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For the Agricultural Horizons Team

Interim Report

Objectives: The objectives of this project are to: a) evaluate the impact of alternative crops on establishment, growth, yield, and economics of winter wheat and spring cereals, and b) evaluate the impact of winter and spring cereals on establishment, growth, yield, and economics of spring seeded alternative crops in a continuous cropping system. Due to the lack of available funds the project was scaled back from what was proposed. We only conducted the study at one site and included only three broadleaf and two cereal crops. The experiment addressing objective B was not initiated at this time.

Key Words: alternative crops, crop rotations, chemical fallow

Statement of Problem: Lack of information about the effect of alternative crops on cereal grain production has limited the effectiveness of designing profitable crop rotations in the intermediate rainfall area of Washington.

Zone of interest: Intermediate rainfall zone

Abstract of Research Findings:
A study was initiated at the WSU Wilke Research and Extension Farm near Davenport to evaluate the effect of broadleaf and cereal crops on establishment, growth and yield of winter wheat and spring cereals. Results from the first season of a two-season study showed that spring cereal yield greater and there are more options for weed control than broadleaf crops. Weed competition and dry conditions caused yellow mustard yield to be lower than expected based on available spring moisture. Pea yield was average or above average based on past experience. Spring wheat and barley yield was equivalent to surrounding fields. Safflower yield had not been determined at the time of writing but used significantly more moisture than other crops and also had severe broadleaf weed problems. Chemical fallow had a net loss of one inch of moisture in a six foot profile over the growing season. Winter wheat was seeded in October 2003 and spring wheat and barley will be seeded in the spring of 2004.

Results and Interpretation:
Evaluation of impact of alternative crops on cereal yield. The focus of this project is to determine the impact of alternative crops on winter and spring wheat and barley. Results from the four year Wilke project concluded that cereal production in a rotation was generally the only crop that was profitable, therefore, maximizing cereal yield (especially winter wheat) in a rotation is desirable. The experiment was conducted at the WSU Wilke Research and Extension
Farm near Davenport, WA in an area with historically 15 inches of precipitation per year. Yellow mustard, spring pea, safflower, spring wheat and barley were seeded in the spring of 2003. Crops were fertilized at time of seeding based on soil tests and projected crop yield. Chemical fallow was included as another alternative in a rotation as potential to increase winter wheat yield. Prior to seeding, the plot area was treated with glyphosate to control weeds and volunteer cereals. The experimental design of the study is a split-block arrangement of a randomized complete block with alternative crops as main-plots and winter wheat and spring cereals as sub-plots and crops being randomized within a block with four replications. Main plots were 36 by 36 feet and sub-plots are 12 by 36 feet. Replications are separated with alleyways to allow equipment operations between replications and alleys will be seeded to a spring cereal. Crops were seeded into cereal stubble in a field that have been direct seeded for five years with a double disk direct seed plot drill that seeds six feet and has the capability to supply the complete fertilizer requirement at seeding time.

Crop establishment and weed populations were assessed by counting the number of plants in two 0.25 m² areas in each plot. Weeds were treated using registered herbicides if any. The chemical fallow plots were kept weed free applying glyphosate when needed. Yield was determined by harvesting a 1.5 m by 35 feet swath in a representative area of each plot using a small plot combine. Soil moisture in the profile to 6 feet were evaluated gravimetrically prior to planting and after crop harvest to determine crop use during the growing season to evaluate crop water use. Rainfall during the growing season was monitored. Winter wheat was seeded on October 18, 2003, into previous crop residue and spring wheat and barley will be seeded in the spring of 2004.

Populations for broadleaf crops were in the range considered to be normal and initial weed populations were fairly low (table 1). As the season progressed, late germinating weeds caused significant competition with yellow mustard and safflower potentially decreasing yield. At harvest time, all three broadleaf crops were infested with large lambsquarters and Russian thistle plants at high populations. This was due to the lack of effective herbicides to control broadleaf weeds in these broadleaf crops. Cereal crops were treated with labeled rates of Harmony and 2,4-D and weed populations were kept in check. Chemical fallow plots required 4 applications of glyphosate to control weeds. Late in the summer, Russian thistle became difficult to control in the chemical fallow plots. It required 2,4-D to be mixed with glyphosate to effectively control Russian thistle. Because of weed infestations and lack of rainfall during the growing season caused yellow mustard yield to be lower than expected. Pea yield was not as affected by weed competition because of early maturity before weeds competed with the crop. Cereal yields were equivalent with other crop yields reported in the area.

During the growing season, safflower used significantly more water for production than the other crops and all other crops used nearly the same amount of water (table 1). A net one inch of water was lost from the chemical fallow plots during the growing season but there was sufficient moisture in the seed zone for seed germination due to timely rainfall.

As mentioned previously, spring wheat and barley will be seeded and the experiment will be repeated in the spring of 2004. Also, a study evaluating the establishment of alternative crops after wheat or barley will be established in the spring of 2004.
Table 1. Crop establishment weed populations, yield and water use.

<table>
<thead>
<tr>
<th>Crop (variety)</th>
<th>Stand plants/A</th>
<th>Weed population plant/m²</th>
<th>Yield lb/A</th>
<th>Water use in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow mustard (IdaGold)</td>
<td>228,731 a</td>
<td>7.5</td>
<td>229</td>
<td>4.8</td>
</tr>
<tr>
<td>Pea (Cruiser)</td>
<td>121,968 b</td>
<td>6.5</td>
<td>882</td>
<td>4.6</td>
</tr>
<tr>
<td>Safflower</td>
<td>143,748 b</td>
<td>5.5</td>
<td>1551</td>
<td>4.8</td>
</tr>
<tr>
<td>Barley (Baronesse)</td>
<td>217,800 a</td>
<td>2.0</td>
<td>1712</td>
<td>4.4</td>
</tr>
<tr>
<td>Spring wheat (Alpowa)</td>
<td>143,748 b</td>
<td>2.0</td>
<td>1712</td>
<td>4.4</td>
</tr>
<tr>
<td>Chemical fallow</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>34.249</td>
<td>4.1</td>
<td>285</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Crop water use is calculated by collecting soil moisture at beginning of season subtracting soil moisture at season end plus any precipitation recorded.

Interaction With Other Scientists Conducting Related Activities:
This project is complimentary to other cropping systems projects currently funded by STEEP. This includes Bill Schillinger, Joe Yenish, Don Wysocki, Jim Cook, Dennis Roe.

Publications and Presentations:
This project was shown and discussed at the 2003 Wilke Field Day attended by 52 people.