Table 3. Data for seed treatments for stem borer control. Ganado, TX. 2008.

Variety	Treatment[a]	Rate (mg ai/seed)	Panicles/ft of row	No. WH[b]	Yield (lb/A)
Cocodrie	Dermacor X-100	0.025	23	5 c	6835 c
Cocodrie	Dermacor X-100	0.05	25	4 cd	6769 cd
Cocodrie	Dermacor X-100	0.10	24	0 ef	6759 cd
XL723	Dermacor X-100	0.025	26	7 bc	8261 b
XL723	Dermacor X-100	0.05	22	2 de	8409 b
XL723	Dermacor X-100	0.10	26	0 f	9070 a
Cocodrie	X	X	23	30 a	6209 de
Cocodrie	Karate Z	0.03 lb ai/A	23	1 ef	6652 cd
XL723	Karate Z	0.03 lb ai/A	22	0 f	8681 ab
Cocodrie	Untreated	---	24	28 a	5808 e
XL723	Untreated	---	24	10 b	7036 c
			NS		

[a] Karate Z applied at 1-2 inch panicle and again at late boot; Dermacor X-100 is a seed treatment

[b] WH = whiteheads in 4 middle rows

Means in a column followed by the same letter are not significantly (NS) different (P = 0.05, ANOVA and LSD).

PRECISION AG PRESENTATIONS

How Can Geospatial Technologies Help Improve Farming Efficiency

Presented by Dr. Roberto Barbosa
Assistant Professor, LSU AgCenter

Introduction

Much has been discussed about the potential benefits that geospatial technologies can bring to farmers. Better known as Precision Agriculture (PA), these technologies utilize global positioning systems (GPS) receivers, computer programs such as geographic information systems (GIS), controllers, sensors, and electronic monitors such as the yield monitor (YM) to bring information to the farmer about fertility, crop status, harvested yield, etc. The next question is what do we do with this all this information? Putting the potential agronomic and environmental benefits that PA can bring to the farm aside for a moment, we're going to focus on how can we use geospatial technologies to increase our farming efficiency.

Increased Cost

Figure 1 shows a 10-year index of prices paid for major inputs used in the farm: fertilizer, fuel, insecticide, herbicide, and machinery. The base period is 1990-1992, and the source of this information is the USDA Agricultural Statistics Service (Gould, 2008). We

can see how fuel and fertilizer have gone up in the past 5 years, and how important it becomes for us to use our limited resources wisely. According to the Agricultural Economics and Agribusiness Department of the LSU AgCenter for a cotton farmer in Louisiana for example, the cost of fertilizer, diesel, and insecticide alone can add up to more than 40% of his direct crop expenses.

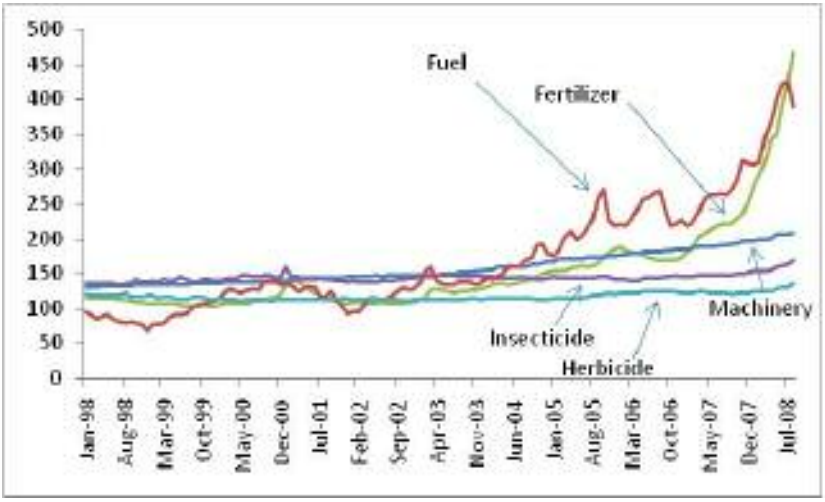

Figure 1. Price index of fuel, fertilizer, machinery, insecticide, and herbicide in the US since 1998.
Source: USDA Statistical Service

Yield Monitor

Let's start by discussing the yield monitor. Yield monitoring has been around for a while, it was first introduced in the mid 1990's in grain crops and technology has been adapted for cotton and other crops. Every type of yield monitor uses electronic sensors to measure harvested crop and a GPS receiver to assign coordinates to that point. YM can also track moisture content, harvested amount, and be used to map field details during harvest. A few examples on how yield monitoring can help our farming efficiency:

1. Long term yield monitoring will help determine different production zones in farming areas. Causes of variation can then be addressed.
2. Long term yield monitoring can also help in determining if your farm is more or less productive than regional average and therefore aid in the price negotiation.
3. Areas with historic yield maps can receive customized fertilizer prescription based on removal rates.
4. Yield monitoring helps on farm variety trials. The ability to match yield information with planted seed variety gives the farmer an unique opportunity to evaluate what works and what doesn't in his property.
5. During harvest, the farmer can map possible yield-reducing variables such as patches of weed.

The decision to invest in a yield monitor may not be an easy one. To aid farmers interested in this technology, the University of Tennessee has developed the CYMIDA (Cotton Yield Monitor Investment Decision Aid) software. This program helps farmers evaluate yield gains and input savings required to pay for a cotton yield monitor. The program can be downloaded at (http://economics.ag.utk.edu/cymdiaanalysis.html).

Global Positioning Systems Receiver (GPS)

One key component of any PA system is a GPS receiver. With the aid of a GPS many technologies can be used to help us farm more efficiently. The first task a GPS receiver

can help us in the farm is to determine the correct field area. Many times farmers use information from outdated maps to calculate area, often under or over-estimating field area as much as 20%. GPS receivers can also be used to map collected soil samples, drainage tiles, and additional information that can aid farmers in planning the next seasons.

GPS coordinates collected during harvesting can be used to analyze equipment and operator productivity (Grisso et al., 2002). GPS coordinates contain information such as combine speed that can be of help when planning field layout. Grisso (Virginia Tech) compared field efficiency between straight and contour patterns looking only at GPS coordinates and concluded that straight patterns have a 10% gain in efficiency when planting and 20% when harvesting.

Spray monitoring systems

A GPS can also be used as part of a auto-boom shutoff system spraying system. In this type of system, whenever overlap occurs the controller shuts off the spray for that section avoiding double spray and saving chemical. For a simple idea of the magnitude of savings that can be generated with this technology, an overlap of only 18 inches will result in a 50-acre overlap in a 2,000-acre field. With an auto-boom shutoff system, maps can be created specifying "spray" and "no-spray" zones and based on the GPS coordinates the sprayer will only operate in the "spray" areas.

Guidance Systems

Guidance systems can aid farmers during several tasks. Using a lightbar for machine guidance during soil preparation, planting, and spraying will have numerous benefits to the farmer such as: reduced skips and overlaps, increased number of acres per hour and hours per day, along with improving savings on diesel and chemical when spraying.

Auto-guidance systems (autopilot) are making a huge success in the American farmland. This system uses a very precise GPS along with electronic sensors to guide machinery in the field, helping farmers to keep rows evenly spaced and making the fieldwork less tiring. By taking the guess out of the work, an auto-guidance system can allow farmers to stay in the field longer and get more acres done in the hour and more hours worked in the day improving overall efficiency. Dr. Raper (USDA-ARS National Soil Dynamics Laboratory, Auburn, AL) worked with a precise GPS system to locate how far should in-row subsoiling be from the cotton plant row to maximize yield. Noted that it would be difficult to plant directly over the loosened soil zone because of crop residue, he experimented with different distances and designs. Results of his work show that cotton planted 2 inches from in-row subsoiling yielded 44% more that areas that did not receive any subsoiling. Only with a GPS-based auto-guidance system can we maintain that kind of precision in the field. Auto-guidance systems came down on price substantially in the past few years, from over $40,000 in 2004 to less than $20,000 in 2006.

Variable-rate Systems

Variable rate application of fertilizer and seeds are additional PA technologies that may generate increased efficiency in the farm. Using a variable rate system, fertilization can be field tailored avoiding under or over fertilization. Variable rate seeding during planting can improve yields by allocating different number of seeds per acre according to a prescription.

Conclusion

New advances in sensors and computer technology has brought several products that farmers can use to increase their operation efficiency. All technologies rely heavily on the use of GPS receivers to bring information to the farmers. Whether collecting yield information or using a lightbar for machine guidance, farmers today must let technology in their land to be able to increase their efficiency and survive.