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## Use of paper fiber by-products for bedding dairy cattle

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### Abstract

Bedding and bedding management contribute to cow comfort, udder health and milk quality. A clean, dry adequately bedded stall maintains cow cleanliness, inhibits microbial growth and transfer to teat skin, resists compaction and lessens chapping of teats. A comfortable stall bed encourages resting, minimizes injury and fatigue and accommodates reasonable rates of heat loss. Four bedding materials used were kiln Dried Shavings (DS), Green or Wet Sawdust (WS), dried paper fiber (PF) and a combination of paper fiber, ash and other ingredients used on twenty four lactating cross bred at farmers' field in Maharajganj district during 2012 to 2014. The Fiber Mix was a very close second and compared quite favorably to the dry shavings. The pH of the Fiber Mix significantly limited bacteria growth in the bedding and on the cow's udders. Also, the Fiber Mix performed equally as well as other tested materials in terms of cow cleanliness. The SPF products were denser than the dry shavings and the green sawdust, and tended to freeze more in sub-zero conditions. The ash and lime content of the SPF products allowed these products to maintain a higher pH throughout the trial as compared to the shavings and sawdust.

**Keywords:** Cattle, dry matter, bedding material, short paper fibre residue (SPF)

### Introduction

Dairy cows spend roughly half their time lying down. Research has shown that comfortable bedding materials influence resting times, cow comfort and subsequently milk production. Because they come in contact with the cow's udder, bedding materials also play a key role in cow cleanliness and in the prevention of mastitis. This is extremely important since mastitis is the most important and costly disease affecting dairy cattle. Over the years, farm by-products such as paddy straw and wheat bhusa have been the primary beddings used on dairy farms. Recently the harvesting of rice-wheat crops through combine harvesters and an increase in the use of these by-products for the compost and organic manures preparation have drastically reduced the supplies of good bedding materials and increased the prices paid for these materials by farmers. For these reasons suitable alternative beddings must be identified and researched.

What makes good dairy bedding varies with the farm and depends on the type of housing, the management of the bedding and stalls, and the type of manure handling system. In general, good bedding materials must be comfortable for the cows to lay on, nonabrasive to the knees and hocks, non-slippery and offer confident footing when cows recline and rise, high in absorptive capacity for water and urine, easy to handle and maintain in stalls, inexpensive, safe for land application and should be in constant supply.

Of all the materials available for bedding, sand has been shown to excel in cow comfort and mastitis prevention. However the use of sand as a bedding material is not without problems. Sand can be quite variable in its quality and composition, it is heavy, non-absorbent, dusty and abrasive to both cows and equipment, and can freeze quite hard if not totally dry. Because of the problems with sand, many dairy farmers would still prefer to use products similar to sawdust and shavings if they were available.

One product that shows potential as an alternative to traditional wood by-products as a livestock bedding is Short Paper Fiber residual (SPF). SPF is a byproduct of the pulping process and consists of wood fibers of insufficient strength or length to be reused in the pulp manufacturing process. SPF is plentiful and available in tarai regions. It contains organic matter, clay fillers and lime that when applied to the land, can improve soil structure, fertility and pH. One disadvantage of SPF as a bedding material is that it is quite wet as it comes directly from the plant and must be dried or mixed with dry ingredients to be suitable for livestock bedding. Keeping these objective in minds, the objectives of this on farm trial were to evaluate the suitability and use of dried SPF products and mixes as bedding materials for dairy cattle.

## Material and Methods

Twenty-four lactating cross bred dairy cows were used in the trial. They were housed in a selected farmers' dairy farm in five selected villages of the district. The stalls were 60" or more in width and 66" in length with a rubber-filled mattress over concrete as a base. The cows were divided into 4 treatment groups with each group being bedded with one of four bedding materials. The four bedding materials used in the experiment were kiln Dried Shavings (DS), Green or Wet Sawdust (WS), dried paper fiber (PF) and a combination of paper fiber, ash and other ingredients in a proprietary, patent-pending formulation referred to in this report as Fiber Mix (FM). The trial was conducted in 2012 to 2014. All bedding materials were stored undercover in open-faced sheds. The trial was conducted in months of January and February 2012-2014. At the beginning of the experiment all bedding was removed from the stalls and replaced with 4 cubic feet of the test bedding per stall. The stalls and bedding were maintained as would be expected in a typical tiestall facility. Visible manure, urine and feed were scraped from the stalls as needed with new bedding added twice daily to the back 1/3 of the stalls.

Samples of each bedding were collected from the stalls on Day 0 (immediately after fresh bedding was added), and on Day 0.5 (12 hours), 1, 2, and 6, prior to the stall maintenance. Bedding samples were returned to the lab to determine dry matter and pH value. In addition the teats of each cow were swabbed on Day 0, 0.5, 1, 2, and 6 prior to the AM milkings.

## Results and Discussion

First it must be noted that no cases of clinical mastitis were observed with any of the bedding materials, throughout the course of the study. Analysis of the data showed a number of significant findings. Dry Matter (DM) content is indicative of a bedding's ability to maintain a dry environment for the cow's udder while discouraging the growth of bacteria. Table 1 is a summary of the dry matter and pH changes between the fresh and soiled beddings used in the trial. As you can see, fresh DS was highest in DM while WS was the lowest with the SPF products being intermediate in DM content. Throughout the experiment the WS, PF and FM remained similar in DM content, however a significant decrease (18%) in DM content was observed with the DS. An explanation for this drop in DM content is unclear but may involve differences in the bedding's exposure to water/urine, moisture absorption or drying ability.

**Table 1:** Dry Matter and pH changes with bedding use

	DM Day 0	Avg. DM Days 0.5 - 6	pH Day 0	Avg. pH Days 0.5 - 6
Dry Shavings	69	51*	5.35	7.70*
Green Sawdust	45	48	8.00	7.04
Paper Fiber	66	66	9.17	8.75
Fiber Mix	62	61	10.48	9.08*

\* Indicates significant difference ( $P < 0.05$ )

Beddings with a high pH (>9.5) have been shown to reduce bacteria growth especially of coliform organisms. The lime and ash contents of the SPF products contributed to the high pH's of these fresh products. As would be expected, manure and urine soiling, with use, tended to move all the bedding materials to a more neutral pH, however the ash and lime content of the PF and FM helped keep the pH consistently elevated throughout the trial.

## Other Factors and Observations

An important factor to some dairy producers is the visual cleanliness of the cows. They would avoid beddings that stick to the cows, make them look dirty or discolor them. This visual appearance may be completely independent of the bacteria counts found on the cow's udders. Results showed there was no significant difference in cow cleanliness between the any of the beddings used in the trial.

Following the trial, farm personnel working with the cattle were interviewed to gather their observations and opinions on the various bedding materials. In general their opinions of the SPF products were positive, and that either of the SPF products would be a suitable alternative if dry shavings were unavailable or if traditional bedding materials were too expensive. There were two exceptions to their generally positive comments. First is the density of the SPF products. Though they were not weighed during the trial, similar volumes were noticeably heavier than the DS and WS. This may not be as important a factor when bedding is handled by machine as opposed to hand tools, as was the case in this study. This trait may also make these beddings desirable in windy conditions. A second factor was the freezing of these beddings. During most of this trial, daily temperatures were at or below 0° F, causing the SPF products to freeze while the DS and WS remained loose at these temperatures. Though the SPF beddings froze, machine handling of these beddings in cold weather may still be possible.

## Conclusions

Many factors need to be considered when selecting the best bedding for a particular farm. Based on the results of this study, the dry shavings were the preferred bedding. It was the least dense of the four materials tested, which made it the easiest to handle with hand tools in a tie stall situation. The Fiber Mix was a very close second and compared quite favorably to the dry shavings. The pH of the Fiber Mix significantly limited bacteria growth in the bedding and on the cow's udders. Also, the Fiber Mix performed equally as well as other tested materials in terms of cow cleanliness. The SPF products were denser than the dry shavings and the green sawdust, and tended to freeze more in sub-zero conditions. The ash and lime content of the SPF products allowed these products to maintain a higher pH throughout the trial as compared to the shavings and sawdust. In addition to the pH being of benefit in the stall bacteria levels, the higher pH could provide lime value to the farm when spread upon crop land.

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