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Trends in forage harvesting technology

Below, important trends in forage harvesting are presented, which will also be reflected by the machine and implement programme shown at the Agritechnica 2007. This preview cannot replace a trade fair visit. It only provides pre-information and does not claim to be complete.

All links of the process chain "silage harvest" from the field to the trough or recently also the biogas plant must harmonize as well as possible in order to provide high-quality preserves of grass and maize. During this process, important parameters must be met. On the one hand, biogas production leads to an increasing variety of new crops (e.g. whole grain plant silage, green rye, Sudan grass, sunflowers), and more intensive mechanical conditioning is gaining in importance.

On the other hand, the large harvest quantities needed for a biogas plant require high efficiency, suitable logistics, and sophisticated management. Given these conditions, the entire harvest chain is offered more and more often by contractors/machinery rings, and these services are also accepted by the farmers. Thus, responsibility for the harvest process and quality lies in one hand. This also means that the service provider gets the opportunity to use his machines and implements efficiently and to exploit their capacity. In addition, he can guarantee cost-effective, high quality work.

Development tendencies in detail

Area capacity during mowing is the product of driving speed and working width. Under good conditions, driving speeds of more than 15 km/h are possible, but it is virtually impossible to increase them any further. At this speed, adaptation to bumps and uneven spots by means of good mower linkage has reached its limits. In addition, the burden on the driver is significant. An unlimited extension of working width is also not possible. The weight of front and rear-mounted mowers sets certain limits, and lateral pull on sloped fields may not be underestimated. In addition, soil contour adaptation restricts the extension of working width. The combination of several mowers in a front-rear combination (up to three units) on a tractor with a reversing system allows working widths of more than 10 m to be realized. Depending on growth, terrain, and driving speed, however, significant power requirements of 100 to 150 kW must be taken into account. Self-propelled machines are offered with working widths of up to 15 m and have an area capacity of up to 10 ha/h. In this case, however, profitable use requires an application area of more than 1 500 ha per year.

The mower type variants offered are still the "drum mower" and the "disc mower". The advantages of disc mowers are lower weight and lower specific drive power, whereas robustness and a large range of applications speak in favour of disc mowers. Short field lying times and a small number of passes are striven for not only for efficiency, but also for the work quality of the harvesting technique. The combination of a mower and a conditioner can make a significant contribution towards the achievement of this goal. Crimped hay evaporates more water. Thus, tedding can be dispensed with. The question of whether hay should be deposited in swaths or in a loose, wide layer is still being discussed. At least for large growth quantities, a swath is no longer advantageous for quick drying, and turning is recommended.

High efficiency has one disadvantage: Working width and speed make it more and more difficult for wild animals to avoid mowers. Measures which drive animals away as well as improved technical solutions (animal savers) can both save lives and reduce the danger of botulism during feeding.

Tedders and turners provide an even work pattern in the longitudinal and lateral direction at working speeds of 5 to 7 km/h. Thus, an efficient increase in output can primarily be reached by means of larger working width. Implements which are up to 15 m wide are available. They are no longer suitable

Fig. 1: Stoll presents its GXT-Triple mowing combinations with working widths of 11.6 m or 14.6 m

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Keywords

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Fig. 2: Bergmann has adjusted its trailer HTW 65 for chopped forage to the increased capacities of the forage harvesters: 65 m3 loading volume and a hydraulic Tridem travelling gear are the insignia.

for rear mounting and must be designed as drawn implements. Change from the transport to the working position is hydraulic. Nevertheless, the tedding pass often seems to be a tight bottleneck in the process chain. This problem can be addressed with the aid of conditioners, for example.

The collection technique is decisive for swathing

The collection technique is decisive for swathing because both the form and the thickness of the swath must be adapted to the demands of the following collection machines. Large working width is necessary so that the efficient collection machines can be provided with sufficient swath mass. When travelling back and forth, two-rotor swathers with lateral swath deposition can produce single swaths with sufficient mass. Large swathers with four rotors and central swath deposition can even do the same work in one pass and are convincing due to their efficiency. Technically mature chassis as well as optimized rotor suspensions and sensing wheels provide good soil contour adaptation even at high driving speeds so that efficient clearing with little forage soiling becomes possible. In addition, conversion from the working to the transport position, which is necessary for the observation of the road traffic regulations, must be comfortable and quick. Other requirements are high driving speed on the road and good roadability, in particular for cooperatively used machines.

For collection, several technical alternatives are available. Even for cooperative work, the loader wagon is still used for small field-silo distances. A loading capacity of up to 40 m^3 and a permissible gross vehicle weight of more than 20 t provide high collection performance. Nevertheless, soil pressure and tractive power requirements should be kept low by means of large tyres with low inflation pressure.

Multiple-blade cutter bars provide theoretical cutting lengths of 34 mm. Swivelling cutter bars facilitate access.

In round and square balers, cutter bars with rotary gathering units have established themselves. Different blade sets allow theoretical cutting length to be varied between 40 and 20 mm. This enables the structure of silage to be preserved better and improves the compression of shortly cut dry grass or hay in big bales. In addition, it becomes easier to dissolve the bales, and straw does not need to be comminuted again before it is used as litter.

Bale silage has established itself as a supplementary technique for small areas and as a variant for late cutting. In bale silage, the quality of stretching-in significantly influences the success of ensilage because it guarantees the exclusion of air for anaerobic fermentation. This work can be carried out either in a separate work step with a wrapper or in combination with implements for baling and stretching-in.

As compared with the divided technique, this allows one work step, one tractor, and one worker to be saved. In addition to the combination of the well-known single machines, completely new developments are available which are more compact and handier.

The biogas plant boom has led to lively demand for forage harvesters. Extended maize cultivation and the high yields provided by energy maize result in a particular demand for efficient forage harvesters. This demand is met primarily by means of more engine power (> 584 kW). Accordingly, large headers (also row-independent) for maize and grass are available. In addition, there are approaches aimed at the optimization of the assemblies and the crop flow in the forage harvester so that less energy is needed to meet the requirements. In analogy to combine development, the maintenance and repair times required for forage harvesters are being minimized, and their operator friendliness is being improved (cutting height control, yield measurement and mapping, dry mass measurement, adjustment of cutting length, adjustment of the cracker, the accelerator, and the outlet). To a growing extent, the "intelligence" of the machine is used in order to optimize work planning, to document the calculation of the harvesting work performed and to make it more objective. This means that accounting is no longer based on the number of hectares harvested, but on tonnes of harvested crops.

Given the enormous collection capacities of these machines, storage and compression in the silo are more and more becoming a bottleneck. This important aspect emphasizes the optimal harmonization of all links of the process chain, which was called for at the beginning, and illustrates the high requirements to be fulfilled by the management of high-quality silage preparation.

Fig. 3: Kemper has developed the row-independent cutting head Champion 475 for the harvest of high-yielding energy maize