Title: Stand establishment of winter canola in the low- to intermediate-rainfall zones of the Pacific Northwest

PI: Frank Young

Funding term and duration: FY 2011

Graduate student: Chasity Watt, WSU Department of Crop and Soil Sciences.

Technical support: Funding provides half-time support for an Associate in Research and time slip personnel through the Crop and Soil Sciences Department, Washington State University.

Background: Approximately 60% of the cereal and grain legume production areas of the PNW are characterized by the winter wheat/summer fallow system. This system is plagued by winter annual grass weeds such as jointed goatgrass, feral rye, and downy brome. Growers are becoming more interested in producing winter canola in this region to improve pest management strategies, diversify markets (food, fuel, and feedstock), and increase sustainability. However, winter canola stand establishment is a major impediment to growers in the non-irrigated, low- to intermediate-rainfall zones, so it is considered a high risk to produce. Even at best, an avid winter canola producer in an 11-inch rainfall zone experiences a 20% failure rate of establishing winter canola (Painter and Roe 2007). Traditional deep furrow planting techniques for winter wheat are not as reliable for winter canola because canola is very sensitive to the hot, dry soil covering the emerging seedling (Young et al 2008). The vast majority of winter canola research has been conducted in irrigated systems at Prosser, WA (Hang et al 2009), Lind, WA and pre-irrigated systems at Pendleton, OR. As with winter canola, very little spring canola research has been conducted in the wheat/fallow region with the exception of irrigated systems (Hang et al 2009) and one year when spring canola was planted in lieu of a failed winter canola crop (Young et al 2008).

Objectives
Research:
1. Determine the optimal seeding date, rate, and method for winter canola in the low- and intermediate-rainfall regions of the PNW to improve stand establishment, seedling survival, and crop yield.
2. Determine optimum row spacing and best variety of spring canola in north central WA.
3. Evaluate herbicides for feral rye control in winter canola to improve quality of future winter wheat crops and prevent herbicide resistance in weeds.
4. Evaluate several winter canola varieties for winter survival in north central WA.

Partnership and Community Development: Continue a partnership created in 2008 focusing on the Colville Confederated Tribes (CCT) to improve human and animal health, improve self-sustainability, and stimulate the local economy by creating jobs and keeping the dollar local.

Methods:
Objective 1: Sites were established near Okanogan and Bridgeport from 2007 to 2011 and near Pullman in the spring of 2008 and 2010. Winter canola was seeded at 4 lbs and 8 lbs/A throughout August and early September each year. In addition winter canola was planted at 2, 4, and 6 lbs/A on August 31, 2009. Roundup Ready® (RR®) winter canola was planted at all of the Okanogan and Bridgeport sites with a modified JD HZ drill. Modifications included a grass seed box for accurate seed rates, 10, 13, or 15”
shovels to move the hot soil out of the seed row, and 55 lb packer wheels to insure good seed-soil moisture contact.

**Objective 2:** In the spring of 2011, two glyphosate tolerant spring canola varieties (early and late maturity) and one glufosinate tolerant variety were planted in 7- and 14-inch row spacing at the same plants/A population. Data collected include crop population, yield, and oil quality.

**Objective 3:** A preliminary herbicide efficacy study for the management of feral rye was initiated in winter canola in the spring of 2011. Select (cethodim), Assure II (quizalofop), and Roundup (glyphosate) were applied early spring. Percent weed control, weed seed produced, weed biomass, and crop yield were recorded. The study is being repeated this year in a severe, natural infestation of rye. The same three herbicides will be applied in the fall, spring and both fall and spring.

**Objective 4:** Seven winter canola varieties were planted on August 9, 2011 at Bridgeport, WA (2,500 ft elevation) and August 17 at Okanogan, WA (1,500 ft elevation) to evaluate winter survival. Varieties included 2 GMO varieties and 5 conventional varieties (four *Brassica napus* and one *B. rapa*). Plant populations were recorded fall 2011 in three, 1-meter row areas per plot to compare to counts recorded in spring 2011.

**Results and Discussion**

**Winter canola rate and date of planting study:** The 2010-11 growing season concluded our rate and date study in north central WA. This study has been conducted for four years. “Camas” Roundup Ready® canola was planted at 4 lbs and 8 lbs/A on July 28, August 10, and August 18, 2010. The July 28th planting did not survive a hail and rain storm on July 31 which crusted the soil and prevented emergence. The remaining four treatments (4 and 8 lbs/A seeding on August 10 and 18) had nice stands going into the winter. Sun and growing degree days were lacking in the spring, however canola yield was excellent. As in the past, there was no advantage to increasing seed rate with regard to yield. When averaged over seeding dates, yield was 1,650 lbs/A at 4 lbs/A, and 1,580 lbs/A at the higher seeding rate. Canola yields for both August seeding dates were also similar – 1,605 lbs/A for the August 10th date and 1,620 lbs/A for the August 18th date.

**Spring canola row spacing and variety study:** When averaged over row spacing, Invigor (glufosinate tolerant) canola yielded 935 lbs/A compared to the glyphosate tolerant DKL late maturing (1,120 lbs/A) and early maturing (1045 lbs/A) varieties (Fig. 1). Yields were slightly higher in the 7-inch spacing for both the Invigor and late maturing DKL variety compared to the 14-inch spacing (Fig. 2). Both glufosinate and glyphosate controlled all annual grass weeds and Russian thistle.

![Figure 1](image1.jpg)  **Figure 1.** Spring canola variety trial.

![Figure 2](image2.jpg)  **Figure 2.** Spring canola row spacing study.
Preliminary herbicide efficacy study: Because winter canola plants had canopy closure in the fall of 2010, feral rye was sprayed only in the spring. Final feral rye control in mid-May was 74%, 64%, and 99% for Assure II, Select Max, and Roundup, respectively (Table 1). Feral rye biomass and head counts responded similarly within each herbicide treatment. In the plots treated with Roundup no seed heads were produced, and Assure II treated plots resulted in only three feral rye seed heads/yd². This is in sharp contrast to 255 feral rye heads/yd² produced in the untreated plots (Figs. 3 and 4). Winter canola yield increased 40% to 48% compared to the untreated check depending on the herbicide treatment.

Table 1. Effect of grass herbicides on feral rye control, biomass, seed heads, and winter canola yield.a

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Control</th>
<th>Rye Biomass</th>
<th>Heads</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>UongREATED</td>
<td>0</td>
<td>3,920</td>
<td>255</td>
<td>1,165</td>
</tr>
<tr>
<td>Assure II</td>
<td>74</td>
<td>823</td>
<td>3</td>
<td>1,635</td>
</tr>
<tr>
<td>Select Max</td>
<td>64</td>
<td>1,597</td>
<td>40</td>
<td>1,680</td>
</tr>
<tr>
<td>Roundup</td>
<td>99</td>
<td>290</td>
<td>0</td>
<td>1,730</td>
</tr>
</tbody>
</table>

*aBiomass and head counts recorded June 1, 2011. Control recorded on May 16, 2011.

Herbicide efficacy study 2011-2012: An herbicide efficacy study was initiated in the fall of 2011 in a natural stand of feral rye in Douglas County. Assure II, Select 2EC, and Roundup were applied to CP115 canola (glyphosate tolerant) on October 16, 2011. Three weeks later control of the initial severe feral rye population with Roundup was excellent; however controlling this population opened up the canopy and a new flush of feral rye was emerging and establishing (Fig. 5). This new flush of rye was not occurring in the untreated or other two herbicide treated plots because feral rye ground cover was complete in these treatments. Assure II and Select 2EC stunted the feral rye considerably.
Impact/Potential Outcomes: Our project has provided information to the USDA Risk Management Agency to procure crop insurance for winter canola in Okanogan and Douglas Co. This has decreased greatly the risk of producing winter canola. For example, a grower in Okanogan Co. lost 275 acres of winter canola in 2011, and was paid a guaranteed price for a production average of 1,500 lbs/A and $50/A to reseed to spring canola.

We have discovered the optimum time of planting is when “Mother Nature” tells you to – generally from August 5 to August 20-25 when cool weather is forecast. The past two years, growers have actually stopped wheat and canola harvest to plant their winter canola. Because of the innovative farmers we have cooperated with, our research in the area, and multi-agency sponsored field days, five new growers planted winter canola in Okanogan and Douglas Co. in August 2011. Winter canola acreage has increased from 15 acres to almost 2,500 acres since 2007. One member of the CCT planted 35 acres of winter canola in 2011. We have worked with the CCT to assist them in establishing an Agriculture Team focusing on canola production. The team has 45 acres ready to plant in the fall of 2012. After attending our 2011 spring canola field day at Okanogan, a grower in Okanogan Co. contracted to plant an irrigated circle of spring canola for seed increase.

Affiliated Projects and Funding. We are cooperating with USDA-ARS at Pendleton, OR to increase residue in the wheat/fallow region. We are duplicating the study at Ralston, WA. If we can increase residue and subsequent soil moisture we can no-till winter canola at the optimum time without a dust mulch.

We are also cooperating with ARS Pendleton on the use of in-line near infrared (NIR) spectroscopy for measurement of seed quality (canola seed oil concentration) in a moving stream. Spectra of samples from four crop years at three locations in WA were obtained by sliding grain directly across the sensor. Reference analytical results were estimated using NIR optical spectra as regression estimators. The resulting prediction equation resulted in a coefficient of determination ($R^2$) of 0.987 and standard error of prediction of 0.4167%. These results demonstrated that in-line NIR spectroscopy is capable of accurately monitoring a grain stream for oilseed quality. These findings have important implications for screening in breeding trials and providing information to the oilseed processing industry during harvest.
We received a small grant from the CCT to expand oilseed production into the other tribal districts and to advise them on planting canola.

**Publications:**


**Proposed Future Research/Extension:**
- **Research:** Continue with herbicide efficacy study, spring canola row spacing, and winter canola variety winter survival study. Establish cropping systems/stripper header study at Ralston so we can produce winter canola on chemical fallow.

- **Program and Community Development:** Assist the CCT Ag Team in implementing their Conservation Innovation Grant to plant oilseeds in eastern 3 districts. A hands-on workshop is planned for the CCT spring 2012 to learn how to calibrate drills and set drills for planting.

- **Extension/Outreach:** Participate in field day hands-on workshop to educate the CCT on how to calibrate drills for planting canola, prepare seedbed, and harvest the crop.

**References:**

