

Gero Wallmann and Hans-Heinrich Harms, Brunswick

# Feeding Devices for Combine Straw Choppers

## Improving Chopping Quality and Reducing Power Requirements through a Changed Chopping Principle

*Increased demands on the chopping quality of combine-choppers have caused the power requirements of this aggregate to be one of the highest in the combine. At the Institute of Agricultural Machinery and Fluid Power in Brunswick, feeding devices with one-sided straw clamping were developed, which improve the work process of the chopper.*

The increased practice of mulching and direct seeding bring a higher requirement of the finely chopped straw. It is necessary to evenly distribute this straw across the whole working width of the combine harvester. Any remaining longer pieces of straw can cause problems during sowing and also, due to the slower rotting process, to disturbances in the growth of the following crop.

### Aims of Research

Research is being carried out as to whether the operation of the combine harvester can be improved by changing the method of feeding the straw into the chopper. To date the usual method was letting the straw fall freely from the chute of the harvester into the chopper. This is to be replaced by various rollers and belts to compact the straw and clamp it only on one side. The aim is to ei-

ther increase the quality of the chopping, with the same amount of power, or to reduce the power consumption without reducing the straw chopping quality. [1].

### Realisation

Two guiding devices, of which one works with feeding rollers and the other with feeding belts, have been developed. The existing test rig [2] was extended to include a straw walker in the right proximity to the chopper in order to simulate the actual working conditions as closely as possible.

Fig. 1 shows the various feeding devices in relation to the intake funnel, used to date.

The intake rollers work with a speed of 120 rpm. Star shaped profiles are fixed onto the rollers, which are spaced at 100 mm from each other. These are in close proximity to the flail knives.

Dipl.-Ing. Gero Wallmann is scientific assistant, and Prof. Dr.-Ing. Dr. h.c. H.H. Harms is the dean of the Institute for Agricultural Machinery and Fluid Power (ILF) at the Technical University of Braunschweig, Langer Kamp 19a, 38106 Braunschweig; e-mail: ilf@tu-bs.de.

### Keywords

Combine straw chopper, power requirements, straw chopping quality

### Literatur

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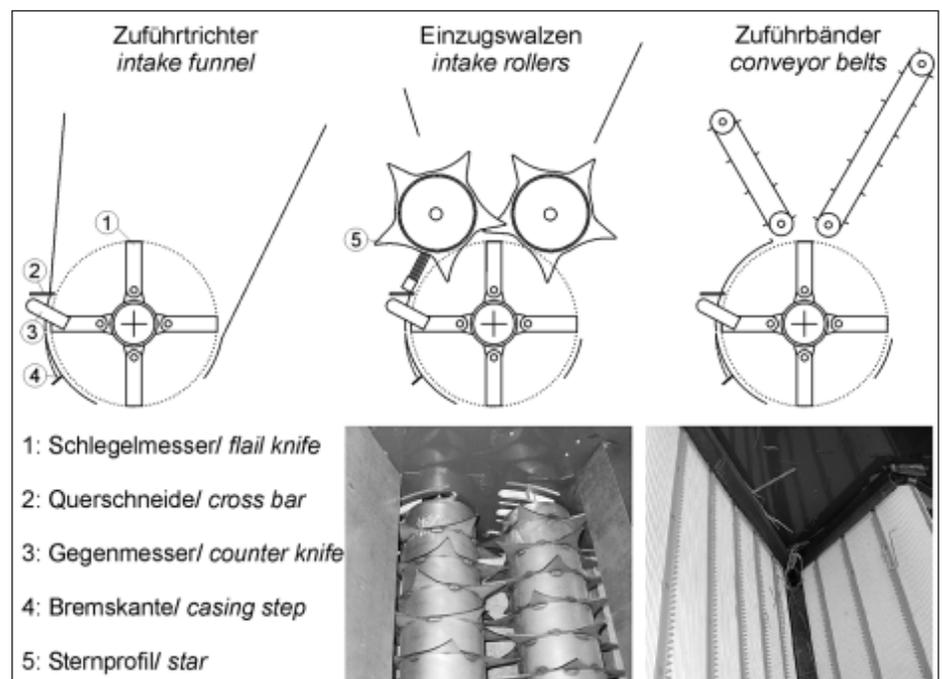


Fig. 1: Feeding devices

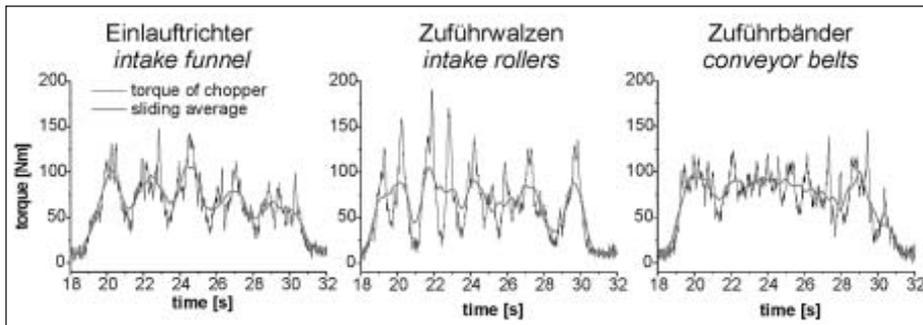


Fig. 2: Course of chopper torque for different feeding devices

The conveyor belts run at a speed of 1,1 m/s with a minimum distance of 75 mm. In order to reduce slipping between the straw and the belts, these have been furnished with cogged baffles.

The cross bar and counter knives as well as the casing step still find utilisation.

### Measuring Technology

The power consumption of the straw chopper is calculated by means of a torque measuring hub integrated in the drive combined and a speed sensor.

The rotational speed adjustment of the electrically controlled feeding devices is infinitely variable by means of a frequency converter, which also enables a torque measurement.

The straw chopping quality can be ascertained with the aid of a cascading sieve. A sample of the material is fed through slightly sloped oscillating diminishing gauged sieves. The higher the percentage of the straw caught on the larger sieves (30 mm and 67 mm), the worse the quality of the chopping and the higher is the amount of rejected straw, with a length of up to 25 cm [2].

### Test Results

Using feeding devices increases the quality of the chopping. Should a chopper with cross bar and counter knife as well as the casing step be used, then the use of feed rollers or conveyor belts result in a considerable decrease in the amount of over long straw (sieve size 30 mm and 67 mm) without a considerable increase in very fine particles (sieve size 2 mm) which are difficult to distribute.

While the average power consumption remained constant when using feed rollers, the consumption increased by up to 20% when using conveyor belts. Due to the fact that one roller only requires 300 W and a conveyor belt 800 W in order to transport the straw, the additional consumption incurred by the

feeding devices is negligible.

The even distribution of chopper use is shown in Fig. 2. The measurement records show the torque of the chopper during the tests, at a feed speed of 3 kg/s with a chopper speed of 95 m/s (3500 rpm) when using a chopper with cross bar and counter knife as well as the casing step.

With regard to the torque course, when using the conventional free fall funnel varying intervals with higher and lower loads can be seen. These can be traced back to the forming of air pockets above the rotating chopper as it is necessary for a certain amount of straw to gather before it can fall by force of its own weight in one go into the chopper [2].

On the other hand the straw coming from the straw walker via the rollers is pressed into the chopper without delay, which is shown in the higher torque. The maximum torque peak, which is increased by 26 percent, does

not mean only higher mechanical wear, but also requires a 26 percent higher capacity of the motor of the harvester, which is a considerable disadvantage of this alternative.

The conveyor belts enable a comparably even run of the chopper. Although there is an increased consumption, there is no increase in the torque peaks in comparison to the previous version.

A possibility for reduced consumption is shown in Fig. 3. Should one dispense of the casing step when utilising a feed device, then it is possible to reduce the power consumption of the chopper.

In the case of conveyor belts, such dispensation has no negative effects on the quality of the the chopping. The percentage of long straw is almost halved while the power consumption is 15 percent lower than the intake funnel.

### Conclusion

Feeding devices enable an improvement in the working efficiency of the combine straw chopper. As opposed to feed rollers with high torque peaks, the conveyor belts enable a even running of the chopper. The dispensation of the casing step in combination with the use of the conveyor belts makes an increase in the quality of the straw chopping and at the same time a reduction in the power consumption possible.

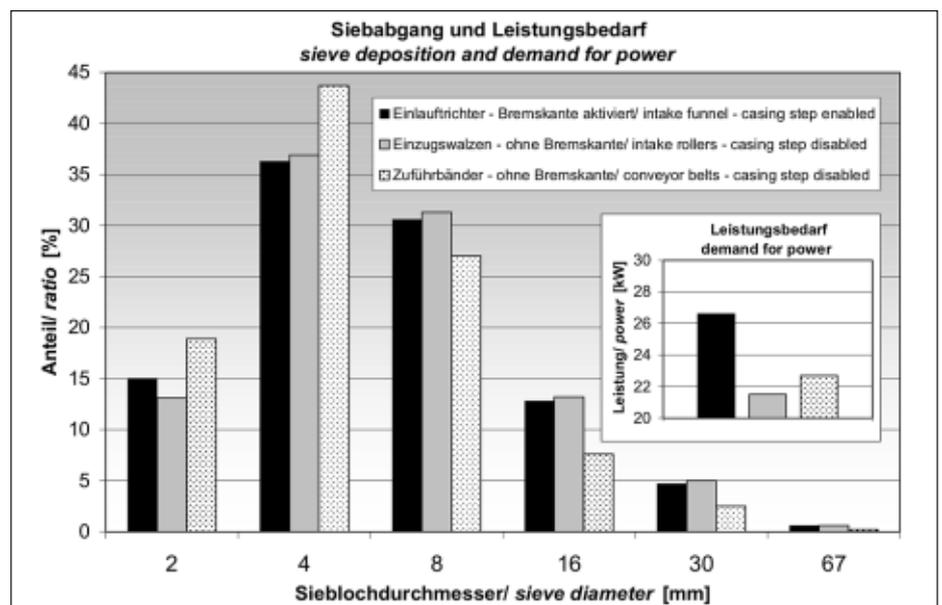


Fig. 3: Effect of feeding devices on chopping quality and power requirements