Photo 1. **This photo taken August 15 illustrates delayed flowering of winter varieties in S3. Winter varieties (left) are still green and flowering, while spring varieties (right) are ready for harvest.**

although this difference was only statistically significant in F2. Figure 2 depicts mean yields of all varieties for each planting. F1 and F2 had highest yields, then S2 and S3, and S1 had the lowest yields overall. It is important to note that S3 was negatively biased by the significantly lower yields of the winter types. Spring types in S3 average yield was 480g/plot, comparable to yields of spring types in F1 and F2. Another interesting trend for spring types is yield increased as planting date got later. Overall, these results demonstrate winter camelina biotypes are capable of performing as well, if not better than, spring types, as long as they are planted early enough to ensure vernalization occurs.

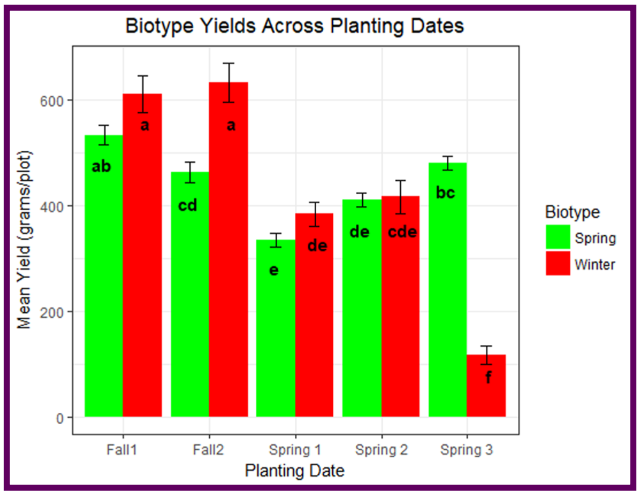

Figure 1. **Biotype yields across planting dates. Lowercase letters represent significant differences (Tukey HSD).**

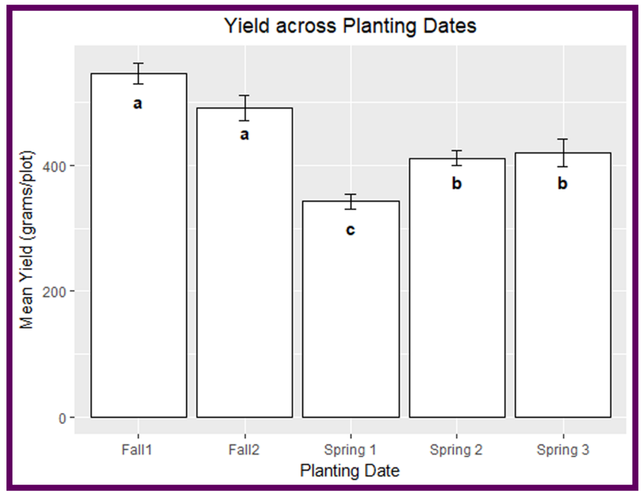

Figure 2. **Mean yields across planting dates. Lowercase letters represent significant differences (Tukey HSD).**

Recommendations for Growers

Winter varieties: Plant as soon as moisture is available. But if spring planted, be sure to plant early enough to ensure vernalization.

Spring varieties: Spring varieties can be either fall or spring planted. Later spring plantings did not compromise yields in this experiment, so waiting for weeds to emerge for control before planting may be a better strategy in higher rainfall zones. For more comprehensive information on planting dates for spring varieties, please see *Camelina: planting date and method effects on stand establishment and seed yield*.

Integrating Livestock to Dryland System - Grazing on Dual-Purpose Winter Canola

STEVE VAN VLEET[1], DENNIS ROE[2], ISAAC MADSEN[2], STEVE FRANSEN[2], DON LLEWELLYN[1], AND HAIYING TAO[2]
[1]WSU EXTENSION; [2]DEPT. OF CROP AND SOIL SCIENCES, WSU

Integrated livestock and cropping systems are essential for sustainable farms. Also, alternative feed sources are needed for livestock during the fall on Washington farms/ranches to extend the grazing season and reduce feeding costs. A project was implemented raising winter canola for a harvestable crop the following season while also providing fall grazing forage prior to winter dormancy. Winter canola ("Amanda") was seeded mid-July and cattle grazing introduced to well-developed plants in mid-September prior to frosts and winter dormancy. The cattle grazed the study area for 14 days and were moved to adjacent ungrazed strips of canola after specific levels of grazing impact were observed.

Cattle gained approximately 1.43 lbs/day throughout the canola forage grazing period. Winter canola survival and yield will be determined from ungrazed and grazed areas during the 2018 growing season.

Winter Pea: We Finally Have a Hardy, Stable, and Easy-To-Grow Alternative Crop for the Drylands

BILL SCHILLINGER[1], RON JIRAVA[2], JOHN JACOBSEN[1], AND STEVE SCHOFSTOLL[1]
[1]DEPT. OF CROP AND SOIL SCIENCES, WSU; [2]COLLABORATING FARMER

Researchers and farmers in the dry croplands (<12 inches annual precipitation) have experimented with numerous crops and rotations for over 100 years, but none have been found to be as stable, reliable, and profitable as winter wheat-summer fallow (WW-SF). This long wait may finally be over. Winter pea (WP) is a cool-season, nitrogen-fixing pulse crop. Prior to 2012, essentially no edible WP was produced anywhere in the PNW. Winter pea plantings in the WW-SF region of Washington have gone from basically zero to more than 10,000 acres from 2012 to 2017. Although the land area planted to WP currently is still small, the annual increase in planted acres has been exponential.

Field research conducted since 2010 near Ritzville, WA (11.5-inch annual average precipitation) has demonstrated that WP is well suited for the low-precipitation drylands. The objective of our long-term Ritzville study is to determine the yield potential and yield stability of WP and associated rotation benefits to the subsequent crop compared to WW. Two 3-year rotations are evaluated: WP-spring wheat (SW)-SF versus WW-SW-SF. Over the first seven years of the study, WP yields averaged 2275 lbs/acre versus 73 bu/acre for WW (Table 1). No fertilizer was applied to WP whereas 50 lbs N and 10 lbs S/acre were applied to WW. Winter pea used significantly less soil water than WW. Over the winter months, a lesser percentage of precipitation was stored in the soil following WP compared to WW because: (i) very little WP residue remained on the soil surface after harvest compared to WW, and (ii) the drier the soil, the more precipitation is stored in the soil over winter. However, soil water content in the spring was still greater following WP versus WW. Soil residual N in the spring (7 months after the harvest of WP and WW) was greater in WP plots despite not applying fertilizer to produce WP. Spring wheat grown after both WP and WW received the identical quantity of N, P, and S fertilizer each year. Average yield of SW was 34 and 32 bu/acre following WP and WW, respectively (Table 1).

Table 1. Yield of winter pea (WP) and winter wheat (WW) as well as the subsequent yield of spring wheat (SW) following both WP and WW over a 7-year period at Ritzville, WA.

Treatment	2011	2012	2013	2014	2015	2016	2017	7-yr avg.
Winter crop								
Winter pea (lb/ac)	1960	2820	2085	------*	1515	2530	2730	2275**
Winter wheat (bu/ac)	77	85	87	50	63	73	79	73
Spring crop***								
SW after WP (bu/ac)		30	45 a	16	34 a	47	33	34 a
SW after WW (bu/ac)		32	40 b	14	25 b	46	34	32 b

* WP was winter killed in 2014 and replanted to Banner edible spring pea, which yielded 775 lb/A.
** Winter pea average is for six years (i.e., 2014 not included).
*** ANOVA is for SW only. Within column means followed by a different letter are significantly different at $p < 0.05$.