

Precision farming for improved soil health

By Dr WA Lombard, Department of Agricultural Economics, University of the Free State

The Fourth Industrial Revolution is well underway and is characterised by the fading boundaries between the physical, digital and biological world. It is further characterised by advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), genetic engineering and three-dimensional (3D) printers, among others. In our changing world new technologies are also being developed for the agricultural sector, which will enable this industry to improve production.

Are livestock farms geared?

Livestock farmers have not fallen behind, and precision farming is a reality on many livestock farms. The technology that is utilised incorporates, among other things, the collection of advanced information. It monitors the use of certain resources and controls certain production processes with precision. By using electronic data collection, processing and utilisation, precision farming offers producers the opportunity to improve animal productivity, reduce costs and promote animal welfare.

International studies illustrate the customised precision farming system developed for Australian beef cattle branches. The development of the system was based on the elements of the so-called Hazard Analysis Critical Control Point (HACCP) method and can also be used for other livestock enterprises.

The principles on which this system is based include:

- Identifying those aspects that have an impact on productivity, profitability or sustainability. In this

instance aspects are considered that may impede the branch's sustainability if not applied correctly. The number of aspects involved must be manageable, as it needs to be applied consistently throughout. As an example, there are only 29 processes that are included in an entire beef cattle branch system and which are considered critical for maximising profit and sustainability.

- Identifying variables in each critical process to ensure that it is successfully completed.
- Predicting which corrective action will be cost effective if the information collected indicates that the branch is not functioning within specified parameters during a specific process. As the corrective steps that will apply when parameters are exceeded are specified in advance, the situation is less stressful for the branch manager.
- Specifying standard operating procedures for each branch and each of the critical processes in advance. This will ensure that these processes remain within the specified parameters under normal circumstances.
- Providing resources to measure these critical processes, interpret the data and determine which corrective steps to take. This is critical as it will form part of consumers' acceptance of the technology.

Benefits of the HACCP-based system

Where precision farming is already integrated with traceability, role-players in the livestock industry have noted the following benefits:

- Livestock feed manufacturers and input suppliers can improve the composition of their products if they

have access to abattoir statistics in which livestock feed profiles on a farm have been considered.

- Producers can use this type of system to identify the right feed or feed supplier. They can also optimise feed intake or consumption of their livestock by basing it on the results of other producers who are using the technology.
- Abattoirs and feedlots, in collaboration with producers, can use the system to produce more animals or realise certain weight or conformation requirements.
- Reliable industry-specific information can be used to influence decision-makers as well as the direction in which an industry is moving.

Extensive livestock farming

The precision technology developed for extensive livestock branches works mostly with radio frequency identification (RFID) systems, which help producers keep more accurate records. Intensive industries also use technology that can help identify and treat sick animals timeously. These systems work by using cameras.

As far as soil health is concerned, producers who manage their grazing efficiently may already (knowingly or unknowingly) be engaging in some form of precision farming.

Producers often express their concerns or are wary of applying high-productivity management systems in their farming operations. This concern is often related

to the risk of financial losses due to the unpredictability of the environment, market-related factors, or damage to infrastructure such as the soil and grazing on a farm. Although it seems as though technology that addresses soil and soil health management on livestock farms is in short supply, it remains extremely important.

All life comes from the soil

There is a lot we can learn about soil health and the role it plays in livestock farming from Burke Teichert, an American livestock consultant. According to him, most cattle farmers put their livestock first, followed by grass, while their soil receives the least attention. He suggests a reversal in the way we think and our approach to grazing management. Soil must come first, as all life comes from the soil.

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Livestock is an important role-player which can either improve or damage soil, but many producers do not really give much thought to their approach. Livestock simply graze as and when needed. He also believes most producers are unaware that they are overgrazing the veld as they do not actually know what overgrazing entails.

Grazing is usually managed to benefit livestock, and at times the grass, while little attention is paid to the soil and its health. Many farmers are ignorant to the fact that livestock can be used to improve the soil's organic matter content, increase water infiltration rate, improve water-holding capacity or enhance nutrient circulation. If these aspects are incorporated, the grassland will be far more productive.

Livestock as an aid

Livestock must be valued for more than just their end value; they must be seen

as a useful aid for soil improvement, which in turn leads to improved grazing. Short periods of grazing followed by a period during which grazed plants can recover fully before being grazed again, as well as the animal waste deposited on the soil surface or the spreading of manure and urine over the grazing, are important elements in soil improvement.

The judicious use of herbicides and pesticides is also vital, as poison does not only damage the target organism. Although the nett effect is good, the unplanned consequences are often overlooked by the unskilled or uninterested eye.

Teichert also lists other factors that may affect soil health, including the predator-prey ratio and the effect of poison on organisms that promote the circulation of nutrients in soil. His opinion in a nutshell: Instead of managing for what we do not want, we must manage for what we want. What we want is healthy soil with a lot of biodiversity above and below the soil surface.

Make it part of management

While livestock must be managed for their end value (on market day), this must be done within context. If your soil's improvement and conservation does not form part of the first aspects considered when drafting your farm's strategic management plan, it is likely to be left behind.

Your farming approach must be adaptable in order to optimise good grass and grazing management. This may mean that important events such as calving, mating or weaning will not occur on the same piece of land every year, but that the result will still be good. Those involved in on-farm livestock management understand that nature



is partial to a little chaos. Livestock management must complement grass management and grass management must be in line with soil health and soil improvement goals.

In conclusion

The technological livestock systems currently focusing on profitability, input costs and sustainability are largely aimed at intensive production systems for species such as pigs and layers. However, we can expect to see new developments soon, even for extensive livestock producers. Intensive livestock systems are aimed at managing productivity per animal. This point of view could possibly be adapted to focus on productivity per hectare or per large stock unit (LSU), so that it makes sense to the extensive farmer.

As far as soil health is concerned, producers who manage their grazing efficiently may already (knowingly or unknowingly) be engaging in some form of precision farming. Allowing grazing to recover after it has been grazed, allows for important processes to take place. The management system used may need to be assessed by an expert in the field on a regular basis and the carrying capacity adjusted based on weather conditions. This may well be refined by new technology in the future. 🌱

For more information and references, send an email to Dr WA Lombard at LombardWA@ufs.ac.za.