Harvesting and Processing Biomass Experiences and Challenges

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MAKING GREEN POSSIBLE
Vermeer Corporation

Forage Solutions

Environmental Solutions

Specialty Excavation

Solutions for UG Installations
Corn Residue Harvesting

Methods vs. Yield

1. **Corn cobs only** – removes *15% of residue
2. **Direct bale** – removes *25% of residue
3. **Rake/Bale** – removes *50% of residue
4. **Shred or chopping corn head/rake/bale** – removes up to *75% of residue

*Approximate removal rates
Corn Residue Harvesting

Challenges

- Tight harvest window
- Moisture level variations
- Corn variety
- Sustainability
- Dirt/Ash content vs. residue yield
- Long-term storage
- Current equipment built for typical farming applications
Common Energy Crops

Switchgrass
Miscanthus
Energy cane
King grass
Arundo

**Process**

- Switchgrass, Miscanthus – single harvest after frost
  - Mow – (rake option) – bale
- King, canes, Arundo…. tropical
  - Mow – dry down - bale
Energy Crops - Challenges

• Mowing tall, high-volume crops
• Moisture content at harvest
  • Weather – fall, cool temps, frost, rain/snow
  • Tropical customer understanding of higher moisture bales and the impact to storage
• Ash content during harvest
Storage of Biomass Bales

- Single row vs. stack
- Gravel bed vs. dirt
- Tarp vs. building
- Round vs. square
- Netwrap vs. twine
Round vs Square

Purchase price (1/3)
HP to operate (1/2)
Storage – moist climates
12x – units sold annually

Continuous baling
Trailer loading/hauling

Common Ground
Similar performance in most crops
Bale density
Crop preparation and bale handling
Feedstock Specifications being defined – OEM needs clarification

- **Food** grade vs **Fuel** grade biomass
- Consistency
- Moisture content / range impacts harvest window
- Ash content
- Density - truck weight & quantity, distance, energy to harvest, cost to manufacture/operate
- Next process – grind, material size, can we create more value in field
- Who is the customer?  
  - farm
  - custom
  - regional center
  - plant
- Feedstock value (farm ROI)
  - Harvest cost
  - Harvest impact
  - Market need

Many opportunities to improve once specifications are clear
Biomass Processing

- Biomass moisture and ash levels are critical
  - Effects productivity, consistency, wear, etc.
  - Storage and harvest methods important
- Need for flexibility in product and size
  - One solution is not the answer for everyone
- Multiple pass processing tends to be more efficient method when pelletizing or fermenting
  - Contaminants
- In plant vs. infield processing
- Diesel vs. electric
- Must have dust control
- Feeding the “System” capacity
Processing Biomass Non-Woody

Bioscreen Kit

- Better size control
- Variable moisture OK
- Lower maintenance costs
Processing Biomass

- **TG5000**
  - Loader option
  - Diesel or electric
  - Trailer or skid
  - 540 HP
  - Bioscreen

- **Biomass**
  - Round or square
  - Loose, bulky material
  - No longer than tub dia.
How a Tub Grinder Works
Processing Biomass

• HG6000
  – Diesel or electric
  – Trailer or skid
  – 700 HP
  – Bioscreen

• Bales –
  – Large square or up to 4’ dia. round
  – Logs, brush, C&D
How a Horizontal Grinder works
Biomass Opportunities - Equipment Evolution

• Higher duty cycle products to harvest & process
• Flexibility in processing equipment
• Profitability: land owner – harvester – storage site - transport – process – energy producer
• Contaminants (ash) & varying moisture
• Logistics of low-density biomass
• Consistent feedstock to end user
• Year-round supply – storage
• Commercial scale supply
Questions?
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