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Arable Update

Maize: Issue 92

Mechanical weeding in maize

Background

Mechanical weeding has improved almost immeasurably in the last decades, and turn-key solutions are now available from many suppliers, including many of the world's largest agricultural machinery companies. Europe is returning to mechanical weeding due to herbicide resistance. Maize is one of the easiest crops to mechanically weed and levels of weed control comparable to herbicides can be achieved.

Most mechanical weeders work best in hot, dry, windy conditions which desiccate the weeds. They are less effective in cool wet conditions. This contrasts with herbicide application where hot, dry and windy conditions can prevent application. Mechanical and chemical weeding therefore have contrasting and therefore complementary application windows. Where both options are available this can considerably increase the overall weeding window.

Most mechanical weeders need cultivated soil to work and while they can cope with some residue, as a rule, they are unable to cope with large amounts.

In-crop weeders

In crop weeders are divided into two main types: Contiguous and incontiguous.

Contiguous weeders are also called 'broad acre' weeders. They are contiguous because they weed the whole field surface. They include the spring tine harrow, the spoon weeder and the Einböck Aerostar-Rotation.

Successful contiguous weeding requires the crop to withstand the weeding action and the weeds to be susceptible. As a large seeded, deeper sown, strong , quick growing crop, maize is well able to withstand the weeding action, while most weeds in annual crops are small and susceptible. Contiguous weeders can be a drop-in alternative for boom applied herbicides, which are also applied contiguously. No other changes to the farm system are required.

Incontiguous weeders are typified by what were called interrow-hoes. However, as these machines no longer just weed the interrow, they are increasingly called 'row-hoes'. Having different weeding tools in the interrow and intrarow gives considerable flexibility. Highly aggressive tools can be used in the interrow achieving very high levels of weed control, even with bigger weeds, while intrarow tools can be matched to the weeds' and the crop's growth stage, achieving weed control with minimal crop harm.

The key requirement of incontiguous weeders is that the hoe and the drill need to exactly match, i.e., the number and spacing of the drill coulters needs to exactly match the gaps in the hoe. In practice this means having dedicated pairs of drills and row-hoes set up the same. Therefore, unlike contiguous weeders, row-hoes are not a drop in replacement for herbicides.

Key points

- Maize is one of the easiest crops to weed mechanically and results can be exceptional.
- There are two main forms of mechanical weeders; contiguous and incontiguous.
- Contiguous weeders for maize include the spring tine harrow, spoon weeder and the Einböck Aerostar-Rotation. They are a straight drop-in replacement for herbicide application.
- The most common incontiguous weeder is a row-hoe. Modern row-hoes weed both the interrow and intrarow. They are more aggressive than contiguous weeders and require the drill and row-hoe to be perfectly matched.
- As the ideal weather windows for mechanical weeding and herbicide application differ, the two approaches are highly complementary.

Computer guidance systems have solved what used to be one of the biggest challenges for row-hoes i.e. accurate steering. Computer guidance systems are mostly camera based, although a few use RTK-GPS systems. Guidance systems are now a mature technology with many providers; many row-hoes and guidance systems are sold as a single package. There are pros and cons for each, and large operators often have both. Get expert advice, FAR can help.

It is not an either / or option between contiguous and incontiguous weeders. Typically, organic growers who completely rely on mechanical weeding will have both, possibly even more than one type of weeder from each class. This is akin to having different types of herbicide, e.g., pre- and post-emergence, selective, broad spectrum etc. Clearly there are costs in buying multiple weeders, but, where there are significant weed challenges, and/or larger areas of crop, the extra flexibility of multiple weeders can pay off.

Spring tine harrows

The dominant incontiguous weeder is the spring tine harrow / weeder and they are probably the best entry point into mechanical weeding in arable crops. These weeders use flexible steel rods, between 5 - 10 mm in diameter that 'comb' through the soil surface breaking and burying weeds (Figure 1).

Figure 1. Spring tine weeder with pneumatic seeder.

Spoon weeder

Spoon weeders (called rotary hoes in North America) consist of multiple spoked wheels with the ends of the spokes flattened into a spoon shape and angled, so that they enter the soil nearly vertically, and exit more horizontally, thus picking up a small amount of soil and flinging it into the air (Figure 2). They are able to cope with higher levels of residue and harder packed soil, and are used to break soil caps to release emerging crops.

Figure 2. Left, high residue original North American spoon weeder (rotary hoe); right, new European design (Einböck GmbH).

Einböck Aerostar-Rotation

The Aerostar-Rotation is a proprietary design unique to Einböck. It consists of multiple spoked wheels, but, unlike the spoon weeder, the spokes are simple round steel rods, and the wheels are angled to the direction of travel, forcing the spokes to scuff through the soil. It's weeding action is therefore more like the spring tine harrow than a spoon weeder. However, the Aerostar-Rotation is more aggressive than a spring tine harrow meaning it can penetrate harder soils, such as under no-till, and cope with higher levels of residue. As such, it also has more potential to damage crop plants if not used with care.

Figure 3. Einböck Aerostar-Rotation. Photos Einböck GmbH.

Row-hoes

Modern row-hoes are very different from their interrow ancestors, with many consisting of multiple independent parallelogram units (Figure 2). These units keep the toolframe parallel to the ground and at the correct height. The toolframe in turn carries the weeding tools.

Figure 2. Row-hoe consisting of a number of independent parallelogram units mounted on a toolbar. Right photo Garford Farm Machinery Ltd.

Acknowledgements and further information

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