CHOOSING THE RIGHT SYSTEM

At Willershausen in Hesse, Germany, a long-term soil cultivation trial has been conducted for around 30 years under the leadership of the Giessen Regional Council (Hesse Plant Protection Service). What began in the mid-1990s as a practical investigation into weed control has developed into an impressive long-term trial that is now more relevant than ever. In this interview, trial technician Manfred Kirchner and Ruben Gödecke share their key findings for the agricultural sector.

Innovation: What was the original aim of the trial – and how has it evolved over the years?

Kirchner/Gödecke: The trial was established in 1995. The starting point was a practical challenge: species of brome grass were becoming increasingly prevalent in the region, particularly in connection with conservation tillage systems. At that time, no approved herbicides were available for their control in wheat and barley. Over the years, the scope of the research has expanded significantly. Today, the focus is on understanding the long-term effects of different tillage systems on crop production and arable farming practice. We investigate the opportunities and limitations associated with technical developments and assess how different systems influence soil structure, disease pressure and grass-weed populations.

Over time, additional topics have gained importance, including black-grass management and nutrient distribution in the topsoil, such as the accumulation of phosphorus and potassium under no-till seeding systems.

Looking back, the early establishment of this long-term trial proved to be a far-sighted decision. The long-term results provide valuable insights into the opportunities and limitations of different tillage systems under evolving agronomic conditions.

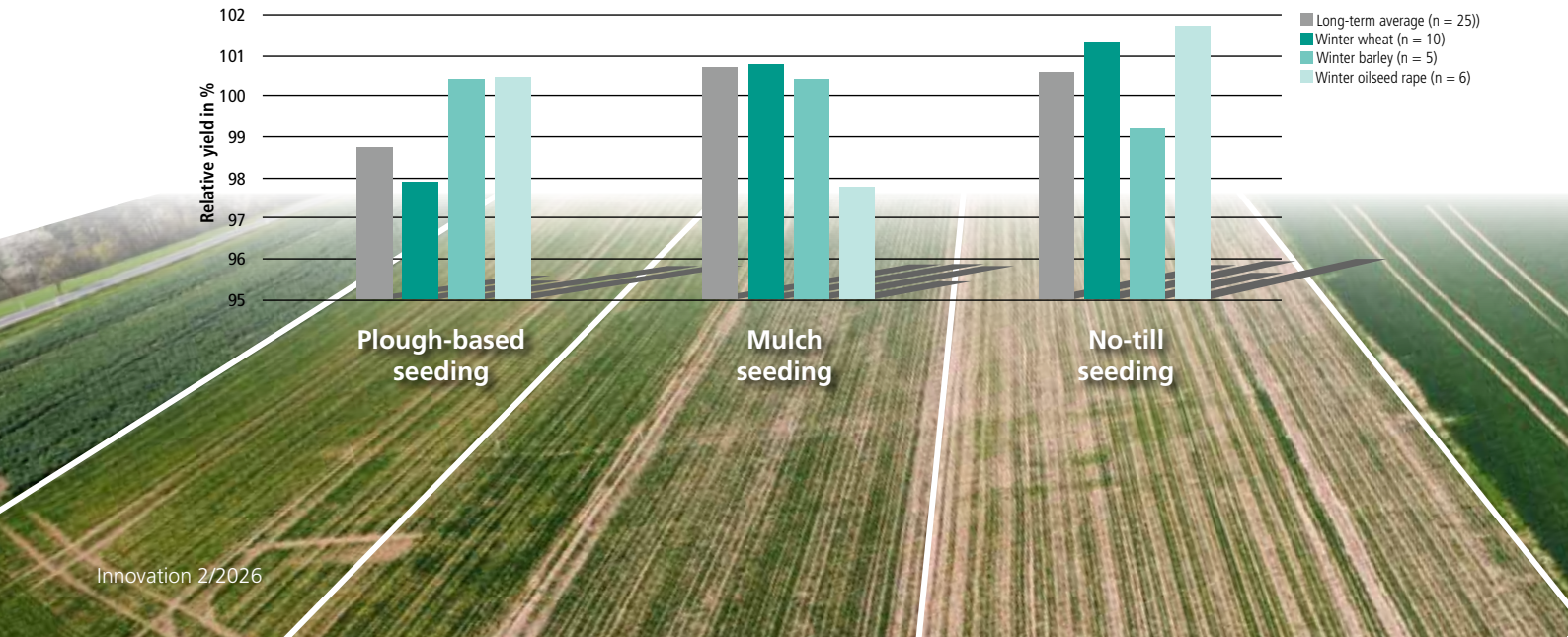
Innovation: How is the trial structured and what is its main focus?

Kirchner/Gödecke: It is deliberately designed as a practical strip trial. The three tillage systems – plough-based seeding, mulch seeding and no-till seeding – are each being

»There is no specific variety type for no-till seeding or Plough-based seeding. We focus on varieties with stable yield performance that are suitable across different tillage systems and can help mitigate the effects of seasonal variability.«

Manfred Kirchner and Ruben Gödecke

FIG. 1: YIELD DIFFERENCES AMONG THREE TILLAGE SYSTEMS IN THE MAIN CROPS WINTER WHEAT, WINTER BARLEY AND WINTER OILSEED RAPE



POLARKAP – Consistent performance across tillage systems

TAB. 1: YIELD EFFECTS OF PLOUGH-BASED SEEDING, MULCH SEEDING AND NO-TILL SEEDING SYSTEMS

		Plough-based seeding	Mulch seeding	No-till seeding
Yield	dt/ha	88	89	89
Tillage and sowing	dt/ha	19	17	13
Fertilisation	dt/ha	17	17	17
Crop protection	dt/ha	17	22	25
Margin above direct and operating costs	dt/ha	35	33	34

Margin Above Direct and Operating Costs (excluding harvesting), average of 2000-2018 (n = 28), dt/ha (Kirchner, 2026)

tested on a long-term basis. In addition, we are examining other factors such as different sowing rates, varieties, crop rotation effects, fertilisation strategies, and herbicide and fungicide treatments. The crop rotation is market-oriented and dominated by winter crops – this is the only way to generate and assess a relevant level of weed pressure. The aim is to understand how the individual measures within the systems interact and where adjustments may be beneficial or necessary.

Innovation: What differences have been observed between the systems over the years?

Kirchner/Gödecke: As shown in Figure 1, yield differences between the individual tillage systems and the long-term average were no greater than 3% over the 25-year trial period.

The so-called year effect, particularly weather conditions, plays a major role. Depending on seasonal conditions, yields among the different treatments can vary by more than 10 per cent in a single year. However, such effects tend to balance out over the duration of the trial.

A closer look at the three most frequently grown crops within the experiment confirms this picture. In winter wheat, which was included in the trial for ten years, yield relationships were similar to those observed in the long-term average. In winter oilseed rape (six years), Mulch seeding achieved average yields approximately 3% higher than no-till seeding. In winter barley (five years), no-till seeding tended to produce sligthly lower yields than Plough-based seeding and Mulch seeding. However, none of these trends can be statistically confirmed.

The key point is that farmers should adopt a systems-based approach and manage it consistently over time. Each tillage system has its own specific advantages and limitations. Successful arable farming is not determined by switching between systems from one year to the next, but by adapting management practices appropriately within the chosen system. This may include adjustments to factors such as sowing date, seed rate or sowing depth, for example in response to a wet autumn.

> **Tillage is not a stand-alone measure, but part of an integrated farming system.«**
>
> **Manfred Kirchner and Ruben Gödecke**

The same principle applies to variety selection. There is no specific variety type for no-till seeding or Plough-based seeding. Instead, we focus on varieties with stable yield performance across a range of management systems and growing conditions, helping to reduce the impact of year-to-year variability. The variety POLARKAP is one example. While it may not always stand out at first glance, it has demonstrated consistent and reliable performance over time across different tillage systems.

Innovation: Have any measures or combinations proven particularly effective?

Kirchner/Gödecke: One interesting finding relates to no-till seeding. Contrary to scientific assumptions, a thicker layer of straw did not negatively affect the effect of herbicide. On the contrary: plant counts showed that black-grass populations were, in some cases, lower under no-till seeding. We assume that, with no-till seeding, the seed bank is more concentrated in the topsoil and can be targeted more effectively. However, this requires a herbicide strategy suited to the system. A key finding of the trial is that measures are only successful if they are suited to the tillage system and are implemented consistently over the long term.

Innovation: What conclusions can be drawn after 30 years, and what lessons can farmers take away from the results?

Kirchner/Gödecke: With regard to yield effects, Table 1 shows that differences between the systems were generally small. To facilitate comparison, the various cost components were converted into dt/ha equivalents.

The trial indicates that successful arable farming is influenced less by the choice of a particular tillage system and more by how consistently that system is implemented. Plough-based cultivation, Mulch seeding and no-till seeding can all form part of successful crop production when the characteristics of the system are understood, management measures are applied appropriately, and key management factors are adjusted accordingly.

One of the major strengths of this trial is the long-term continuity and comparability of the results generated over three decades. Under changing agronomic conditions and emerging challenges, these long-term observations provide valuable insights into the performance of different tillage systems.

A key takeaway is that tillage should not be viewed as an isolated measure, but as one component of a broader farming system. Aligning management decisions with the requirements of the chosen system and applying them consistently over time can support sustainable arable farming, regardless of the tillage approach used.

Interview conducted by Paul Steinberg and Friederike Ruoff.