PURDUE UNIVERSITY

CAPSTONE EXPERIENCE 2014

Agricultural & Biological ENGINEERING

Precision Farming Evaluation

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Problem Statement:

The goal of this project is to understand how long an investment in precision equipment would take to pay for itself. Many farmers currently over apply nutrients and seed due to lack of precision technology. The team looked at a variety of scenarios that a farmer could consider when purchasing equipment and compared them to see how many years it would take a farmer to break even on his or her investment. The hope is that the results show how an investment in more technology can actually provide a quicker return than the basic system.

Figure 1. Jay and Andrew measuring unplanted area in point rows

Background Review:

Overlap and overplanting are key issues that cause higher input costs. The team will be working with Doug Mears on the precision project. Mr. Mears is a local farmer that operates near Delphi, Indiana. The field that the team studied for this project was about 36 acres in size and has several point rows. Figure 1 shows us taking measurements last fall to see how much overlap Mr. Mears currently has and the number of acres currently goes unplanted due to lack of multiple row shutoffs. The results calculated are based off of this single field and a 16 row planter.

Alternative Solutions:

Through the evaluations the team determined if it is more profitable to use no precision agriculture equipment, use partial precision agriculture equipment, or use all precision agriculture equipment. To make this justification, they combined the different aspects that are beneficial of precision technology and see if the amount of money and time saved is substantial enough to invest in the technology that is currently available. The way the team chose to approach this study is to use real world data collected from Mr. Mears to see how a switch to precision agriculture would pay off. If there was not a farmer available for the study, the team would have had to use information found on the internet to estimate the time it would take for precision equipment to pay for itself.

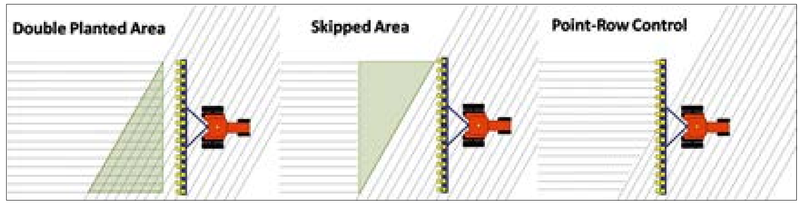

Figure 2. Examples of Overplanting and Underplanting

Economics:

Tables 1 through 3 show the predicted total setup cost of installing shutoffs and guidance on a Case Puma 210 tractor. These numbers are what are used to determine how long it would take for the equipment to pay for itself. Figure 3 shows charts of the number of years it would take for different number of row shutoffs to pay for themselves in savings. Figure 4 compares the time it would take for the system to pay off when only getting savings from tillage and seed. This figure compares the most expensive guidance (AutoPilot with GNSS) to the least expensive guidance (EZsteer with WAAS).

Table1. Different Prices of Installing Equipment with EZ Steer (the least expensive)

Scenario (EZ Steer)	Total Setup Cost (WAAS)	Total Setup Cost (OmniStar)	Total Setup Cost (RTK)	Total Setup Cost (GNSS)
Individual Row	$ 23,346.00	$ 27,846.00	$ 32,346.00	$ 33,031.00
Shut off Every 2 Rows	$ 17,592.00	$ 22,092.00	$ 26,592.00	$ 27,277.00
Shut off Every 4 rows	$ 15,642.52	$ 20,142.52	$ 24,642.52	$ 25,327.52
Shut off Every 8 rows	$ 14,667.75	$ 19,167.75	$ 23,667.75	$ 24,352.75

Table2. Different Prices of Installing Equipment with EZ Pilot (midrange steering system)

Scenario (EZ Pilot)	Total Setup Cost (WAAS)	Total Setup Cost (OmniStar)	Total Setup Cost (RTK)	Total Setup Cost (GNSS)
Individual Row	$ 24,271.00	$ 28,771.00	$ 33,271.00	$ 33,956.00
Shut off Every 2 Rows	$ 18,517.00	$ 23,017.00	$ 27,517.00	$ 28,202.00
Shut off Every 4 rows	$ 16,567.52	$ 21,067.52	$ 25,567.52	$ 26,252.52
Shut off Every 8 rows	$ 15,592.75	$ 20,092.75	$ 24,592.75	$ 25,277.75

Table 3. Different Prices of Installing Equipment with AutoPilot (Most Expensive)

Scenario (AutoPilot)	Total Setup Cost (WAAS)	Total Setup Cost (OmniStar)	Total Setup Cost (RTK)	Total Setup Cost (GNSS)
Individual Row	$ 28,366.00	$ 32,866.00	$ 37,366.00	$ 38,051.00
Shut off Every 2 Rows	$ 22,612.00	$ 27,112.00	$ 31,612.00	$ 32,297.00
Shut off Every 4 rows	$ 20,662.52	$ 25,162.52	$ 29,662.52	$ 30,347.52
Shut off Every 8 rows	$ 19,687.75	$ 24,187.75	$ 28,687.75	$ 29,372.75

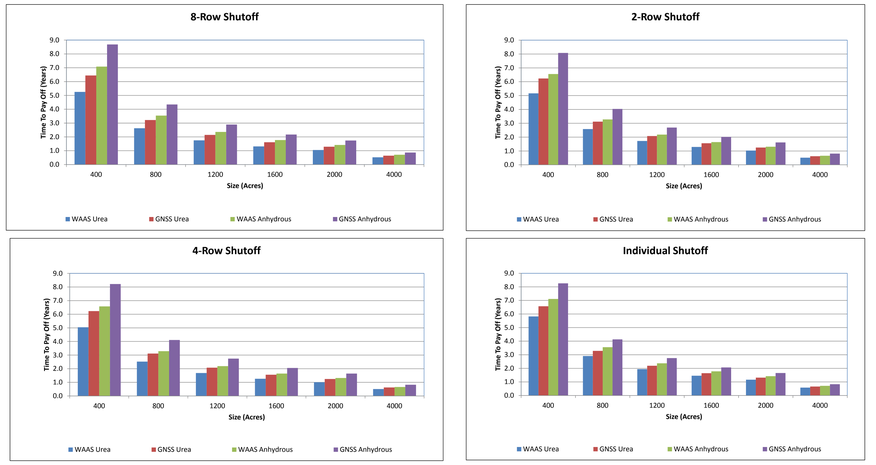

Figure 3. Number of years it would take to pay for itself.

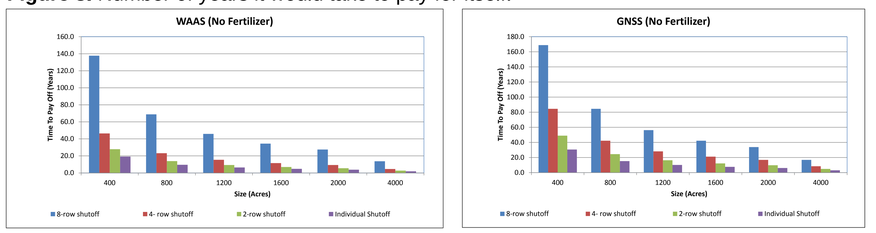

Figure 4. Number of years it would take to pay for itself (GNSS vs WAAS)

Sustainability/ Conclusion:

From the data calculated in this project, it is evident that investing in more technology provides a quicker return even though the original start up cost is higher. By more managing fertilizer, seed, and fuel accurately, farmers can reduce many hazards that typically impact the environment. The result of using this technology greatly increase the profitability of the operation. Once the initial cost is covered, the precision equipment provides large savings annually.

Figure 5. Example of overlapping rows when planting without section control

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