Camelina as an Alternative Crop in Wheat-Fallow Rotation

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Introduction

Rainfall in the Great Plains (GP) is often scarce, and its distribution is variable; thus, efficient management and use of available moisture is required for dryland agriculture to be productive. As a result, wheat-fallow rotation has been a common production system throughout the GP because this system is simple, and the fallow period may conserve soil moisture. The wheat-fallow rotation, however, is often not very economical. Average rainfall within the two-year period of the rotation is more than a single wheat crop can typically use. Continuous cropping, on the other hand, increases moisture usage and helps to insulate the soil surface against direct solar energy. This makes it possible to crop more than once every two years.

Replacing the fallow period with an alternative crop in the wheat-fallow rotation could broaden herbicide options and break up the pest and disease cycle. Diversity of the species used in the cropping system may improve soil quality, as different plants use and replenish different soil nutrients. The crop adopted to replace the fallow period must have an agronomic benefit to the cropping system and also provide economic benefits to the farmer.

Camelina offers potential as a possible substitute for the fallow period in the semiarid and arid regions of the GP, including eastern Wyoming, and it also has potential in the Bighorn and Wind River basins of northwest Wyoming. It is a short-season (85–100 days) and drought-tolerant crop. In general, camelina is compatible with existing farm equipment, and, when cultivated on low-fertile lands, it is usually able to do well. Besides the agronomic benefits, the potential for wide application and use of camelina help make it a good choice. Among the uses are low-cost feedstocks for biofuel and animal nutrition. Additionally, the fatty acids contained in camelina can be used in a variety of skin products.

Objectives

The goal of the study was to evaluate water use of camelina and its impact on winter wheat productivity when the fallow period in the wheat-fallow rotation is replaced with camelina.

Materials and Methods

This is an ongoing project at the Sheridan Research and Extension Center (ShREC). ‘Yellowstone’ winter wheat and ‘Blaine Creek’ spring camelina were seeded at 60
pounds/acre (lb/ac) and five lb/ac, respectively. Due to limited seed availability, winter camelina was not seeded in the first year of the study. Data was collected on plant emergence, seed yield, plant materials left on the field after harvest (residue biomass), and percent yield loss from shattering (breaking of the seed pod) during harvesting. A 3 ft x 3 ft area from each plot was harvested immediately as the plot matured. After the first harvest, a 5 ft x 20 ft area was harvested from each plot when plants had all matured. Yield differences between both harvests were expressed as a percent of yield loss.

A neutron probe was used to measure soil moisture in 8-inch depth increments to 40-inch total soil depth.

Results and Discussion

Effects of the cropping systems can only be assessed after the second year of the growing season, so treatment comparison was not made. Preliminary results, however, show that camelina has good promise as a well-adapted crop for dryland cultivation in areas of Wyoming and perhaps beyond (Table 1). Average seed yield was 943 lb/ac for camelina and 3,680 lb/ac (61.3 bushels/ac) for wheat. Percent yield loss due to shattering of camelina was 35.4% and for wheat 18.7%. To curtail this constraint, swathing (pre-harvesting a crop before maturity) of camelina should be considered; however, optimum time to swath needs to be studied since early swathing could potentially reduce oil yield and quality of the crop. The average days to flowering and maturity of camelina were 44 and 80 days, respectively. This is shorter than what is commonly reported in literature, most probably due to late seeding (May 13, 2013). Average residue biomass of wheat and camelina were 7,461 and 3,556 lb/ac, respectively.

In general, moisture depletion of camelina was primarily within the 16-inch soil depth, whereas that of wheat was within 24–40 inches (not shown). Data collected in subsequent years may allow us to make a conclusion about the impact of replacing the fallow period with camelina.

Table 1. Average growth and yield of camelina and wheat for the first growing season.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Plant height (inches)</th>
<th>Seed yield (lb/ac)</th>
<th>Residue biomass (lb/ac)</th>
<th>Yield loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>39.3</td>
<td>3,680</td>
<td>7,461</td>
<td>18.7</td>
</tr>
<tr>
<td>Camelina</td>
<td>30.1</td>
<td>943</td>
<td>3,556</td>
<td>35.4</td>
</tr>
</tbody>
</table>

Acknowledgments

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