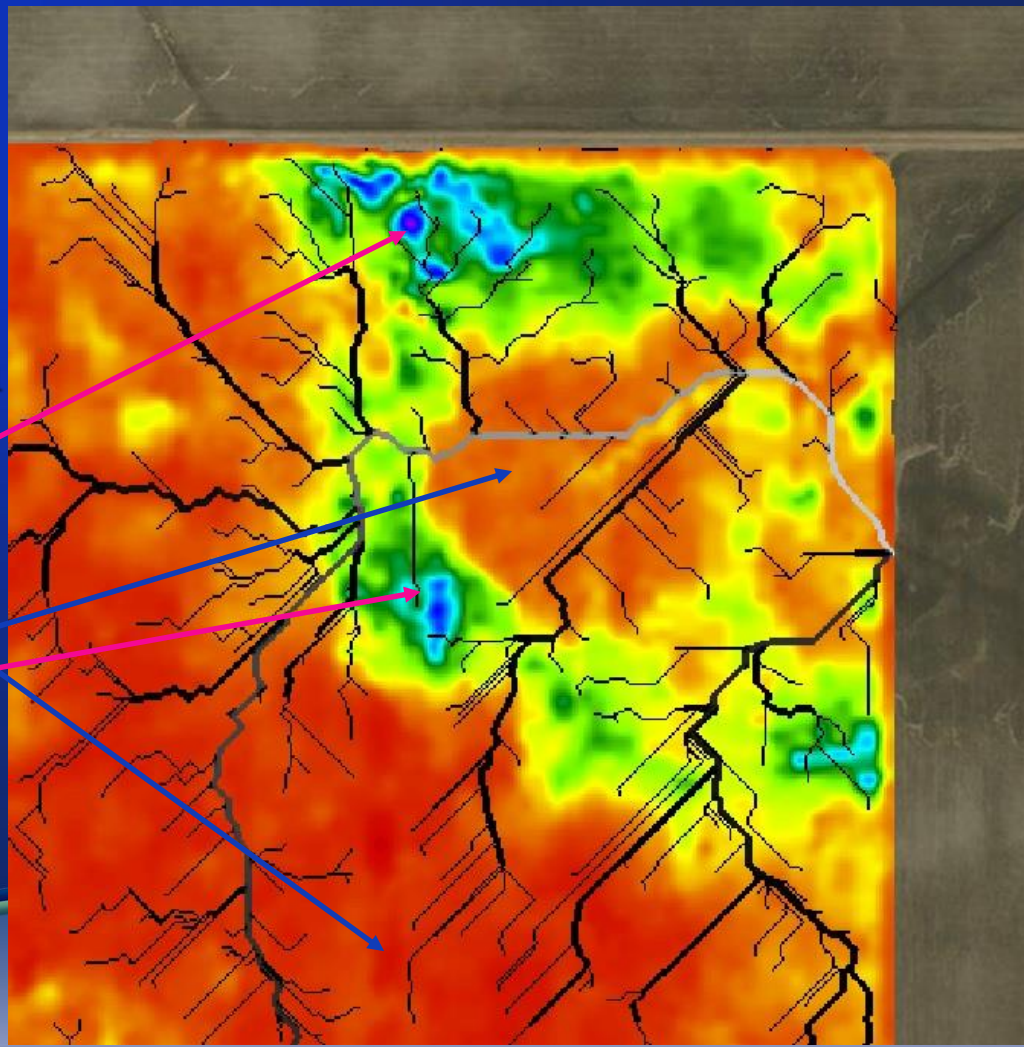
Example Field
Wadena, SK

CropPro Consulting

3-D Electrical Conductivity

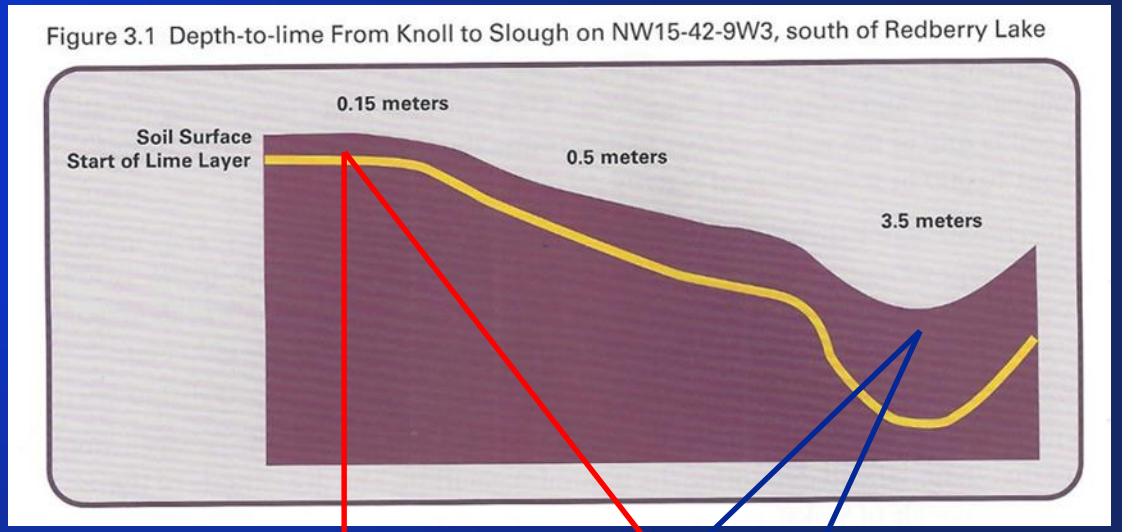


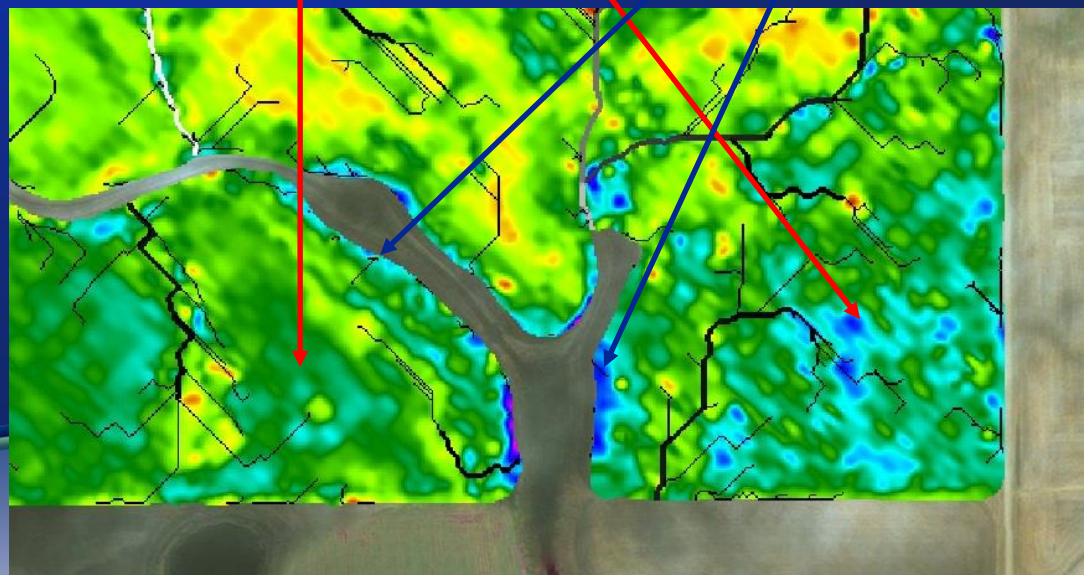
Bathtub Ring Salinity
(Pilot Mound, MB)

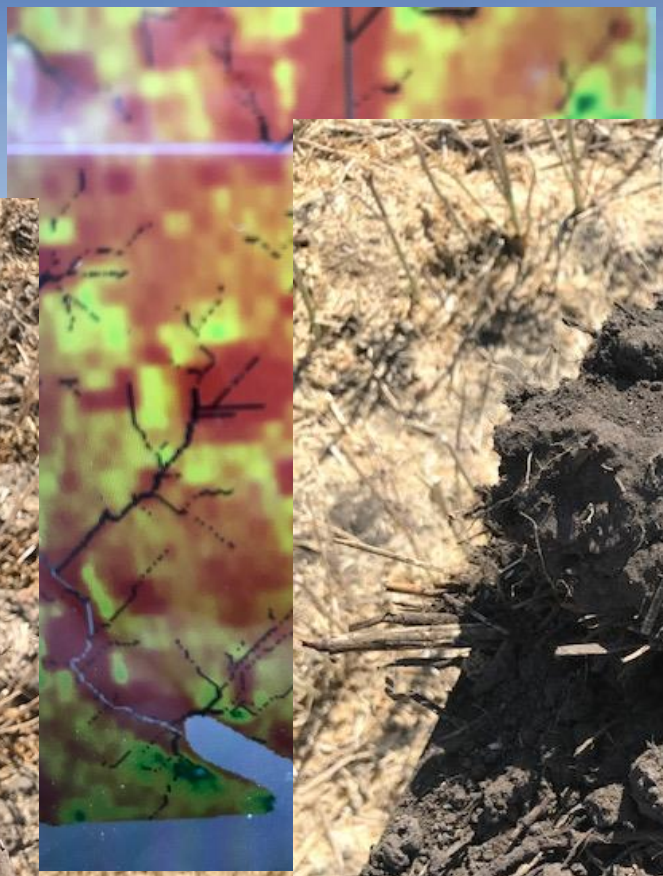


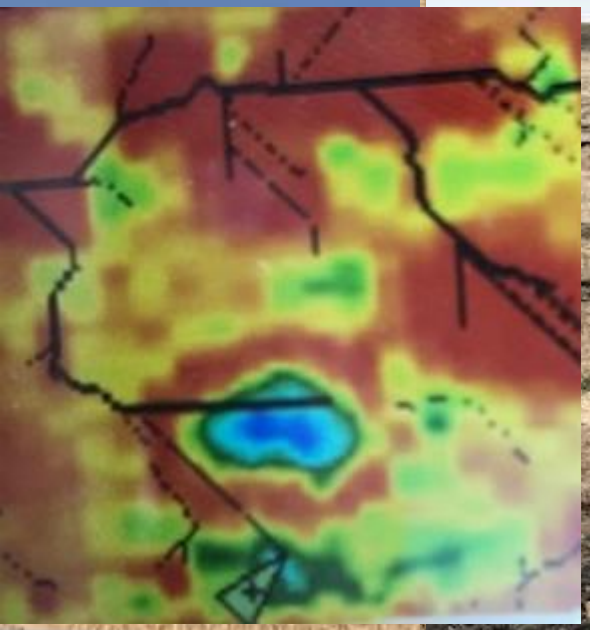
Depth to Lime
(Melfort, SK)

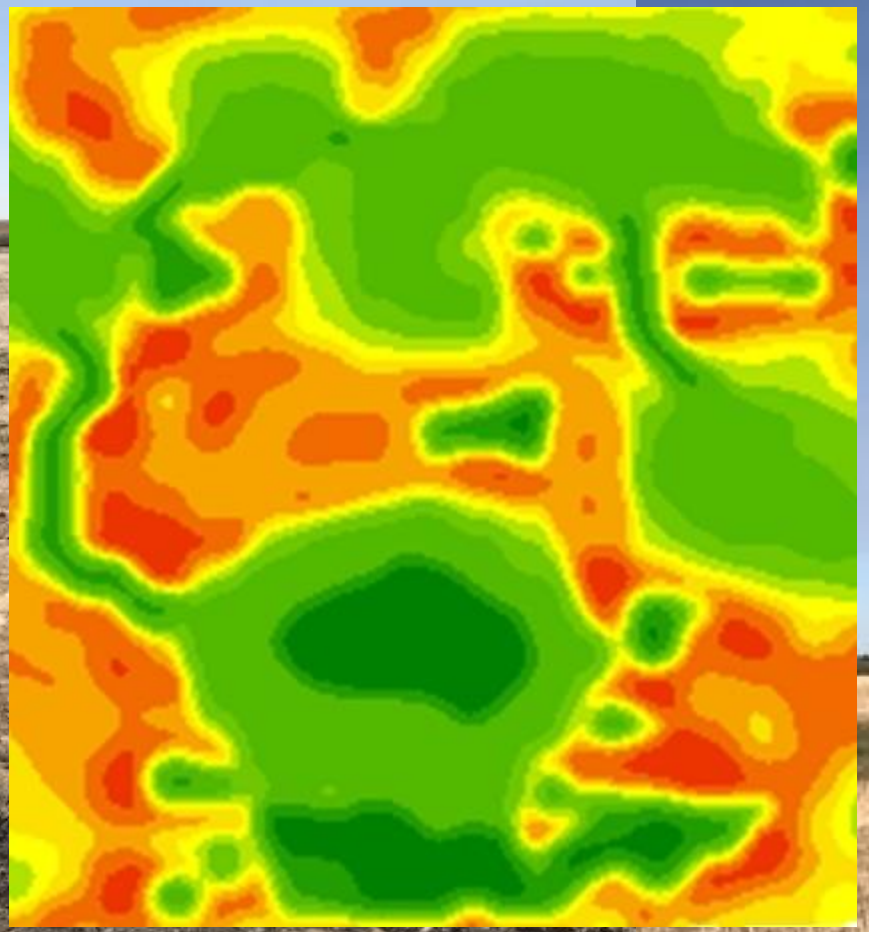
- Hills eroded and calcareous subsoil near surface – high EC
- Water collecting areas are saline around the ditch– high EC
- "You can't use EC as a layer on it's own"







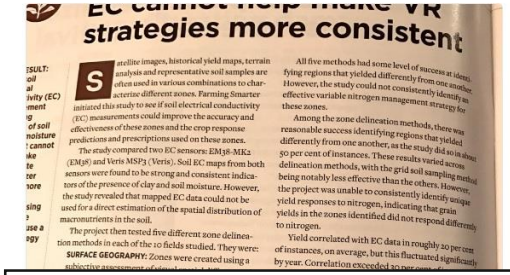




Does EC Correlate with Yield?

Cory Willness
@CropProCory

@canolacouncil according to the conclusions "NOTHING" they tried to make zones with worked. Yield zones were worst method.



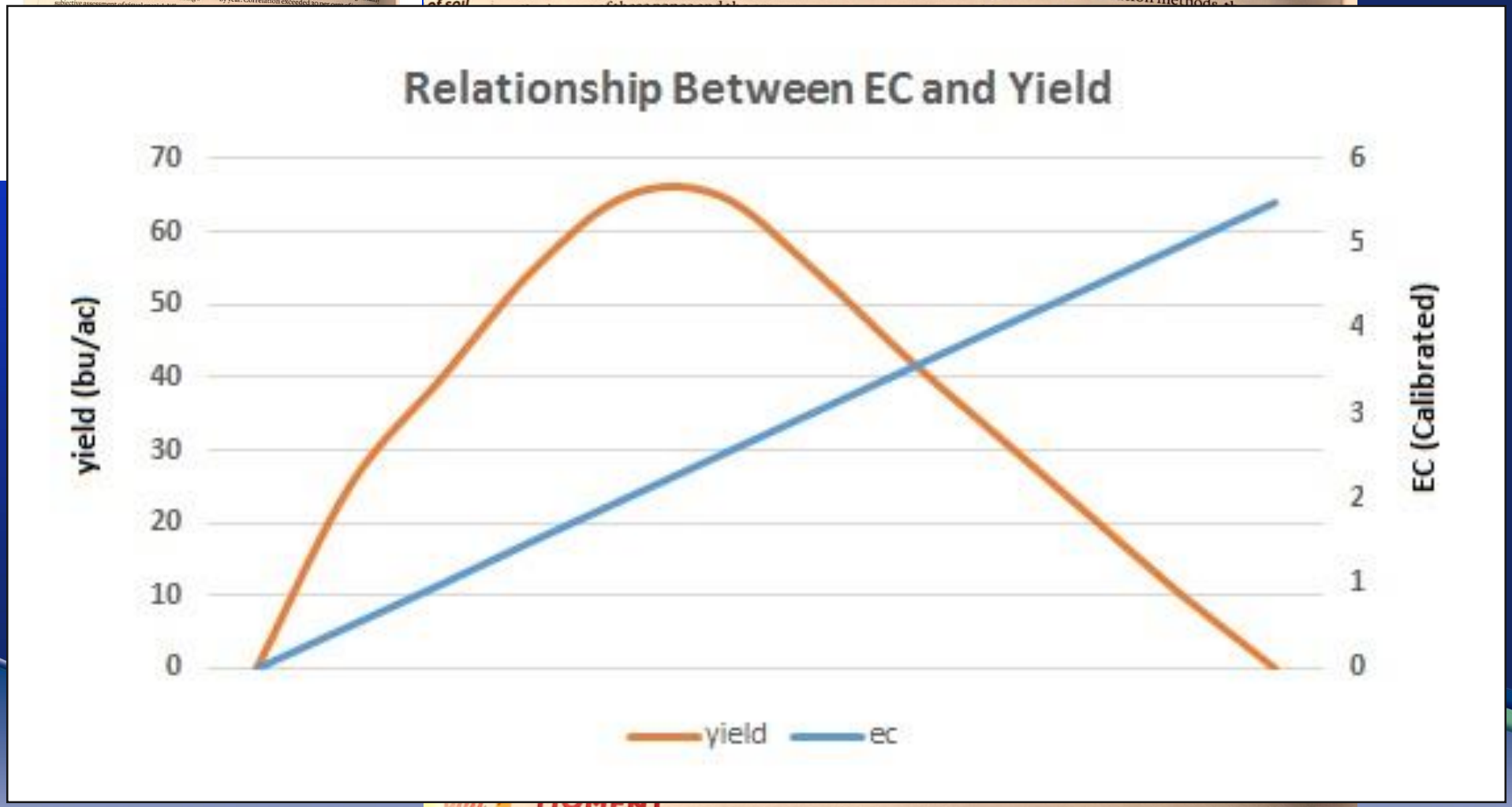
FERTILITY MANAGEMENT

EC cannot help make VR strategies more consistent

Satellite images, historical yield maps, terrain analysis and representative soil samples are often used in various combinations to characterize different zones. Farming Smarter initiated this study to see if soil electrical conductivity (EC) measurements could improve the accuracy and

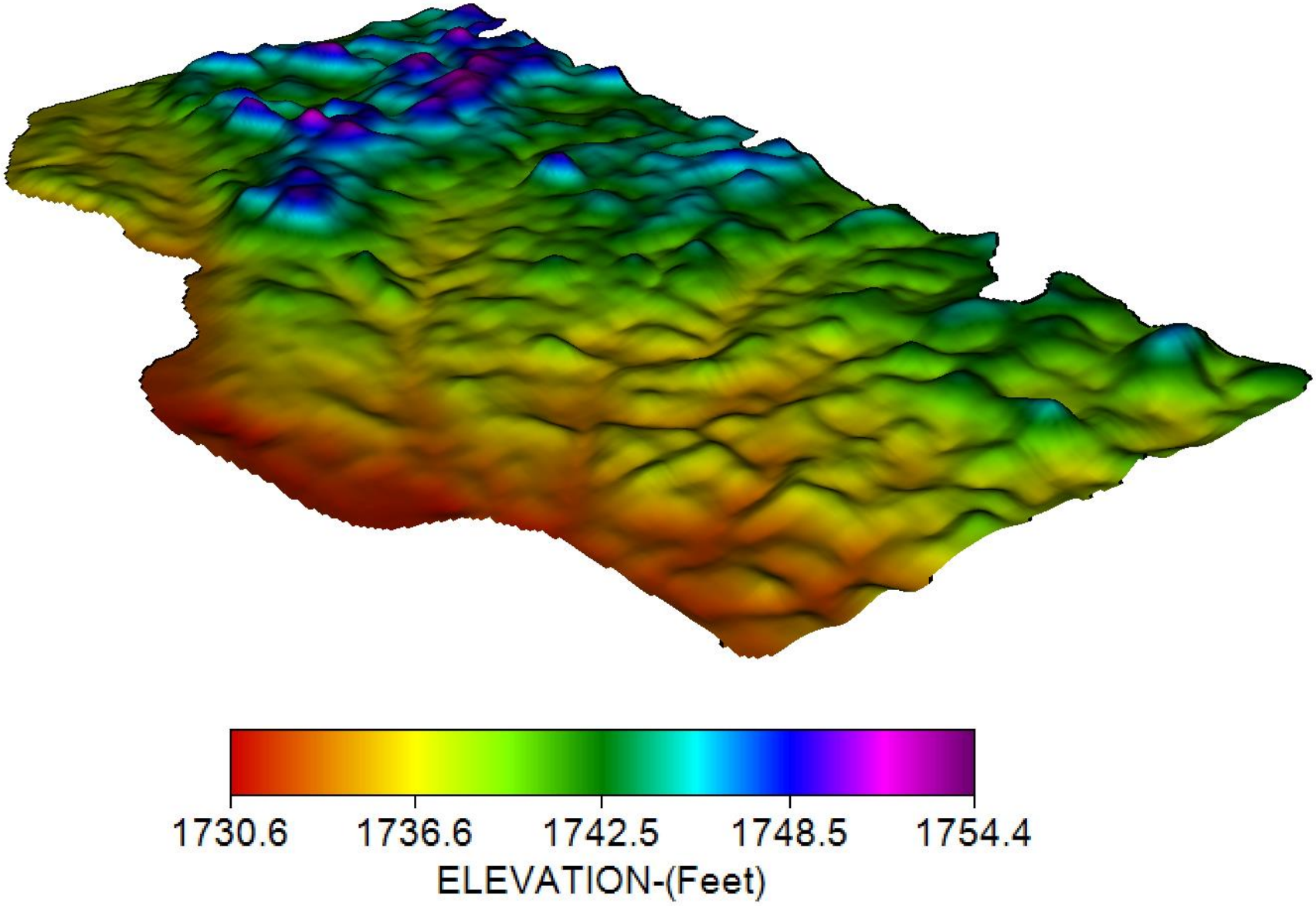
All five methods had some level of success at identifying regions that yielded differently from one another. However, the study could not consistently identify an effective variable nitrogen management strategy for these zones.

Among the zone delineation methods

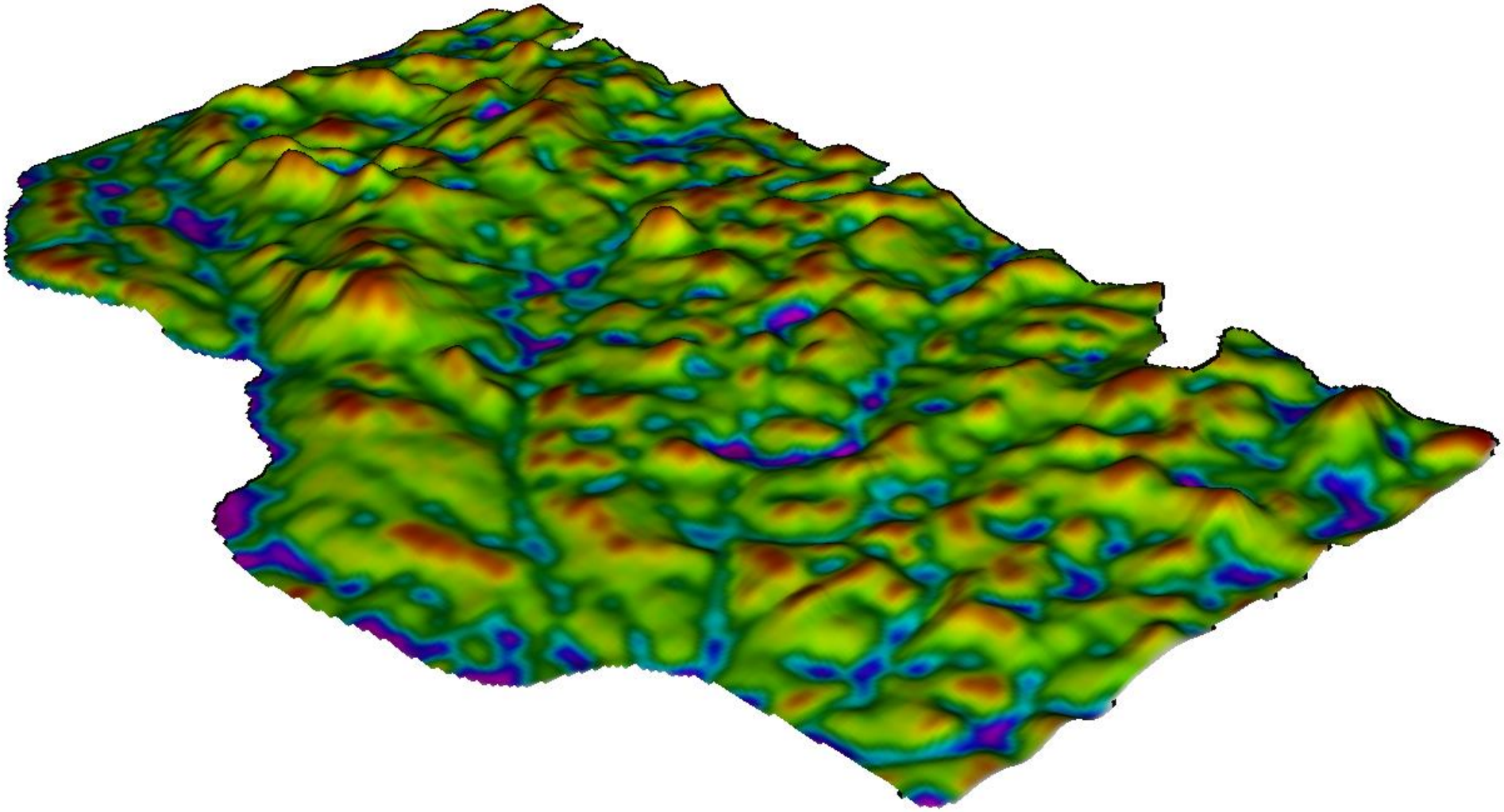


Does Elevation Correlate with Yield?

3-D RTK Elevation

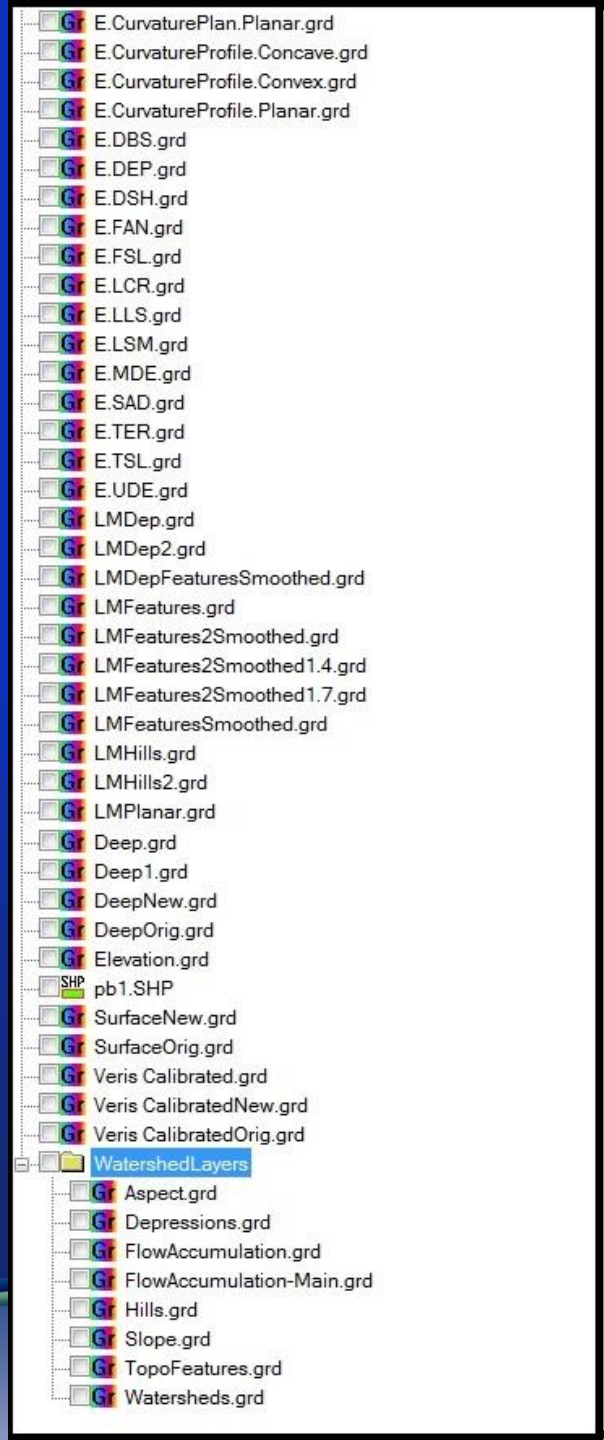


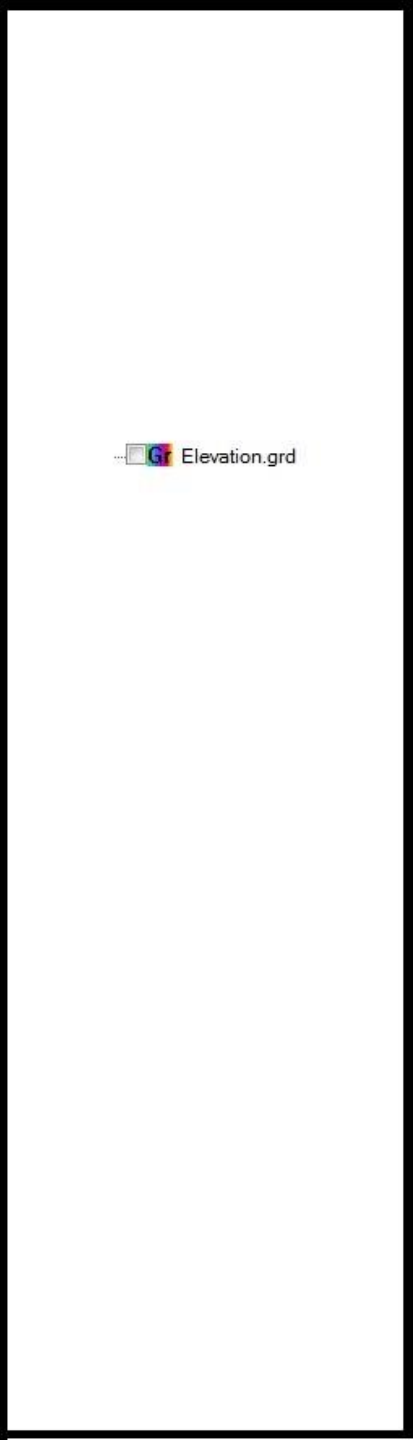
3-D Topography Model



ELEVATION IS NOT TOPOGRAPHY

QUIT TRYING TO USE IT IN YOUR DATA ANALYSIS IT'S WRONG





Cory Willness
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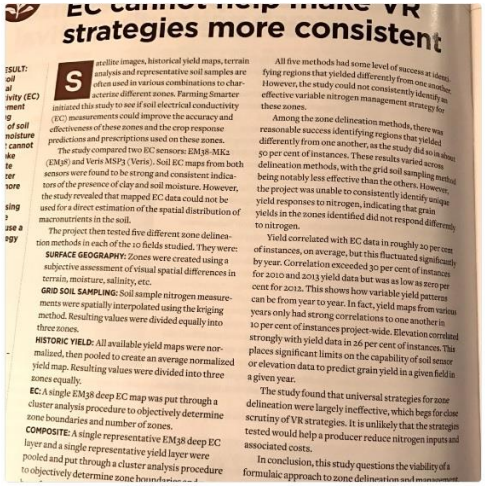


FERTILITY MANAGEMENT

EC cannot help make VR strategies more consistent

Satellite images, historical yield maps, terrain analysis and representative soil samples are often used in various combinations to characterize different zones. Farming Smarter initiated this study to see if soil electrical conductivity (EC) measurements could improve the accuracy and effectiveness of these zones and the crop response predictions and prescriptions used on these zones.

The study compared two EC sensors: EM38-MK2 (EM38) and Veris MSP3 (Veris). Soil EC maps from both sensors were found to be strong and consistent indicators of the presence of clay and soil moisture. However, the study revealed that mapped EC data could not be used for a direct estimation of the spatial distribution of macronutrients in the soil.

The project then tested five different zone delineation methods in each of the 10 fields studied. They were:

SURFACE GEOGRAPHY: Zones were created using a subjective assessment of visual spatial differences in terrain, moisture, salinity, etc.

GRID SOIL SAMPLING: Soil sample nitrogen measurements were spatially interpolated using the kriging method. Resulting values were divided equally into three zones.

HISTORIC YIELD: All available yield maps were normalized, then pooled to create an average normalized yield map. Resulting values were divided into three zones equally.

EC: A single EM38 deep EC map was put through a cluster analysis procedure to objectively determine zone boundaries and number of zones.

COMPOSITE: A single representative EM38 deep EC layer and a single representative yield layer were pooled and put through a cluster analysis procedure to objectively determine zone boundaries and number of zones.

All five methods had some level of success at identifying regions that yielded differently from one another. However, the study could not consistently identify an effective variable nitrogen management strategy for these zones.

Among the zone delineation methods, there was reasonable success identifying regions that yielded differently from one another, as the study did so in about 50 per cent of instances. These results varied across delineation methods, with the grid soil sampling method being notably less effective than the others. However, the project was unable to consistently identify unique yield responses to nitrogen, indicating that grain yields in the zones identified did not respond differently to nitrogen.

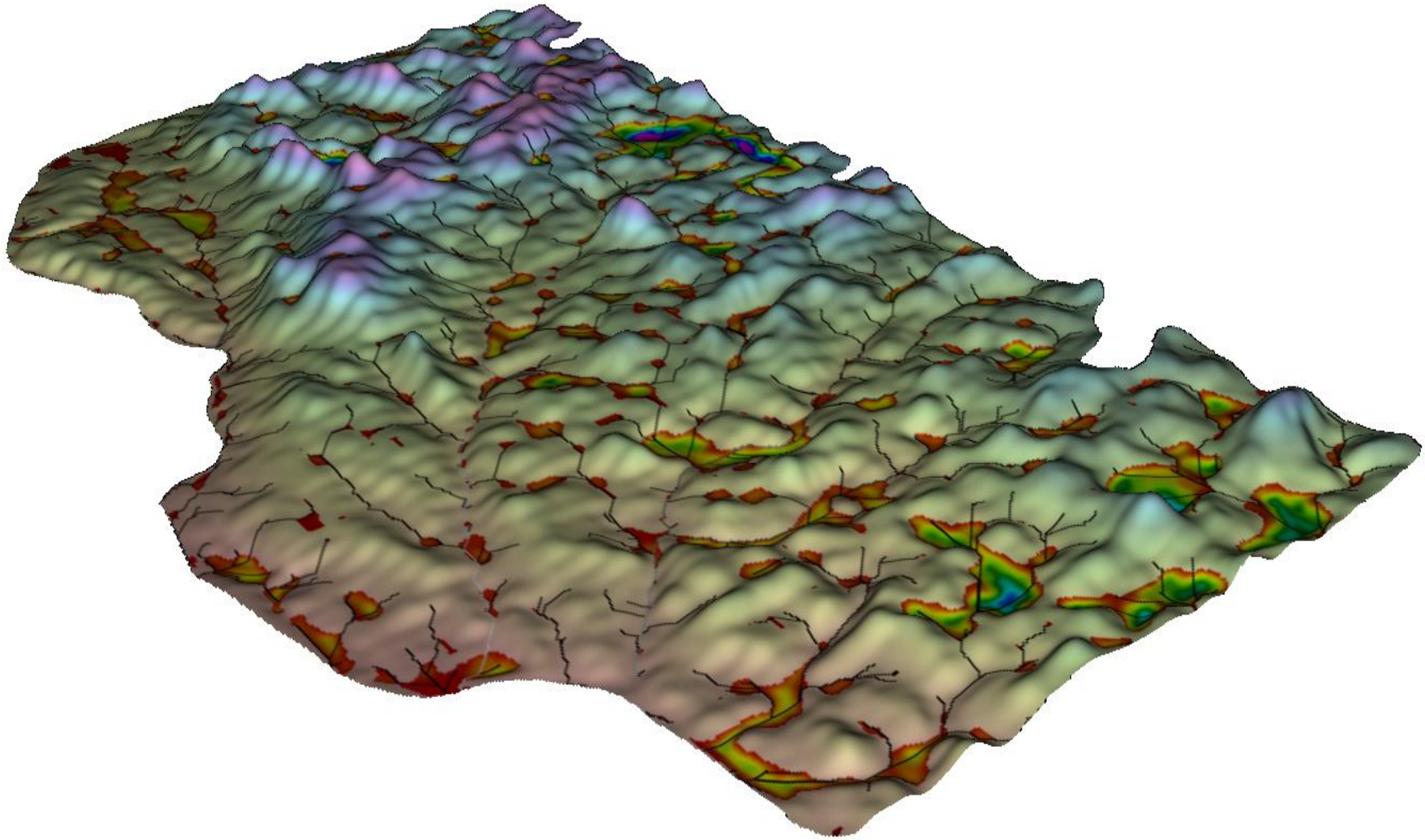
Yield correlated with EC data in roughly 20 per cent of instances, on average, but this fluctuated significantly by year. Correlation exceeded 30 per cent of instances for 2010 and 2013 yield data but was as low as zero per cent for 2012. This shows how variable yield patterns can be from year to year. In fact, yield maps from various years only had strong correlations to one another in 10 per cent of instances project-wide. Elevation correlated strongly with yield data in 26 per cent of instances. This places significant limits on the capability of soil sensor or elevation data to predict grain yield in a given field in a given year.

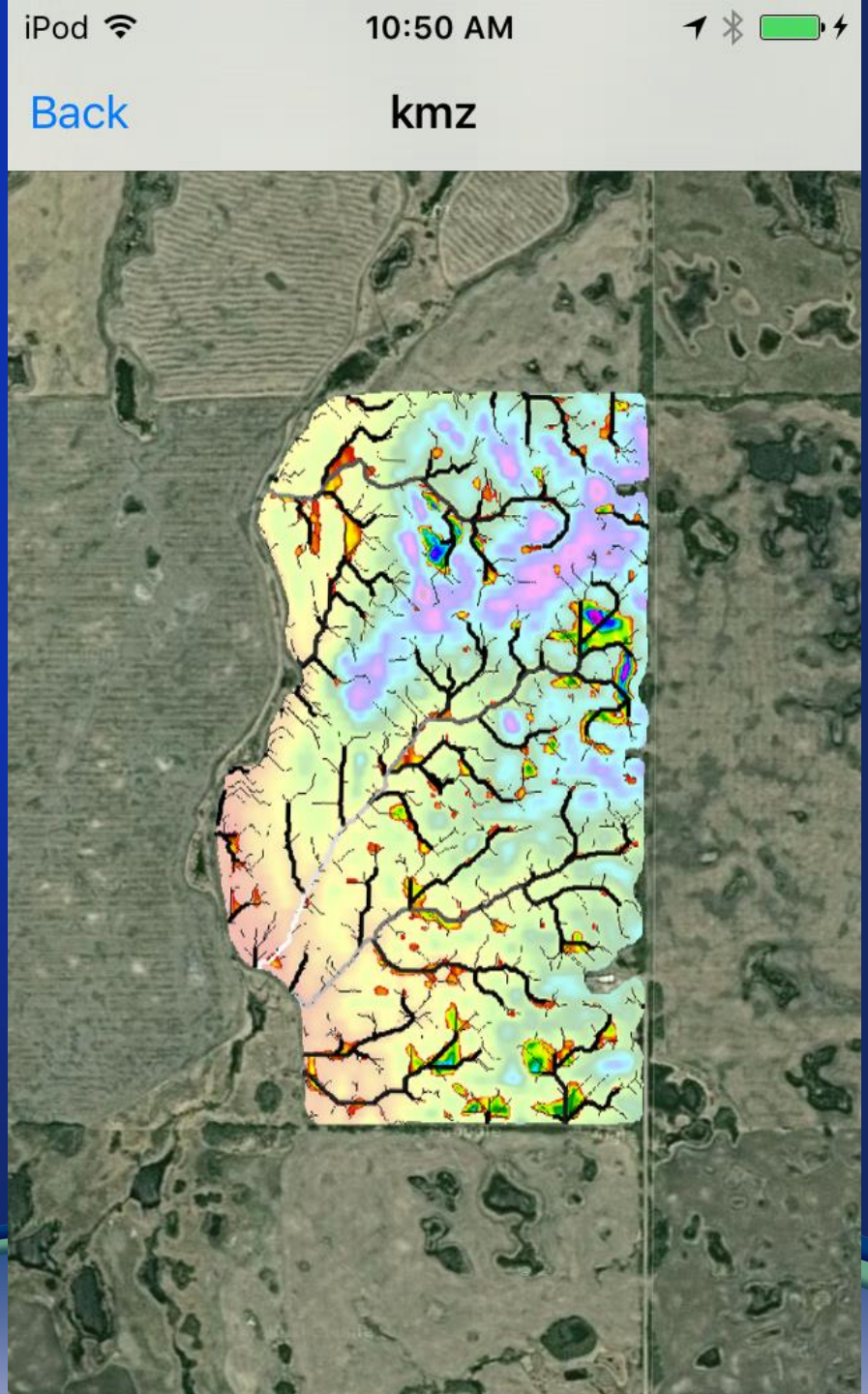
The study found that universal strategies for zone delineation were largely ineffective, which begs for close scrutiny of VR strategies. It is unlikely that the strategies tested would help a producer reduce nitrogen inputs and associated costs.

In conclusion, this study questions the viability of a formulaic approach to zone delineation and management. Producers should be prepared to develop a specific variable-rate strategy for each field each year.

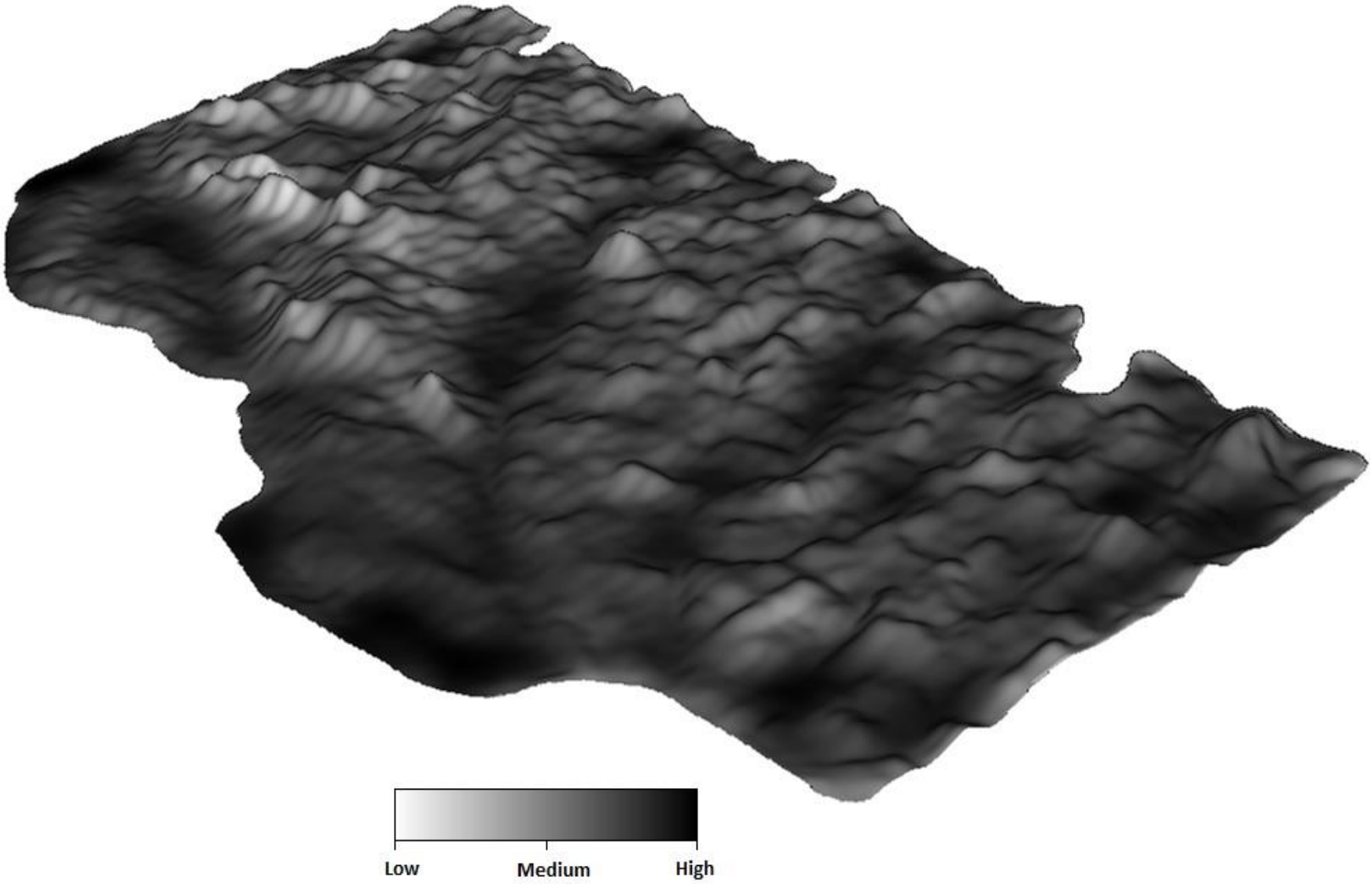
aha! MOMENT

3-D Elevation, Flow Paths, Water Holding Depressions




iPod
10:50 AM
Back
kmz

3-D Organic Matter (Imagery)

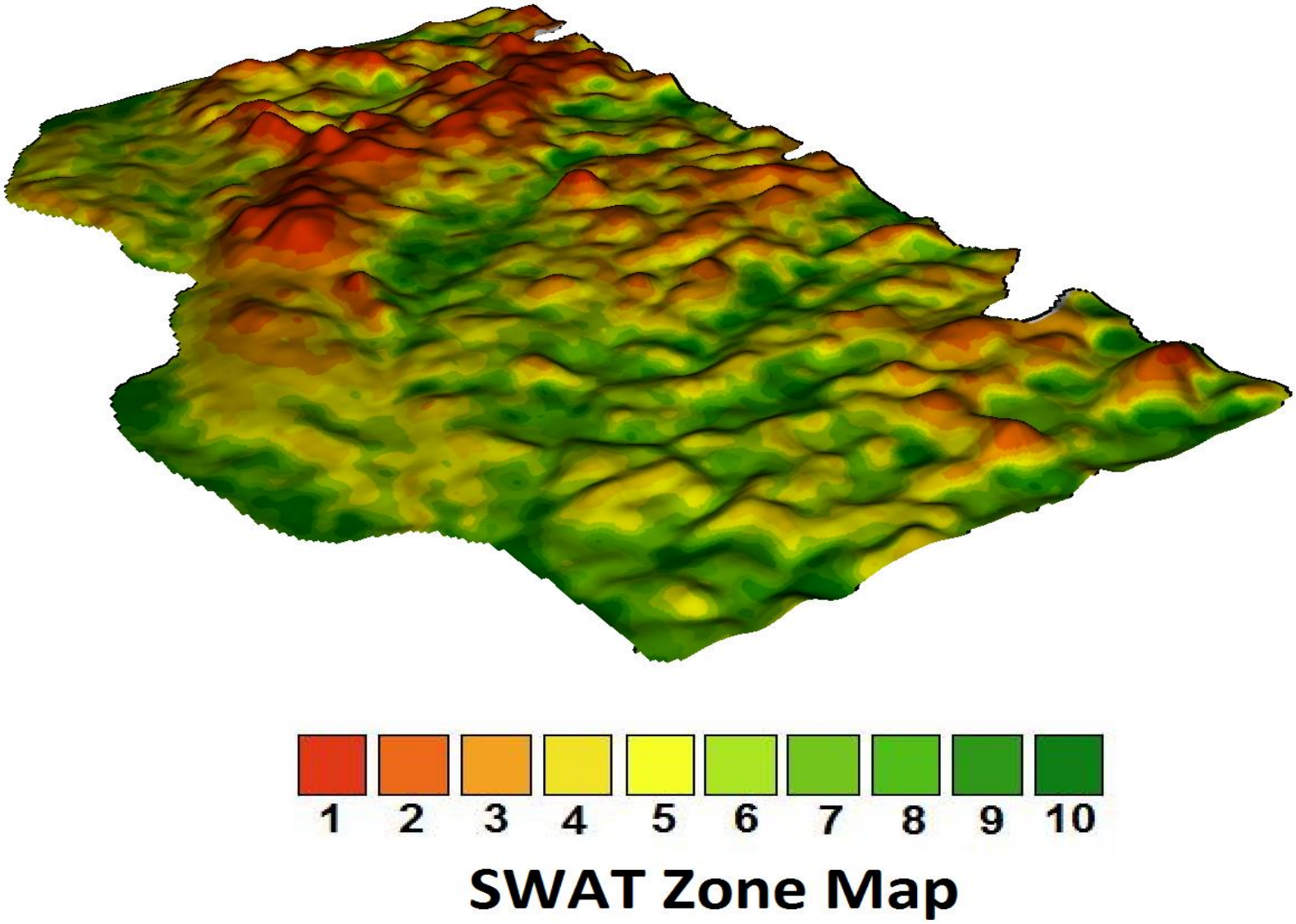


Initial data is just a base for models

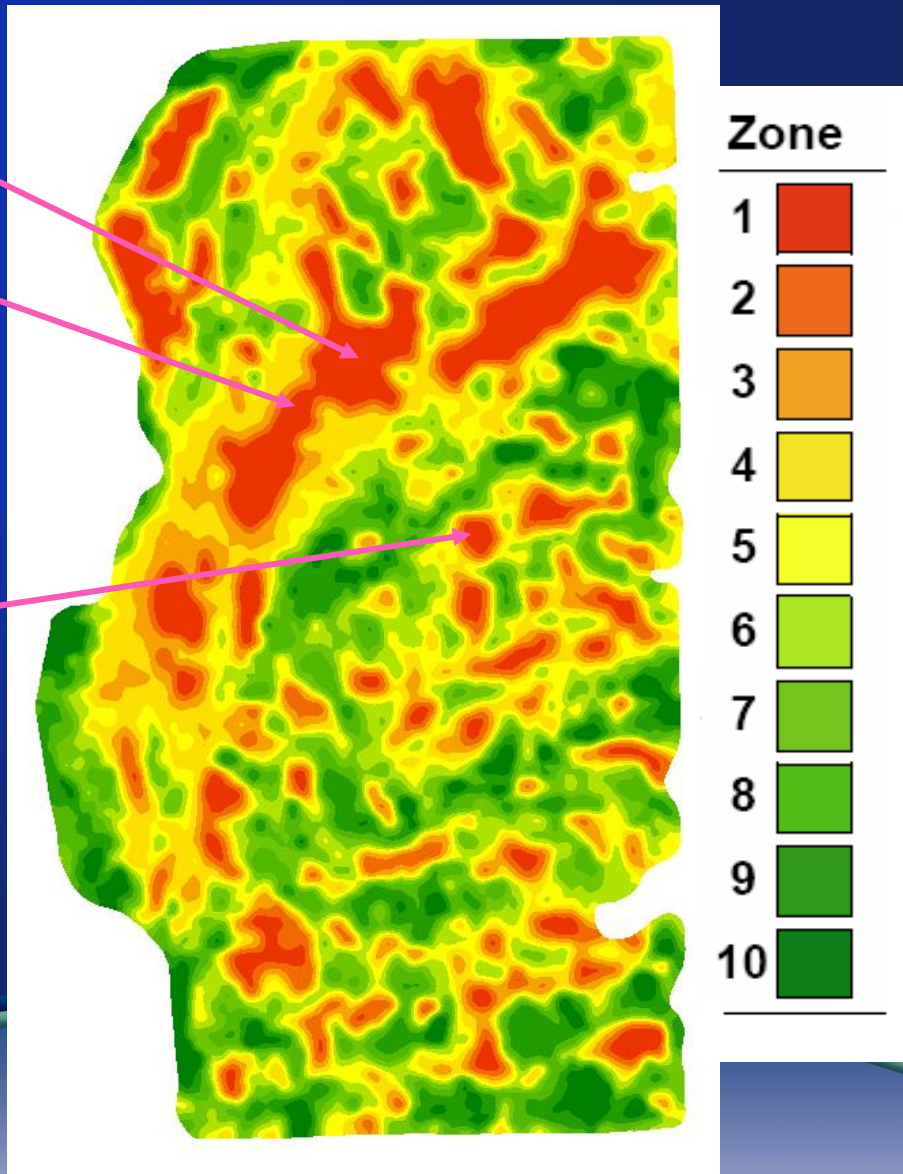
- EC provides a base to model:
  - erosion, water flows, solute accumulations, salinity, textures, sub-surface water issues
- Elevation provides a base to model:
  - Topography, water flows, depressions, hills, organic levels, erosion potential
- Soil colour provides a base to model:
  - Organic levels and erosion

CropPro Consulting

3-D SWAT MAPS

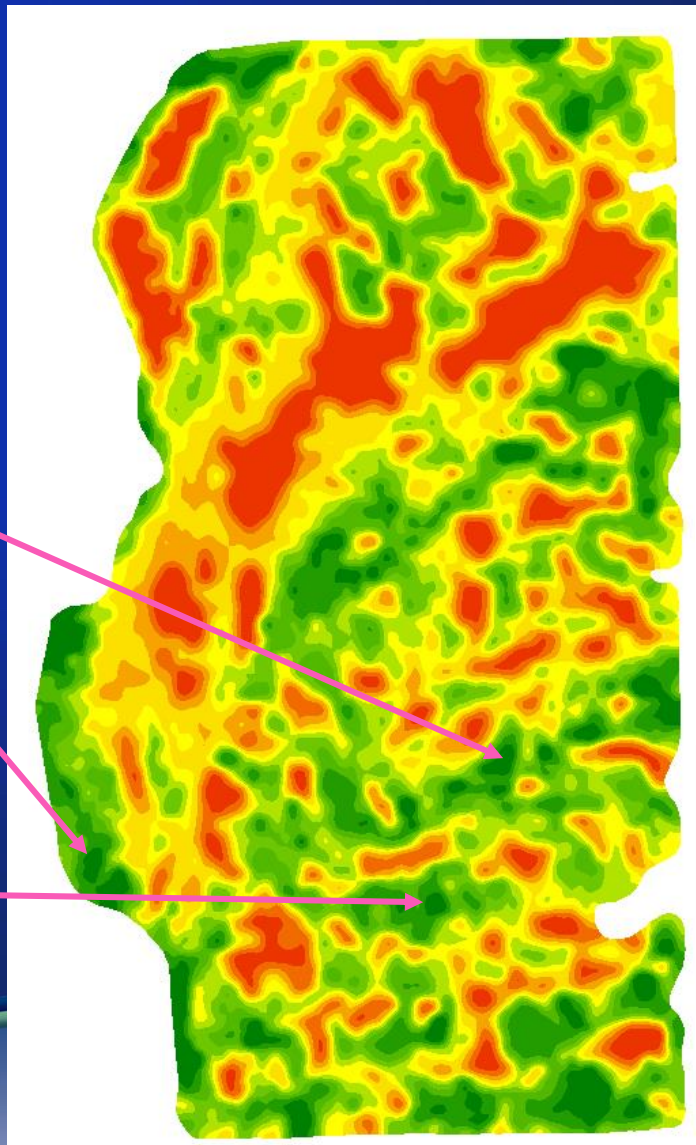


Zone 1 - knolls

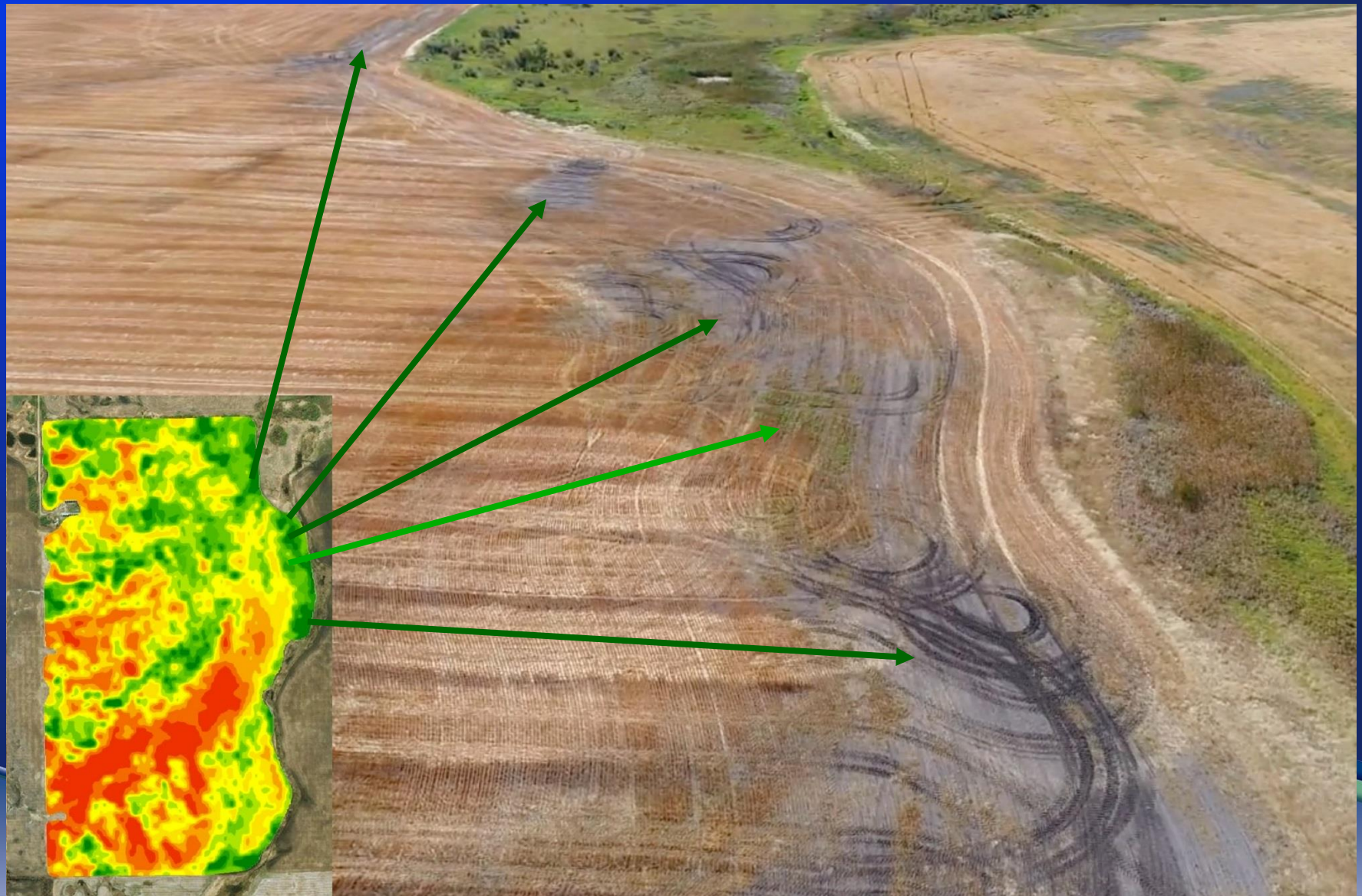


Zone 1- Highest Water Shedding
Zone 2 – Lower Water Shedding

Zone 10 - saline



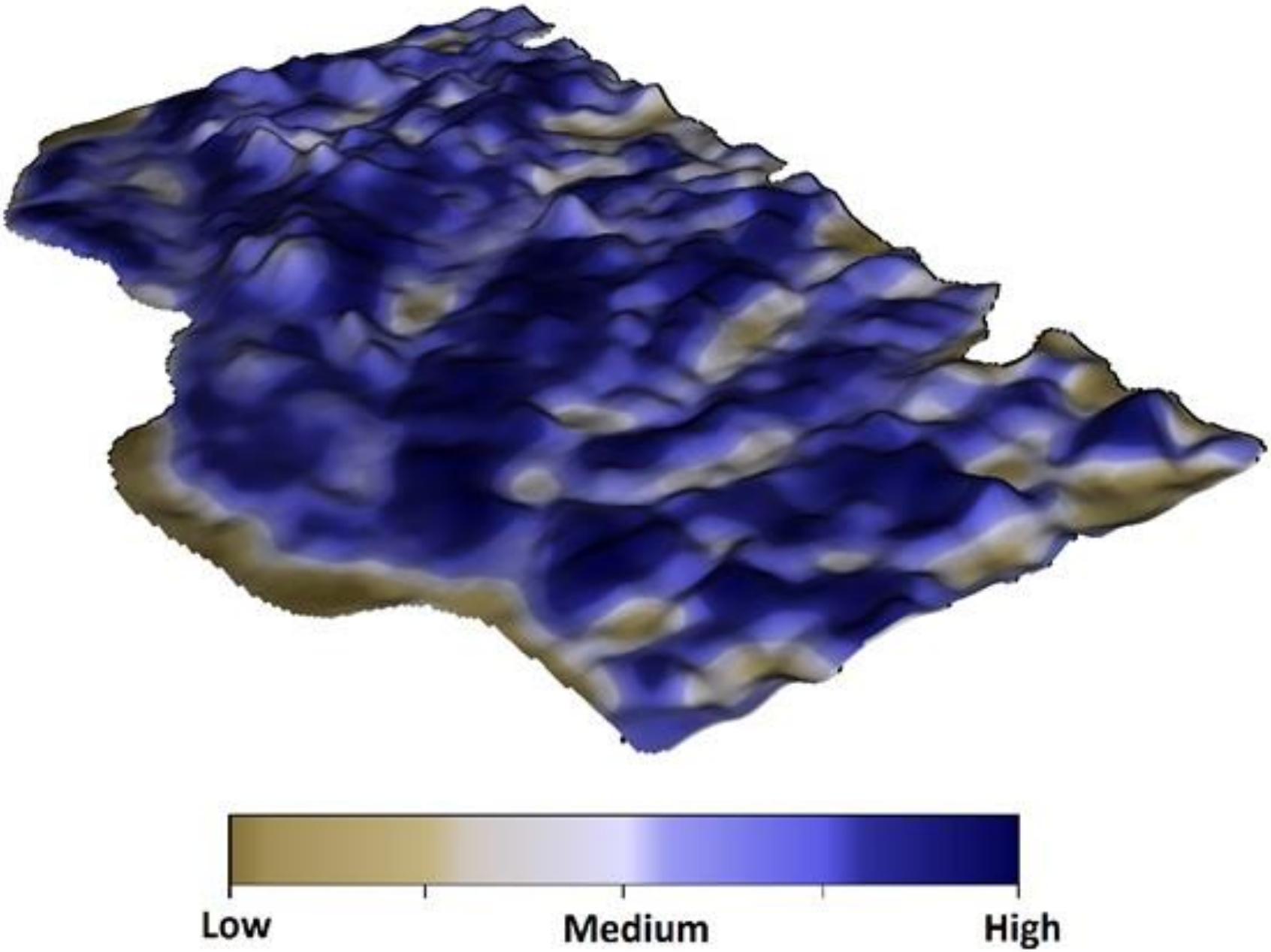
Zone 9 – Light Salinity
Zone 10 – High Salinity



Zone 1
Hills

Zone 8
Non-saline
depressions

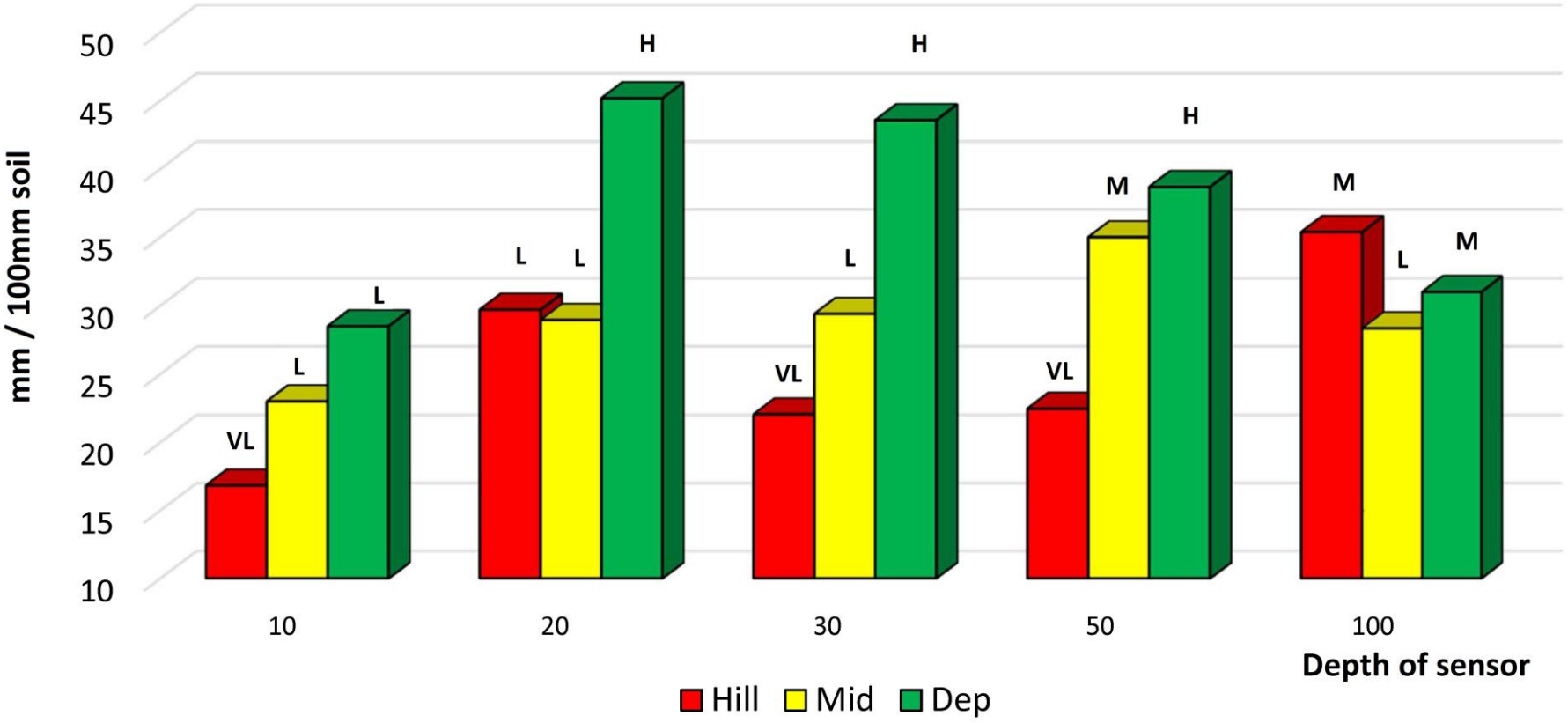
CropPro
Consulting



BAY MAPS

JD Field Connect Soil Moisture

(Note: prototype 3 sensor unit)

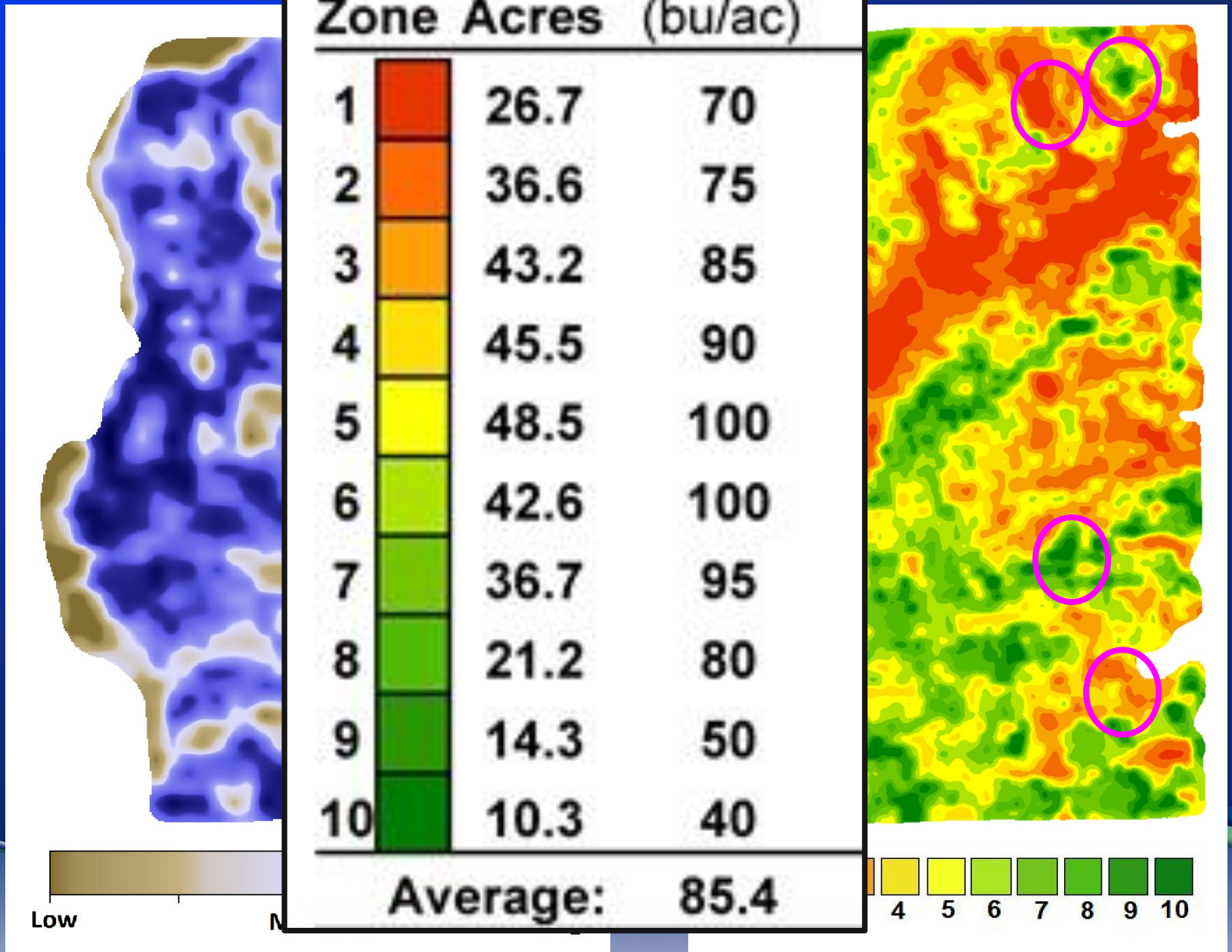


CropPro Consulting

Season Long - Topographic

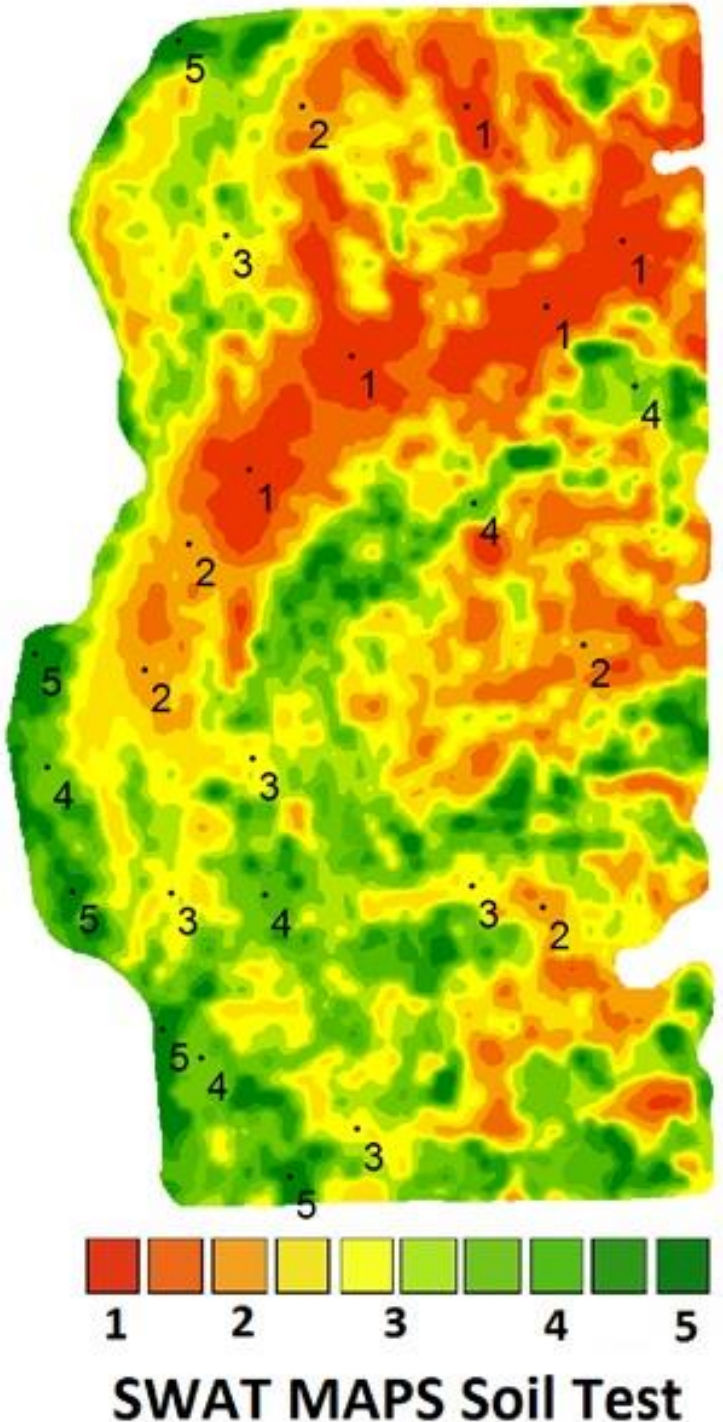
CropPro Consulting

2008 Ju AT Zones



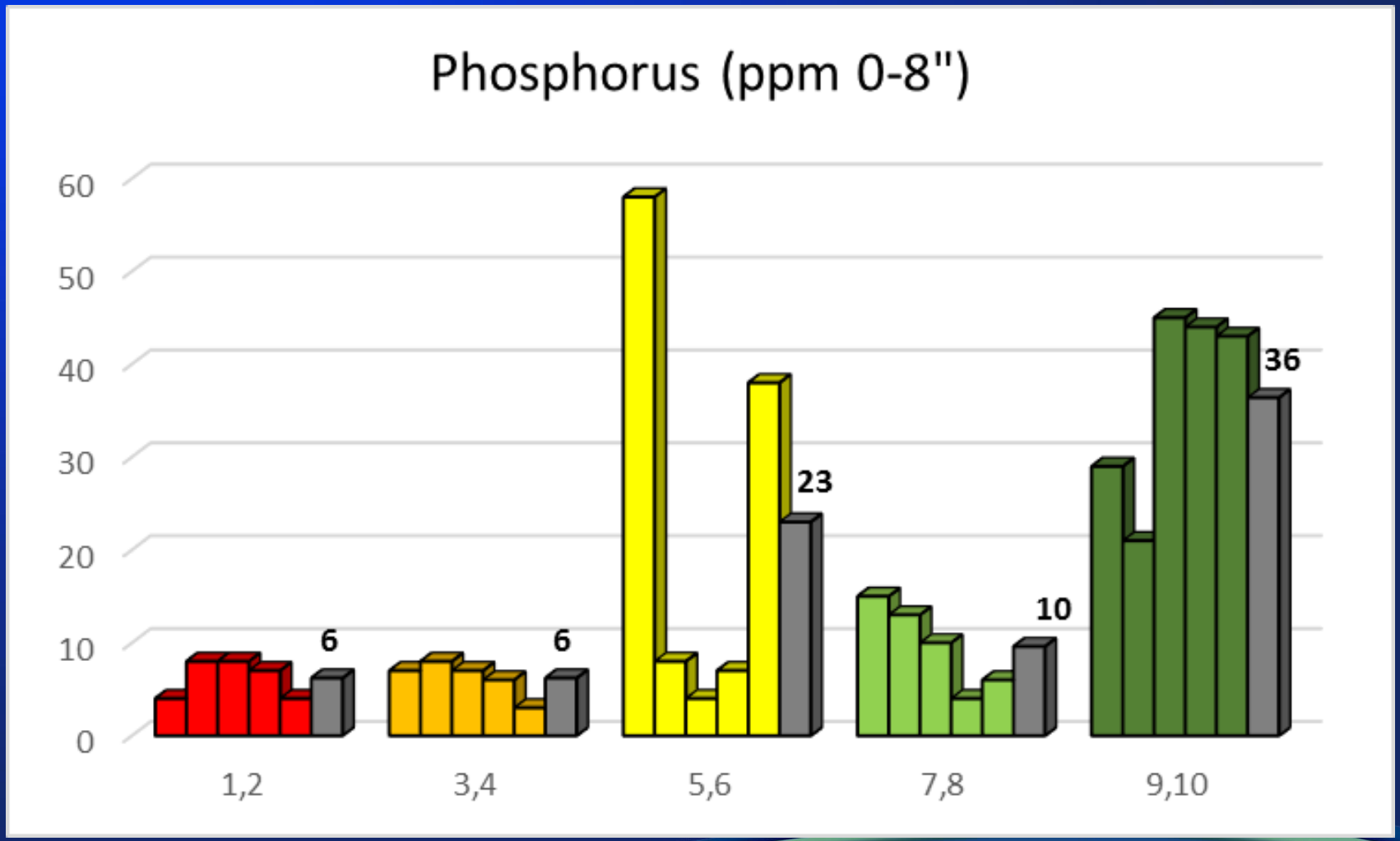
SWAT MAPS Soil Sampling

- Sample 10 zones on MAPS into 5 zones
- select points that will represent the most acres of the zones
- Best compromise on detail versus costs



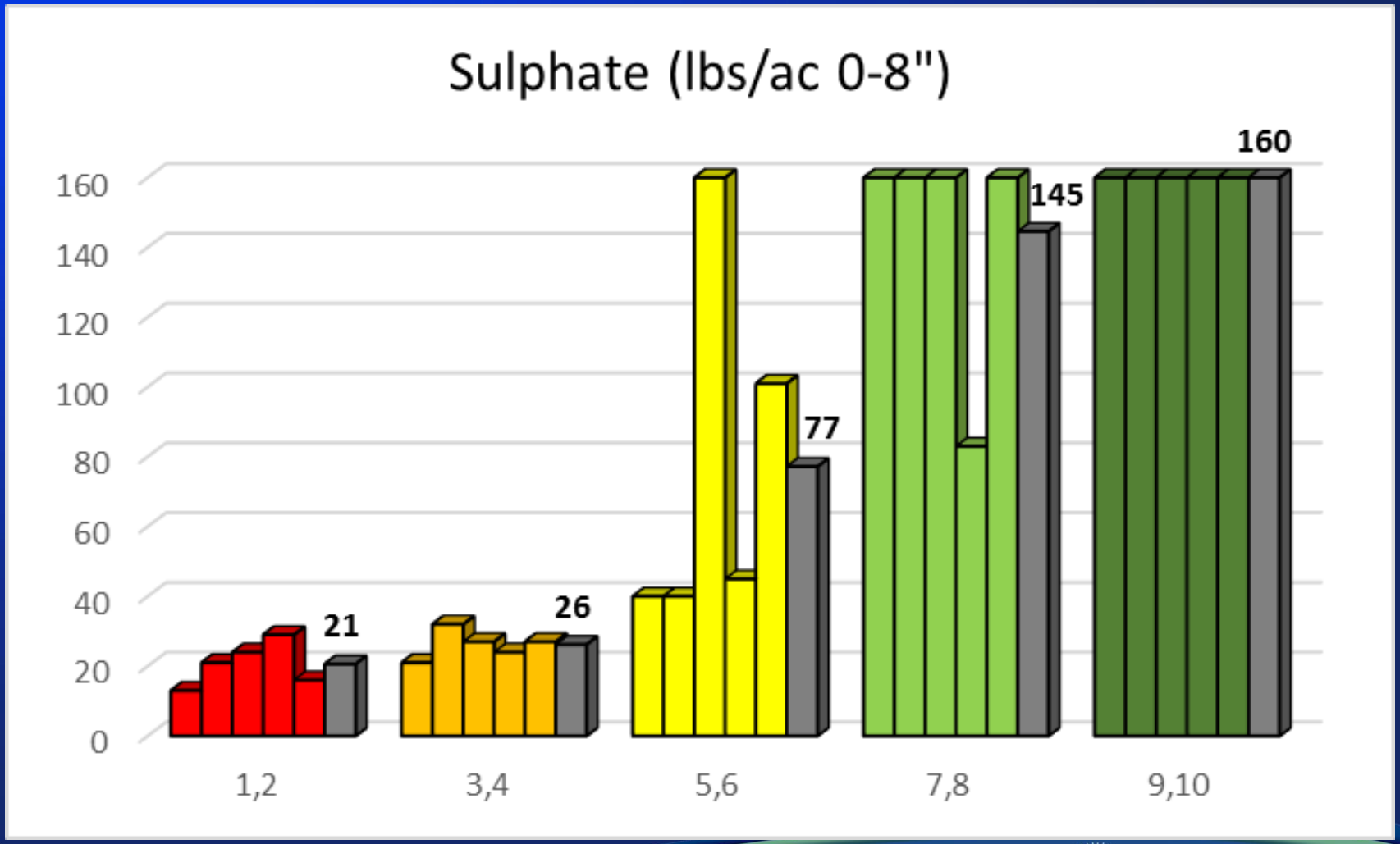
Wintex
1000
1 2 3 4 5

Fall 2017



CropPro Consulting

Fall 2017



CropPro Consulting

VRx MAPS
Variable-rate Prescription MAPS

Fundamental Principles of VR

GOAL: apply the right rate in the right zone

1) MUST get the **Zone MAPS** right
   - areas grouped together MUST have similar fertilizer response characteristics
2) MUST get the **Fertilizer Rates** right
   - rates applied to each area provide the optimum return

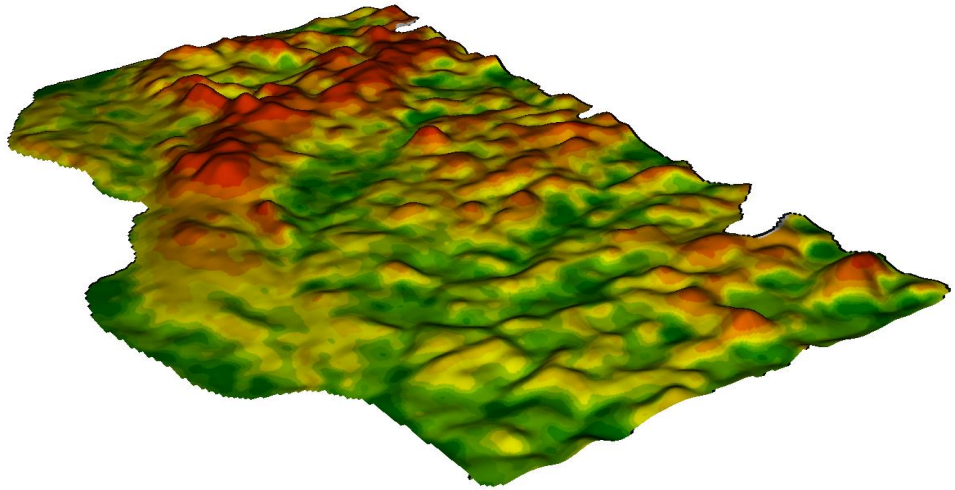
CropPro Consulting

SSM N Fertilizer Calculator

- OM
- Mineralization prediction based on SCZ
- Soil nitrates
- Moisture expectations
- Yield and protein goal

VR Fertilizer – Wadena, SK

GPS Acres	779.4	Wheat	PK	Urea
	Acres	Layer #1	Layer #2	Layer #3
	21.5	170	85	240
	85.9	160	85	240
	126.6	150	85	240
	146.4	150	85	240
	135.5	150	80	240
	103.5	150	80	230
	72.2	160	65	215
	40.2	170	60	175
	22	180	55	130
	9.8	180	40	85
Total Acres	764	154.9	78.8	227.7
			Averages	

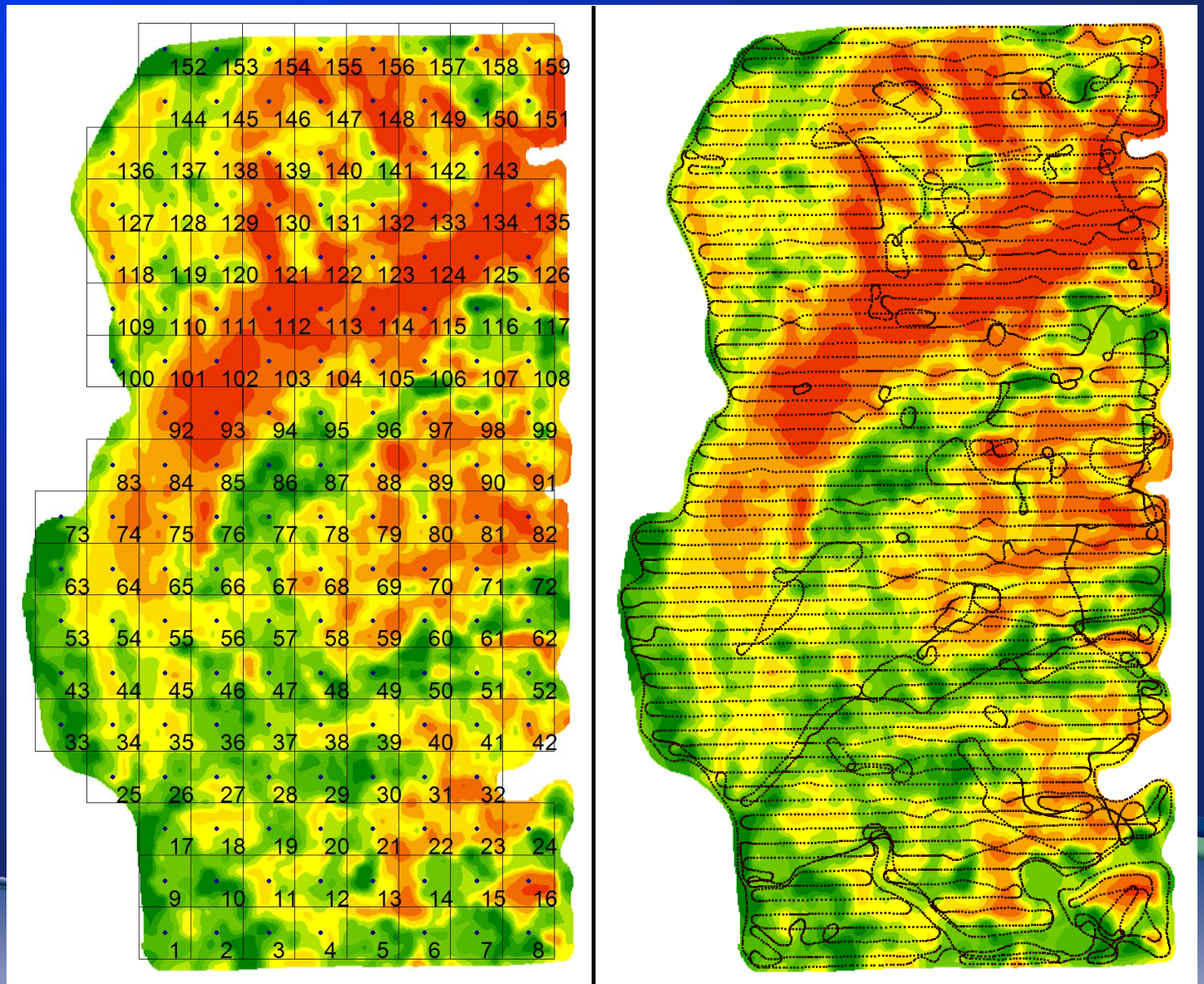


1 2 3 4 5 6 7 8 9 10

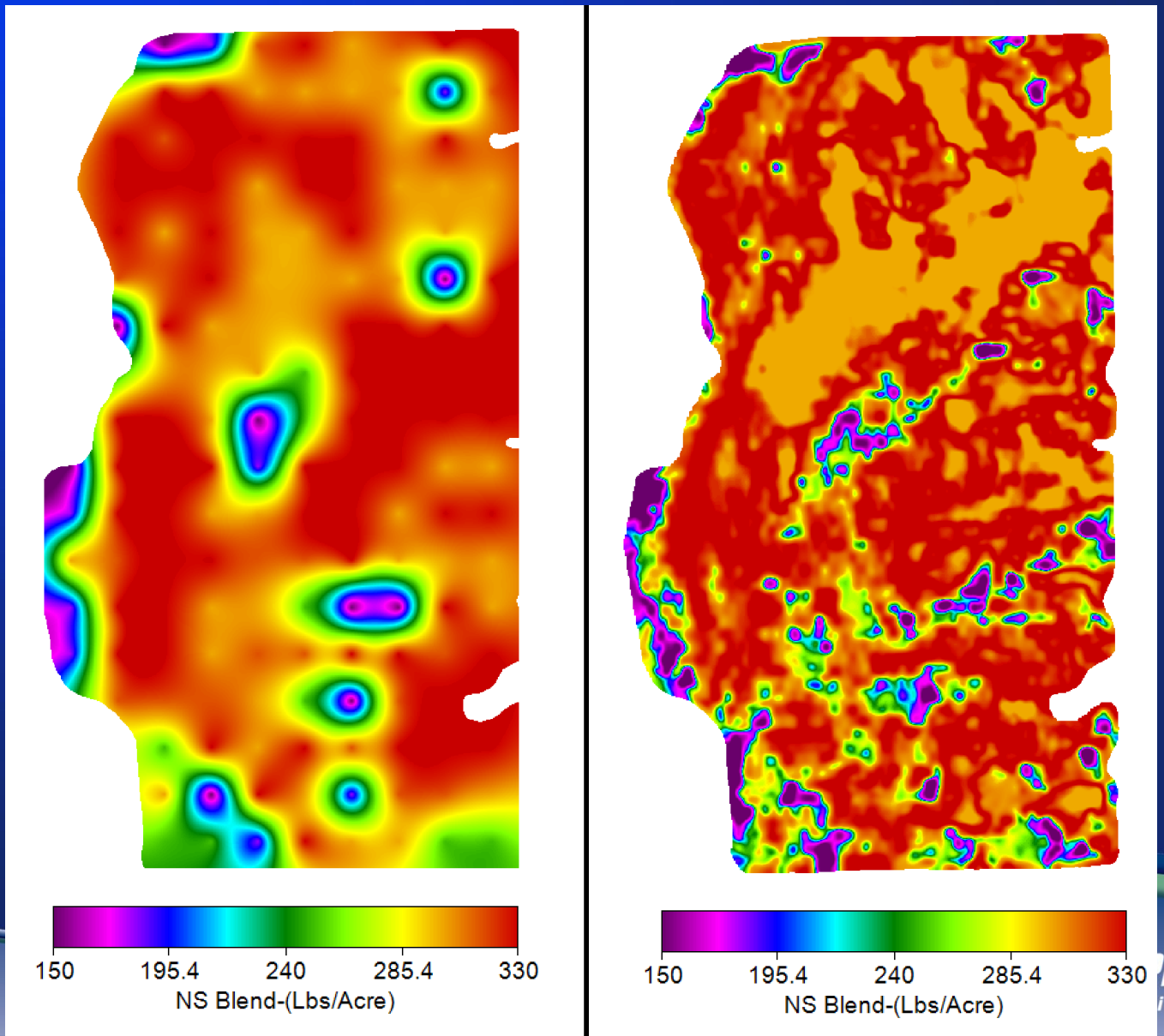
If you do 160 grid samples, will you have way better VR prescriptions than 5 SWAT zone samples?

CropPro Consulting

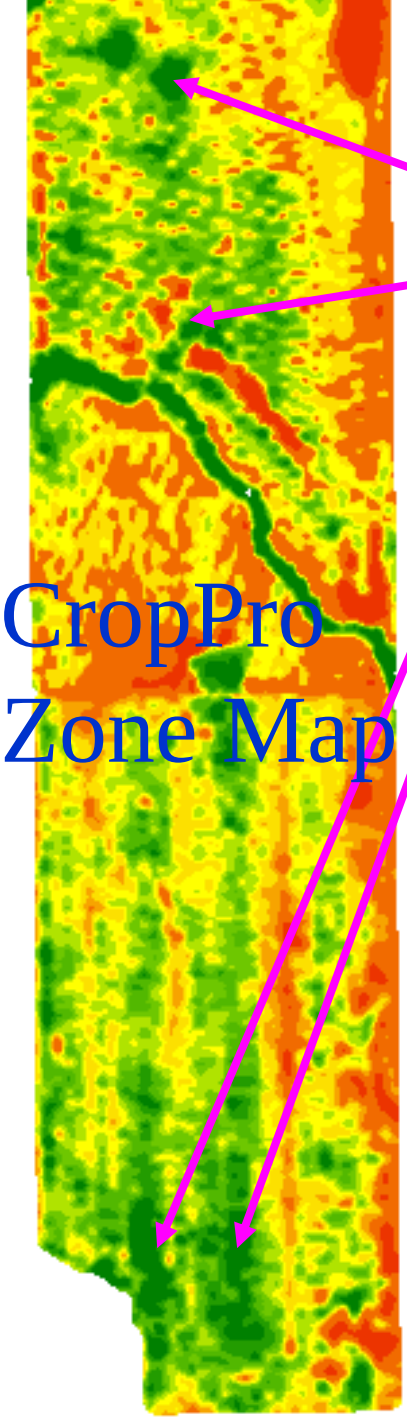
2ac Grid (159 points) SWAT (14,000 points)



2ac Grid (159 points) SWAT (14,000 points)
zone every 420 feet OR zone every 1.5 meters



SWAT zooms in on soil, water and topography influences. What does imagery zoom in on?

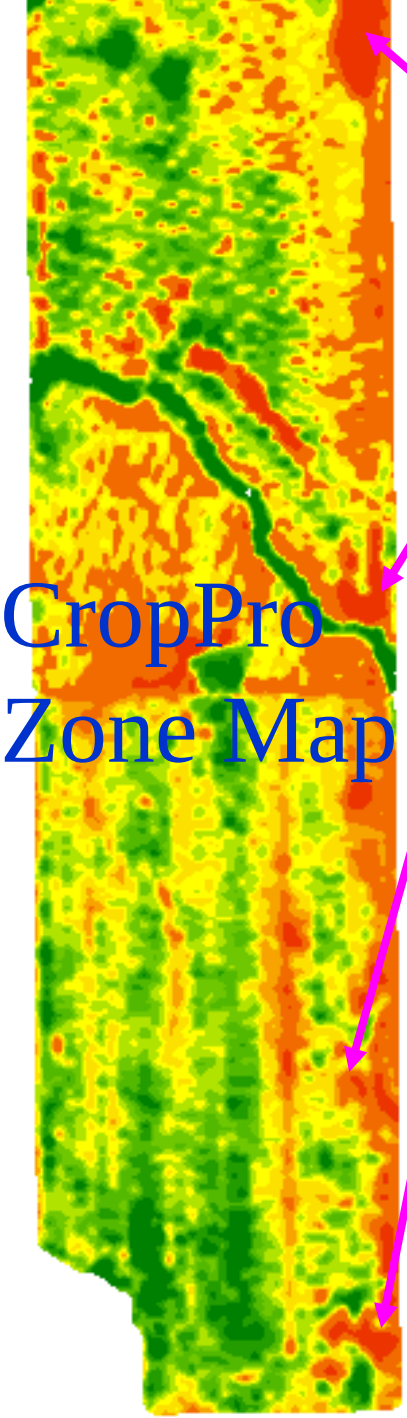


CropPro Zone Map

Saline areas

- Areas of poor growth
- Very high fertility levels
- Cut back on all nutrients warranted

Satellite Image



CropPro Zone Map

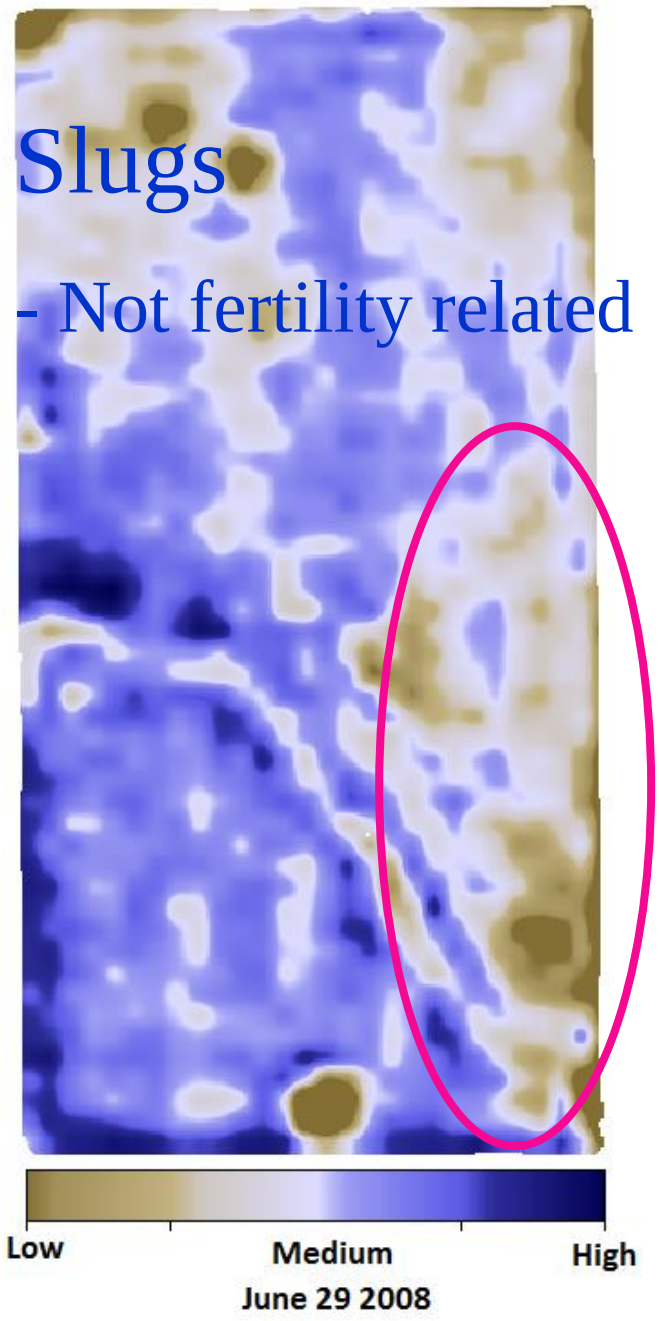
Eroded Knolls

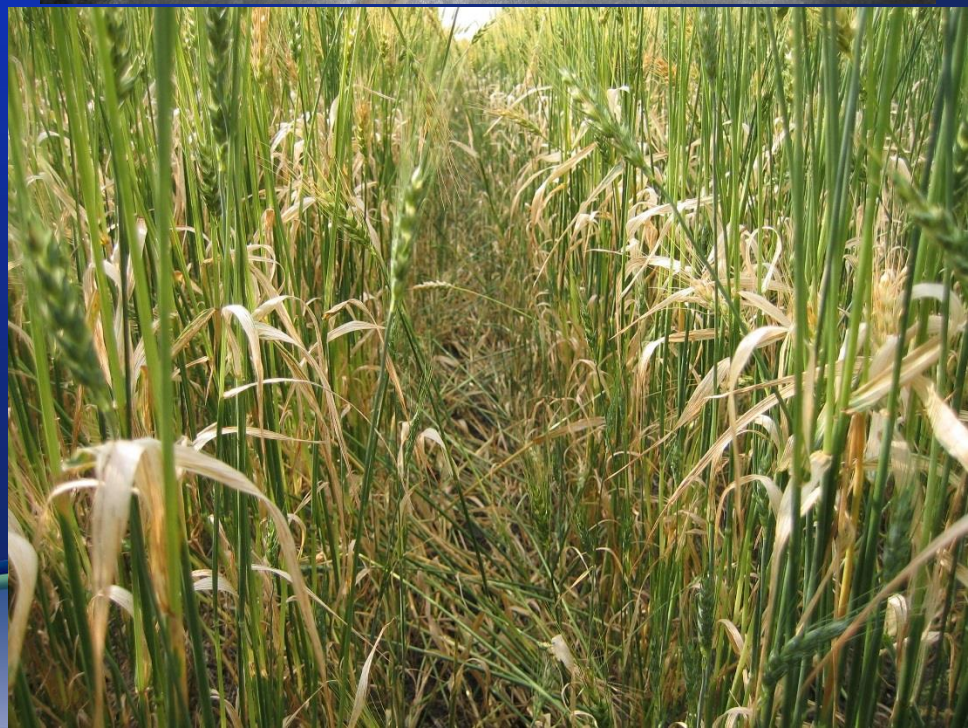
- Areas of poor growth
- Very low fertility levels
- These areas need nitrogen, phosphate, and sulphur to maintain a decent yield

Satellite Image

Slugs

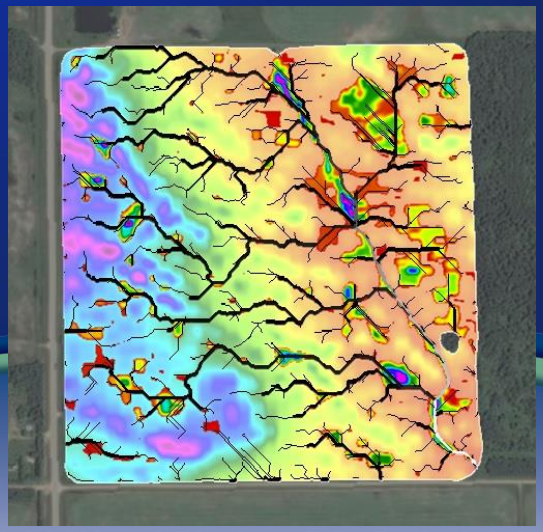
- Not fertility related





VR N-Serve

N-Serve
NITROGEN STABILIZER
1005
N-Serve
NITROGEN STABILIZER

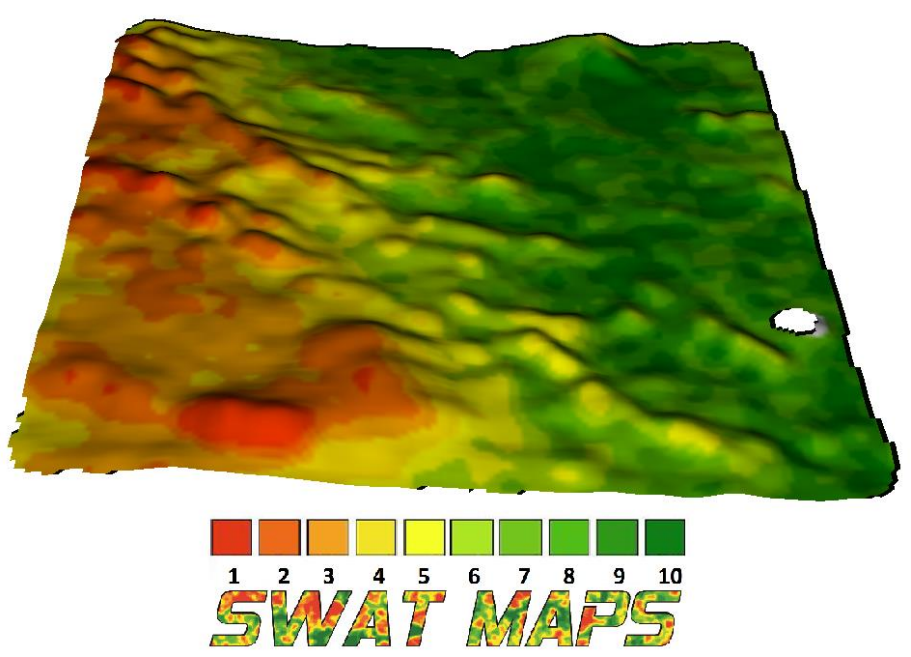


VR N Stabilizer

(could also do ESN or Super U)

	Acres	NH3 Layer #1	Nserv Layer #2
	2.9	80	Off
	15	80	Off
	18.7	80	Off
	11.8	80	Off
	12.6	70	Off
	14.3	70	Off
	13.7	60	On
	19.22	50	On
	26.3	30	On
	15.7	30	On
Total Acres	150	58.6	0

- 20,000ac at $12/ac
- 100% of ac = $240,000
- 30% of ac = $72,000



SWAT MAPS

Soil, Water And Topography MAPS

- Soil Potential MAPS
- Soil sensors / RTK
- Stable - field SWAT properties don’t change
- Soil sampling, Nmin tests, moisture monitor
- VR fertilizer and seed
- Spatial - For applying inputs in the “soil”

BAY MAPS

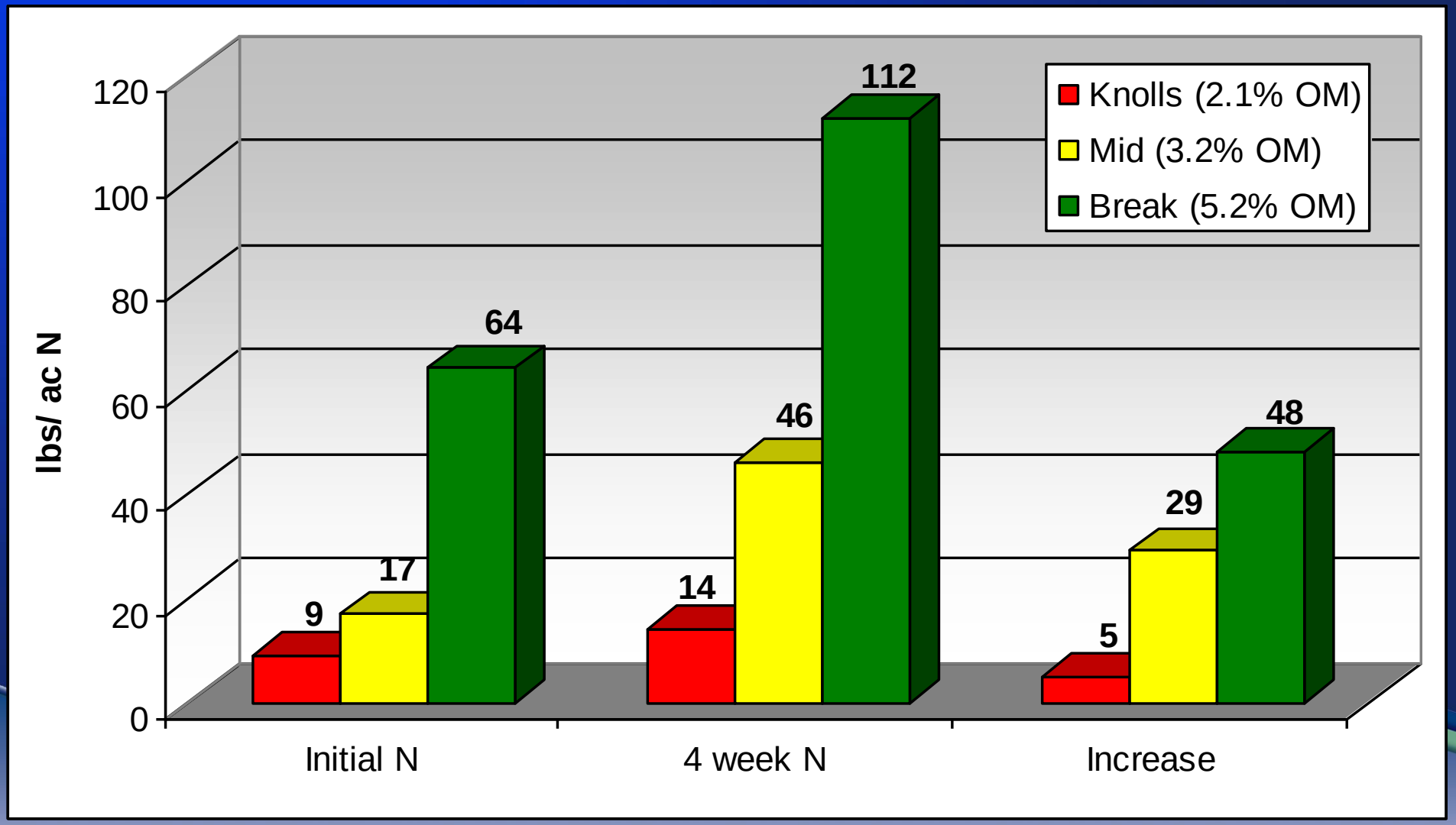
Biomass And Yield MAPS

- Yield Potential MAPS
- Drone, satellite, combine
- Unstable - changes when weather changes
- Crop health, chlorophyll, disease, insects, trials
- VR fungicide, dessicants
- Temporal - For applying inputs in the “crop”

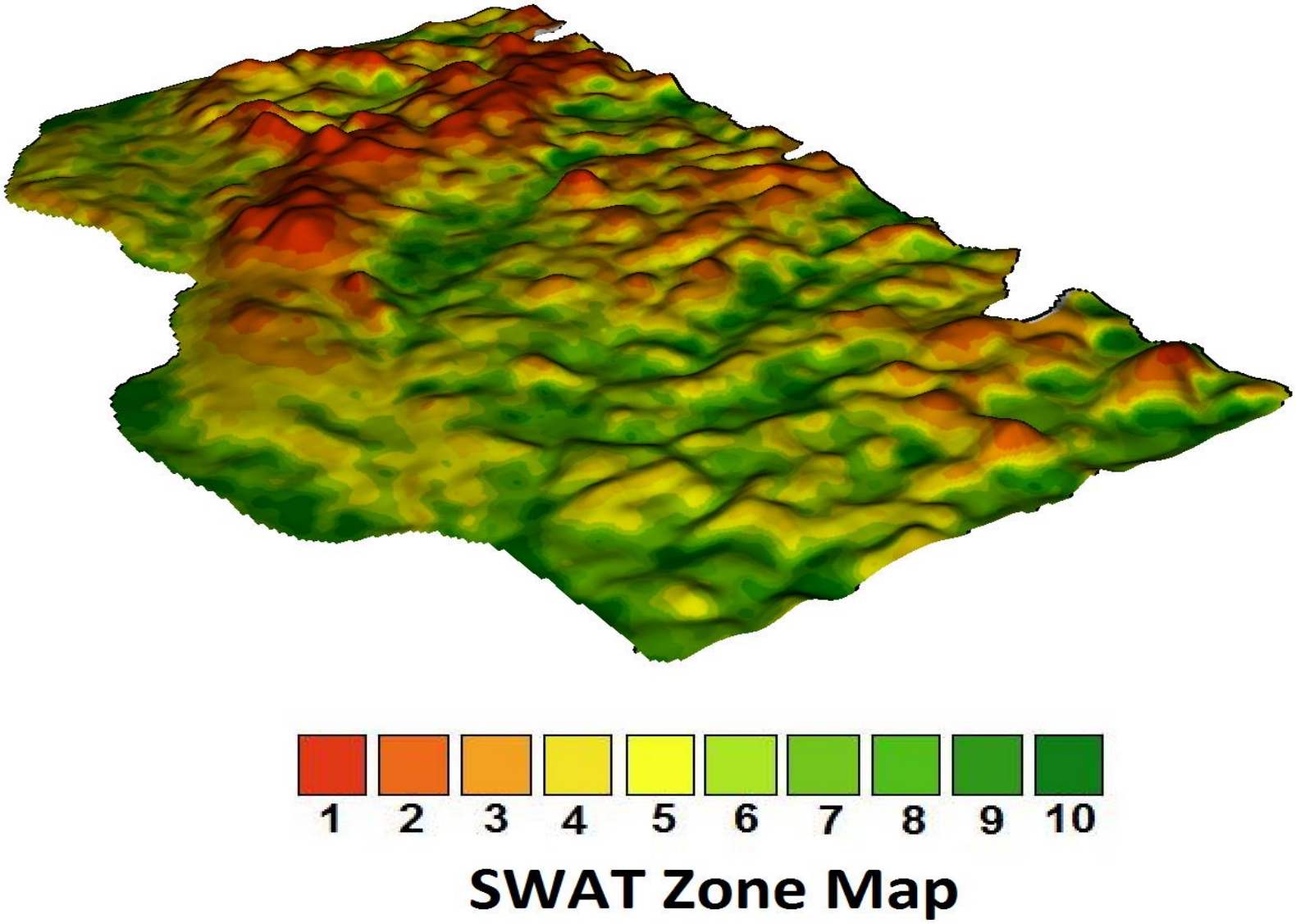
Henry Test – 23 fields by zone

Duplicate samples incubated 28 days for Nitrogen Mineralization
Fall 2015

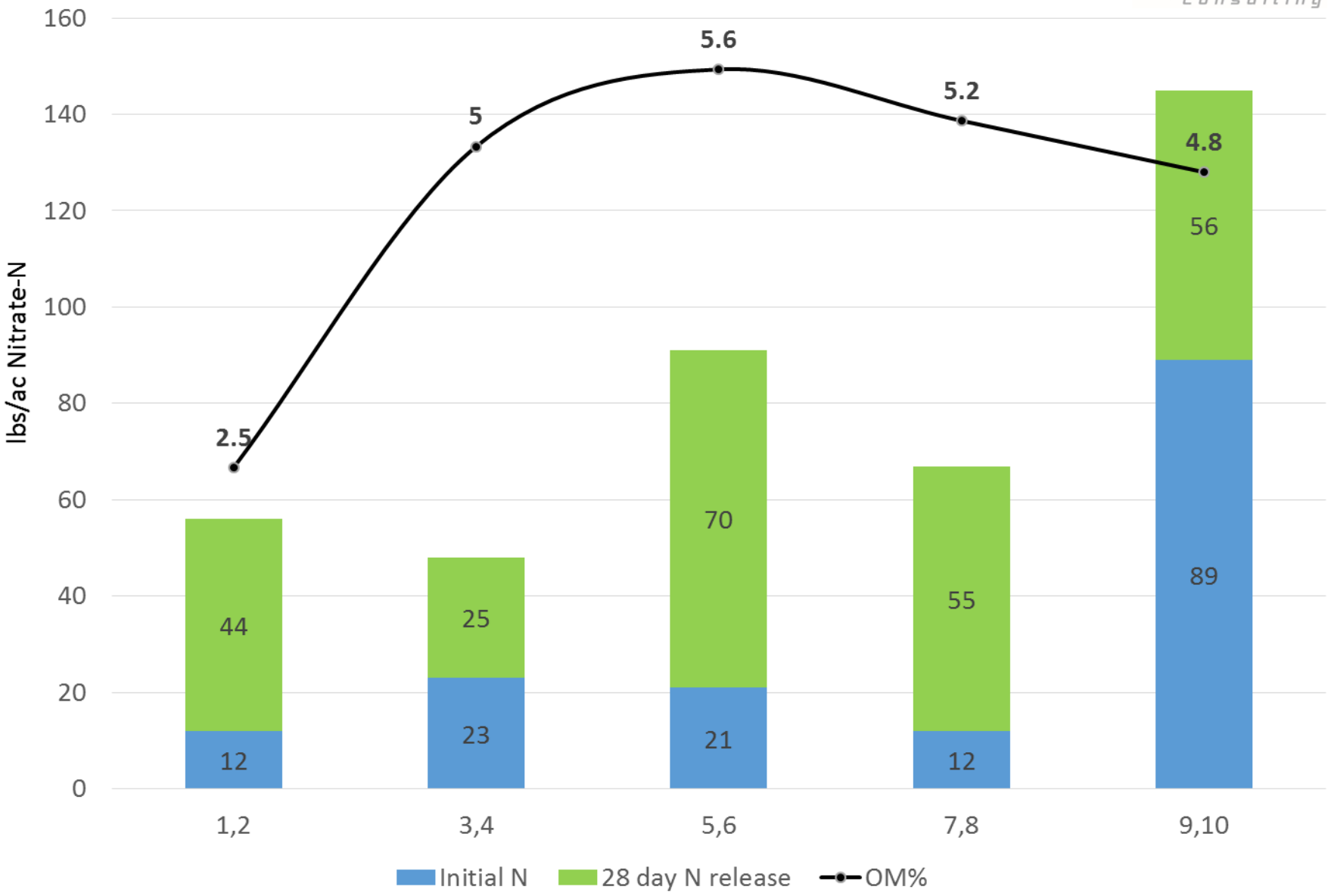
Les Henry's N Min Test



3-D SWAT MAPS

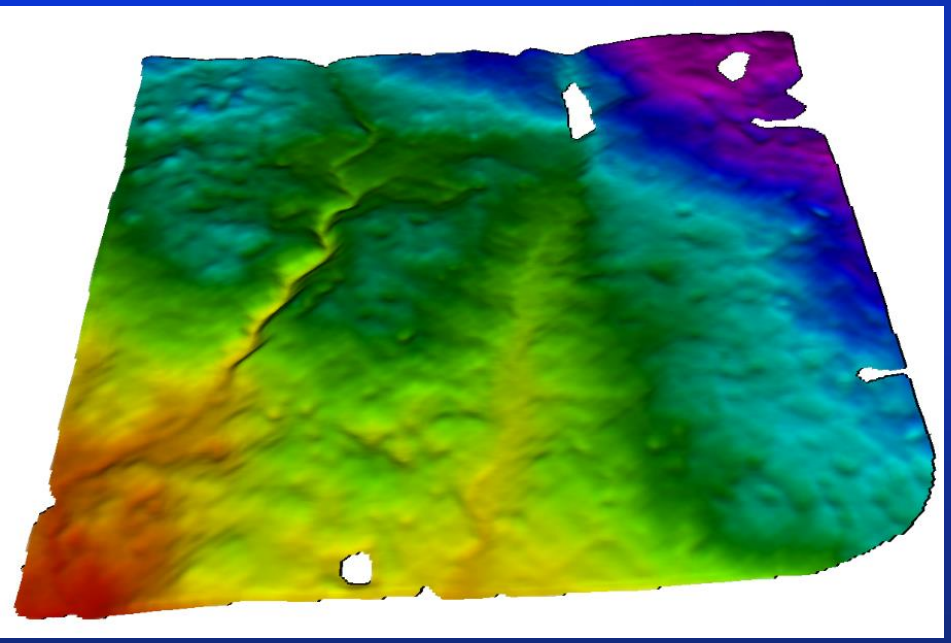


CF (Sowas East) - Henry Test 2015

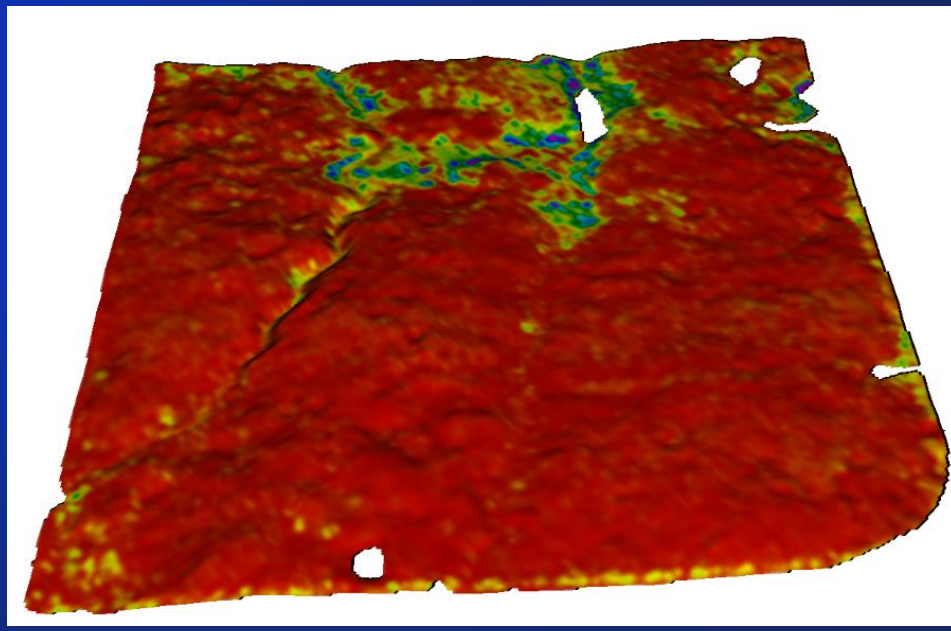


Creelman
(East of Weyburn)

Elevation



EC



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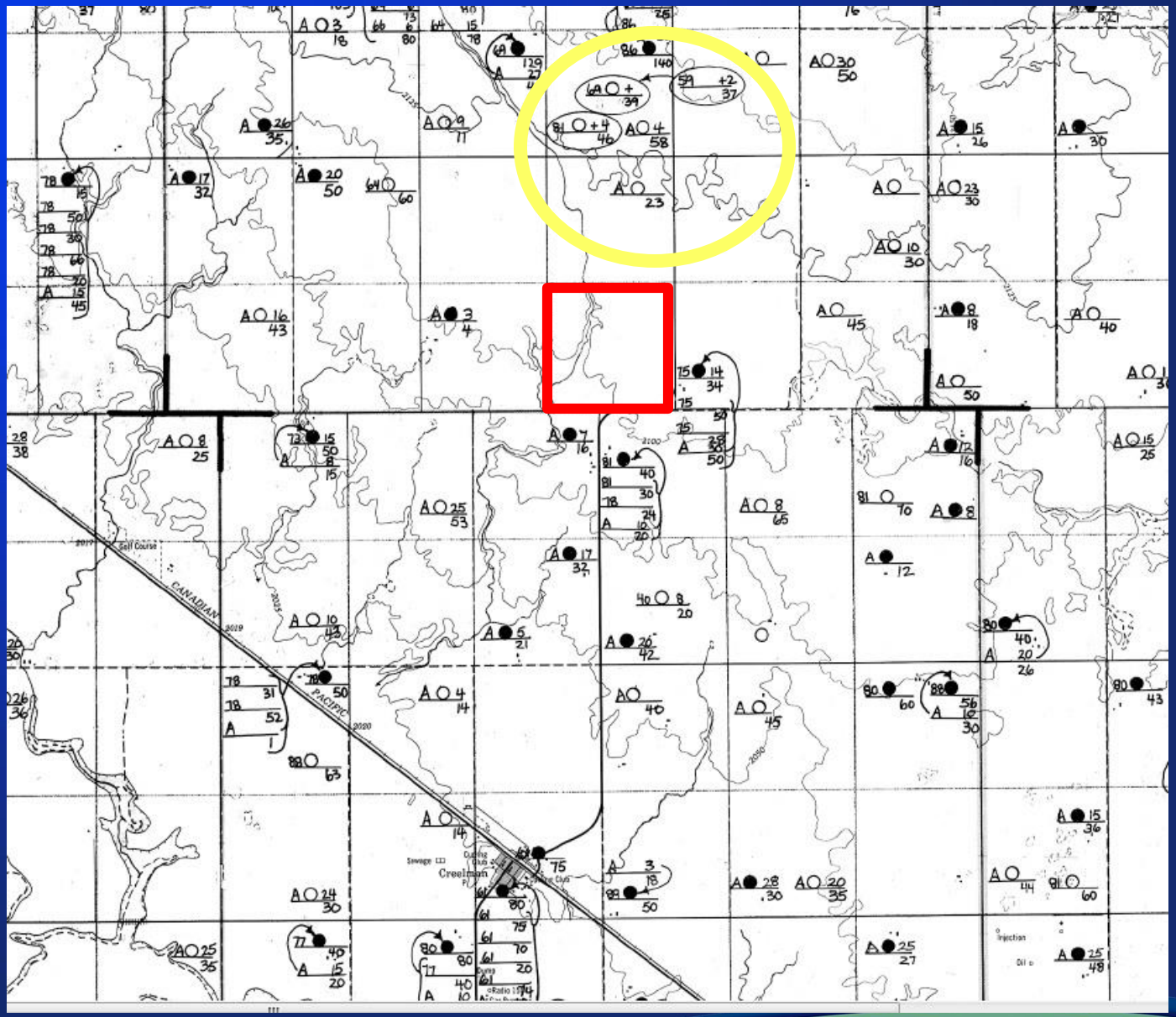
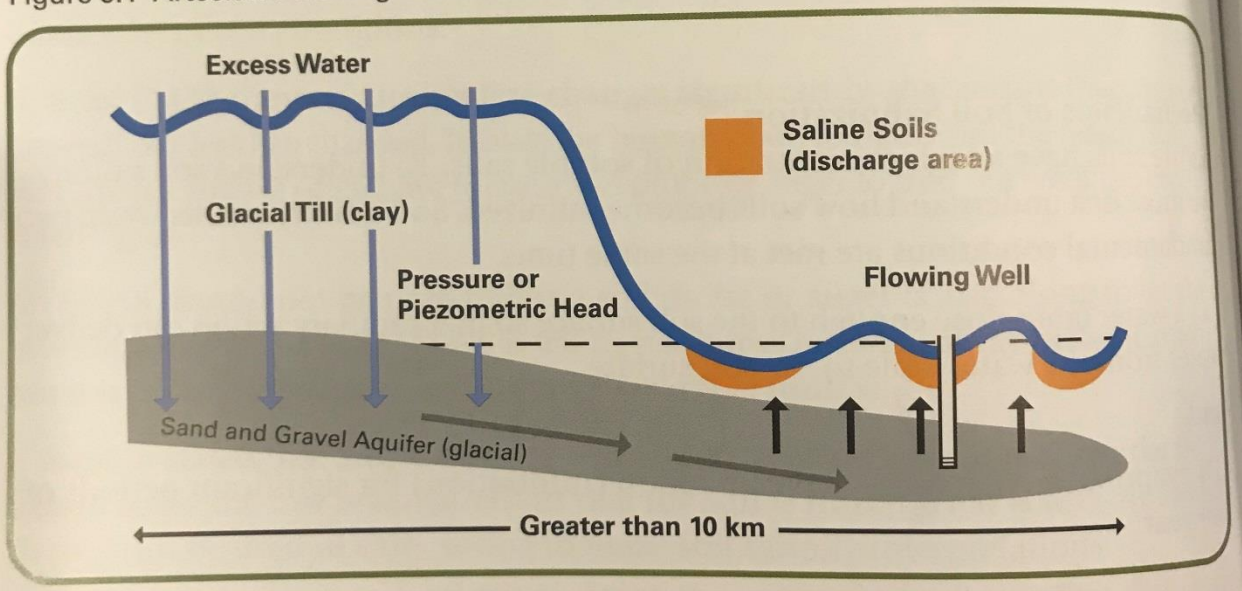


CropPro Consulting

1. Artesian Discharge

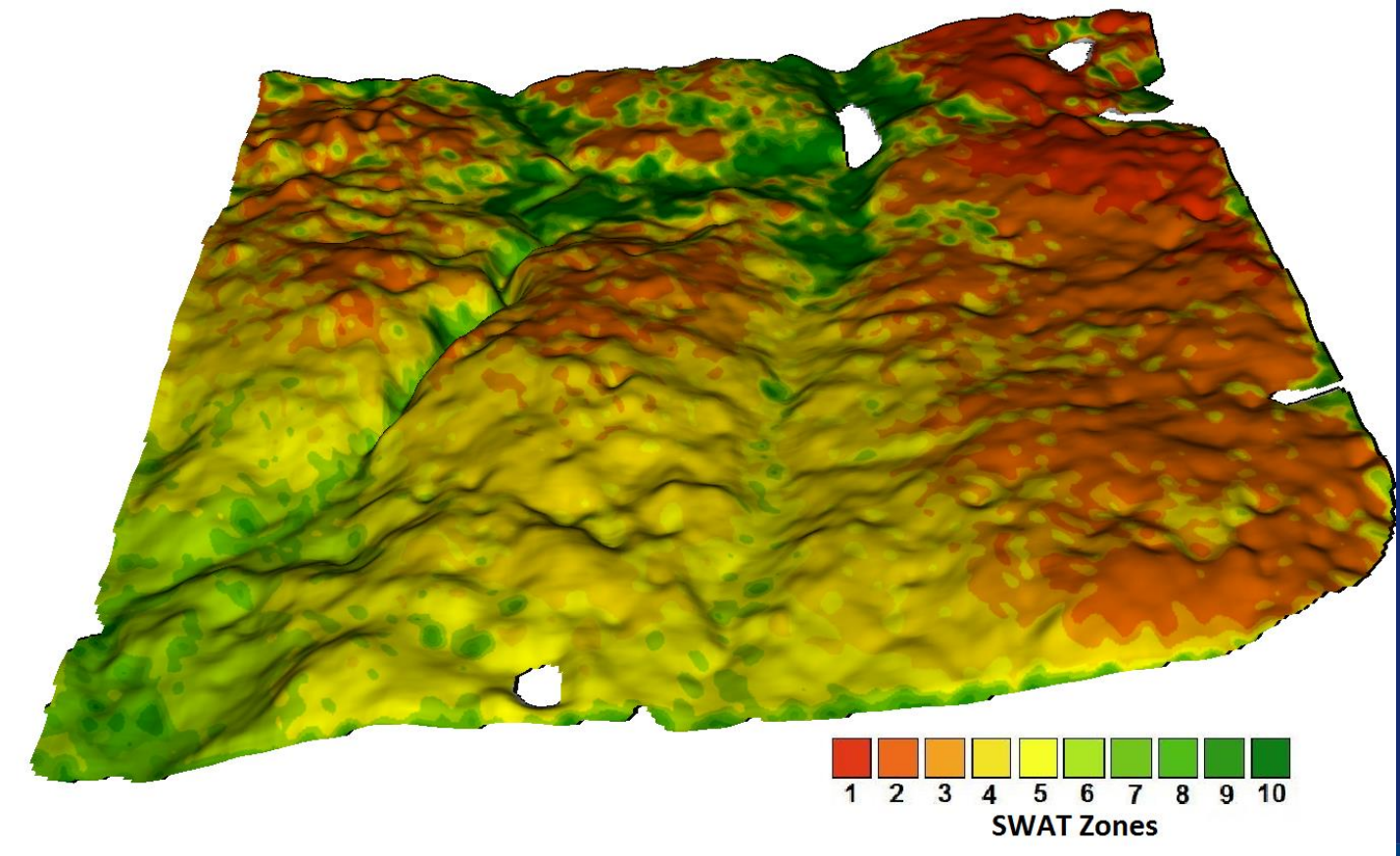
In the artesian discharge model, groundwater flow in an aquifer results in high pressure conditions where the aquifer 'pinches out'. If an aquifer drains as springs to a valley, no pressure will build up. Where no such natural drainage exists, pressure from the aquifer provides a constant upward flow component that maintains a high water table even under dry climatic conditions. Flowing wells are common in saline areas where artesian discharge is the culprit.

Figure 5.1 Artesian Discharge Mechanism of Soil Salinization



SWAT MAPS

Soil, Water And Topography MAPS



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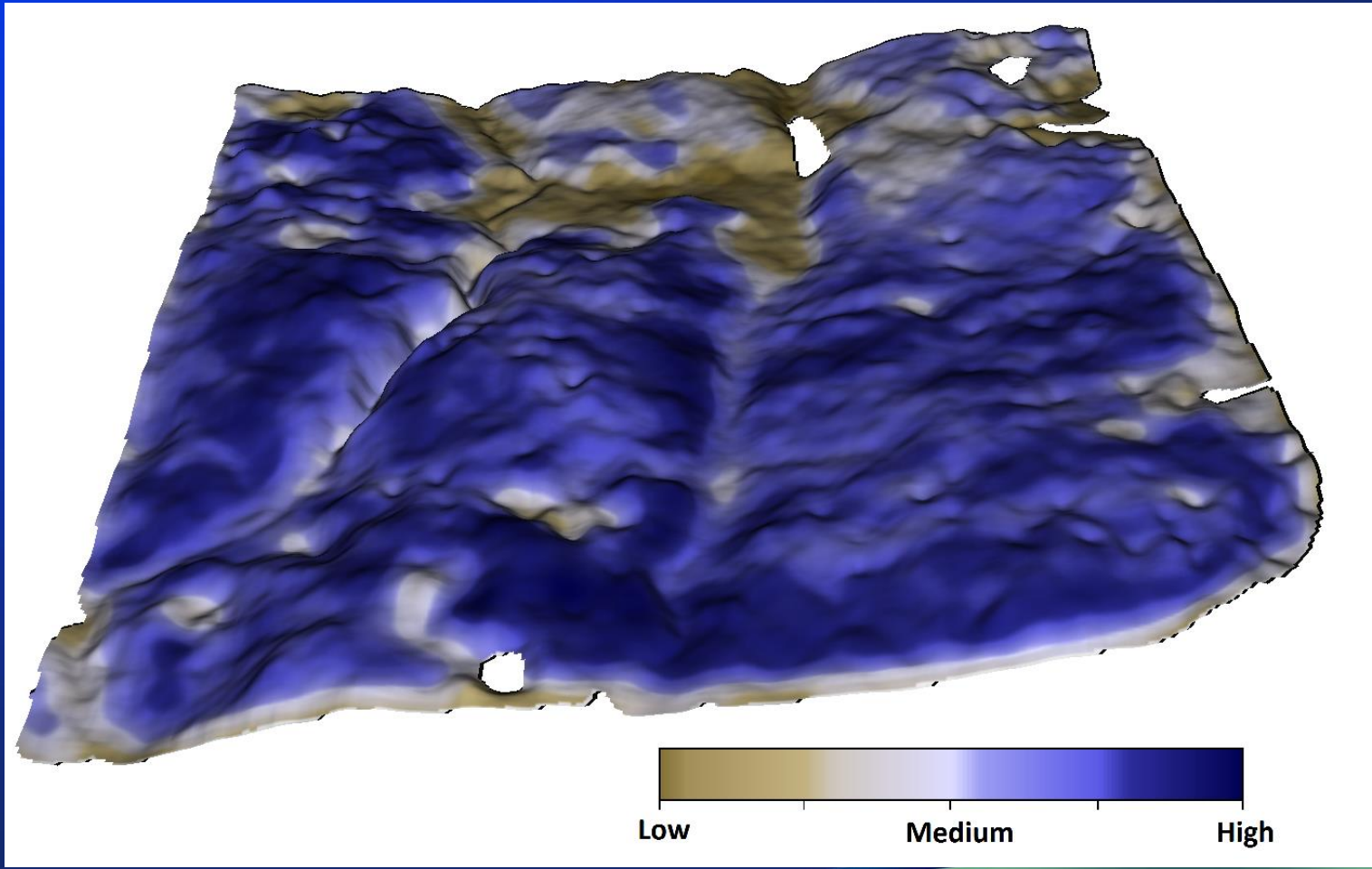
Zone 4 Zone 8 Zone 10

BAY MAPS

Biomass And Yield MAPS



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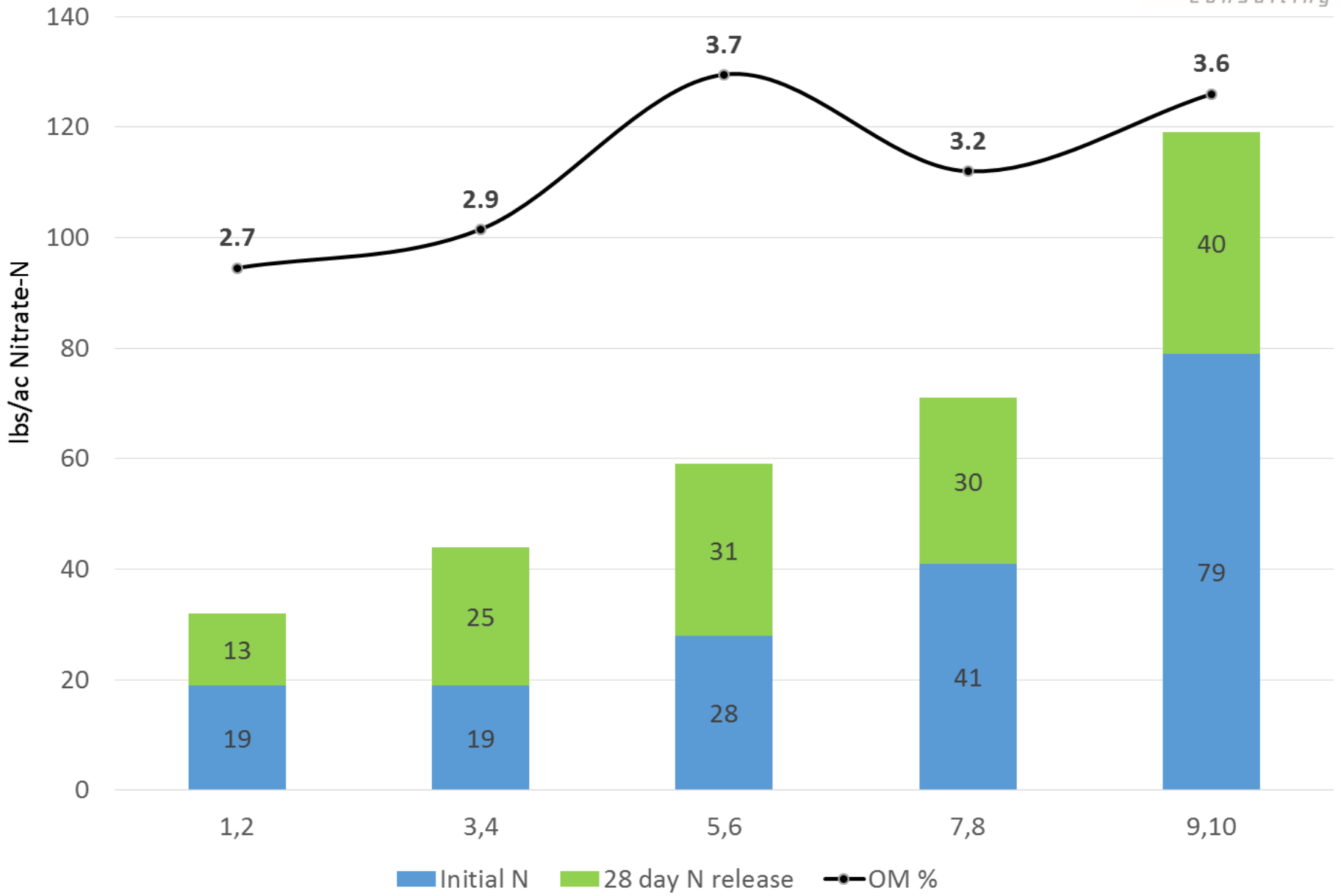
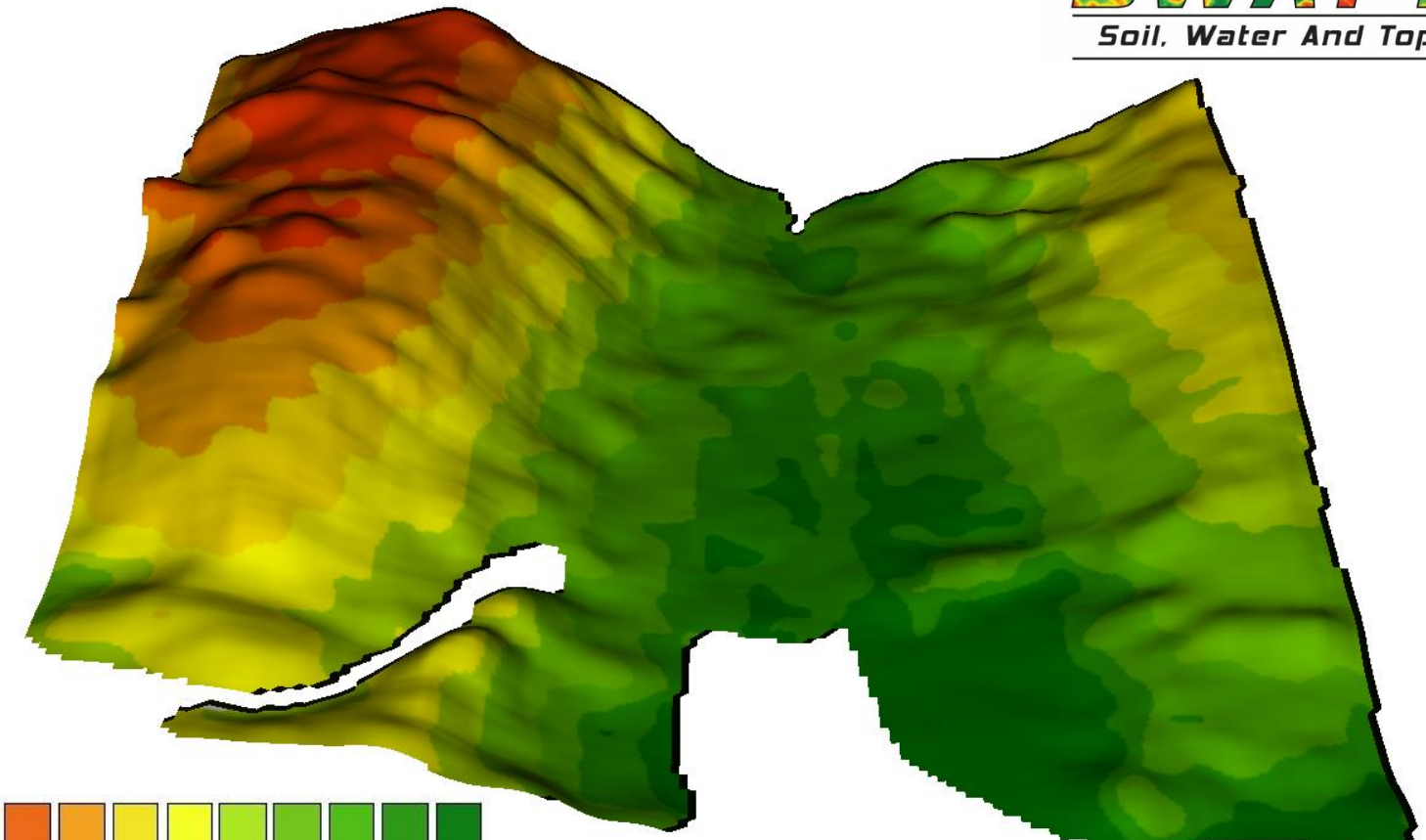
JVM (North Horner) - Henry Test 2015



St Brieux

SWAT MAPS

Soil, Water And Topography MAPS



1 2 3 4 5 6 7 8 9 10

SWAT Zones

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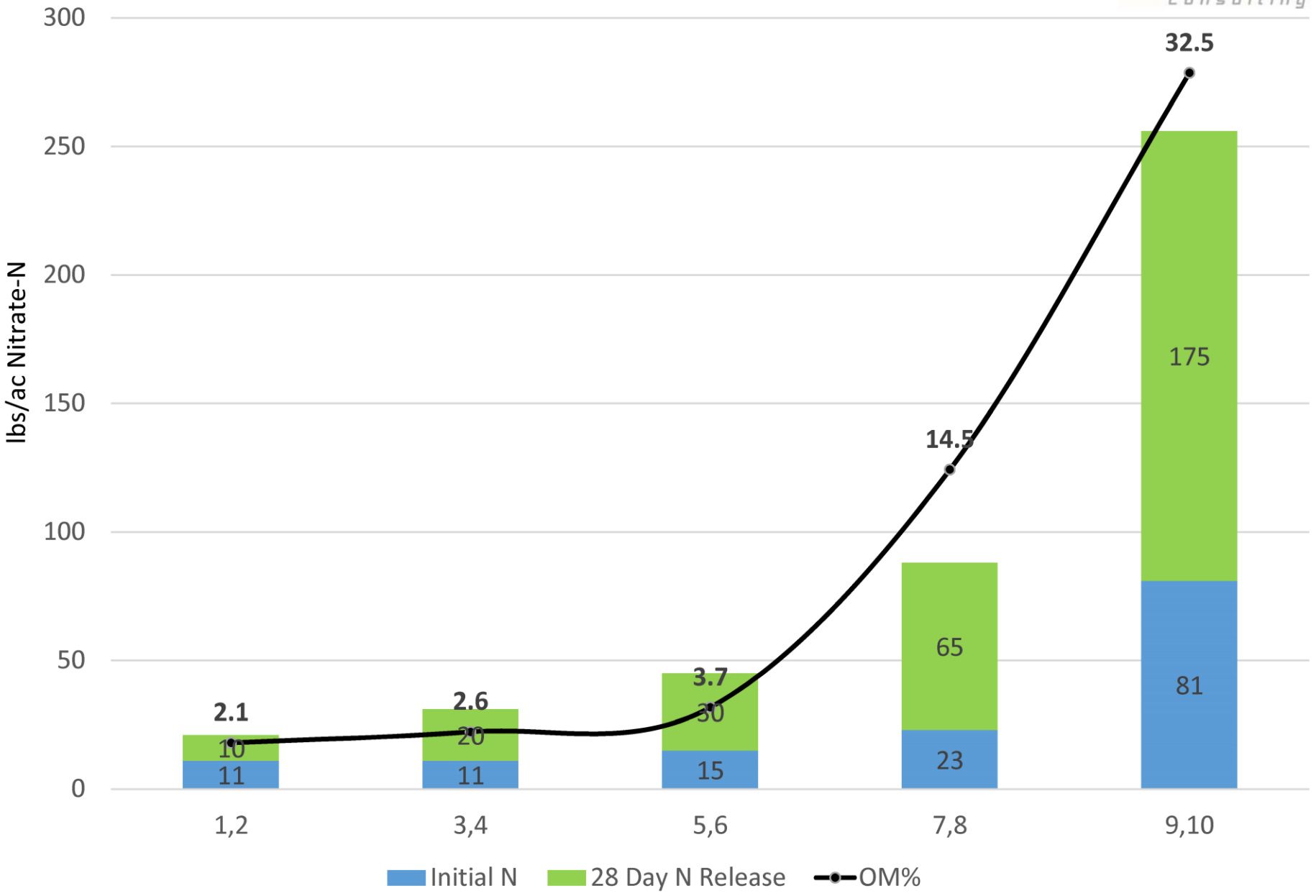
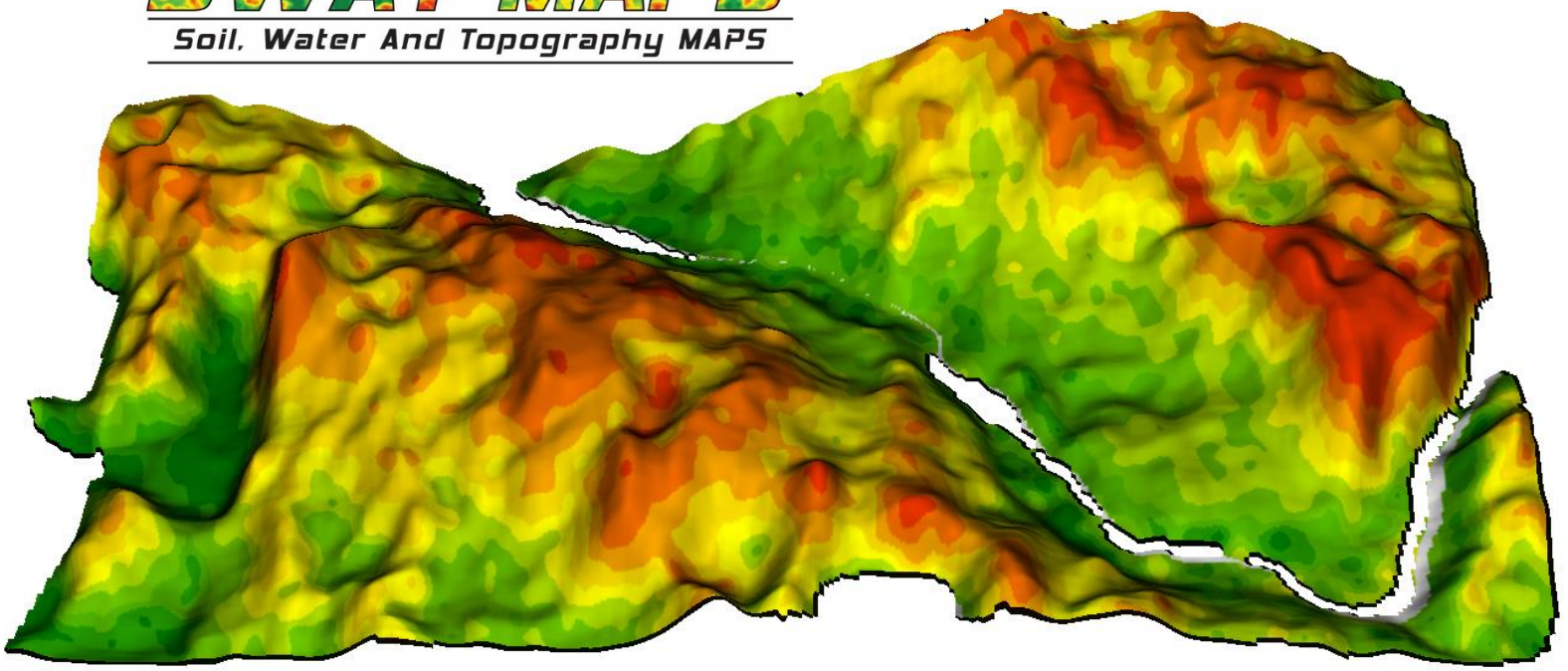
SR (E St.B) - Henry Test 2015



Meath Park

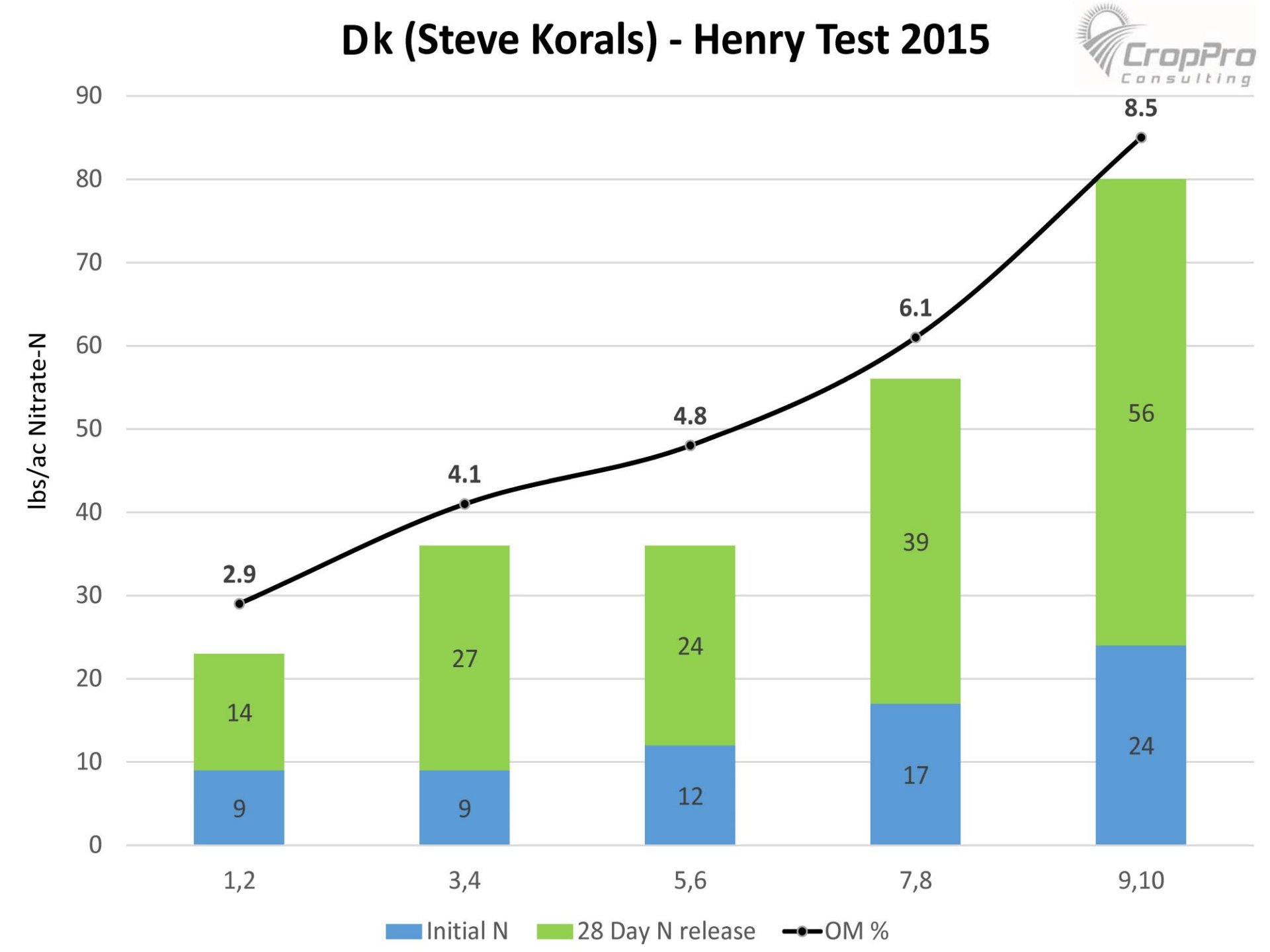
SWAT MAPS

Soil, Water And Topography MAPS



1 2 3 4 5 6 7 8 9 10

SWAT Zones


Dk (Steve Korals) - Henry Test 2015
CropPro Consulting
lbs/ac Nitrate-N
90
80
70
60
50
40
30
20
10
0
2.9
4.1
4.8
6.1
8.5
14
9
27
9
24
12
39
17
56
24
1,2
3,4
5,6
7,8
9,10
Initial N
28 Day N release
OM %

What happens if you have very saturated soils and do a Henry test?

Henry Test Summary

- Fall 2015
  - 50% of the fields the test seemed to be working
  - We made protocol changes and went at it again
- Spring 2016
  - was wet and many samples came in saturated
  - Half the samples had negative results – lost N!

Protein and Tissue Tests

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Background

- 53 fields of Zone Tissue Testing 2011-12
  - Canola – leaves at ground cover/bolting
  - wheat, barley, oats – flag leaf at early heading
  - Looking for potential uptake issues by zone
- 27 fields of Zone Protein % in 2012
  - Wheat and barley grain samples
  - Looking for trends in %N with protein by zone
  - Can tissue test N be used to manage protein

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Protein and %N Tissue Test

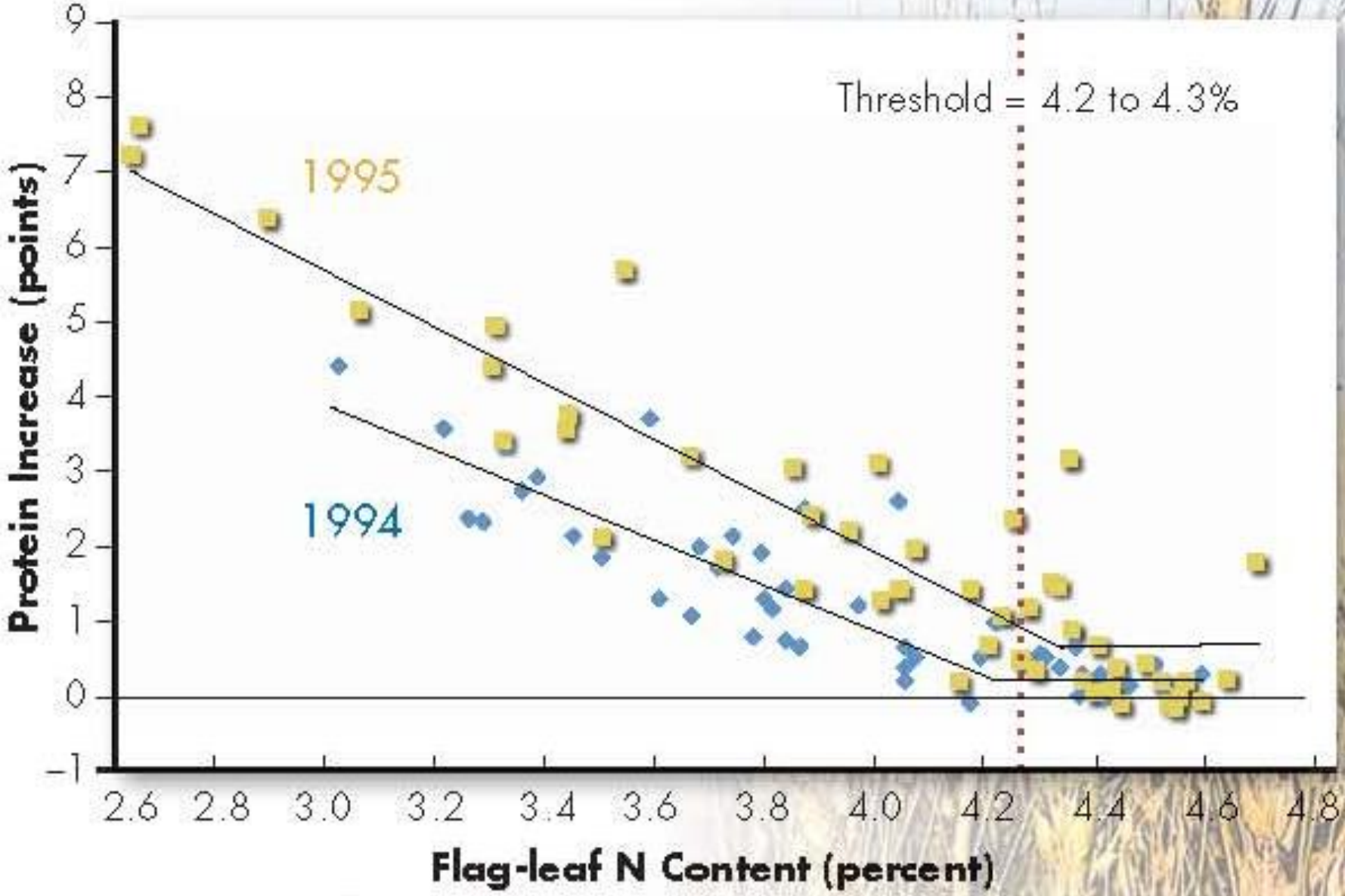


FIGURE 4. Irrigated spring wheat grain protein response to 40 lb N/acre top-dressed at heading for a range of flag-leaf N contents at flowering (*FF12*).

CropPro
CropPro

Naicam – barley 2012

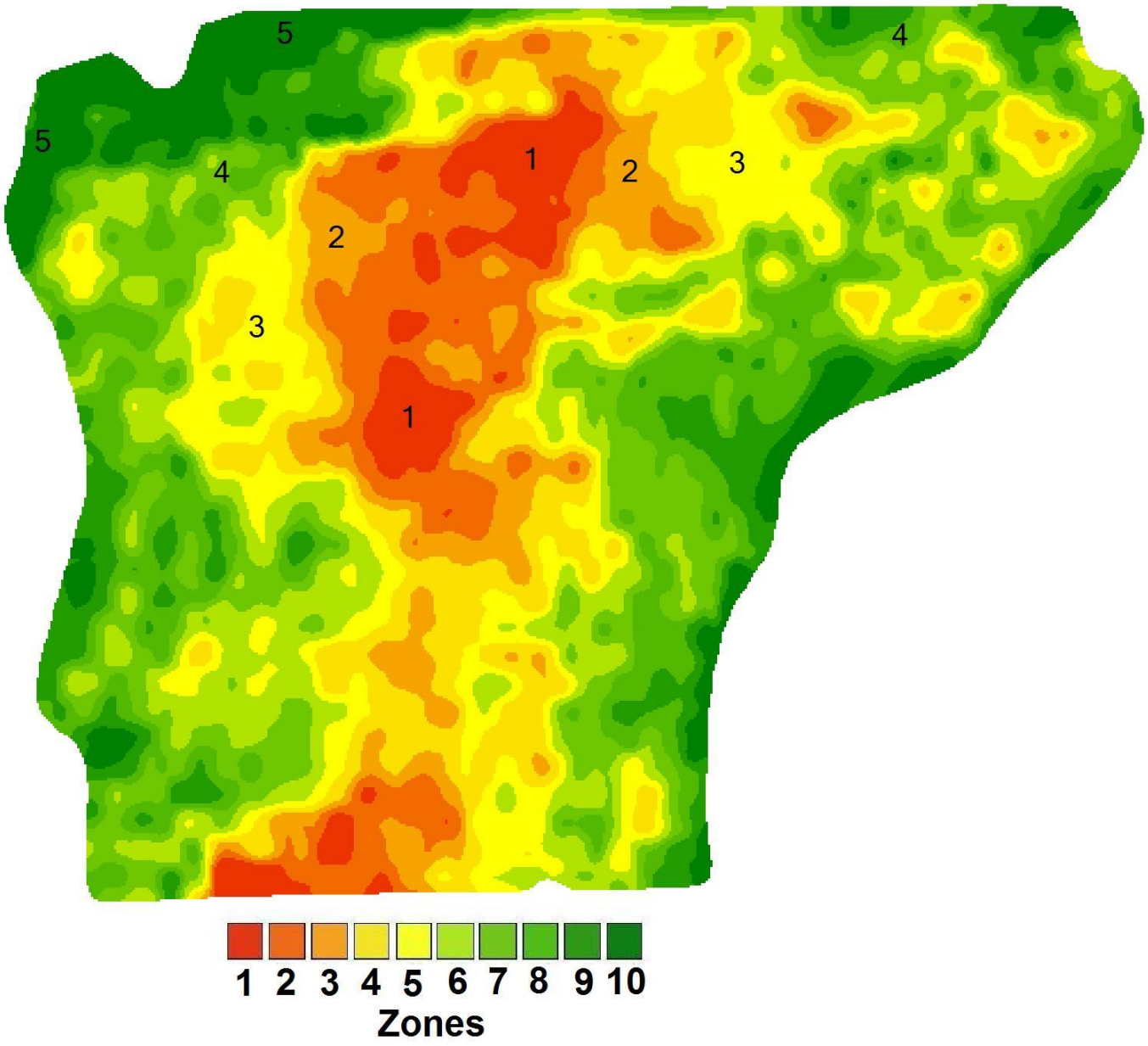


Figure 1

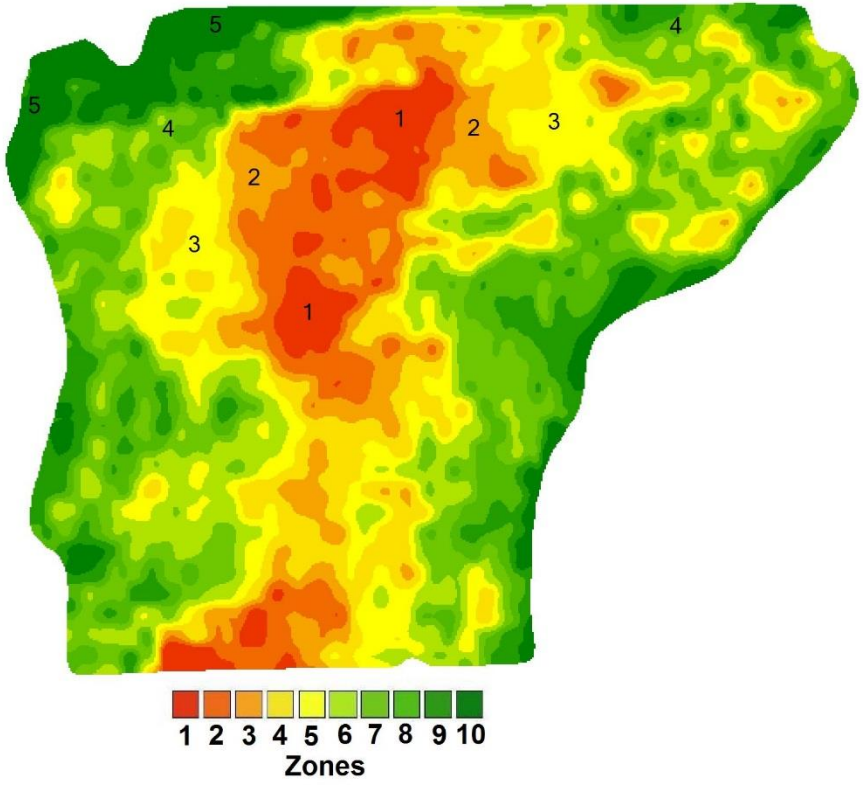
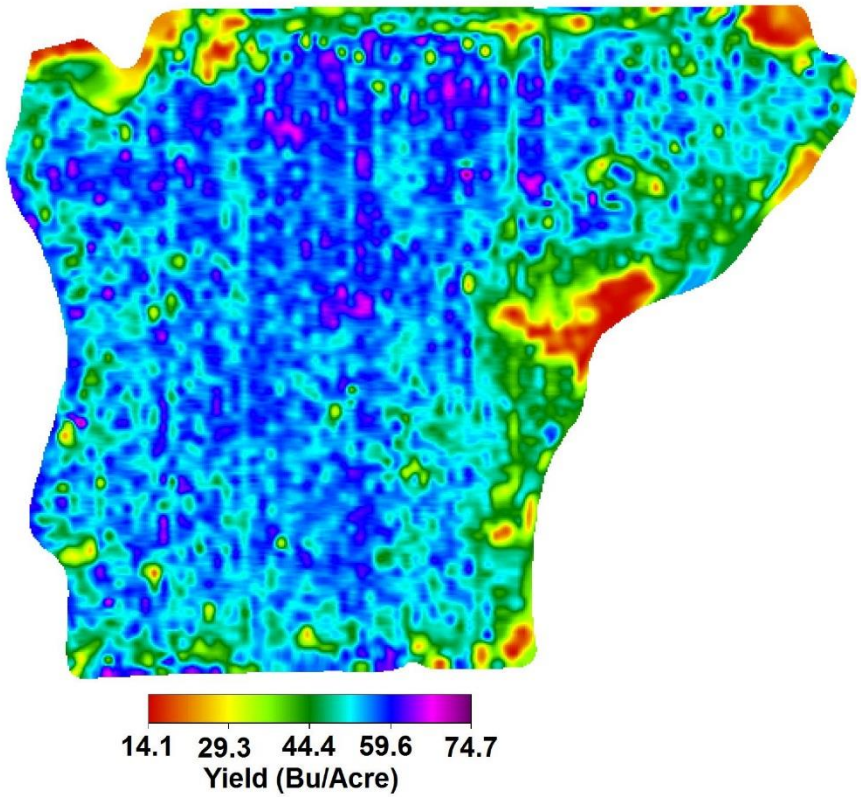


Figure 2



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Tissue Test Report

(4) Between Ditches - Malt Barley

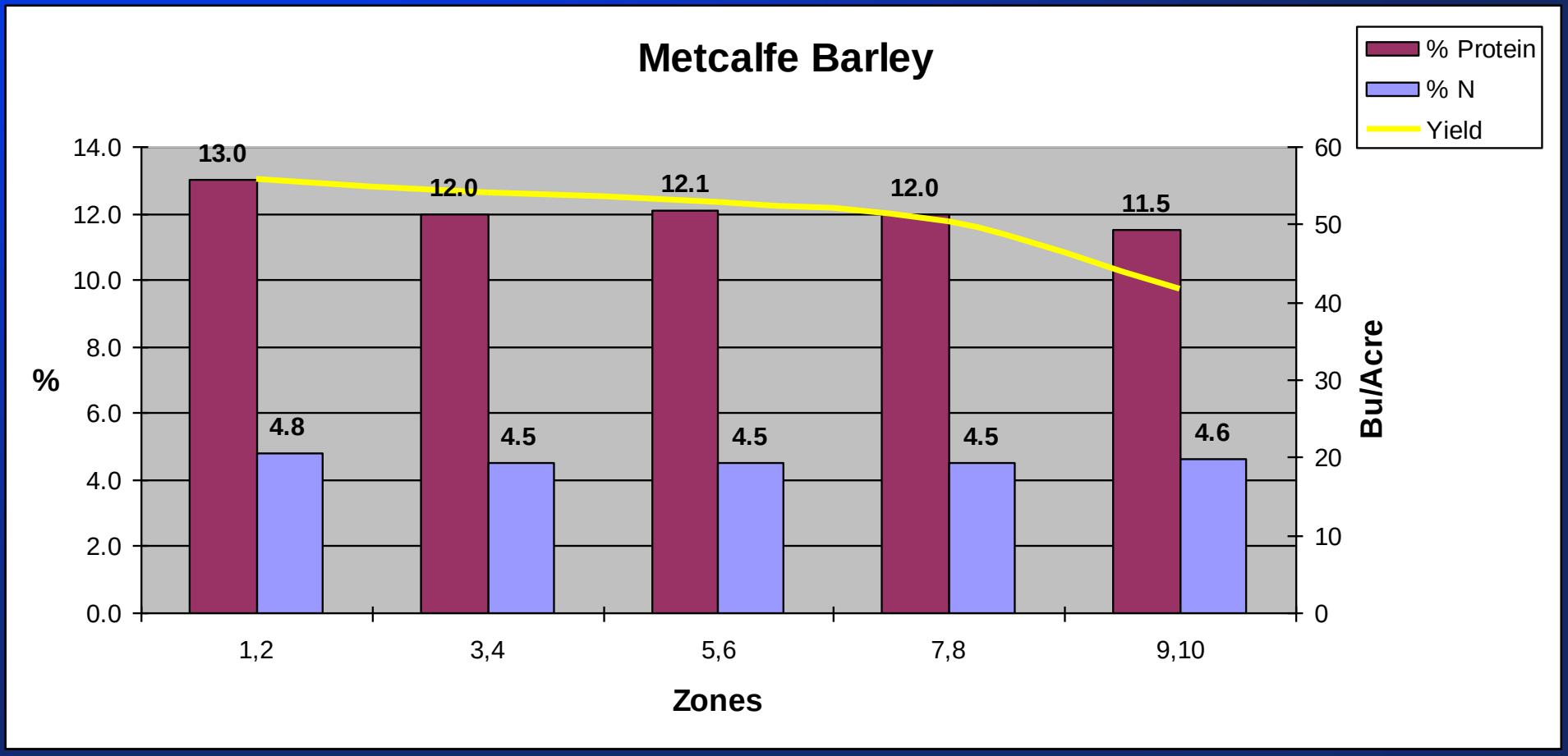
		REPORT OF ANALYSIS-PERCENT								REPORT OF ANALYSIS - PARTS PER MILLION				
SampleID		**N** Nitrogen	**P** Phosphorus	**K** Potassium	**Mg** Magnesium	**Ca** Calcium	**S** Sulfur	**Na** Sodium	**Cl** Chloride	**Fe** Iron	**Mn** Manganese	**B** Boron	**Cu** Copper	**Zn** Zinc
zone 1,2		**4.8**	**0.27**	**0.99**	**0.32**	**0.98**	**0.47**	**0.02**	**0.14**	**80**	**81**	**15**	**10**	**16**
BFT 6		H	L	D	S	H	S	S	L	S	S	S	S	L
BARLEY	High	4.5	0.5	3	0.4	0.5	0.5		0.5	250	100	24	24	70
NW16688	Low	3.6	0.3	2	0.15	0.3	0.2		0.21	50	25	3	5	70
stage of growth: Heading														
zone 3,4		**4.5**	**0.27**	**1**	**0.28**	**1.03**	**0.42**	**0.01**	**0.32**	**85**	**71**	**15**	**10**	**14**
BFT 7		S	L	D	S	H	S	S	S	S	S	S	S	L
BARLEY	High	4.5	0.5	3	0.4	0.5	0.5		0.5	250	100	24	24	70
NW16689	Low	3.6	0.3	2	0.15	0.3	0.2		0.21	50	25	3	5	70
stage of growth: Heading														
zone 5,6		**4.5**	**0.27**	**1.07**	**0.25**	**0.91**	**0.42**	**0.02**	**0.25**	**70**	**47**	**13**	**10**	**16**
BFT 8		S	L	D	S	H	S	S	S	S	S	S	S	L
BARLEY	High	4.5	0.5	3	0.4	0.5	0.5		0.5	250	100	24	24	70
NW16690	Low	3.6	0.3	2	0.15	0.3	0.2		0.21	50	25	3	5	70
stage of growth: Heading														
zone 7,8		**4.6**	**0.29**	**1.27**	**0.25**	**0.84**	**0.45**	**0.01**	**0.2**	**90**	**33**	**11**	**10**	**16**
BFT 9		H	L	L	S	H	S	S	L	S	S	S	S	L
BARLEY	High	4.5	0.5	3	0.4	0.5	0.5		0.5	250	100	24	24	70
NW16691	Low	3.6	0.3	2	0.15	0.3	0.2		0.21	50	25	3	5	70
stage of growth: Heading														
zone 9,10		**4.6**	**0.26**	**1.53**	**0.29**	**0.49**	**0.53**	**0.03**	**0.23**	**82**	**19**	**18**	**8**	**14**
BFT 10		H	L	L	S	S	H	S	S	S	L	S	S	L
BARLEY	High	4.5	0.5	3	0.4	0.5	0.5		0.5	250	100	24	24	70
NW16692	Low	3.6	0.3	2	0.15	0.3	0.2		0.21	50	25	3	5	70
stage of growth: Heading														

D or Deficient, L or Low, S or Sufficient, H or High, E or Excessive

Brad Dunnington, Dip Ag
874-8112

What would you expect the typical % protein trend to be in the field?

Trend in %N and Protein



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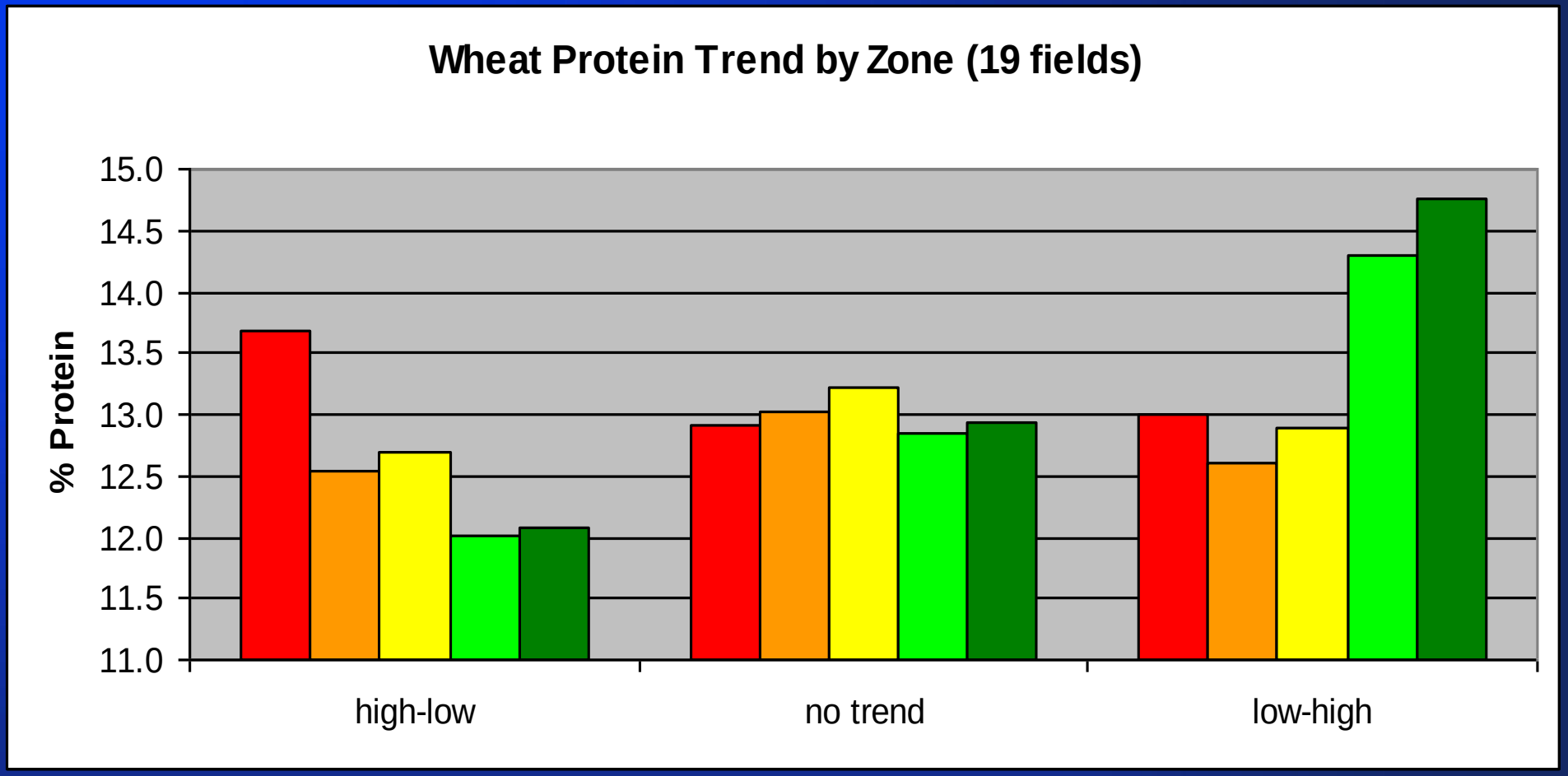

37% (10) 56% (15) 7% (2)

Wheat and Barley Trend?

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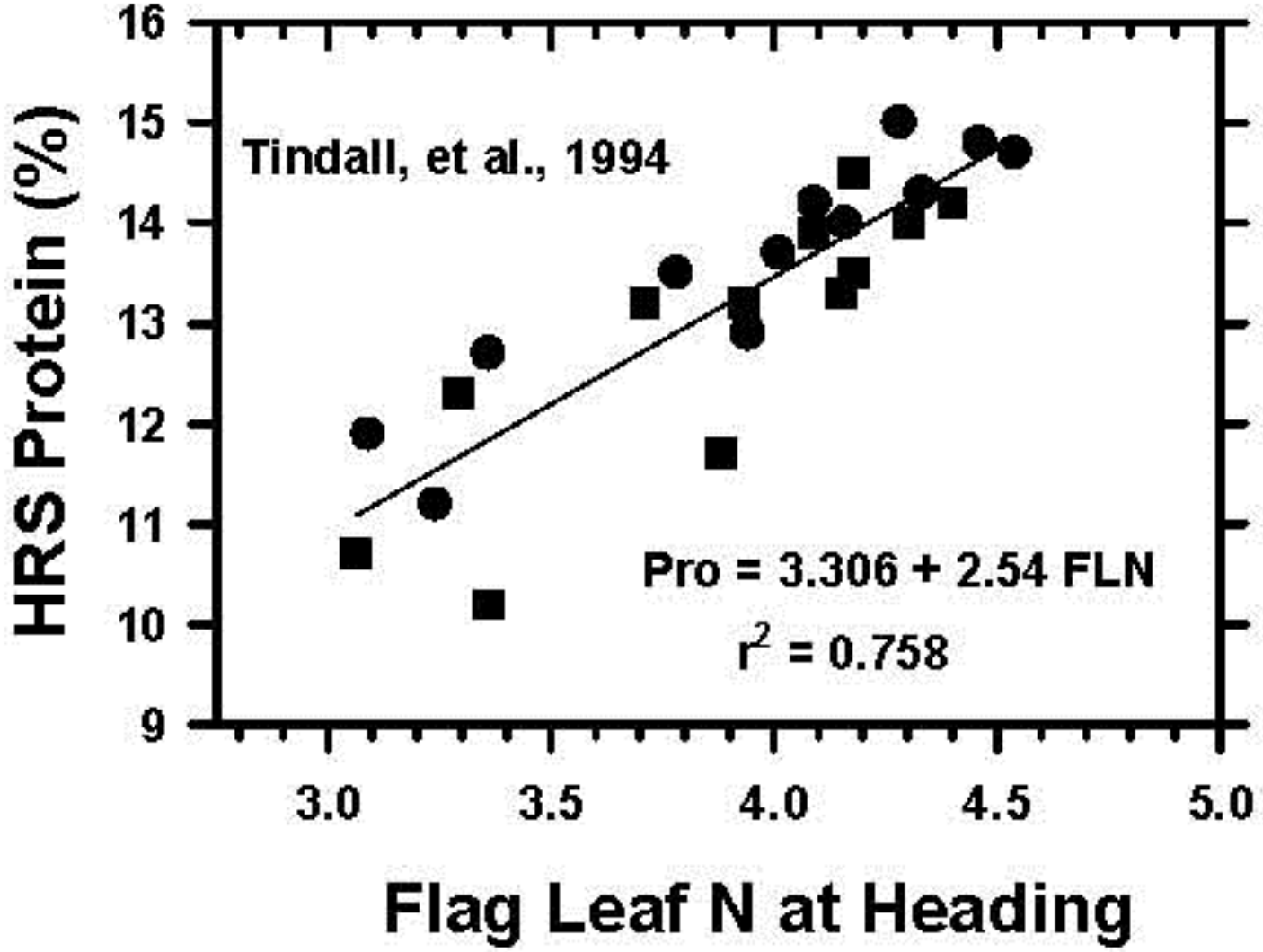

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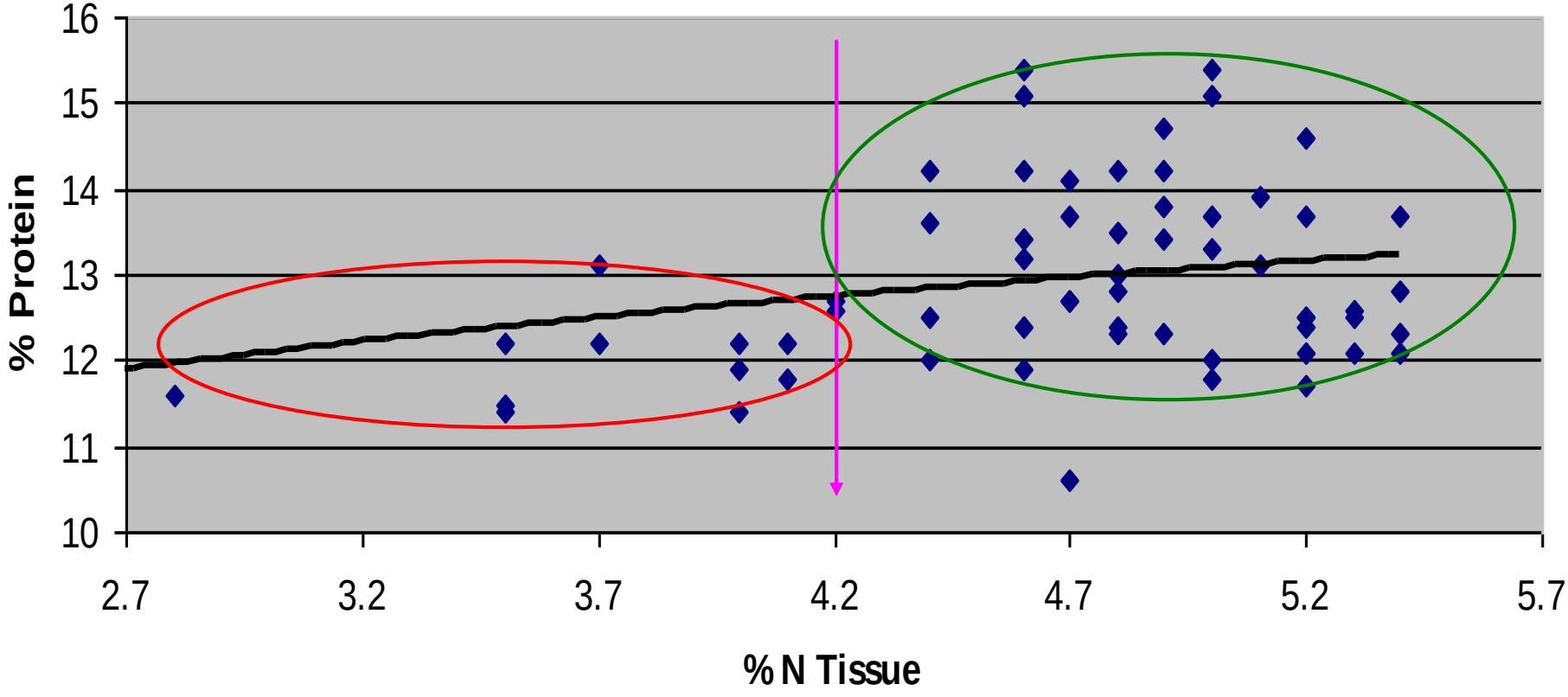
Wheat Tissue Test versus Protein (64 samples)



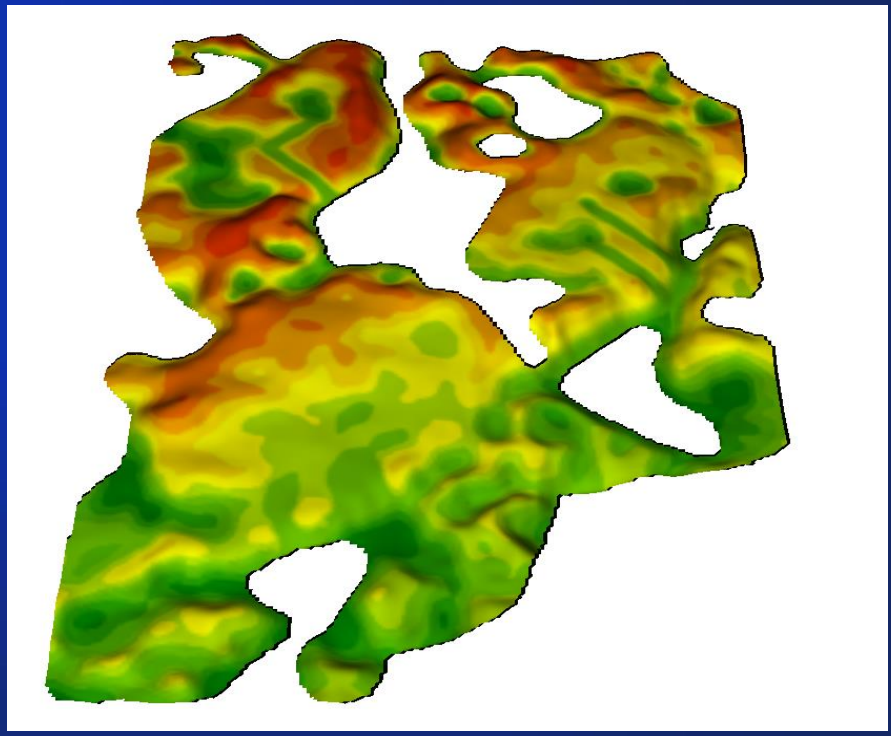
CropPro Consulting

Adam Gurr – Agritruth
Faller wheat maps

CropScan

Features

- Real Time Protein, Moisture and Oil results
- Paddock Mapping
- Bin by Bin Averaging
- Data Management Tool
- Cloud Base Data storage
- Sample Scan every 10-15 seconds
  - 3500 measurements per day
  - 150,000 measurements per harvest



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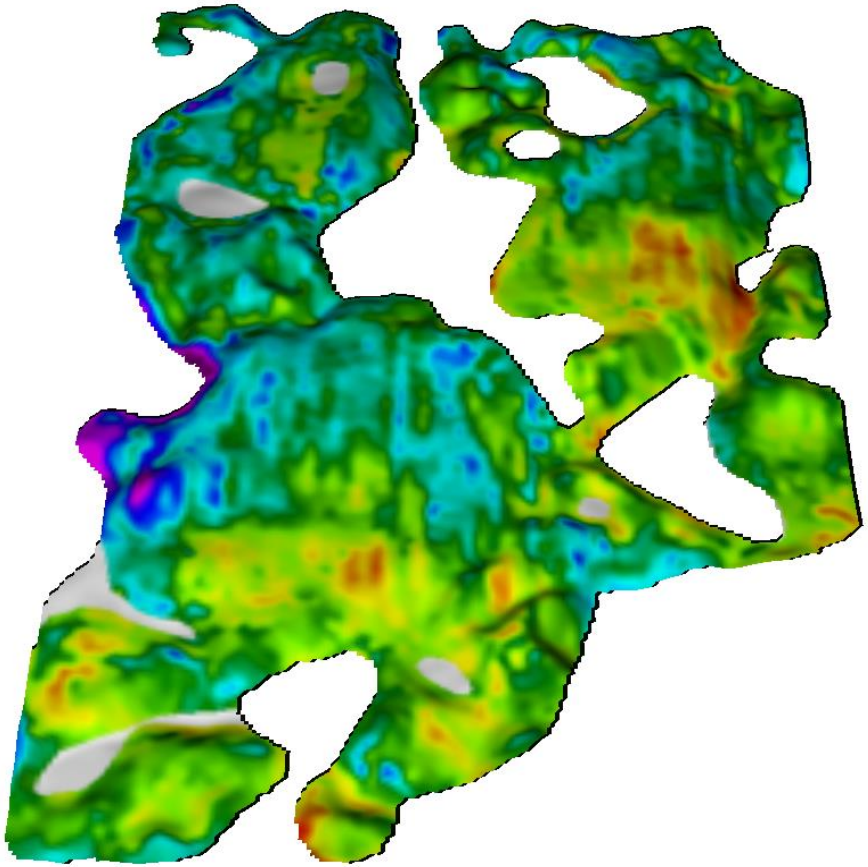
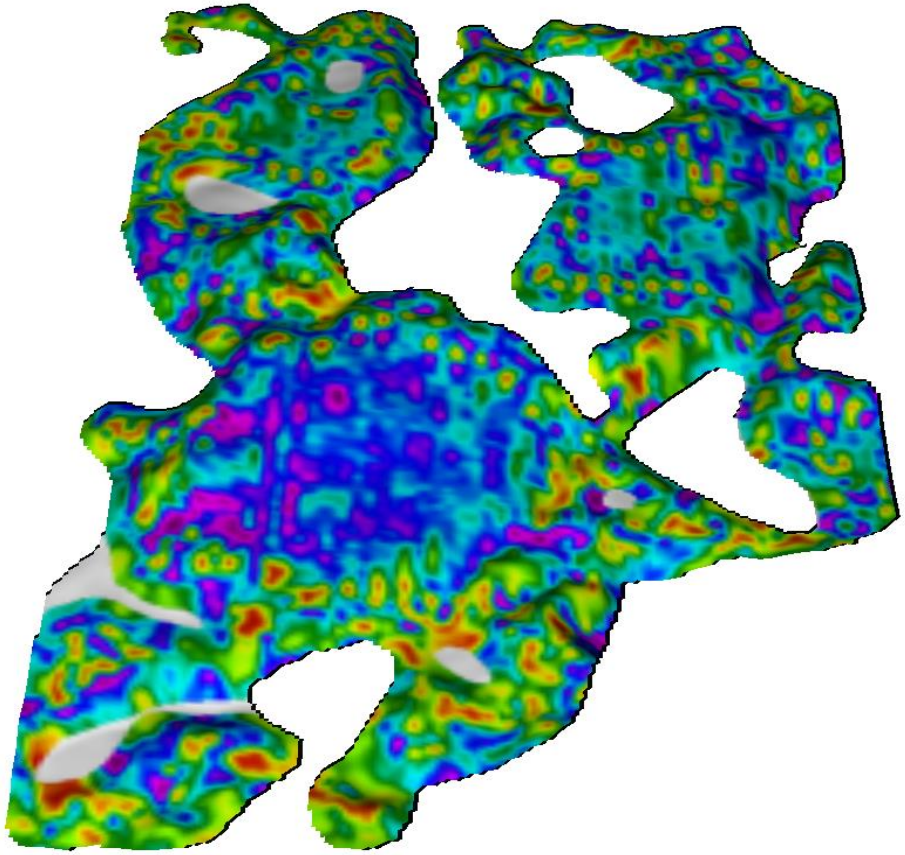
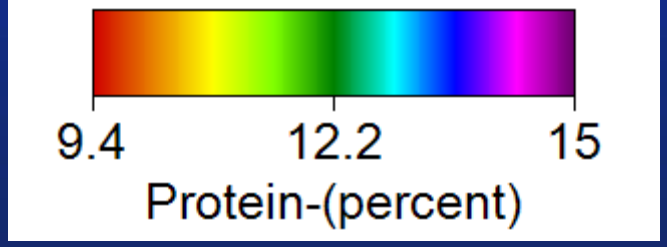
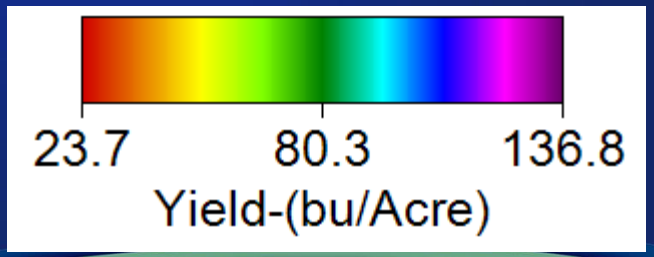
Is % Protein mostly influenced by Yield? Or N min potential? Or Water?









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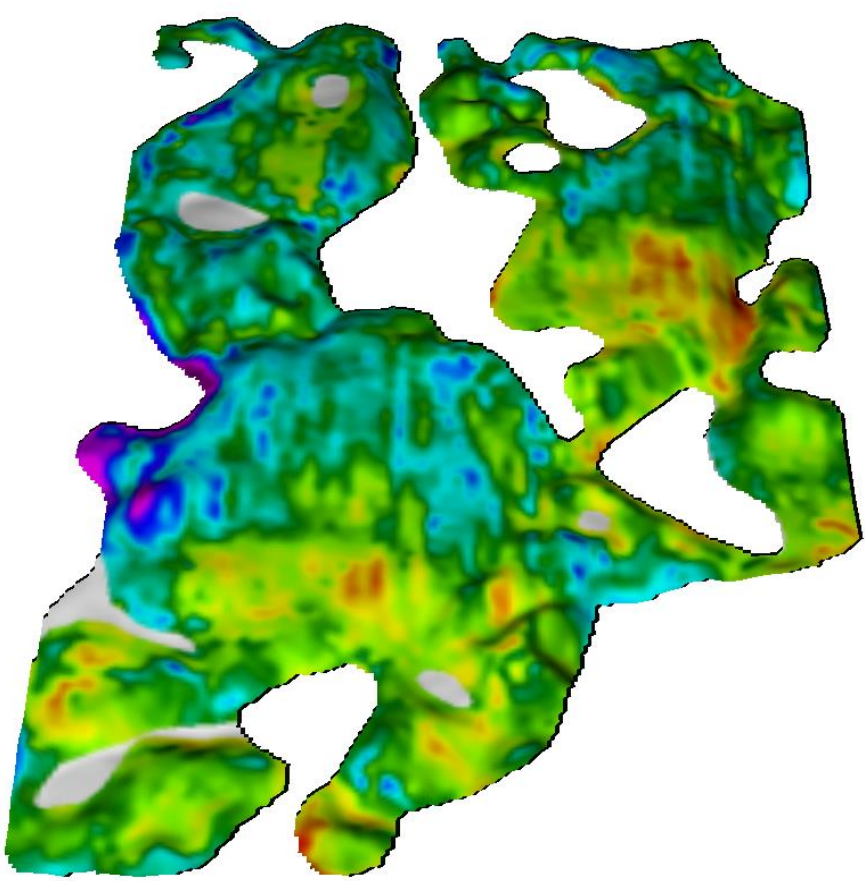

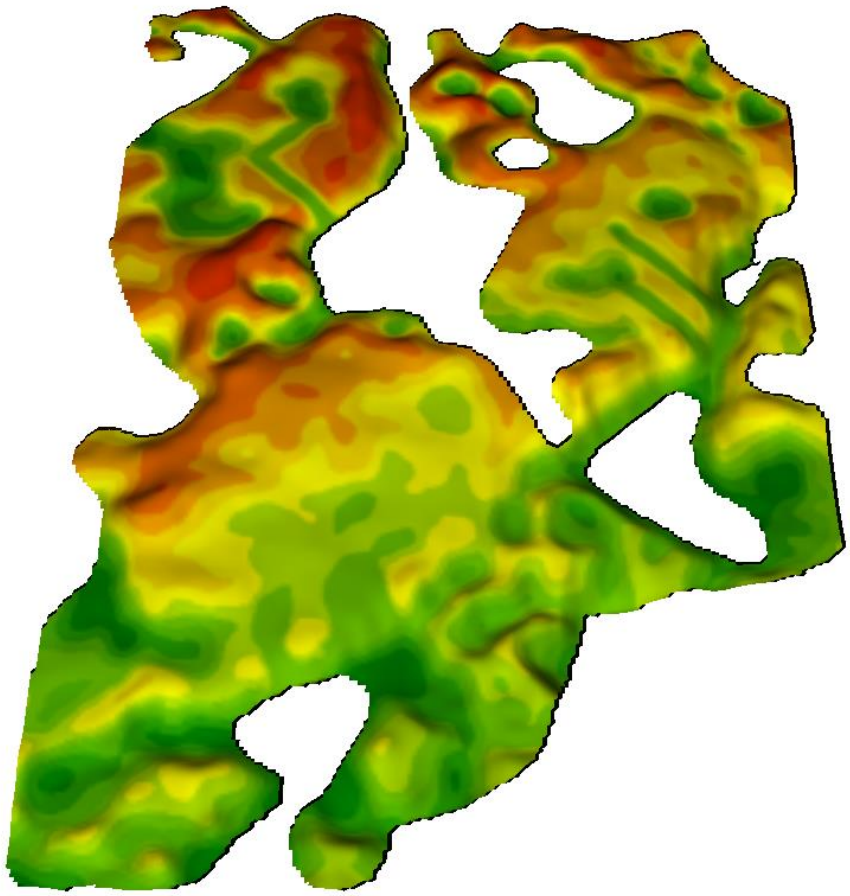

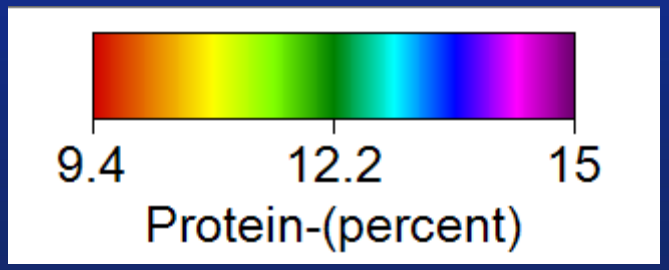

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Protein and % N Summary

- Potential to use %N at flag to predict potential response to N to boost protein
- Over 4.2% odds of a protein boost are low
- In 2012 about 1/3 of fields showed higher protein on zone 1,2 or else trended flat
- Overall trend to high end of %N in all crops in all zones

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“Start with the End in Sight”

The foundation of VR Fertility is…?

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Thank You

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