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Precision goes boundary spreading

How accurate are the various boundary spreading systems in applying the correct rate to the field margin? To find out, the Austrian Innovation Farm put four different systems and techniques from Amazone through their paces.

Photo: Tastowe

50 Jahre top agrar

In the top-agrar jubilee year we take a look into the future.

Border spreading systems ensure the fertiliser is not thrown past the boundary and increase yields whilst striking a balance between ecology and productivity. Hence, they are a good investment into the future.

△ A multi-plate unit or so-called Limiter consists of multiple deflector plates that alter the trajectory of the granules preventing fertiliser loss across the boundary.

Fertiliser that is thrown past the boundary is lost for the crop and leads to reduced yields in the headland areas. The smaller a field and the larger the bout widths, the higher is the percentage of headland area. Therefore, growers seek to apply the correct rate as perfectly as possible all the way up to the boundary. In addition to that, environmental legislation calls for accurate spreading that makes sure no fertiliser is thrown onto roads or into watercourses. It is this combination of environmental and economical requirements that drives the development of ever new boundary spreading techniques. Yet, which system suits which farming operation? This question was explored by Innovation Farm in Austria which compared four systems from Amazone.

LARGE SPREADING WIDTHS

A centrifugal spreader produces trapezium- or triangular-shaped patterns, which means that fewer granules are found in the headland areas than in the bout. However, for even spreads in headland areas it is necessary that the spreader must throw granules here too as it matches up with the previous pass. This means, it must throw further than the work width – typically twice as far. This is not a problem in in-field runs

SUMMARY

Boundary spreading systems ensure the full target rate is thrown to the boundary but not past it.

The multi-plate unit is useful in narrow bout widths for high yields in headland areas.

For high grain yields at large bout widths, however, a more accurate technology is needed.

Boundary spreading systems make particular sense when application rates are high. In these cases also the costlier systems will pay off.

and in fact ensures a good distribution across rows. Not so along field margins, because you don't want to throw fertiliser across the boundary. Consequently the pattern to the headland side needs to be different from the normal in-field pattern which is achieved by various boundary spreading technologies. These systems offer various spreading strategies and setting options that are provided in spreading charts:

- **Focus on yields:** This strategy applies the full rate to the boundary. This is acceptable where the adjacent field is owned as well. In this case, the granules are thrown across the field margin yet not very far.
- **Focus on environmental protection:** Only very few granules are thrown across the field margins that border on greening areas, for example.
- **Focus on watercourses:** The fertiliser is not applied all the way up to the boundary, which eliminates the risk of contaminating watercourses.

The Austrian Innovation Farm compared four boundary spreading systems and their evenness of throw. The tests were carried out at two different sites - Wieselburg and Mold.

The following Amazone systems came to the test:

- Multi-plate unit (Limiter)
- Hydro (controls disc speeds)
- AutoTS (controls spreading vanes)
- BorderTS (spreads from the border)

The designs of the various systems are described in the section titled "Boundary spreading systems" on page 95 in this article. All four systems were set up by the engineers and to the environmental parameters given in the chart - once for 18m and once for 36m.

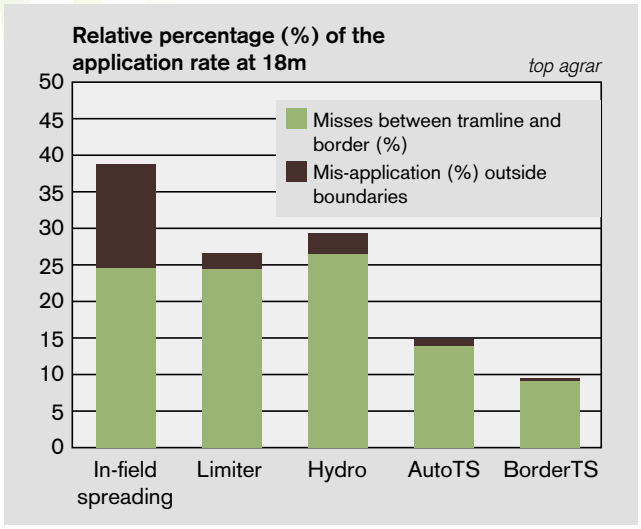
In a preliminary pass, they applied the granules in the regular in-field pattern which would then serve as reference for assessing the impact of the boundary spreading systems more accurately. The machines were set up to apply 27% N granules at 140kg/ha in each pass.

At both work widths, the regular in-field pattern produced a clearly triangular-shaped spread and led to a target rate reduction of 50% at the field margin. At the same time, about 17% of the total rate was thrown across the boundary – a high percentage that calls for a boundary spreading system, both for economical and environmental reasons.

Photo: Manufacturer

△ The testers from Innovation Farm placed countless trays in the field to collect the granules. Then the contents were emptied and weighed.

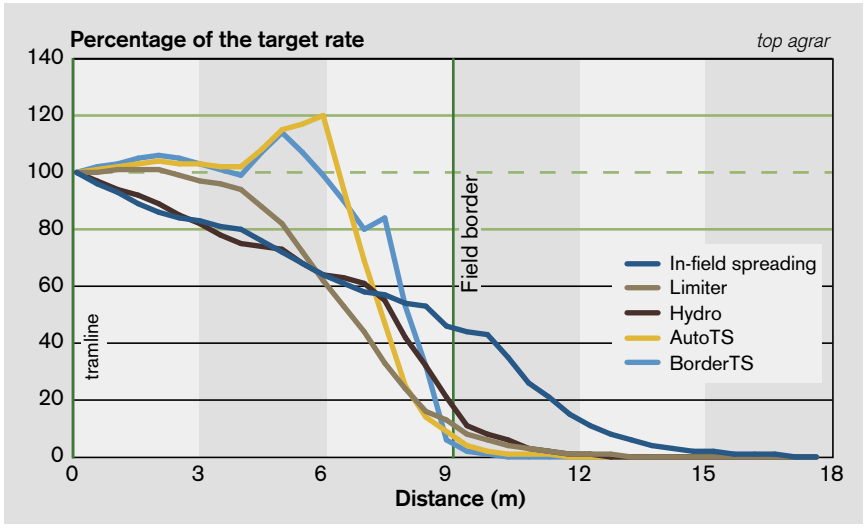
FIGURE 1: MIS-APPLICATION AT 18 METRES



Source: Innovation Farm

◁ In in-field spreading mode, Limiter and Hydro produced nearly identical percentages of misses. Mis-applications were clearly reduced by Auto TS and Border TS, which translates into higher yields.

FIGURE 2: SPREADING CURVES AT 18 METRES



Source: Innovation Farm

△ All boundary spreading units reduced the number of granules thrown across the boundary.

18M WORK WIDTH

The multi-plate unit (Limiter) and the Hydro system produce similar patterns at 18m (figure 2). The two application lines in the graph drop steadily the closer the granules are spread to the boundary. Both systems reduced the spreading width by about 6 metres compared with the regular in-field spreading width. As a result, the per-

centage of granules thrown across the field margin was only about 2.5% on both the Limiter and the Hydro.

By comparison, AutoTS and BorderTS throw nearly the full rate up to two metres to the boundary and nearly no granules past it. Accordingly, the percentage of fertiliser found outside the field was less than 1%. The difference between the individual patterns is greatest at 6 metres from the tramline and 3 metres from the boundary. Here, AutoTS and BorderTS applied the full target rate whereas the multi-plate unit (Limiter) and Hydro applied only 60%. Especially on the multi-plate unit, this is attributed to the fact that the chart reflects a significant reduction of the rate by as much as 37%.

This is also clearly illustrated by the graph that shows the percentages of misapplied fertiliser. While the percentage of fertiliser thrown past the boundary was nearly zero on the multi-plate unit, the unit applied only 24% of the full rate to the boundary – not enough.

36M WORK WIDTH

The spreading curves look much different when the work width is 36m instead of 18m. Here, especially Limiter and Hydro reduce the rate continuously to the boundary. The Hydro system unit throws 50% and the multi-plate unit (Limiter) only 25% of the target rate of the target rate 3m to the boundary. At a 9m distance from the tramline, both systems applied less than 80% of the full rate.

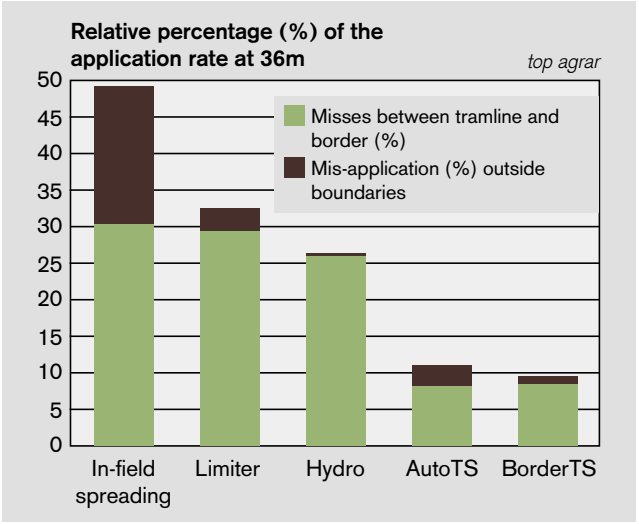
The AutoTS and BorderTS spreading curves show high spread rates in relatively even patterns all the way up to the boundary where the rate drops steeply, with AutoTS reducing the rate to less than 80% at 15m from the tramline and BorderTS at 16m. This suggests high yields also along the field margins. Figure 3 visualises the misapplied rates. In the 36m test version, the multi-plate unit and Hydro applied considerably less than the target rate in the headland areas. This was different on AutoTS and BorderTS which continued to apply a very even spread. In fact, in these test versions the mis-applications even decreased at wide work widths. This means that AutoTS and BorderTS should be preferred at large working widths.

AutoTS threw noticeably more granules across the boundary though, which could probably be avoided by reducing the disc speed by 15rpm says Amazone. This shows once again that operators should use trays to check on accurate application across rows and to the boundary.

WHICH SYSTEM IS BEST FOR ME?

All boundary spreading systems reduce significantly the amount of fertiliser that is thrown across boundaries, which is good for the environment. At the same time, they apply the expensive fertiliser only within field boundaries to the benefit of the crop, which makes all of them intriguing in terms of productivity. With regard to undertreatment near the field margins, the differences are great though. The long-term viability of a system depends on the actual work width, the field size and the average field size. We did a number of sample calculations and list results in figure 5. Our calculations are based on the following parameters: KAS fertiliser (€650/t) for full coverage of N requirements (180kgN/ha); a crop of wheat yielding 7.8t/ha and a wheat price of €350/t. The size of the headland area was assumed on the basis of a square field. In reality, this figure will be larger though. The yield levels are assumption by Innovation Farm and based on existing spreading curves and long-term yield data. The figures reflecting the annual savings are based on comparing

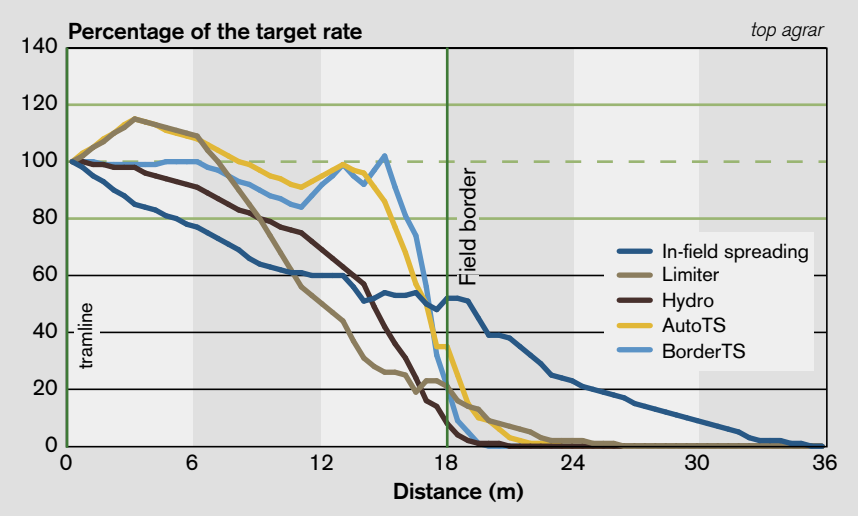
FIGURE 3: MIS-APPLICATION AT 36 METRES



Source: Innovation Farm

▷ At 36m, the volumes wasted were partly higher. For this width, more precise boundary spreading systems would be more economical.

FIGURE 4: SPREADING CURVES AT 36 METRES



Source: Innovation Farm

△ Auto TS and Border TS are able to apply the full target rate nearly to the field margin - also at large work widths.

the results obtained from the boundary spreading pattern with the in-field pattern. These annual savings incorporate input savings and increased wheat yields if applicable.

The smaller the field the more profitable is expensive boundary spreading system, whereas savings are smaller where work widths are large. At the same time, a boundary spreading system pays off also for small farms and wheat fields of about 200ha and more in size. However, if N is not applied exclusively by the spreader but also by the slurry tanker, the spreader will have to cover a much larger area before the boundary spreading system pays off, because in this case it will have a smaller impact on the actual yields.

FIGURE 5: ADVANTAGES PER SYSTEM

		Saving potential per ha and year		
	Av. field size	2 ha	4 ha	12 ha
18m work width	Limiter	€7.85	€5.56	€3.18
	Hydro	€2.06	€1.46	€0.83
	Auto TS	€24.37	€17.25	€9.86
	Border TS	€30.40	€21.52	€12.29
36m work width	Limiter	€52.28	€36.96	€21.35
	Hydro	€56.04	€39.61	€22.89
	Auto TS	€117.02	€82.71	€47.79
	Border TS	€121.22	€85.68	€49.50

top agrar; source: Innovation Farm

◁ A wider work width or smaller field size increases the productivity of a boundary spreading system.

BOUNDARY SPREADING SYSTEMS

How the various systems work

MULTI-PLATE UNIT (LIMITER)

Operated hydraulically or electrically by a linear motor, metal deflector plates alter the trajectory of the granules and reduce the rate thrown to the boundary by 37% when operated in environmental mode. The costs for such a system are about €1,420. We tested the Limiter on a ZA-V.

HYDRO

On this system, the spreading discs are driven hydraulically. The hydraulic system allows operators to choose a different speed for each disc. For spreading to the boundary, the spreader reduces the speed of the disc nearest to the field margin while maintaining the speed of the in-field disc. The discs are controlled via the Isobus. In environmental mode, the rate is reduced by 25%. The system price is approx. €5,500. We tested the hydraulic drive on a ZA-V.

AUTO TS

This system reduces the throw with the help of short vanes that are integrated in the spreading discs and operated by an actuator. In addition, the system alters the position of the funnel and hence the impact point of the granules on the disc. Last, AutoTS also reduces the disc speed. Amazone says in environmental mode the unit reduces the rate by 23%. The price premium over a standard specification spreader is €5,150. The unit was tested on a ZA-TS.

BORDER TS

Unlike the other three systems which throw the granules from the first tramline to the boundary, BorderTS throws the granules from the boundary to the field. As this requires an extra tramline along the boundary, this system is especially designed for grasslands or initial fertiliser applications in cereals. To avoid throwing granules across the boundary, BorderTS combines AutoTS with a partition in the middle of the unit. When travelling the perimeter of the field, the operator sets the target rate to 50%. When entering the first tramline, the rate is also set to 50% in order to total to 100%. The price premium for the combination of AutoTS and BorderTS is €6,800 compared to the price for a standard-spec spreader. This system was tested on the same ZA-TS as the AutoTS.

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Photo: Tastowe

△ The Limiter consists of multiple deflector plates that alter the trajectory of the granules.

Photo: Höner

△ The boundary spreading control on the ZA-TS directs the granules to the short vane.