TECHNICAL NOTE
FOR IN-SERVICE USE

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Precision Agriculture in Florida

Precision agriculture or precision farming is an agricultural concept that is based on the existence of in-field variability. Its application has been made possible by the availability of new technologies, such as Global Positioning System (GPS), sensors, satellites or aerial images, and geographic information system (GIS) to assess and understand these variations. Collected information may be used to more precisely evaluate optimum sowing density, estimate fertilizers and other input needs, and to more accurately predict crop yields. It seeks to avoid applying the same practices to a crop, regardless of local soil/climate conditions, because they provide minimal economic or conservation returns. Also, use of precision agriculture methods may help to better assess local situations of disease or lodging.

Precision agriculture may be used to improve a field or a farm management from several perspectives:

- Agronomical perspective: adjustment of cultural practices to take into account the "real needs" of the crop (e.g., better fertilization management)
- Technical perspective: better time management at the farm level (e.g., planning of agricultural activity)
- Environmental perspective: reduction of agricultural impacts (better estimation of crop nitrogen needs implying limitation of nitrogen run-off)
- Economical perspective: increase of the output and/or reduction of the input, increase of efficiency (e.g., lower cost of nitrogen fertilization practice)

Other benefits for the farmer may be to help establish a history of farm practices and results, which will help in decision making and to address traceability requirements that are becoming more common within the agricultural sector.

Elements of this Technology

- Global Positioning System (GPS) is based on a network of satellites developed for and managed by the U.S. Defense Department. The GPS constellation of 24 satellites orbiting the earth, transmit precise satellite time and location information to ground receivers. When ground receiving units acquire location information from several satellites at a time, it can be used in calculating a triangulation fix, thus determining the exact location of the receiver.
- Geographical Information System (GIS) consists of a computer software database system used to input, store, retrieve, analyze, and display, in map like form, spatially referenced geographical information.
- Yield monitors are crop yield measuring devices installed on harvesting equipment that record and store yield data at regular intervals along with positional data received from the GPS unit. Precise yield maps can then be generated using GIS software.

Remote sensing image data from the soil and crops can be processed and then added to the GIS yield database.

- Variable rate technology (VRT) consists of farm field equipment with the ability to precisely control the rate of application of crop inputs and tillage operations based on current or historic assessments.

Applications of these technologies in Florida Agriculture

Yield monitors are now being used on cotton and peanut pickers in the panhandle region and in the citrus groves in central and south Florida. Global positioning systems have allowed variable-rate application of water, nutrients, and pesticides.

In row crops in the panhandle, the predominate use of precision technology has been the variable rate application of fertilizer based on information gained from GPS soil sampling. Even with this new technology, the key to good decisions is good sampling. Sampling field soils for nutrients has been studied intensively. At present in the southeast U.S. zone sampling, based on yield zones (areas that yield the same or respond similarly), has come to the forefront. Zone sampling requires knowledge of where crop yields differ in areas of the field and what zones respond similarly. By linking soil sampling to yield zones more is known about the field and the grower knows where responses begin and end. Even without yield monitors many growers, who have run a harvester or grain combine over a field for many years would know what areas or zones have similar yields or soil types and can sample accordingly. When nothing is known about a site, grid soil sampling can be done although it is more intensive than zone sampling.

In the citrus groves of central and south Florida ultrasonic sensors are used to measure tree canopy height and have been put on sprayers to detect tree size. This same concept has been applied to variable rate granular fertilizer spreaders. The fertilizer is banded in the amount regulated by sensors detecting tree canopy size. University of Florida research has shown that fertilizer usage can be reduced up to 40 percent, nitrate leaching can be significantly reduced, and less than a half-second is needed to dispense the correct fertilizer dose.

Harvest managers also can identify problem areas in citrus groves by using yield monitors and mapping. Yield monitors geo-reference each tub/box of fruit with a GPS receiver as it is loaded on the truck. Tub/box density can be calculated and converted to fruit yield maps. Yield monitors for the new shaker-type harvesters are being developed. These will give greater data accuracy, because they will be based on a single tree versus the multiple trees that the tub/box monitors now record. Other monitoring methods are being developed that will map yields at different locations on a given tree. Canopy volume can be measured by using ultrasonic sensors and a digital GPS receiver. Ripe fruit counts can be estimated by machine vision cameras and that, combined with the canopy volume, can be used to predict individual tree yields. Precision agriculture can also be used to remotely control irrigation in citrus groves. Automated irrigation pumps, using computerized controls, offer water savings from better zoned irrigation scheduling and added freeze protection through automatic start capabilities.