Potential of Annual Forage Crops for Fort Belknap Reservation as Livestock Feed and Biofuel Feedstock

By
Chengci Chen¹, Dan Kinsey², Ed Doney², and Don Addy

¹Montana State University
²Fort Belknap College
Introduction

- Fort Belknap farmers identified the research priority is to increase forage hay production in the reservation.
- With the nation moving from corn-based fuel ethanol to cellulosic fuel ethanol, Fort Belknap farmers may grow multi-purpose crops for livestock feed as well as for cellulosic ethanol feedstock.
Objectives

- The ultimate goal of this project is to enhance the agricultural economy of Fort Belknap Reservation and to increase the self-sufficiency of its farmers and ranchers.
- The specific objective of this collaborative project between the Fort Belknap College (FBC) and Montana State University (MSU) was to introduce specialty crops to Fort Belknap Indian Reservation for livestock feed and potential cellulosic ethanol and biodiesel feedstock.
Experiment Design

- The first phase of the project was to evaluate the adaptation of different crops to Fort Belknap environment and to test the quality of the crops for livestock feed, as well as for cellulosic ethanol and biodiesel feedstock.

- The experiment was complete block design with four replications.
Experimental Design (cont.)

- The second phase of the project was to test crop water use, to fine-tune fertilizer use, and to develop application recommendation.

- The experiment was a complete block design with four replications.
## Field Plot Layout

<table>
<thead>
<tr>
<th>101</th>
<th>Barley</th>
<th>301</th>
<th>Winter Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Winter Wheat</td>
<td>302</td>
<td>Canola</td>
</tr>
<tr>
<td>103</td>
<td>Canola</td>
<td>303</td>
<td>Barley</td>
</tr>
<tr>
<td>104</td>
<td>Camelina</td>
<td>304</td>
<td>Camelina</td>
</tr>
<tr>
<td>201</td>
<td>Canola</td>
<td>401</td>
<td>Camelina</td>
</tr>
<tr>
<td>202</td>
<td>Camelina</td>
<td>402</td>
<td>Barley</td>
</tr>
<tr>
<td>203</td>
<td>Winter Wheat</td>
<td>403</td>
<td>Canola</td>
</tr>
<tr>
<td>204</td>
<td>Barley</td>
<td>404</td>
<td>Winter Wheat</td>
</tr>
</tbody>
</table>
Sampling and Measurements

- Soil moisture
- Crop biomass
- Biomass and grain yield
- Lab chemical analysis for quality
Results

- Crop Growth and Water Consumption
Ideal crop biomass accumulation curve
Winter Wheat and Barley Biomass

Biomass Yield (lb/a)

W. wheat
Barley

Date (mm/dd/yyyy)

Canola and Camelina Seed Yield

<table>
<thead>
<tr>
<th>Crop</th>
<th>Seed Yield (lb/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola</td>
<td>2200</td>
</tr>
<tr>
<td>Camelina</td>
<td>1400</td>
</tr>
</tbody>
</table>
Water Uptake of Crops

**Wheat**

**Barley**

Water Content (%)
Water Uptake of Crops

Canola

Camelina

Water Content (%)

Soil Depth (inch)

0  5  10  15  20  25  30

0  10  20  30  40

21 Jul

7 Jul

23 Jun

7 Jun

Water Content (%)

Soil Depth (inch)

0  5  10  15  20  25  30

0  10  20  30  40

21 Jul

7 Jul

23 Jun

7 Jun
Discussion

- Student Training
  - Basic knowledge of field experimental design
  - Sampling method and sample processing
  - Yield estimation
  - Statistical analysis
- Extension and Outreach
  - Field day crop tour
  - On farm demonstration
Conclusion and Impact

- This project involved the research and extension personnel from MSU and FBC.
- The project provided FBC students with opportunities to directly participate in agricultural research, while enhancing the extension program’s outreach efforts among reservation farmers and ranchers.
- A few farmers accepted the crops and started growing winter cereal crops this year.
- Fort Belknap has 165,763 acres of crop land, if hay production is increased by 3 tons/acre, the total increase could potentially reach 0.5 million tons or $40 million.
Acknowledgement

- Students from FBC and MSU.
- Technicians from FBC and MSU.
- Funding support from USDA-Tribal Research Grant.
- Equipment and land use from FBC and MSU.
- Local tribal farmers for cutting and baling hay.
Thank you!