

Crop Management with Active Sensors



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Background

Active crop sensors like the CropCircle, Yara ALS and Greenseeker use a light source to illuminate the crop and measure the reflectance in several specific wavelengths. This crop reflectance can be calibrated to the crop characteristics of interest – e.g. Green Area Index.

Until recently Precision Agriculture (P.A.) has mainly consisted of relating historical data to current crop and soil management. This works well to measure and manage characteristics which only change slowly over time like:

- EMI / Soil Conductivity which shows the accumulated soil erosion and deposition over millennia
- Soil Fertility (pH, P, K, etc) is the accumulated sum of of fertiliser and lime applications and crop and wleaching losses over decades.
- Yield Maps are the sum of everything that happened to that crop in the previous growing season.

This approach allows us to manage soil fertility, seed rates and sometimes N rates. However this historical approach has a significant problem when we are trying to manage the crop currently growing in the field.

The Problem

Different weather patterns cause crops to grow and respond differently to inputs on different soil types and aspects. In a dry years heavier areas with greater water holding capacity might be best while in wet years lighter free draining areas will thrive. The management of the crop has to change to take into account the current weather patterns and the response of the crop to those patterns. Active sensors are the ideal tool to do this.

The Role of Active Sensors

The crop is the perfect sensor and active sensors allow a snapshot of the crop to be taken every time the crop is sprayed or fertilised. As active sensors have an inbuilt light source they are not limited by time of day or ambient light conditions. The scan can either be used in real time to variably apply N or growth regulators or it can be mapped back at the farm office and an application map created. Either technique allows growers the ability to respond to crop variability introduced by current weather patterns. It also allows growers to compare crops across fields and get an objective relative quality and amount of crop variability for each field which aids decision making when assigning fertiliser rates and job priority.

Crops do not grow evenly across the field and another very useful product of Active sensor scans is a “change” map where a previous map is subtracted from the current map. This is easy to do with active sensors but much more difficult with satellite images due to atmospheric correction problems. A change map shows problem areas where the crop is not growing strongly and also can be a help when producing N application maps – If an area has already had some nitrogen and has not responded to it is unlikely to respond if more N is applied. When trying to increase nitrogen use efficiency the easiest way is often not to apply more to areas that are unlikely to respond to it.

Management Strategies

Variable rate application with active sensors is usually limited to nitrogen and agrochemicals simply because those are the main inputs applied to the growing crop. The nitrogen application strategy can change based on different agronomic models, timings and crops but the system should allow agronomists and growers flexibility to choose the best strategy for their crop.

Summary

Active crop sensors allow crop scouting and real time management of nitrogen and agrochemicals and therefore can contribute to an improvement in the current growing crop's margin per ha.