PURDUE UNIVERSITY

CAPSTONE/SENIOR DESIGN EXPERIENCE 2018

Machine Data Utilization

Agricultural & Biological ENGINEERING

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Background: In an ever increasing digital and technological world, Agriculture is using data collected during field operations. This kind of information is used to make better management and input decisions.

Statement of Problem: Explore the potential quantitative relationships among machine data in agriculture in order to make better decisions in real agriculture practices.

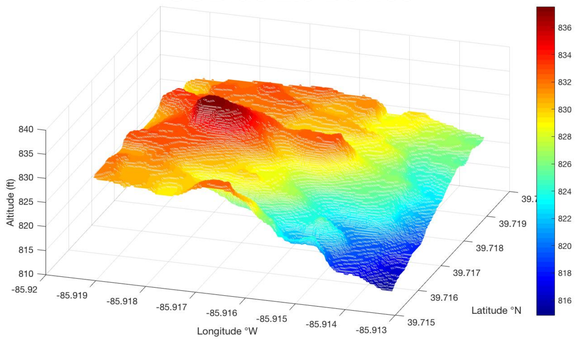
Alternative Solutions:

- Altitude vs Lidar
  - Track Field Topography
  - 3D visualization for easy contour viewing
- Tracking Machine Performance
  - See effects of daily maintenance
  - Determine when to shut off grain cart tractor

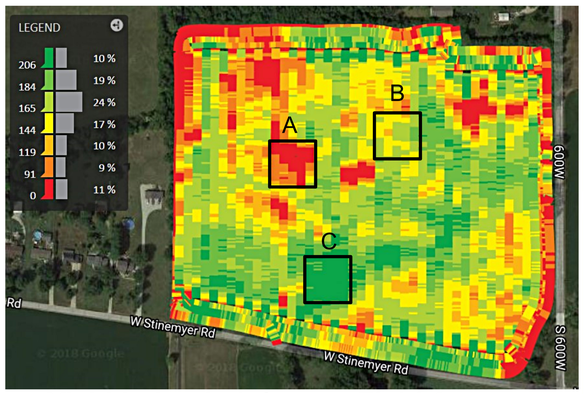
Method:

- Data Collecting
  - Device: ISOBlue 2.0
  - Place: New Palestine, IN
- Data Analysis
  - Corresponding PGNs of variables
    - Percent Load- 61443, 3
    - Fuel Consumption rate- 65266, 1-2
    - Altitude-
  - Conversion from Machine Data to numerical data In MATLAB
  - Acquired relationship among all variable with yield

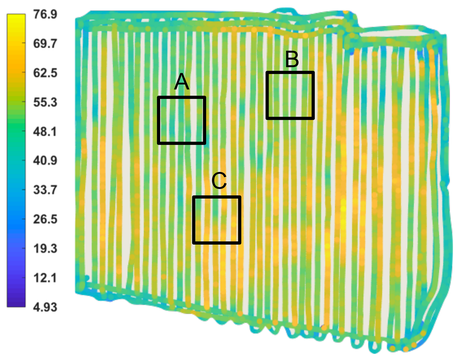
ISOBlue 2.0 Device



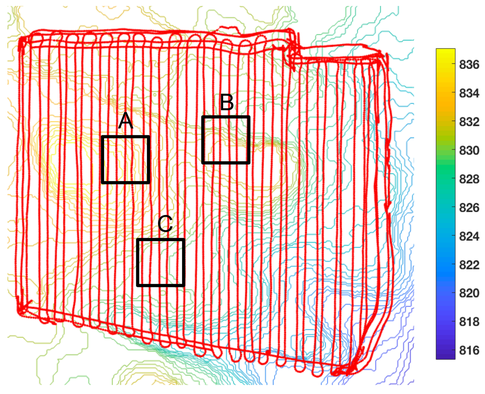
3D Topography Map. 23 feet difference



Yield in bushels/acres. Field Average- 158 bushels/acre



Fuel Consumption in L/hr



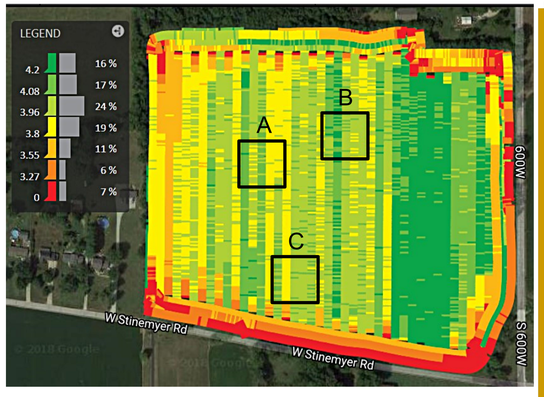
2D Contour Map with Travel Path

Legend:

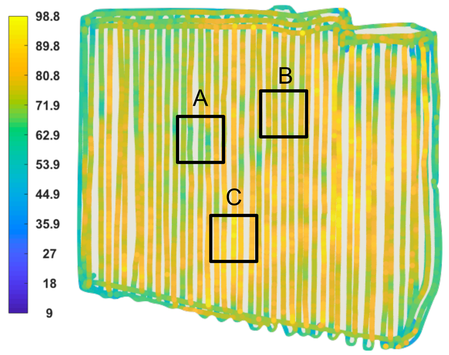
- A= Low Yield Area
- B= Average Yield Area
- C= High Yield Area

Analysis:

- Looking at the different yield areas
  - A,B,& C
- Comparing to:
  - Fuel Consumption
  - % Engine Load
  - Topography
  - Soil Type
- Finding any correlation that would allow the farmer to make better decisions on the farm
  - Determining if it is worth the extra fuel cost to improve yield
  - Etc.



Speed in mph. Field Average- 3.86 mph



Percent Engine Load in %

Analysis:

- Area A vs. Area B
  - Yield
    - 70 bushel/ acre increase
  - Fuel Consumption
    - 7.2 L/hr increase
  - Percent Load
    - 9% increase
  - Altitude
    - 4 ft decrease
- Area B vs Area C
  - Yield
    - 48 bushels/ acre increase
  - Fuel Consumption
    - 14.4 L/hr increase
  - Percent Load
    - 18% Increase
- There didn't seem to be much of a correlation with yield and soil type.
  - This year started off wet
  - Ended dry. Didn't get rain when we needed it

Economic Analysis:

Material	Purpose	Cost
*ISOBLUE 2.0	Collecting Data	Sponsored
MATLAB	Data Analyzing Software	$49
Flash Drive(64G)	Large Data Storage	$15
Travel expenses	on-the-spot investigation	$50

*The ISO Blue2.0 device costs less than 1,000 dollars if not sponsored.

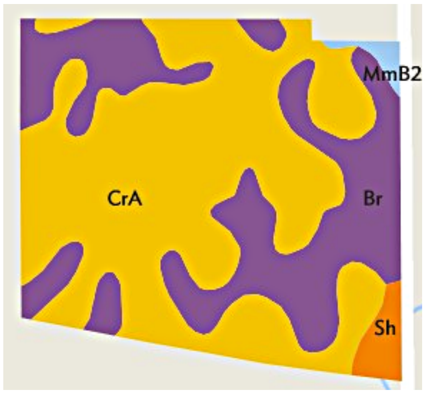
Digital agriculture has taken off in recent years as **commodity prices are low** and **input prices are high**. Collecting data like machine operations, and yield data allows farmers to see problem areas in their fields and help to know where to focus the operations efforts. This side of agriculture is something that companies and farmers alike are going to be using in the future.

Conclusion:

- There are a lot of different variables that go into making management decisions in a farming operation
  - Seeding Rate
  - Soil
  - Topography
  - Etc.
- This is just one small part in a larger picture that growers are looking at to better control inputs and maximize profits
- Takes serval years' worth of data like this to get a better picture of each field

Soil Code	Description	Percent of Field
CrA	Crosby silt loam, 0 to 2% slopes	60.9%
Br	Brookston silty clay loam, 0 to 2% slopes	35.6%
Sh	Shoals silt loam, 0 to 2% slopes, Frequently flooded, very brief duration	2.4%
MmB2	Miami silt loam, 2 to 6% slopes, eroded	1.2%

Soil Type Chart



Soil Type Map

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