



# SHAPING THE FUTURE

SOIL AS A PRECIOUS  
RESOURCE –  
CHALLENGES AND  
SOLUTIONS

LEMKEN LIVE – THE MAGAZINE  
FOR PROFESSIONAL ARABLE FARMING

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Live



Dear readers,

As we all know, the future always begins now. We are only too aware that sitting back and doing nothing is not an option. That is why there are two phrases that are probably red flags in any family business – regardless of whether it is an international agricultural machinery manufacturer or a local farming business. The first is: “But we’ve always done it that way.” And the second is: “But we’ve never done it that way before.” Family businesses are so successful because they do not take either of these phrases to heart.

Family businesses are anything but powerless – we have the power to make the changes we need to position ourselves well for the future. And once we know our goals, we move towards them step by step. We deliberately say step by step because it is essential that we set ourselves milestones that are feasible and achievable, especially in view of our big goals. This does not just apply to small family businesses that employ relatively few people, but also to global corporations. And once we have taken the first step, we’ll move on to the second and the third – and we get going. Sometimes we might launch into a sprint, sometimes we might pace ourselves as if for a marathon, but we are always on the move.

Family businesses are so successful because they work every day to become a little better, to continually adapt to changing markets. We might even change these markets ourselves through special innovations, forcing our competitors to adapt. LEMKEN has adapted to the changing markets in 2023: Equalizer has joined the LEMKEN family as a new member, and Steketee’s integration into LEMKEN highlights how well the companies have worked together in recent years.

A lot has also happened on your farms this year. You show in your daily actions that you are willing to change. Your goal is to set up your own farms as sustainable, resilient businesses while complying with agricultural policy regulations. Sustainability and climate change are the game changers that are transforming existing markets and creating new ones. However, we must not lose sight of the real goal of agricultural production: Farmers ensure that the world is fed.

Firstly, as farmers, you ensure that people around the world have access to high-quality food – regardless of their wealth or



background. However, in return you should (secondly) be able to make a good living from your work today and in the future, while also receiving the appreciation you deserve. You regard our soils as the basis of life, you care for them and ensure that we will still bring in successful harvests in ten, twenty and thirty years’ time. You are willing to implement agricultural practices that combine income-securing, reliable yields with effective nature, environmental and climate protection – not just today, but in the future! And we at LEMKEN support you with the right technical aids – our agricultural technology. We will only be able to make agriculture crisis-proof if we work together constructively in charting our future course.

What causes us headaches is not the resource conservation goals we are expected to meet, but rather the journey to reach these goals whilst ensuring that our efforts are worthwhile and will really make a difference. To this end, we will continue to put our corporate philosophy as “The Agro-Vision Company” into practice and to stand at your side as your partner for Next Level Farming. We have visions, we are working hard to implement them, and we want to have solutions ready for you whenever you are faced with a new challenge.

We work with you, hand in hand and on equal footing. Because that is exactly what we are about: We are one big family that sticks together in good times, but also in difficult and challenging times, and we work together to find solutions, always following Dante Alighieri’s motto: “The secret of getting things done is to act!”

We hope you enjoy reading our completely redesigned issue!

Yours,  
  
 Nicola Lemken  
 Partner

Yours,  
  
 Anthony van der Ley  
 Managing Director



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Weseler Strasse 5 · 46519 Alpen · Tel.: +49 2802 81-0  
 info@lemken.com · lemken.com

Person responsible under German media laws:  
 Anthony van der Ley, Managing Director

Editors: Katrin Fischer and Matthias Wiedenau

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# OUR SOIL – OUR FUTURE

**Sustainable farming – isn't that what agriculture has been doing for centuries anyway? In principle, yes, but not always and not everywhere. Soil is our capital – the whole of humanity lives from it.**

We must take the best possible care of our soils and use them responsibly, because soils are a little like orchestras: Everybody and everything must play in harmony for there to be success. During the green revolution, some knowledge of arable farming has been forgotten. What was that about extended crop rotations again? We are currently experiencing a renaissance, remembering tried and tested practices and integrating them into modern farming concepts.

There is no single recipe that offers guaranteed success – our soils and climatic conditions are too varied for that. Our soils are not only the foundation for food production but also the habitat of many useful creatures and organisms. They form the basis of farmers' daily work, and the huge diversity of soil types is endlessly astounding. But soil is finite and must therefore be protected.

We want to work together to promote soil fertility, protect the soil, maintain soil moisture and constantly optimise the soil so that we can continue to harvest rich crops in the future. Because our soil is our future!

## Soil – the skin of the earth

Soil is an important basis for life and a resource that is only marginally renewable. It fulfils numerous functions that are essen-

tial for life. But do we actually know much about the ground beneath our feet, or does much remain hidden beneath its surface? Some soils are brown, others black. Some are coarse with many stones, others very fine and sandy. Some are moist and sticky, others dry and brittle. But here's what soils always provide, no matter what they look like. Soils:

- make up fields and pastures,
- serve as the basis for roads, settlement and traffic areas,
- offer recreational space,
- are a habitat for plants and animals,
- store nutrients and water,
- filter and buffer pollutants,
- supply raw materials AND
- have an archival function.

What does the appearance of soils depend on? There is a variety of soils that have developed differently and have different properties. The appearance and local occurrence of soils depend on the climate, local parent rocks, flora and fauna, the terrain, the water supply as well as human factors. Soils are therefore the product of abiotic soil-forming factors, i.e. rocks, climate and terrain, and biotic soil-forming factors, i.e. flora, fauna and humans.

Humus can be used to enhance the soil.



Catch crops are an important component in cropping systems – not only in conservation tillage.



## What does soil consist of?

Soil is a complex mixture of inorganic components, dead organic material (humus), soil air and soil water, which contains dissolved inorganic and organic substances. These inorganic substances are mainly silicates. Clay minerals are very important stores of plant nutrients.

Organisms in the soil convert dead organic material into humic matter, which is then further decomposed. This is the most important natural source of nitrogen fertiliser, but it also contains many functional groups which can bind cations. Humic matter and clay minerals are linked via chemical bonds to form the "clay-humus complex", with humic matter being more effective in binding nutrients than clay minerals. The most important plant nutrients are the cations potassium ( $K^+$ ), calcium ( $Ca^{2+}$ ) and magnesium ( $Mg^{2+}$ ) as well as nitrate and phosphate. Arable soils in Central Europe contain 1 to 2% humic matter on average. Black earth soils contain up to 7% and pasture soils up to 10% humus.

## Soil is life

Only healthy soils allow healthy plants to thrive and healthy foods and feeds to be produced. However, our soils are exposed to many kinds of stresses: Soil compaction in the root zone impedes plant growth and vitality, compaction-induced waterlogging suffocates microorganisms and roots, periods of low rainfall lead to drought stress and cause plant damage, and a lack of nutrients and low microbiological activity prevent the natural regeneration of the upper soil layers. However, there is a high and diverse potential for soil optimisation.

Introducing species-specific soil additives or adapting tillage practices helps improve the soil structure sustainably and strengthens the resistance and immune system of plants. Catch

crops act not only as a food source for numerous insects and as a shelter for small game, but can also contribute significantly to optimising the soil. The cultivation of catch crops is an important component of conservation tillage systems, as the effects of tillage can be imitated through catch crop cultivation. The healthier, more vital and humus-rich the soil, the

- higher the quality of the food it produces,
- greater its water absorption capacity (flood protection),
- lower the risk of nutrient loss,
- better the protection of drinking water,
- more balanced the climate,
- more efficient its natural soil fertility,
- more efficient its nutrient storage capacity,
- greater its biodiversity (including species diversity),
- less prone it is to erosion,
- more balanced nutrient supply to plants,
- more favourable the soil structure,
- better its water storage,
- more  $CO_2$  is captured from the air.

Arable, meadow or forest soils are dynamic systems that behave like living organisms. Just one gram of good arable soil contains millions of soil organisms such as bacteria, including actinomycetes, moulds, yeasts, amoebae and algae. The living matter in the soil is highly changeable and varies in the course of a year or even a day, actively adapting to the prevailing environmental stimuli and nutrient supply.

Fertile soil does not contain a specific number or specific types of microorganisms. But appreciate that a mere handful of soil contains more creatures than there are people living on earth. Most of these – microorganisms and microfauna – are invisible to the naked eye. The decisive factor is the provision of biologically valuable compounds, which are transferred to the



soil in a living structure and therefore represent the basis of life of an active, healthy soil.

The primary goal of every arable farmer is to maintain bio-diverse, healthy soils that are loose year-round and support the cultivation of healthy, high-yielding crops without requiring excessive and costly mechanical or chemical measures to maintain yields. Conventional soil management is not adapted to the way soils function naturally. As a result, conventionally managed soils do not achieve optimal performance in terms of mechanics, physics, chemistry or biology. This in turn causes soil-borne crop diseases. LEMKEN is convinced that regenerative agriculture combines the best of different worlds and is also fundamentally sustainable.

### Improving soils – improving soil fertility

An essential common feature of all arable soils is topsoil that contains humus. Topsoil is created by regular tillage, sometimes several times a year. The depth of tillage is usually between 3 and 35 cm. Depending on the type of tillage, the topsoil is turned, loosened, mixed, reconsolidated, levelled and/or crumbled.

Tillage is used to control weeds, incorporate plant residue and fertiliser, loosen the soil and prepare the seedbed. The depth and intensity of tillage significantly impacts on the humus content and stability of the soil.

Soil fertility is necessary to prepare soils for climate change and make them resilient to extreme weather events. The aim is to improve the soil as a basis for production so that it produces stable yields at increasing profitability. To achieve this, organic matter needs to be retained in the soil to feed soil organisms

and build up humus. This requires high-quality plant source material, primarily in the form of green plant matter. This matter is then incorporated into the soil through controlled decomposition. The resulting green, energy-dense, soil-available mass must only be incorporated into the top few centimetres of the topsoil so that it can be metabolised.

### Soil and water:

Soils in Central Europe consist of about 50% solids and 50% pores, which are filled with about half soil water and half soil air. Soil water contains dissolved nutrients and organic substances. The solid components comprise 40–47% minerals and 3–7% organic substances. Peat soils can contain more than 25% organic matter.

Soil is therefore an important water reservoir. Cultivation and soil management influence the soil structure, and water infiltration impacts not only on plant growth, but also on nutrient leaching and erosion. The challenge for farmers is to make soils fit for climate events. Soil cover, structural stability, storage capacity and a balanced web of soil nutrients support farmers in this endeavour.

The fertility of arable soils depends not only on climatic influences but also to a large extent on the parent soil material (grain size distribution and mineral content) and soil development. Arable soils transformed by humans have many things in common but are nevertheless very different. In Germany, arable soils have formed from almost all parent rocks close to the surface. Most of the medium to deep soils, from loamy sands to loamy clays, were gradually converted to arable land and modified through tillage, drainage or irrigation, fertilisation and

other cultivation measures. Key factors for soil fertility are the soil's capacity to store water and nutrients and make it available to plants, its vitality, the stability of the soil structure, the terrain and the climatic conditions.

The water storage capacity of soils is very variable and depends mainly on the grain size and humus content of the soil and its pore size distribution. Sandy and clay soils can only store little water that can be used by plants, while clay and silt soils can store a lot more water.

The availability of soil water and the soil space in which the roots of the crop plants can access soil water vary greatly depending on the granularity, pore distribution and thickness of the arable soil. Arable soils in Germany have a water storage capacity of between 50 and 300 litres per m<sup>2</sup> in the effective root zone for crops. The soils in loess regions have the highest yield potential.

### Soil to the rescue of our climate?

As the German climate is changing with rising temperatures, decreasing precipitation in the summer months and increasing extreme weather events, agricultural production risks are also on the rise. Sustainable humus management is therefore gaining importance as an adaptation measure to climate change. Within the framework of soil management for minimal nutrient loss, measures to build up humus offer a wide range of positive effects and opportunities for soil fertility, yield security and soil and climate protection.

Arable soil, along with the world's oceans and forests, is a major carbon sink. The humus in the soil, i.e. the proportion of decomposed and transformed organic matter, contains carbon

that has been removed from the atmosphere. This has a positive effect on the climate. At the same time, soils are the largest terrestrial carbon sink in Germany, with 2.5 billion tonnes of organic carbon stored, and they provide a multitude of other ecosystem benefits. Soils store around four times as much carbon as above-ground vegetation and more than twice as much as the atmosphere. Organic soils, especially cultivated peat soils, must be considered as a category of their own.

In arable farming, the most important greenhouse gas-relevant emissions are nitrogen emissions, especially from fertilisation, the decomposition of crop residues and organic fertilisers, and the mineralisation of peat soils. In addition, there are carbon dioxide emissions from drained agricultural peatland sites and from direct energy consumption. While direct energy consumption causes relatively low CO<sub>2</sub> emissions, the adapted use of peatland sites has far greater potential in terms of climate protection.

We are fortunate that Germany is one of the most fertile agricultural regions in the world. This is thanks to the good properties of our soils and favourable climatic conditions. We should keep in mind, though, that soils are a non-renewable resource. If we want to maintain the high fertility of our soils in Germany, we must continue to manage them sustainably. LEMKEN stands by farmers as a reliable partner. Your Partner for Next Level Farming!



Austria



Netherlands



USA



Brazil



Canada



South Africa



# 29 FACTS ABOUT SOIL

Soils are formed from **mineral, abiotic rock** and **dead organic matter**.

Soils have **liquid** (soil water), **solid** (organic and **mineral** components) and **gaseous** (soil air) components.

Soil properties can change **reversibly** and **irreversibly**.

Soils can be **neither built nor restored**.

Soils differ over **space** and **time**: Soil has **four dimensions** which change slowly but continuously.

Soils have **transitions** but not delineations. The many different soil types are **not sharply delineated from one another regionally**, but **transition seamlessly** in our fields and in forests.

Soil sealing: About **45%** of settlement and traffic areas in Germany are **currently sealed**. This causes key soil functions such as water permeability and soil fertility to be **lost**.

**Humus** is a storage and buffer medium for water, nutrients and pollutants and **significantly impacts** on the capacity of soils to retain nutrients and pollutants.

Overall, our soils provide the **main basis** for

**90%**  
of all foods.

Organic carbon is the **main component** in humus.

Under one hectare of **healthy soil** there are about 15 tons of living soil organisms.

**"Die Böden Deutschlands – Ein Reiseführer"** (Soils in Germany – A Travel Guide) by the Federal Environment Agency informs about soil discovery trails, museums and profile collections.



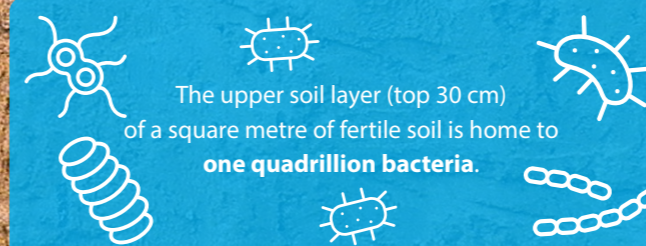
5 December is **World Soil Day**.

Each year features a **"Soil of the Year"**.

Germany has a system of describing soils (division, soil class, soil type, horizons), which takes into account soil **development over time** and **different soil properties**.

The formation of a **1-cm layer** of humus in soil can take between **100** and **300 years** but can be lost in a single erosion event.

Germany has had a **Soil Protection Act** (BBodSchG) since 1998, also a **Soil Protection Ordinance**.



There is a **soil museum** in Osnabrück.

All **natural elements** occur in the soil, and about 40 to 50 can be found in plants.

There are broadly four **main soil types** (sand, silt, clay and loam). The decisive factor is the proportion of sand (grain size between 0.063 and 2 mm), silt (0.002–0.063 mm) and clay (<0.002 mm).

Arable soil acts as a **carbon sink** and is therefore hugely important for our climate (1 ha of arable soil stores about 95 t CO<sub>2</sub>).

It takes

**2000 years**

to create 10 cm of soil.

Just 1 m<sup>2</sup> of conventionally farmed arable land grows enough **barley** for **1 litre of beer** or enough **animal feed** to produce **1 schnitzel**.

**2.000 m<sup>2</sup> arable land** is available for **every person** on earth to produce food and feed as well as renewable raw materials.

More than **24 billion tonnes of soil** are lost worldwide every year **due to erosion**.

**Soil compaction impedes** soil aeration, water balance and nutrient uptake.

In many regions, the **water supply** is crucial for **soil fertility**.

Of the more than **400 million tonnes of plastic produced** worldwide each year, about one third ends up in soils and inland waters.





## VIKTOR LEMKEN IN APPRECIATION OF HIS BIRTHDAY

Viktor Lemken turned 85 on 24 September. He was responsible for growing the 243-year-old agricultural machinery specialist with extraordinary success for almost 55 years and built his 6th-generation family business from an agricultural machinery forge to a leading global agricultural technology company.



↑ Viktor Lemken receives the Order of Merit of the Federal Republic of Germany from Federal President Horst Köhler

↗ Queen Elizabeth II welcomed Viktor Lemken at the World Ploughing Contest 2000

→ in 1998, LEMKEN was the main sponsor of the world championship in performance ploughing in Germany



The 1930s were formative for the agricultural machinery company LEMKEN on the Lower Rhine: Viktor Lemken senior and his brother Leo developed and patented a reversible plough with a fixed front section, the so-called auto-steering system. The company moved from the local blacksmith's workshop in Birten to its present location in Alpen, and on 24 September 1938 Viktor Lemken was born in Rheinberg as the second-born son of Katharina and Viktor Lemken to the sixth generation of the family business. These were milestones in the history of the LEMKEN family business and its factory.

Viktor Lemken grew up in Borth. After completing primary school in the village, he, like his brother Johannes, went to the Lüdinghausen boarding and grammar school in the Coesfeld district. During the last three years of his schooling, he lived on a farm run by relatives, where he discovered his love for technology. Even today, Viktor Lemken says that technology is his life's passion. However, throughout his career he did not have much opportunity to indulge his love of technology: Apart from filing for patents later on, there was only a one-year internship with a large agricultural machinery company in southern Germany, during which he was able to build on his technical skills and expand his technical knowledge, especially in the field of manufacturing.

His father forced him to complete a commercial traineeship. That decision was difficult for him to understand at the time, but it was the right one, as Viktor Lemken later benefited enormously from it when he took over responsibility for the business. After training as an industrial manager and subsequently studying business management in Mönchengladbach, Viktor Lemken joined the family business in 1966.

### Corporate culture

He took over the family business in April 1969, following his father's sudden death. It was a proverbial throw in the deep end,

as Viktor Lemken repeatedly stated in conversations throughout his life. When Viktor Lemken took over the business, which was founded as a blacksmith's shop in 1780, LEMKEN already employed 225 people and mostly manufactured ploughs on a seasonal basis. Taking responsibility has been a central theme and challenge for Viktor Lemken throughout his career. With foresight and a sense of duty towards his employees and the company's tradition, he ensured that the family business would remain independent. Viktor Lemken has been instrumental in shaping the company's positive development.

Even though he had plenty of practice making decisions and running the company from a young age, his style of leadership is anything but authoritarian. During his time at the helm of LEMKEN, he promoted a cooperative management style characterised by trust, especially in terms of organisation and employee participation. Viktor Lemken always ensured that it was not only managing directors and partners who set the course, but that all employees had a say in the development of the company. All LEMKEN employees think and act together, completing their work in a spirit of trust and fairness.

### Commitment

The 85-year-old still embodies this company culture. Every week, he visits the company and all its departments to talk with employees. One aspect that is particularly close to his heart is training the next generation of skilled workers, even beyond LEMKEN's internal staffing needs. "Not having a job is bad; not having a qualification is even worse."

For his work, Viktor Lemken was awarded the Order of Merit of the Federal Republic of Germany by Federal President Horst Köhler during a ceremony at Charlottenburg Palace on 4 October 2004. Initially, the entrepreneur reacted negatively to the award proposal because he is modest and does not like to be

at the centre of attention: "I don't need much for myself, I leave everything in the company."

That's why Viktor Lemken rarely took a holiday while he actively worked for the company, just a day every now and then. Otherwise, he recharged his batteries at home, in his garden, as he loves nature. He and his wife Franziska have lived in Sevelen since they got married in 1970, and Viktor Lemken is firmly rooted in the Lower Rhine region. Steadiness is also his trademark when it comes to his hobbies. He has loved horses since he was a child. Viktor Lemken started breeding ponies at an early age and later took up equestrian sports. He used to drive carriages with passion, and he has also successfully participated in tournaments at state level.

As he became more and more involved in the company, he retired from active equestrian sports, but continued to support and promote local clubs in Alpen. Even today, the sprightly pensioner sits in the saddle almost every day – although he has swapped horses for a bicycle to keep fit.

### An entrepreneurial spirit

Viktor Lemken is not one for daring experiments, neither privately nor in business. LEMKEN stands for everything to do with arable farming. For decades, the plough was the tillage implement that LEMKEN embodied – everything else was more of a side business. In 1980, the OptiQuick feature ultimately ensured the company's breakthrough in the industry and made it the market leader in ploughs. Until then, farmers had to adjust the front furrow width and side draught separately.

Many agricultural machinery companies evolved from small blacksmiths' shops, and these often manufactured seedbed combinations with working widths of up to 3 m as well as ploughs. As mechanisation progressed, it was clear that agricultural machinery needed to become more efficient. At the time,

farmers needed to suspend sections individually and fold them in with chains for road transport.

LEMKEN came up with a completely new approach: support arms for individual tine sections. This new design concept was viewed with scepticism by farmers, forcing the company to develop a marketing approach for selling its machines for the first time. As part of this, Viktor Lemken agreed to promise a lifetime guarantee on a product – a key promise of quality.

Through two successful portfolio expansions – seeding technology in 1996 and LEMKEN's entry into crop care technology in 2005 – Viktor Lemken set the course for the company's consistent, above-average growth, despite the ups and downs of business cycles. Now in the seventh generation, LEMKEN is still in family hands and has established itself as an industry-leading company, both in Europe and worldwide. Last financial year, LEMKEN's currently near 2,000 employees worldwide achieved a turnover of €550 million, 80% of which was realised in over 50 international markets in which the company is represented. With its innovative and practical technology for modern arable farms, LEMKEN also sees itself well positioned for the future.

LEMKEN's philosophy has always been "Advantage through technology" to remain at the cutting edge of developments. During his active time in the company, Viktor Lemken always strived to be as far ahead as possible, and he did so very successfully. That's where the beginning of the "AgroVision Company" idea was born. Thanks to his foresight, Viktor Lemken also ensured that the family tradition has been preserved: The current management consists of his daughter Nicola Lemken, managing director Anthony van der Ley and the five division managers for development, production, sales, IT and commercial administration.



# ALL-ROUNDER OR SPECIAL-PURPOSE MACHINE?

An optimal machine for every purpose – farmers who wanted to collect such a diverse machine park, which would of course be nice, would soon fill up their machine hall while possibly just as quickly emptying their account.



KARAT



KORALIN



KRISTALL

Are there criteria on how best to choose machines? And how can farmers cover a range of applications with a manageable number of machines? Farm machinery is as diverse as farms, locations, crop rotations and farm managers' mentalities. Economically minded farmers will try to keep their machinery fleet as small as possible. They are after hugely versatile all-purpose machines, the "jack of all trades".

In tillage, for example, this would be cultivators, which are particularly suitable for base soil preparation and stubble cultivation. In practice, there are many types of cultivators, which differ in terms of working depth, intensity of cultivation, line spacing and reconsolidation, among other things. There are shallow and deep cultivators, spring tine cultivators, two- or multi-bar designs etc.

Cultivators can be fitted with different shares and rollers to achieve many effects that usually require special machines. One example is the LEMKEN Karat 10 cultivator: This machine can be optionally equipped with wing and DeltaCut shares as well as with share points with different widths, including special narrow shares. Using the quick-change system allows the tools to be changed over quickly and easily for the desired application: The interchangeable share foot, which is secured with a lynch pin, is removed without tools and exchanged for the version without wing shares for deeper cultivation, for example. When selecting shares, quality of work should always be given priority over low draught.

## Many variants for many applications

The Karat cultivator can also be fitted with a variety of trailing rollers, from simple, lightweight tube bar rollers to trapezoidal

### A small ABC of rollers

**Double rollers in tubular bar or combined tubular bar and flat bar design:** These trail behind stubble tillage implements in light and medium soils. They loosen the soil very well and provide good levelling and reconsolidation with precise depth control.

**Knife rollers:** Similar to double rollers, but only used in heavy soils. These cut and break up coarse clods very well.

**Packer profile rollers:** Reconsolidation of topsoil and subsoil after deep loosening. The front roller with a furrow press profile works deep in the soil, while the rear roller with a W profile prepares a good seedbed. For semi-mounted implements only due to their heavy weight.

**Trapezoidal packer rollers:** For intensive bands of reconsolidation, for example with combined seedbed preparation and seeding, e.g. with the classic combination of a rotary harrow and seed drill.

The LEMKEN range comprises a total of 12 different rollers for cultivators to cover virtually all requirements.

packer rollers. The rollers can be changed depending on the intended use. The machine can also be used without a trailing unit. An additional optional single-row harrow creates optimum germination conditions for volunteer cereals and weed seeds and ensures that roots are pulled from the soil.

Of course, even a versatile Karat 10 will reach its limits at some point, for example if the soil is only to be cultivated to a very shallow depth, i.e. only about 2 to 3 cm, all over. DeltaCut shares support working depths from just under 5 cm. But farmers who want or need to work at even shallower depths without compromising are better off with a special machine. In this case, that would be a Koralin. With this machine, depth is not controlled via a roller as in the cultivator, but via depth control wheels.

That's why it can also be equipped with a four-row harrow. In addition to the Koralin, LEMKEN offers a wide range of all-rounder and specialist machines for tillage, seeding, fertilising, mechanical weed control and digital agricultural technology. Thanks to a large variety of equipment variants, these tools can be optimally adapted to individual operating conditions and needs.

### Special machines must pay off

However, this is where business management considerations come into play, if not before: Will you buy a machine of your own or will you form a machine cooperative with like-minded neighbours? Is there perhaps a machinery cooperative or a contractor nearby with a Koralin in the fleet? Whether it makes sense to buy your own machines essentially depends on the scope of use. Calculating the annual minimum cultivation area (according to the KTBL) is quite straightforward:

$$MC = \frac{fC}{IL - vC}$$

MC = Minimum cultivation area in ha/year

fC = Fixed machine costs (e.g. depreciation, insurance, taxes, interest costs, storage) in €/year

IL = Inter-farm lease or service in €/ha

vC = variable costs (e.g. repairs, fuel, oil) in €/ha

### Arable farming benefits and gut feeling influence machine purchases

But apart from numbers, which are easily calculated, other factors often play a more important role. What is the arable farming benefit from effects on soil structure or soil water, for example? Equally important is the gut feeling and mentality of the farm manager. If timely completion, well-maintained machines or maximum independence are assigned greatest importance, then the individual minimum cultivation area might be significantly smaller.

This effect, for example in combine harvesters, is responsible for the fact that many harvesting machines are underutilised in practice. But the fear of unfavourable harvesting conditions



### LEMKEN quick-change system

The LEMKEN quick-change system ensures that different tools can be changed quickly and easily in all LEMKEN Karat, Kristall and Koralin cultivators.

With the quick-change system, the entire share foot is changed together with tools.

The share foot is secured by means of a folding latch and can be changed without tools.

Set-up times are reduced to a minimum. As a result, the cultivator can always be set up quickly with the right tool. For both shallow tillage with wing shares and deep tillage with narrow shares.

and possible losses in yield or quality runs deep among many farmers. The same applies to hoeing machines, which must be used within very narrow windows of time, especially in years with poor conditions.

### Which share for which application?

**DeltaCut shares:** for working depths of less than 5 cm

**Wing shares:** 8-cm share point with 33-cm share wing, among others: full-width work with undercut and good penetration in heavy soils

**Narrow shares:** 6-cm wide share point for working depths up to 30 cm, 12-cm share point and sharply angled 10-cm guide plate with intensive mixing effect in light soils

**TriMix shares:** intensive mixing thanks to curved guide plates on the wing shares

**DuoMix shares:** for light soils, with straight, more strongly angled wings for intensive mixing

The following share variants are available: Standard, hard-faced, carbide.



# A GROWING FAMILY

Some machines are simply right for their times. One of them is the LEMKEN Koralin – another specialist for ultra-shallow tillage and cutting weeds across the full working width, ready to take on your fields.

After the Koralin semi-mounted shallow cultivator with disc and tine section was first presented at the 2019 Agritechnica, the mounted version with a tine section will now follow in 2023. But why should you take a look at this machine? The name Koralin stands not only for ultra-shallow tillage but also for mechanical weed control that cuts weeds across the full working width.

## The Koralin – a machine for modern times

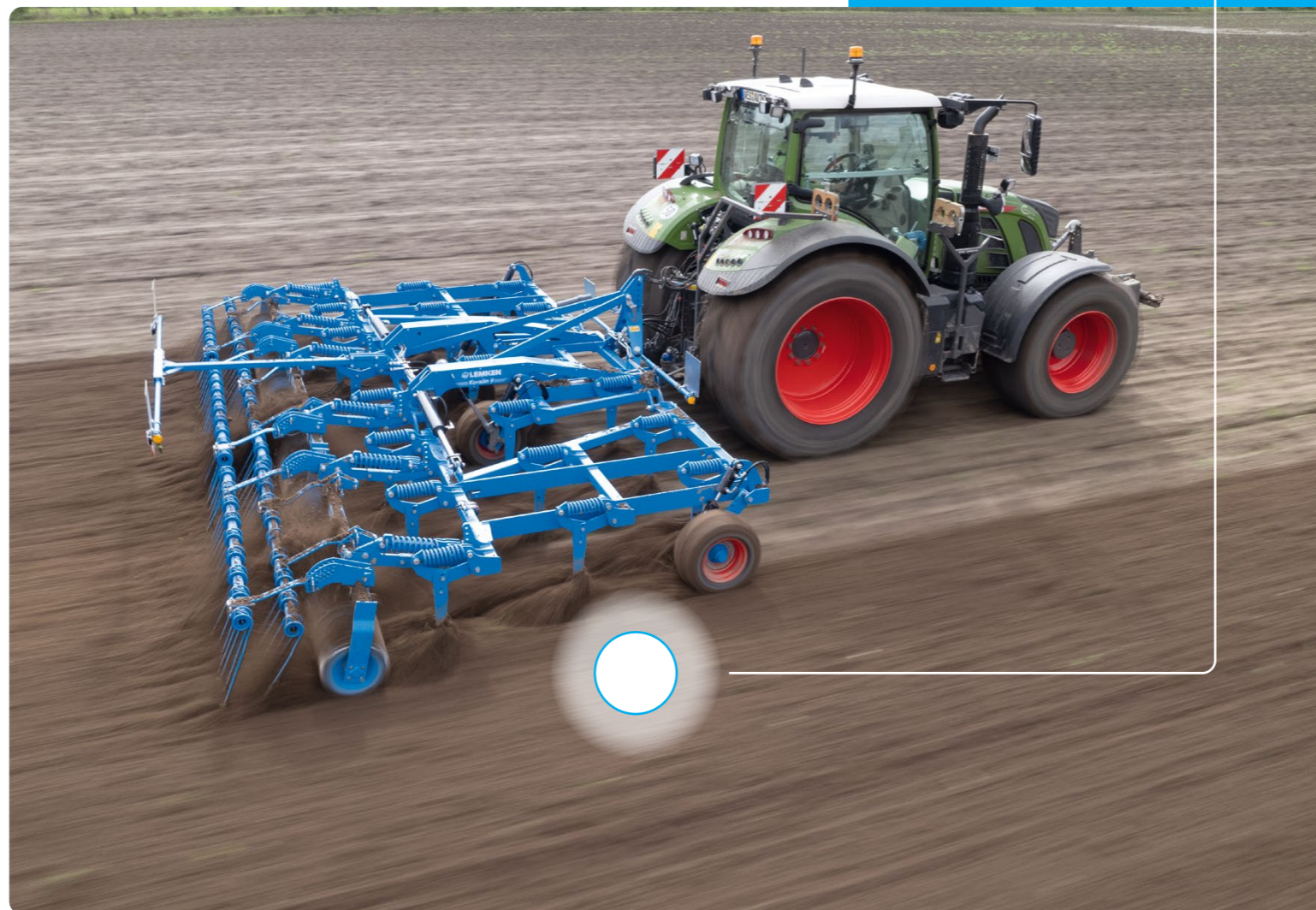
A machine for full-width shallow tillage – that was the goal LEMKEN set itself at the beginning of the development process. The machine was to be designed mainly for stubble tillage, turning catch crops and weed control. All that without placing unnecessary strain on soil water reserves. What makes the semi-mounted version special is that it combines the advantages of a disc harrow and a cultivator and thus opens up new areas of application.

The machine is a perfect fit for modern agriculture, where the careful use of available water increasingly determines yields. The market for the Koralin is expanding in view of the growing number of organic farms and the move away from chemical crop care given EU bans on herbicidal agents.

The mounted version of the Koralin will be revealed to the public in 2023. The machine features a slightly modified basic structure to make it suitable for a wider range of farms. The main difference compared to the semi-mounted version is that there is no disc section. The tine section is equipped with the proven DeltaCut duck-foot shares. The shares are still rigidly mounted. This means that they can maintain their precise tillage depth, unlike spring-mounted tines. The tines are optionally equipped with automatic overload protection or a lighter shear bolt protection.

## Mounted equals less weight and more agility

As in the predecessor machine, a sophisticated system of depth control wheels and hydraulics takes care of depth control. This ensures that – if desired – a uniformly shallow tillage depth of only two centimetres can be maintained across the full machine width.



LEMKEN KORALIN	mounted	semi-mounted
Working width [m]	6.60	6.60; 8.40
Working depth (max.) [mm]	120	120
Share type	DeltaCut	DeltaCut
Line spacing; underframe clearance [mm]	300; 570	300; 570
Line spacing – discs [mm]	–	150
Disc diameter [mm]	–	510
Weight (without roller, harrow) [kg]	2,109	7,029-8,495
Power requirement (min-max) [kW; HP]	170-240; 231-330	170-240; 231-330 / 215-309; 294-420

## Multitasking

“We used the mounted Koralin for the first time in spring 2023. That was possible thanks to our many years of excellent cooperation with LEMKEN and our local dealer. We were looking for a way to effectively control our problem weeds before the main crop.”



Previously, our workflow was as follows: Depending on plant growth, we cut green manure with a knife roller in late winter before turning it in with a disc harrow or plough. We used a shallow cultivator repeatedly to combat weeds as they subsequently emerged. We also employ the “false seedbed” technique, where we essentially prepare our fields ready for sowing. Any re-emerging weeds are then turned in before sowing.

The Koralin replaces our shallow cultivator. Because the shares cut at a shallow depth across the full width, we can even control problem weeds such as thistles, sorrel or couch grass better in multiple passes without drying out the soil. This pays off in the subsequent crop, which needs less hoeing: Manual hoeing in between rows is particularly time-consuming.

The tractive power of our 200 hp Fendt tractor is plenty for this machine, as is its lifting capacity, if we don't use the roller and automatic stone protection. An important feature of the mounted version is its manoeuvrability. That's a great bonus for us in vegetable production because we always keep our headlands as narrow as possible.” (Dirk Heitmann, Head of Arable Production)

The Pohlmann vegetable growers are located outside Munster (North Rhine-Westphalia). They grow mainly chives, pumpkins, celery and courgettes on 350 ha. To ensure an adequate supply of nitrogen, this organic farm's crop rotation includes around 70 ha of legumes, mainly soya, lupines, peas and grass-clover.

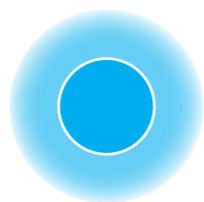
There are different versions of the trailing roller to choose from, which reconsolidate and crumble the soil differently. These can be combined with either a single or a double-row harrow. To make the mounted version even more customisable, the roller can alternatively be taken out, and a four-row harrow can be mounted.

As with the semi-mounted version, the main application is in stubble tillage during the first and second stubble breaking. This step is ideally done at a shallow depth to conserve water. The machine is also very well-suited for turning in catch crops and for weed control before seeding. However, in contrast to the heavier semi-mounted version, it needs significantly less tractive power. Without a disc section, the machine is lighter and shorter and can be driven with a three-point linkage with a working width of 6.60 m. It is very agile and particularly offers strengths in smaller or irregularly shaped fields with light and medium soils.



# CATCH CROP CULTIVATION

## – A GREAT OPPORTUNITY



Many arable farmers are convinced of the benefits of growing catch crops. As the EU imposes greater restrictions on farming, including on herbicide use, farmers need to find solutions that work for their specific conditions.



By late winter at the latest, farm managers are faced with the question of how to deal with catch crops in order to create ideal conditions for sowing their main crops. Which machines are optimal for turning in catch crops and then preparing the seedbeds? There is no single answer for how to do this, though.

Which green manure was grown? How much organic matter has formed? Have problem weeds become established in patchy stands? What are the weather and soil conditions like? And last but not least: Which main crop will follow? Restrictions on herbicide use also affect the decision-making process. In contrast, the mulch tillage technology available on the market is constantly improving, and incorporating catch crops is therefore not as arduous as it used to be even a decade or two ago.

Justus Kaulingfrecks is an expert on these questions. He works in LEMKEN's product marketing, and he is firmly convinced that growing catch crops makes a lot of sense, both from his own experience and his agricultural training. "Soils benefit from catch crops. They should be seen as an opportunity." Catch crops offer

wide-ranging benefits for soils, water conservation and biodiversity. However, some farm managers are still sceptical when it comes to turning in catch crops. The LEMKEN expert also has his opinion on this: "We have the right machine for almost every application: Our spectrum ranges from disc harrows in various sizes to a diverse range of cultivators and ploughs. There is no blanket solution that works for all farms."

Kaulingfrecks has had positive experiences with the Koralin 9: "In field use, we've seen that the machine cuts vegetation across its full width at a depth of 3 cm. A disc harrow with a narrow line spacing can only work at a minimum depth of 6 cm." This means that the Koralin consumes less diesel and conserves water better.

In addition, the mat of plant material it creates on top of the soil surface provides shade and therefore conserves soil moisture. Exposed stems dry out and break during the next pass, i.e. when preparing the seedbed or sowing. Material that is covered by the soil, however, retains moisture longer.



### Benefits of intercropping:

- Accumulation of easily degradable organic matter, mainly as nutrient humus
- Improved water retention capacity of the soil
- Protection of the soil against weather and reduced wind and water erosion
- Soil stabilisation through crumbling (tilth from cover), root mass and root depth
- Promotion of soil life
- Access to the subsoil and increased water infiltration
- Suppression of weeds through deprivation of light, water and nutrients
- Improved biological activity in soil and self-hygiene in crop rotation as specific pathogen antagonists are promoted
- Biological control of beet nematodes by growing specific crop species and varieties
- Nutrient storage in plant mass, increased nutrient availability (especially of nitrogen)
- Reduced phosphate losses and therefore less eutrophication of water bodies
- Reduced nitrate leaching due to reduced accumulation of leachate in autumn
- Decomposition of crop care products through increased soil biological activity
- Production of high-quality, affordable fodder
- Production of biomass for biogas plants

Source: Federal Information Centre for Agriculture (summary)

### The Koralin for turning in catch crops

"Fertile soils are the basis for successful farming. That's why I want to improve the humus content and structure of my soils with winter-hardy catch crops. For example, with grass-clover or vetch-cereal mixtures, wheat and rye mixtures. But because I don't plough, I need different solutions for turning in my catch crops and creating a weed-free seedbed for the summer crops as far as this is possible.

This year I had a semi-mounted Koralin 9 with a working width of 6.60 m available for testing. Depending on the catch crop, I did one or two preparatory passes with a chain disc harrow and then used the Koralin, also for one or two passes. Compared to conventional disc harrows or shallow cultivators, the Koralin offers an advantage in that its discs have a vertical cutting action, while the DeltaCut shares undercut roots at a shallow depth across the full working width. That's a real novelty on the market.

I want to compliment LEMKEN on the hydraulic design, which maintains the depth precisely. I also really like the four-row harrow, which effectively extracts plants from the soil so that they dry out more quickly. The discs in the disc section are only 15 cm apart, which is essential for shallow tillage.

My 240-hp tractor is a good match for this machine, but if you



Seiringer turning in catch crops with the LEMKEN Koralin 9.

want to work at the maximum depth of 10 cm, a few more hp wouldn't hurt. I liked the Koralin so much that I have now bought it." (Valentin Seiringer, farm manager)

Valentin Seiringer manages a 210-ha arable farm in Wieselburg (Lower Austria). His main crops are maize, soya and hemp. Annual precipitation in his region varies between 700 and 1,000 mm, and his soil quality ranges from 30 to 50 points.





# AS GOES THE SOWING, SO GOES THE HARVEST!

More than 25 years ago, LEMKEN introduced the Solitair, the first seed drill developed in-house. How did it come about and what became of it?

For more than 200 years, until 1995, LEMKEN exclusively produced tillage implements. When the company acquired the seed drill manufacturer Hassia, it added an existing range of mechanical mounted and semi-mounted seed drills to its product portfolio. It took only two more years until the first internal-

ly developed pneumatic seed drill was presented – the Solitair was born. That innovation allowed customers to choose whether they wanted seeds to be mechanically dropped or pneumatically injected into the seed furrow. At the time, 25 years ago, that was state-of-the-art technology in the 3-m segment. Today, pneumatic systems are firmly established for wide seed drills.

What was the incentive for venturing into a new product range and investing in research and development? In the 1990s, more and more farmers were looking for solutions for streamlining individual processes. There were many reasons for this, ranging from improved quality of work to greater ease of use and lower labour costs. It did not take LEMKEN long to define its goal: to combine tillage and seeding in a single pass. This goal was achieved in 1997, when the first Solitair 9 pneumatic seed drill developed by LEMKEN was launched on the market. A milestone.

### Creating a solid basis

To stay at the cutting edge and meet the challenges of modern agriculture, we have continued to develop this technology. 2006 was another milestone in our seed drill portfolio: The Compact-Solitair 9 with compact disc harrow and a 3-m working width was the first LEMKEN seed drill combination to come on the market. Only two years later, this drill combination was upgraded with the OptiDisc double disc coulters, which at the time took seeding to a new level.

Competitors' double disc coulters were loaded via a spring in the parallelogram, but this approach had a downside: This system limited the options for central adjustment. That is why LEMKEN went one step further by separating the parallelogram, and the company still applies this functional principle even today. The depth control roller is mounted on the share frame and is only connected to the share by a wire rope. A pressure accumulator tube is provided above the shares, and small piston rods apply pressure directly to the shares. The wire rope connection ensures that pressure is initially only applied to the share and is only transferred to the depth control roller when the rope is tensioned. The real advantage, however, lies in the ability to adjust the pressure centrally. This design principle created the basis for

blockage-free seed placement and precise depth control. Opti-Disc shares allowed higher working speeds in mulch tillage and row pre-consolidation in dry soil conditions.

### Creating challenges

Over the past 25 years, both arable farms and LEMKEN as a company have changed. Our international outlook means that we need to address a broad range of demands regarding seed drill technology. Not only that – numerous challenges have also evolved on the domestic market. Larger farms, new management concepts and political requirements are parameters that we can plan for, at least to some extent. Much more important, however, are the widely varying climatic conditions farmers work in and climatic changes, which represent incalculable variables for both farmers and agricultural technology.

LEMKEN has already responded to on-farm and legal requirements such as the Farm to Fork Strategy, diverse crop rotations, biodiversity and increasing restrictions in terms of fertilisation and crop care by adapting its seed drill technology. For example, we have introduced multi-tank systems. These offer the advantage that farmers can apply and place either seed and fertiliser or two different types of seeds at the same time.

But that is not all. LEMKEN seed drill technology gives farmers the option of deciding how they want their seeds to be placed, in single or double-shot mode. Single-shot means that two different components are metered separately from the seed hopper, mixed upstream of the seed distributor and placed together in a row. In double-shot mode, two components are metered separately and placed alternately in every second row or together in one row at different drilling depths – this requires twice the number of distributors. But this by no means constitutes the limits of what this company from the Lower Rhine envisages for modern seeding methods.

<b>1997</b> Solitair 9 with 3 m working width	<b>1999</b> Solitair 9 in semi-mounted and folding versions	<b>2001</b> Solitair 12 with up to 12 m working width	<b>2006</b> 1st drill combination: Compact-Solitair 9 with compact disc harrow	<b>2008</b> Compact-Solitair folding	<b>2008</b> OptiDisc double disc coulters with Compact-Solitair Plus	<b>2010</b> Compact-Solitair KK version	<b>2012</b> Compact-Solitair KHD for under-root fertilisation	<b>2014</b> 10,000th Solitair	<b>2015</b> Solitair 25 with innovative metering and distribution concept	<b>2019</b> Front hopper Solitair 23; OptiDisc 25 coulters bar	<b>2019</b> Update Solitair 9 to Solitair 9+	<b>2021</b> Drill combination Solitair DT	<b>2023</b> Multihub as 3rd tank



## GO WEST

Farming in XXL format, agricultural adventures and a new seed drill – LEMKEN trainee Martin Kannen visited the USA in spring 2023. His mission: To conduct Solitair DT product training for dealers and commission these machines for customers. A six-week roadshow across the land of opportunity.

The USA, the proverbial land of opportunity. That's what it has been to Martin Kannen and LEMKEN's innovative Solitair DT. In autumn 2022, the then 26-year-old prospective Master of Agricultural Sciences presented and demonstrated this drill combination to German customers and dealers as a LEMKEN student trainee. Just six months later, he was sent to "go west". As a trainee in product marketing, Martin supported the market launch in the USA.

The first ten of these machines were shipped well ahead of the time Martin boarded his plane to Salt Lake City on 2 April 2023 so that they would be on their new owners' farms in time for the spring sowing season. A majority of these customers had switched from an existing Compact Solitair KH to the new DT. However, we also gained new customers who were impressed by the quality of seeding and work the Solitair DT delivers.

Martin spent six weeks in the USA to support our local area sales manager Richard Johnson in several states in providing training for dealers and customers and commissioning customers' machines on their farms. First destination: Idaho.

### Challenging weather also in the USA

Similar to Germany, the Idaho spring stayed wet and cold for four weeks longer than usual in 2023, so that farmers could not start seeding their summer crops until mid-April. In the northwest of the United States, the main crops sown at this time are spring barley, spring wheat and, finally, alfalfa. Here, every day that farmers are able to work their fields counts if they want to make sure that tillage is completed at the optimal time.

"Following the winter period, we soon saw that farms with a Solitair DT or a Compact Solitair were able to start field work almost a week earlier than others," Martin noted from his local experience. There is an obvious reason for this: Many farmers in the region work with mechanical seed drills with leading roller harrow, which tend to clog in wet conditions. This is where the LEMKEN drill combinations show their unique advantages.

The new Solitair DT features a leading tyre packer to ensure good reconsolidation in the first step. For seedbed preparation in the second step, the Solitair DT is equipped with a compact disc harrow with comparatively large concave discs with a diameter of 465 millimetres and leaf springs for individual overload protection.

If farmers want to reduce the intensity of tillage, they can swap the concave discs for vertical corrugated discs. These penetrate the soil less, reducing both moisture loss and the

↑ *The Solitair DT impresses with its low draught, integrated compact disc harrow and large tank.*

↑ *In the field, the tyre packer roller ensures uniform reconsolidation of the seed horizon.*

emergence of weeds. In the last work step ahead of the tried and tested coulter bar, seed rows can be reconsolidated via a trapezoidal disc roller so that seeds have optimal contact with the soil.

### A head start in difficult conditions

During the hard winter in Idaho, wheat crops were destroyed by frost in some places. Crops were in very poor condition and could not be left in the fields. At the same time, they were too well-developed to just turn them in entirely. The alternative: reseeded. Again, the DT impressed during a no-till pass, proving that it can also be used for a seeding method that resembles direct seeding.

The tool sequence control allowed farmers to work with the coulter bar lowered and the disc section raised. The US farmers immediately recognised the benefits this brings: less fuel consumption, no wear of the disc section and a wheat crop that preserved the remaining wheat plants.

When the fields were finally dry enough for spring sowing, farmers quickly started seeding spring barley and spring wheat. At a driving speed of 10 miles per hour (= 16 km/h) and with average field sizes of 40 ha, it was not uncommon for the machines to achieve an area output of 100 ha per day, so that some of the machines had already seeded 600 to 700 ha just a week after having been commissioned. These dimensions





### Arable farming in "potato country"

*"Bigger, faster and with less red tape. Compared to German standards, agriculture in Idaho is easier in many respects: there are hardly any restrictions on fertilisers and chemical crop care agents, and most areas are irrigated. Although yields are significantly below the German average, cultivation is less intensive. LEMKEN technology also allows farmers to work in fewer passes and farm with German precision."*  
(Martin Kannen, Trainee)

are simply unheard of in Germany! For the LEMKEN trainee this meant: mission accomplished, pack your bags and hit the road. After all, he was also to complete a demonstration tour.

#### Premiere for the DT in Arkansas

Martin had not been entirely aware of what a US roadshow would mean. Of course, he knew his mission. He had already been on the road in Germany as a student trainee, visiting dealers and customers on his tractor and delivering DT machines at a speed of 40 km/h per axle. Different country, different distances. In the USA, a roadshow is unthinkable without an airshow. From Idaho, Martin travelled to Arkansas, 2,500 km away, for the next events – by plane, of course.

Arkansas is a state in the south of the USA, located near the Mississippi River. It is one of the warmest regions in the USA, where the effects of climate change are strongly felt. Local temperatures have allowed farmers to grow rice for decades. One of the best-known local brands is Uncle Ben's. What may surprise some, however, is that farmers grow wet rice. The water for flooding the wet rice fields is pumped to the surface partly from the nearby Mississippi River and partly from groundwater using large electric pumps.

At the beginning of May, the time had come for Martin to sow his first rice crop – a premiere for both him and the DT. Fields are drained for sowing and flooded again once the seeds have emerged. Here, above all, good and homogeneous re-consolidation is essential to prevent the young plants from being washed away. The Solitair DT achieves this thanks to a combination of front tyre packer, continuous tyre packer and trapezoidal disc roller.

Whether this combination of tools is suitable for growing rice can only be determined after the harvest, when the yields obtained with different sowing techniques can be compared. However, first impressions are promising, and LEMKEN seems to be living up to its excellent reputation. Tillage implements are widely used in Arkansas, but seed drills are still a rarity. In the coming years, this will hopefully change with the Solitair DT – that is what we hear from local dealers.

## FORECASTS COMING TRUE

In the last two decades, climate change and the loss of biodiversity have gone from being abstract warnings from scientists to a harsh reality. Agriculture is one of the sectors of the economy that is most affected.



Rainfall patterns will change, and periods of drought will tend to increase. The years when we could be wasteful with water are over. That's what our forecasts say. The good thing is that farmers are already thinking about strategies for managing water as a precious resource: Collecting and saving water and using it in a targeted manner will become more and more important. The climate has always challenged farmers. The past centuries have seen rising temperatures and periods of drought. With evolution, humans have probably developed into climate drivers. Average annual temperatures are rising continuously and so is evaporation from arable land.

Fortunately, the annual average rainfall is not expected to change noticeably. However, its distribution is, or will be, problematic. Rain comes more sporadically, often as heavy rain, which causes substantial runoff instead of replenishing groundwater reserves. What is even more serious is that rain comes at the wrong time. The winter months are often too wet, whereas spring and summer – when crops need rainfall for developing and growing – are too dry.

In some regions of Germany, farmers already rely on irrigation systems if they want to continue farming. At 2%, water consumption in agriculture is still relatively low compared to other uses. But this may change in the future. Irrigated farmland in Germany is expected to quadruple by 2035, while the groundwater level will drop at the same time. In order to avoid water shortages, the German government, in 2023, published the Water Strategy – a catalogue of 80 measures for using water responsibly. This strategy is controversial, however, as it involves closer monitoring of farmers and will allow supplies to be cut off if necessary. This will have consequences not only for the world's food supply, but also for the profitability of each and every farm. Once water quotas have been used up, irrigation

### Irrigation management in Canada

*South of Calgary in western Canada, farming is only possible on irrigated land – and it feels like it always has been. Waterways were built as early as in 1903 to supply the region with water from the Rocky Mountains.*

*Irrigation systems run mainly on meltwater from snow and glaciers, but even this is in limited supply. Experts assume that most glaciers will have melted in 30 years' time at the latest. What will happen then?*

*The growing season is short: The first crops can be planted in mid-April at the earliest, and the harvest must be completed by the end of September. In the winter months it is too cold for any kind of arable farming, with temperatures dropping down to -40°C. The summers are hot and dry. Irrigation systems run 24/7; there is hardly a day when centre-pivot, i.e. circular, irrigation systems are not rotating constantly. Some farmers start irrigating land even before sowing so that they can till the soil to promote seed emergence.*

*In this region, field sizes are determined by the dimensions of irrigation systems. At just under 250 hectares, fields are the right size to be served by centre-pivot irrigation systems. Currently, farmers do not yet pay for their water usage; they only need to provide electricity for the pumps. More and more farmers install solar systems along the field boundaries for this purpose.*





systems will be stopped. The logical consequence is that crop rotations and crops grown on arable land will change. It is time to collect water during times of abundance so that it is available during dry periods. Initial ideas for creating water reservoirs and retention basins are in place, as are options for filling them. It is worth taking a global perspective here. In some regions, this problem is already more urgent, and solutions are being trialled or have already been found.

**Water management**

Irrigation is only a drop in the ocean. Well thought-out water management is fundamental. In a nutshell: As the weather becomes more volatile, the agricultural paradigm needs to change from “maximum yield in perfect conditions” to “resilient yields in variable weather conditions”. To find out how arable soils are doing, it is best to examine their humus content or available field capacity. Measures which can help improve these parameters include minimum tillage and year-round ground cover, for example, to minimise water loss from the soil and increase its storage capacity.

Next Level Farming is a central approach in agriculture to, on the one hand, reduce the negative impacts on soils and the climate and, on the other, improve the economic situation in the entire agricultural and food system. Regenerative agriculture is defined as an adaptive approach to farming that uses proven, science-based measures that focus on soil and crop health to improve yield resilience while creating positive impacts on carbon and water cycles and biodiversity.

**Thinking about the future**

Healthy soils are the most important prerequisite for productive agriculture. Most regenerative practices are designed to support soil function by protecting and nourishing its biodiversity. This revolves around the following three principles: avoiding all tillage, including by direct seeding; providing permanent ground cover, ideally with plants or alternatively with a mulch layer; and promoting biodiversity, including by rotating crops more widely.

Even with direct seeding it is clear that success will require more than just refraining from tillage and using suitable direct seeding machines instead. With direct seeding, seeds are placed directly into the crop residue of the previous crop with minimal mixing of the soil (only 5 to 20% of the surface is tilled). Depending on local conditions, this approach offers a range of advantages, which individual farmers will assess differently. Economic factors also play a role, because tillage is not economical in regions where yields are low due to a lack of water. However, no-till farming carries many risks, including the spread of dis-

eases and pests, unevenly distributed crop residue and soil compaction that cannot be broken up mechanically. Carefully planned crop rotations can assist farmers in minimising the above risks, although pests and volunteer cereals need to be controlled chemically.

**Minimum-till or no-till approaches**

Conventional tillage, minimum tillage or no-till farming? The right approach for each business must be determined individually. However, if we look at farms worldwide, we can see trends in the way they are managed. Globally, no-till farming or direct seeding (DS) is the most commonly practised cultivation method, although it is still quite uncommon in Germany. In Australia (74%), South and Central America (69%) and North America (34%), however, direct seeding is much more established. Europe (6% DS), Asia (4% DS) and Africa (1% DS) continue to rely on minimum or conventional tillage. These figures show that direct seeding plays a greater role in arid regions, such as those commonly found in Eastern Europe, North America or Australia.



With direct seeding, the soil under the mulch layer heats up less

Farmers in Germany are more sceptical towards direct seeding than towards conservation tillage. When asked why, they usually argue that direct seeding increases the need for chemical crop care agents, reduces the mineralisation of nutrients, causes problems with slugs and mice, leads to heavy soil compaction and inhibits the warming of the soil in spring. Many other unresolved issues are also important considerations: What will happen if or when glyphosate is banned? Will direct seeding still be possible then? How can the requirements of the Green Deal be reconciled with direct seeding?

**Next Level Farming: the future of seeding**

When LEMKEN acquired Equalizer, an agricultural machinery manufacturer based in Cape Town (South Africa), the company strategically broadened its position in the seeding technology segment and is now able to meet almost all customer requirements in this field. So far, Equalizer has a strong presence in South Africa and Australia. Its seeding technology, which can be used for both minimum-till and no-till farming, was introduced to the North American market at a trade fair in August and was received very positively.

Equalizer was founded in 2000 by a farmer. It therefore has its fingers on the pulse of agricultural developments, and the company wants to inspire other farmers with its technology. To offer the best machines on the market, Equalizer focuses on seeding technology (planters and seeders) with working widths from 12 to 24 metres, which are aimed at large farms. Equalizer machines are designed for a minimum or reduced tillage approach that is suitable for sowing almost any type of seed.

One challenge when using these methods is to create a suitable seedbed or to use suitable tool combinations for seeding to ensure that seeds have good contact with the surrounding soil. Equalizer uses its technical expertise and optimises the placement of seeds to achieve this.

For the Canadian market, a seeding unit with a 30-mm row spacing was deliberately selected, which places seeds in the single row at a depth of 5 to 50 mm. The seeding depth is adjusted

**Attention grabber**  
*“The first impression of the Equalizer is positive throughout: It is well designed and built. It therefore represents something exciting and different for the Western Canadian market. Equalizer should be a good fit for the local market and provide us with a great product to meet the needs of Western Canadian farmers. We very much look forward to getting the machine in the fields to seed quite a few hectares with it. There is also a lot of interest in future products from Equalizer as well as in a disc seeder.” (Matt Amey, LEMKEN Product Specialist, Canada)*

in 6-mm increments without a need for tools, so that farmers have a total of nine working depths available. The machine features individually guided zinc seed coulters, which place up to three components at a customisable seeding horizon while removing organic matter and clods. The seeding coulter forms a furrow and clears clods and organic material from the seed horizon. Seeds are placed in this furrow and pressed into the moist soil by a pressure roller.

This ensures excellent field emergence even under extreme climatic conditions. Seeding can be done in tilled or untilled soil taking a minimum-till or no-till approach. A 16-mm tine coulter with a long service life and low wear or a 10-mm tine coulter for reduced or minimal soil penetration are available as coulter variants. There is a choice of pressure rollers depending on the soil type: 150 mm for sandy soils or 80 mm for clay and loam soils. This ensures field emergence and sets the course for a successful harvest.

Technical data min-till tine seeder 12000V	
Working width [mm]	12,000
Row spacing [mm]	300
No. of seeding coulters	40
Seeding depth [mm]	5 – 50
Frame	3-section with vertical folding
Transport width [mm]	6,000
Transport height [mm]	5,200
Max. tine working depth [mm]	180
Tank volume [l]	6,150 (2250/1650/2250)
Number of chambers (tank)	3
Power requirement [kW; hp]	280; 375
Attachment	Cat. 3 hitch
Tyre size – carriage	600/50 R22.5
Tyre size – support wheels	400/55 R22.5

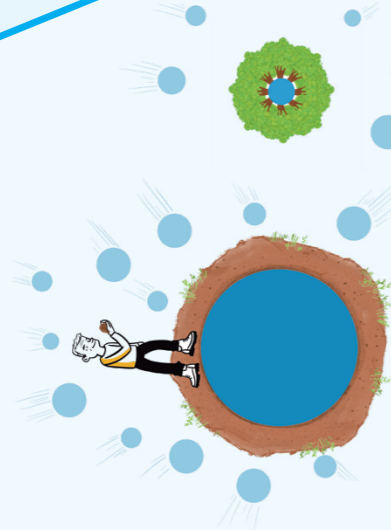




# LEMKEN

## OUR SOIL- OUR FUTURE

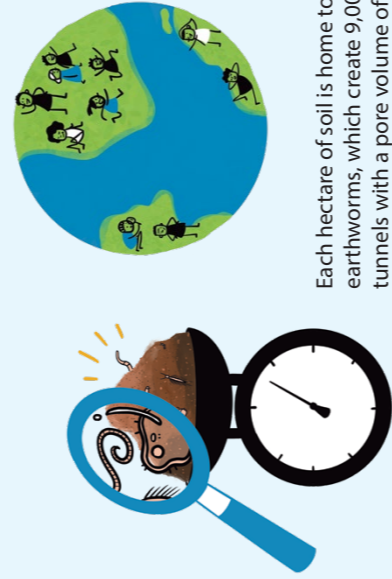
**Soil and Carbon Farming:**  
Germany's agricultural areas hold about 2.4 billion tonnes of stored carbon. This means that soil stores more than twice as much carbon as all of Germany's forests and more than three times the amount of CO<sub>2</sub> that is released in the whole of Germany every year.



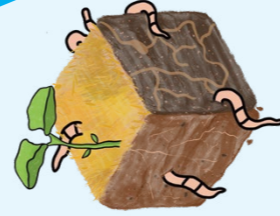
How much carbon is sequestered depends on the soil type and the intensity of soil cultivation. Carbon farming refers to agricultural practices that increase the sequestration of CO<sub>2</sub> in soil while providing a source of income for farmers and contributing to climate protection.

### Soil and Biodiversity:

Below each hectare of healthy soil there are about 15 t of living soil organisms. This makes soil the most densely populated "territory" on earth. It also means that about 1.5 kg of soil are home to as many living creatures as there are currently people on earth.

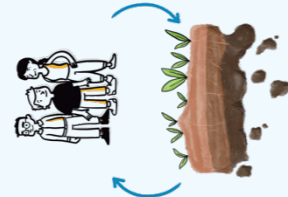


Each hectare of soil is home to 2 t earthworms, which create 9,000 km of tunnels with a pore volume of 90 m<sup>3</sup> and a surface area equivalent to 7 football fields.

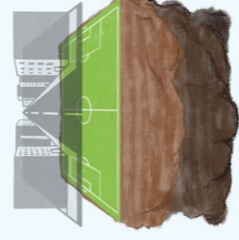


### Soil and People:

Humans depend on soils; the amount of land available for arable farming is limited, and cultivation affects soil quality.



Soil as a resource is at risk; in Germany 1.4–3.2 t of fertile arable soil per ha are lost every year due to erosion; moreover, an area equivalent to about 22,400 football fields is sealed in Germany every year.

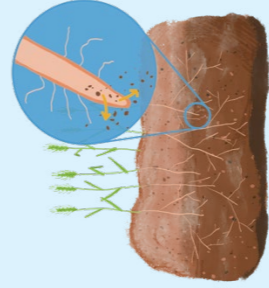


Farmers, who work with soils, must protect this valuable resource and manage it sustainably.



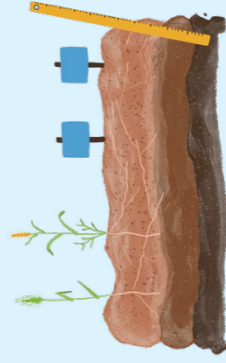
### Soil and Roots:

Plants influence their environment in the soil through exudates from their roots!



During the growing season, between 5 and 21% of carbon compounds are released into the soil in the form of exudates. Exudates from roots are thus an important source of carbon in soils.

The majority – around 75 to 90% – of roots are located in the top 30 to 35 cm of the soil cover.



Examples of root lengths:

- of a rye plant: up to 80 km
- of a wheat plant: up to 50 km in topsoil



### Soil and Water:

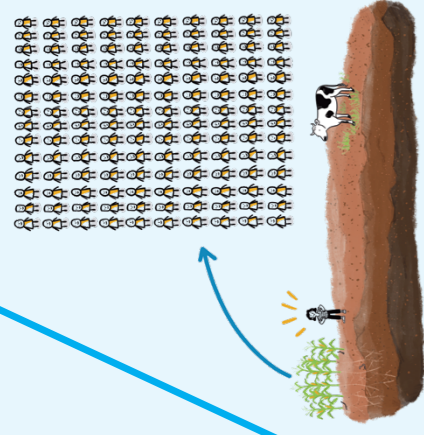
Soil is an important water reservoir, and cultivation and soil management influence not only soil structure, water infiltration and plant growth but also nutrient leaching and erosion. The challenge for farmers: how to prepare soils best for climate events.

- Measures:
- Provide soil cover
- Stabilise soil structures
- Increase retention capacities
- Feed the soil's nutrition structure

### Soil and Food:

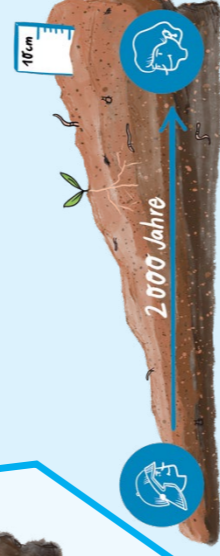
Today, 1 farmer feeds 140 people – and the basis for this are our soils.

Healthy soils are essential for healthy food.



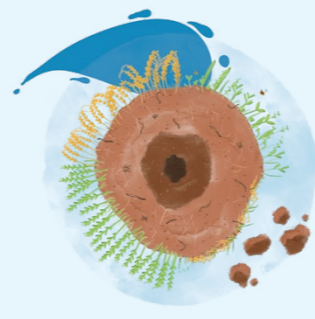
### Soil and Formation:

It takes about 2,000 years to build up a layer of 10 cm of healthy soil. This corresponds roughly to the period from the end of the Roman Empire until today.



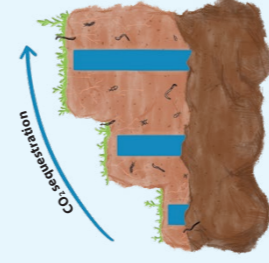
### Soil and Climate:

Climate change poses new challenges for land use.



How to prepare soils for climate change:

1. Provide year-round soil cover with living plants and/or plant residue for erosion control and water retention
2. Increase humus content and with it CO<sub>2</sub> sequestration in the soil
3. Promote the biological stabilisation of soil structures and biological activity in soil for better nutrient digestion and humus production



### Soil and Fun Facts:

England has a unique competition, the "World Worm Charming Championships": 3 m<sup>2</sup> area + 1 task: to get as many worms out of the ground as possible – but without digging!  
The record: 567 worms.



In Germany, the citizen science initiative "Soil Expedition" invites people to bury tea bags and research soils using a range of scientific methods.



The results are fed into a European database, where they can be used by scientists to improve soil and climate models.





# THE SOIL IMPROVER

**Valentin Seiringer from Wieselburg (Austria), Arable Farmer of the Year 2022 (Ceres Award), runs an organic arable farm, where he focuses on building up humus. Since his leased land was low in humus, he developed a plan to make his farm's soil more fertile again. His approach includes cultivation without ploughing, shallow tillage and an evergreen cropping concept. The young farmer is preparing for the future with innovative ideas.**



## Where does your interest in building up humus in arable farming come from?

Humus-rich soils absorb water and supply plants with nutrients – they are fertile. For me, they are therefore the basis of profitable arable farming. However, the humus contents in soils of organic market crop farms are usually shockingly low. Crop rotations must be designed to build up humus and create a good soil structure if farmers want to increase their yields.

I currently run two farms with similar soil types that have been managed completely differently over the last 25 years: one with a strategy to build humus (currently at 4%) and one with a humus-depleting strategy (currently at 1.5%). With identical crop management, grain maize yields, for example, are around 80% higher from the improved soil. Humus-rich soil not only acts as a CO<sub>2</sub> sink, but a high humus content also increases the water infiltration and storage capacity of my fields. This prevents erosion and flooding and ensures security of supply in dry periods.

My goal is to increase the value of humus-poor farmland; if the soil has just one percentage point more humus, it is worth at least one euro more. I can only build up humus successfully if I keep a close eye on all relevant parameters. These include the soil structure I find with each spade diagnosis, the growth and maturity of each crop and catch crop as well as the precise settings of each implement I use.

## How quickly can humus be built up?

This process needs a lot of patience. Realistically, you can expect average increases of 0.1% per year.

## What role does compost play in soil structure?

My father has a composting plant, the second largest in Austria in fact. The aim of composting has always been to build up humus in arable soils, as compost contributes three key properties: It is a C fertiliser, supports microbiology and returns nutrients to the soil. But if it is to fulfil these functions, we need to produce

high-quality compost. We control the decomposition process in small composting heaps over a period of 10–12 weeks. We not only aerate and irrigate the heaps, but of course also closely monitor their microbiological processes.

On our own farm, we have been fertilising our land exclusively with compost for 15 years and do not use any kind of mineral fertiliser. This works very well for some crops like maize, soya and hemp, but not at all for others. This year I tried to grow malting barley, but with little success, as I have too little effective N fertiliser for growing winter crops, but I want to change that in the future. We are currently planning a biogas plant for our residue and waste (organic waste, food leftovers, maize straw etc.). This plant will produce liquid fermentation residue and therefore supply the fertiliser we need for market crops. Its solid products can then be further refined in the composting process.

## What do your crop rotations look like? What experiences and insights have you gained in the past few years?

I follow an evergreen cropping plan without set crop rotations. I can do that because I run my farm organically and (still) without livestock, meaning that I get to enjoy both the advantages and disadvantages of not keeping animals: While I don't have a ready source of organic fertiliser, I also don't need to produce fodder and can respond very flexibly to soil conditions when I plan my crops. My main crops are maize, soya and hemp. I use a mixture of vetch, rye/wheat/triticale and optionally turnip rape or rapeseed as winter cover. Alternatively I can also undersow a clover-grass mixture, which I sow with maize and also in all legume-cereal cover crops, just to be sure.

I'm only 24 years old, but my personal learning curve in arable farming has been very steep over the last few years. Only a few of my recently gained insights come from my own innovations alone. I've copied many existing concepts and ideas, adapted them to my farm and put them together to develop a new, holistic concept. My approach to farming is based on the expertise of various farmers, teachers and advisors who have



← Valentin Seiringer and his colleague critically check the work produced by the Koralin 9.

→ Seiringer's most important tool in the field is the spade he uses to assess his soils.

↓ Only healthy soils are profitable – and that's what counts.



shared their knowledge with me. In my farming practice, I have up to 70 experiments running in parallel. I'm fortunate to have these scientifically supervised and evaluated by students from the Wieselburg agricultural college so we can obtain meaningful and reproducible findings. On my farm, it's incredibly important for me personally to share my insights. I record measures taken and key parameters very accurately to make successes repeatable and document mistakes.

## We used the LEMKEN Koralin to incorporate our undersown crops. What do you pay most attention to when incorporating undersown crops to make sure they've really been killed off? How do you control weed pressure?

When incorporating catch crops or undersown crops, it's important that I don't disturb the solid soil horizon and only work the upper soil layer (maximum 5 cm). To do that, I break down winter green cover with a chain disc harrow. Next, the green mulch layer is broken down further and mixed with the arable soil. At this step, it's important to keep the soil loose and prevent panning so that surface water can infiltrate the soil. This works with (ultra) shallow tillage.

When I set up the Koralin, I make sure that the discs work deeper than the wing shares. With undersown crops, perennial ryegrass is a challenge, as it has a lot of root mass to create a good soil structure. Ideally, I'd incorporate this grass by ploughing, but that would annihilate the structure-forming effect of the undersown crop. Working with a tiller would be an alternative, but its area output is too low. With other machines with a higher area output, such as disc harrows or cultivators, I have to make sure that I don't till too deeply and pull out grass and root clumps that will grow back.

I use hoes and harrows to combat weeds. For this, timing is crucial. Weeds germinating in light are problematic. To suppress these, I grow winter crops for 1 to 2 years or establish a permanent soil cover with undersown crops. An active soil life ensures that seeds decompose.

## What ideas do you have for the future?

I'd like to integrate some livestock mob grazing to make the most efficient use of catch crops and undersown crops. In this way, I could ensure that catch crops produce high-quality foods. Not only that – ruminants optimally pre-digest catch crops to promote a healthy soil life without compacting the ground. I'm currently running my first trials on grassland with broilers and Angus cattle. However, solid and reliable findings and statistics on the success of mob grazing are still few and far between.

For me, it's very important that the various initiatives I implement are profitable. To monitor that, I collect data such as tractor and working hours to reduce the number of working hours per hectare. I also make use of the opportunities available from precision and smart farming. At the moment I'm trying to switch to strict controlled traffic farming.

## Best practice: What tips do you have for colleagues who want to improve their soils?

It's important to take a spade to your fields and take a close look at the soil. That's the only way to find out what condition the soil is actually in. I suggest that farmers shouldn't take soil samples themselves but hire a service provider for this. This way they'll get "unadulterated" results. And then I suggest that they shouldn't overthink things – rather try them out instead. There is no one-size-fits-all solution; things differ between regions and even between individual farms.

The easiest way to build up soil is to always keep fields green. Undersowing is inexpensive and straightforward. Once you are more confident, you can work with winter-hardy or summer catch crops. The important thing is to encourage as much plant growth as possible with as little disruption of the soil as possible.



## A VISION BROUGHT TO LIFE



**Agriculture 2030 – sustainable, efficient, environmentally friendly, competitive and socially accepted. Are these the characteristics that will describe the agriculture of the future? Or will agriculture be shaped by shorter-term trends in 2030? In public discussions about future land management strategies, the agricultural sector is not given an appropriate role.**

It is increasingly rare to see the interests of a future-oriented agriculture being considered in political decision-making processes. When visions are to be implemented, it is essential to involve people with practical experience. Using the guidelines and policy frameworks provided, farmers must ensure that their farms are on the right track to meet the challenges of the future. In order to minimise the negative impacts of agricultural production on the environment, nature and animals while maintaining competitiveness and productivity, farmers need a well-stocked toolbox of technologies. Unfortunately, there has been a lot of change in this regard, not all of it positive: Tried and tested tools disappear and are not replaced, while new tools are added to toolboxes, often before they have been adequately tested – a dilemma for many practitioners.

To counteract these developments, the agricultural sector needs to develop strategies on how it intends to meet these production and societal challenges. As the conditions for agricultural production vary depending on locations and methods used, each production unit must be analysed and evaluated

separately. Different farms will achieve different results regarding specific indicators, and it therefore makes sense to use a weighted total of all indicators as the evaluation standard. A comprehensive sustainability assessment allows farmers to evaluate the specific negative environmental impacts caused by their businesses over time so that they can counteract undesirable developments early on and choose the production processes and tools that are right for them. This approach will enrich public discussions with the necessary facts and build trust in the sustainability of modern agriculture. The agriculture of the future is likely to be shaped by a wide range of technological, environmental and social changes.

### Eyes on the goal

The primary goal of agricultural production is to ensure that the world's population can be fed. Given the increasing global demand for food and the limited resources, sustainable farming practices are becoming more and more important. These include the use of environmentally friendly production methods,

the protection of biodiversity, the reduced use of chemical crop care agents and the preservation of soil health, among others. Advanced sensor technology, drones, GPS and data analytics allow farmers to monitor and manage their fields more accurately.

Sophisticated data analytics and AI technologies could help predict crop yields, detect diseases early and identify efficient farming practices. These technologies make irrigation, fertilisation and pest control more precise, which in turn reduces resource use and increases yields. These are just a few examples that show that digitalisation urgently needs to be adopted in everyday farming life.

In addition, agricultural production will increasingly need to address the effects of climate change in the future, including by developing climate-resistant crop varieties and implementing cultivation methods that can be adapted to changing climatic conditions. One thing we know is that plant breeders must meet the challenges of climate change and take into account extremely diverse cultivation conditions. Will existing resour-

ces be sufficient for production or will new, innovative practices need to be developed and established? What about vertical and indoor farming or hydroponics and aquaponics? Do urban areas also lend themselves to food production? Some of these approaches will allow crops to be grown in controlled environments without natural soil, saving space, conserving water and breaking away from our dependence on soil, a limited resource. But will the available plants and seeds thrive on nutrient solutions? We will need new plant material – soon and not only for new areas of cultivation, but also for existing arable land. Advances in genome editing, such as CRISPR-Cas technology, should not be dismissed either. These could be an effective tool in making plants more resistant to diseases and resilient against environmental stressors.

### One step ahead

It is important to emphasise that the agriculture of the future is likely to be a combination of all of these and other trends and technologies, with local conditions and needs playing the deci-



sive role. There will not be the one cure-all; instead we will need farm-specific solutions that contribute to economic success and therefore to continuous agricultural production. Sustainability and environmental protection will likely remain core concerns. Will regenerative agriculture, an approach that is enthusiastically supported by many, be the means of choice in this context, or will we need more broadly based cultivation methods?

**LEMKEN is your partner**

The term “regenerative agriculture” is currently on everyone’s lips and is often described as the “ultimate cultivation system” in discussions about the future of agriculture. Regenerative agriculture is a results-oriented food production system that is designed to promote and restore soil health, protect the climate, water resources and biodiversity, and increase farm productivity and profitability.

Regenerative agriculture is well known among farmers worldwide, but does not always have a positive connotation, as it is often used to cast “conventional agriculture” in a bad light. Conventional agriculture is described as “maximum tillage agriculture” in terms that suggest that it contributes to soil degradation, erosion and pollution.

LEMKEN clearly distances itself from statements that suggest this and has set itself the goal of developing a neutral descriptor for site-sensitive agricultural methods that are designed to reduce impacts on soils and the environment. This will enable all farmers – regardless of whether their approach is maximum, minimum or no tillage – to position their businesses well for the future and to take them to the next level while also operating profitably.

Next Level Farming is based on the approaches of regenerative agriculture, which are supported by many farmers, environmentalists and sustainability advocates worldwide. However,

LEMKEN is focused not only on environmental goals but also on economic success. With our definition of sustainable agriculture, we strive to provide solutions that deliver long-term success and do not favour or exclude any cultivation method. As farmers’ “Partner for Next Level Farming”, LEMKEN would like to contribute to accelerating this process with the proven innovative ideas it develops as the AgroVision Company. This is the only way we can ensure that we will be able to feed the earth’s population in the future while protecting our resources as far as possible. When we talk about next level farming in the future, it will currently be about the five topics of resource conservation, research and consulting, water management, digitalization, and processes and autonomy.

**The LEMKEN Circle**

Resource conservation in agriculture is a holistic approach that takes into account ecological, social and economic aspects to ensure sustainable food production, provide food security for the world’s population and preserve the environment for future generations.

Researchers and advisers support each other and work together to develop the agricultural sector and help farmers meet



LEMKEN employees support farmers with helpful advice

the challenges of modern agribusiness. By combining scientific findings and practical knowledge, agricultural productivity can be increased, environmental impacts reduced, and the sustainability of agriculture improved. Another core task is to raise awareness in society.

Sustainable water use in agriculture not only contributes to securing food production, but also to protecting the environment and preserving water as a resource for future generations. Water management in agriculture is a process that must adapt to changing environmental conditions caused by climate change.

Digitalisation of course brings its own challenges, for example access to technology in rural areas, privacy concerns and the need to raise awareness of the need for new technologies. However, digitalisation brings many benefits to agriculture, including increased productivity, more efficient use of resources, improved quality of agricultural products and better adaptability to changing environmental conditions.

Production processes in agriculture vary according to geographical location, climatic conditions and cultivation methods. Farmers who have the latest machinery and technology have the option of networking their data, creating additional opportunities for controlling and optimising their production processes. Automation and autonomy contribute to progress, are elementary components of this development and serve to increase efficiency.

If agriculture is to meet all the new demands that society places on it, we need a major eco-social transformation. As part of this process, the framework conditions for agri-environmental policy, food security, farm incomes and entrepreneurial freedoms must be redefined. LEMKEN believes that the value of ecology and climate protection must be quantified in euros. This is the only way to steer entrepreneurial decisions in the right direction in the long term. LEMKEN supports all farmers as their partner for Next Level Farming.

NEWS



**Global adventures**

In the wide world of agriculture, there are no limits to innovation and collaboration, as has been proven by LEMKEN’s L-Team this year. The team’s experts have travelled around the world to support farmers from a wide range of countries. From France to South Africa to Chile – there was no distance too far for the team. Visit our LEMKEN.Agrovision YouTube channel to see what challenges the team has overcome so far and what exciting adventures still await these experts as they embark on the next stages of their global journey in the USA and Canada.

**A new name and new factory**

Construction of the new four-bay factory and office buildings in Dinteloord will be completed shortly, so that the production of LEMKEN crop care technology can start at the new site before the end of the year. The new building was therefore completed in record time: Only 15 months had been set aside from the first piling – a somewhat different ground-breaking event – to rolling out our first hoeing machines. Our driving force: Your success!



**Down-to-earth podcast**

Our “Boden&ständig” podcast is entering its third year, and we will produce its 60th edition live at Agritechnica 2023. Every fortnight, a steadily growing audience eagerly follows the discussions between our hosts Johannes from LEMKEN and Carina Dünchem, a creator of agricultural contents. The podcast not only covers a broad range of agricultural topics, but also features regular guests, among them Christoph Grimme and member of Parliament Carina Konrad.



**A tidy job**

The 3-bar Karat 10 cultivator with 3 to 7 m working width was introduced to the market in a wide range of mounted and semi-mounted versions. Even at first glance, it appears tidier than its predecessors: Thanks to the symmetrical arrangement of the tines to the drawbar axis, this new generation of cultivators is extremely low draught, works without side draught and guarantees intensive mixing. A hydraulic traction booster is available for the semi-mounted models for optimum traction transmission, as is the ContourTrack system.



**In the fast lane**

LEMKEN has rounded off the top end of its Rubin compact disc harrows with a model with 10-m working width, launching a machine that has EU-wide road approval for speeds of up to 40 km/h despite its large 645-mm disc diameter. Like the smaller Rubin 10 models with up to 7 m width, the Rubin 10/1000 boasts a symmetrical disc arrangement, making it very fuel-efficient and eliminating side draught.



**Work & Travel**

Many young people want to go abroad for a gap year after school. While that sounds very attractive, only few actually end up doing that. However, LEMKEN’s technical apprentices now have an opportunity to travel abroad within the LEMKEN world. Noah Sanders and Lutz Wehri (apprentice mechatronics technicians) took the opportunity and supported colleagues from LEMKEN UK and LEMKEN France on site for 3 weeks.



**Practical**

LEMKEN UK has a long relationship with Agrii, which provides agronomy, technology and agricultural advice to many farmers in the UK, Ireland and Europe. The main focus here is on early research into the herbicide resistance of weeds in cereal crops. Especially with black grass, there is a close relationship between cultivation strategy, timing of seeding, seeding method, crop rotation and weed control measures. LEMKEN has supplied various machines for these trials.



**Excellent**

“iQblue tool monitoring” is a system kit for detecting tool breakage and wear as well as for analysing the wear of cultivator shares. A camera system monitors the shares and automatically records their condition during the headland run. An algorithm evaluates this and then displays it on the ISOBUS terminal with a traffic light system. The system kit supports the farmer in achieving optimal work quality, as he can change wear parts at the ideal time. “iQblue tool monitoring” is awarded the silver medal at the Innovation Award at Agritechnica 2023.





# FARMER OF THE YEAR 2023

**Cultivation of special crops in Hesse, regenerative farming on the Baltic Sea and clever arable farming with catch crops and undersowing near the North Sea – this summarises the profiles of the farmers who made it onto the shortlist for the Ceres Award 2023 in the arable farming category.**

The Ceres Award, presented for the 10th time this year, is considered a particularly prestigious award in German agriculture. Farmers competing for the Ceres Award do not necessarily have to demonstrate top performance in the field – what counts instead are excellent economic results combined with entrepreneurial virtues in agriculture, such as courage, inventiveness and a sense of responsibility towards people, animals and nature.

“Farmers ensure our food supply and must constantly adapt to changing conditions to be fit for the future. We want to actively shape this transformation by offering them innovative processes and sustainable solutions. As a traditional family business, there is something we share with farmers: our use of knowledge and passion to drive progress. Every farmer deserves recognition, thanks and respect for the work they do, and the Ceres Award showcases farmers’ efforts in a positive way. As award sponsor, we are happy to support the arable farming category,” says Nicola Lemken, explaining the agricultural machinery manufacturer’s decision to sponsor the award.

From the applications received, each jury shortlists three candidates per category using a comprehensive evaluation system. Jury members then assess candidates’ farms on site. Each jury teams consists of one editor of the agrarheute magazine, one representative of a trade association and one representative of the category sponsor.

**Andreas Damm from Frankfurt Bergen-Enkheim (Hesse): Special crops and special requests**

Andreas Damm knows his customers well. His arable farming business just outside Frankfurt is strongly oriented towards local needs. He only grows what he can ideally sell in his farm shop or via regional retailers. Currently his main crops are potatoes (80 ha), onions (10 ha), asparagus (12 ha) and strawberries (10 ha) as well as winter wheat and sugar beets.

His proximity to the Frankfurt metropolitan region is both a blessing and a curse. While it presents challenges in terms of land management, it also ensures plenty of visitors to his farm shop, creates proximity to customers and allows him to sell his entire potato harvest year round via local food retailers. Andreas Damm implements a balanced crop rotation on his almost 300 ha of farmland.



**OUR CONGRATULATIONS TO MARKUS MUSHARDT!**

**Markus Mushardt from Cuxhaven-Altenbruch (Lower Saxony): Mission Together**

For Markus Mushardt, networking is a daily habit. He not only has a constant thirst for knowledge, but also wants to pass on what he learns to as many colleagues as possible to help ensure that agriculture can develop successfully and sustainably. The 31-year-old therefore regularly shares insights into his farming practice on Instagram.

He grows wheat, barley, oats, rapeseed and legumes with catch crops and undersown crops on almost 300 ha near Cuxhaven in a sophisticated crop rotation. His farm is on the way towards regenerative agriculture with direct seeding, soil conservation and the reduced use of diesel, mineral fertiliser and crop care products. Markus Zeitke also works as a contractor and rents out several holiday apartments, which gives him even greater exposure to consumers.

**Matthias Zeitke from Lüssow (Mecklenburg-Western Pomerania): Regenerative farming on the Baltic Sea**

Since taking over the farm, Mathias Zeitke has realigned his farm in Lüssow near the island of Rügen. He no longer uses ploughs, cultivators or similar implements. On his 500-ha farm, the 40-year-old works entirely without tillage and instead relies on direct seeding of wheat, barley, maize, rapeseed and catch crop mixtures. His catch crops are put to good use for mob grazing by his herd of sheep. This approach offers clear benefits: The crops are grazed off, and the fields are organically fertilised. This helps protect the fields against drought and erosion.

Zeitke also uses Cultan fertiliser and has greatly reduced his use of mineral fertilisers and chemical crop care agents. As a result, small game has returned to his fields, and soil fertility is increasing. Zeitke is one of the pioneers of regenerative agriculture.

**Unanimous jury decision**

Markus Mushardt’s fields are challenging and require constant attention to the soil ecosystem. But the 2023 Arable Farmer of the Year does not shy away from these challenges – on the contrary. He has a vast thirst for knowledge. He is in constant exchange with colleagues and has started regional cooperations; he attends networking events and continuously seeks further training. He also likes to look beyond Europe for inspiration.

This farmer courageously breaks new ground, establishing a new arable farming strategy on his farm in just a short period of time. Through diverse crop rotations and minimal tillage, he uses less chemical crop care agents and improves the water balance and soil fertility. Investments in new technology and process optimisation result in greater efficiency, and this farmer never loses sight of financial success.

Our Arable Farmer of the Year initiates pioneering projects and field trials with scientific support and seeks regular contact with consumers to raise awareness. He dreams of an institute for sharing knowledge and opportunities in regenerative agriculture to promote sustainable land management in Germany and around the world.



↑ Why, why, why? Matthias Zeitke answered the questions of the expert jury.

← At the end of their visit to Andreas Damm’s farm, the jury thanked this shortlisted candidate with a small gift.

↓ Markus Mushardt adapts his cultivation methods to the needs of his soils and crop management.





# HOLISTIC HUMAN "SENSORS" ARE LOSING IMPORTANCE

Digitalisation is changing the way we work, communicate and consume – in short, our entire lives. In agriculture in particular, farmers have adopted automated work processes in farm management for some time and are starting to do so in their fields.

A quick jump in time: Do you still remember the 1990s? When automatic milking systems were introduced to dairy barns, revolutionising everyday work? That technology had a rocky start, but milking robots soon became established. With the switch to automatic milking, the demands on skilled personnel changed fundamentally. Physically demanding but relatively simple work routines performed at specific times and places were superseded by flexible, intellectually demanding tasks with a high degree of self-organisation and decision-making in order to maintain both animal health and efficiently functioning technology.

These days, it is impossible to imagine agriculture without technical innovations. With Agriculture 4.0, we are far ahead of many other industries. However, state-of-the-art technology has not quite taken off in the fields themselves. There still seems to be a lack of momentum. Despite all the opportunities digitalisation offers, there are challenges that will need to be solved in the short term. Before digital technologies can become broadly adopted, rural regions will need efficient and secure infrastructure, i.e. reliable mobile phone reception and full RTK coverage. But that is still not enough. Systems from different manufacturers need to be able to communicate with each other easily. A compatible interface could jump-start this development.

Some start-up companies are already out in the fields, showing what may be feasible in the future. Some of the few autonomous systems that are relevant in practice feature integrated

process monitoring, but they still depend on systems that are operated or optimised by humans. Human tractor drivers are still absolutely essential, as they act as holistic "sensors" of their environment.

## A changing scenario

Drivers will not be superseded for the time being, but it is time to think about the future of arable farming. Which processes will be helpful at the early stages of the path towards autonomous technologies? Which tasks are better replaced by autonomous systems: the more basic ones, which might be easier to replace by robotics, or the complex ones, which place higher demands on both technology and operators? This question is hotly debated. One thing is clear however: The work of vehicle drivers will change. They will become machine controllers and even robot pilots. They will be the humans who set the (field) parameters for the work of powerful machines so that these can implement work processes completely autonomously.

The revolution in farm management may serve as a useful blueprint. Today, the main challenges are found in field work – challenges that were resolved in farm management 30 years ago: too little time for operational processes, seasonal staff shortages, and monotonous work that is unattractive for skilled staff and can be easily automated. At the same time, implement operation is becoming more and more complex, and farmers are required to document their work



Combined Power is a joint project of LEMKEN and KRONE. It allows numerous autonomous processes to be mapped in arable farming and forage production.



more extensively. All these factors require increasing technical support, so that the future will be autonomisation rather than automation. We are already able to link a wide variety of processes and actors through rich data. However, interface compatibility between products from different agricultural machinery manufacturers and data linking remain key challenges.

*"There is less time lost driving and more time available for value-adding tasks such as crop planning."* (Stefan Haverkamp, LEMKEN Head of Predevelopment)

## Joining forces

One problem, multiple stakeholders. The DKE's agrirouter illustrates the issue very well. In 2016, ten agricultural technology companies recognised that smart farming will only work if data can be exchanged across manufacturers and products. Today, the consortium already has 85 partners, but its product has not really caught on in practice yet.

Many farmers and contractors have had bad experiences with the early stages of digitalisation and have lost confidence. Now, the chances of a large number of agricultural machinery companies agreeing on a common denominator that the market will accept are decreasing.

Start small, grow big – a new approach to the autonomy project. LEMKEN and KRONE are a good match: Both companies are located close to each other, have successfully implemented joint projects in the past, and their product portfolios do not overlap. It only took them a few workshops to agree on a common goal, namely to focus on a comprehensive, optimised and open system for six selected processes. To connect implements to tractors, all interfaces and implement connections must offer 100% compatibility and connectivity. In practice, the sensors, cameras etc. should handle tillage and green fodder harvesting processes autonomously and as smoothly as possible. This in-

cludes that they avoid and detect disruptions and document, improve and control the quality of work. But what would be the point of upgrading an implement if it can't be put to use in the fields? Implements need tractors, and this is where we ran into difficulties. Our search for a system partner for a tractor failed because we could not agree on the hierarchy between the tractor and implement within the system.

The project initiators believe that the autonomous process must be subordinate to the respective work process: Process intelligence and know-how would therefore reside in the implement. "That's our knowledge, we don't want to hand it out! The tractor needs to carry out the commands coming from the implement," says the project team. This is a new approach for vehicle manufacturers. Tractor Implement Management (TIM) meant initial progress in this field, but it was not broadly accepted. This provided the impetus for the major Combined Powers project to develop an autonomous process engineering unit (PEU).

Unlike many tractor manufacturers and start-ups, KRONE and LEMKEN do not focus on the tractor and associated navigation. They believe that the work process needs to define the driving strategy and track planning. The communication between the tractor and implement will need to be clarified at a later stage. Another aim of the joint project is to develop a solution for precisely this problem and to take it through a standardisation process.

It is expected that the autonomous PEU will provide greater reliability, consistent precision, increased quality of work and high tracking accuracy. Its specifications set demanding benchmarks for every operation – no matter how long it lasts. If high performance and reliability can be achieved, farmers and contractors will be able to organise their working hours more flexibly and focus more on management tasks. This will be essential, because with automatised they will need to collect data to create more value on their farms, similar to the benefits achieved with milking robots.





## WHO BENEFITS FROM DIGITALISATION?

**“Precision farming is not worthwhile on our small fields; we prefer to manage our fields as we always have.”**

**Lukas Berwinkel-Kottmann has heard this and similar statements far too often. That is why the 31-year-old from South Westphalia University of Applied Sciences was particularly keen to take on the EIP project “DigitalFarmPraxis NRW”.**

The European Innovation Partnership (EIP) project focuses on five mixed farms typical of the Munsterland region in North Rhine-Westphalia with an average field size of about 3 ha and highly variable soil quality. The trials were set up with winter wheat, winter barley and winter rye as well as with silage maize, grain maize and CCM. The goal was to investigate the benefits of section-specific seeding rates and organic and mineral fertilisation in wheat, barley and maize. The trials were based on application maps drawn up on the basis of soil samples, yield data, satellite and drone images and farm managers’ experience.

### Integrating technology

At the beginning of the project, only one tractor on the participating farms was equipped with a permanently installed GPS-based steering system. There was no other technology to rely on. “That’s why we invited the Freckenhorst machinery cooperative to become a project partner, which had machines, software and licenses for all purposes we needed.” For the trials, harvests from 2021 (wet spring) and 2022 (dry spring) were evaluated. It immediately stood out how homogeneous the grain and maize crops were. Because the crops matured evenly, it was easier for farmers to decide when to harvest.

In terms of yield, section-specific management was found to offer a slight advantage over conventional management. Section-specific fertilisation, in particular, resulted in slightly higher yields in the grains trials. The averages from all trials showed

that application map-based fertilisation resulted in about 6% greater yields, whereas section-specific seeding or increased seeding rates tended to reduce yields.



*“In this way, precision farming can also pay off for smaller farms.”*

Lukas Berwinkel-Kottmann, South Westphalia University of Applied Sciences

In the maize plots, as in the grain plots, section-specific fertilisation produced slightly better harvests than standard fertilisation without the use of sensors or application maps. On average, the section-specific application of fertiliser delivered a 2% increase in yields. Section-specific maize seeding, however, produced more impressive results. In the drier spring of 2022, the average yields from the trial fields were 6.5% higher than with conventional seeding.

### Digitalisation pays off

Almost all trials proved to be profitable even once the additional costs of using the digital technology provided by the machinery cooperative had been factored in. In some cases, farmers earned up to €200 more per hectare than with conventional farming – and that at average prices. “This inspired the farmers

to manage their remaining fields with precision farming technology as well,” Berwinkel-Kottmann adds with a smile.

However, he does add a caveat. It is important to note that the short two-year duration of the trials constitutes a limitation; also, farmers need to familiarise themselves with high-precision technology first before they can reap these benefits. Technical issues included compatibility problems between implements from different manufacturers and difficulty using complex interfaces.

### Digitalisation requires commitment

Thilo Jäger has already gained digital experience: “Our everyday life is becoming more and more digital, as are our tractors, machines and farm management. For me, there’s no way around it. What my grandfather and father still did with pen and paper or Excel spreadsheets, I can now do very efficiently with digital tools. But I must be prepared to engage with new technologies on a regular basis – it won’t happen on its own.”

Thilo Jäger and his father run a contracting business and an 80-ha arable farm in Walsrode (Lower Saxony). They employ 6 permanent staff and 15 casuals and use technology in a variety of ways in their business, mainly for section-specific seeding and fertilisation, field databases, work scheduling, documentation, soil sampling and invoicing. These aspects of their work are networked so that data input is reduced to a minimum.



*“The world is becoming more digital – as is agriculture.”*

Thilo Jäger, farmer and contractor

All employees have tablets for entering and retrieving data. For Thilo Jäger, this is where digitalisation offers the greatest advantage: “Everyone is always up to date. We make fewer mistakes. When I’m on the road as a contractor, I always have my customers’ data with me. This way, I can discuss measures carried out earlier or even in previous years during the planning meeting, and we have a better basis for our decisions.”

Of course, digitalisation is more expensive than using pen and paper, and it also requires learning. But the bottom line is that it pays off through time saved and higher contribution margins. Anyone who takes the trouble to compare the yields from fields with section-specific and conventional management and compare the effort involved will soon be convinced. “The same applies to farm managers in the 50+ age bracket, who often have no successor and may have missed the boat on modern technology,” adds Jäger from experience.

Networked digitalisation also makes sense in determining fertiliser needs or when producing the very extensive documentation farmers are now required to prepare. Society demands transparency in agriculture, and digitalisation can provide this at a reasonable cost and with reasonable effort. Thilo Jäger definitely wants to continue on this path and close gaps

that still exist in his networks, for example by integrating a scanner when collecting soil samples and using data for invoicing. To be able to manage all this, he always looks for talented young employees.

What is the best way to get started with digitalisation? Or is it best to start slowly? Dr. Beat Vinzent is in charge of digitalisation at the Institute of Agricultural Technology and Animal Husbandry at the Bavarian State Research Centre for Agriculture (LfL). He says that “the top 3 digital solutions in our consulting domain are field databases, steering systems and section control applications. Steering systems and section control can reduce direct costs in arable farming, for example for diesel, fertiliser and crop care, by €15 to €50 per hectare, depending on the implement working width and the number of passes. Add to this the savings in working time and reductions in driver strain.”

### Dare to get started

Section-specific management with sensor systems requires high investment costs for individual farms, which often do not pay off for smaller arable farms in Bavaria. But remote sensing solutions can be useful alternatives, as long as up-to-date data is available. Regardless of the farm size, using agricultural robots for weed control or to support harvests makes sense if they help save many hours of expensive labour, for example on organically managed farms, in horticulture or in the contract cultivation of herbs.

Digital technologies are generally used when they are expected to provide a large benefit at a reasonable cost or at least a manageable investment risk. Farm size plays a subordinate role; farm structure is more important. But user personality must also be factored in: Users must be prepared to engage with digitalisation and familiarise themselves with digital tools. For many farmers, time is their greatest challenge. The convenience factor and functional reliability are therefore of great importance – just think of intuitive smartphones.



*“Digitalisation is not a question of farm size.”*

Dr. Beat Vinzent, LfL

There is no way around digitalisation because it is synonymous with progress and affects all areas of life. “Many applications are indispensable, but in my experience some are more of a gimmick. The IT sector develops at an incredible pace. There will (have to) be further progress in user interfaces and interconnectivity,” says Dr. Vinzent, confirming that there is a need for further research. The full integration of different applications makes sense in principle, provided that it is stable and can be implemented at reasonable costs. However, stand-alone solutions are often just as good if they make machines and processes resilient and run stably.



# DO YOU WANT TO MAKE YOUR PLOUGH OR CULTIVATOR SMARTER?

The iQblue connect module can be installed in new and existing machines. It reduces operator strain, makes work more precise and documents recorded data.

Have you ever heard of iQblue connect? Not yet? Behind this term lies a module that enhances your plough or cultivator with previously undreamt-of capabilities. This electronic tool regulates the working width on ploughs and the working depth on semi-mounted cultivators. While this may not sound earth-shattering at first, it actually adds considerable added value for users. iQblue connect is part of LEMKEN's iQblue range of digital products that make your field work more efficient and your administrative work faster.

## How does iQblue connect work?

To make a machine compatible with iQblue connect, it only needs to be fitted with a sensor. On ploughs this is an angle sensor on the longitudinal axis for working width control, whereas on cultivators it is an inclination sensor on the drawbar for depth control. These sensors are connected to the iQblue connect control module, which is attached to the implement. It includes a job computer, a modem for sending and receiving data and a GPS receiver. The module is connected to the in-cab terminal via a cable and the ISOBUS socket, so that measured values can be compared with previously entered reference values.

The module then accesses tractor functions based on the data it receives. With ploughs, the relevant function is the control unit for adjusting the cutting width. With cultivators, in contrast, it is the control unit for depth control as well as the lifting gear. This requires a tractor with TIM function (Tractor Implement Management). The tractor must meet this ISOBUS standard for the implement to be able to assume control of the tractor's functions.

## What benefits does this application offer?

With ploughs, GPS-controlled working width adjustment results in perfectly straight furrows, even on changing soils. Curved furrows, which tend to happen when ploughing in the dark, are therefore a thing of the past. Field wedges can be ploughed optimally. There are no overlaps so that crop residue that has been ploughed in is not brought up again. Drivers need to turn less often because iQblue connect supports more efficient work on headlands with certain field geometries. This results in less soil



compaction and not only speeds up work, but also produces better results. With cultivators, iQblue connect supports section-specific depth control. The motto is always: as deep as necessary, as shallow as possible. This creates optimal conditions for growing crops, ensures more efficient fuel use and protects the water balance in the soil.

The iQblue connect tool considerably reduces drivers' workloads, but also offers another key benefit: The system can transmit the collected data via the modem, for example to the agrirouter data exchange platform, so that information can be neatly documented.

A new feature of the system is that iQblue connect is now manufacturer-independent. This means it can also be installed in implements from other manufacturers. The control module is portable and can be used on any plough or cultivator, regardless of its manufacturer and machine size. It can be transferred between implements in just a few simple steps.

iQblue connect is therefore a good option for retrofitting existing machines with hydraulic cutting width adjustment or hydraulic depth adjustment at a low cost. Now, farmers do not necessarily have to buy a new machine equipped with integrated electrohydraulics and electronics to be able to access these functions.

## Who is this solution most interesting for?

The system is particularly useful on farms with irregularly shaped fields. Managers of farms growing special crops such

as onions or potatoes really appreciate the dead straight furrows created with RTK guidance. When harvesting these crops, it is important for the harvesters to run smoothly without rolling or tilting. This can be achieved by consistently driving on top of the former furrow ridge because the soil is never com-

pletely level even after seedbed preparation. Section-specific cultivation makes a lot of sense in fields with changing soil conditions, where the soil is ideally tilled at different working depths.

## Tractor Implement Management (TIM)

While there are many electronic functions that allow mounted implements to be controlled from the tractor or an in-cab terminal, the TIM ISOBUS function works exactly the other way round. The device controls certain tractor functions such as the driving speed, hydraulic control valves, lifting gear position, PTO shaft speed and even the steering. It therefore ensures autonomously that it operates in its optimal state. It automates processes and therefore ensures consistent work quality, maximum implement utilisation and, above all, a significant reduction in the driver's workload.

TIM is based on ISOBUS Class III. This is currently the highest standard for ISOBUS-based machine communication. For successful communication between the tractor and implement, the ISOBUS packages on both machines need to be at the same level. This may require software updates or the unlocking of certain ISOBUS functions.

## High quality of work and driver relief

*"By using iQblue connect to automatically adjust the cutting width, I keep exactly to my AB line and create dead straight furrows. I can then adjust my subsequent tillage accordingly. My rotary harrow, for example, can always work parallel to the plough furrow. That saves significantly more energy and makes work more efficient. When I plough wedge-shaped fields or want to reduce my headlands, I can rely completely on the system. It always creates a precise furrow along the edges without me having to work out manually how to get closest to the field boundaries. This clearly saves me a lot of work."*  
(Lukas Siebers, LEMKEN employee in Test + Trial, Prototype Construction)





Hoeing machines are making a major comeback on many farms. While they have always been essential tools on organic farms, they are now found on more and more conventional farms as well. For decades, chemical herbicides were the method of choice to efficiently eliminate weeds in conventional farming.

But times are changing. The use of chemicals in agriculture is under ever closer scrutiny, as societal and political pressure increases. Approval procedures are being tightened, key active substances are not being reapproved, and the EU wants to reduce the use of herbicides by 50% as part of its Green Deal. Although chemical solutions can still be applied in most cases, hoeing is becoming more and more popular again, especially among forward-looking farmers who want to be independent of further potential restrictions. They also benefit from the fact that hoeing technology has evolved considerably.

#### The camera makes the difference

A current LEMKEN EC-Weeder differs significantly from standard hoeing machines 30 years ago. While LEMKEN still offers the options of working with a row sensor or having the implement controlled by a second person on the machine, many farm managers choose automatic control via the powerful IC-Light camera. This proprietary development detects shades of green and the RGB colour spectrum. It learns the specific hue of the crop grown and works with extreme precision even in the dark, thanks to LED lamps.

In combination with the terminal, a job computer and a parallel steering frame, it moves the hoeing machine through the crop to within 2 cm of each plant as if by magic – all at maximum

speed. The user interface of the terminal is intuitively designed so that any corrections can be made easily and quickly. Drivers can concentrate fully on monitoring the process. The machine does not get tired, so no plants are accidentally destroyed even after long hours of work.

This greatly increases the area output compared to what was possible in the past. The system enables working speeds of up to 15 km/h. Working speed is crucial because the time windows for using hoeing technology can be very short in some years, yet farm sizes have increased in recent decades. This creates time pressure, and then it is all about efficacy to eliminate weeds at an early stage of development.

#### Each hoeing machine is unique

But it is not only efficacy that counts – the quality of work is also important. Here, LEMKEN benefits from Steketee's many years of experience. There are solutions for almost any purpose. Various hoeing and protective tools, harrow elements, finger hoes and ridging tools ensure maximally effective weed control both between and within rows. And that with a minimal number of passes. All tools are made by LEMKEN. They meet the company's renowned quality standards.

#### Professionals working together

But technology can only work optimally if drivers know how to use it. The starting point is a look at the soil condition and the weather forecast. Next, drivers must be able to select the right tool and adjust it correctly, which requires experience as well as knowledge of the complexities of arable and crop farming.

### Blue means performance

Five years ago, the agricultural machinery specialist LEMKEN acquired the Dutch company Machinefabriek Steketee B.V., expanding its crop care product portfolio with implements for mechanical weed control and future-oriented camera-assisted machine guidance. The full integration of the crop care business was completed in November 2023: Steketee became LEMKEN, and Steketee machines are now delivered in LEMKEN blue instead of Steketee red.

This strategic decision marks a milestone in the development of both companies and offers promising opportunities for future growth and innovation. Since the acquisition of Steketee, LEMKEN has worked hard to maximise the synergies between the two organisations. The integration of teams, processes and technologies has been extremely successful and has already resulted in increased innovation and a broader range of services offered.

Another forward-looking step is the expansion of production capacity. Production at the new LEMKEN site in Dinteloord (Netherlands) started in November 2023 to meet growing demand as sales have tripled in recent years. The site will become LEMKEN's Crop Care Competence Centre.

LEMKEN offers important assistance to beginners and advanced users. This starts with our in-house experts supporting customers in configuring hoeing machines that meet their individual needs. Authorised dealers are trained in the technology at the LEMKEN Agrofarm to ensure they are able to provide competent advice. They supervise the initial deployment at customers' farms and are available to answer any questions about machine settings, among other things. The same applies to our product specialists. LEMKEN additionally offers a remote service to answer questions via remote maintenance.

#### Anyone can do the basics – LEMKEN does more

The EC-Weeder represents only a part of the LEMKEN product range for mechanical weed control. The IC-Weeder is the right solution for vegetable crops with row spacings of at least 25 cm and plant distances of at least 20 cm. The implement is equipped with several cameras so that it can work precisely around the plants, both between and within rows.

The EC-Ridger is designed for ridge crops with 75-cm row spacing. In potato and carrot crops, this modular machine cuts weeds along and on ridges, loosens the soil between ridges and then returns the ridges to their shape with a ridging body. The EC-Ridger is available for front and rear mounting.

The EC-Steer steers any hoeing machine – whether made by LEMKEN or another manufacturer – safely through your crops. To achieve this, the hoeing machine is attached to the parallel steering frame, which is mounted to the three-point linkage. The EC-Steer can be optionally equipped with IC-Light camera control or steered manually via a joystick from the seat. Its swivel range is 20 cm each to the left and right.

### An end to resistance

"Winter wheat, winter barley, spelt and oats are the market crops I grow on my organic farm. These may sound like standard crops with easy weed management, but that's not the case given my local conditions. We often have wet weather in spring. We also mainly have heavy pelosoils, that is dyked marshland soil that was still

under the North Sea until 400 years ago. That's why efficacy is a key quality criterion for me. But people who equate efficacy exclusively with high driving speeds are seriously mistaken. At a maximum speed of 10 km/h, I can do around 6 hectares per hour, but what's the point of high area output if the results aren't good and I need to do another pass on my crops?"

The grain-heavy crop rotations in our region promote black grass growth. I can eliminate this weed largely by hoeing and harrowing, because there is no resistance to hoeing, provided that the right hoeing machines are used at the right time with the right tools. However, there will always be some residue, but I have learned to live with that.

When I bought my 9.5-m wide Steketee hoeing machine, an EC-Weeder, in 2020, I deliberately opted for "premium" equipment because I wanted the best possible results. My machine has parallelogram guidance of the hoeing tools, section control and IC-Light camera control. I'm very impressed by the performance of the cameras. Whether there is little or much weed growth, whether I drive slow or fast, with its two cameras, the EC-Weeder works very precisely as close as 2 cm from plants, and it does so with gentle steering movements, so plants aren't damaged. I'd never trust myself to achieve this level of accuracy with manual steering.

But this only works because the hoeing machine matches my seeding technology, for which I use a LEMKEN Solitair 12 with the same working width. Since converting to organic farming, I have been seeding at double row spacing, i.e. with a 25-cm spacing, to leave enough space between the rows for the hoeing elements. This has a positive side effect: I can use the same tracks for seeding and hoeing to minimise compacted areas." (Georg Penon, farmer)

Georg Penon runs a 120-hectare arable farm near Leer (Lower Saxony). He converted to organic farming in 2016.



## CROP CARE WITH LEMKEN: FROM BASIC TO SUPER SMART

Hoeing is making a major comeback on conventional farms. This is primarily due to technical advances, as well as changing political requirements.



# MINIMAL USE OF HERBICIDES, RELIABLE WEED CONTROL

Farmers who combine mechanical and chemical weed control can now benefit from the advantages of both methods. LEMKEN offers the new SprayHub front tank and updated SprayKit for this purpose.



There is a trend in weed control to return to hoeing and band spraying. These practices had disappeared from most conventionally farmed fields in Europe for several decades. With its Farm to Fork Strategy and Green Deal, the European Commission has set the target of reducing the use and risk of chemical crop care agents by 50% by 2030. This will have consequences for agriculture.

## Potential for savings of up to 60%

Farmers are therefore looking for ways to significantly reduce the use of chemical crop care products. For those who do not want to rely exclusively on mechanical methods, band spraying is an option for row crops. With this approach, only a few centimetres to the right and left of each row are treated chemically, the rest is hoed. This enables farmers to reduce their use of chemical crop care products by up to 60%. As a result, they are able to meet policy requirements and at the same time significantly reduce their costs for chemical products, for example in sugar beet and maize crops, which can be expensive to treat chemically.

By using a combination of mechanical and chemical approaches, farmers gain several advantages at once: In addition to financial savings, they achieve maximally effective weed control within crop rows, which are generally more difficult to keep weed-free, while using less chemical crop care products. The spaces between rows can be weeded reliably with hoeing

machines. But there is more: This combined approach not only controls weeds but also breaks up hardened patches of arable soil.

## The SprayHub in detail



## Back to the future

LEMKEN now offers an optimised technical solution for combining mechanical and chemical weed control. The new SprayHub combines all functions required for the speed-dependent application of liquids. To achieve this, the front tank is equipped with its own controls, agitator and cleaning system. It is ISO-BUS-controlled and can be intuitively operated via the IQblue spray software. The SprayHub has a tank volume of 1,100 or 1,500 litres, which is sufficient for more than 10 ha of sugar beet crops. Its flat design ensures a clear view even when the tank is front-mounted. The SprayHub comes with a clean water tank, hand wash tank and filling screen. An additional rinsing nozzle for dissolving solid agents is available as an option.

This is combined with the SprayKit, which consists of a basic fitting, pressure line and flexibly positionable nozzle holders.

## If you use band spraying, it might as well be high-tech

*"In 2021, we combined our Steketee hoeing machine with SprayHub and SprayKit prototypes. In the first year, we mainly used this combination to apply foliar fertiliser. I have now bought a series implement, which I mainly use to apply crop care products. I decided on a LEMKEN implement because I thought, 'If I'm going to invest in a hoeing machine with band sprayer, I may as well go for a high-tech machine.'"*

*For me, the automatic rinsing of the SprayHub and the easy attachment of the SprayKit to the hoeing machine are very well designed. Additional positives of this hoeing machine include its large underframe clearance, which also allows the machine to be used in tall maize, or the individual lift of the hoeing units controlled via Section Control, which is important in irregularly shaped fields. The icing on the cake are the cameras, which reduce the driver's workload hugely. Drivers can sit back and focus on monitoring the work.*

*I use this machine combination on 400 to 500 hectares, mainly maize fields and some sunflower fields. From my experience, I have saved about 60% in chemical crop care products. That's why I can get subsidies for this method from my regional water supplier, as we have water protection areas.*

*With band spraying, my customers get better protection against weeds in row crops compared to hoeing alone. At the same time, hoeing between the rows contributes to managing resistance in weeds that are difficult to control. The costs my customers save on crop care products cover a significant part of the costs of machine use. Hoeing also offers other benefits in addition to resistance management: It loosens the soil, breaks up silting, if necessary, and promotes mineralisation.*

*The more precisely maize is sown, the more accurately and quickly can it be hoed. Dead straight rows and even row spacings are essential if I want to drive at speeds of around 8 km/h. Depending on the field structure, I can hoe about 1.5 to*

Mounted to the LEMKEN EC-Weeder, this combination is a powerful unit from a single manufacturer. The use of the SprayHub and SprayKit is not limited to crop care products; this equipment is also suitable for liquid fertiliser and crop adjuvants. The SprayKit can also be used alongside other implements apart from hoeing machines, and it features mechanical section control.

The height-adjustable nozzle holder features a scale for easy adjustment of the desired spraying height and position. This allows the width of the required spray band to be individually determined depending on row spacing, crop and type of application. Different nozzles can be used depending on the individual application. Special band spraying nozzles with spray cones that ensure a uniform concentration of spraying liquid across the set band width are particularly suitable for combining band spraying with hoeing technology.



*3 hectares per hour with a 6-m working width. The combination of band spraying and hoeing after seeding with my LEMKEN Azurit works very well because I can rely on precise row spacings and use the RTK track lines for hoeing." (Henning Müller, contractor)*

Henning Müller runs an agricultural contracting business near Verden (Lower Saxony), which was spun off from a typical regional farm with pig fattening and arable farming in 2015. Together with two permanent employees and five casuals, Müller offers tillage, seeding, crop care, fertilisation and combine harvesting services, among others.



# A NEW START

Harrows are probably the most important implements in organic farming. Given their versatility and good cost-benefit ratio, they form part of the basic set of implements of every organic farm. However, more and more conventional farmers are becoming interested in harrows in view of increasing scepticism towards and decreasing availability of herbicides.

There is mounting societal and political pressure to reduce the use of chemical crop care agents. Additionally, herbicide resistance is increasing, while the availability of new active substances is shrinking. Rethinking crop care – that is the challenge many farmers are currently facing. Alternative weed control methods already available and used in organic farming can generally also be used in conventional crop production; these are extended crop rotations, adapted soil and seedbed preparation as well as the use of hoeing machines and harrows.

Chemical weed control has been so dominant to date because it offers high technical, economic and labour efficiency: Its most important advantages are reliable and timely weed control that is largely independent of weather conditions and supports a high area output. Conversely, this highlights the limits of alternative methods, which must offer a sufficient level of certainty regarding their effectiveness and economic efficiency, i.e. costs, time required, yield protection etc. Other aspects such as sustainability, resource protection, environmental compatibility and resilience with regard to climate change must also be taken into account.

For most conventional farmers, appropriate herbicide use in compliance with relevant legal requirements remains the weed control measure of choice. Alternative methods can be addi-

tionally used to reduce the use of chemical agents to a site-appropriate minimum and make it easier to implement the Green Deal requirements. In good conditions, mechanical methods can control weeds with a success rate of over 90%.

### A partner in many situations

Different versions of harrows and hoeing machines are the most important groups of implements for mechanical weed control. Harrows are mainly used to work across the full surface area of grain fields rather than in row crops, while hoeing machines are particularly effective in row crops. Harrows primarily work by pulling out and burying weeds. Their tines turn the top soil layer to a maximum depth of 3 cm. The smaller the weeds, the more effective these tools are. The earliest possible harrow pass is always the most efficient.

Blind harrowing is particularly effective. With this method, the harrow works above the seed placement depth before the first cotyledons of plants appear. Precise depth control is essential for this approach to ensure that crop plants are not damaged and their germination is not impaired. The germ tubes of weeds, in contrast, which are above the seeding horizon, are brought to the surface, where they dry out in good weather. As a general rule, the first harrow pass can take place

Thulit – technical data	Thulit M/600	Thulit M/900
Working width [m]	6.20	9.20
Transport width [m]	2.98	2.98
Transport height [m]	2.20	3.68
Length [m]	3.45	3.45
Weight [kg]	1,120	1,440
Number of front support wheels	2	2/4
Number of rear support wheels	2	2/4
Tyre size	16 / 6.5 / 8	16 / 6.5 / 8
Tine pressure (min; max) [g]	100; 5,000	100; 5,000
Tine diameter [mm]	8	8
Tine spacing [mm]	31.25	31.25
Bar spacing [mm]	180	180
Underframe clearance [mm]	450	450
Power requirement (min) [kW; hp]	45; 60	70; 95
DA spool valves (min)	2	2
Unpressurised return line (max. 5 bar)	1	1
Lower link implement attachment	Cat. 2/3	Cat. 2/3



### Successful harrow use

- Adjust the harrow precisely.
- Harrow use is most effective when the weeds are still small.
- The soil must not be too wet or too dry.
- No large crop residues, otherwise there is a risk of the tines becoming blocked.

as soon as crop plants have established sufficient roots and will not be uprooted or damaged – this applies to almost all crops.

With its Thulit weeder harrow, LEMKEN now introduces the right mechanical weed control technology for this purpose to the market. This newly developed harrow stands out from previously available technology. The Thulit impresses with innovations such as hydraulic tine pressure adjustment for precise weed control during sensitive crop stages. With optimised visibility, minimised risk of blockage, a well-balanced machine weight, true-to-track tines and folding harrow tines, this weeder harrow sets new standards in terms of efficiency, safety and reliability when used in the field.

### Precise pressure adjustment

During the first pass, the harrow should be operated with little pressure and at low speed. The larger the weeds are, the more pressure and speed are necessary for effective control. The choice of machine setting is a compromise between causing minimal damage to crop plants and maximal damage to weeds. In order to find the right setting, farmers need time and experience as well as a tool that allows them to adjust settings with precision.

The Thulit's unique hydraulic tine pressure adjustment ensures uniform tine pressure over the entire travel of the harrow tine. This is achieved by a constant lever arm ratio between the point of contact of the harrow tine and the point of application of force of the individual cylinders. The adjustment options range from gentle harrowing at less than the tine weight (<100 g) to a maximum contact force of 5,000 g per tine. The tine force can be adjusted conveniently from the tractor cab.

Key factors for successful use are loose soil with good structure, weather conditions that are neither too wet nor too dry and no coarse crop residues which could clog the tines. That is why LEMKEN relies on a flexible hydraulic section control system within the frame sections, as this reduces overlap. The innovative frame concept with four beams and eight rows ensures that the harrow tines are optimally distributed, which results in an excellent flow of material and blockage-free work even with large volumes of organic matter.

Harrowing also offers other positive effects in addition to weed control: It breaks up the soil surface and therefore aerates the soil and mineralises some nitrogen. In grain crops, harrowing also has a positive effect on tillering. The Thulit can be used with practically all crops. With ridge crops, it can even be used across the full surface.



# SPARE PARTS – USING PHOTOS FOR IDENTIFICATION AND ORDERING

What used to be a pipe dream is now becoming reality thanks to artificial intelligence (AI). A new, additional search functionality has been integrated into the agoparts Mobile app and now enables customers to order spare parts more conveniently and accurately.

When parts break during work or simply become worn at some point, they need to be replaced. In the past, customers usually called their dealer, but now more and more farmers are using the option of ordering the parts they need via the agoparts spare parts platform. This platform includes the LEMKEN spare parts catalogue, among other things. Exploded views make it easier to select the required part, which can be clearly identified based on the serial number of the implement.

## Faster access to the required part

However, as machines have become increasingly complex with thousands of parts and numerous variants, these practices have reached their limits. Researching the required spare part with the necessary care can be very time-consuming. Thanks to the image recognition function, customers can now identify and order the right spare parts more quickly and conveniently. agoparts Mobile is a smartphone app for use in the field or warehouse. This multi-brand app allows customers to download machine-specific catalogues to make them available offline.

The app has recently been extended by a powerful image recognition system that suggests a list of possible spare parts based on photos taken with a smartphone. The app checks whether the information provided is conclusive based on the implement's serial number and therefore makes sure that only parts are displayed that are actually installed in the relevant machine. If there is a match, the chosen part can be placed in the shopping basket.

LEMKEN will introduce this solution at the Agritechnica, the world's leading trade fair for agricultural technology, initially with a Karat cultivator. In the paid version of the app, all LEMKEN products can be searched via image recognition from the launch date. Customers can check online whether their se-



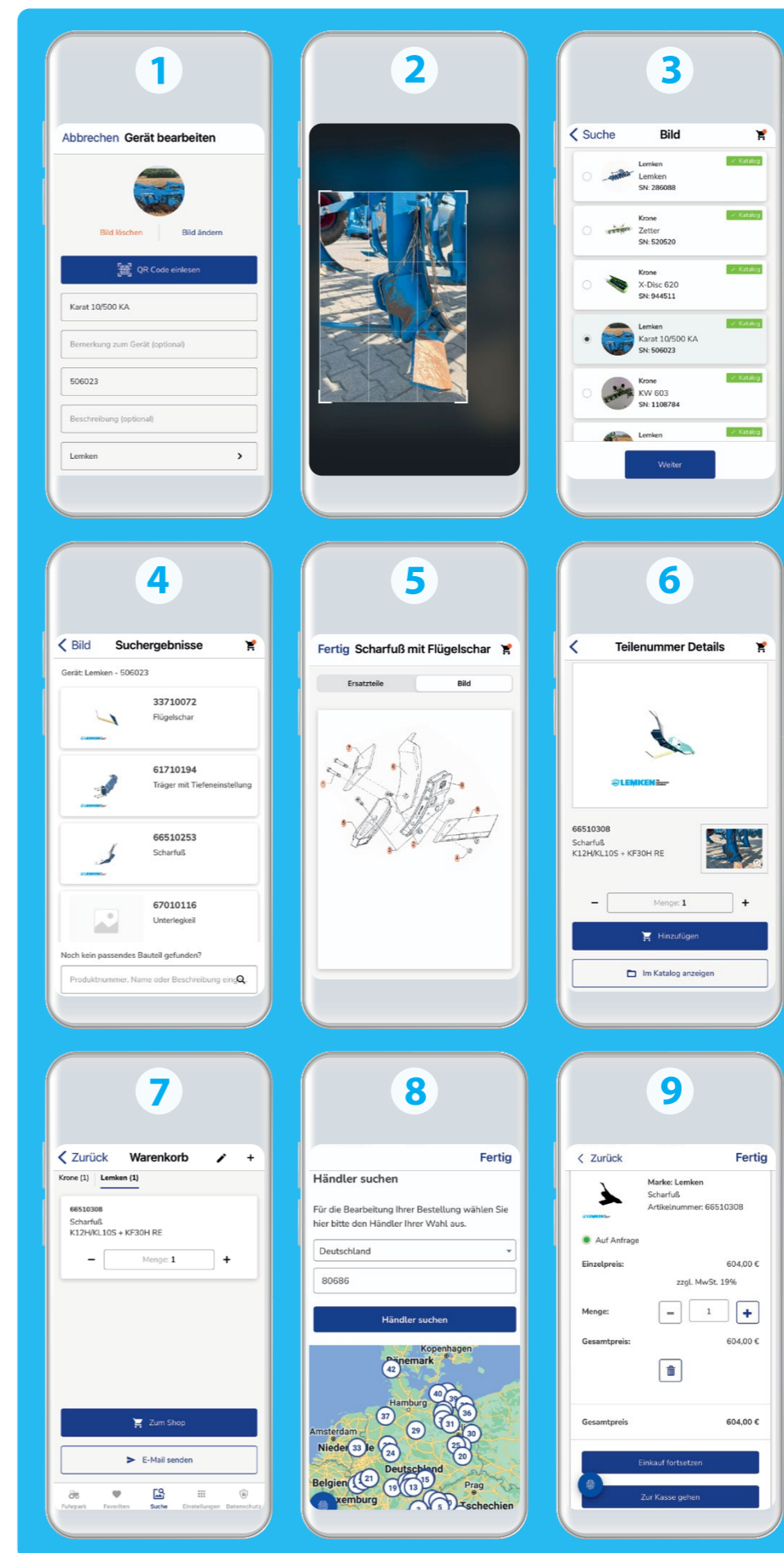
lected dealer has the required spare part in stock. They also see prices and can place their order immediately. The spare part can then be collected directly from the dealer or ordered from the respective LEMKEN central warehouse.

## An eye for subtle differences

If reference images are available, the app identifies parts with excellent accuracy. It recognises even worn-out spare parts and distinguishes between similar ones. This simplifies and speeds up the search for the right part. With a total of 8.1 million spare parts shipped by LEMKEN in 2022, there is plenty of potential for saving time and making sure the right part is selected at the first go. Digitalising the ordering process offers benefits to everyone involved!

## How does image recognition with artificial intelligence (AI) work?

1. LEMKEN data on all spare parts as well as industry data (photos, naming systems and previous searches, including from other manufacturers) are transferred to an AI-enhanced search database.
2. Each search query, i.e. the photo submitted by the app, is compared with the information available within the app.
3. The results list is sorted according to the calculated accuracy score.
4. Additional data (new picture, serial number, model name) can be entered to narrow down the selection and improve the search result. agoparts Mobile "learns" with each search query.



## Step by step

From a worn share point to a parcel from LEMKEN

### Installation of the app (one-off):

- Download the agoparts Mobile from the app store and install it on your smartphone (screenshot).
- Register with agoparts and subscribe, then assign a specific user.

### Ordering process

1. create devices in the app (once). The serial number is required.
2. Take a picture of the worn or defective part and determine the image section. The better the image quality, the better the search result.
3. Assign the spare part search to a machine from the machine list.
4. App compares photo with stored drawings and displays search results. Only parts that were installed with the serial number are displayed.
5. If desired, an exploded view of the selected part number is displayed.
6. Details of the selected part number are displayed and can be added to the shopping cart with the desired quantity.
7. If more spare parts are required, repeat the search. To proceed to the order, the shopping cart must be called up.
8. Once in the store, the desired dealer must be searched for. The delivery will be made to the selected dealer.
9. Complete the purchase by clicking on the button "Proceed to checkout". An order confirmation will be sent by mail to the specified mail address.



# THE LEMKEN LOGO MAKES ALL THE DIFFERENCE

When farmers and contractors look for spare parts for their agricultural machinery, what counts most is quality. That's what LEMKEN delivers. Thanks to a sophisticated production process and targeted quality assurance measures, products bearing the LEMKEN logo are market leaders.

There is plenty of choice in the market for spare parts. A basic distinction is made between original spare parts and replica products from many different manufacturers. It is possible to get nasty surprises with both. For example, the quality of spare parts from some agricultural machinery suppliers does not match that of their original equipment, even if they are genuine. Replica products often do not fit properly or are not as resistant to breakage.

If that is the case, supposedly cheaper replica products can soon turn out to be expensive mistakes. Often, consistently poor quality is comparatively easier to deal with than variable quality, for example when it comes to a set of share points for a cultivator. "With original spare parts from LEMKEN, buyers are always on the safe side. We offer our customers consistent quality at the highest level," says Boris Bröcheler, Head of Spare Parts Sales Service.

## TIP

Why not add to your personal, positive experience buying original LEMKEN parts by visiting your LEMKEN dealer for your wear parts needs and take advantage of the current early-bird promotion?



More information?  
Scan the code!

## Core competence in forming

What leads Boris Bröcheler to make such a confident statement? "The process of forming the base steel material we receive into the finished spare part has always been one of our core competences. After all, our company originated from a blacksmith's shop," he explains. Over the years, the company has developed a great deal of expertise in achieving the optimal combination of hardness, durability and toughness for each part. Hardness alone is not everything – that is something farmers and contractors working in stony fields know very well. If material lacks toughness, it is brittle and will therefore break easily.

"Our mouldboard strips stay in the press for 2 minutes. That is a comparatively long time, and that costs money, but ensures durability in the field. If material is hardened optimally and evenly, it will perform better than parts from other manufacturers that are hardened with a carburising process, for example."

## Made by LEMKEN

LEMKEN's design engineers do not simply copy from others, but design each tillage implement according to specific requirements. During the development process, parts are extensively validated to confirm their quality of work, reliability and durability. In addition, LEMKEN predominantly uses special, high-quality boron-alloyed steels. Drill holes are avoided as much as possible, as they always compromise stability due to the notch effect. Care is also taken to ensure that carbide wear parts do not shift the wear point to more expensive components, for example from comparatively inexpensive share points to more expensive mouldboards. While many spare parts suppliers do not manufacture their products themselves, LEMKEN has a large

# QUALITY ASSURANCE – STEP BY STEP

LEMKEN products have always had a good reputation. In the last 10 years, the company has refined its quality assurance system even further. Karsten Wessels summarises the LEMKEN system:

## Incoming goods inspection of semi-finished steel products:

- Visual appearance
- Spectral analysis and comparison with the supplier's material test certificate
- Spectral analysis serves to determine the content of key alloy elements such as iron, cobalt, copper, boron, chromium, nickel etc., which impact the quality of manufactured parts
- Assignment of an internal tracking number for each production batch

## Process control:

- Inspection of prefabricated pieces during production
- Automated control and documentation of temperature control during the tempering process (heating, rapid quenching and subsequent reheating to relieve internal stress)
- Monitoring and documentation of the quench tank media

## Product control:

- Continuous checks of the geometric shape of workpieces by means of gauges and measuring callipers

- Hardness testing after hot forming and repeated tempering (heating)
- Paintwork checks

## Employees:

- Work instructions and plans govern all investigations performed by employees
- Regular staff training
- Internal, state-of-the-art materials laboratory for fast transfers and high responsiveness
- Regular inspection, maintenance and replacement of forming tools, which are subject to natural wear

## Audits:

- Standardised questionnaires for verifying defined processes of incoming goods inspection and production
- Regular product audits for examining all characteristics in the measuring room and in the laboratory

vertical range of manufacture. This means that most parts are produced internally by the company and, above all, at its headquarters in Alpen (Germany). Therefore, rather than depending on suppliers, LEMKEN has full control over the production process and quality requirements.

## A tight net of checks

LEMKEN's internal QA department has implemented a very tight net of checks over the years. This starts with the incoming goods inspection and ends with spare parts ready for dispatch. "If our colleagues in our internal materials laboratory report a problem, we can stop the manufacturing process immediately at the relevant point," explains Karsten Wessels, Head of Quality Management. Spare parts bearing the LEMKEN logo are only released for sale once all quality control steps have been successfully completed.

Customers can therefore rest assured that they are receiving high quality when they buy LEMKEN spare parts. LEMKEN also does not differentiate between the quality of original equipment and spare parts: "Our parts all come off the same production lines." Other strong points of original wear parts are high accuracy of fit, fast supply and long availability, even for older machines, as well as warranty and goodwill. "That's why I don't like to talk about the prices of spare parts in isolation – the decisive factor is the value customers receive," concludes Boris Bröcheler.

## Hardness FAQs

### Why are materials hardened?

Hardening improves material properties. This results in a long service life for tillage implements and ensures that structural parts have a high strength.

### What is hardness?

Hardness is a material's mechanical resistance to mechanical penetration by a harder body. It is measured in HRC (Rockwell hardness). A good kitchen knife has about 60 HRC, LEMKEN Duramaxx strips have 60+3 HRC, for example.

### How is hardness tested?

In the forming process, Rockwell hardness is tested according to DIN EN ISO 6508. A diamond cone is pressed into the component with an initial test force of 90.07 N and loaded with a total test force of 1.471 kN (150 kg). After the load has been taken off, the depth of penetration is determined by a measuring gauge and expressed in HRC as hardness value.

### Why are HRC measurements reliable?

LEMKEN checks its hardness testers internally every day using hardness comparison plates. Additional once-yearly checks are performed by an external calibration laboratory.





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