Five nitrogen application timing treatments were used (Table 1). As expected, the reduced nitrogen rate resulted in lower seed yield, but winter survival was not affected. Winter survival and seed yield were reduced when all of the recommended nitrogen was applied at planting. The yield reduction associated with applying all of the nitrogen at planting (160 lbs. N per acre) was so great that the two-year mean yield of that treatment was equivalent to the low nitrogen treatment that received only 35 lbs. of N per acre.

Table 1. *Mean seed yield of two canola cultivars with five nitrogen fertility timing regimes.*

Fertilizer Timing Treatment	Winter Survival	Seed Yield		
		2014	2015	Mean
	- -score[1]--	---------- lbs. per acre ----------		
Reduced N (40%) at Planting Only	6.5 a	1,680 c[2]	2,695 b	2,154 b
All at Planting	5.4 b	1,978 b	2,405 b	2,178 b
None at Planting, 50% in Fall, 50% in Spring	6.9 a	2,346 a	3,775 a	3,038 a
25% at Planting, 25% in Fall, 50% in Spring	6.7 a	2,306 a	3,594 a	2,929 a
25% at Planting, 75% in Spring	6.8 a	2,360 a	3,257 a	2,794 a

[1]Scored on a scale of 1 to 9 with one equaling no survival and 9 equaling complete survival.
[2]Means within columns with different letters are significantly ($p<0.05$) different.

The numerically best fertilizer timing regime based on the two-year average seed yield was the one with no nitrogen applied at planting and a 50:50 fall-spring split; however, this regime was not significantly different from the 25:25:50 and the 25:0:75 treatments. The worst approach was to apply all the fertilizer at seeding. The decreased winter survival seen in that treatment suggests that extra vegetative growth in the summer reduces cold hardening in winter canola. The yield decrease seen with the all-at-planting treatment could be due to decreased winter survival, loss of nitrogen during the summer from volatilization of the urea, loss of nitrogen and sulfur during the winter from leaching and denitrification, or more likely a combination of all three. We observed no effects from the fertilizer treatments on seedling emergence. To maximize yield, the rate of fertilizer applied at planting should be kept low, especially when planting at dates that are earlier than traditional, and the remaining fertilizer should be split between late fall and early spring applications. A more in depth report can be found at <*www.cals.uidaho.edu/brassica/*>.

Winter Canola Water and Nitrogen Use in Low Rainfall Areas of Eastern Washington

MEGAN REESE[1], BILL PAN[1], FRANK YOUNG[2], AND WILLIAM SCHILLINGER[1]
[1]DEPT. OF CROP AND SOIL SCIENCES, WSU; [2]USDA-ARS

Fertility management of winter canola is more complex than spring canola due to its additional growth stages and potential markets of feed, food and fuel. In addition to the complexities of nutrition management, water use is of paramount concern to growers in the water-limited environment of the Pacific Northwest. Analyzing winter canola water and nitrogen (N) use can be approached throughout three growing seasons: vegetative growth (from planting to winter dieback), winter survival, and harvest season (spring regrowth to seed harvest). In the 2014 season, winter canola water and N use was monitored in variety trial plots seeded around August 20 in Okanogan and Pomeroy.

Fall 2014 water use in Okanogan and Pomeroy varied from 2-7 in., 15-20% of total water use. Canola at Pomeroy extracted water to at least 5 ft in the fall and used nearly all available water by harvest. In contrast, canola water use at Okanogan was relegated to the top 3 ft during fall, but moisture deeper in the soil profile was accessed during spring regrowth. Total water use was 12 in. at Okanogan and 22 in. at Pomeroy. Available water remained in the soil profile after harvest in Okanogan (Fig. 1), possibly due to hardpan layers or subsoil nutrient restrictions. Canola grain yield was 2185

lb/acre at Pomeroy, which had greater soil water and N supplies than at Okanogan, which yielded 795 lb/acre. Water use efficiencies were 65 and 105 lb/ac yield per inch water used for Okanogan and Pomeroy respectively, similar to spring canola in the area. Total season unit N requirements were higher than current regional extension bulletin literature, at 26 lb N per 100 lb yield in Okanogan and 17 lb N per 100 lb yield in Pomeroy. N inefficiencies appeared to occur in the fall and winter seasons to a greater degree than the harvest season. Volatilization, immobilization, and ammonium fixation are potential N loss pathways.

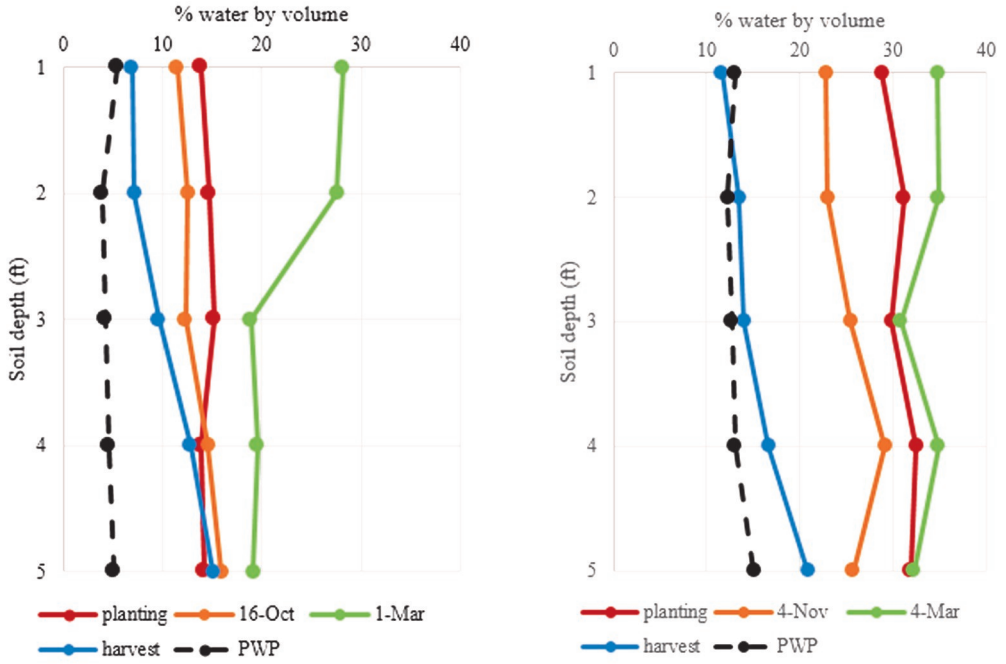

Figure 1. Soil water profiles at Okanogan (left) and Pomeroy (right) in 2014-15 for selected sampling dates, compared to dry soil at permanent wilting point (dashed).

Cropping Systems: Economic Returns to Canola Rotations in Eastern Washington

VICKI A. MCCRACKEN AND JENNIFER R. CONNOLLY
SCHOOL OF ECONOMIC SCIENCES, WSU

Canola growers have observed rotational benefits from growing canola including increased yield in subsequent wheat crops, decreased weed pressure, and improved soil quality. These benefits accrue in crops following canola, impacting total farm returns. Growing canola in traditionally cereal-only rotations also impacts costs due to the use of herbicides that are compatible in rotations with canola, and different tillage needs following canola as a result of canola residue breaking down differently than cereal crops. These impacts affect both costs and returns in the year canola is grown and in years later in a rotation.

Assessing returns for complete rotations gives a more accurate picture of the profitability of canola than assessing returns for a single year. Enterprise budgets have been developed for the low and intermediate rainfall areas of eastern Washington and include expanded features that allow for the rotational impacts of canola. These interactive computer tools are available online and can be used by growers and advisors to growers (e.g. bankers and other agricultural industry personnel) to assess the on-farm economics of growing canola. Each enterprise budget file includes separate tabs for summary, crop calendars, crop budget sheets (differentiated by rotation), and machinery complements and costs. The summary tab presented below (based on 2013 data) provides detailed, interactive summary economic information useful in comparing alternative crops and rotations with and without canola.