



Wolfgang Müller tests bedding systems for cows at the Grub State Research Farm in Bavaria.

10 attributes of a good cubicle

- 1 The floor is soft and grippy.
- 2 The air quality around the nose of the lying cow is excellent.
- 3 The cow can move her head without restriction.
- 4 The neck band is flexible and fixed at the maximum height. The bottom of the neck rail is 125-135cm from the ground.
- 5 The maximum height of the brisket board is 5-10cm from the bed floor.
- 6 The minimum bed width is 125cm.
- 7 The partitions between the cows are flexible and clear from the ground.
- 8 The maximum height of the brisket board is 20cm.
- 9 The minimum bed length in new barns is 190-200cm.
- 10 The cows are able to lie conveniently back to back.

Bedding down the cows

The research team at the Bavarian State Research Farm Grub regularly trial new approaches to cubicle bedding and lying comfort for cows. In all the testing, the focus is always on cow preferences. The Grub dairy farm uses many different bedding systems – from structural pellets to cooled waterbeds that help cows cope with heat stress.

The cow house has 62 cubicles supplied by four different manufacturers. 50% of the cubicles from one manufacturer are managed as deep-litter systems and 50% have mats with minimal bedding. Each cubicle has an ultrasonic sensor installed overhead which measures its occupancy – an impressive way of determining cow preferences. Deep bedding at Grub means the cubicle has a mat of lime and straw. Yet, lime isn't really the best bedding material, because it causes rough skin. Apart from that, the mix of lime and dung tends to cling to the hair coat, sometimes even forming a cap on the hoof. Another drawback – especially in the warm season – is that the lime-straw mix tends to dry to a very hard mat, which of course is detrimental to lying comfort.

As all cubicles at Grub have flexible partitions, some cows lie slightly diagonally in their cubicles, which quickly leads to a wet bed, especially with



Photos: Max Riesberg

For clean hocks, it is important that liquids in the cubicles are absorbed as effectively as possible.

animals of a smaller frame size. With these drawbacks in mind, Wolfgang Müller, who is the farm's coordinator for livestock rearing, started to look for alternative bedding options. In autumn 2022, he found a suitable solution – structural pellets that are made from straw.

Structural pellets are absorbent and almost sterile

The special characteristics of the compressed material are that it is made from unchopped straw and, at 16mm in diameter, each pellet is rather large. Thanks to the high

percentage of fibres, pellets are extremely absorbent and also absolutely dust-free. Indeed, their absorbency is 10 times that of long straw. Apart from that, they are produced at high pressures, which in turn lead to high temperatures of up to 90°C, at which most pathogens are killed. Thanks to these excellent properties, structural pellets make very good bedding material and feedstuff. This at least has been the experience at the Bavarian State Research Farm.

The large surface area of pellets makes the material very absorbent – 1kg of structural pellets absorb up to 4 litres of water, hence offering optimum properties for absorbing animal liquids in the form of dung and urine. Furthermore, by absorbing smells and ammonia from the air, they also improve the overall climate in the barn. When pellets come into contact with liquid, they crumble and form a dry mat.

With this method, it was possible to drain the swamped cubicles at Grub fast and

effectively. Also, dry and hygienic cubicles keep udders healthy and clean, to the effect that cleaning before milking is faster now.

After the farm switched to pellet bedding, the team observed that the cubicles with deep bedded-pellets quickly became the most popular lying spaces in the barn. After all, the sensors clearly showed that occupancy was highest in these cubicles. In fact, the cows even started queuing for these spaces. Yet, apart from offering good lying comfort, pellets also exude a pleasant aroma, something that is very much appreciated. After all, cows have a keen sense of smell. The quality and the pleasant aroma of the bedding material also have an impact on the lying times – the cows simply stay longer on a clean and dry bed! So, the magic formula for increased milk production is clean and dry bedding.

Less bedding, less work, less mucking out

Using pellets as bedding material means that you need substantially less material than when using chopped straw, for example. Yet the use of pellets not only reduces the consumption of bedding material but also the amount of muck produced and consequently the time required

for mucking. Spreading the structural pellets is straightforward too. You can either spread them by hand or use a bucket or dispenser. Once a decent mat has established in the cubicle, it is enough to refresh the bed once a week. This translates into about 15-20kg of structural pellets for one cubicle every 10 to 14 days. At a bulk density of 600-700kg/m³, the material also takes less storage space, which is of course an advantage in view of the notorious shortage of space on farms.

Does the liming of deep-litter cubicles have the desired effects?

There are many dairy farmers who lime deep-litter cubicles every day. The idea behind this is that lime or mineral powders create a dry and hygienic cubicle, which is of course conducive to sustained udder health. So, liming actually serves as some kind of justification in terms of udder health. After all, a study conducted on 145 dairy farms showed that lime indeed had a drying effect, yet on the skin! Dry skin cracks and exposes the body to germs that can cause infections.

Moreover, although the pH level increases it doesn't increase enough to have the desired effect on udder health. After all, the large amounts of organic material in the cubicle allow the pH value to drop to between 5.5 and 8, which is not enough to reduce the spectrum of udder pathogens. This would require a pH of 11.

And this means that lime neither reduces the incidence of pathogens nor effectively the pH. Daily liming and refreshing the bedding has in fact little or no effect – neither in deep-litter system nor on mattresses. So, the question is, which is the best bedding for mattresses? After all, the bedding material that is used on rubber mattresses must protect the cows from

Field test: Do straw granules make suitable bedding for mats?

A rubber floor bed always requires additional bedding that is able to absorb liquids (milk, dung, urine, sweat) and protect hocks.

If these liquids are not absorbed, the cow will suffer hair loss and skin irritation. As a result, the skin loses its protective function and allows pathogens to enter the body, which in turn leads to hock lesions.

Traditional and well-proven bedding material: Chopped straw, crumbled straw powder, saw dust and lime mixes. Straw granules are a relatively new option.



Photos: Wolfgang Müller

The Grub State Research Farm in Bavaria tested straw granules and their suitability for bedding in various cubicles with rubber flooring and little minimal bedding. They found that straw granules make excellent **bedding for rubber mats**.

The results

Very well received by the cows

Very dry and clean beds

Very clean cows

Cubicles with mats require refreshing twice a day

Removal of dung

The entire cubicle space needs bedding (100%)

Requires refreshing once or twice a day (most materials don't stick well to floor mats)

Straw granules are gentle on the hocks: Test for abrasiveness by rubbing it on the back of your hand

abrasion and should be very absorbent. The rule here is that smaller particles offer a higher absorbency.

- **Straw chops** are capable of absorbing 3 times their own mass in moisture within 5 minutes.

- **Straw powder** absorbs 5 times its own mass in moisture within 3 minutes (< 10mm particles)

Straw crumble powder and straw granules for mattresses

For many years, the Grub State Research Farm used a mix of straw powder and mineral powder to litter cubicles that had rubber flooring with minimal bedding. Yet, as this mix actually left the cows caked with dust, it was decided to cut out the powder. This was in February 2024. Lo and behold, within a few weeks the animals looked clean as a whistle and cell counts had not increased. Currently, the farm is field testing straw granules for use as bedding on mats. The granules protect the cows from physical damage. The straw granules are produced from shredded and mould-free straw which is milled to powder and then pressed to pellets at very

4 litres

of water are absorbed by 1kg of structural bedding pellets

high temperatures before, as a last step, they are broken into granules that offer an enormous absorbency. The high-pressure process generates high temperatures at which most pathogens are killed. Furthermore, straw granules absorb smells effectively and don't develop a lot of dust, because they are sieved before they are delivered to the customer. The cubicles with rubber floors and minimal bedding of straw granules are well received by the cows. The lying spaces here are indeed very clean and dry.

In fact, their popularity among the cows compares to that of foam mattresses with an uncooled waterbed topper, which have been in use at the Research Farm for several years. In mid 2024, the dairy farm is going to install ten cooled waterbeds. What was the reasoning behind this decision?

Waterbeds cool animals in heat stress

Grazing cows were observed to prefer a cool ground for lying. It was also found that warm air forms an insulating layer above the back of an animal, which impairs the skin's ability to regulate the body temperature. As two thirds of the body temperature are diverted through the cow's belly skin, a cool mattress is more effective for regulating body temperature than air-cooling fans – an intriguing aspect to consider when considering heat stress.

Both types of bedding – deep litter and comfort mattresses – do have an insulating effect, which is indeed most welcome in the winter, but certainly not in the summer. Wolfgang Müller, who is a certified 'cow signal recognition trainer', says that, in the summer, many cows stand in the cubicles instead of lying down. He also observed that every cow claims two or three cubicles her 'property' which she is nonetheless happy to share with her barn mates.

**Wolfgang Müller,
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