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Mechanical treatment of bedding material for animal husbandry to improve the quality

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Summary

According to a review of professional literature and based on personal experience, the current state of knowledge is that there is enough straw available in Germany to keep farm animals on straw bedding, insofar as it is appropriate for each type of animal. Soil fertility could be increased with a return of the solid manure back into the soil, and the process would contribute to the ecological philosophy that all organic materials should be kept in a permanent, natural cycle. Many good reasons for animal husbandry on straw litter have been voiced, and appropriate, modern stall systems are also available which are on the threshold of allowing economically competitive animal keeping on slatted floors. The main point for improvement is to reduce the amount of physical labor required in litter systems.

An important point is the improvement of the litter quality in order to reduce the amounts of straw needed and the use of mechanical transportation and distribution equipment. For many years very concrete instructions have been given for using mechanical treatments to increase, for example, the level of liquid absorption, although doubts have been voiced in more recent publications.

The testing of this phenomenon is done in indirect ways via laboratory and semi technical studies on the definition and determination of relevant statistics. The consideration of the principles of mechanical chopping and the dispersion system used in industrial machinery follows the evaluation of their results.

The determining evaluation takes place in a direct manner in a five-year practical study with a total of 200 growing beef cattle in a two room deep litter stable. The focus is on the separation and collection of liquid from differently prepared litter materials measured on the basis of their use as well as on the cleanliness of the animals and the surface area of the litter.

At the same time, the structure and the penetration resistance of the litter/solid manure layer can be calculated. Three groups each with 13 heifers of the same weight were kept during

the winter stable period under identical time and space conditions in parallel studies. The only variable was the type of preparation. In each case an intensively and not so intensively prepared variety was used, and as a reference, long straw from round bales was used. A number of factors influence the success of the mechanical preparation of litter materials for animal husbandry.

These include

1.) The quality of the litter/solid manure mattress in the stable: it was shown that preparation via the pressing of round bales is an inexpensive solution. The amount of litter required is minimal, daily just 3.5-4.0 kg per Animal Unit (500 kg live mass). That is much less than up to 12 kg as said in the literature. Elasticity, insulation and cleanliness of the animal and laying area are ensured. The resistance to penetration from the animal's foot is sinking from 1.6 to 0.4 MPa during three months and is sufficient. The litter material is able to take in two to three times as much excrement and urine as the own mass.

2.) The quality of the solid manure: The variations with straw prepared intensively with a chopper or litter machine are the most appropriate, because their consistency makes it easy to distribute, to remove from the stable and to load. With chopping also the energy demand goes down to 0.75 SAG solid manure respectively 34 kWh/ha farmland. This also holds true for the rotting of the straw and thus the natural fertilizer characteristics in the soil.

3.) The handling and logistical characteristics: It generally holds true that the more the size of the product kernels resemble filling matter, the more likely it is that continually working logistical elements even those which are closed and develop little dust. Every chopping of straw leads to an increase in the filler density and thus to a reduction in the necessary transportation and storage volume. Long straw from round bales needs a specific volume of 150 m³/t and cut straw only a third, that is 50 m³/t. This supports the less or intensively prepared variations.

Cum grano salis, it must be concluded that a complicated, additionally mechanically preparation of already baled straw in order to give it the characteristics of a litter layer is not conducive. Since both the litter material and the solid manure need to be handled and the characteristics of less prepared straw, for example via a very inexpensive implementation of chopping equipment in balers, and only slightly lower quality than the bales of long straw, this type and the minimal level of preparation are seen as a comprehensive compromise. It is also conceivable that badly damaged straw from combine harvesters with a tangential threshing system break the straw down enough that no other measures are required.

The carrying of the litter into the stable could take place via an simple, slow running conveyor belt. Such conveyor could also serve the purpose of bring in glitter material stored outside of the stable into the stable with minimal dust emissions. In cases where large distances need to be overcome in the littering of a stall, and pneumatic support can not be avoided, then a throw-blower should be used at a minimal airspeed and carriage amount as possible. There is also the possibility to prepare the litter outside the stable in a separate dust exhausted room.

There is still a demand of research, to protect men and animals of dust emitting especially during the littering process.