

Irrigated Spring and Winter Canola Production in Washington

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Winter and spring canola have been produced on limited acreages in Washington State for many years. However, that concentration is rapidly expanding due not only to food (canola oil) and feed (canola meal) demand, but state and federal mandates for increased biofuel production from in-state feedstocks.

In 2007, over 5,000 acres of irrigated winter and spring canola were grown in Washington State, primarily in the Columbia Basin. Irrigation reduces crop establishment problems that dryland producers face, and producers and researchers alike are finding that canola in particular suppresses weeds, diseases, and pest populations. Numerous reports indicate significantly higher crop yields following canola, and combined with higher market prices for the crop, there is reason to consider canola as part of your rotation. Research at Prosser, Othello, and Paterson, Washington, is helping determine the best varieties and agronomic practices for optimal irrigated spring and winter canola production in this region.

Canola Defined

Canola and rapeseed belong to the *Brassicaceae*, or mustard family, which also includes turnip, cabbage, mustard, and Brussels sprouts. Rapeseed has been grown since the 13th century in Europe for lamp oil, and was used during World War II as a lubricant in ships. After many years of breeding and selection in Canada, canola (derived from **C**anadian **o**il, **l**ow **a**cid) was developed with lower erucic acid in the oil and low glucosinolate content in the meal to be more valuable as a cooking oil and more palatable for use in livestock feed meal.

Canola oil is one of the healthiest and most affordable oils available for cooking, and the canola meal remaining after oil extraction is an important source of high-protein meal for livestock feed. The two most common types of canola are *Brassica napus*, an Argentine variety, and *B. rapa*, a Polish variety. Spring *B. napus* requires 105–110 days to mature, while *B. rapa* is a shorter season crop at 85–90 days to maturity. *B. rapa* has a smaller seed, is more heat



Figure 1. Irrigated winter canola at full bloom (photo by Karen Sowers).

and freeze-tolerant, and less prone to shattering than *B. napus*, but has lower seed and oil yield potential (Hang et al., 1982).

Crop Rotation

The most important parameter to consider before planting canola is plant-back restrictions based on herbicide use in the previous crops grown in the field(s) you will be using. Read all information on herbicide labels to determine the best crop sequence to avoid any herbicide carryover in canola fields. An example rotation for irrigated production in central Washington is winter wheat–potatoes–winter wheat–winter canola. This rotation produces winter canola once every 4 years. Successive canola crops can increase the risk of disease, decrease yield, and increase weed pressure, much like any other continuous crop rotation.

Canola uses residual fertilizer effectively after potatoes or wheat, and the deep taproot of canola can absorb the residual nitrogen (N) that moves below the root zone of many crops. At Prosser, yield increased by 24% for spring canola in rotation after spring wheat compared

to continuous canola, which may be attributed to residual N uptake. Many growers have reported increased wheat yields following canola in rotation. The yields of potato and spring wheat crops following spring canola were 25% and 20% greater, respectively, than with continuous potato or spring wheat at the Roza Research Farm, WSU Prosser (Hang, 1996).

Besides the yield benefit to succeeding crops, canola increases water infiltration with its root structure and breaks pest, disease, and weed cycles. Canola is not a host of or susceptible to the Russian wheat aphid, Hessian fly, or wheat diseases such as take-all and eyespot, which may explain subsequent wheat yield increases. It is also important to consider that no additional equipment beyond that used for wheat or other small grains is required for canola production; however, some modifications of existing equipment may be necessary.

Varieties

Numerous and long-term national and regional canola trials at Prosser, Othello, and Paterson include herbicide-tolerant varieties that should be considered when choosing the best variety for the conditions in your area. Recent studies of irrigated winter and spring canola showed significant yield differences, particularly among winter varieties (Table 1). Unusually low temperatures in the Columbia Basin during May and June 2008 may have contributed to the yield reduction of Salute, a *B. rapa* variety, more than the *B. napus* varieties that mature later. The Salute had already completed the critical blooming stage and had begun pod fill during the cold weather, while the other varieties were 15 days behind in growth and development.

Table 1. Yield results for irrigated winter canola grown at Othello, Washington (2007–08).

Variety ¹	Yield (bu/a) ²	Yield (lb/a)	Test weight (lb/bu)
Rapier	103	5,258	50.9
Athena	105	5,632	51.4
DKW 13-86	112	5,756	51.6
Camus	71	3,609	50.8
Baldur	116	5,904	51.1
Salute	24	1,175	49.2

¹ All varieties are *B. napus* except Salute, which is *B. rapa*.

² Planted September 10, 2007, and harvested July 23–24, 2008.

Winter canola varieties consistently yield higher than spring ones in the Columbia Basin (Table 2). While emergence and fall growth may vary between cultivars even under irrigation, yield and oil concentration differences appear to be less significant, particularly for winter canola (Hang, 1994). Field studies are currently underway at Prosser to determine

various N rates and timing dates and irrigation effects on several winter canola varieties.

Table 2. Yield results for irrigated spring canola grown at Paterson, Washington (2006–07).

Variety ¹	2006 ²	2007 ³
KAB360	1,652	2,135
InVigor5630	1,924	1,503
Python CF	—	1,703
Rugby	—	1,950
Hyclas 712	1,261	1,840
Hyclas 905	1,568	2,180
Hyclas 924	1,664	1,345
Sterling	1,294	—

¹ All varieties are *B. napus*.

² 2006—Planted June 3, 2006, and harvested September 12, 2007.

³ 2007—Planted April 27, 2006, and harvested August 15, 2007.

Results for the Pacific Northwest spring and winter canola variety trials are published online at <http://www.ag.uidaho.edu/brassica/for growers.htm#Field%20Trial%20Results>. Several Washington State locations were investigated in the studies, including irrigated trials at Moses Lake.

Seeding

Seedbed preparation

Because canola seed is very small, proper seedbed preparation is critical to successful germination and early seedling growth. Large soil clods, surface crusting, and uneven residue distribution can all be detrimental to seed germination and establishment. Preplant irrigation and packing will ensure a firm, moist seedbed that is essential for attaining maximum germination and emergence. A hoe drill or double disc drill followed by a packer or a press wheel has been satisfactory in irrigated field trials.

Planting date

Winter canola is planted in the fall from late August to mid-September in central Washington. Research over the past 20 years shows that planting winter canola a month before early fall frost is safe for winter survival. If the plant reaches the 8-leaf (rosette) stage before frost, most winter canola varieties can survive temperatures down to 21°F without snow cover. Late-planted winter canola (mid-October) has increased risk of winterkill, as the plant is not mature enough to withstand freezing temperatures (Hang, 1986). Although the crop may make it through the winter, stands and yield will likely be poor. However, oil concentration is not affected by planting dates.

Spring canola is planted from early April to early May depending on the soil moisture and temperature and



Figure 2. Canola at rosette stage (photo by Becky Lyle).

type of canola. *B. napus* cultivars yield best with early to mid-April seeding, while the optimum planting time for *B. rapa* is mid-April to early May (Hang and Gilliland, 1984). Early planting can have positive effects on seedling vigor, yield, and oil concentration if the seed has sufficient soil moisture from winter precipitation or irrigation to germinate. Good seedling establishment can also reduce weed pressure by forming a canopy quickly enough to suppress weeds. Ideally, canola needs to set blooms before temperatures reach 90°F, when this level of heat can decrease flower fertilization and result in poor pod set and subsequently lower yields.

Seeding rate and depth

Recommended seeding rates vary slightly between canola varieties, but average 4–7 pounds of seed per acre. The smaller seed size of *B. rapa* canola varieties allow a lower seeding rate of 4 lb/A, while the larger-sized *B. napus* varieties typically require a higher seeding rate. Irrigated canola research trials have found optimum seeding depth is from 3/8" to 3/4". Canola seed placed deeper than 1" resulted in delayed emergence, weak seedlings, high weed pressure, and lower yield. Because canola is an indeterminate plant, it can compensate to some extent for sporadic plant population by increasing the number of branches and pod set. The recommended plant density is 6–8 plants/ft². Row spacing for irrigated trials is typically from 6 to 12 inches. Wider row spacing may result in increased weed pressure.

Fertilizer

Fertility is a key factor in canola growth and development. The fertilizer response of irrigated winter canola is similar to that of irrigated winter wheat. With fertilizer prices on the rise, soil testing is critical to determine baseline nutrient levels prior to fertilization. Any supplemental fertilizer required should be based on available nutrients and expected yield. Irrigated winter canola yields have

historically been double that of irrigated spring canola, so it is important to know the expected yield when determining fertilizer requirements. Research in Oregon showed N requirements at 7 lb per 100 lb of seed yield/A (cwt/A) (Wysocki et al., 2007), while central Washington trials suggest optimum N rates may be as low as 4–5 lb per cwt/A. N application can be split between the fall and spring with approximately one-third applied at or before planting. Early spring N application should be top-dressed, as side-dressed N can damage roots, promote vegetative growth and lodging, and delay maturity, all of which can significantly reduce seed yield and seed quality.

Recent research at Prosser has relied on spring soil tests to determine if fall-only applications of N fertilizer are sufficient. Contrary to dryland canola research, excessive fall growth or winter damage was not observed, nor were yields reduced. However, additional research is needed to confirm these results.

Sulfur (S) is another important nutrient for canola; required levels are higher than for other grain crops. The recommendation for central Washington is to bring soil S (applied preplant) to 35 lb/A, with a total N:S ratio (soil plus fertilizer) of 5:1. Canola will also respond to potassium and phosphorus if soil test levels are not sufficient to meet yield goals. Phosphate applied with the seed should not exceed 50 lb P₂O₅/A (25 lb P/A) to avoid stand reduction.

Weed Control

A good weed control program is essential because canola is very uncompetitive in the seedling stage. Lower seeding rates or poor seed germination can result in fewer plants per unit area, so it takes longer for the crop to cover the ground and thus gives weeds more time to establish and compete with young seedlings for nutrition, water, and light. As noted in the crop rotation discussion, knowledge of plant-back restrictions is necessary for successful weed control and crop production. Do not plant canola on wheat ground treated with long-lasting residual herbicides or after legumes where imazethapyr (e.g., Pursuit) was used.

Preemergence weed control is normally used at seedbed preparation for both spring and winter canola. Herbicides such as trifluralin (e.g., Treflan) can be applied and incorporated in the top 4 inches of soil to control broadleaf weeds and certain grasses before planting. Winter canola competes well with weeds in the spring because of early establishment and growth. With spring canola grown on sandy soils, clopyralid (e.g., Stinger) can be used to control nightshade at the 1–2-leaf stage and when canola has at least 2 or more leaves. Sethoxydim (e.g., Poast), quizalofop (e.g., Assure II), or clethodim (e.g., Select,



Figure 3. Irrigated winter canola at mid-bloom (photo by Karen Sowers).

Select Max) compounds can be used to control grasses at the 3-leaf stage. Note that canola is very sensitive to 2,4-D, particularly during the early growth and development stages, so extra care is needed when applying 2,4-D to neighboring crops to minimize drift onto canola.

For the latest recommendations, consult the annually updated *Pacific Northwest Weed Management Handbook*, which includes specific herbicides labeled for canola. Before using any chemical, read and follow the label for recommended rates and use.

Pests and Diseases

Canola seed planted in Washington can be treated with fungicide to prevent seedling disease pressure, particularly blackleg, which can affect other *Brassica*

crops. Because blackleg has not been identified in Washington, it is important to maintain this status as a blackleg-free state. Purchasing certified seed is the best way to prevent this and other diseases from establishing here. Consult your county Extension agent or seed dealer for more specific recommendations for your local area.

Although flea beetles have not been a problem at Prosser or Paterson, they have been observed in canola grown near Walla Walla, Washington. Flea beetles can cause serious injury to canola by feeding on cotyledons and the first true leaves of canola seedlings. Helix XTra or Helix Lite is recommended for use with canola seed to control early seed and soilborne diseases and flea beetle infestations as well as promote more rapid and uniform stand establishment. After a mild winter, spring canola should be monitored regularly for aphids at pod set. For more detailed information on pest management of canola, see the WSU Extension publication *Crop Profile for Canola in Washington*.

Water Requirements and Irrigation

In the United States, irrigation information for canola is very limited, but the crop is known to be responsive to irrigation, particularly in dry climates. Canola does not perform well in flooded situations, so careful irrigation management is required to maximize water use efficiency and yield. Research trials on loam soils at Prosser and sandy soils at Paterson found 1 (loam soil) to 3 (sandy soil) preemergence irrigation applications were necessary to provide sufficient moisture for winter canola germination. If there is an extremely dry fall, an additional irrigation will benefit canola establishment before winter. Irrigation should



Figure 4. Spring-flowering canola under critically-timed center pivot irrigation near Othello, Washington (photo by Becky Lyle).

be started again in mid-April when the crop resumes growth, and continue through blooming. Canola will grow quickly during this developmental stage, and timely irrigation will result in higher yields.

Irrigation scheduling studies at Prosser showed significant yield increases in 2 cultivars with 5 spring irrigations, indicating a late irrigation at pod filling is beneficial (Hang and Gilliland, 1988; Gilliland and Hang, 2001). In another 2-year study at Othello, Washington, seed yields of all winter canola cultivars tested in the first year increased as irrigation increased, yet maximum yields were not achieved at the highest irrigation level (Table 3). In the second year, both fertilizer and irrigation were increased in order to reach the optimum potential yields of these varieties (Table 4). Results from both years showed yields were optimum at 9–13" of irrigation water applied. Yield increases above that level were not enough to justify additional irrigation water. Optimal total water (irrigation plus precipitation and soil water) for canola is therefore 20–22", or 80–90% of evapotranspiration (ET) in central Washington.

To help you determine the most efficient amount of irrigation to apply on your farm, consult AgWeatherNet for ET, rainfall, and related information. Additional irrigation studies are ongoing

to provide more information to growers about best management practices for irrigated canola.

Irrigation should end by pod and seed-fill or when leaves drop, which is typically 3 weeks to a month before harvest. Another method to determine when irrigation should end is to look at a random sampling of seed pods. If some seeds are brown, it is time to end irrigation to allow sufficient time for pod fill and drying prior to harvest.

Spring canola requires a similar amount of irrigation water as winter canola, about 10–12". Begin irrigating soon after emergence and continue until full pod set. Critical watering periods include establishment and throughout flowering, which will occur during the hot summer months when ET is very high.

Harvest and Storage

Winter canola is harvested from early to mid-July in the Columbia Basin. Spring canola is not ready for harvest until mid to late August. Pod fill and seed maturity occurs during the last month of canola growth. Check canola fields several times a week before harvest to determine when the crop is ready for harvest. Canola pods ripen from the bottom to the top of the plant. When seeds in the lower pods are brown and most pods are yellow, the canola is ready

Table 3. Irrigation and yields of winter canola grown at Othello, Washington (2006)¹.

Precipitation (in) ²	Irrigation (in)	Soil moisture used (in) ³	Total water use (in)	Yield (lb/a)			
				Athena	Ericka	Inca	Rapier
1.8	1.0	10.3	13.0	1,857	1,647	1,846	1,635
1.8	2.3	10.3	14.4	2,385	1,933	2,072	2,030
1.8	6.9	9.5	18.1	2,567	2,236	2,178	2,050
1.8	8.7	9.2	19.6	2,657	2,343	2,626	2,521
1.8	9.0	8.6	19.4	2,875	3,024	3,013	2,804⁴

¹ Soil N and fertilizer N = 250 lb.

² Precipitation was measured from April through June.

³ Determined by neutron probe readings before irrigation began and prior to harvest.

⁴ Bold font indicates an optimum amount of irrigation was applied.

Table 4. Irrigation and yields of winter canola grown at Othello, Washington (2007)¹.

Precipitation (in) ²	Irrigation (in)	Soil moisture used (in) ³	Total water use (in)	Yield (lb/a)			
				Athena	Ericka	Inca	Rapier
0.5	0.4	8.3	9.3	3,956	3,409	3,234	3,879
0.5	4.1	7.3	11.9	4,208	3,824	3,845	4,370
0.5	12.8	4.9	18.2	4,006	4,079	4,036	4,803⁴
0.5	19.5	3.4	23.4	4,040	4,149	3,796	5,109
0.5	24.0	3.2	27.9	3,750	4,255	3,727	4,757

¹ Soil N and fertilizer N = 250 lb.

² Precipitation was measured from April through June.

³ Determined by neutron probe readings before irrigation began and prior to harvest.

⁴ Bold font indicates an optimum amount of irrigation was applied.



Figure 5. Ripe canola pods (photo by Karen Sowers).

to harvest. Harvesting too early can reduce seed yield and oil concentration. If the canola is direct-harvested with a combine, a pod sealant such as Spodnam can be applied up to 3 weeks prior to harvest when all the pods are at least greenish in color. The canola will continue to ripen after application and the sealant will protect the pods from shattering and seed loss from wind, rain, and temperature fluctuations that may occur before harvest.

Canola seed flows easily and is very small, so combines and trucks should be inspected prior to harvest for any holes or cracks that need to be covered with duct tape. Combine speed and cylinder speed may need to be adjusted to reduce overloading and blocking the machine. Cylinder speed should be set at half the speed normally used for wheat, and concave clearance adjusted until the canola pods are threshed without

excessive dockage and seed cracking. Fan speed should also be turned down to reduce seed loss.

In central Washington, winter and spring canola seed moisture varies from 5 to 6% at harvest, well below the required standard for commercial seed moisture of 8%. If long-term storage is needed, canola should be kept at 68°F. Canola seed can continue to respire for up to 6 weeks after harvest before becoming dormant. Bins should be monitored regularly to avoid overheating.

Conclusion

Canola may not be the first crop you think of when planning an alternative in your irrigated rotation. However, research shows that with proper management, canola provides many benefits in the Columbia Basin. In addition to the yield potential of irrigated canola, improved soil tilth, increased pest control, breaking disease and pest cycles, low irrigation requirements, and potentially higher yields for subsequent crops are all reasons to consider growing winter or spring canola. Begin with consulting a local seed dealer or field agronomist who is familiar with canola varieties for your area, and then choose a field without chemical plant-back restrictions and keep close tabs on the crop throughout the growing season. Talk with Extension agents, researchers, and/or other growers who have experience with canola to find out what worked and didn't work on their farms. As with any crop, best management practices—from judicious irrigation and fertilizer application to regular field inspections—will make the difference between an average and above-average canola crop.



Winter canola in mid-March under center pivot irrigation near Othello, Washington (photo by Becky Lyle).

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