Smart Farming

A new formula for success

Parallel tracking is well established because it saves time and inputs and makes life easier for the tractor driver.
Parallelfahrsysteme haben sich in der Praxis weitgehend durchgesetzt, weil sie Zeit und Betriebsmittel einsparen und den Fahrer entlasten.
Les systèmes de pilotage automatiques sont presque devenus monnaie courante parce qu'ils économisent des intrants et allègent le travail du conducteur.

Many farmers are now reviewing precision farming with slightly more reservations. Often, machinery manufacturers simply promised too much, too fast. Or farmers with the new technology find themselves drowning in a flood of data without knowing how to apply it. Many have been overwhelmed by the new technologies. And mostly they haven't helped much as decision aids either.
But there's still a lot of movement in the precision farming area. For instance, machinery manufacturers are actively pushing the ISO-BUS standard. They realised that »island solutions« were not going to help anyone any longer. There's also a move to consider more the needs of the crop plant and to apply new technology to support farmers more simply and more efficiently in their decision making. The aim of science, advisory organisations and the industry is to integrate all the linked crop production factors more strongly into the system precision farming.

High labour costs in recent years have encouraged larger, wider and faster machinery for cost efficient production. The latest innovations in this development feature sensors and machinery control systems. New sensors record changing growth conditions of crops more sensitively, accurately and efficiently. Hi-tech machinery and sub-systems adjust automatically and rapidly to changing conditions.
The principles of precision farming were not new but it was only with availability of satellite-supported navigation systems (GNSS) that this approach became technically realisable and, in-part, completely automated.

John Deere

What precision farming hasn't managed so far, though, is to structure general on-farm data management in a simple way. The additional area and time related data and other relevant information won by recording has not been able to be integrated simply and reliably into new strategies for crop or farm management. There are still problems with compatible interaction between information from open or private business information sources. Automated decision aids that exploit different information sources in support of energy efficiency and cost effectiveness as well as environmental compatibility, are missing.
Precisely here is where »smart farming« is trying to get a foothold. Smart farming is based on precision farming but also dependant on information-intensive technology. The difference from previous systems is that this approach takes all areas of information into consideration and also has a higher level of knowledge and automation.
What smart farming concepts already exist? And how can they be further developed? Here are a few examples.

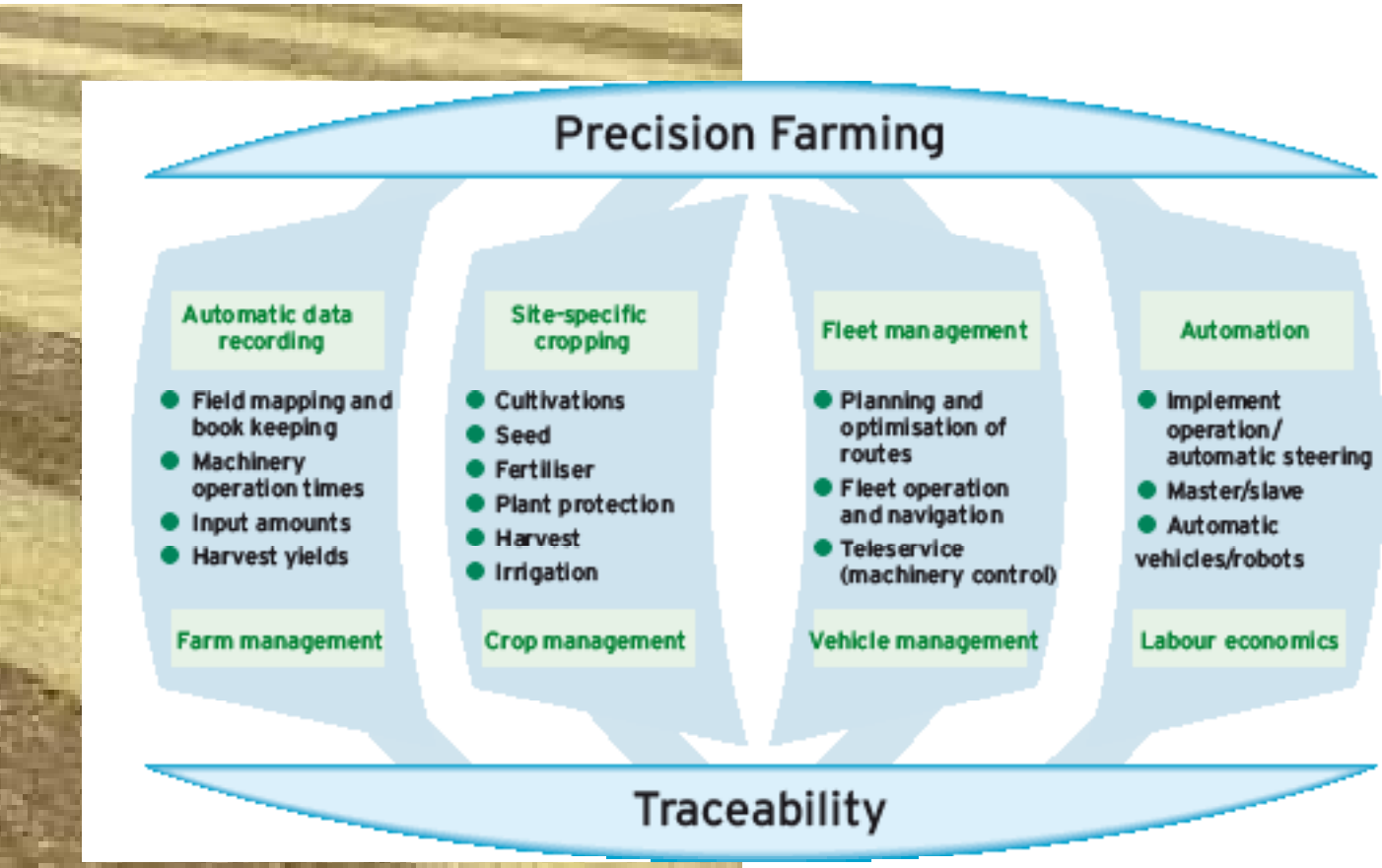
1 Automatic data recording. Mostly, tractors and implements on a farm come from different manufacturers. Increasingly, tractor-attached implements are controlled electronically and this can be standardised via ISOBUS. The potential here is a long way short of being fully exploited. The utilisation of automatic data recording and transmission and storage of operational information on the farm computer is very promising. But application of this technology is still difficult because there are »harmonisation« problems between the different data formats. Data that could well be already on the farm computer (e.g. digital soil maps or yield maps) cannot be simply integrated with sensor data. And even where this functions, the linking regulations are missing so that no clear decision aids can be made available to the farmer.

There's also a case for integration of more information from outside the farm, e.g. from suppliers and custom-

SMART FARMING

Show Special in hall 16

Advanced electronic systems now play a crucial role by providing automatic real-time communication of vital operating performance data via ISOBUS from farm equipment to the in-cab information console.
At AGRITECHNICA the Show Special »Smart Farming – Intelligent and Sustainable Plant Production« will host a wide range of independent experts from leading agricultural consultancies and specialists from academia.



Wanted in future: more automatic integration of information flows from which reliable decisions can be made.
Künftig müssen mehr Informationen automatisch verknüpft werden, um sichere Entscheidungen treffen zu können.
A l'avenir, il faudra corréler davantage d'informations afin de pouvoir prendre des décisions sûres.

ers, agricultural contractors and machinery dealerships. Legislation and certification regulations could also be drawn into the system.

2 Machinery control – automatic steering. Automatic steering systems are a commercial success. Through minimising overlapping they save fuel, time and reduce driver workload. Turning manoeuvres and distances on headlands are reduced. Savings: these can be over 40% in time and diesel.

3 Site-specific technology – real time sensors for fertiliser application. Very promising are methods that combine mapped information (e.g. from soil maps) and parameters measured in real time. Mainly applied in site-specific fertiliser application nowadays are online systems (e.g. the N-Sensor) recording particular crop parameters in real time. But usually biomass and chlorophyll density are the only two recorded although there are plenty other parameters used in everyday crop management: plant population, tiller and ear counts, varietal characteristics, growth stage, plant diseases, weed pressure, etc. Also desirable: integration of long-year advisor know-how and variety trial results.
A growing crop is a complex system and one or two parameters cannot sufficiently describe the nutrient situation. The most important parameters must be automatically recorded, in real time or from maps, for an optimal automation of fertiliser application.

4 Machinery control via optical sensors. Optical sensors such as cameras can contribute to an important reduction in work e.g. during silage harvest and transport of the chopped forage. The silage harvester is steered through optical recognition and localisation of the swath. At the same time the trailer dimensions and actual amount loaded can be determined as well as the position of the throw direction vane. Camera systems offer a new quality of control in machinery steering, helping to minimise harvest losses and assisting the operators of both harvester and tractor.

5 Site-specific technology – automatic individual nozzle control with plant protection spraying. Small fields with large sprayer booms, tramlines not at right angles with the headlands: all lead to double-dosing or misses. More accurate positioning systems with automated individual nozzle control avoid these errors. Savings in plant protection spray with such systems can be as high as 18%.

6 Machinery control – Controlled Traffic Farming. Automatic steering is also used to minimise the proportion of driven-on soil on a field area. It is a part of Controlled Traffic Farming featuring permanent tramlines with the rest of the area not driven on at all. The crop grows undisturbed and this results in higher yields and lower inputs of energy. Controlled Traffic Farming is often associated with non-inversion cultivation systems.

Conclusion. Decisions in crop production nowadays are mainly reached on the basis of too little area and time related information. Accordingly, such systems continue to have limited acceptance. These will be replaced by automated systems wherein a number of relevant parameters are applied for helping decisions. The systems will also be much simpler to use.

Prof. Dr. Hans W. Griepentrog, University of Hohenheim

Future homework

If more relevant influence factors are to flow into decision making, then better »datafusion« must be achieved: the integration of data from different sources. There's a special need for research and development in this respect. And data integration has to be automated to save time and labour. There's still plenty of potential for this strategy. For instance, with fertilising. So far, precision farming has looked at mainly one parameter, chlorophyll content, when adjusting fertiliser rate in real time. More parameters have to be recorded, analysed and applied, whether from real time recording or from other sources such as soil maps. This also applies to complex machinery control systems. Just one measurement factor is not enough. Needed here are strategies that support the operator with a wide selection of possibilities for optimising process control to reduce, for example, harvest losses or downtime. The system must be capable of combining machinery control, process data and external information (via Internet) so that a practical option can be recommended by the computer to farmer or farm contractor.

Viel versprochen, teuer verkauft, wenig gehalten – Precision Farming hat bei vielen Landwirten einen schlechten Ruf. Zwar hat die Technik in den vergangenen Jahren enorme Fortschritte gemacht. Der große Mehrwert blieb für die Praktiker aber meist aus. Künftig gilt es beim Smart Farming, pflanzenbauliche Zusammenhänge bei der Entwicklung technischer Lösungen stärker zu berücksichtigen, um dem Landwirt eine belastbare Entscheidungshilfe an die Hand zu geben.

L'agriculture de précision a été vendue cher pour tenir moins que ce qu'elle avait promis. Pour cette raison, beaucoup d'agriculteurs en ont une mauvaise opinion. Cette technologie a eu beau faire des pas de géants ces dernières années. Les agriculteurs n'en ont guère vu la valeur ajoutée annoncée. A l'avenir, l'agriculture intelligente va davantage prendre en compte la relation entre la plante et le développement de nouvelles solutions techniques afin de proposer à l'agriculteur une aide à la décision clés en main.