

# SWITCHGRASS: a dual-purpose crop providing high quality bedding and improving rumen function

by

Roger Samson



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# Why Switchgrass for Ontario Dairy Farmers?

## Easy to grow:

- It is a productive, low input native warm season perennial grass
- Well adapted to marginal lands



## Convenient to Use:

- Dairy producers generally prefer it to wheat straw as livestock bedding
- An emerging high fibre component of mixed dairy rations

## Self sufficiency and Cost Control:

- Growers are looking for a low cost source of straw to replace spring cereal straw (purchased or grown)
- Strong interest in producing larger volumes of straw/ha



**REAP-Canada has been conducting R&D on switchgrass in Eastern Canada since 1991. Ontario Biomass Producers Cooperative is organizing producers to develop the sector. REAP's new switchgrass breeding selections are being scaled up in Ontario by OBPC growers.**



Switchgrass is a resource efficient and long lived native warm season grass. It is proving well adapted to Class 3 marginal farmlands in Grey County.

(photo of Urs Eggimann farm in late June near Markdale)



**The biomass crop is generally mowed after the first killing frost in late fall (~Nov. 1)**



**SG is raked and baled in early spring (~May 1). Field recovered yields of 7-11 tonnes/ha can be expected.**



**Spring harvested switchgrass typically goes into storage in a very dry state of 7-10% moisture (ideal for use in bedding applications).**

## What Makes a Good Dairy Bedding?

- Comfortable surface for cows to lay down on.
- Absorbs fluids to keep the stall dry and cows clean.
- Absorbs nutrients, ammonia and other odours.
- Non-slippery and cushions the cow's feet.
- Non-abrasive to cow's knees and hock joints.
- Contains low numbers of environmental mastitis causing organisms in raw state.
- Readily available at reasonable costs.
- Easily stored, applied and removed.
- Low dust.
- Environmentally friendly when spread on land

(adapted from Milk2020)





**Ontario farmers and researchers are making efforts to further develop switchgrass as a more convenient and improved livestock bedding**





**Don Nott of Clinton Ontario is producing pre-chopped high density bales to improve user convenience**



**Roto-chopping prior to baling leaves the dust in the field and increases SG bale density**

# Switchgrass (SG) vs. Wheat Straw

SG fiber length and strength is greater

SG stem walls are about 2-3 x thicker

SG is  $\sim .3\%N$  , wheat straw is  $0.8-1.0\%N$  (SG is more biologically inert)

Chopped or baled SG has a higher bulk density ( $\sim 15\%$ )

(improving user convenience)





**The fibre strength of SG and its hollow stem structure appears to create a more textured surface to the pack than wheat straw which is “flattened” more easily. These plant traits appears to be responsible for SG:**

- 1) more efficiently evaporating water from the pack when good ventilation is present**
- 2) providing better support to resting and standing cows.**



**Many positive producer testimonials:**

- ***SG breathes and releases moisture from the pack***
- ***SG stays drier on the top and doesn't deteriorate as quickly***
- ***Better footing for the animals***
- ***SG doesn't need to be reapplied as frequently***

## **Switchgrass and manure packs based on switchgrass provide important soil quality benefits to producers**

1. Switchgrass has a large root system and can develop 10-15 tonnes/ha of below ground biomass.
2. Leaves of switchgrass are prolific producers of phytoliths (plant stones or opals). Phytoliths are highly resistant to decomposition. Organic C encapsulated in phytoliths is a substantial component of the carbon pool in deep carbon rich prairie soils.



## Carbon : Nitrogen Composition Changes of Bedding Packs after 6 Weeks

(Spieshet et al., 2012)

C:N ratio	Wheat straw	Switchgrass	Wood Chips	Wood shavings
0 weeks	69:1	222:1	404:1	485:1
6 weeks	17.4:1	22.8:1	28.2:1	24.5:1

Note1 Wheat straw is more vulnerable to decomposition with low C:N ratio

Note 2. Herbaceous-based bedding packs will more efficiently turn over manure N to the subsequent crop compared to wood-based manure packs.

Note 3. Herbaceous manure packs will also make better feedstocks for anaerobic digestion





Detailed studies are soon to be published by team led by Dr Renee Bergeron at the University of Guelph assessing cow preference and performance of switchgrass vs. wheat straw bedding packs.

# Switchgrass (SG) can substitute for straw in Dairy cattle feeding

Two main options:

- 1. Can be used as a low energy–low potassium feed in a dry cow TMR's.
- 2. Can be used in a lactating cow TMR's to increase the effective fiber in the ration for improved rumination

# 1. Use in Dry Cow TMR

- Straw (or potentially switchgrass) inclusion typically ranges from 6 to 12 lb. per cow day depending upon availability and cost and TMR mixing constraints.
- Potential benefits for dry cows in addition to dietary energy restriction include reduced dietary potassium and cation-anion difference to reduce the incidence of milk fever and increased rumen fill to reduce the incidence of digestive disorders (such as displaced abomasums). (Shaver and Hoffmann 2014)

# Using Low Potassium straw or SG in a TMR for Close-up Dry Cows

- Early lactation cows often experience low blood calcium due to the demands of the onset of lactation. The resulting hypocalcemia can result in milk fever, retained placenta and mastitis as well as other metabolic disorders (1).
- High concentrations of potassium (K) in forages fed to dry cows can have a large influence on the incidence of hypocalcemia in early lactation cows. (McFadden 2008)

# Potassium Content of Alfalfa Hay

## Comparison of Forage Potassium levels of legume and legume-grass mixtures in Wisconsin, Ashland, 1994

		-----% Potassium-----			
		Cut 1	Cut 2	Cut 3	Average
<b>Alfalfa</b>	Solo	3.82	2.97	2.36	3.05
<b>Alfalfa</b>	With ryegrass	3.45	3.80	2.24	3.16

## Potassium Content of Ontario Straw and Switchgrass

Wheat straw (~1.20%)

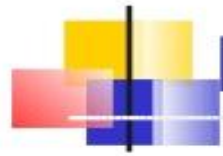
Fall harvested switchgrass (~0.90-1.00%)

Spring harvested switchgrass (~0.05-0.10%)

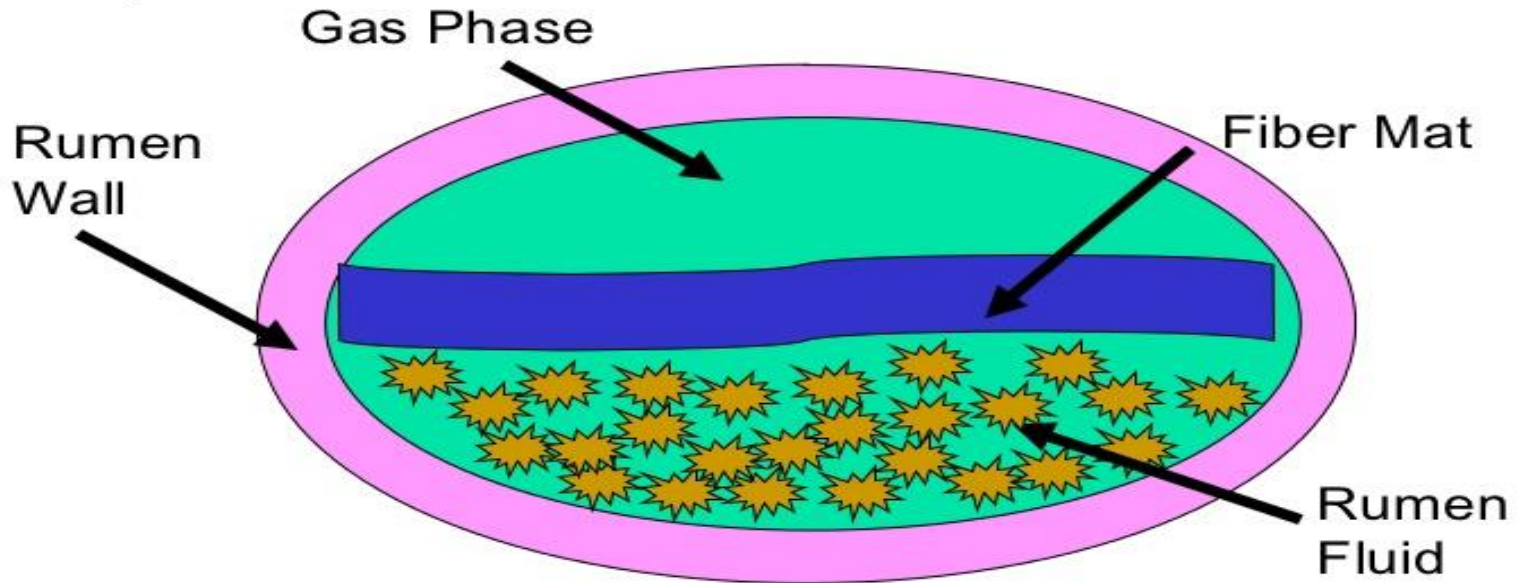
(spring harvest is highly leached by winter/spring precipitation)

## 2. Improving Rumen Function with Straw or Switchgrass in Lactating Cows

- Nutritionists may recommend need to increase the effective fiber in the ration for improved rumination, desire to increase rumen fill and (or) or slow the rate of passage of digesta from the rumen when only finely chopped and (or) very highly digestible forages are available on the farm, and the need to extend farm forage inventories.
- Straw inclusion is typically limited to less than 2 lb. per cow per day to avoid greatly reducing intake or the energy density of TMR's for lactating cows. Usage is most common in TMR's for fresh cows. (source: Shaver and Hoffman 2010)



## Location of Microbes



Feeding a high fibre source like straw or switchgrass at up to 2 lbs/day can help ensure an effective fiber mat is present in the rumen. This can help improve cud chewing and help enables slow growing fibre decomposing microbes to digest materials. Straw or switchgrass is not required if sufficient fibre is present in the ration. A possible inclusion rate should be based on a ration analysis. Some producers have found straw or SG to help increase depressed butterfat levels.

# Summary

Switchgrass is emerging as a promising new crop for dairy farmers:

1. It is a very well adapted crop to the marginal lands of Bruce and Grey counties with significant straw production potential
2. The use of SG as a bedding is becoming more mainstream as producers recognize superior bedding pack traits over straw including moisture and comfort aspects.
3. Feeding use of switchgrass in dairy rations is developing as producers better understand potential applications for dry and lactating cows.



# For more Information:

- Contact [www.Ontariobiomass.com](http://www.Ontariobiomass.com)



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