

Green Bedding...

Get the most out of your manure !

Reuse manure by producing your own green bedding and offer maximum comfort to your herd

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What is green bedding ?

A plant cell wall is made up of three components: lignin, hemicellulose and cellulose. Of these, hemicellulose is the most digestible, followed by cellulose, with lignin being almost indigestible by ruminants. This undigested fiber passes through the animal and is excreted in their manure and is called manure fiber.

Green bedding is the recycling of these cow's undigested fibers, separated from the liquid manure and reused as bedding. Green bedding is produced mechanically with a manure separation system from raw manure collected within 24 hours. The green, in green bedding has nothing to do with the color or the environmental viewpoint; it refers to the fiber which has not been through a pathogen kill process (compost or anaerobic digestion) prior the separation treatment.



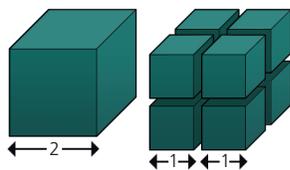
Characteristics of quality bedding

Cows will spend approximately 11.3 hours per day lying down and get up and down an average of 13.6 times (Cook 2009). While lying down, the cow increases blood flow to her mammary system and spends this time turning her feed into milk. Quality bedding is therefore a must for good milk production and is dependent on many factors such as :

Fiber length

The fiber length is important and will dictate the fibers likelihood of :

- **Causing air quality issues** - Air movement either from fans or from the wind can cause some bedding material to become airborne and blow around. Bedding fiber that is too small and light can actually create air quality issues for the cows. Longer fibers are usually heavier and will remain on the stall surface.
- **Sticking to teats** - Smaller fibers are more likely to stick to the teat skin of the animal and be carried into the parlor, which requires more cleaning during cow prep. Longer fibers tend to be heavier hence are less apt to stick and their length increases the possibility for the cow to brush them off as she is moving.
- **Encouraging bacterial proliferation** - Finely ground bedding has a larger surface area per volume of bedding, providing more opportunity for rapid bacterial growth since there is more food available.



Example :
 $(2 \times 2) \times 6 \text{ sides} = 24 \text{ units}^2$
 $(1 \times 1) \times 6 \text{ sides} = 6 \text{ units}^2$
 $6 \text{ units}^2 \times 8 \text{ cubes} = 48 \text{ units}^2$

Cushioning

A bedding material should return to its original shape and size as the forces are removed. The material should not be crushed to smaller particles or compacted and should keep its cushiony feel after multiple uses. High quality dairy bedding must provide cushioning for the animal while transitioning from standing to lying as well as provide support while lying. This will help avoid injuries and will increase the animal's time spent lying down.

Dry matter content

A dry matter content of 30% to 34% will allow for better control over bacterial proliferation. When spread in a cow stall (cubicle), the larger size and lower bulk density of fiber from a roller press allows the material to dry quickly with normal ventilation. Testing and research has shown moisture dropping by several percentage points and raising the dry matter content above 40% in a short period of time.

Bacterial content

Millions of different bacteria live on every surface of the earth and it is a false yet frequent practice to associate bacteria with a negative connotation. Not all bacteria are harmful to the cow's health. In fact, millions are necessary to keep it alive. While some are harmful and others necessary, most bacteria are tolerated/used by living organisms until they reach a certain concentration after which they become harmful. Put simply, it's all a matter of balance.

The same bacteria can often live in different locations. For example, Streptococcus bacteria, bacteria known to cause mastitis, live in feces, on the nose and skin of the cow along with its bedding. Since bacteria already live on and within the cow, contamination is inevitable, which is why it is unrealistic to try to eliminate them. Also, since all good and bad bacteria live together, trying to destroy the bad can harm the good. Instead, a healthy competition should be established to maintain bacterial levels of different strands at a healthy equilibrium and not have one dominating.

Typically five different families of bacteria are monitored in bedding as they are the ones responsible for environmental mastitis. The families include:

- Coliforms
- Klebsiella (a type of coliforms)
- Streptococcus
- Staphylococcus
- Enterococcus

These bacteria colonies vary enormously depending on the farm, their management, etc. The best solution to control these colonies is good hygiene and bedding maintenance. It will dictate whether the implementation of green bedding is a success or a failure.

Herd Health

Evaluating herd health is traditionally done by observing somatic cell count, mastitis and herd diseases. Hundreds of studies done by universities have been performed and published to better understand the role of bedding on the animal's health. The conclusion: there is no single factor guaranteeing good herd health. Any bedding type requires attention and good maintenance.

Somatic Cells

Bulk tank somatic cell count is a blanket indicator of overall herd health and has many associated factors, including management practices, milking procedures and animal bedding. In general, herds that have switched to manure fiber bedding have noticed a decrease in somatic cell count (Buelow 2008, Bunting 2012). This decrease has often been attributed to increased cow comfort by achieving proper bedding levels.

Mastitis

It is important to understand that the biggest causes of environmental mastitis are :

- Overpopulation
- Poor ventilation
- Poor maintenance of stall
- Poor maintenance of alley
- Poor maintenance of feeding area

Farms that have these problems to start with will not have a good experience with green bedding if the causes above are already a management issue.

Herd disease

Using manure fiber bedding can make it difficult to eliminate some harmful bacterial. Using any recycled bedding material is not recommended on herds that are known to have Johne's (Noyes).



Comparing bedding types

Bacteria

Many studies have demonstrated that concentrations of pathogens are equivalent within 24-48 hours in all organic bedding materials. Schwarz, Bonhotal and Staehr from Cornell University PRO-Dairy, pushed their 2008 research further and performed an elaborate study on the behavior of different manure separated solids as beddings in similar environments.

These results show that no matter how dried manure solids were produced, there were no significant differences in bacteria levels when used as bedding. This research confirms that regardless of the bedding production method, what happens in the stall is critical to success of a manure solids bedding system.

*See page 6 for the tables of data collected in the study.

Regardless of the bedding type used, stall maintenance is what matters the most.

Fiber length

The type of separator will determine the quality of fiber produced for bedding material. A roller press type separator protects the fiber length passing through the system and produces a longer fiber than a comparable screw press type separator.

Economic considerations

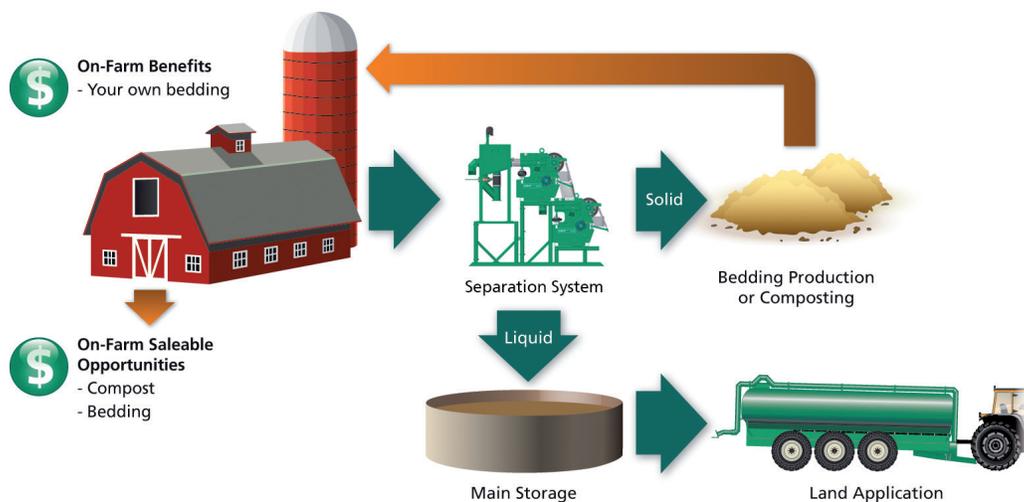
Most farms have experienced a cost savings when switching to manure fiber bedding. This is due to multiple reasons:



- Farms are not subject to the variable costs and availability of bedding.
- Reduced manure hauling expenses.
- Manure solids are easier to handle than some bedding types, and are gentle on equipment.
- Slight increase to storage capacity - farms are not storing sawdust, straw or sand in their lagoon.
- Potential revenue streams by selling excess fiber.

Each system will have different costs to install, operate and maintain, as with any equipment, power usage and cost and availability of replacement parts should be evaluated along with performance. How long it will take to payback the equipment to produce green bedding is therefore unique to each installation.

Taking all economic factors into account, including separation equipment, farms in a Cornell study saved an average of R2.2 per 100 liters (\$0.12 per cwt) of milk produced (Schwarz et al. 2008).



Using green bedding

The goals of a properly designed animal housing system are to maximize comfort for the animal while minimizing labor to keep a clean environment.

The bedding must be easily maintained by employees to routinely provide a clean, properly groomed stall. With any bedding, stall and bedding maintenance is key to providing a clean, comfortable bed. The back part of the stall must be cleaned as often as possible and fresh bedding added on a regular basis.

Alley scrapers or other frequent manure collection systems help the success of fiber bedding systems. Automatic scrapers have been proven to provide cleaner, dryer alleys which reduce the chances of cows tracking manure into stalls when entering the beds.



Several different styles of stall management have been successful on farms. Management practices to consider are :

- **Rear of stall cleaning frequency** - At least every milking while the cows are out.
- **Bedding frequency** - Several (2-3) times or more per week is preferred to keep fresh bedding and prevent stockpiling of recycled solids.
- **Amount of bedding** – Most producers will use more bedding when the material is available and free. It is possible to over bed stalls which limits the usable space for the cow if there are large bedding piles in the front of the stall.
- **Stall grooming** – Most producers groom the stalls several times per week. This can be done by hand or using an attachment on a skid loader. The groomers fluff up the bedding and help maintain the proper slope of material from the front to the back of the stall as well as aid in drying the bedding already in the stall.
- **Curtains and ventilation** – Some producers will raise the bottom of the side curtains 0.3 m to encourage airflow on top of the bedding. They have to be careful to close the curtains during rain. Any airflow over the stalls will assist in keeping the material dry. Additionally, ventilation must be matched to fiber quality of manure fiber bedding to prevent fibers from becoming air borne and creating a dusty environment for the animal.
- **Equipment operation and maintenance** – Bedding dry matter plays a role in bacterial growth. Proper protocols for equipment maintenance and operation are essential to produce a quality bedding every day for the animal.

The preceding practices should be thoroughly discussed and addressed before considering the switch to manure fiber bedding.

Study on different bedding types

Treatment of DMS bedding, type of stalls and frequency of re-bedding used at each farm

Farm Code	Bedding strategy after separation	Type of Stalls	Bedding Frequency
A Farm – Drum	Drum composted for 24 hours	Concrete	3 x / week
B Farm – Windrow	Windrow composted for 10 days	Mattresses	6 x / week
C Farm – Digested	Digested before separation – used directly	Mattresses	2 x / week
D Farm – Separated	Piled 3 days or used directly	Deep beds	2 x / week
E Farm – Drum	Drum composted for 3 day	Deep beds	2 x / week
E Farm – Sand		Deep beds	1 x / week
E Farm – Separated	Used directly	Deep beds	2 x / week
F Farm – Separated	Piled 7 days	Deep beds	2 x / week

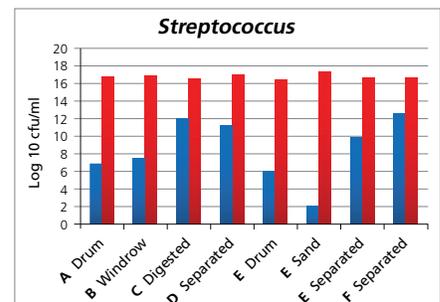
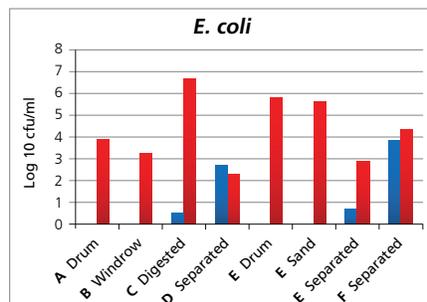
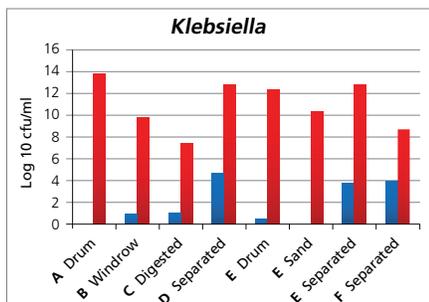
Based on a study of : Schwarz, M., J. Bonhonal, A.E. Staehr. 2010. Use of dried Manure Solids as Bedding for Dairy Cows and «How frequently should stalls be refreshed with new bedding». Cornell Waste Management Institute. <http://cwmi.css.cornell.edu/Ithaca, NY>.

In the chart below, it should be noted that the letters A to F are the farms that were observed during this study. The E farm uses sand bedding and separated fiber produced in two different ways. The blue bars show initial bacterial level content in each type of bedding before being put in the stalls. The red bars show the bacterial content level detected in bedding samples collected after three to four days, just before refreshing bedding.

We see that, regardless of the type of bedding or production method, the bacteria level increases up to a level which is almost the same for each farm observed, more specifically for the Streptococcus type of bacteria. The same phenomenon is observed with the other types of bacteria, but less significantly.

We also see that, even using sterilized bedding or other types of bedding material containing a very low initial bacterial level, the bacteria growth is faster than using separated fiber bedding. This finding can be explained by the fact that a non-existent or low initial level of bacteria gives no competition to those coming from cow's feces and urine or from the farm environment itself. This absence of bacterial competition fosters a faster bacterial growth that will increase your bacteria level up to the same point as the other types of bedding within a fairly short time.

As mentioned previously in this document, trying to destroy bacteria at all cost can leave the field free for bad bacteria growth. Instead, a healthy competition should be established to maintain bacterial levels of different strands at a healthy equilibrium and not have one dominating.



Conclusion

To conclude, regardless of the bedding type used, it is not the initial bacteria level that will ensure the wellbeing of your cows but rather the maintenance that you will do in their stalls and close environment. Providing a clean stall and frequently refreshed bedding will allow for better control over somatic cell counts and mastitis.

Like any decisions related to your farm operation, switching bedding type forces you to bring together your team in order to make a good decision. It is important to set-up standards and work procedures to make sure that the parameters surrounding green bedding production and stall maintenance for all animals is well defined and well-coordinated. Your herd health consultant and manure equipment provider are key players to assist you in this process.

Supported by good and effective management practices, manure fiber bedding is a manageable way to increase profitability of the dairy farm while simultaneously accomplishing the on going task of keeping dairy cows more comfortable.

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