

# Livestock Farm Uses of Switchgrass and Miscanthus

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# Today's Talk

- Bedding with switchgrass and miscanthus in poultry, dairy and deep-bedded hog operations.
- Considerations for adoption of biomass crops at livestock farms

## Status of Biomass Bedding Experience

- Probably dozens of livestock and poultry farmers using switchgrass or miscanthus as bedding this year due to wheat straw shortage.
  - Nearly 100% of switchgrass and miscanthus is sold.
- Dairy and broilers, beef, sheep, and even deep-bedded pigs and alpacas.

## Broiler bedding

- Broiler chickens are normally bedded on wheat straw or wood shavings. Key factors:
  - Moisture management (manure, spillage from waterers)
    - Not just moisture absorption, but wicking and re-evaporating
  - Animal comfort and behaviour, product quality
    - Slipped tendons, foot pad and breast lesions



# Pilot Site: Evergreen Hill Farm, Port Dover, ON

- 2 storey barn, 28,000 sqft total
- 17,000 broiler chickens/floor
- 36 day cycle in the barn
  - day 32 for our visit
- Upper floor wheat straw
- Lower floor chopped miscanthus



## Why consider miscanthus bedding?

- Norfolk area: relative shortage of wheat straw
  - Little wheat grown
  - 2 bad seasons for straw production
  - Significant straw demand for ginseng production
  - Generally local farmers pay up to 10-11 ¢/lb to blow straw into a barn
  - This farm produces its own wheat straw currently
  - Nearby miscanthus grower talked up the idea
  - Try something new

## Observations and Conclusions at Pilot Site Miscanthus vs. Wheat Straw

- Miscanthus had good bedding performance
- Appears to maintain better structure through duration of bird cycle
  - General crusting of the manure on both floors
  - Wheat straw became slimier
- No apparent difference in bird health.
  - Random sample of 10 birds from each floor
  - All rated excellent on breast health, excellent on foot pad health
- No apparent difference in manure characteristics.

# Darkling Beetles



- Darkling beetle, lesser mealworm: “arguably the most significant arthropod pest in broiler production world-wide.”
- Omnivores that feed on bird droppings, spilled feed and dead birds.
- Disease transmission, structural damage to buildings, reduced weight gains and feed conversion within a flock.
- One of main vectors of Salmonella in barn after cleaning and disinfecting
- Substantial impact on both bird welfare and food safety
- Source: [www.CanadianPoultry.ca](http://www.CanadianPoultry.ca)



## Darkling Beetle Observation

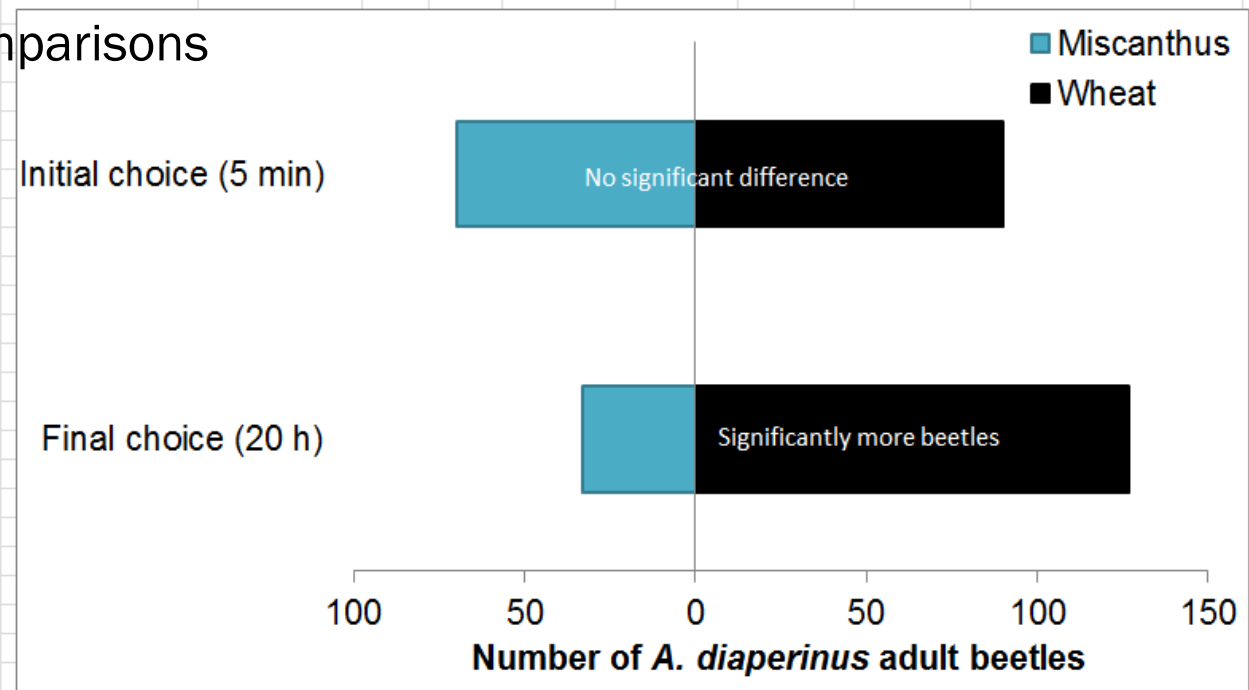
- It appeared as if there were many fewer darkling beetles on the miscanthus floor than on the straw floor at Evergreen Hill Farm
- On straw: “crawling” with larvae and adults under feeders
- On miscanthus: “almost no darkling beetles”, hard to find larvae
- This could have a significant value to the poultry sector



# Darkling Beetle Lab Experiments

## University of Guelph

- Comparison of survival and choice on miscanthus and wheat straw
- 4<sup>th</sup> Year Animal Science student working with Entomologist
- Next steps:
  - Replicate, adjusting experimental set-up
  - Investigate whole life cycle
  - In-barn comparisons



## Pilot Site: David Crowley, Norwood ON

- Organic broilers, half density barns
- 18,400-square-foot , 15,000 chickens, 40 day cycle
- Normally used wood shavings
  - Interested in miscanthus because he's organic
- Processed miscanthus in balebuster, blew into shed.
  - Chopped very fine for max absorption: trying replicate “crunchy” dry shavings
  - Fine dust everywhere: nose, eyes, equipment, even when placing chicks in the barn
  - Compared to shavings it's more work:
    - Receive bales, grind, blow into shed

# Crowley Observations Miscanthus vs. Shavings

- Miscanthus stays fluffed up, effort to rake it down if not spread well.
  - 1/3 the price of shavings, but additional 1.5 days of work raking
  - Steiner rotary fork spreader for shavings plugged up with miscanthus
  - Mixing with wheat straw (which may be “oilier”) to manage dust and spreading issues.
- Interested in trying switchgrass instead.
- Heated up in the manure pile
  - Pile heats and turns in on itself more than shavings
  - Pile ignited when turned over

## Pilot Site: Marc DeJong, Jarvis, ON Miscanthus v. Wheat Straw

- 2 storey barn, 24,000 birds, 1.8 kg bird, 30 day cycle
- Split each floor - half miscanthus, half wheat straw
- Different bale size, tub grinder bale chopper couldn't handle large miscanthus bale:
  - Wheat Straw: 3 X 3 X 7 ft. - 530 lb bale 8.4 lb/cuft.
  - Miscanthus: 3 X 4 X 7.5 ft - 1050 lb bale 11.5 lb/cuft.
  - Denser bale and material



## DeJong Pilot: Miscanthus v. Straw

- Miscanthus wore through the hose wall when blowing it.
- Waterer leak at start-up: 2' X 6' wet spot before birds came. Left it to dry on its own.
- Farm has not had darkling beetle issue, so not significant results at this site.
- Used equal weight of bedding material on each floor. Result: miscanthus was very thin.
  - Would put in 1/3 more by weight compared to straw
- Floor under miscanthus was observably less wet/slimey during occupancy, and during clean-out

## DeJong: Broiler Culls and Condemns

- 14% fewer culls through growth cycle on miscanthus
  - Mostly leg-related culls. Grippier, less slip?
- Body condition: 20 birds per bedding type
  - Equal. 1/40 had minor foot issue
- 50% fewer condemns at the plant for miscanthus birds
  - Loaded 1 truck with miscanthus birds, 1 with straw

	<b>Culls</b>	<b>Condemns</b>
<b>Wheat Straw</b>	<b>478</b>	<b>147 kg</b>
<b>Miscanthus</b>	<b>411</b>	<b>73 kg</b>
<b>% reduction</b>	<b>14%</b>	<b>50%</b>

- Next step: currently running miscanthus vs. wood shavings



## Miscanthus v. Wheat Straw Broiler Farm Observations

- Fewer leg injuries and related culls: non-slippiness?
  - Other bird health factors (foot, breast) equivalent to straw
- Fewer condemnations at the plant (despite thinner bedding)
- Miscanthus appears to maintain its structure: “fresher”, “stemmier”. Stays uncompressed unlike straw.
- Miscanthus appears to draw-in water into body (spongy pith). Whereas wheat straw lacks “body” and seems to gain wetter slimy body coating.
- Miscanthus not slimy under waterers.





## Miscanthus Integration into the Farm

- Bale size for grinding/blowing needs to be coordinated.
- Need to spread it well initially – non-slippiness means hard to rake.
- Grinding finely causes fine dust, and may not be necessary for moisture management.
- Small acreage perennial may fit in broiler context
- Fresh shavings broiler manure can “suck up N” when land applied:
  - Like wheat straw, switchgrass and miscanthus shouldn’t have this issue, meaning more nutrients are retained for crop use.
- Darkling beetles: very interesting: need more trials

# Moisture holding capacity

Material	Type or Form	Absorbency Factor (g water / g bedding)
miscanthus	chopped	2.97
switchgrass (fall harvested)	baled	2.4
wood shavings	bagged softwood	2.2
Literature values:		
wheat straw	baled	2.1
	chopped	2.1
shavings	soft wood	2.0



2014 trials in red using oven-dried material

<http://www.omafra.gov.on.ca/english/environment/facts/97-029.htm>

# Pilot: Deep-Bedded Pigs on Ensiled Miscanthus

John van der Horn, Embro ON

- Fall-harvested miscanthus from COFS, ensiled in tubes: wrong season, just for the show.
  - Ensiled didn't have particularly nice feed smell (and that wasn't the intent).
- Humanely raised low density deep-bedded pigs.
- Pigs took long time to rip apart (9 days vs. 1 day for corn stover): kept them busy
- Pigs lay in the miscanthus, but wouldn't manure in it: good.



## General Observations and Conclusions (1)

- Biomass crops can be a drop-in replacement for wheat straw (miscanthus in poultry, switchgrass in dairy)
  - Need to compare the reverse (miscanthus in dairy, etc)
  - Biomass growers wants long-term contract
  - Need to establish sales agreement early to ensure proper product (bale size, chop length, harvest time)
  - Need to figure out handling of chopped fibre

## General Observations and Conclusions (2)

- Opportunity for livestock farms to produce bedding/feed themselves
  - Easy crop to grow, interesting value compared to small grains for bedding
- Improved grip and moisture management a clear benefit for broilers on reduced culls and condemnns
- If darkling beetle opportunity is proven, a big deal for the broiler sector
- Holds up well in bedding pack, longer than straw/stover
- Low potassium switchgrass may be interesting as dry cow feed.
- High absorbency may merit investigation under milking cows.



- Questions?

