Livestock Farm Uses of Switchgrass and Miscanthus

OBPC Ag Biomass Day
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Jake DeBruyn P.Eng.
Environmental Management Branch, OMAFRA
jake.debruyn@ontario.ca  (519) 826-4584
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
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
- 4th 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 absorbtion: 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

<table>
<thead>
<tr>
<th>Bedding Type</th>
<th>Culls</th>
<th>Condemns</th>
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</thead>
<tbody>
<tr>
<td>Wheat Straw</td>
<td>478</td>
<td>147 kg</td>
</tr>
<tr>
<td>Miscanthus</td>
<td>411</td>
<td>73 kg</td>
</tr>
<tr>
<td>% reduction</td>
<td>14%</td>
<td>50%</td>
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</table>

- 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 condemns 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 (spongey pith). Whereas wheat straw lacks “body” and seems to gain wetter slimey body coating.
- Miscanthus not slimey 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

<table>
<thead>
<tr>
<th>Material</th>
<th>Type or Form</th>
<th>Absorbency Factor (g water / g bedding)</th>
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<tbody>
<tr>
<td>miscanthus</td>
<td>chopped</td>
<td>2.97</td>
</tr>
<tr>
<td>switchgrass (fall harvested)</td>
<td>baled</td>
<td>2.4</td>
</tr>
<tr>
<td>wood shavings</td>
<td>bagged softwood</td>
<td>2.2</td>
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</table>

**Literature values:**

<table>
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<tr>
<th>Material</th>
<th>Type or Form</th>
<th>Absorbency Factor (g water / g bedding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>wheat straw</td>
<td>baled</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>chopped</td>
<td>2.1</td>
</tr>
<tr>
<td>shavings</td>
<td>soft wood</td>
<td>2.0</td>
</tr>
</tbody>
</table>

2014 trials in red using oven-dried material

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 condemns
- 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?