Driving efficiencies with precision agriculture

By Carin Venter

Technology as we know it is changing the world and the way we live. This is undoubtedly true for agriculture as producers have more advanced technological solutions at their disposal than ever before.

Producers know that greater yields translate into greater profits. They also realise that they cannot leave anything to chance when it comes to improving the productivity of agronomic crops. This is where precision agriculture can be of great value, as it helps producers to make critical decisions and get the job done accurately when it matters most.

FarmBiz spoke to experts in the field of precision agriculture for an overview of the latest technological trends.

Smart farming technologies
Dr Tingmin Yu and Johan van Biljon of the Agricultural Research Council’s Agricultural Engineering division summarise precision agriculture as an approach that uses smart technologies to accurately manage crop variability in the field, so as to ensure that the crops and soil receive exactly what it needs for optimum health and productivity.

The goal of precision agriculture is to grow more food with fewer resources at lower production costs. In other words, it aims to make crop production more efficient while producers and natural resources work smarter, and not harder. This is achieved by using technology to guide immediate and future decisions on every input in the field, such as seeds, fertiliser and chemicals. It allows these inputs to be applied in a certain quantity, at a particular rate, and at the best time.

Some of the key technologies that characterise trends in precision agriculture include the adoption of mobile devices, wireless communication, access to high-speed internet, low-cost and reliable satellites, unmanned vehicles, and tractor implements that are optimised for precision agriculture.

Taking a holistic approach
Dup Haarhoff is the head of Agricultural Services at GWK, where a holistic approach is taken in respect of precision farming. They aim to bridge the gap between technology and its application by independently adding value.

“Our goal for each producer is to reach the best possible way of working based on the situation at hand, known as best practice, and to reach a point of financial sustainability,” says Dup. “It doesn’t matter whether producers farm conventionally, practise conservation agriculture, or apply no-till practices.”

He believes that the excellent return on investment is one of the reasons why investment in precision agriculture pays
and admits that, while the equipment does not come cheap, smaller producers can sidestep this hurdle by making use of contractors who own and use the required equipment.

On the topic of affordability, Dup refers to GWK’s handy ‘e-cost guide’, which sets out the costs of all the different tractor and implement combinations to enable producers to make sense of the mechanisation component of precision farming.

Decision-making in the field
At Agri Technovation, the primary objective of precision agriculture is to maximise profitability, efficiency, and sustainability on the farm – aspects most producers strive to improve.

“In 2015, we envisioned a digital solution that would replace the limited and frustrating paper-based approach to farming practices,” says Earl Smith, head of MyFarmWeb™ and Services at Agri Technovation.

MyFarmWeb™ is a convenient internet-based platform that is easily accessible to all producers and is at the forefront of digital innovation, especially concerning precision agriculture.

It offers consumers the opportunity to easily apply precision farming in their daily farming practices with the help of a cloud-based app. In addition, its affordability allows it to cater to everyone, from the smallest farmers to the largest commercial producers. “By improving overall production efficiency, it enables producers to make swift yet informed decisions,” remarks Earl.

Precision land management
New Holland Agriculture’s Precision Land Management (PLM) precision farming equipment and software, include a full range of various GPS steering systems and options to meet producers’ needs. Some notable features include:

- **Software for the analysis of yield data** to reduce production costs, as well as advanced telematics. The latest data management programs and upgrades include the new My PLM Connect portal, which is designed to help producers manage agronomic data from their office, smartphone or tablet.
- **Farm management:** This tool enables producers to monitor their operations from a distance with a bird’s-eye view of their fields, as well as prescriptions and agronomic data. They can also track equipment and monitor individual machine performance. From a single location, farm managers can provide the necessary information to run equipment optimally. Data for field setup, such as guidelines, boundaries and prescriptions, can be shared with various pieces of equipment for maximum efficiency and ease of use.
- **Fleet management:** The fleet management portal is optimised for ease of use with intuitive technology that transfers information to farm managers, owners, and traders outside the premises. Notifications for equipment parameters can be configured to detect and receive data about mobile equipment. If problems occur, farm managers can be proactive and mitigate the situation.
- **Data management:** Data management allows users to collect data in the cloud and display it immediately. Producers can now seamlessly transfer data to and from the field to share insights to enable informed decision-making.
- **New API Partners:** Owners and operators of New Holland equipment can connect their accounts with third-party businesses focused on agriculture to use their data or receive field data.

No one-size-fits-all solution
Frikkie Senekal is an area manager at Equalizer. He believes that each area has different needs based on climate, soil type and historical practices. He highlights the following trends:

- **Minimum tillage** is still going strong, and producers are reaping the benefits of a single-pass system. Certain areas, however, still prefer conventional planters and for valid reasons.
- **The adoption of precision planting systems** over the past four years has been remarkable. Five years ago, control systems on planters comprised a small portion of the market. However, most Equalizer planters are now fitted with a control system, varying between seed and fertiliser application. This trend specifically applies to the eight-row and larger planter market.
- **Liquid fertiliser** adoption has seen a year-on-year increase for the past five years. The benefit is easier handling of the liquid product, but the quality should be considered. Like granular fertiliser, the product’s quality is critical. If the quality is poor, the planting process can become tedious. It is important to note that some liquid fertiliser control systems only function correctly with clear liquid solutions.
- **Producers are applying more products** during the planting process, such as in-furrow starter fertiliser and herbicide. To put it in perspective, five years ago the planters offered by Equalizer applied fertiliser at a single point and planted seeds. Planting units now have seven different locations from which producers can choose to apply liquid and granular products.

Precision spraying in orchards
According to Marius Ras, marketing director at Rovic Leers, the future of precision spraying lies in a reduction of...
Sub-Saharan Africa, believes that the future depends on technology. He notes that it is all about enabling producers to plan faster and more precisely. Accurate data is gathered on the different types of agricultural equipment for tillage, planting, spraying and harvesting to help producers make faster and more informed decisions.

For example, in the category of planting and seeding, technology allows for on-the-go adjustments on row cleaners and coulters from the comfort of the cab. It also allows for more hectares to be planted in a day. Maize and soya bean growers can experience an improvement of up to 75% in the time spent to adjust a single row cleaner.

The speed and ease of adjustment also increase the likelihood of the operator adjusting the equipment for changing conditions, which can lead to improved emergence and a yield improvement of between 5 and 17%. Nowadays, many factors affect planting windows, but technology fortunately allows for faster ground speed and more precise seed and fertiliser placement.

With advancements in artificial intelligence, machine learning and a fully integrated data ecosystem, producers will not only be able to use their machine data to drive efficiencies in their operations, but also share real-time agronomic and field data with their trusted advisors, who can analyse it and respond with updated recommendations while the producer is still in the field. The power of data and smarter machines will shape the future of variable-rate applications to move closer to a ‘per plant’ management of all inputs and outputs.

The race against time
John Deere realises that producers will need to produce 50% more food before 2050. They must achieve this by using less land and limited resources, which is a significant challenge. Stephan Nel, marketing manager at John Deere

variation. Thus far, the single biggest challenge to overcome has been that a variation of 50 to 70% in the deposition of chemical spray is quite common and improvements to below 50% have not yet been consistently achieved. Currently, this considerable variation is mostly countered by oversupplying the amount of spray per hectare compared to what could be effective, should these variations be brought to below 20%.

Marius points out some factors that support the achievement of this objective:

- Tree structure should be managed to enhance the possibility of penetrating the target area. No amount of liquid or air movement can penetrate a solid wall. Allowing air laden with spray particles to penetrate the tree evenly will support more uniform deposition. Without this focus, little further progress towards more uniform deposition is possible.
- Once the tree structure has been modified to the required uniform permeability, the amount of air momentum required to displace the dry air in the tree at the chosen spraying speed must be balanced to dissipate all energy within the tree canopy.
- The design of the correct air velocity profile according to the shape of the tree and the droplet spectrum volume median diameter (VMD) selection will allow the entire target area to experience the same air velocities in the vertical plane sectors. This will dissipate all the air momentum in the target volume, depositing the atomised liquid evenly in a declining gradient towards the furthest side of the tree. Spraying again from the other side will thus theoretically result in an even deposition throughout the structure.
- Determine the required litres per hectare to reach the correct level of recovery at the chosen droplet spectrum based on the litres per cubic metre of the target volume. In deciduous fruit, the trusted and tested tree row volume (TRV) model is still the only reliable basis, where 93,7% of atomised liquid (50 to 175 micron VMD) per 1 000m² of foliage yields the point just before run-off.
- Novel technology such as light detection and ranging (LIDAR) would be the goal in principle – measuring the tree leaf density in each segment in real time and adjusting the flow for each region accordingly.
- Remote sprayer control systems do the thinking, adjustments, and even the driving, while the operator corrects in-field problems on site.

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