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Trends in Tillage

In this contribution, important trends in tillage are presented which will manifest themselves in the machinery and implement programme shown at the Agritechnica 2003. This preview only provides pre-information and cannot replace a trade fair visit. Completeness is not aimed for.

In addition to the securing of yields, trends in tillage are more and more determined by the reduction of production costs and the requirements of soil protection - today even to a greater extent because environmentally friendly farming is subsidized as part of modulation. Since this kind of farming leaves residues on the surface, lateral straw distribution by combines must meet growing requirements. Because stubble cultivation is often basic and secondary tillage at the same time, implement technology must fulfill increasing demands as well. Universal implements, such as the wing share cultivator, are being superseded by special implements more and more.

Stubble Cultivation

Even if some farms have straw combs, no compromises may be made with regard to straw distribution by the combine. Especially during threshing in the dew, the straw comb is useful for after-distribution because it drags the straw over 60 to 80 cm. Gentle straw removal for the straw mulch seeding of sugar beet, however, remains its main area of application.

Even if lateral straw distribution becomes increasingly problematic at working widths of more than 6 m, the high cut during mowing followed by general chopping with flail choppers rather remains an exception. This is an additional work step, which causes enormous dust development like in this summer. The application of this technique is useful if the stubble mowed in laid grain is too long.

The first stubble cultivation after the harvest is generally superficial in order to stimulate the germination of self-sown cereal and weed seeds and to initiate straw rotting. In the past, the wing share cultivator was primarily used for this purpose. Since it more or less „swathes“ the straw into the soil, it no longer fulfills the increased stubble cultivation requirements today and will be superseded by other implements in the medium run. They include the newly developed short-disc harrows, which are meanwhile offered by almost all manufacturers. Mounted implements are more manoeuvrable and cheaper. Due to higher rear wheel loads, however, they put a greater burden on the headland when lifted out than semi-mounted implements. The discs are offered with smooth and serrated edges and diameters ranging from 430 to 660 mm. They must be chosen depending on the conditions at the individual location. For precise reconsolidation, the heavy, expensive packer rollers (dented, crosskill-, trapezoidal ring-, spring stamp-, prism-, flexicoil-, tapered ring-, or tyre packer rollers) of the sowing combinations are used. Short-disc harrows are able to work very superficially and provide large area capacity at low fuel consumption (125 kW for a working width of 5 m: 5 to 6 ha/h; 5.5 l/h). These are special machines, and it is very likely that they are not a passing fashion because together with 3-/4 bar cultivators for second, deeper cultivation they are a well-designed combination for the mulch seeding work chain.

Superficial cultivators featuring several bars, duck-foot shares, and often sprung tines are also used for superficial stubble cultivation. During angular rides, they drag the straw over approximately 30 to 40 cm. The newly developed cultivator/disc harrow combinations generally have 4 bars and are equipped with a double disc harrow and a packer roller. They provide the most even straw incorporation. In combination with share-change systems, they are universal implements for superficial and deep stubble cultivation. Unfortunately, it is difficult to adapt working width and driving speed to the available tractor power.

Rotary spade harrows and heavy, semi-mounted X-or V-shaped disc harrows are

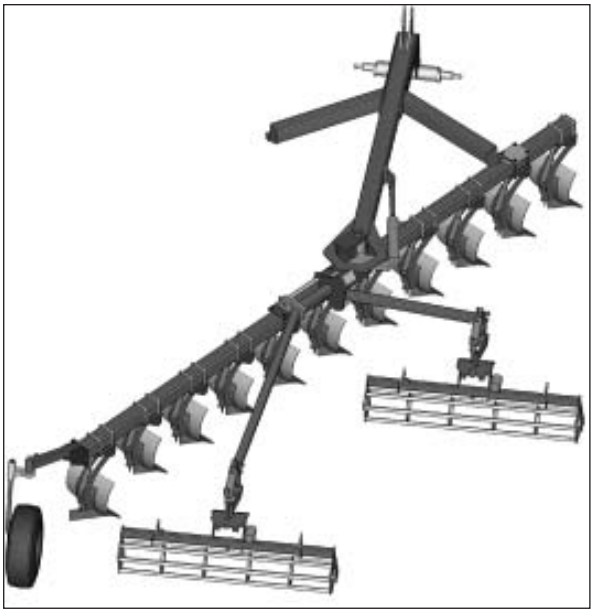

Fig. 1: The skim-plough Glimmer by Lemken should combine the advantages of conventional and conservation tillage (Photo Lemken)

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going to lose in importance for stubble cultivation.

For good rotting and trouble-free plant development of the successive crop, large straw quantities must be mixed into the soil more deeply, which means that a „dilution effect“ must be striven for (2 cm incorporation depth per 10 dt/ha of straw).

For this purpose, 3-/4 bar cultivators (share distance 20 to 23 cm) with spiral or chisel shares, levelling tools, and packer rollers are very suitable. As mounted implements with one cage roller for depth guidance, these cultivators are very inexpensive and the ideal special tool for the second, deep cultivation or plough replacement (125 kW for a working width of 3 m). They are meanwhile offered by all companies with improved levelling tools and packer rollers. During the second pass, cultivator/disc harrow combinations mix the straw in very intensively. This plays a particular role when the disease infection potential during mulch seeding must be reduced. These combinations are suitable as universal stubble cultivation tools for large farms and allow the successive crop to be cultivated using a sowing machine suitable for mulch seeding without secondary soil cultivation.

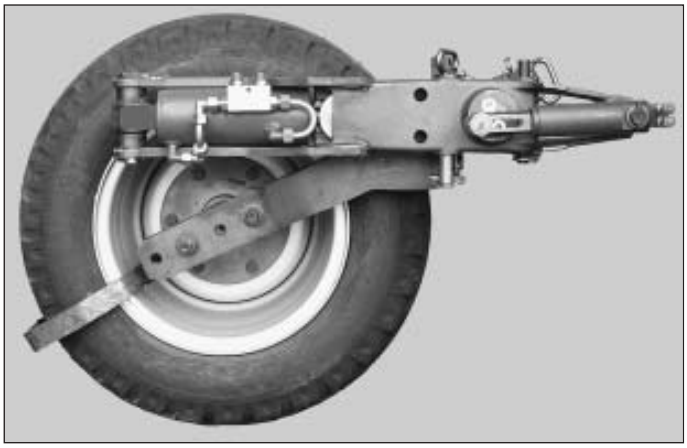

Fig. 2: Rabe offers a hydraulic working depth adjustment for it's mounted 180° return ploughs Photo Rabe

Basic Tillage

Turning Soil Cultivation with a Plough

The plough is primarily used after moist harvesting conditions in autumn and in close crop rotation. Ploughs are no longer owned by every farm. Instead, they are often used cooperatively. It is not the plough itself which accounts for the largest part of the expenses caused by ploughing, but rather the tractor and labour.

Given the insignificant share of onland ploughs, the aspect of soil protection during ploughing is still given little attention. The share of vario-ploughs is stagnating at less than 50 % because the additional expenses of € 3,000 to 4,000 (for 4-/5 furrow ploughs) are significant and generally the widest setting is used for ploughing. At less than 50 %, striped bodies have not gained more acceptance because they provide significant advantages only on very sticky soils and not so much with regard to fuel consumption and wear costs.

Electronic plough control is still being offered. Due to the high expenses, however, it has been virtually unable to establish itself.

New developments have occurred at the plough/cultivator interface. Here, attempts are being made to combine the advantages of both implements, such as fuel savings, large area capacity, and soil turning. Such implements are used in close crop rotation where the infection potential is intended to be buried in the soil without deep soil turning. Even if turning is only superficial, additional tools allow the soil to be loosened more deeply. The terms used for these implements, such as cultivator plough, minimal plough, or paracultivator, will have to be considered intensively (*fig. 1*).

Conservation Tillage

All in all, the share of conservation tillage is going to grow because modulation includes subsidies for mulch- and zero tillage, for example. This makes it easier for many farms to start using these techniques, and it helps experienced farm managers to tackle difficult constellations of crop rotation and location. The implements suitable for conservation tillage have already been discussed with regard to stubble cultivation.

Since the mechanical control of self-sown cereals and weeds is one of the main problems in mulch seeding, precise and superficial stubble cultivation with the aid of the above-described short-disc harrows, superficial cultivators, or cultivator/disc harrow combinations, for example, is required. The sowing of the main crop requires undisturbed seed-soil contact, which necessitates a thinning effect on the straw in the topsoil if large straw quantities are present. 3-/4 bar cultivators with simple runners optimally adapted to the tractor power lend themselves as a technical solution for this purpose. The pre-tension of the tines (up to 500 kp) must be chosen correctly, in particular on stony soils. Special implements for loosening, such as the paraplough or the subsoil cultivator, do not have great importance and are rather used to recultivate areas affected by harmful soil compaction.

After the completion of basic tillage, both drawn and driven mulch seed combinations are used for mulch seeding. In the drawn combinations, only details have been improved. Some implements meanwhile feature an additional chassis in order to prevent the tyre packer roller from clogging during turning under moist conditions on the headland. Some manufacturers offer semi-mounted chassis with a stubble cultivation implement (short disc harrow or cultivator) mounted to their front part, followed by a packer roller which also serves as a chassis and is equipped with a semi-mounted sowing machine. Drawn combinations are primarily used on large, rather homogeneous areas with precipitation below 500 mm/year.

PTO-driven sowing combinations are exhibiting a clear trend towards rotary harrows with gripping tines. This improves suitability for mulch seeding as a result of better mixing work and upgraded drawing behaviour into the soil. When purchasing such an implement, however, one must make sure that the manufacturer equipped these rotary harrows with stronger tine carrier shafts because enormously large torques act upon the bearings, in particular when the harrow hits stones. Tine change or the alteration of the rotational direction of the rotary harrow allow the implement to be quickly adapted to different locational conditions. A sufficient distance of the tine carrier from the tub increases the soil-straw mixture flow.

The PTO-harrows are generally combined with mounted sowing machines supported by the packer roller. More and more manufacturers are pursuing the principle of „selective heterogeneity“, according to which a prism-, trapezoidal ring-, or tapered ring segment, for example, is used to reconsolidate the soil only in the area where the seed coulter follows. This results in good field emergence combined with a high infiltration rate in the non-reconsolidated space between the packer rings. In such combinations, rolling coulters with rubber discs or two-disc coulters loaded with 30 to 80 kp should follow in order to permit trouble-free mulch seeding. Rolling coulters already account for 60 % of the coulters sold in Germany. For even deposition up to 3 m, a mechanical sowing machine is sufficient, whereas large working widths require pneumatic seed conveyance.

PTO-driven 3-m cultivation combinations are widely used in small-lotted regions and on frequently changing soils with precipitation in excess of 600 mm/year and reach seasonal capacities of 300 ha. In addition, they can be decoupled from the sowing machine and are used in the spring to prepare the seedbed for mulch-sown sugar beet, maize, and potatoes.