Strategies for wheat producers facing climate change

Clark Seavert (clark.seavert@oregonstate.edu) OSU, Laurie Houston OSU, and Matt Miller OSU

Climate change researchers project that fall and winter rainfall will increase in the Pacific Northwest. These changes pose interesting management decisions for wheat farmers in the low rainfall regions of the Pacific Northwest.

Wheat regions in the Pacific Northwest can be separated into three precipitation zones based on annual precipitation: less than 12 inches, 12 to 18 inches, and 18 to 24 inches. Where annual precipitation is less than 12 inches, a wheat/fallow rotation is followed. In the 18- to 24-inch zone, continuous cropping is practiced, with wheat as a crop option. In the 12- to 18-inch zone, crop options range from a wheat/fallow rotation to crops grown on an annual basis, depending on soils and management. The general trend toward increased winter precipitation increases the possibility of successfully planting on an annual basis within the 12- to 18-inch precipitation zone. Some farms within this zone already successfully plant on an annual basis and are interested in adding diversity to their operations by adding peas or biofuel crops such as canola and camelina into their rotations (Figures 1–3).

REACCH researchers recently set up a case study to demonstrate how AgTools™ software can be used to evaluate the profitability and feasibility of such changes in crop rotations at the individual farm level. This software is designed to analyze a farm’s liquidity, solvency, profitability, and repayment capacity. This case study was set up to represent a plausible farm in eastern Oregon that receives an average of 16 inches of rainfall annually. It is representative of a 3,800-acre wheat farm that currently follows a winter wheat/fallow rotation on 1,425 acres each year using direct-seeding (no-till) practices. Half of the acreage is cropped each year, and the other half is left in chemical no-till fallow to conserve soil moisture, reduce soil erosion, and reduce fuel usage. Additionally, 475 acres are planted to spring wheat. Thus, each year, the farm has 1,425 acres in winter wheat and 475 acres in spring wheat following 1,900 acres of fallow.

Most farms in this zone practice summer fallowing to capture moisture in the fallow phase to increase crop yield in a dry year and reduce crop yield variability. On shallow soils that are unable to store substantial moisture, such as the north, east, and south fields from the case study, fields are not fallowed even though yields are low. Some farms in the same precipitation zone crop wheat annually on deeper soils, and climate change is expected to make this practice more common in the region.

The increased winter precipitation anticipated with climate change is expected to increase wheat yields. However, researchers in the REACCH project have estimated that the annual variability in wheat yields could increase by as much as 20 percent with higher incidences of insects and wheat diseases. Also, experiments with crop rotations that incorporate biofuel crops have shown promise for the potential of increased wheat yields and increased net returns.

In the past, the grower felt the added equipment expense for this farm, along with labor and input costs, did not justify the marginal annual sales generated from switching to annual cropping of wheat or other crops. However, costs have been rising over the past several years, and the farm’s net income has been declining each year. Thus, the grower has decided to examine the feasibility of alternative cropping rotations.

University research and Extension faculty, industry representatives, and agricultural lenders were consulted to obtain current loan and balance sheet information, along with expected future yields and prices for winter wheat, spring dry peas, winter canola, and camelina over a 10-year period. This information was inputted into the AgTools™ software to conduct an economic assessment of the various cropping rotation options to determine how changes in input and output costs and changes in projected debt-

Figure 1. Camelina is an ancient oilseed crop with new potential. Photo by Darrin Walenta.
to-asset ratios would impact the financial position of this representative farm in the future. In addition to the changes in inputs and outputs associated with changing to a continuous cropping system, the farm also needs to obtain a $325,000 loan to purchase an additional tractor and combine to complete the farming operations in a timely manner. Three alternative crop rotations were considered: winter wheat followed by dry peas, winter wheat followed by canola, and winter wheat followed by camelina. The cash flow was estimated for each of the owned and leased fields on the farm to project net income on the farm.

The projected net incomes from each crop rotation are presented in Table 1. Using an 8% discount rate, the net present values were calculated to determine the most profitable crop rotation.

The results are presented in Table 2. From a profitability perspective, a continuous winter wheat and canola cropping system was the most profitable across all field types on the farm. The second most profitable system on the north and east fields was winter wheat and camelina, while winter wheat after dry peas fared slightly better on the leased south and west fields. Looking at the feasibility of each cropping system on a whole-farm basis, the winter wheat following canola cropping system generated higher net incomes, lower debt-to-asset ratio, and higher current ratios over the 10 years. Thus, the additional investment in machinery to switch to a continuous cropping system of winter wheat and canola would generate higher profits for this farm than their current practices.

As shown by this example, AgTools provides a useful decision tool for growers. It allows them to better understand financial and planting options, as well as associated impacts to farm profitability under uncertain future climates, technologies, and prices.

Table 2. Net present value of 10 years’ net returns for possible crop rotations by field.

<table>
<thead>
<tr>
<th>Crop rotation</th>
<th>North field ($/acre)</th>
<th>East field ($/acre)</th>
<th>West field (leased) ($/acre)</th>
<th>South field (leased) ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat after fallow</td>
<td>639</td>
<td>1,113</td>
<td>231</td>
<td>65</td>
</tr>
<tr>
<td>Wheat after dry peas</td>
<td>231</td>
<td>65</td>
<td>589</td>
<td>490</td>
</tr>
<tr>
<td>Wheat after canola</td>
<td>1,466</td>
<td>2,039</td>
<td>758</td>
<td>669</td>
</tr>
<tr>
<td>Wheat after camelina</td>
<td>953</td>
<td>1,490</td>
<td>431</td>
<td>319</td>
</tr>
</tbody>
</table>

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