

Spot-on treatment at the touch of a button

Direct injection increases flexibility and enhances environmental protection. We talked to farmers, consultants and developers about the benefits of the new DirectInject technology from Amazone.

The system allows me to apply a highly effective yet expensive product against early and late blight only where it is needed and spray the primary liquid in the remaining stand”, specifies German potato grower Christoph Sandbrink one advantage of the new development that injects chemical products directly into the spray circuit. Christoph is one of several farmers who have tested DirectInject prototype systems before these enter production.

In spring 2022, Amazone is going to launch an integral system that injects chemical products directly into the

KEEPING IT BRIEF

Applying all plant protection products mixed together on the entire field is not always necessary.

Direct injection systems meter and apply specific products as and where needed. Such systems have been ‘island solutions’ up to now.

Response time and cleaning issues are challenges for implementing a direct injection system.

DirectInject meters an additional product into a primary liquid and applies it in specific patches and at variable rates. This can be done manually or with the help of application maps.

By priming a second line, the ‘enriched’ spray solution arrives at the nozzle much faster and makes the system significantly more responsive.

spray circuit of UX sprayers. The development was awarded a silver medal by the DLG Innovations Commission. Keen to learn how DirectInject operates and how the farmers fared who tested it, we invited these and two experts for a talk in late November 2021. These were our guests:

- Dirk Westrup from the Westrup-Koch GbR farming cooperation in Bissendorf near Osnabrück. Dirk tested the first few functional samples as early as in 2019.
- Christoph Sandbrink runs a farm with a focus on energy and potatoes. Based in Bersenbrück in Lower Saxony, Christoph tested a pre-production model in the 2021 season.
- Christian Hinz is the managing director of a 2000ha estate in Klein Bünzow near Anklam in north-eastern Germany. He joined in the talk via video conferencing.
- Harald Kramer is a Plant Protection specialist at the Chamber of Agriculture of North Rhine-Westphalia.
- Developers and product specialists from Amazone.

THE IDEA IS NOT NEW

The idea of direct injection is not a new one: high-precision pumps meter the product into the spray circuit shortly before the solution is applied through the nozzles. This means that in top-level specification, the main tank is merely filled with clean water and the chemicals are injected and applied only where needed and at variable rates. This is at least the theory.

Yet, as the technology is very complex, the number of additional products that can be applied alongside the

▷ DirectInject sprays chemicals at variable rates.

primary liquid is limited to one or two. Although various solutions have been launched during the past few years, they have remained niche products, because the technical challenges are great: the pump must be able to meter the product into the circuit at extremely accurate rates and regardless of the current pressure in the spray line. The pump must meet a wide range of requirements relating to the average application rate per hectare, the working width and the forward speed.

There is yet another problem which applies specifically to patch treatment. After all, it takes quite some time before the agent has reached in the necessary concentration at the nozzles; this depends on where exactly in the spray line the product is injected. This leads to the familiar V pattern and under-application at the start of a bout; under-application is critical as it translates into resistance issues.

In principle, it would seem very practical if the metering pumps sucked the chemical directly from the container – but in reality this is not so, because in large fields, the operator would often have to immerse the suction lance into the next container. In addition, prod-





Photo: Manufacturer photo

ucts that tend to settle or segregate would need constant stirring during the application, which is difficult in containers. Also, using granules would be very awkward and cumbersome, if possible at all. Another issue is the question of how to clean the empty containers before they are disposed of.

There are retrofit solutions on the market, e.g. the Sidekick Pro from Raven which stores each product in a separate container and uses a metering pump to feed the product into the circuit. This retrofit system comes with its own Isobus system that controls both operation and cleaning and therefore increases operator strain.

INTEGRATED IN THE SPRAYER

The novelty about Amazone DirectInject is the fact that it is integrated in a standard specification sprayer. The injection is triggered from the regular terminal, which is nice and straightforward.

The additional product is stored in a 50-litre product tank which mounts on the right side of the sprayer. Its electric agitator reaches nearly to the bottom and offers on/off and three speed setting options.

The SideKick electric high-pressure piston pump is sourced from Raven. This can feed the product into a spray line at pressures of up to 10 bar and at rates between 30ml/min and 1,180ml/min. At the start of work, the pump is primed with the product with the touch of a button and the valve is turned to circulation. After spraying, the product can either be pumped through the same valve from the tank back into the container or drained through a hose in the bottom of the tank.

The tank has no level gauge. According to the developers' experience, the pump operates with such accuracy that operators merely have to enter the volume to the terminal after the tank is filled. Should they forget this, the display goes into negative and indicate -10 litres, for example, so the information on the quantity applied is not lost. Like other systems, the pump meters the product into a central cascade mixer. From here, the liquid enters a circuit system that is very different on a DirectInject machine.

The graph on the following page shows that Amazone uses two lines, one (blue) feeding the primary liquid and one (red) feeding the primary liq-

uid plus the additional product that is injected by DirectInject. The two lines are routed separately to the boom with pressure circulation line and individual nozzle control. Each line has multiple check valves through which the product is fed and which are arranged in parallel with the valves on the other line (e.g. ten valves on a 30m boom).

At start, the driver selects direct injection and then enters the desired ap-

WHY THE TOPIC IS IMPORTANT TO ME

Talking with arable farmers, we learned that these were very knowledgeable about the products they use; the direct injection helps them apply chemicals even more selectively and reduce chemical inputs. An interesting approach, I think.



Guido Höner, top agrar
Translated into English by trans-agrar

plication rate of the product in ml/ha. After that, the additional product is injected into the red line. Beforehand, the exact hose capacity was entered to the terminal.

The process continues until the ‘enriched’ primary liquid is present at all check valves. This solution reduces V patterns significantly. Amazone says the response time, which is the time that passes until the enriched primary liquid is applied through all nozzles, is the equivalent of travelling 30 metres.

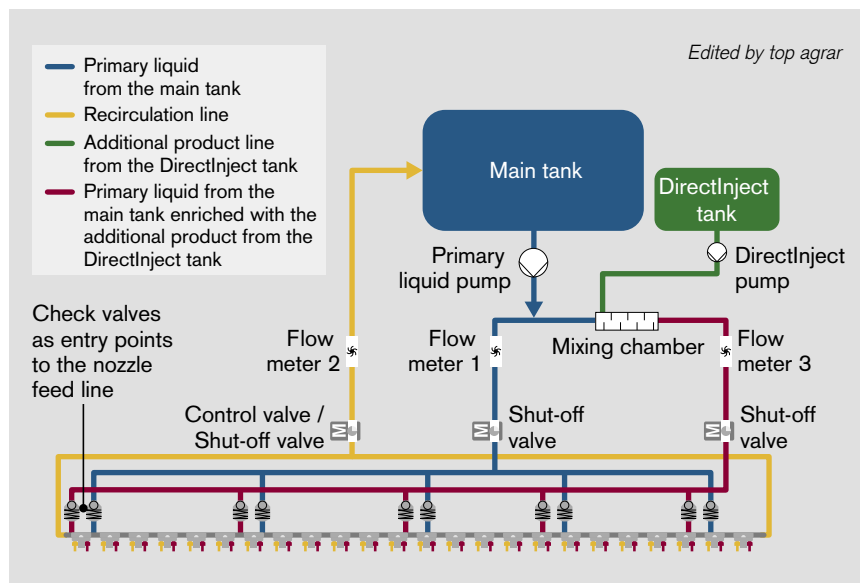
When the electronics switch to the red line, the return line to the main tank is shut automatically. It opens again with some delay after DirectInject is deselected. This automated process prevents the product from mixing with the primary liquid in the tank.

FLEXIBILITY

Direct injection can be selected in various ways – from the touchscreen, the Aux-N joystick or automatically when selecting an Isobus function (e.g. variable rate).

- Once enabled, the system meters a product continuously into the primary liquid as the sprayer is travelling down the tramline. This is very useful, if, for example, the primary liquid and a specific insecticide are not very compatible or if an additional product is going to be applied in the next field (the red line is permanently enabled).
- The additional product is selected for spraying infested patches only or along edges; alternatively, one product is shut off when spraying regulated area, such as along ditches.
- The system is controlled by the variable rate Isobus function based on an

HOW THE SYSTEM WORKS



△ The system enriches the liquid in the red line all the way up to the check valves.

application map. For the product to arrive at the nozzles and be applied where needed without delay, Amazone plans to use the response time as another software parameter when working with application maps. The application maps can be created using satellite data or drone images, etc.

- Controlled by a sensor, the system allows operators to apply a growth inhibitor with spot-on precision by adding it to a fungicide solution, for example.

CLEANING IN VARIOUS STEPS

After the additional product is filled into the DirectInject tank, the operator rinses the containers in the regular induction hopper that mounts on the left

side of the machine. The water is drained from this hopper into the primary liquid tank – a solution that actually contradicts the idea of direct injection and the theory of the main tank containing clean water only.

The metering pump can be cleaned separately from the main tank during a break. When the tank has been emptied, it is possible to use the primary liquid for an initial rinse of the direct injection system through a branch line to the agitator pump. This way of ‘diverting’ the cleaning water prevents the direct injection system from applying a higher rate at the beginning.

During the final cleaning pass with clean water, the cleaning programme of the sprayer also cleans all components of the direct injection system.

The extra tank has a powerful cleaning nozzle for this purpose. This integral solution offers advantages over many retrofitted solutions.

Amazone offers the DirectInject only for the UX 01 series sprayers which must have the Comfort Package plus and the ‘DUS Pro’ pressure circulation system.

In this specification, the list price for DirectInject is about €15,000 (excl. VAT). Multiple such systems on one sprayer could be on the cards for the future.

Your contact to the editorial office: guido.boener@topagrar.com



△ The metering pump sucks the product from a separate 50-litre tank.



△ DirectInject is completely integrated in the circuit and the control system.

Photos: Manufacturer photo

Farmers talks about their test experiences



△ Christoph Sandbrink,
Bersenbrück



Photos: Höner
△ Dirk Westrup,
Westrup-Koch GbR, Bissendorf



Photo: Private
△ Christian Hinz,
Gut Klein Bünzow

- Arable farm
- Twelve staff members (two farm managers, six staff work at the parent farm)
- 170ha of potatoes, 250ha of maize, 95ha of cereals
- Several digesters

"We had the opportunity to test a prototype in the 2021 season – albeit after the weed treatment. We operated the system mainly in potatoes.

I found it easy to use, though admittedly I'm tech-savvy. The flexibility of the system helps us plan serial treatments of multiple fields. Our field sizes range from under 3ha to around 20ha. The most distant fields are 35km away. Without DirectInject we would have planned a separate trip to a field that didn't get the same treatment as the other fields.

The feature allows me to inject an additional product at the touch of a button, which is very useful for me. We used it for applying a very effective fungicide to infested patches and to seed potatoes. The product also kills spores and is very expensive. Then we applied an insecticide in patches that were infested with the Colorado potato beetle.

Savings in expensive inputs or extra kilometres would probably justify the additional costs for us. Perhaps it would be useful, if a future system could handle two additional products and if I could select one or the other, because at present we take separate trips for spraying different products along ditches and in the field.

On the current DirectInject, I would find it useful if the additional product could also be metered into only one of the spray booms or if it was possible to not feed it to the tips. The present system injects the additional product across the full working width without exception.

- Six family members and business partners, five staff, four apprentices
- 609ha of arable land, 134ha of grassland, 4.9ha average field size
- 585 dairy cows plus followers
- Digester

We have been able to trial various functional samples from 2019 onwards. The first product I applied was the trace element manganese which I sprayed for testing the accuracy of the system. Later on, we tested DirectInject intensively.

When controlling weeds in maize, we applied an additional foliar herbicide only where needed. Another example is this: we always sow grass as a catch crop before maize. The seeds produce volunteers on headlands or edges. Thanks to DirectInject, we were able to apply a grass product in these areas.

I like the idea of applying one product spot-on and at the push of a button. In a fungicide application in the flag leaf stage (EC 37), I was able to eliminate individual thistle patches with Ariane C, for example.

I would find it helpful, if direct injection could feed the additional product to one boom only. Although it wouldn't necessarily have to restrict the supply to specific sections, it could allow me to shut off one boom when I see an infested patch coming up on the right side of the tramline, for example.

I like the flexibility and input-saving potential of the system. It actually helps to split the system technically, which can help reduce inputs in general, I think. I believe that such a system is appreciated on specialised arable farms.

- Around 2000ha, 9 to 45 index scores, average 70ha plot size
- Including 400ha of sugar beet, 100ha of maize, 200ha of legumes, 300ha of rape, 200ha of winter barley
- Many striptill and no-till fields
- Ten staff members, three apprentices

In the past, we gathered some experience with a Danfoil sprayer that had triple direct injection but we no longer use it. We tested DirectInject in the 2021 season. It appeals to us to apply certain products spot-on for localised treatment and give the remainder of the field the general application. For example, we had an insecticide in the primary liquid and added a growth regulator in rape. We planned the rate of the growth inhibitor in advance on the PC, based on satellite data. Yet the software still delayed the switch to another product for too long. In the future, however, Amazone says, the software will take the lead time into account and respond more precisely.

DirectInject also makes it possible to treat weed patches, which enables us to eliminate one pass.

I like the fact that the products in the tank are constantly stirred. Sucking a product directly from its container into the circuit bears the risk that it may settle in the lines.

A perfect yet very expensive solution would be to have six injectors and a clean water tank. This way, we would be able to combine various products that don't get along when mixed together.

What I like about DirectInject is that it is well integrated into the sprayer - including the cleaning procedure. Also, the fact that it links up to online sensors is very intriguing. These would have to look far ahead though.