Machinery Management Using Precision Agriculture Technology

This course focuses on agricultural equipment that is commonly used in conjunction with GPS technology. Planters, combines, fertilizer application equipment and sprayer application equipment are commonly equipped with GPS equipment to control and record operational parameters. These parameters focus around the equipment’s geographic location and can be recorded simultaneously with the volume of product applied and weather information (wind, temperature, humidity, etc.). GPS guidance is one of the main technologies to be studied throughout the course. The management of this equipment and the GPS technologies used to control and record this information is the focus of the course.

Outline of Course by Session – The 14 online sessions will be covered in an 8 week period plus 2 days of hands-on training covering an additional 4 sessions.

1. Introduction to Precision Agriculture

A number of technologies have moved agriculture forward. Some of those technologies and innovations have included the tractor, introduction of pesticides and herbicides, crop hybridization and biotechnology. Precision agriculture technologies have been a next step in moving into the future. This session will be an overview of precision agriculture.

2. GPS Systems

Global Positioning Systems utilizing satellite coverage is the heart and soul of most precision agriculture operations. Differential positioning, or using a fixed reference for allowing more precise measurement (RTK), allows even greater accuracy for establishing the spatial dimension of field data. Gaining an understanding of GPS terminology and principles will be covered in this session.

3. Overview of Machinery Management Concepts

Precision agriculture technologies can be tied to machinery management concepts. GPS guidance is one of those technologies. One of the main goals of adopting GPS guidance is to eliminate overlap. Overlap can be quantified by calculating field efficiency, field capacity (acres/hour), and material capacity (bushels/hour). These concepts will be the focus of this session.

4. An Introduction to Mapping (GIS) Technologies

This session will be an introduction of GIS (Geographic Information Systems). How commercial precision agriculture software (GIS) is utilized in a precision ag system for data management and analysis and can be utilized in setting up agriculture machines for GPS technologies from data collection to GPS auto guidance will be one focus of the session.

5. Precision Ag Data Management – Field Identification – A Key Component

This session will focus on the process of field identification as relates to precision ag data management. Identification at the field level management unit is the common tie between each part of the precision ag system. The importance of this common tie will be discussed through the applications of recordkeeping, data analysis, equipment setup, government programs, and crop insurance. Another key component to be discussed in this session will be the importance defining the field boundary.

6. The Nuts and Bolts GPS Guidance – Aided (Lightbars), Assisted Steering, and Automatic Guidance

- systems available, - installation procedures, - cost of various systems

7. Tractor Issues – The main items of discussion will be GPS Guidance/Auto Steer, utilizing control systems - factory installed or aftermarket, data collection issues during the growing season – agronomic and machine data.

8. Overview of Variable-Rate Technologies

All of the precision ag technologies applied to precision farming would be of questionable value if one could not vary the rate of inputs or follow a prescription over a field. Varying rates can allow one to save inputs, reduce cost, and spot apply areas of disease or pest outbreaks. Site-specific crop management becomes possible with the use of either map-based or sensor-based technologies. This session will discuss these technologies.
9. Sensor Technologies for Variable Rate Application

Sensor technology obtains information about an object without directly contacting it. In an agricultural environment, information about the soil or crop can be utilized in variable rate application. This session will specifically focus on agricultural equipment-based sensors for variable rate application.

10. Planters – The main items of discussion will be data collection – agronomic and machine data, variable-rate technology - factory installed or aftermarket. One focus of this session will be proper setup for collecting as-applied data for reporting purposes such as crop insurance.

11. Fertilizer Application Equipment
   - Granular – Pull Type and Self Propelled, Single Product versus Multiple Product
   - Liquid
   - Anhydrous Ammonia
   The main items of discussion will be data collection – agronomic and machine data, variable-rate technology - factory installed or aftermarket. Differences in equipment technology as related to precision agriculture will also be discussed.

12. Sprayers
   - Self Propelled
   - Tractor Drawn
   The main items of discussion will be data collection – agronomic and machine data, variable-rate technology - factory installed or aftermarket. Technologies such as automatic boom control will be part of this section. Differences in equipment technology as related to precision agriculture will also be discussed.

13. Combines – Harvesting Equipment
    Yield monitoring systems will be discussed with an emphasis on the engineering aspects of those systems as related to a precision agriculture equipment system and how these systems can be uses with other pieces of equipment in a production system, i.e variable rate application and GPS guidance. Calibration will be an important part of this session as relates to the accuracy of crop yield reporting.

14. Why Adopt GPS / Precision Ag Technologies?
    - economic issues
    - environmental issues
    This session will be focus on the bottom line in a crop production setting and explore the economics and environmental issues related to adopting precision agriculture to an equipment line. So now you have the bug, what equipment should you keep of your existing equipment line?

Development of a Plan to Incorporate Precision Agriculture Technology into an existing equipment line

Sessions 15, 16, 17 and 18 will be Hands-On Lab Sessions

The lab sessions will consist of two full days. Each day will cover two of the following hands-on lab sessions:

1 lab on GPS setup and diagnostics as relates to data collection with various pieces of equipment. Laptop computers will be used for this session to show how diagnostic evaluation can be made in the field with GPS hardware.

1 lab on RTK GPS setup and operation will be covered during this lab session. RTK GPS receivers are highly accurate and utilized for auto guidance on a number of agricultural machines.

1 lab on GPS guidance/auto steer setup and operation on a tractor will be covered. Operation of guidance systems will also be covered.

1 lab on maximizing the use of precision ag technologies from yield monitoring - combine applications to variable rate controller setup and operation. How can one piece of hardware accomplish multiple precision agriculture applications will be covered.