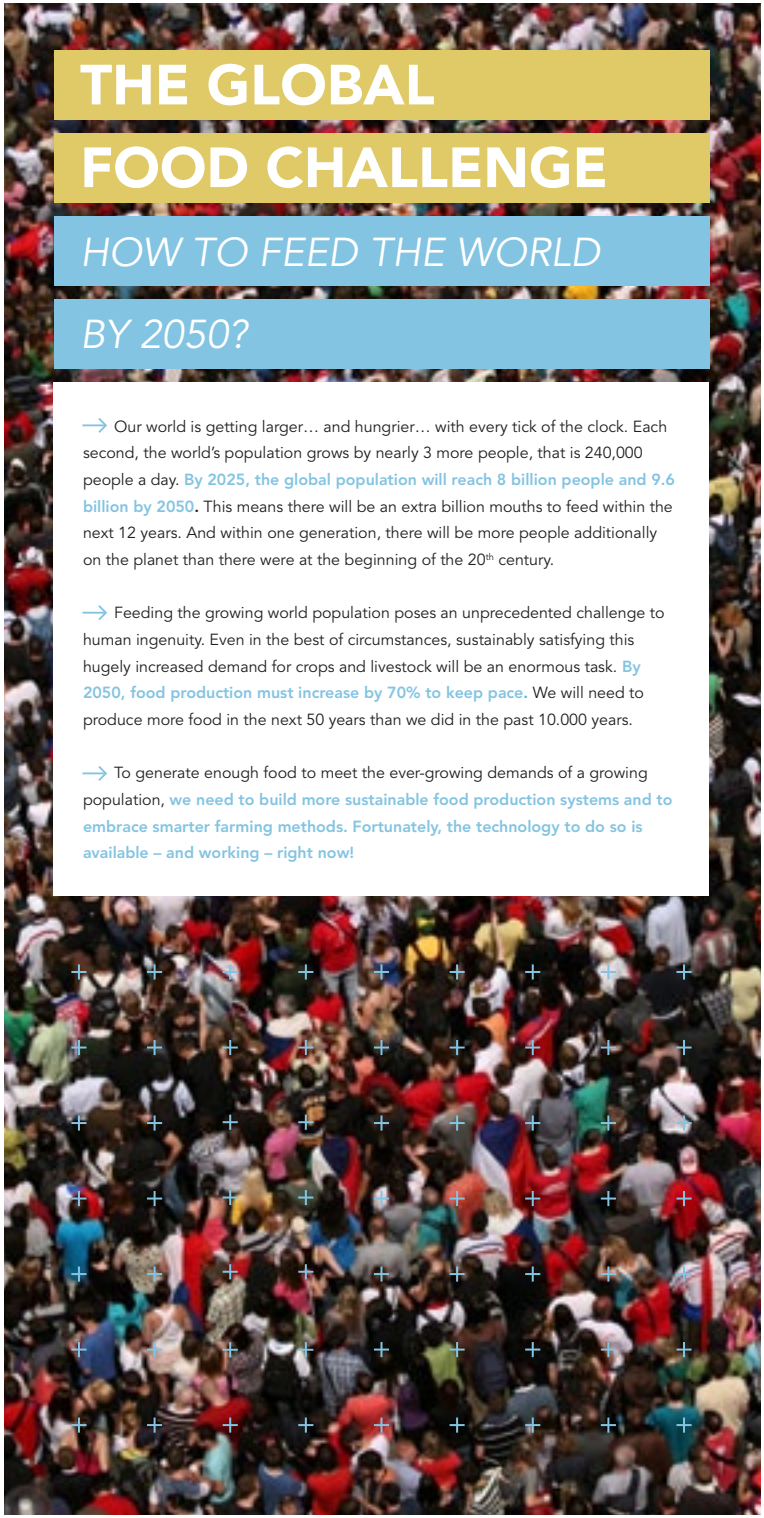

SMART EQUIPMENT FOR
SUSTAINABLE AGRICULTURE
PRECISION FARMING:
PRODUCING MORE WITH LESS
European
Agricultural
Machinery
CEMA



THE GLOBAL FOOD CHALLENGE

HOW TO FEED THE WORLD BY 2050?

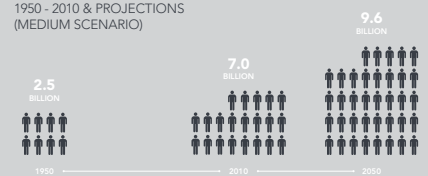
→ Our world is getting larger… and hungrier… with every tick of the clock. Each second, the world's population grows by nearly 3 more people, that is 240,000 people a day. **By 2025, the global population will reach 8 billion people and 9.6 billion by 2050.** This means there will be an extra billion mouths to feed within the next 12 years. And within one generation, there will be more people additionally on the planet than there were at the beginning of the 20th century.

→ Feeding the growing world population poses an unprecedented challenge to human ingenuity. Even in the best of circumstances, sustainably satisfying this hugely increased demand for crops and livestock will be an enormous task. **By 2050, food production must increase by 70% to keep pace.** We will need to produce more food in the next 50 years than we did in the past 10.000 years.

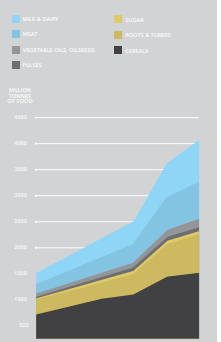
→ To generate enough food to meet the ever-growing demands of a growing population, **we need to build more sustainable food production systems and to embrace smarter farming methods. Fortunately, the technology to do so is available – and working – right now!**

THE GLOBAL FOOD CHALLENGE: HOW TO FEED THE WORLD BY **2050?**

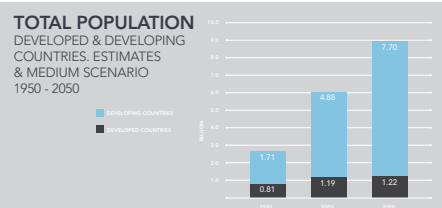
WORLD'S POPULATION
1950 - 2010 & PROJECTIONS
(MEDIUM SCENARIO)



INCREASED DEMAND FOR FOOD
WORLDWIDE



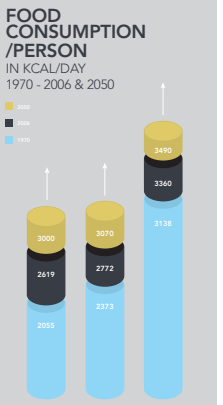
TOTAL POPULATION
DEVELOPED & DEVELOPING COUNTRIES. ESTIMATES & MEDIUM SCENARIO
1950 - 2050



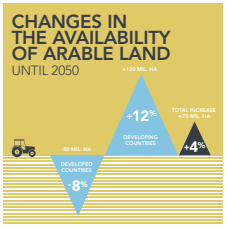
We will need to produce more food **in the next 50 years** than we did in **the past 10.000 years.**

By 2050,
GLOBAL FOOD PRODUCTION
must increase by
+70%

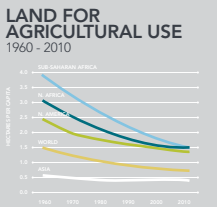
FOOD CONSUMPTION /PERSON
IN KCAL/DAY
1970 - 2006 & 2050



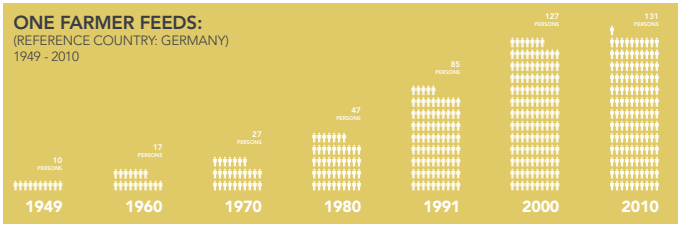
CHANGES IN THE AVAILABILITY OF ARABLE LAND
UNTIL 2050



LAND FOR AGRICULTURAL USE
1960 - 2010



ONE FARMER FEEDS:
(REFERENCE COUNTRY: GERMANY)
1949 - 2010



SOURCES: FAOSTAT; Deutscher Bauernverband, Situationsbericht 2013-Gr12-1

FOOD PRODUCTION UNDER PRESSURE: "A GATHERING STORM"

→ Achieving the level of agricultural productivity necessary to meet the immensely risen world demand for food, fibre and fuel by 2050 will be a tremendous challenge. Meeting this challenge is made even more daunting by a number of stringent constraints - the combined effect of which the Food and Agricultural Organisation of the United Nations (FAO) has termed "a gathering storm". Key constraints that global agriculture is facing:

- Slow-down in productivity growth
- Limited availability of new arable land
- Climate change
- Price and availability of energy
- Impact of urbanisation on rural labour supply

→ In light of the above challenges to our food supply and to the environment, the FAO has declared Sustainable Crop Production Intensification (or SCPI) as their first strategic objective. Sustainable intensification has been defined as producing more from the same area of land while reducing negative environmental impacts. What is therefore needed are innovative tools and techniques that empower farmers to do just that!

FOOD PRODUCTION UNDER PRESSURE "A GATHERING STORM"

FOOD PRODUCTION CHALLENGES FACING THE WORLD
BY 2050

FACTS & FIGURES

EXPECTED GROWTH BY 2050:

DUE TO DIETARY CHANGES

WE WILL NEED TO PRODUCE AN ADDITIONAL

+ ONE BILLION TONNES OF CEREALS

+ 200 MILLION TONNES OF MEAT

EACH YEAR BY 2050

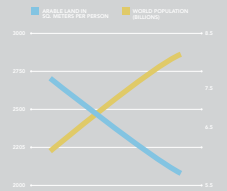
TO COPE WITH THE INCREASE IN MEAT CONSUMPTION

&

TO COVER THE INCREASED NEED FOR FEED IN THE LIVESTOCK SECTOR

LIMITED AVAILABILITY OF NEW ARABLE LAND
& SOIL CONSTRAINTS

The availability of new arable land on our planet is limited. There is virtually no spare land available in south Asia and the Near East/North Africa. Where land is available, in sub-Saharan Africa and Latin America, more than 70% suffers from soil and terrain constraints. Soil erosion and land degradation now rob the world of 70-140.000 km² per year of farming land. Worldwide, soil erosion caused abandonment of 4.3 million km² of arable land during the last four decades.



SLOW-DOWN IN PRODUCTIVITY GROWTH

Yields will need to continue to grow to raise agricultural production to the required level. However, **agricultural productivity growth has been slowing down in recent years**: the growth rates in yields of the major food crops - rice, wheat and maize - are all declining. Annual growth in cereal yields continues to slip from about 3% a year between 1967-1982 to a little more over 1% by 2020.

ANNUAL GROWTH IN CEREAL YIELDS

Crop yields are expected to continue to grow, but at a slower rate than in the past. This process of decelerating growth has already been underway for some time. On average, annual growth over the projection period would be about half (0.8%) of its historical growth rate (1.7%; 0.9 and 2.1% for the developing countries).

PRICE AND AVAILABILITY OF ENERGY

Energy is needed to power farm operations (fuel) and to produce key inputs such as fertilizer.

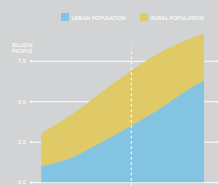
Scarcity and price uncertainty for fossil fuels will require a diversification of energy sources in agriculture production.

CLIMATE CHANGE

Climate variability and extreme weather shocks are projected to increase in the future. Alterations in temperature, precipitation and pest incidence will affect which crops can be grown and when, as well as their yields. Overall it is estimated that **climate change may drive down agricultural productivity in the developing world by 10 - 25% over the coming century.**

IMPACT OF URBANISATION
ON RURAL LABOUR SUPPLY

In 2050, about **70% of the global population will be urban** - compared to around 50% today (FAO). Reduced labour availability in rural areas, particularly during peak seasons, will be a challenge that will need to be tackled with the adoption of labour saving technologies that increase agricultural productivity, such as machinery.



SOURCES: Global Warming and Agriculture: Impact Estimates by Country, William Cline,Peterson Institute for International Economics, 2007; United Nations Population Division; IFPRI IMPACT simulations.

PRECISION FARMING

THE NEW AGRICULTURAL REVOLUTION

For more than 10,000 years people have cultivated crops using trial and error, received wisdom and how the soil feels when they rub it between their fingers. Only recently in history, mechanisation revolutionised the countryside with machinery and replaced horses with tractors. Nowadays, we're witnessing a new farming revolution triggered by the adoption of staggering new technologies: satellites, high precision positioning systems, smart sensors and a range of IT applications combined with high-tech engineering.

Next time you see a field of grain and a picture of pastoral harmony crops up in your mind, think again - and imagine yourself as a farmer: riding along in your air-conditioned combine harvester you push a button to turn on its hyper-specific satellite navigation monitor, which pinpoints your exact location to within 2 cm.

Touching another button, you activate the autopilot system. Thanks to a number of intelligent sensors the system keeps the machine perfectly on track and also remembers where it has been. The yield monitor starts telling you about the grain flow and moisture content while your data management software uploads a colour-coded map that allows you to assess the yield of the harvested portions of the field.

You lift your hands from the steering wheel, sit back and enjoy the ride, saving time and money, as the machine does most of the work. Sounds like a fantasy story? **Welcome to Precision Farming!**

WHAT IS PRECISION FARMING ALL ABOUT?

Precision Farming is about taking **the 4 Rs** *in agriculture from a km² to a m² level: doing the* **right thing**, *in the* **right place**, *the* **right way**, *at the* **right time**.

All aspects of the environment – soil, weather, vegetation, water – vary from place to place. And all these factors determine crop growth and farming success. Farmers have always been aware of this, but they lacked the tools to measure, map and manage these variations precisely.

Precision Farming is about just that: managing variations in the field accurately to grow more food using fewer resources and reducing production costs. Thus, precision farming can make a difference to food production facing the challenge of a rising world population.

PRECISION FARMING HELPS FARMERS TO ACHIEVE:

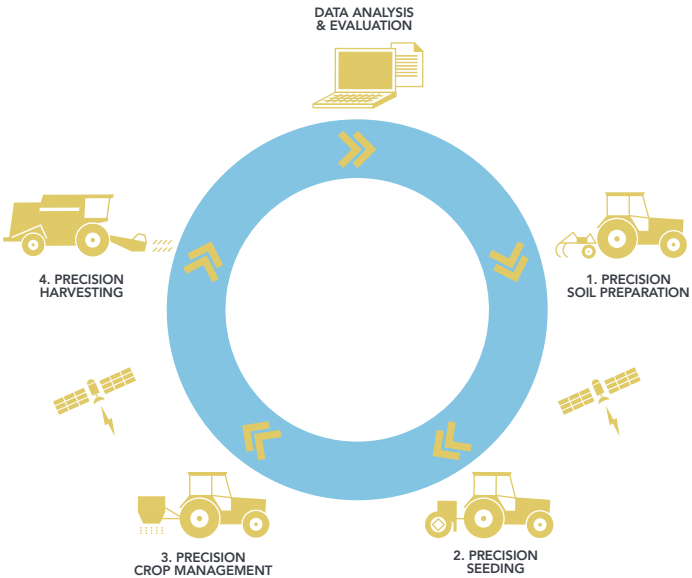
- GREATER SUSTAINABILITY & ENVIRONMENTAL PROTECTION
- HIGHER PRODUCTIVITY
- ECONOMIC BENEFITS

WHAT IS PRECISION FARMING ALL ABOUT?

In the past 10 years, Precision Farming has moved from good science to good practice - and has witnessed unprecedented growth around the globe: 70 to 80% of new farm equipment sold today has some form of Precision Farming component inside.

Thanks to cost-effective monitors and controllers and the integration into single data management systems, Precision Farming is becoming more seamless, cost-effective and easier for farmers to install and use.

This exhibition showcases some of the most prominent Precision Farming innovations in the 4 steps of the crop growth cycle:



THE PRECISION FARMING AND CROP GROWTH CYCLE

PRECISION FARMING

KEY TERMS & CONCEPTS

HIGH PRECISION POSITIONING SYSTEMS

(like GPS) **are the key technology to achieve accuracy when driving in the field, providing navigation and positioning capability anywhere on earth, anytime under any all conditions.** The systems record the position of the field using geographic coordinates (latitude and longitude) and locate and navigate agricultural vehicles within a field with 2cm accuracy.

AUTOMATED STEERING SYSTEMS

enable to take over specific driving tasks like auto-steering, overhead turning, following field edges and overlapping of rows. These technologies reduce human error and are the key to effective site management:

ASSISTED STEERING SYSTEMS show drivers the way to follow in the field with the help of satellite navigation systems such as GPS. This allows more accurate driving but the farmer still needs to steer the wheel.

AUTOMATED STEERING SYSTEMS take full control of the steering wheel allowing the driver to take the hands off the wheel during trips down the row and the ability to keep an eye on the planter, sprayer or other equipment.

INTELLIGENT GUIDANCE SYSTEMS provide different steering patterns (guidance patterns) depending on the shape of the field and can be used in combination with above systems.

GEOMAPPING

is used to produce maps including soil type, nutrients levels etc. in layers and to assign that information to the particular field location.

SENSORS AND REMOTE SENSING

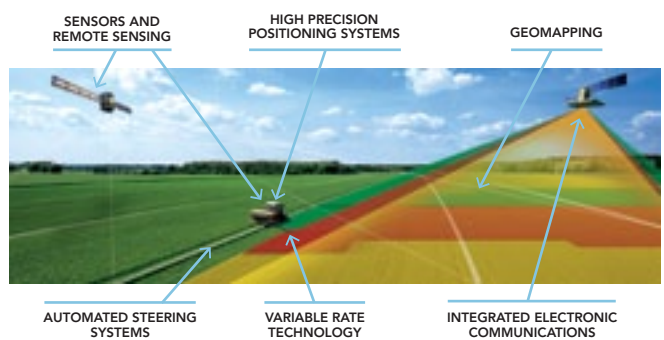
are used to collect data from a distance to evaluating soil and crop health (moisture, nutrients, compaction, crop diseases). Data sensors can be mounted on moving machines.

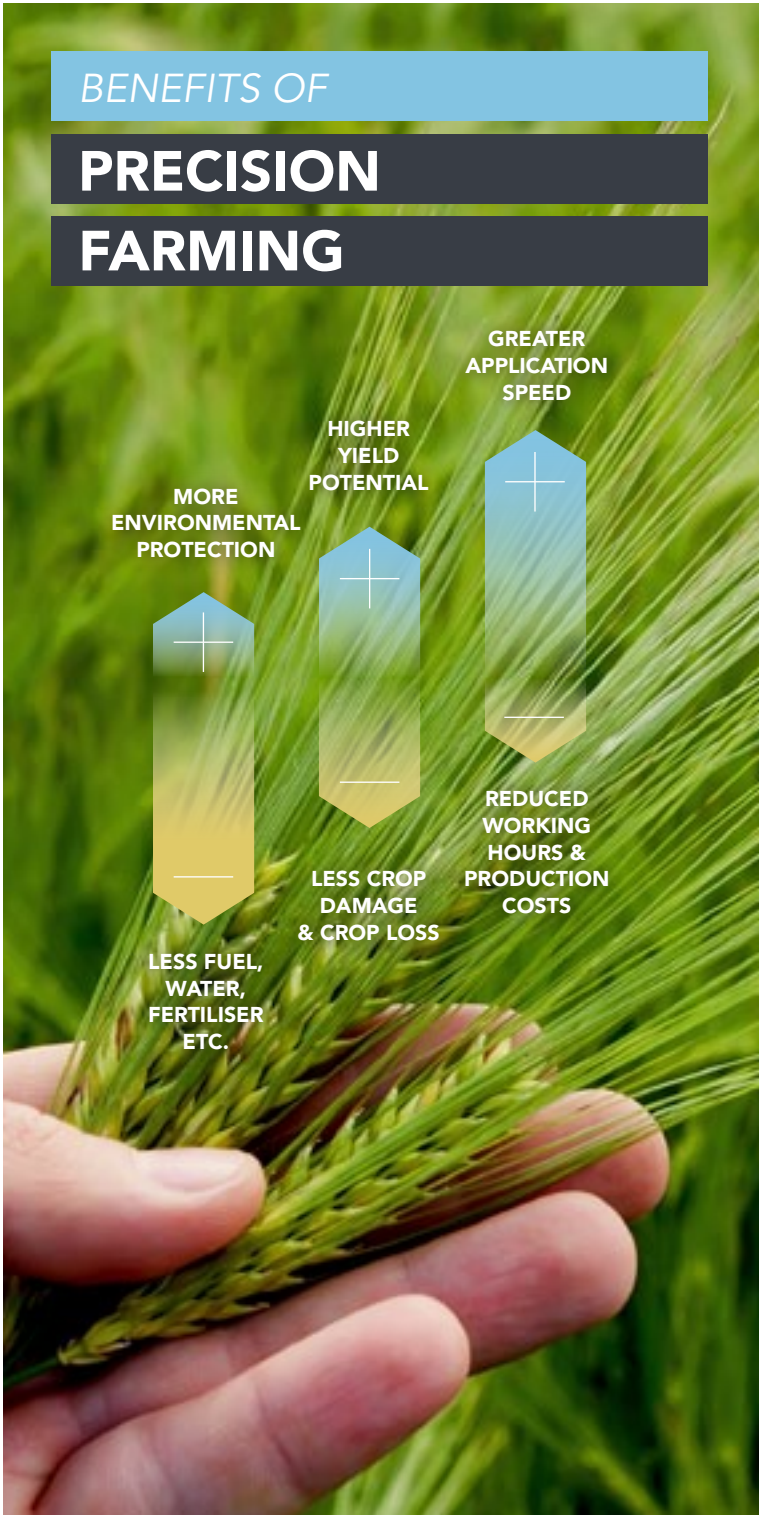
INTEGRATED ELECTRONIC COMMUNICATIONS

are made between components in a system. For example, between tractor and farm office, tractor and dealer or spray can and sprayer.

VARIABLE RATE TECHNOLOGY (VRT)

is the ability to adapt parameters on a machine to apply, for instance, seed or fertiliser according to the exact variations in plant growth, or soil nutrients and type.




BENEFITS OF
PRECISION
FARMING
GREATER APPLICATION SPEED
HIGHER YIELD POTENTIAL
MORE ENVIRONMENTAL PROTECTION
REDUCED WORKING HOURS & PRODUCTION COSTS
LESS CROP DAMAGE & CROP LOSS
LESS FUEL, WATER, FERTILISER ETC.

1. PRECISION SOIL PREPARATION

LESS IS MORE

Soil preparation is the first step before growing a crop. The ultimate objective is to produce a firm and weed-free seedbed for rapid germination and emergence of the crop. One of the most important tasks in soil preparation is **tilling** (or **ploughing**): turning the soil and loosening it. **Tilling** creates optimal soil by:

- **Mechanically destroying weeds** that compete for water, nutrients and sunlight
- **Incorporating organic material:** residues left over from the previous crops are incorporated in the soil and decomposed
- **Loosening the soil:** loosened soil allows the roots to penetrate deep into the soil and to breathe easily. It also supports the growth of earthworms and microbes.

Soil preparation is one of the most energy-consuming parts of agriculture, requiring significant inputs of fuel and time. Depending on the field's location, it may also increase the risk of soil erosion.

→ Today, precision farming equipment exists that helps farmers to use considerably less fuel and time in soil preparation by improving the accuracy, efficiency and sustainability of the process. A prominent example of precision soil preparation is **strip-till**.

European Agricultural Machinery
CEMA

PRECISION SOIL PREPARATION
LESS IS MORE

STRIP-TILL

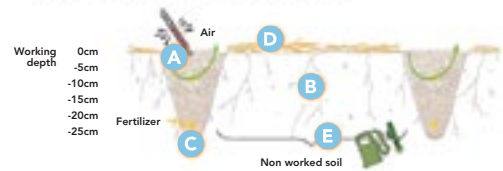
THE BEST OF BOTH WORLDS

Strip-till is a technique whereby only small strips of the soil (as opposed to the entire filed) are prepared into which the new seeds are then planted.

Strip tilling combines certain advantages of conventional tillage with certain advantages of no-tillage. In comparison with conventional tillage (like ploughing) 80% of the soil remains untouched. This reduces the number of required field passes and, overall, requires fewer operations, saving fuel and time.

Compared to no-tillage, strip tillage provides for slightly higher soil temperature from which certain plants can benefit during their initial growth phase, especially during cold springs. In addition, more residues from previous crops are removed, and fertilizers can be placed deeper in the ground.

The assets of strip tilling



- A Heats the seeding strip for a fast start to plant growth
- B Retains humidity and rain infiltration channels between rows
- C Softens without creating a deep pan
- D Organic material is retained on the surface, reducing self-propagation between rows and erosion
- E Saves time and fuel

BENEFITS OF STRIP-TILL

- **Sustainability benefit:** up to 50% reduction in CO^2 emissions and less erosion
- **Higher productivity:** 5% increase in productivity in comparison with no tilling
- **Energy efficiency**: up to 50% decrease in time and fuel costs for tilling in comparison with conventional tilling
- **Better soil structure**, removal of harvest residues and better seedbed (than with no-tilling)

DID YOU KNOW...?

- Soil cultivation is **one of the most energy-consuming parts of agriculture**
- Soil scientists have identified **over 10.000 different types of soil in Europe**
- Soil stores **10% of the world's carbon dioxide emissions**
- The record in strip tilling is **644 hectares in 24 hours**. If you struggle to envisage just how much this is, it amounts to ploughing a 15cm strip all the way around the equator in just one day! The record for ploughing in **24 hours is 321 hectares** - a field nearly the size of Central Park, New York!

2. PRECISION SEEDING

HIGHER YIELD WITH LESS SEED

Seeding (or: sowing) is a critical step in crop growing. For a successful seeding process, two challenges need to be overcome:

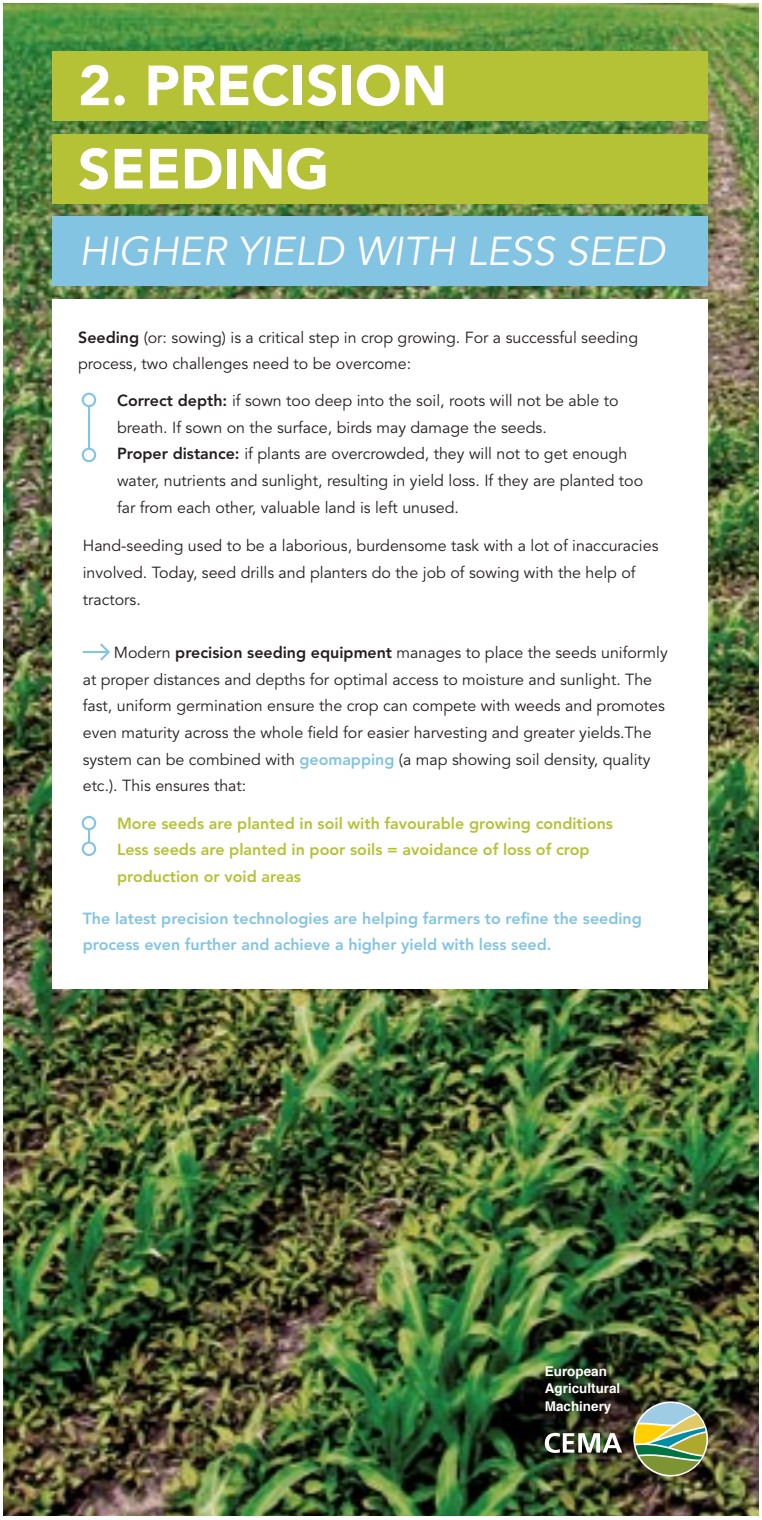
- **Correct depth:** if sown too deep into the soil, roots will not be able to breath. If sown on the surface, birds may damage the seeds.
- **Proper distance:** if plants are overcrowded, they will not to get enough water, nutrients and sunlight, resulting in yield loss. If they are planted too far from each other, valuable land is left unused.

Hand-seeding used to be a laborious, burdensome task with a lot of inaccuracies involved. Today, seed drills and planters do the job of sowing with the help of tractors.

→ Modern **precision seeding equipment** manages to place the seeds uniformly at proper distances and depths for optimal access to moisture and sunlight. The fast, uniform germination ensure the crop can compete with weeds and promotes even maturity across the whole field for easier harvesting and greater yields.The system can be combined with geomapping (a map showing soil density, quality etc.). This ensures that:

- More seeds are planted in soil with favourable growing conditions
- Less seeds are planted in poor soils = avoidance of loss of crop production or void areas

The latest precision technologies are helping farmers to refine the seeding process even further and achieve a higher yield with less seed.



European Agricultural Machinery

CEMA

PRECISION SEEDING
HIGHER YIELD WITH
LESS SEED

PRECISION SEEDING

DON'T SINK INTO THE GROUND

Achieving a uniform planting depth is hard to achieve, as lighter soils naturally cause the wheels of the planter to sink deeper into the ground, thus risking dramatic changes in seed depths.

With the help of an **automatic coulter pressure control**, farmers can:

- **Achieve a uniform, constant seed depth** even when the soil changes from heavy to light (or vice versa)
- **Create a detailed mapping of the soil density** in their fields at the same time

Thanks to a pressure sensor that can be activated from the control terminal in the tractor, the pressure on the depth-guide wheel is constantly measured. If the pressure changes because of a change in speed or ground conditions, the automatic system responds immediately and makes the necessary adjustment to ensure the depth of the wheel remains constant and that seed depth remains accurate.

In addition, the system can also record soil data when linked to a suitable satellite navigation (GPS) unit. This, in turn, can be used to produce a detailed map of soil density. Seed rates can also be linked to the system, with or without a GPS connection, as can the following harrow pressure.

The system provides a constant, accurate seed depth even when soil changes from heavy to light and back, and is independent from any changes in forward speed.

- A Working direction
- B Central hydraulic coulter pressure adjustment
- C Driving speed
- D Buoyant force
- E Penetration resistance
- F Pressure of the depth-guide wheel

BENEFITS OF PRECISION SEEDING

- Produces a uniform growth rate which enables **fertiliser and plant protection products to be kept to a minimum**.
- **Optimised seed placement**, supporting high germination and excellent field emergence and thus, ultimately, higher yields.
- Recorded soil data can be used to **improve and tailor ensuing crop management** operations in the field.

DID YOU KNOW...?

- At the moment, the **world's biggest seed planter** has 48 individual rows and is 37m wide
- The **world's largest seed drill** can be filled with 46,000 litres of seed and can plant an area of 61 hectares - that's like planting seeds on 85 football pitches in just one go!

3. PRECISION CROP MANAGEMENT

PUTTING PLANTS ON A TAILOR-MADE DIET

During their growth phase plants need:

The right amounts of nutrients	Adequate protection from pests and diseases	The right amounts of water
FERTILISATION	CROP PROTECTION/ SPRAYING	IRRIGATION

→ In all three areas, precision farming solutions help farmers to produce more with less. Key precision applications include:

- **Crop sensors**
- **Automatic wind control** → **for Precision Fertilising**
- **Optimised boundary spreading**
- **Satellite steering systems (GPS)** → **for Precision Spraying**
- **Subsurface Drip Irrigation (SDI)** → **for Precision Irrigation**

European Agricultural Machinery
CEMA

PRECISION CROP MANAGEMENT
PLANTS ON A TAILOR-MADE DIET

CROP SENSORS

SCANNING AND FERTILISING ON THE GO

Correct fertilisation is an extremely important task to ensure optimal growth and quality of crops. A plain, uniform application of fertiliser may not provide the right amount of nutrients to certain areas of the field, carrying the risk of over or under-fertilising plants.

With a 'real-time' nitrogen-sensor it is now possible to apply fertiliser precisely and automatically at different rates in a field according to the natural variation of nutrients that are already in the soil.

While moving through the field, the sensor (A) - at the front (or top) of the tractor - is shootinginfrared light at the plants and analysing the wavelengths that reflect back to discern the amount of nitrogen in the leaves – day or night.

Its computer (B) then tells the fertiliser spreader (or sprayer, for liquid fertiliser) (C) at the back of the tractor to deliver the optimal measure. Poorly grown areas of crop that require more fertilisation will obtain higher rates of fertiliser, while less fertiliser will be supplied to already well-growing areas of crop.

> ***Every drop goes where it is needed. The sensor makes a decision in the field on the day you're doing it.***
>
> **Clive Blacker,** UK farmer

For even better results, the sensor can be refined further by combining the scanning data with other mapping information. For instance, by taking into consideration yield mapping data (from the previous harvest), the sensor considers the ultimate yield potential.

In addition to the actual nitrogen needs of plants, it calculates the optimum rate to be applied so that each area achieves its maximum yield. This system also helps farmers to predict yield variations more within a field accurately before the harvest.

BENEFITS OF CROP SENSORS

- **Sustainability benefit:** fertiliser savings of up to 14%
- **Higher productivity:** average yield increase of up to 6%
- **Economic benefit** to the farmer: 50 -110 Euro/ha
- **Eliminates the risk of over and under-fertilisation** (as growth and yield can fluctuate greatly within a field)
- Helps to produce a **uniform growth rate**

DID YOU KNOW...?

- **In 1 hour, a large sprayer can cover an area of up to 100 hectares**, that's around 140 football pitches
- The boom of a state-of-the-art sprayer can be up to **40m wide**
- Large sprayers can hold **up to 4.500 litres of spraying solution in their tank**

PRECISION SPRAYERS

THINK TWICE, SPRAY ONCE

Modern sprayers are equipped with numerous innovative features that ensure highest precision in the application process.

In particular, an automatic steering system is effective in avoiding potential overlap of sprayed areas on the field. Thanks to a fully automated process, sections on the booms are switched off when they pass an already-treated area.

When used in combination with geomapping data, the entire process can be made even more precise: the GPS and sensors on the sprayer can 'read' where weeds and diseases are present and apply the adequate rates (e.g. 70%, 80%, 90%, 100%) for different areas only as and when necessary.

BENEFITS OF PRECISION SPRAYING WITH GPS

- **Reduces spraying** by avoiding overlap areas
- **Promotes higher yield potential** as a result of even crop development and reduced lodging
- **Allows costs savings** of up to 10% for the farmer (particularly on small, odd-shaped fields)
- **Reduced working time & stress** for the driver: allows for precise application even when working at dawn or in the dark

SUBSURFACE DRIP IRRIGATION (SDI)

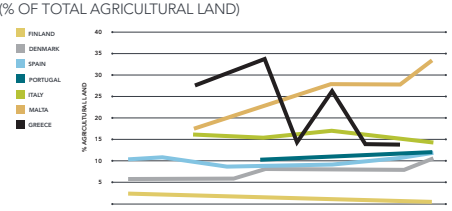
EVERY DROP OF WATER COUNTS

Water is the lifeblood of plants. And it is one of our scarcest resources: in many areas of the world, rainfall and natural water availability are insufficient to allow for successful plant growth. In these areas, crop growing would be impossible without irrigation.

Irrigation levels in European agriculture vary substantially: in the EU, irrigation levels are highest in Mediterranean countries such as Malta (where about 1/3 of total arable land is irrigated), Greece and Italy (around 17%), as well as Portugal and Spain (around 12%). By contrast, only 0.5% of arable land is irrigated in Finland.

Precision farming technologies offer farmers just that. One of these solutions is modern drip irrigation which has become one of the world's most valued innovations in agriculture and is extensively adopted in areas of acute water scarcity and especially for crops such as tomatoes, strawberries, grapes, asparagus, sugar beet, maize, and cotton. Drip irrigation, (also known as trickle, micro, or localized

AGRICULTURAL IRRIGATED LAND
(% OF TOTAL AGRICULTURAL LAND)



Surface irrigation has been used since ancient times. However, efficiency in traditional irrigations schemes is very low: half, sometimes even two thirds, of the water is typically lost during the process. Another major challenge is how to apply the right amounts of water at the right time. The stakes are high: excessive irrigation results in major water losses due to water running off from the field as well as water dropping below the root zone.

To avoid losses and save valuable water and energy, it is therefore paramount to tailor irrigation systems according to the needs of the plants.

irrigation) saves water by allowing it to fall drop by drop through a network of narrow tubes that deliver water directly at the position of the roots of the plants. This can be done either on the soil surface or under the ground (subsurface).

Subsurface drip irrigation (SDI) provides the most effective management tool delivering water directly to the plant roots at the precise time and in the precise quantity needed.

DID YOU KNOW...?

+ In 2012, Daniel Hillel, the inventor of modern drip irrigation, received the **World Food Prize** which honours eminent personalities engaged in fighting world hunger.

SDI ARCHITECTURE

The **water management & control unit** is made out of:

1. **A pump** to draw the water from the source
2. **Water filters** or **filtration systems**: to filter out small waterborne particles which could block the small emitter flow
3. A **backflow prevention device** and **pressure regulator**

The **underground network** of pipes and tubes contains:

4. A **main line**
5. Smaller diameter tubes (**'laterals'**)
6. **Emitting devices** at plants (dripper, micro spray head)

The entire system can be fully automated.

BENEFITS OF SDI

SDI provides **the most effective management tool delivering water and nutrients directly to the plant roots at the precise time and in the precise quantity** needed. In addition, SDI:

- Enables the **use of recycled water** without adverse environmental impact
- **Maximizes yield potential** by maintaining moisture within the root zone of the plants
- **Saves water** due to controlled output, uniform distribution and decreased evaporation and deep percolation
- **Minimizes weed growth**, as SDI produces drier soil surface and reduces weed germination
- Easily **adapts to small and odd shaped fields**
- Is **less work-intense** than other irrigation methods

4. HARVESTING

REAPING THE FRUITS OF PRECISION - WITH PRECISION

For the farmer, **harvesting** is a critical point in time. Speed, accuracy, and timing determine whether the harvest will be successful. Until recently, harvesting was the most burdensome and laborious activity of the entire growing season. Today, the task is taken over by some of the most sophisticated farm machines such as:

The **combine harvester** ('combine'),
one of the most important labour-saving inventions of all times. It combines 3 separate harvesting operations into one single process: reaping, threshing and winnowing. The excess straw is either chopped and spread on the field or - using automated balers - baled to provide feed and bedding for livestock. Combines are used to harvest crops such as wheat, oats, rye, barley, corn, soybeans and linseed.

Forage harvesters ('foragers')
for feed production: foragers chop grass, corn or other plant into small pieces which are then compacted together in a storage silo for fermentation to feed livestock.

Specialist harvesters:
tailor-made machines have been developed for the automated harvesting of other fruits and crops such as potatoes, carrots, sugar beet, grapes, cotton or apples. One key challenge for these machines is how to ensure perfect extraction while maintaining the physical integrity of the crop.

→ Today, precision farming technologies help farmers to improve the timing, accuracy, and speed of the harvesting process, achieving better outcomes while saving valuable time and energy resources. Key technologies include:

- **Automatic guidance systems**
- **Fleet management software**
- **Real-time yield monitor & yield mapping**

European Agricultural Machinery
CEMA

PRECISION HARVESTING
REAPING THE FRUITS OF PRECISION

FLEET MANAGEMENT SOFTWARE

MACHINES "TALKING" TO EACH OTHER

For an efficient harvest chain many different machines need to work together seamlessly at the same time: apart from the harvesting machine(s), several transport vehicles are required to move the harvest in a fast and timely manner from the field to the storage location on the farm.

Innovative fleet management software helps farmers to organize and coordinate the entire harvesting process in a fast and efficient way. The software cross-links all machines into a common network portal where all operating data is presented in a clearly structured layout, allowing the operator to gain a full overview of all processes and instate new measures as necessary in real time. The portal allows farmers and contractors to exchange data and enables the operator to:

- Find out at a glance where the machines are located to easily manage entire vehicle fleets
- Create tasks on the spot and assign them directly to a machine or to a fleet
- View all machines' current status and graphically display machine data during live operation.

BENEFITS OF FLEET MANAGEMENT SOFTWARE

- **More cost-efficient and sustainable harvesting processes**, by reducing travel distances, fuel consumption and working times
- Provides extensive documentation of all activities for **more precise and tailored farm management**

PRECISION HARVESTING
REAPING THE FRUITS OF PRECISION

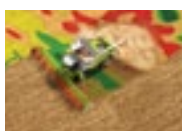
REAL-TIME YIELD MONITOR & YIELD MAPPING

WHAT YOU GET IS WHAT YOU SEE

Inside a modern combine harvester, a grain yield monitor calculates the actual crop/grain yield in real-time during the harvesting process. Using a number of sensors, the grain yieldmonitor typically measures:

- **grain mass flow**
- **moisture content of the grain**
- **the speed to determine the total grain harvested**

> ***A yield monitor is a great tool for collecting data and showing you what actually took place in a field. The interpretation of data is what will lead you to change management practices.***
>
> **- Grant Mangold**



Yield mapping is a precise tool of crop management.

Today, grain yield monitors are typically coupled with satellite positioning systems (such as GPS). With the help of a spatial data management software, this allows for the creation of a yield map, a colour-coded spatial map that displays the grain yield of the harvested portions of the field.

Yield maps can then be used for further analysis and for making informed farm management decisions such as:

- Crop rotation strategies, i.e. which crops to plant on which fields
- At which rates to plant specific seeds in a field
- Which types and rates of fertilizer to use

BENEFITS OF REAL-TIME YIELD MONITORING & YIELD MAPPING

- **Short term:** real-time information allows to load trucks/wagons accurately during harvesting and make appropriate grain storage decisions (based on moisture readings in the field)
- **Medium/long term:** enables in-depth performance analysis (high and low yielding areas, magnitude of yield differences across fields) to tailor management practices and maximize yields.
- **Accurate crop documentation** for landlord negotiations, crop documentation for identity preserved marketing, 'trace back' records for food safety, and demonstration of environmental compliance.

> *It's a visceral pleasure, harvesting a crop and watching the grain flow.*
>
> **Clay Mitchell, US farmer**

DID YOU KNOW?

- A modern combine harvester can harvest enough wheat in **a single day to make 1 million loaves of bread** (of 500g each).
- A state-of-the-art combine harvester can have up to **18 on-board computers**.
- The world record in harvesting stands at **1321 tonnes of wheat in just 20 hours**.
- The World Record of baling stands at **149 bales of straw produced in 1 hour** - that's 28 tonnes of wheat straw or 1 bale every 24 seconds!
- Forage harvesters use **moisture sensors** to determine how fine to chop up forage crops to get the best nutrition.
- **Baler Automation system** lets tractor and round baler presses exchange information: the baler can immobilize the tractor while binding the bale and ejecting it, significantly increasing productivity and reducing fuel consumption.