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Trends in cultivations

Presented here are important technical trends in cultivation machinery as reflected in the machinery and equipment program at Agritechnica 2001. The preview cannot take the place of a visit to the event and instead only offers preliminary information and does not claim to be comprehensive.

Stubble cultivations start with straw distribution from the combine. Optimum lateral spread via baffles and fan is a requirement for the success of following work.

The aim of stubble cultivations depends on the tillage system for the next crop. If ploughing, then the straw should be evenly incorporated and lost grain and weeds dealt with. In minimum cultivations the stubble work has the extra task of loosening, evening and seedbed preparation. For correct drilling and the right seedling development conditions, the large amount of straw must be evenly incorporated with around 2 cm of working depth required for every tonne of straw per ha. However, every extra centimetre of cultivation depth means moving 150 t soil/ha with the related demands on draught and fuel. With respect to the many aspects of cultivation there remains the question if the operation can be carried out by a single implement.

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Mounted rotary harrows are seldom used as they have very little effect on hard ground and are not suitable for deeper cultivations. Heavy disc harrows with up to 770 mm diameter per 100 kg disc have dust-protected double roller bearings and are available with 8 m working width, increasingly with hydraulic cutting angle adjustment for matching the prevailing conditions. Their heaviness means they have bite even in dry conditions, but they have a high draught requirement in hilly land. They don't further distribute straw, so must be applied in the combining direction. Discs are not universal stubble cultivators, being unable to give crumb-depth loosening for minimum cultivation systems or deal with well-rooted weeds effectively. Many firms offer them as an alternative to grubbers but they are widely used only on large farms where two stubble cultivation implements are kept and where discs carry out the first, shallow cultivation.

Four-tine shallow grubbers, usually with sprung tine carriers and duck-foot shares, completely cut away the soil in the first shallow pass and crumble the earth through the vibrating action of the tines.

Most widely used are two-row winged share grubbers with concave discs for surface levelling. Its compactness means that large hydraulically-foldable working widths can be used without having to be mounted.

However, to get the winged shares working properly, especially in hard ground, the first shallow pass is usually done at 10 to 12 cm depth instead of 6 to 8 cm. A further disadvantage is the resultant swath-form incorporation through the winged shares which, especially with minimum cultivations, can lead to crop emergence and seedling development problems.

As subsequent implement there is a complete range of packer rollers which can also be used as part of a drill combination. Widely used are single and double sets of peg roller crumblers.

So-called grubber combinations are becoming established. In that these feature several implement groups one after the other they are usually semi-mounted. Front and rear rollers or rubber tyres control working depth. The grubber tines (rigid or sprung) are fixed at a spacing of 20 cm with at least four

rows. Then comes a double disc harrow mounted individually in parallelogram over a reconsolidation roller. Packer rollers (peg, tooth, prism, flexicoil or tapered ring) are responsible for reconsolidation. In the first stubble cultivation, the duck foot or stubble shares undercut the soil completely. For incorporating straw at half crumb depth double heart and semi-digger shares are available with crumb depth loosening carried out by chisel tines. The share substitution systems offered by some companies are required to allow universal application of these grubber combinations. Only thus is rapid adjustment to conditions possible. GPS-controlled depth adjustment increases the application range in direction of site-specific cultivations.

Stubble implements which are pto driven are the exception because of their low area capacity and high wear. Where, however, three functions in minimum cultivations must be accomplished in a single pass (stubble cultivations, secondary cultivations and drilling), then this approach is more widely applied than pulled combinations and can be applied cost-efficiently.

Basic cultivations

Ploughing

The plough is used less and less before and after leaf crops. In many regions it is widely used between grain crops for dealing with volunteers and on phyto-sanitary grounds and where it is applied avoidance of soil damage is sought.

Broad furrow bodies, stepped shares and knife coulters on the last share allow wide tyres to be used in the furrow for soil damage avoidance. Manufacturers increasingly offer their ploughs for on-land work and this should be taken advantage of when replacing ploughs. Missing is, however, a reliable steering aid. A hydraulic adjustment enables rapid change to in-furrow work when surface conditions are unsuitable for on-land draught. Possible also is loosening of soil about 10 cm under the tractor tyre sole via underground share. Biological stabilisation of the soil structure through a catch crop should be considered.



New rapid-replacement share point from Kverneland



Self-steering system on Lemken semi-mounted plough

The trend to cylindrical cultivation bodies continues because the form is not only of value in sticky soils but also allows high speeds. Hydraulic, fully automatic, stone safety systems allow fast adjustment for optimum activation force to meet the prevailing conditions.

In total, machine stability has increased with induction-hardened steel and larger ball bearing-mounted turning shafts (up to 150 mm diameter) and the wear-free bearing mounting of Vario reversible ploughs and a new hardening system with carbon all reducing downtime.

Some manufacturers offer electronic plough guidance with lateral angle, front furrow breadth optimum draught point and lead to land all able to be controlled from the tractor terminal. In future the top link need only be fitted with an electronic movement sensor for automatic control of working depth.

The plough's over-loosening effect requires a deliberate reconsolidation. Especially in small and medium fields, transport and handling of attached packers is very time-consuming. Thus there are alternative solutions now, either through swivel packers on the front hydraulics or fixed to the plough or a front packer on the drill tractor. A furrow cracker mounted on the plough or packer cuts the clods and delivers, in association with the packer, an improved reconsolidation. Separate packer rings enable easier replacement of defective rings.

Conservation cultivations

Compared with conventional ploughing, fuel and costs can be spared with no-plough cultivations. Usually, existing heavy cultivators or new cultivator combinations allowing a rapid change to narrow chisel tines are applied for crumb-deep loosening. If there is definite compaction damage at tractor wheel sole or underground, a paraplow or staggered depth cultivator may be used – usually shared between farms. Their coupling to stubble cultivation implements and deep looseners is only in limited use because an annual loosening under the tractor wheel sole is not practical and also requires enormous draught power. Important after deep loosening for biological stabilisation of the soil is establishment of a catch crop.

Drilling after the plough or without plough in minimum cultivation

No important further developments have occurred with pulled combinations except for drill combinations used for cereals, rape and leguminous grains. As well as semi-mounting there is the possibility of fitting the drill onto the combination. The implements mounted into the carrying frame range from spring tines through rotary and disc harrows to grubber tines. Through the implements and the larger throughflow these can also be suitable for minimum cultivation drilling. Further requirements are then, however, roller coulters and one or two disc coulters. The seed boom is hydraulically foldable with seed delivery pneumatic. This combination is the main one for large farms with medium soils and annual precipitation up to 600 mm.

As with ploughing and grubbing, many firms now offer rapid-substitute systems for

tines. A long overdue development on articulated shafts is now on the market: joints with box bottom greasing to simplify servicing. Integrated overload security in the power harrow drive additionally allows the use of longer articulated shafts for easier attachment to difficult pto offtakes on the tractor.

Mainly used in small field structures with strongly variable soils and high rainfall are 3 m working width drill combinations of power harrow, packer rollers and built-on drill. Seasonal capacity is up to 300 ha. After one or two passes incorporating harvest remains, the roller coulters with ~30 kp offer consistent performance. Their universal application after both plough and minimum tillage and power requirement which can be handled by tractors from 75 kW have led to further expansion of these combinations. Hydraulic adjustment of coulters and tine harrow pressure and seeding rate can all be controlled to meet changing conditions on variable soils. Rill erosion in tramlines can be minimised with the aid of interval tramline switching.

Working widths up to 6 m can be folded into 3 m with appropriate front-mounted hopper. These types of machines allow a seasonal performance of up to 1000 ha.

An alternative is the use of a carrying frame with grubbers or pulled drill combination for the combination of power harrows with suitable drilling machinery. Such machines are usually applied on large farms with very variable soils or with a high proportion of minimum tillage.

New Turbo-Drill Combi-Speed pulled minimum cultivation drill from Rabe

