

Growing alternative energy crops in West Central Minnesota



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Biomass Feedstocks



- **Current feedstocks**
 - Corn
 - Sugarcane
 - Switchgrass
- **Future feedstocks**
 - Agricultural residues
 - ✦ Corn stalks
 - Wood wastes
 - Energy crops
 - ✦ Grown for energy content

Feedstocks Being Considered



- **2 types of crops**
 - Non-native
 - ✦ Miscanthus
 - Native
 - ✦ Switchgrass
 - ✦ Big bluestem
- **Prairies**



Switchgrass



Big bluestem



Miscanthus



Native Prairie

Common Characteristics



- **Perennial**
 - Grow every year
- **Rhizomatous**
 - Grow by underground stems
- **High Yields**
 - Native grasses
 - ✦ 3-5 tons per acre
 - Miscanthus
 - ✦ 10-17 tons per acre
- **High energy content**
 - 7400-8200 Btu's/lb



Miscanthus



- East Asia
- Tallgrass
 - 3.5 meters high
- Triploid
- High energy content
 - 17.5-18 MJ/kg (7400-8200 Btu's/lb)
- Uses
 - Carbon sequestration potential
 - ✦ 6.3 Tonnes/ha (2.6 ton/acre)
 - Animal Bedding
 - Fiber



Establishment of Miscanthus



- Plant rhizomes
- 2 ways to plant
 - Potato Planter
 - ✦ 3 ha per day
 - Custom Planter
 - ✦ 20 ha per day
- Nutrient addition
 - None in establishment year
- Weed control
 - Herbicide necessary



Management of Miscanthus



- **Overwinter**
 - Poor survival rate
 - Solutions
 - ✦ Hybrid
 - ✦ Cover
- **Nutrients**
 - Nitrogen
 - ✦ 20-80 kg/ha (17.8-71.4 lb/acre)
- **First 2 years of growth**
 - No harvest

Harvest of Miscanthus



- **Spring**
 - Late February to late May
 - Leaves fall off
 - ✦ Lower ash content
 - ✦ Less tar build up in energy conversion
 - Driest stems
 - ✦ Better conversion properties
- **Yield**
 - 10-17 tons per acre



Native Plants



- **Native tall grasses**
 - 1.8-2.5 meters tall
- **High tolerance and adaptability**
 - pH, soil type, weather conditions
- **High energy content**
 - 18-19 MJ/kg (7800-8200 Btu's/lb)
- **Alternative uses**
 - Forage
 - Erosion control
 - Wildlife plantings



Establishment of Natives



- **Broadcast or drill**
- **Nutrient addition**
 - No nitrogen when planting
 - End of season 50kg/ha (44.6 lb/acre)
- **Weed control**
 - Extremely important
 - Herbicide addition
 - ✦ 2,4-D
- **Aboveground growth**
 - Very little establishment year



Management Natives



- **Nutrient**
 - Nitrogen addition necessary
 - ✦ 50-100 kg/ha (44.6-89.2 lbs/acre)
- **Weed control**
 - Continued importance
 - Early season clipping
 - Biomass removal
 - ✦ Burn
- **Not harvested first 2 years**
 - Not substantial biomass

Harvest Native Crops



- **After killing frost**
 - Plants dormant
 - ✦ Does not damage plant
 - Low moisture content
 - ✦ <20%
- **Yield**
 - Switchgrass
 - ✦ 3-5 tons per acre
 - Big Bluestem
 - ✦ 2-4 tons per acre



Native Prairies



- **Dominant ecosystem**
 - Throughout the Midwest United States
- **Fire based**
 - Rely on fire for continued growth
- **Once 1/3 of United States**
 - 3,000,000 km² (741,000,000 acres)
 - Less than 3% remains
- **18 million acres in Minnesota**
 - 1% remains virgin prairie



Prairies and Fire



- **Fire**
 - Biomass removal
 - ✦ Sun warms soil
 - pH buffering
 - ✦ Ash returned to soil
 - Species Composition
 - ✦ Fire Favors C₄ grasses
 - Expensive
 - ✦ 30+ dollars per acre



Harvesting Native Prairies



- **Possible alternative to burning**
 - Biomass removed
 - Shown to favor forbs and legumes
- **Harvested late fall**
 - Most birds have fledged
- **Sections left un-harvested**
 - For remaining animals over winter
- **Effect on habitat**
 - Favor some birds and small vertebrates
- **Yield**
 - 1-3 tons per acre

Conclusion



- **Miscanthus**
 - High yields
 - High energy content
 - Poor overwinter
 - Lack of trial in west central MN
- **Native grasses**
 - High energy content
 - Yields
 - Experience in west central MN
- **Prairies**
 - Harvestable

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