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Effects of Straw Handling

on Dust Reduction and Technological Properties

FAL Bundesforschungsanstalt für Landwirtschaft

Presented at EurAgEng2002
Budapest
02-AP-017

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Problem

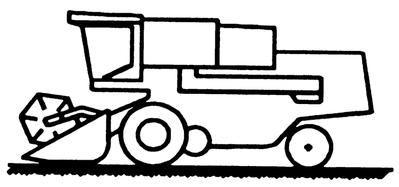
Straw harvesting and processing is not yet strictly orientated to optimize technological properties of the harvested straw when used as bedding material for animal welfare. To compete with liquid systems bedded systems have to reduce amount of straw use and labour demand. Mechanized handling systems have to prevent harmful dust and have to optimize texture and structure of straw to fulfill its manifold functions.

Objectives

The reported project aims to determine the structural change of the straw through the different processing lines, to spot the sources of dust particles and to determine the types and fractions of straw with the highest water-holding capacity.

Methods and preliminary Results

Processing line of straw litter material



Structural change

After a gradation of usual techniques for threshing, baling and littering concerning the expected strain (see table 1 for examples), straw samples where collected from five farms operating harvesting technologies which include severe strain on the straw. The samples, which were taken from the swath, out of bales and after littering, were qualitatively classified according to the following types of strain:

Table 1: Strain on straw by different techniques

Machine	Type of technique	Grade of Strain
combines	conventional threshing mechanism with straw walker	0
	threshing mechanism with accelerator drum and straw walker	0 / +
	four-drum threshing mechanism with straw walker	+ / ++
	conventional threshing with dual separation rotors	+++
	rotary combine harvester	+++
straw balers	high density baler	0
	simple big baler	+
	big baler with cutting unit	++
	round bale press	++
	round bale press with variable bale chamber and cutting unit	+++
littering machines	bale loosening unit with spikes	+
	bale loosening unit with blades	+++

Grade of strain: 0 = low + = moderate ++ = high +++ = very high

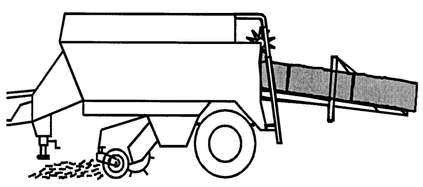
squeezing

folding

grinding

ripping

Especially through the threshing process the straw gets an individual appearance. More squeezed and ground straw is produced from a combine with dual separation rotors than from a conventional thresher.

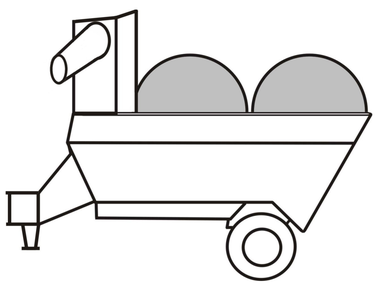


Stem length

The samples were divided into three fractions with a set of sieves with diameters of 10mm and 5mm.

Considerable amounts of tiny parts in the litter develop already during the threshing and baling process. Figure 1 shows exemplarily the distribution of different straw lengths (winterwheat).

Wheat shows on all examined farms an increasing portion of fine material through the processing line.



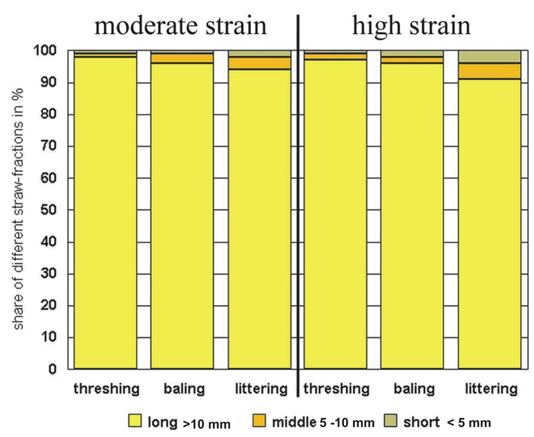


Figure 1 : Different Stem Lenghts in Different Processing Lines

Water holding capacity

Figure 2 : Bulk Density of Straw Fractions

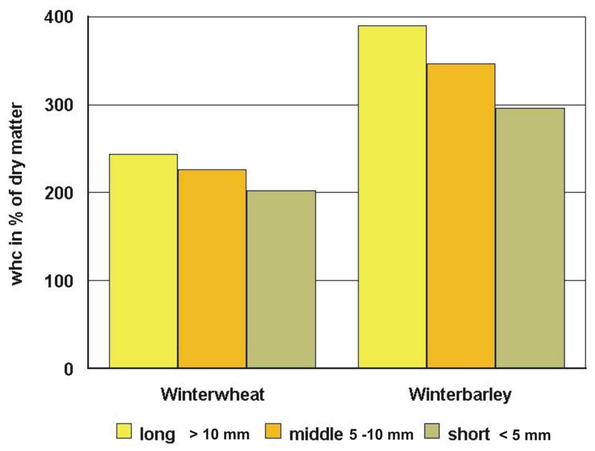


Figure 3 : Influence of Strawtype and -length on Water-Holding-Capacity

Figure 2 shows the size and structure of the fractions. Each jar contains 100g of each fraction and their respective bulk density.

Figure 3 shows the results of the water-holding-capacity from a processing line with a moderate strain. The capacity decreases from the long-fraction over middle- to short-fraction in both cases.

Although the water-holding-capacity decreases within the single fractions, high stress level on straw during harvest and distribution increases the water-holding-capacity in case of wheat (316% compared to 283%) and rye (320% compared to 297%).

Conclusions

Dust particles during the littering process develop already during harvest.

Against many extensionists recommendations to chop the straw during littering the water holding capacity decreases from the long straw fraction to the short straw fraction.

The mere modification of the loosening unit of the littering machine is not expected to be very effective in terms of dust reduction.

Dust has to be prevented by technical means during littering process.

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In cooperation with : HAWE-Wester GmbH & Co. KG

Financed by : DBU