



EASY – Efficient Agriculture Systems

Precision farming



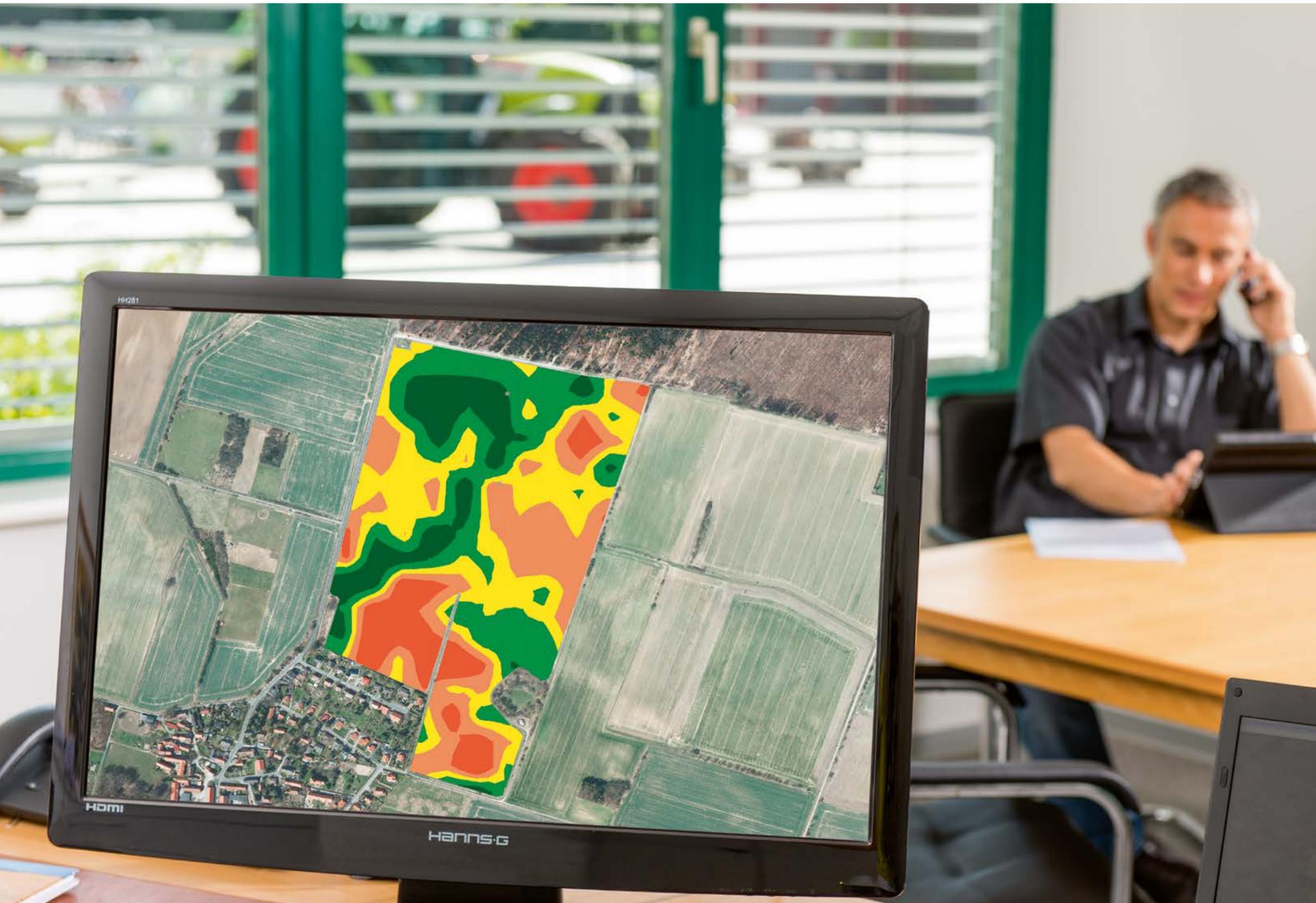
Simply get more done.

Productivity and efficiency are the buzzwords in modern farming. Only those who farm successfully with these principles in mind will survive in a climate of fluctuating markets and uncertain political conditions to create a sustainable foundation for future generations.

At CLAAS, we are committed to providing you with the right tools to tackle this challenging task.

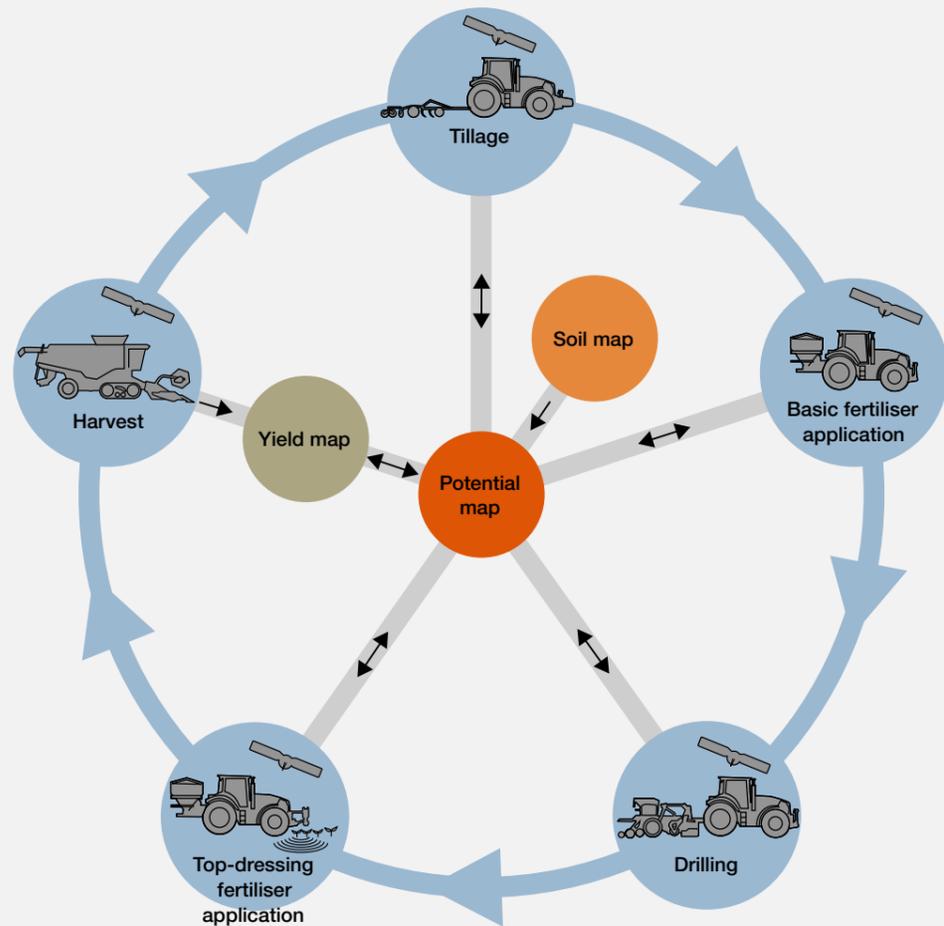
True to our guiding principles "Striving for excellence" and "Never stand still", our products are intelligently designed to network the process chain on your farm. Data and information are processed in ways which make your work simpler and more efficient.





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# A field's potential at a glance.



## A comprehensive approach.

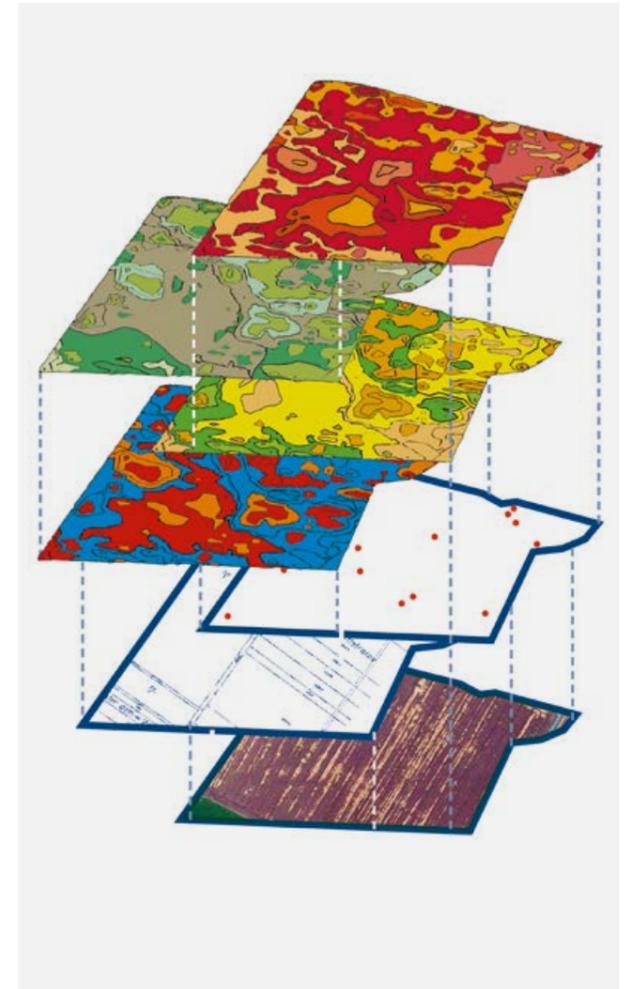
Every farmer aims to achieve maximum yields in a way which makes good economic sense. The naturally occurring conditions in every field must be considered individually and treated accordingly.

The best-established site-specific applications are:

- Basic fertiliser application
- N application
- Drilling
- Crop spraying

A wide range of mapping methods are used. A distinction is made between offline and online methods.

The soil classification map is often used as the basis for initial data collection. The yield potential is assessed according to the soil type on the basis of the classification. Scores are added to or subtracted from established reference values in order to take account of other terrain-related factors, e.g. slope and climate.



## Site-specific management.

Precision farming has raised modern agriculture to a new level. It encompasses a range of systems designed to provide differentiated, targeted management of agricultural land based on the current position in the field.

The aim of precision, or site-specific, farming is to identify differences in soil characteristics and yield potential between areas within a field and to respond in line with requirements.

The precision farming cycle starts by identifying variability. The fertiliser application and drilling rate can then be adjusted and regulated on the basis of this information. Yield mapping allows effective monitoring of the success of site-specific management systems. Soil maps also make site-specific tillage (working depth adjustment) a reality.

All these systems are supported by processes such as soil mapping, soil sampling and yield potential mapping.

This increases yields and saves on inputs while also protecting the environment and conserving scarce resources.

## Offline methods.

Offline methods are those where data collection and field treatment take place at different times. The corresponding application maps are based on:

- Yield mapping
- Mapping with a biomass sensor
- Biomass measurement with remote sensing data
- Soil nutrient maps based on soil analysis
- Soil mapping through conductivity measurement

## Online methods.

In online methods the measurement data are collected during machine operation and converted into an application rate as part of the same process. They include:

- N application with the CROP SENSOR
- Growth regulator application with the CROP SENSOR

Data from the offline approach can also be used (map overlay).

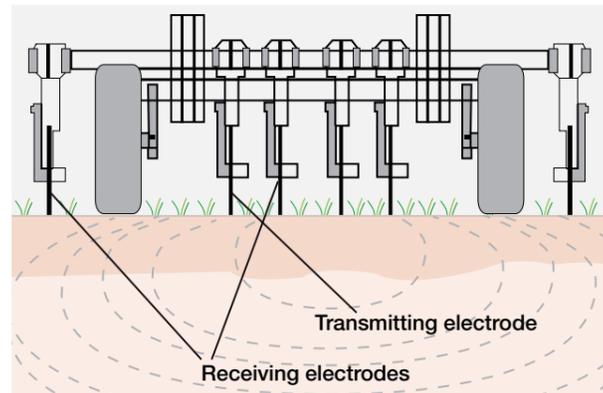


## Soil sampling.

How well do you know your land? The soil conditions within a field can vary enormously. Whole-field management inevitably results in lost yields. A sound understanding of the soil type distribution and resulting yield potential within a field is therefore crucial to site-specific farming. Meaningful soil mapping gives you a detailed knowledge of the characteristics of each site and their spatial distribution within the field.



## EM 38 conductivity measurement.



### Advantages and benefits:

- Accurate information about variability
- Information about yield potential
- Details of soil composition
- Basis for application maps and potential maps
- One-off investment

### Rapid and detailed recording of soil variability.

Soil mapping is established in agriculture as a method of showing soil variability with high spatial resolution. A soil scanner measures the apparent electrical conductivity of the soil, which is mainly influenced by the soil texture. The benefits of the soil scanner are clear:

- Precise delineation of soil zones
- Fast, reliable information about soil variability
- Light vehicles can drive across the fields efficiently carrying the scanner, without damaging the crop
- Soil conductivity maps can be used for precise planning of soil sampling or site-specific seeding
- A one-off, long-term investment

## Soil sampling plan.\*



Different yield potential zones use up different amounts of basic nutrients. Soil sampling therefore reveals a huge amount of information about the site and serves as a basis for detailed planning of cropping strategies. Zoned soil sampling gives you information about the nutrient supply in the individual zones. These zones form the basis of subsequent application maps. During the planning stage, the focus is on targeted removal of soil samples from specially selected areas, taking account of pre-defined parameters. The sampling method is chosen according to the situation on each individual farm. It is also important to choose the right grid size.

### Results and advice.

The soil samples are analysed in an independent, certified and officially approved laboratory according to VDLUFA guidelines. You will then receive the results electronically on a data CD, so you always have the key parameters to hand. The processed information can be read into all current GIS programs.

You also receive an individual, large-format overview map (A3 or A0 print-out) showing the four main nutrients, as well as the written results for documentation purposes. This gives you a clear picture of the whole situation. A soil sampling plan can then be drawn up on the basis of existing conductivity measurements.

Modern soil sampling must satisfy many requirements and we are very well placed to help you meet them:

- Soil variability is taken into account when planning the sampling (dynamic grid)
- GPS-supported sampling using lightweight vehicles in the course of your normal farming activities
- Samples analysed in accredited laboratories
- Analysis data processed for importing into the field file and supplied in digital and graphic form as a farm overview map (A0 printout)
- Direct use of soil sampling results for variable-rate application

### CLAAS services at a glance:

- Data collection
- Analysis of site-specific information
- Preparation of a soil sampling plan
- GPS-documented, machine-based soil sampling
- Analysis in a certified laboratory
- Results of analyses presented as graphics
- Print-out of the farm nutrient map
- Handover and, if required, integration into the farm PC
- Advice on preparing application maps
- Creation of a yield potential map

# Sound management.

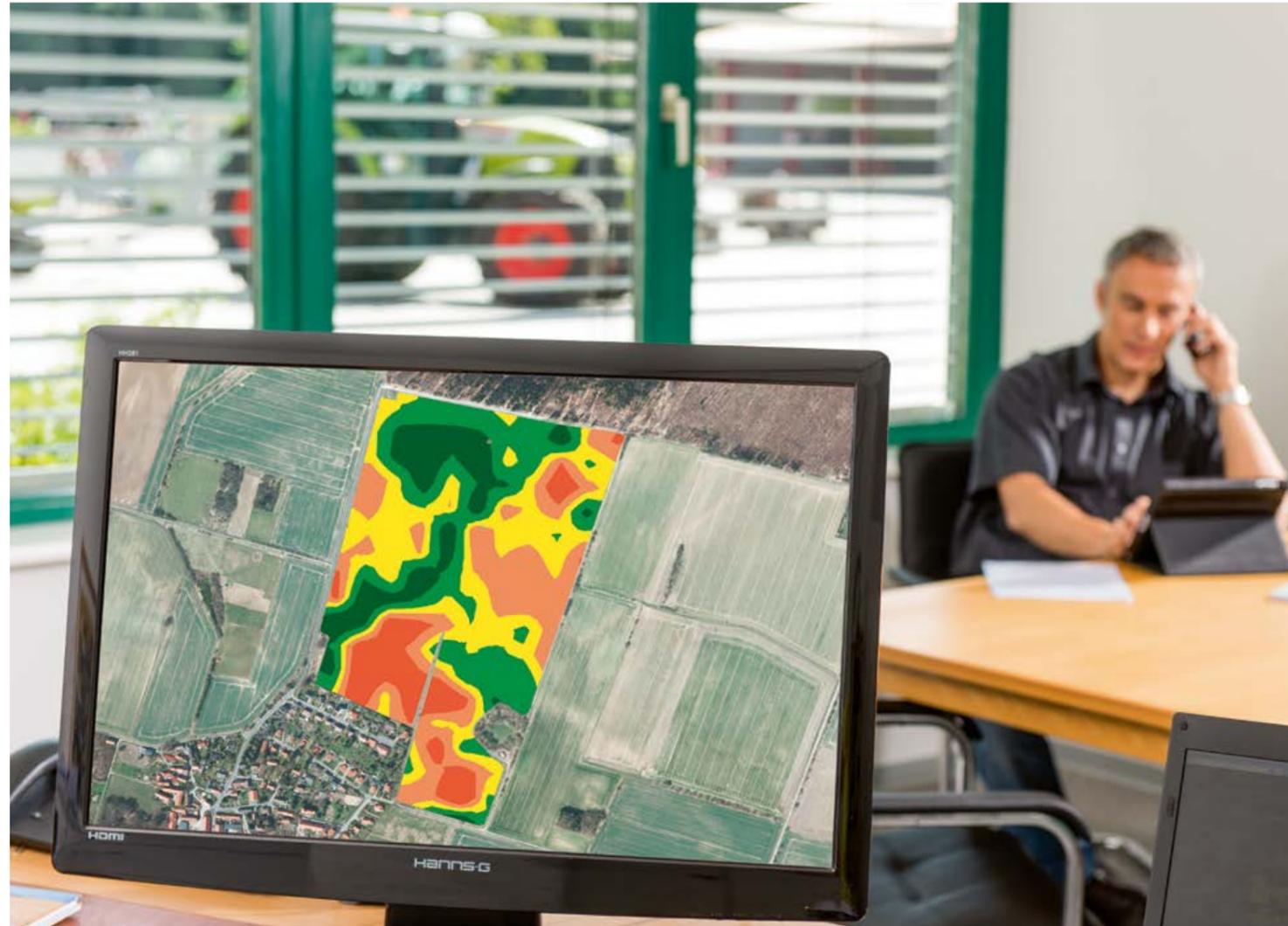


As much as necessary, as little as possible.

Even at drilling, it is sensible to take account of the varying conditions within a field. Different drilling rates are advisable because there may be variations in germination conditions and yield potential. Most farmers already change the drilling rate for individual fields. Drilling maps can now be used to respond to these variations. These maps are created on the basis of information such as soil maps or EM 38 measurements and automatically adjust the drilling rate of the drill according to the position in the field.

#### Advantages and benefits:

- Consistent crops
- Achieve the full yield potential
- Makes harvesting easier



#### Basic fertiliser application and liming.

The results of soil analyses in conjunction with appropriate zoning provide the underlying data for site-specific basic fertiliser application and liming. Technical implementation is straightforward and the economic benefit is related to the characteristics of the site: the greater the differences in nutrient supply, the greater the potential savings. CLAAS software makes it easy for anyone to create the maps.

The complete solution from planning to application maps: nutrient maps and pH values show where the ground is poor in nutrients. Targeted measures to combat this, and only adding fertilisers or lime where they are essential to provide an optimum supply for the plants, save valuable money – essential in times of rising fertiliser prices!

The aim is for all nutrients at each site in the field to be in nutrient content class C.



#### Advantages and benefits:

- Optimum nutrient supply to the crop
- Prevents nutrient accumulation
- Increased yields
- Application maps are transferred to the implement
- Data are recorded and fed back into the field map
- Good nutrient balance
- Targeted liming and fertiliser application improves the nutrient supply from the soil
- Saves resources



## Four eyes see more than two.

Farm managers need a complete, well-rounded product package which offers them plenty of options but still allows them full freedom of choice.

### The components – all from CLAAS:

- Online sensor system
- ISOBUS terminal for control and documentation
- Optional: yield potential maps

The benefit is clear: too much nitrogen damages soils and watercourses and increases operating costs. Too little nitrogen reduces yields. But how much do you really need? Previously the same amount was applied across the whole field, but

the optical sensor with active light source can now detect differences which are invisible to the human eye. The readings are directly translated into variable amounts of fertiliser, fungicide or growth regulator. Depending on the strategy chosen, the result is clear savings on inputs or optimised redistribution of fertilisers. The ultimate aim is to fully utilise yield potential which has not previously been exploited.

The CROP SENSOR measures the biomass and nitrogen supply in the crop using two different vegetation indices. The results are used to derive target values which are automatically transferred to the spreader or sprayer, so the application rate is adjusted to changing conditions within the crop. Naturally, the farm manager's local knowledge also plays an essential role in agronomic decision-making.

## Cost-effectiveness of sensor use.

### N application with a sensor in comparison to whole-field fertiliser application:

- Savings in the region of 5-10%
- Typical increase in yield: approx. 2%
- Protein content often increases
- Proven improvement in N efficiency
- Good nutrient balance
- Noticeable reduction in lodging
- Significantly higher threshing output
- Higher, more consistent harvest quality

### CROP SENSOR features:

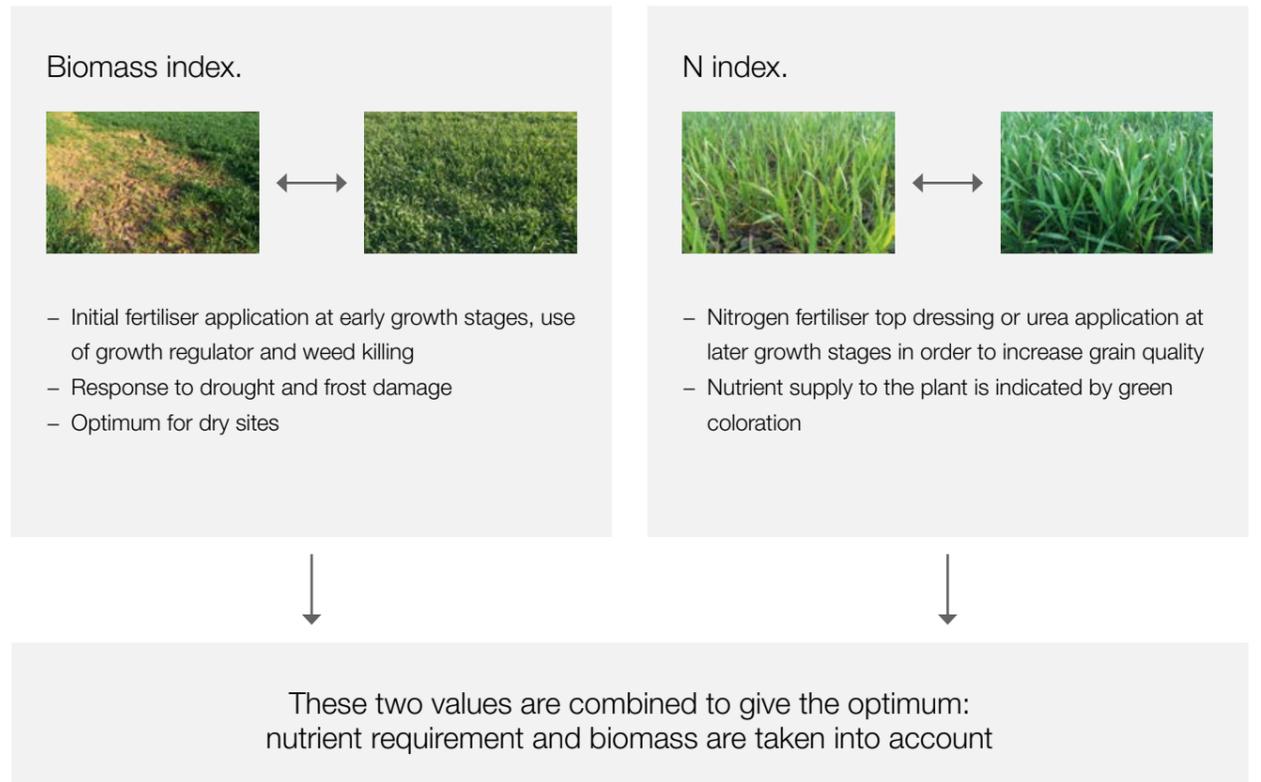
- Active optical sensor
- Measures approx. 3.0 m from the tramline in a representative crop
- ISOBUS sensor, easy to connect and simple documentation
- Two different indices for maximum reliability
- Suitable for use in any crop
- Free calibration with full freedom of choice for the farm manager, or calibration-free expert systems
- Optional use of yield potential maps allows inclusion of soil information and yield data
- No follow-up costs, no additional licence costs during operation
- First AEF-certified online sensor on the market

## Variable-rate spraying.

Although site-specific management was once confined to N application, there is now a growing interest in site-specific spraying. Its main use at present is the application of growth regulators. Like N fertilisers, it makes sense to apply these to the field in line with requirements using an optical crop sensor, with rates adjusted according to the biomass index. The principle is that less growth regulator is applied to weaker crops, which have a lower biomass index, than to the average crop. Application of the average amount to weaker crops would make them too short, with a negative impact on yield. However, a higher rate should be applied to stronger crops which have a higher tendency to lodging in order to minimise this risk.

It also makes sense to use an online sensor for fungicide application because here, too, the target areas differ depending on the density of the crop. However, in this case particular attention must be paid to the legal requirements and the instructions for use specified by the product manufacturer with regard to maximum and minimum application rates.

# Four eyes see more than two.



## High-precision sensors.

The CROP SENSOR from CLAAS is based on an active measuring system with four high-performance LEDs. These LEDs enable the sensor to be used 24 hours a day as the system is not affected by ambient light levels or time of day. For this reason, there is also no need to re-calibrate the system. Operating at a frequency of 10 to 800 measurements per second, the system covers a large measurement range without saturation, depending on environmental conditions. Its high measurement frequency enables it to take several measurements from individual plants, creating an extremely accurate picture of plant status as a measured value.

Naturally, the measuring system can be used in any variety and vertical deployment in the crop enables it to detect the leaves and biomass more effectively. This allows better scanning of individual plants.

## Easy to calibrate.

For daily use, the user has a number of options available. Free calibration offers a choice between the single-point and the two-point method.

In the single-point method a required N level for a specific measurement at a specific site is pre-defined. The adjustable control intensity, which can be changed at any time during operation, allows the control system to be adjusted in line with the farm manager's preferences and the site.

Single-point calibration is particularly suitable for applying a specified average rate to the field in the appropriate way. The single-point mode is also ideal for growth regulator application.

In AUTO mode the CROP SENSOR carries out all the calibration processes for the driver. Automatic single-point calibration automatically calculates the average for the crop and the optimum adjustment range for all crop types and all treatments. This avoids setting and calibration errors – the driver just has to define the average application rate and the upper and lower limits. AUTO mode simplifies use of the CROP SENSOR considerably.

## ISARIA – the expert fertiliser system.

The ISARIA fertiliser system provides an alternative to free calibration. This unique system carries out application rate measurements automatically – and is therefore extremely simple to use.

In the ISARIA fertiliser system, sensor-specific N application takes place without further calibration. N uptake by the plants is measured by the sensor heads and compared with the ISARIA fertiliser curve. This shows how much N is missing and the amount of N needed to achieve the target yield is applied to the crop automatically. Just a few inputs – the growth stage and expected yield – are needed to create a suitable control curve before you can start work.

The ISARIA fertiliser system is currently available for winter wheat as an optional module. The algorithms for the ISARIA fertiliser system are the result of more than 20 years of research at the Technical University of Munich.

# Yield potential map.



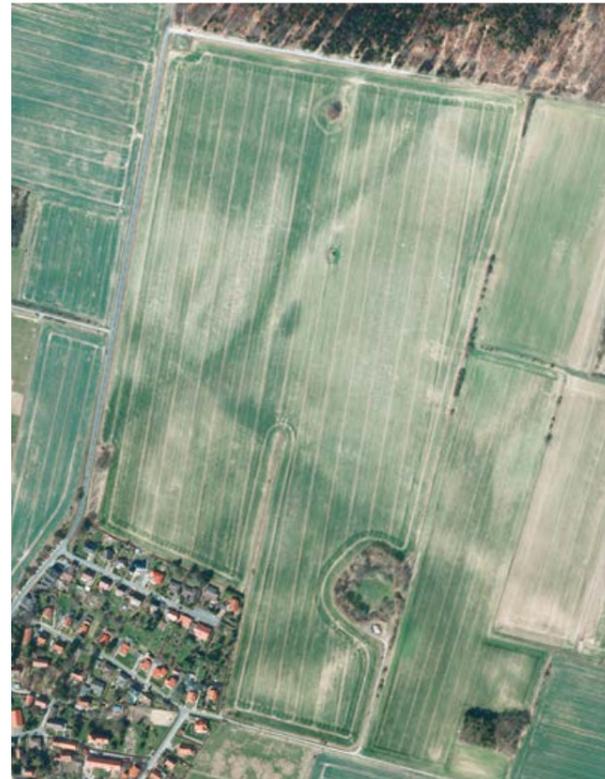
## Variable-rate application.

Cost optimisation is an important factor in times of growing concern for the environment and rising production costs. The principle to be applied is: as much as necessary, as little as possible. The optimum application rate largely depends on the expected yield, which may fluctuate greatly according to the site within the field.

## The yield potential map.

Using the yield potential map, the field is divided into zones with different expected yields. The 100% zone represents the target yield that the user has entered in the fertiliser system. In zones where the yield potential is different, the system automatically corrects this target yield upwards or downwards as appropriate. This guarantees that the fertiliser which is saved in zones with lower values is added to higher-value zones in the field. This is the only way of achieving yield-oriented fertiliser application with an optimum fertiliser balance.

A number of data sets (see graphics) can be used to create yield potential maps and then combined. This approach produces the optimum result and is only possible in conjunction with the ISARIA fertiliser system. CLAAS also offers the creation of individual yield potential maps based on a range of data as a specialist service.



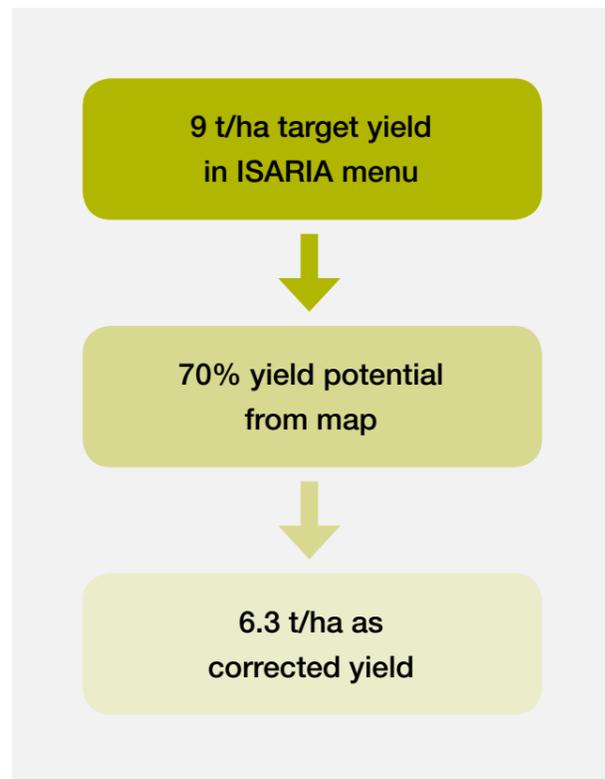
Aerial photograph



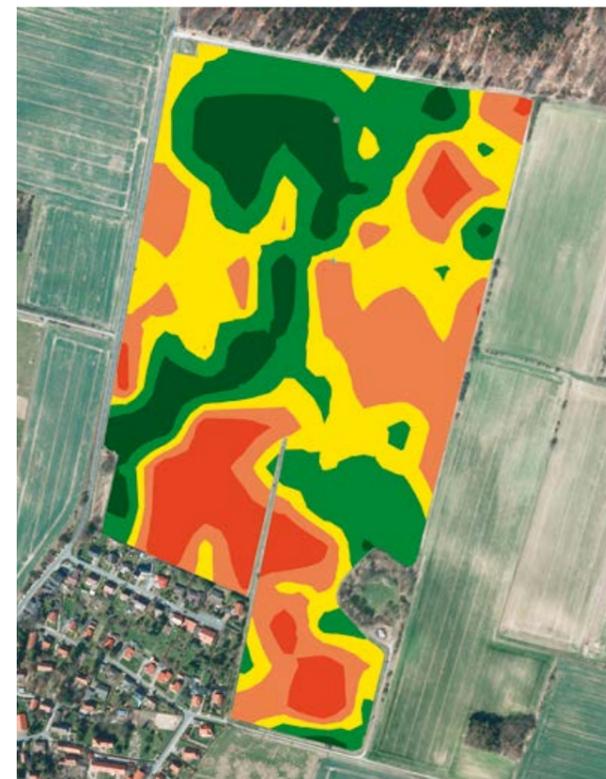
Soil assessment



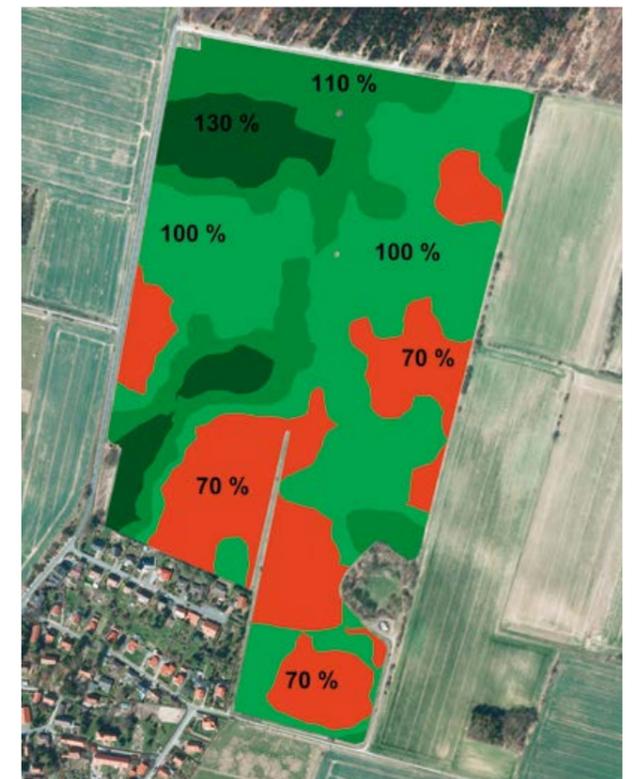
EM 38 – soil mapping



Example of a map overlay calculation



Yield map 2011



Map overlay



## Yield mapping.

Any production process ends with an assessment of its success. This is particularly true in crop production. It is essential to document the quantities harvested so that you can find out whether the treatments applied over the course of the year have been successful and achieved their objectives. Yield measurement and mapping is another way of recording the various characteristics of a field, making it easier to plan future seed and fertiliser strategies.

Sensors on the combine harvester record the yield and grain moisture by measuring the amount of grain, the distance travelled and specified working width. A yield value is recorded every one to two seconds. Geographic coordinates can be added to the yield measurement points by linking the yield measurement to accurately corrected GPS signals (georeferencing). Yield mapping provides a complete picture of the real spatial yield potential for the whole field.

Using TELEMATICS or a memory card, the data can be imported from the machine into any ISO compatible farm management software such as AGROCOM NET or 365FarmNet, where it serves as a basis for precision farming. Yield maps created in the software quickly reveal yield variations within a field and make it possible to locate potential problem areas. These maps can then be used to plan site-specific management measures and to monitor changes by making comparisons in subsequent years. The yield potential of different crops can be compared by defining yield zones. Comprehensive potential maps and forecasting trends can be developed on the basis of several years of data.



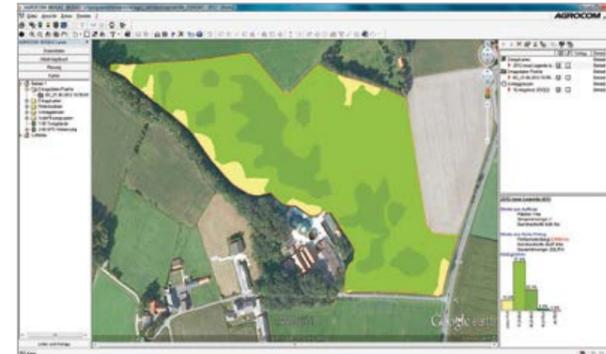
### Benefits:

- Geolocation of "weak points" so that the cause can be investigated
- Identification of differentiated sampling areas
- Direct information about nutrient removal by considering the yield in relation to the basic fertiliser application

### Yield potential maps. Influence of terrain on yield.

Low-lying areas and hilltops have a significant impact on yield. These zones can be reliably identified by means of an elevation model. The potential soil moisture map can be used as a basis for seeding and fertiliser maps and for the yield potential map (CROP SENSOR).

- Reliable data quality thanks to extremely accurate elevation data
- High- and low-yield zones are displayed with water-limiting growth conditions
- Low-cost additional information for successful, precise crop production



## Software.

Rising input prices and stricter environmental protection requirements are making site-specific management more attractive all the time. A program such as AGROCOM NET is essential for creating application maps with minimum effort in the shortest possible time.

- Map catalogue for saving all relevant GIS data
- Pre-plan reference lines using existing field boundaries
- Application maps for all fields with just one click
- Geo-documentation of work processes

### AGROCOM NET – modular and expandable:

- Mobile data entry with smartphone app
- Connects to all current on-board computers
- Central master data maintenance
- Cropping plans
- Cross compliance documentation
- Store management
- Land and lease management
- Graphical data
- Application map manager
- Network-compatible



## TELEMATICS.

Understand your machine better and make full use of its potential: machine performance and machine costs have a critical impact on the success of farms and service providers. For contractors and larger farms, maintaining an overview of all machine and personnel resources is a challenging task. TELEMATICS helps you to deploy your machines and resources most effectively.

### Benefits:

#### Automatic data documentation.

- No intervention by the driver
- Minimises operating errors
- Much less office work

#### Automatic daily report.

- Summary of the previous day as a report, sent automatically by email
- For documentation and the daily briefing meeting

#### Remote diagnostics.

- Direct access to workshop experts
- Optimise service times and machine settings
- Reduce machine downtime and costs



Ensuring a better **harvest.**

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