Drones in Agriculture The Saskatchewan Experience

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Topics

- Where did I Start?
- What did I learn?
- What works best?
- How can remotely sensed images help agriculture?
- What holds back the general use of remote sensing in Ag?
- What do we need to do?
- What works for growers?

Where did I Start?

- Started with two fixed wing drones to learn the industry
- Each survived one season
- Flew over 50 missions with 50 hours of airtime piloting the aircraft
- In 2015 we upgraded to the RF-70, a Phantom, and a Manned Cessna Aircraft
- In 2016 operations were moved nearly exclusively to Cessna aircraft

What did I learn?

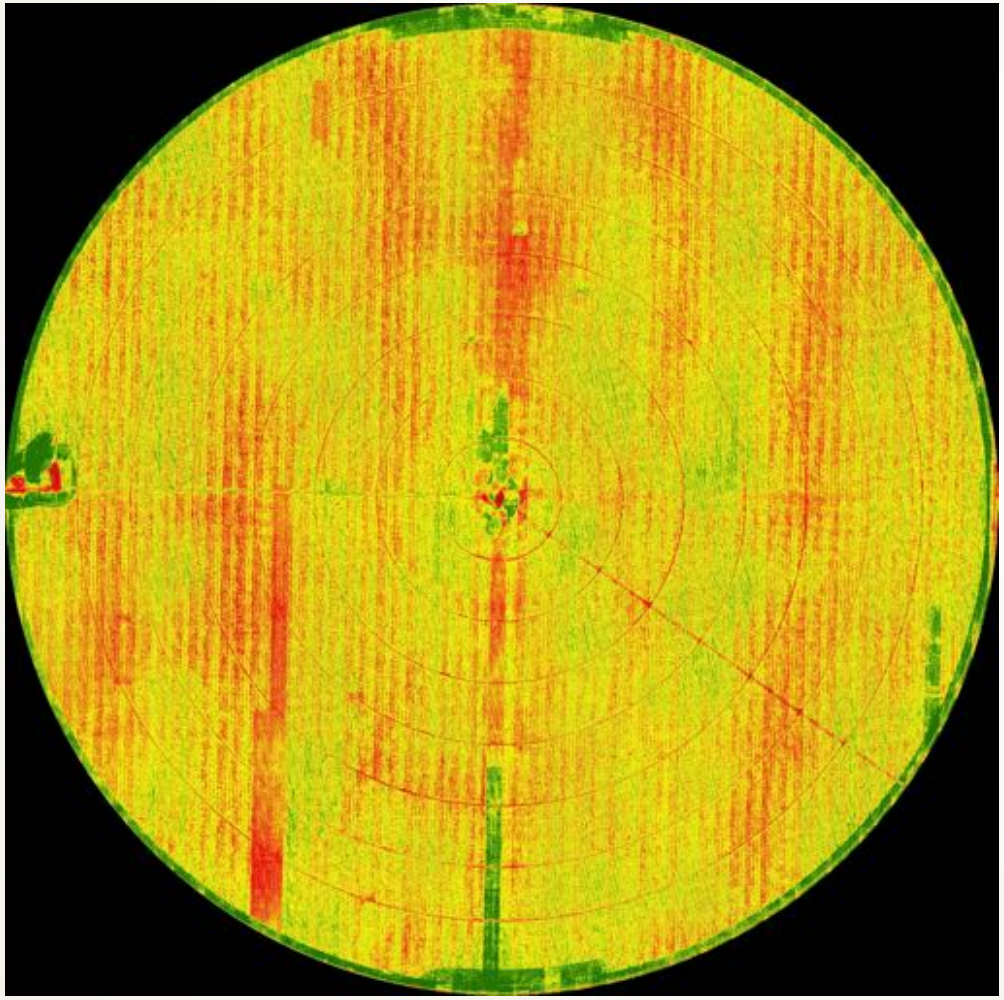
- Information gathered is the key
- UAVs have limitations in Ag
- The data gathered can help in decision making
- Cessna aircraft are an inexpensive and efficient way to collect data
- You have to provide more then a picture or more then a geo-rectified image

How can Remote Sensing Help Ag?

- Find underperforming areas of fields and determine the cause
  - Nutrient deficiencies
  - Water stress (high or low)
- Help in pesticide drift assessment
  - Determine accurate areas effected
- Help in any crop related insurance claims
  - Unseeded acreage, Hail, drought, or flood
- Survey large farm operations for any deficiencies
- Use as a tool for yield determination of some crops

Nutrient Deficeincy

Nutrient Deficiency



Drought Stress and Herbicide Drift

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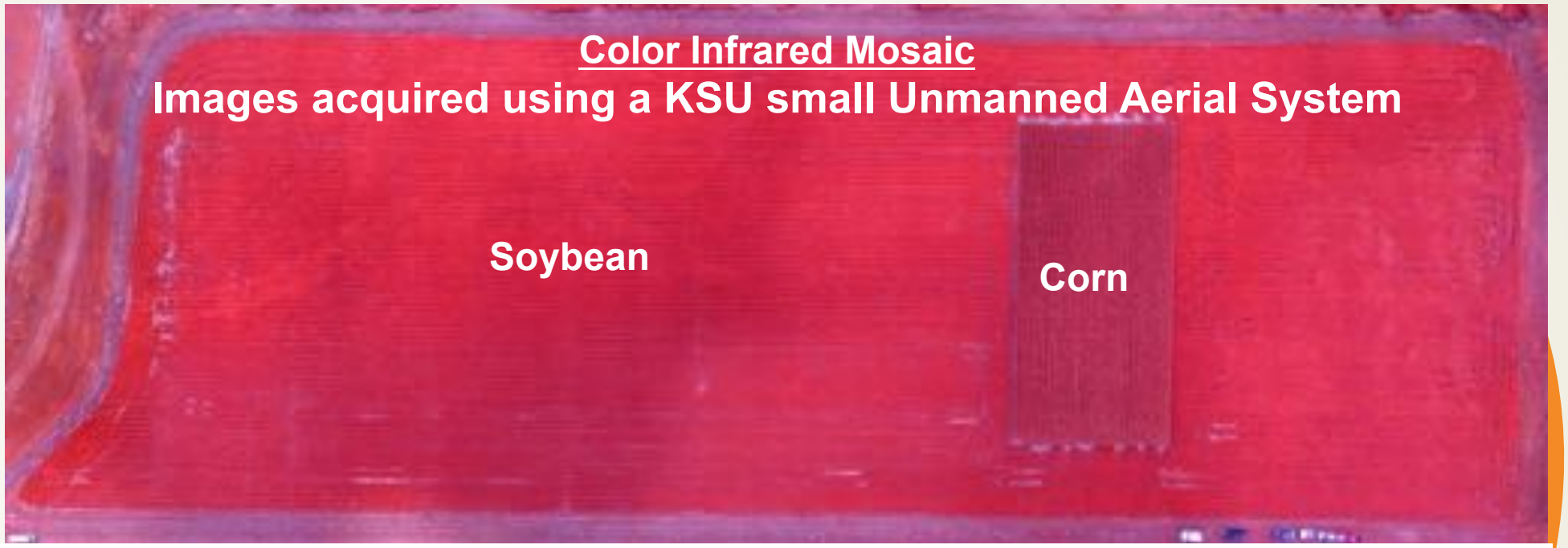
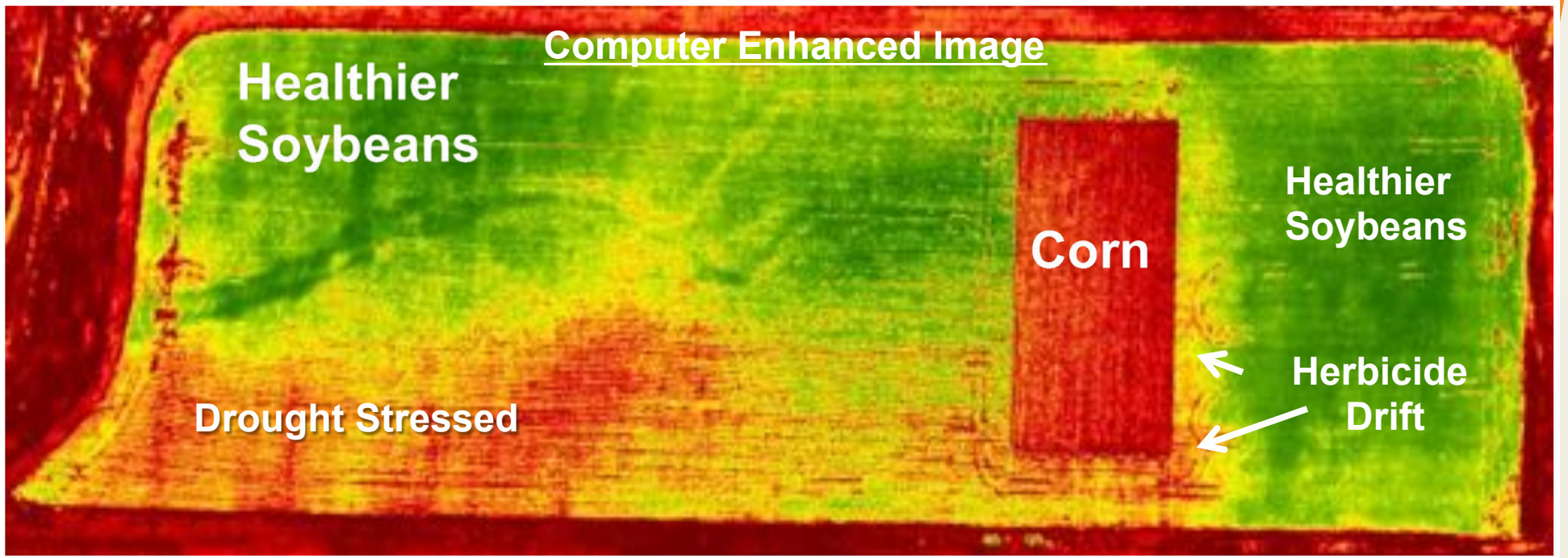
Color Infrared Mosaic

Images acquired using a KSU small Unmanned Aerial System

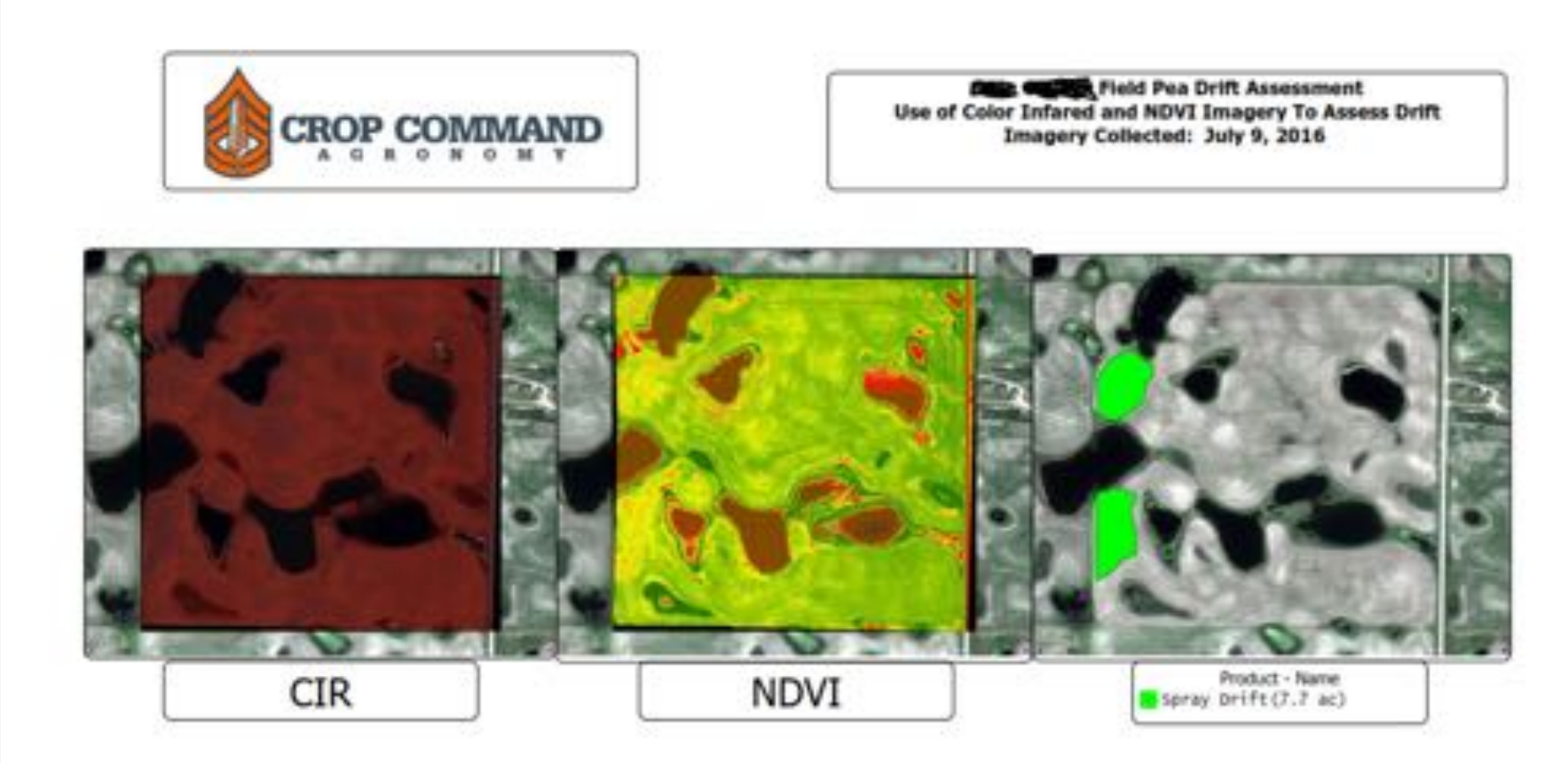


Computer Enhanced Image

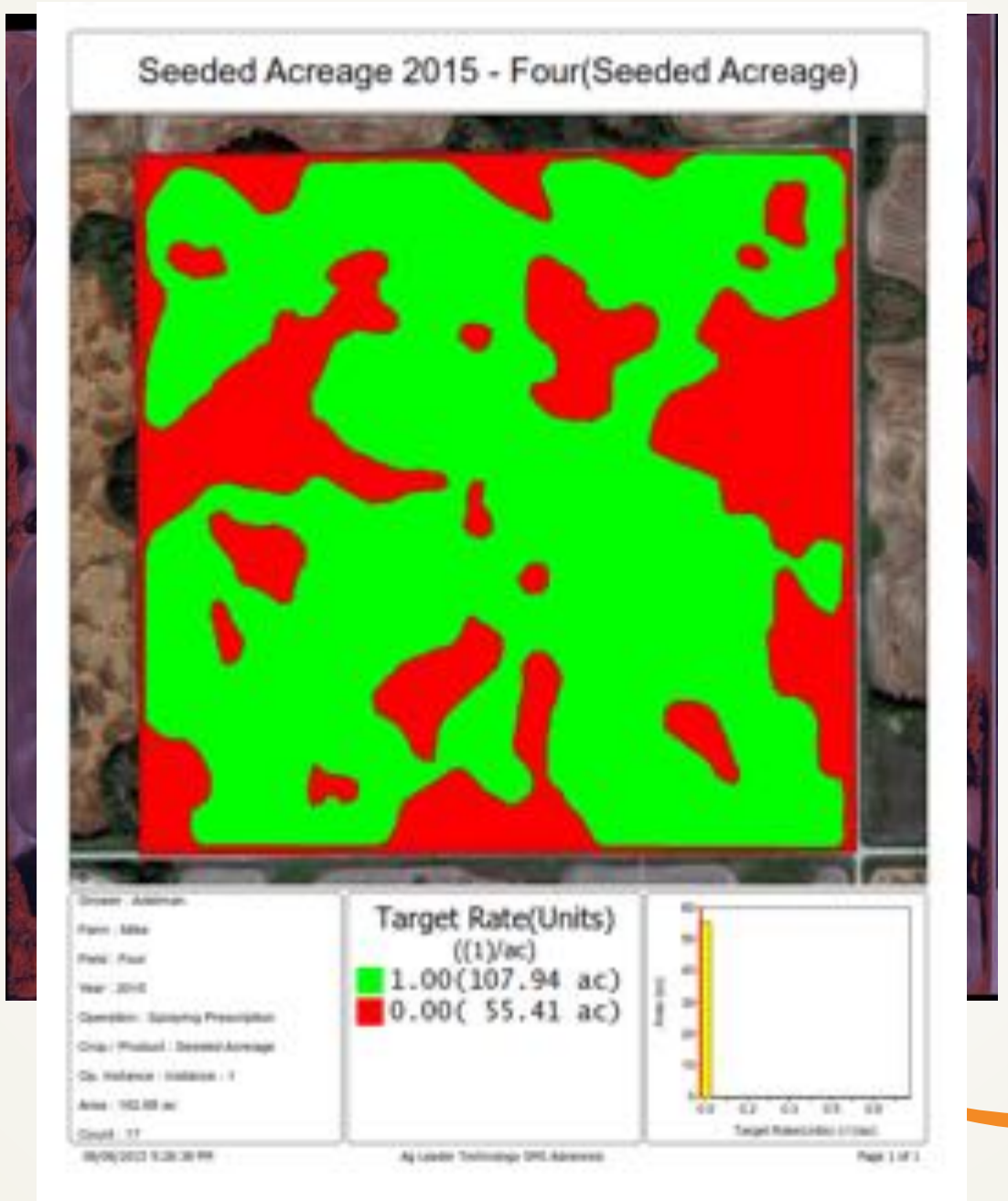


Insurance Claim Assessment

Herbicide Drift on Peas



Unseeded Acreage Report



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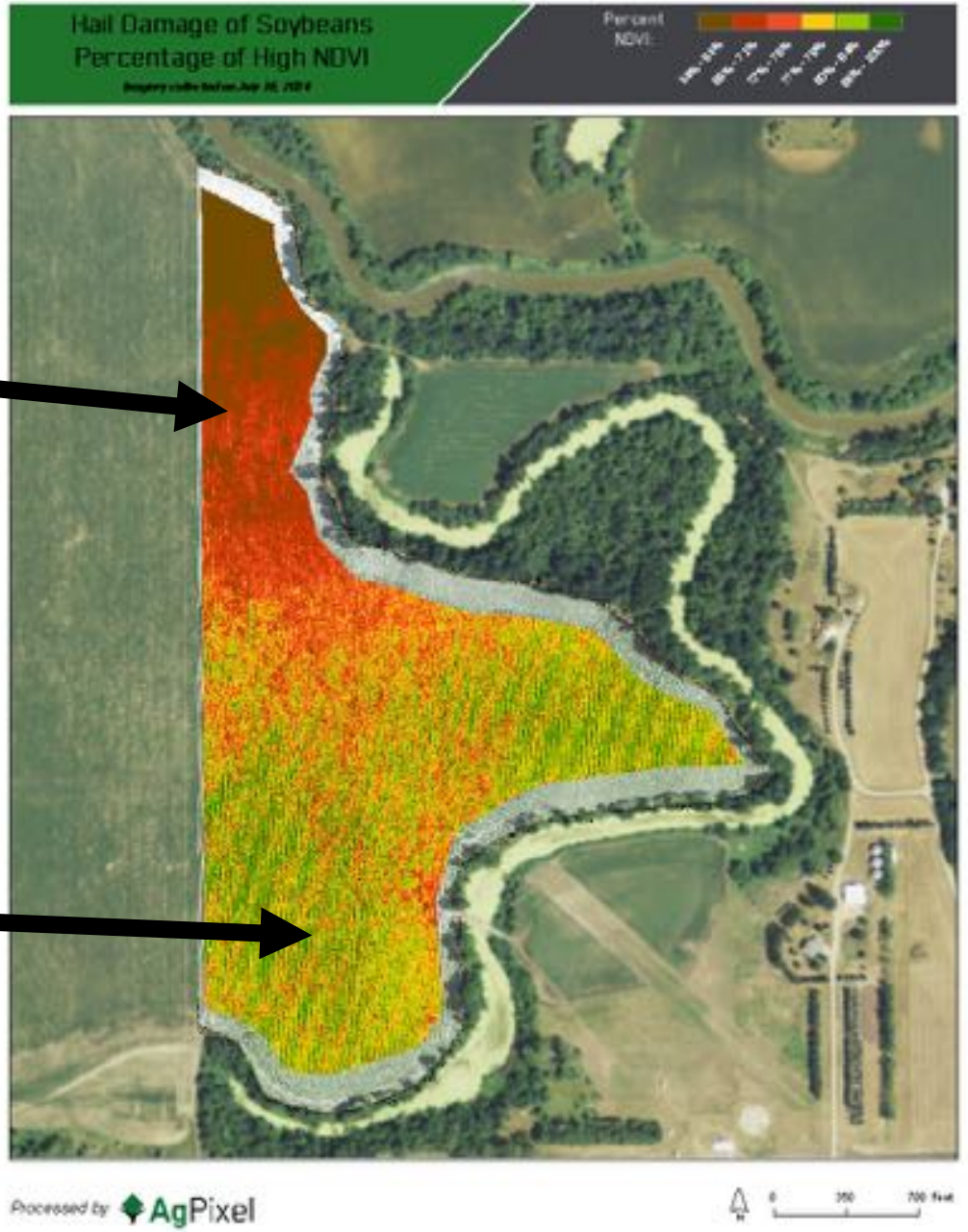
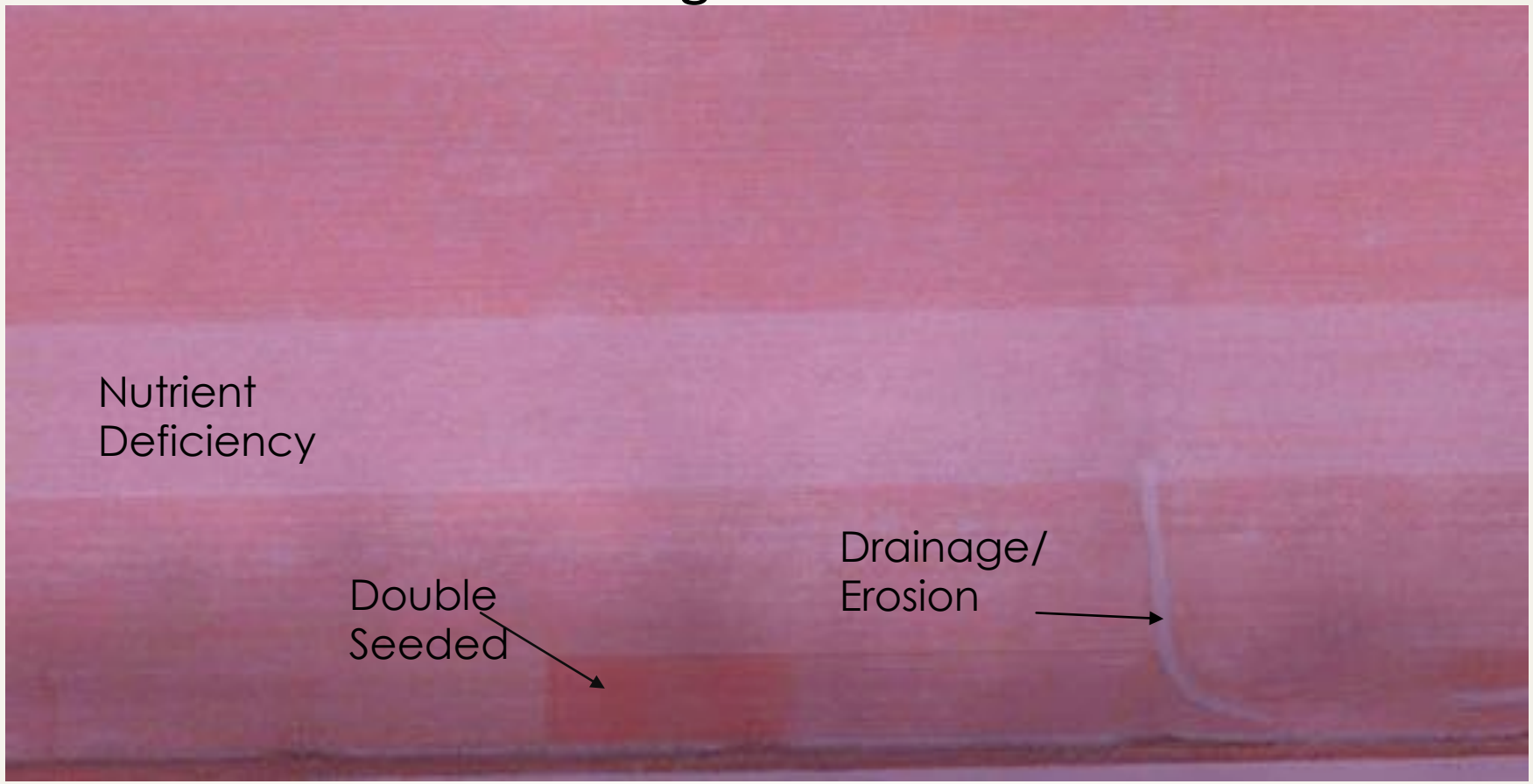
Hail damage event took place June 21, 2014 in a soybean field near Hillsboro, North Dakota. Field was flown on July 16, 2014.



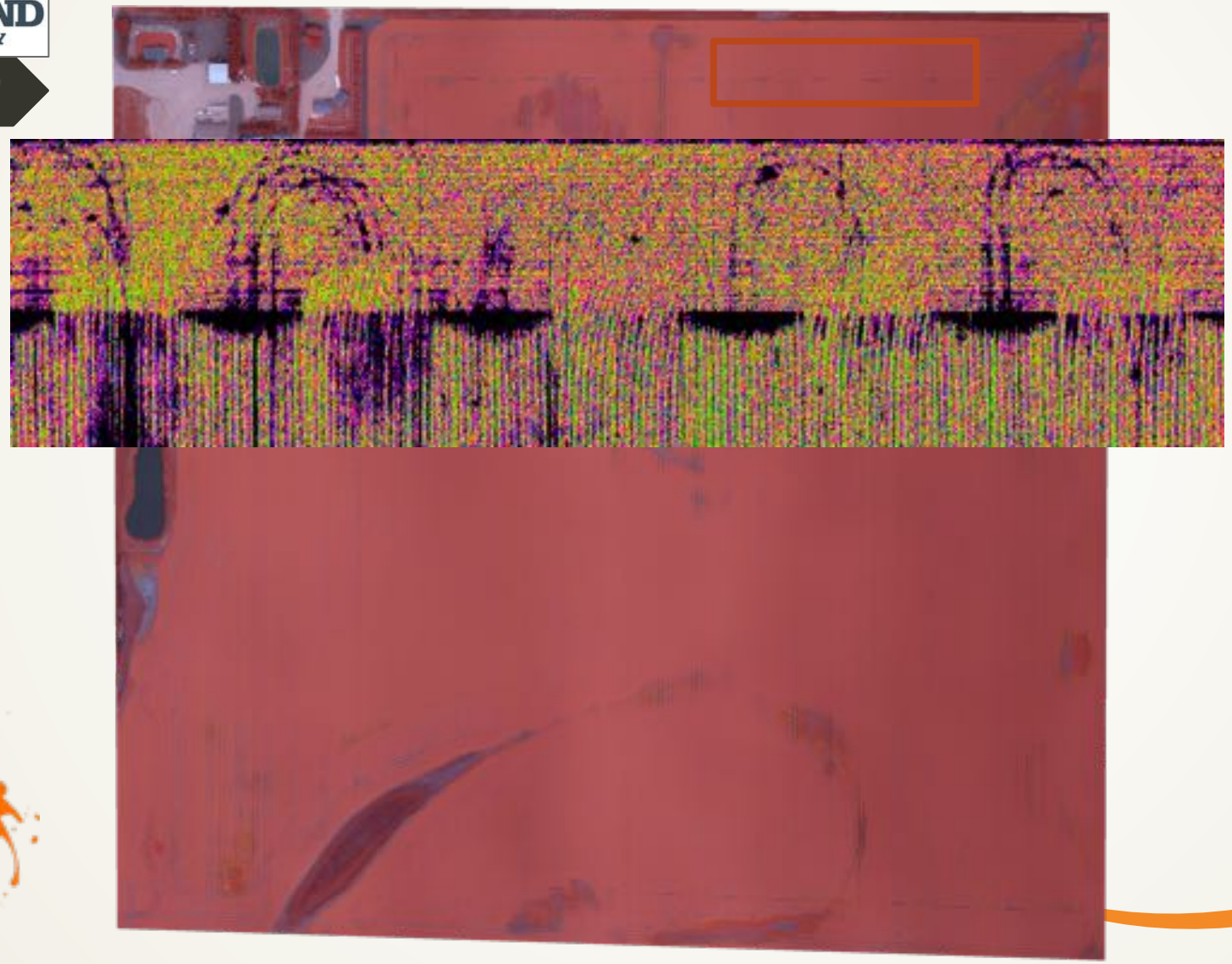
Large farm Surveilance

Monitor Crops from Above

Nutrient issues, double planting, soil erosion, poor emergence



Willcox, SK Canola Seeding



Yield Determination

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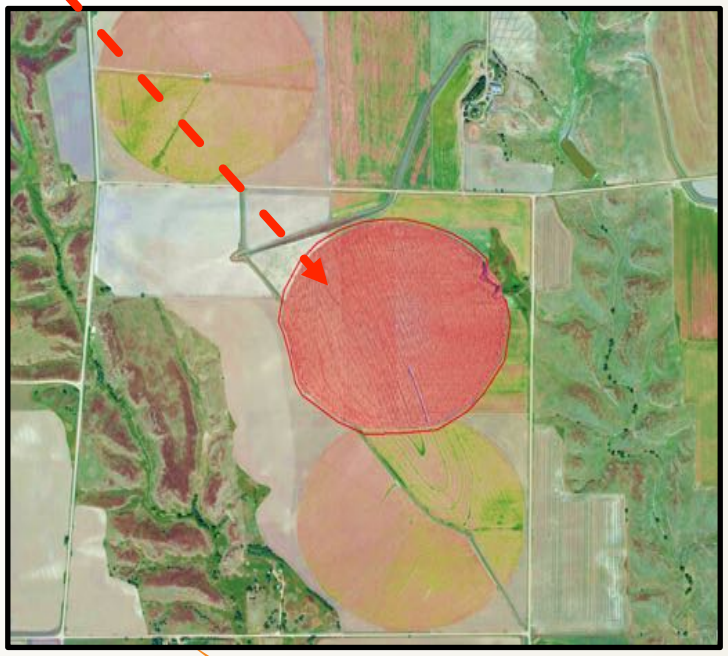
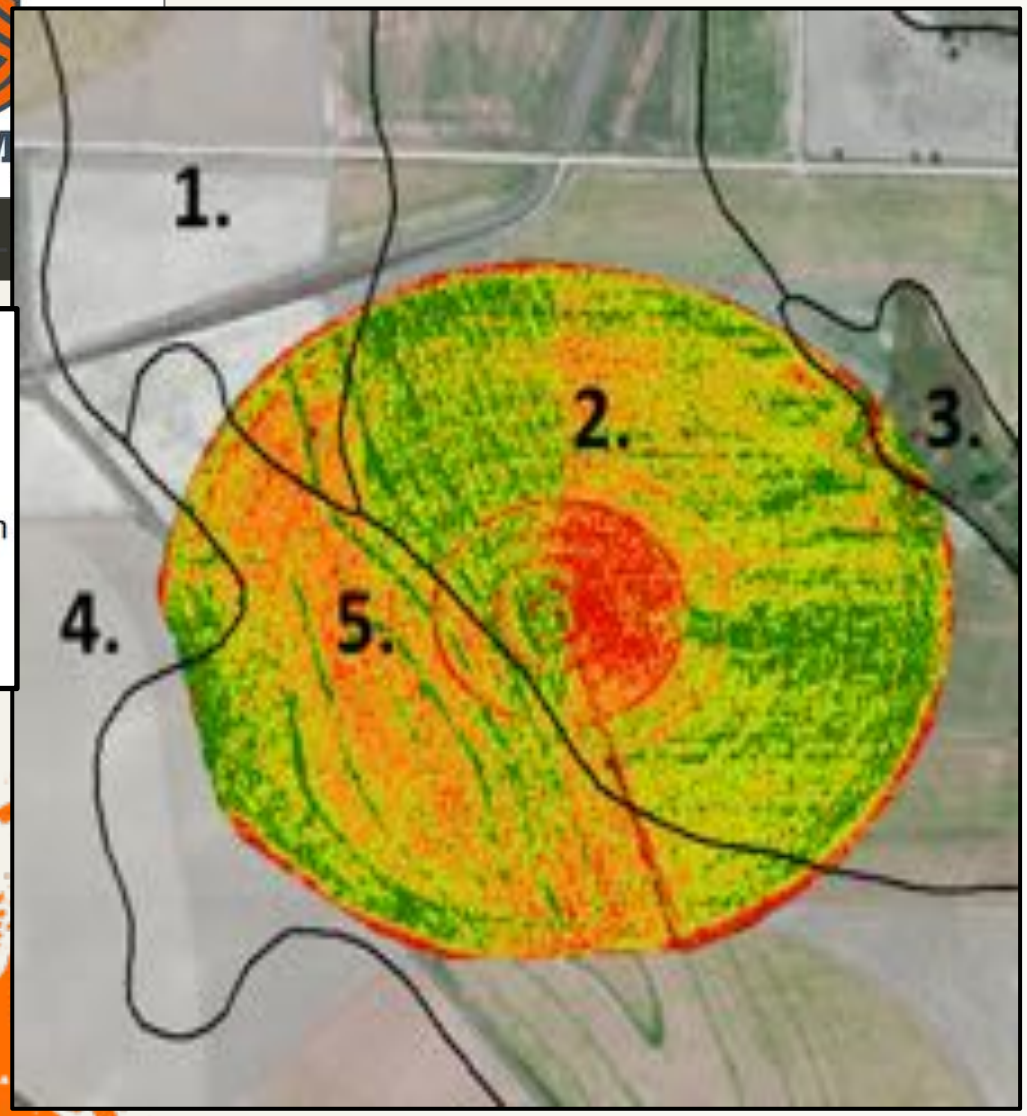


SOILS MAP SUPERIMPOSED ONTO AN NDVI MAP



1. Keith silt loam, 3 to 6 % slopes, eroded
2. Keith silt loam, 1 to 3 % slopes
3. Sulco-Ulysses silt loams, 9 to 30 percent slopes, eroded
4. Keith silt loam, 1 to 3 % slopes
5. Keith silt loam, 1 to 3 % slopes, eroded

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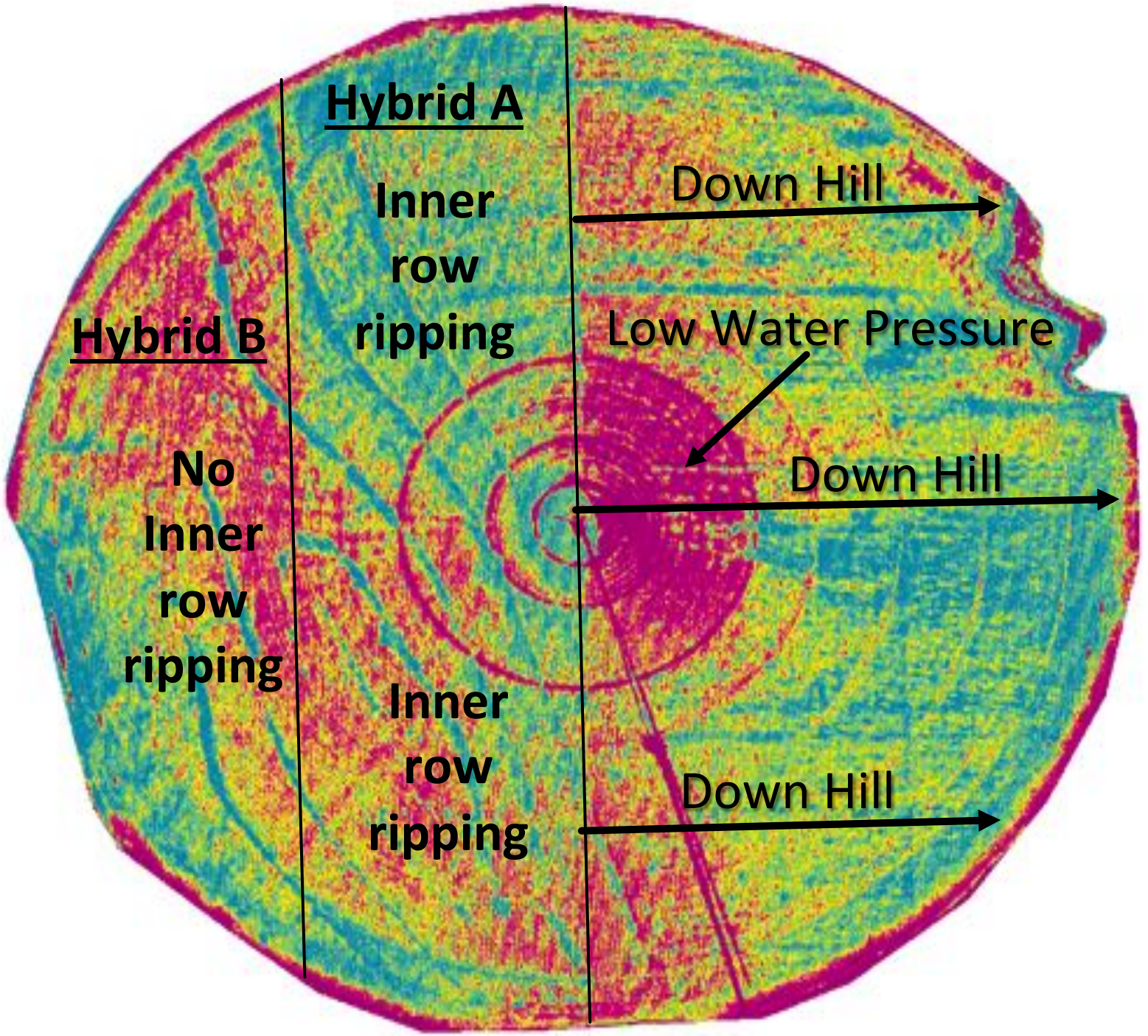

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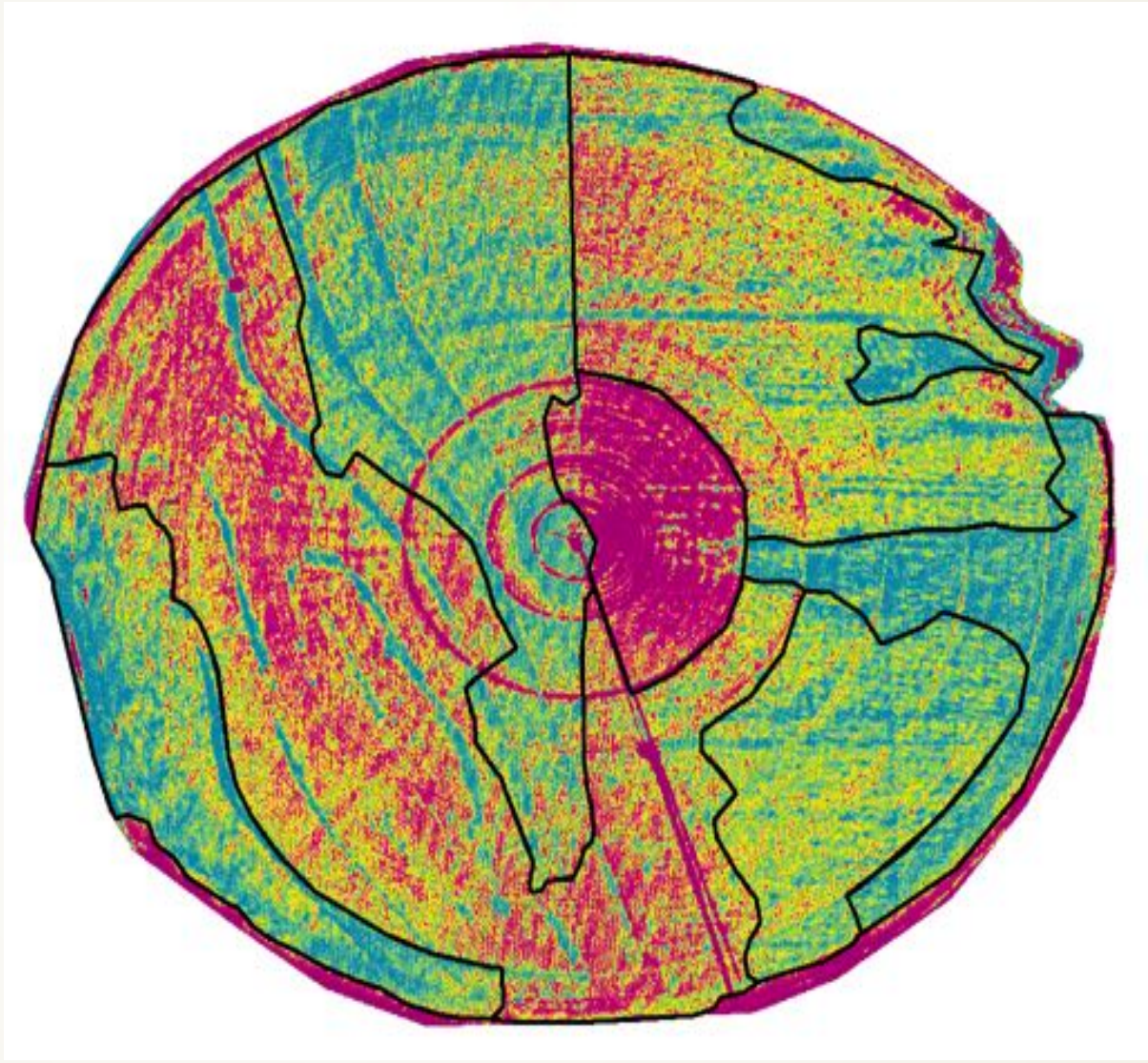
Nutrient management zones

For variable rate nitrogen applications

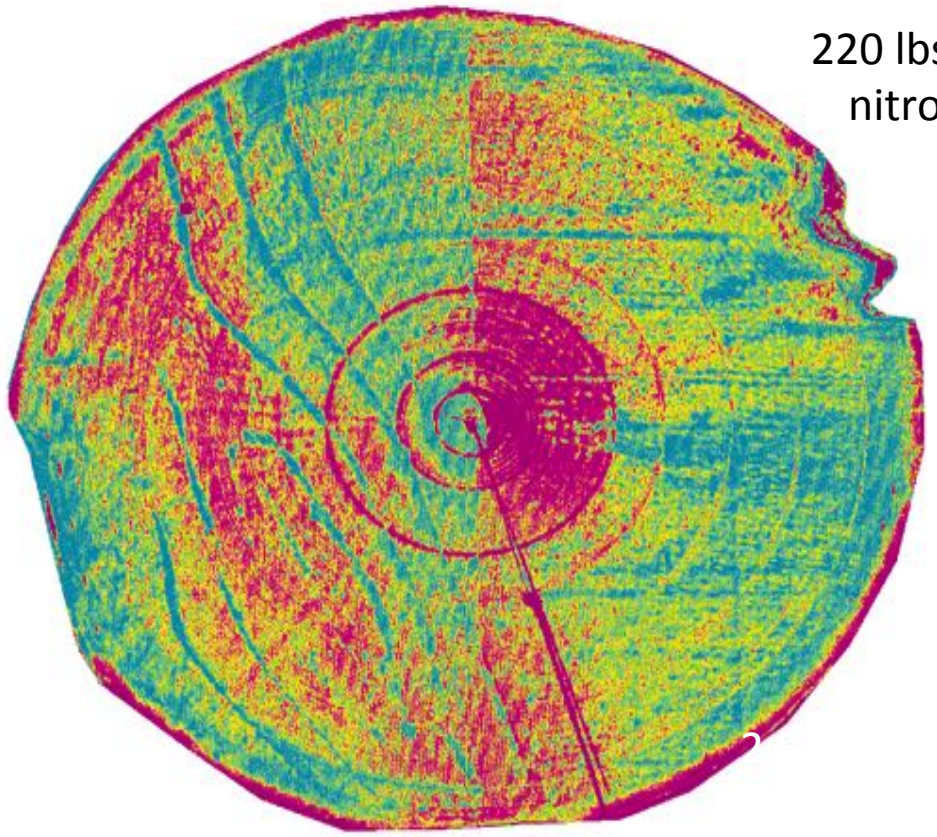


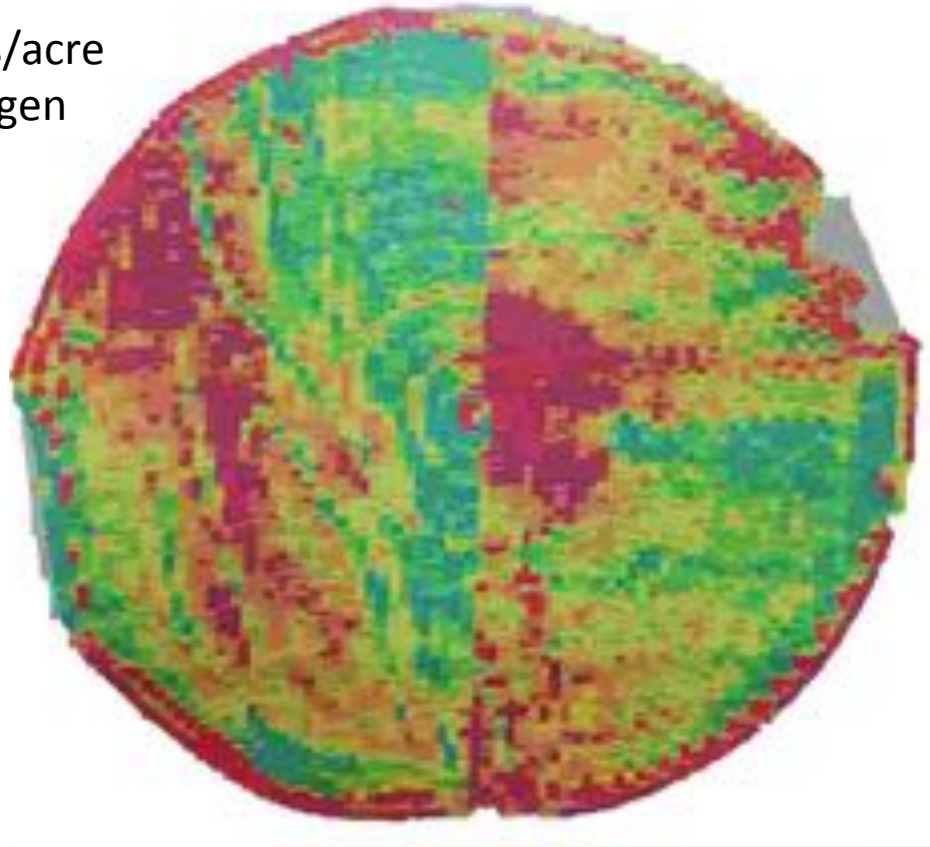
COMPARISON BETWEEN NDVI AND CROP YIELD MONITOR MAPS FOR CORN

NDVI Map
Flown August 1, 2014

Crop Yield Monitor Map
Harvested October 16, 2014

220 lbs/acre nitrogen





Lower Yields

Higher Yields

Bushels

0 50 100 150 200 250

Low NDVI

High NDVI

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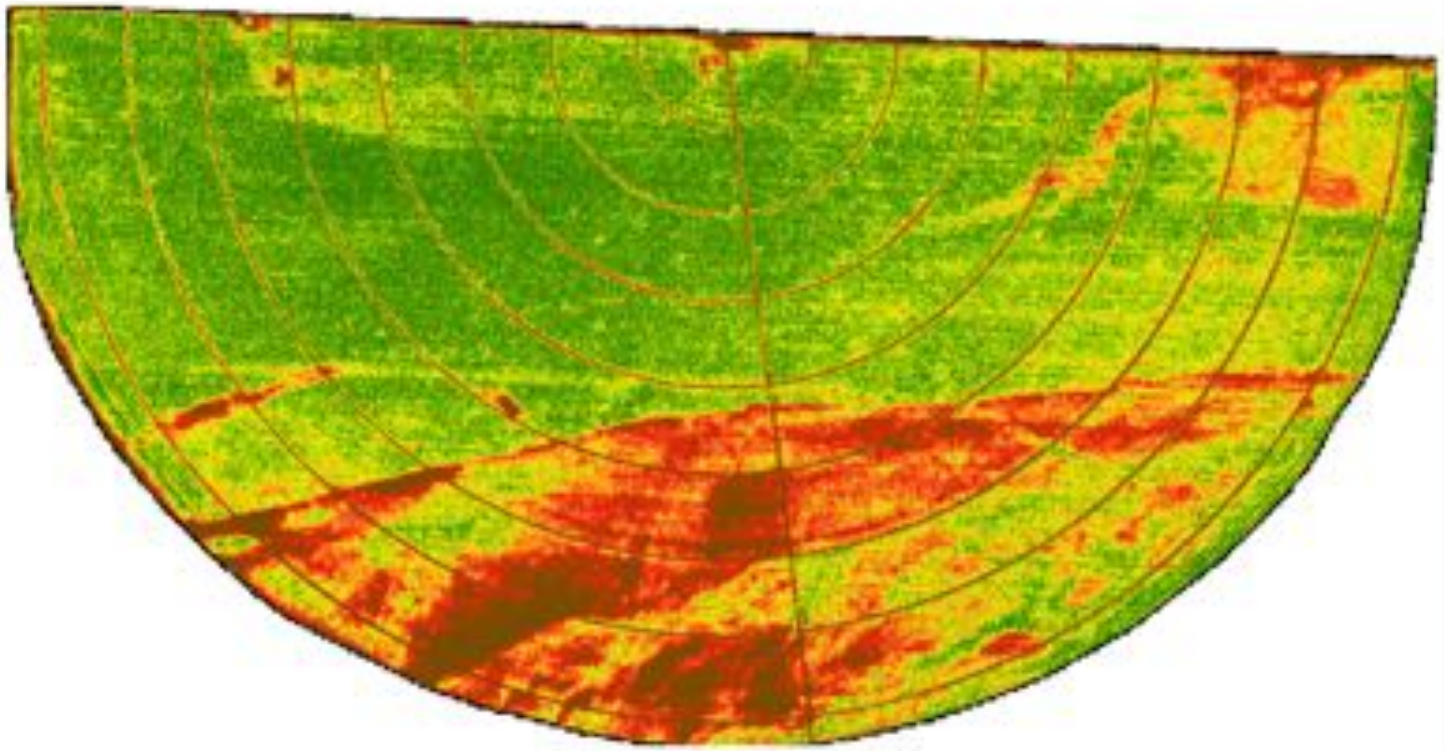
31-27-21 S Alberts - Field Report

RoboFlight → Luke Demuth → Demuth Farms



Surveyed: 8/17/2016
Area: 61 ac

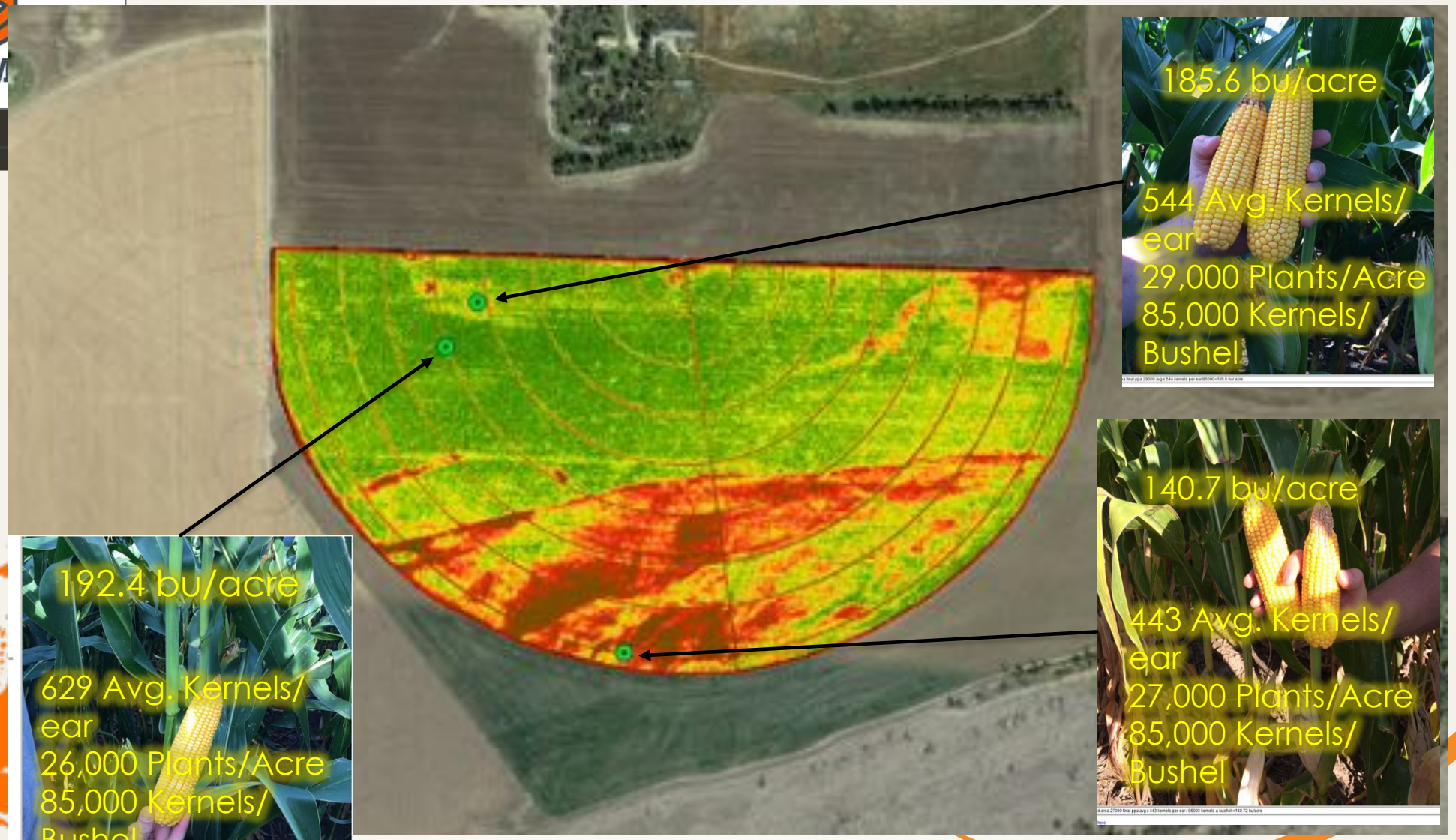
G_NDVI Classes

	High	
16.3 %		9.9 ac
21.7 %		13.2 ac
18.9 %		11.5 ac
12.3 %		7.5 ac
6.0 %		3.6 ac
6.8 %		4.1 ac
5.2 %		3.2 ac
4.1 %		2.5 ac
2.4 %		1.5 ac
6.4 %		3.9 ac
	Low	

Statistics

Min:	28
Mean:	142
Max:	255
SD:	9.2
Var:	85.34

31-27-21 Ground Sampling



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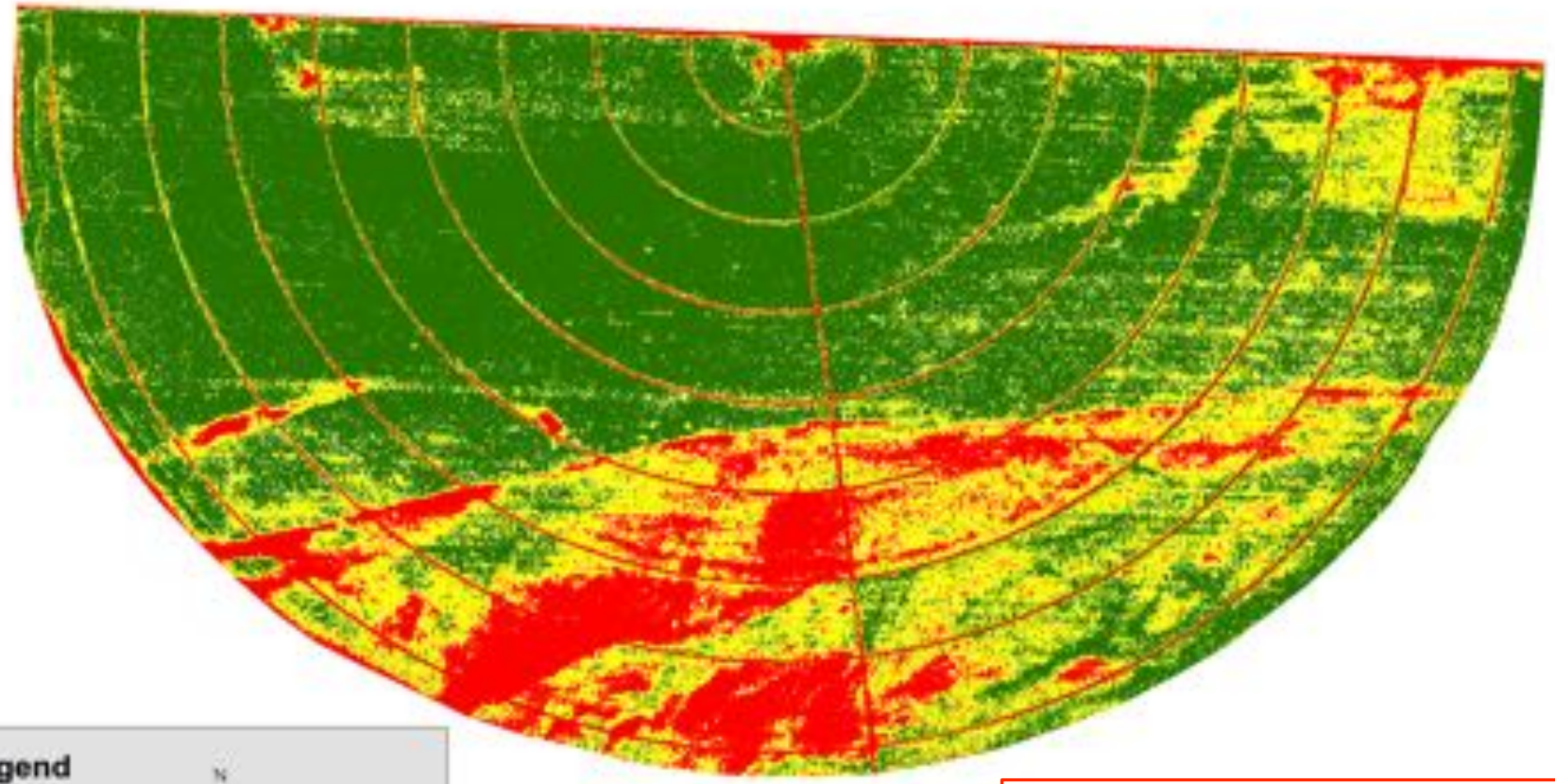
Imagery to Information

31-27-21 S Alberts 08-17-2016



Legend

Yield

- 8.6 Acres @ 140.72 bu/ac -- 1210 bu
- 15.2 Acres @ 185.6 bu/ac -- 2821 bu
- 34.6 Acres @ 192.4 bu/ac -- 6657 bu

N

Aproximate Total Yield:
10688 Bushels / 58.4 Acres = 183 bu/ac

0 0.0425 0.085 0.17 Miles

Estimated Yield = 183 bu/ acre

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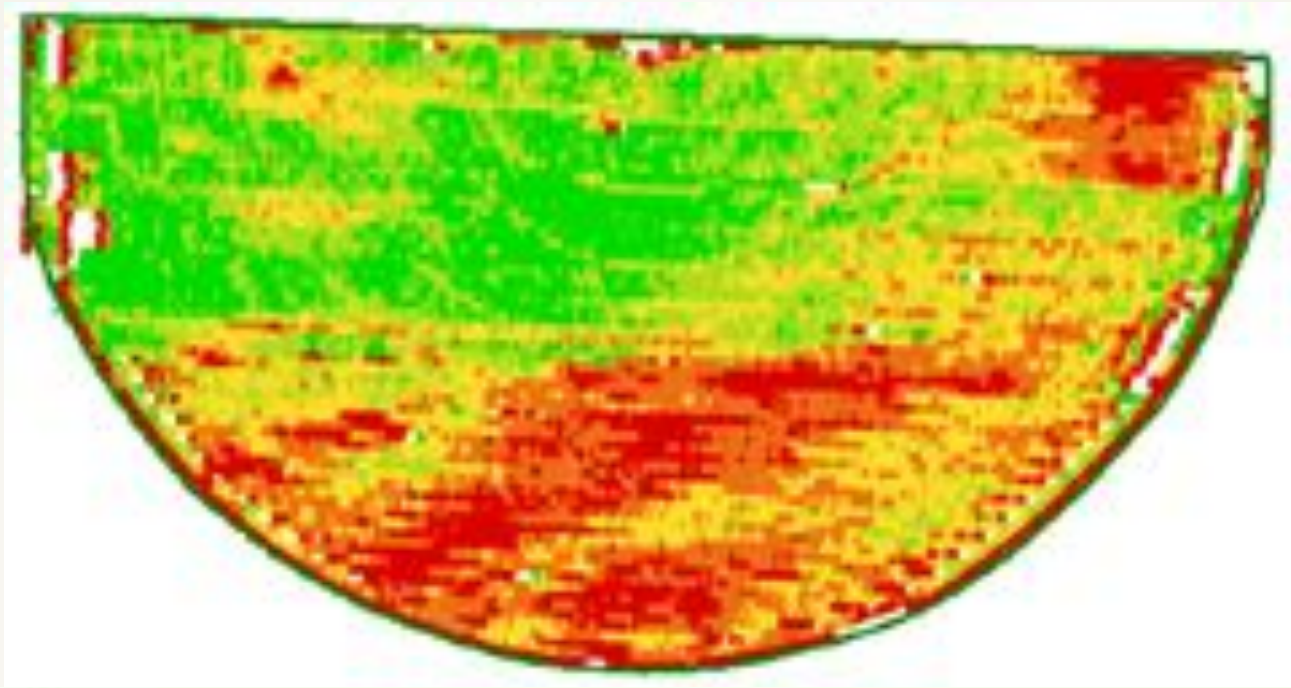
Imagery to Information

31-27-21 Harvest Yield Map



Grower: Demuth Farms
Farm: Demuth Farms
Field: S Alberts, 31-27-21
Date: 10/27/2016
Area: 63.80ac
Lat: 37.65708°N
Lon: 099.66404°W

Crop Season: 2016
Harvest Date(s): 9/27/2016

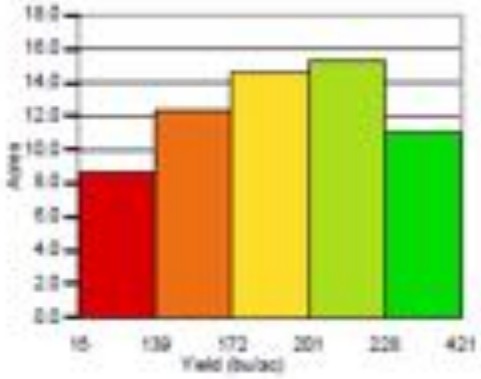
Harvested Area: 62.00 ac
Min: 14.85 bu/ac
Max: 421.41 bu/ac
Avg: 186.11 bu/ac
Total Product: 11,538.05 bu

N

One in = 403 feet

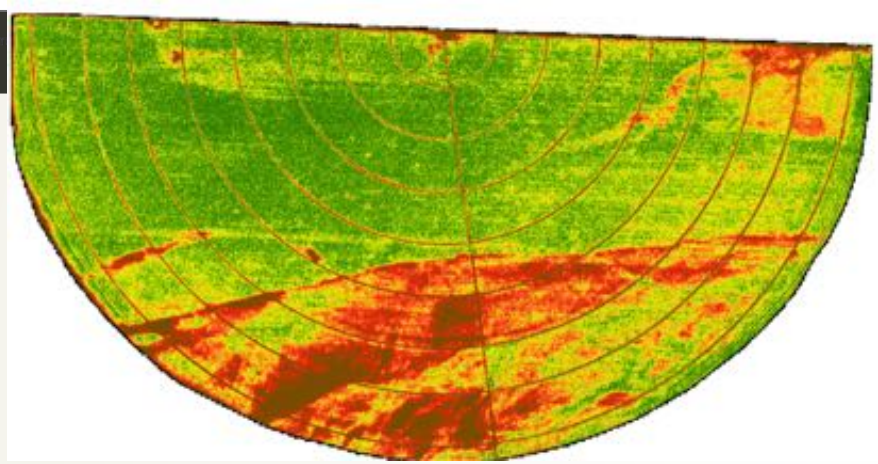
0 140 280 420 561 701

Actual Yield = 186.11 bu/acre

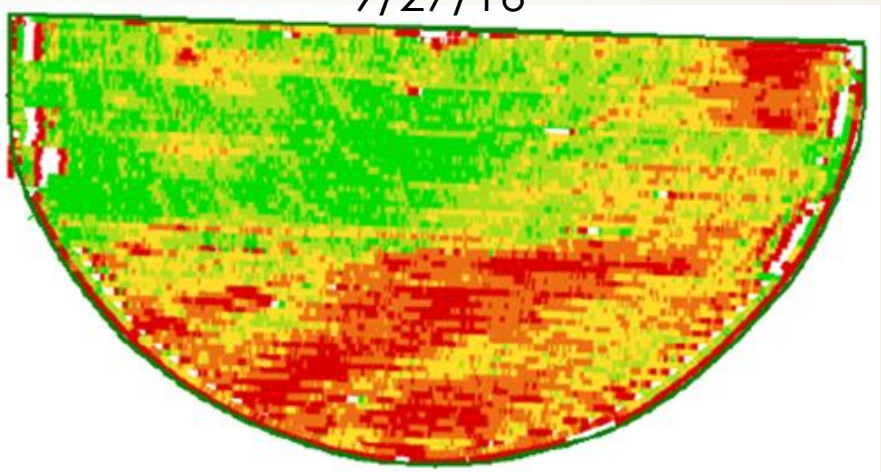


Conclusions

NDVI Flown 8/17/16



Harvest Yield Map 9/27/16



- Yield map variation correlates strongly with late season NDVI imagery
- Yield was predicted from NDVI imagery within 1.7% error 41 days prior to harvest with the minimum 3 ground samples collected for each color zone
- More samples could potentially increase accuracy, but in this example, the difference was negligible

What works best?

- Drones work best for research purposes where extreme high resolution is needed (<1cm)
- Drones cannot efficiently cover large areas of farmland in Saskatchewan
  - Drones can cover a maximum 1000ac per day
  - A Cessna can cover 20,000 to 300,000 acres per day
- Agronomists don't have time to fly the field and then look at the data
- Data needs to be in the agronomists hands before they reach the field

What holds back Drones in Ag?

- Over promising and under delivering by manufacturers
- Growers not educating themselves in precision agriculture
- Equipment dealers attitude towards precision ag
- A defined ROI on the usage of remote sensing

What do we need to do?

- Educate growers in an unbiased matter
  - Lose the hype
  - Provide precision education to growers
- Get buy in from Equipment dealers
- Utilize the information as a page to the whole story
  - Doesn't replace other forms of information
- Realize that remote sensing will empower agronomists

What type of Drones work for Agricultural Growers?

Questions?

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