

March 9 2005 Farm Tip – Precision Agriculture, Part 2

One of the first obstacles in starting a precision agriculture program in your farm operation involves obtaining accurate farm and field boundaries. Accurate field boundaries are needed to begin customizing management and crop inputs to individual zones *within* fields.

Two approaches are available. First, the user can use a commercially available computer drafting program (e.g., AutoSketch, available at Office Depot for about \$130) to trace or outline the field boundary superimposed over an aerial photograph. This method works well in many situations and is relatively inexpensive. However, if recent aerial photographs are not available, or if the field was recently modified through land leveling or clearing, it might be difficult to locate the exact edge of the current field.

Second, the user can use real-time GPS mapping to determine the actual field boundary. Real-time GPS mapping involves driving or walking the perimeter of the field recording GPS coordinates with an ATV or backpack mounted GPS system and personal handheld computer. The resulting data is then downloaded into a geographical information system (GIS) for mapping calculations and display. This method is more accurate, but requires a hand-held computer to store data and resulting maps, a differential GPS receiver to collect accurate location data, and GIS software to process GPS data and perform geographic calculations.

The initial equipment and software needed to get started making field boundaries is easy to buy. For example, several companies have internet sites that allow users to purchase equipment on-line and have it mailed directly to the user's location. Companies with on-line shopping services that sell GPS and GIS equipment suitable for basic precision agriculture operations (e.g., making field boundaries) include:

Hand-held Computers:

- <http://welcome.hp.com/country/us/en/prodserv/handheld.html>
- <http://www1.us.dell.com/content/products/category.aspx/pda?c=us&cs=19&l=en&s=dhs>

Differential GPS Receiver:

- <http://www.ravenind.com/RavenPrecision/GPS/antrec.cfm>
- http://www.trimble.com/ag_mapping.shtml

GIS Software:

- http://store.esri.com/esri/showdetl.cfm?SID=2&Product_ID=45&Category_ID=15
- http://store.esri.com/esri/showprod.cfm?SID=2&Category_ID=11
- <http://www.farmworks.com/>

Iowa Land Service uses a HP iPaq 2215 Pocket PC as the hand-held computer data collection device. The iPaq uses an Intel® XScale™ 400MHz processor, Microsoft® Windows® Mobile 2003 Premium for Pocket PC operating system, and uses a 3.5" transfective TFT display with backlight. We link the Raven Invicta 210 differential GPS (DGPS) receiver to the iPaq to provide real-time sub-1.0 meter position solutions (typically delivering 5 GPS solutions every second). The Invicta 210 combines a high performance GPS receiver and a dual channel beacon receiver that operates off the USCG network of radiobeacons providing free DGPS service. Our iPaq is installed with ESRI's ArcPad™ software to collect GPS positions and generate field boundaries (in addition to many more GIS tasks). ArcPad™ provides database access, mapping, GIS, and global positioning system (GPS) integration to users out in the field via handheld and mobile devices. Once field collection is finished, we connect the iPaq to a laptop or desktop computer in the vehicle or office and download the collected data into ArcView™ for data manipulation and interpretation. ArcView™ is desktop GIS software that provides robust geographic data visualization, mapping, management, and analysis capabilities along with the ability to create and edit data and customize user interfaces. The total cost for this equipment was about \$4,500. The user may ultimately choose to use the services of an experienced GIS consultant or farm management firm with the necessary GIS equipment and skills due to the initial start-up costs.

When you begin a precision agriculture program on your farm, you should see financial incentives in several areas. Benefits of precise field boundaries and the corresponding calculated field areas include:

- Accurate planter and sprayer calibration
- Minimize input costs and prevent potential environmental pollution
- Quantity of inputs is appropriate for actual acres treated
- True yield maps
- Generate cash rent and farm program payments based on accurate total acres (using ground-truth location data)

Once in the field and ready to collect field boundaries, the user or consultant will collect GPS coordinate data (actual locations on the ground) at certain intervals, typically one GPS data location every second. However, more frequent GPS solution calculations (5 GPS solutions per second or for high accuracy variable rate applications, 10 GPS solutions per second) are typically more accurate. Regardless of GPS rate, the consultant uses the inherent 'on-the-go' mapping features of their hand-held computer and installed software to verify no areas of the field are missed. When finished in the field, the consultant will transfer the GPS coordinate data into

the appropriate field boundaries using GIS software like ArcView or FarmWorks. The resulting field boundary and other field information are then provided to the user or owner (see Figure 1 for example). Once the user has the field boundaries mapped, then they can begin mapping additional farm resources (e.g., tile lines, soil types, etc.) and performing more detailed calculations and queries of their farm operations.

Figure 1. Example of a final field boundary showing total acres, average Corn Suitability Ratings (CSR), land-use type, and field names for each field. Each field boundary was created using a backpack GPS unit while driving the field boundaries on an ATV.

4M Farms - North Farm

