Project Title: Examine the effect of cropping systems that include canola (*Brassica napus* L.), yellow mustard (*Sinapis alba* L.) or oriental mustard (*B. juncea* L.) on yield of subsequent spring wheat in western Whitman County, Washington State

2. Determine the rotational effect of oriental mustard compared to spring wheat, canola, and yellow mustard on subsequent spring wheat yield in direct seed systems.

Materials and Methods

Both objectives were investigated using a large-plot study grown on the Stubbs farm near Dusty, Washington over a period of three years beginning in April 2005. In the spring of 2005 and 2006, a rotational crop

driving in the adjacent crop. An application of a broadleaf herbicide such as bromoxynil, described below, could have been substituted for the hand-weeding. During the second year of the study, herbicides were applied to all crops on May 25, 2006 with a shielded plot sprayer to prevent off-target drift. Grassy weeds were controlled in the canola and mustard plots with an application of Select herbicide (clethodim) at 6 fl. oz. of product per acre, and broadleaf weeds were controlled in the canola plots with an application of Stinger herbicide (clopyralid) at 4 fl. oz. per acre. A tank mix of Rhino (bromoxynil and MCP ester) and Puma 1EC (fenoxaprop-p-ethyl) herbicides at a rate of 16 fl. oz. and 10 fl. oz. per acre, respectively, was applied to the spring wheat in the rotational crop trial to control broadleaf and grassy weeds. While not applied as part of this study, a post-harvest treatment of Surefire herbicide (diuron and paraquat dichloride) is typically used to control Russian thistle after a yellow mustard crop on the Stubbs Farm. This treatment is usually necessary on approximately half the yellow mustard acreage.

Weeds were controlled in the recrop trial during both years with the same herbicide regime used in the surrounding commercial field. Weed control began with a fall application of glyphosate, followed by a second, pre-plant application of glyphosate in the spring. A post-emergence application of Bronate (bromoxynil and MCPA) was used to control broadleaf weeds in the crop.

The first year of the rotational crop study was harvested on August 8, 2005. In the second

more than IdaGold and Hyola 401, but in 2006, Pacific Gold had the lowest yield in the trial, while Hyola 401 canola and IdaGold yellow mustard had similar, intermediate yields (Table 1). In addition to the change in ranking, yields of the mustard and canola plots were reduced in 2006 as compared to 2005. These differences between years are likely due in part to increased stress caused by less early spring rainfall in 2006 and unseasonable high temperatures during May 2006. Lower seed oil content in 2006 also suggests that this year had higher levels of stress than 2005.

Table 1. Stand counts, yield and percent oil of rotational crops grown near Dusty, Washington during 2005 and 2006.

CROP	STAND		YIELD		OIL CONTENT	
	2005	2006	2005	2006	2005	2006
	plants/ ft of row		*lbs/acre*		*percent*	
Wheat	7.0	10.6 a	2271 a	2615 a	*	*
Oriental Mustard	5.3	6.4 b	1737 b	624 c	33.5 b	27.8 b
Yellow Mustard	5.8	5.4 b	1433 c	964 b	23.3 c	21.7 c
Canola	4.1	4.8 b	1036 d	999 b	34.6 a	32.4 a

Means with different letter suffixes are different at p=0.05 by Fisher's protected LSD.

When the data from both years is combined, spring wheat had the highest yield of all crops tested, the two mustards had similar yields, and spring canola had the lowest yield (Table 2.) Seed weight of the mustard and canola crops was distributed as expected, with yellow mustard having the largest seed and oriental mustard having the smallest seed. The seed weights found in this trial are typical for the drier areas of the Palouse region, and are in the low end of the acceptable range for commercial production. The oil content rank of the canola and mustards was also as expected, with canola having the highest percent oil and yellow mustard having the lowest. The oil content of the mustards is typical for those crops, but the oil content of canola was lower than ideal. This is not unexpected; western Whitman County is generally not considered an ideal environment for *B. napus*-type spring canola, and the environmental stresses seen in the region typically result in lower oil content in spring canola seed.

Table 2.

plots; total moisture remaining in 5 feet of soil after oriental mustard was 8.2 inches, with 5.9 inches of moisture remaining in the spring wheat plots. The difference in soil moisture contents found in 2006 was at 4 and 5 feet; the moisture remaining in the top three feet were similar between crops. The reasons for this are unclear, but perhaps root growth in the oriental mustard was limited the early season stress mentioned above, resulting in the lower moisture use and lower yield that was observed in 2006.

Recrop Trial. Results of the recrop trial indicate that the previous crop did not have an effect on a subsequent spring wheat crop yield or test weight averaged over both years (Table 3); although a previous crop of oriental mustard or canola did result in a gain in test weight versus growing wheat on wheat in 2006. (See previous report.) Stand counts of wheat were statistically similar across previous crop treatments.

Table 3. Spring wheat stand counts, yields and test weights when gr

Discussion

The economic analysis of the rotational crops suggests that yellow mustard can economically competitive with spring wheat in western Whitman County. Yellow mustard prices sometimes peak at levels higher than contract prices during the winter months, so if a grower is positioned to take advantage of those price peaks, the economic return of yellow mustard could easily equal or perhaps exceed that of spring wheat in western Whitman County. At current wheat prices ($11.78 per bushel), yellow mustard must be approximately $0.38 per pound for an equivalent return based on the yields achieved in this trial.

In this study, oriental mustard was not as economically competitive with spring wheat as yellow mustard, but this is primarily a function of current prices, because oriental mustard yielded as well as yellow mustard averaged over both years, and it has a lower differential production cost. Growers in western Whitman County should watch mustard prices and contracts carefully when choosing which mustard species to grow on their farms, since both are viable crops. Of course, growers need to consider commodity prices and production costs on at least an annual basis when choosing rotational crops.

Even though the cost of production of non-herbicide resistant canola was less than that of yellow mustard and spring wheat, canola was not economically competitive with spring wheat or either mustard species. This is primarily due to the low yields of spring canola seen in the trials, which were not unexpected for the region. Western Whitman County is typically considered to be a poor environment for growing *B. napus*-type spring canola cultivars due to the low rainfall and high summer temperatures. *B. rapa*-type spring canola cultivars are earlier and somewhat more resistant to high temperatures and might be an option for region.

No significant differences were seen in subsequent wheat yields. Even though the mean wheat yields were not exactly the same based the previous crops, the statistical analysis of the data indicates the small differences observed are due to error and/or random environmental effects. This is contrary to previous research and experience that has shown that wheat often performs better after a rotational crop such as mustard or canola, in part due to reduced disease pressure. The lack of differences in this project could be a caused by a number of factors; perhaps disease pressures were low across the entire experiment due to the environmental conditions, or perhaps the disease resistance package of the wheat varieties used was ideal for the conditions encountered. The fact that the mustard and canola crops did not reduce the yield of a subsequent wheat crop is also important. One of the reasons that this experiment was undertaken was to determine if the potential for mustard crops to use more soil water than other crops would be a detriment in western Whitman County. That was not the case in the experiment, suggesting that these crops will not have a detrimental effect on subsequent wheat crops.