Diversifying Rotations: Crop Sequence Choices

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Moccasin, MT
Moccasin MT, USA

- 47.0528° N, 109.9100° W
- Elevation: 1275 m
- Mean annual precipitation: 15.3 in
- Mean annual temperature: 43°F

Figure 1. Latitude, longitude, elevation, and climate information for Moccasin in central MT.
Figure 2. Central MT counties used to compute land use in Fig. 3.
Figure 3. Major land uses of arable land dedicated to dryland cropping systems in central MT.
Warm-Season Crop Sequence Trial (p 76-78)

- Determine the impact of previous crop on wheat performance in a 2-yr crop sequence
Methods

• 26 crop/crop-combination treatments planted year prior to planting wheat

Buckwheat whole plot

Grain/seed

Cover/green manure

Forage

4.6 m
• Corn
• German and Hungarian foxtail, proso, and pearl millets
• Forage and grain sorghum, sudangrass, sorghum x sudangrass
• Teff
  • Spring wheat
• Buckwheat
• Mung bean
• Navy and pinto dry bean
• Soybean
• Spring pea

MIXES
• Maize + pinto bean
• Maize + grain sorghum + sorghum x sudangrass + cowpea
• Proso millet + pinto bean
• Spring wheat + barley + lentil + pea

• FALLOW
- Maize, Hungarian foxtail millet, proso millet, sunflower, maize + pinto bean, proso millet + pinto bean, WS mix
Results and Discussion
Figure 4. Winter wheat yield following cool-, warm-, and full-season crops along with fallow in central Montana during 2017.
Figure 5. Winter wheat grain protein following cool-, warm-, and full-season crops along with fallow in central Montana during 2017.

12.1% critical N threshold (Engel et al., 2006)
Conclusions
• Previous crop did not affect grain yield and protein compared with fallow in 3 of 4 yr.
  
  o Grain yield less following Hungarian and proso millet in 2017.
Crop Matrix Trial (p 74-75)

• Determine the impact of previous crop on subsequent performance in a (repeating) 2-yr crop sequence (i.e., ‘tight’ rotation)
Figure 6. Crop matrix planting design.
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Table 1. Grain/seed yield of five crops in 2-yr crop sequences at Moccasin and Contrad, MT.

<table>
<thead>
<tr>
<th>Crop</th>
<th>2019 Crop - yield (lbs/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Barley</td>
</tr>
<tr>
<td>Barley</td>
<td>1488</td>
</tr>
<tr>
<td>Canola</td>
<td>1700</td>
</tr>
<tr>
<td>Lentil</td>
<td>1627</td>
</tr>
<tr>
<td>Pea</td>
<td>1704</td>
</tr>
<tr>
<td>Spring wheat</td>
<td>1699</td>
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</tbody>
</table>

2019 Matrix Study - MSU Northern Triangle Agricultural Research Center
Conclusions (concluding remarks)

• Recently received funding from the MT Wheat and Barley Committee to expand this project to incorporate soil fertility and water, and pathogen data.
Rotation And Tillage Systems (p 79-81)

• Determine the impact of diversifying wheat-based cropping on crop performance and economic/environmental sustainability
Figure 7. Winter wheat & spring wheat yields in CARC RATS study.
Funded was provided from the Montana Wheat and Barley Committee & federal Hatch funds for project