pea with a ratio of 1:1:5:10:10 and was planted at a seeding rate of 30 lb/acre, as recommended by USDA NRCS. The experimental plot is 50 by 100 feet with six replicates of each rotational treatment following a randomized complete block design. For the rotation with fall-planted cover crops, field pea and hairy vetch survived after the winter and spring pea failed to withstand the winter hardness in both Arbon Valley and Rockland. Turnip and radish survived the winter in Arbon Valley, but failed in Rockland. The air temperature in Rockland was as low as -20°F with snow cover mostly during the winter of 2016-2017. In both Arbon Valley and Rockland, total biomass of all cover crop species from the fall planting (Arbon Valley: 530 lbs/ac; Rockland: 1043 lbs/ac) was higher than spring planting (Arbon Valley: 298 lbs/ac; Rockland: 479 lbs/ac), but in Arbon Valley, biomass of turnip and radish from the spring planting was higher than the fall planting. Selection of cover crop species should thus consider environmental conditions and management practices. Species that are able to withstand winter, such as field pea and hairy vetch, could be planted in the fall and produce greater biomass during the long growing season. Species with poor winter survival, such as spring pea, turnip, and radish, could be planted in the spring and terminated by winterkill.

Figure 1. Cover crop mix planted in the fall 2016 (left) and spring 2017 (right).

Part 3. Oilseeds and Other Alternative Crops

Large-Scale Canola Variety Trials – An Outreach Success Story

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Canola acreage hit a record high in Washington state and the Pacific Northwest in 2017. Contributing factors include local crushing facilities offering competitive pricing, below normal wheat prices, and more growers recognizing the many agronomic benefits canola has to offer in both dryland and irrigated production regions. With the increased awareness of canola as a viable rotation crop, the need for education on all production fronts is essential to improve the chance of success of first-time and veteran canola growers.

Variety selection is a key item on the 'Canola 101' list. With funding assistance from Viterra, Inc. we have conducted large -scale spring and winter canola variety trials on farms in eastern Washington and north central Oregon since 2016. What has evolved with the trials was far more than we anticipated in terms of research and Extension. Several researchers on the WSU-WOCS team have added projects within and alongside the trials, including fertilizer management, plant population, nitrogen cycling, and pollinators (see related abstracts). Industry has supplied seed, provided weigh wagons for harvest, and helped with data collection. Oregon State University has assisted with data collection at The Dalles site.

Most importantly, we are building relationships with the canola growers hosting the plots who then reach out to more growers and others near them who may or may not be familiar with canola. The end result has been increased participation by all stakeholders, and a comprehensive review during field tours of the variety trials, WOCS research, and industry, OSU, and UI canola information. We reached 190 people through tours at our 2017 variety trials that featured a wide range of presentations (Fig. 1).

Figure 1. Tours at all of the canola variety trials were well attended. Photo from the St. John winter canola site.

Yield results from the 2016-17 winter canola and 2017 spring canola variety trials are in the tables below. Winter canola yields were at or above historical records at St. John and Ralston. St. John had the highest mean yield of 3,046 lbs/acre, followed by Ralston and Odessa at 2,971 and 2,352 lbs/acre, respectively. Spring rains and saturated soils prevented us from applying weed control which affected the Odessa site the most as it had heavy catchweed bedstraw and other weed pressure. Despite clear visual differences in early season vigor of the spring varieties, there were no significant yield differences at any of the trials locations. Planting was delayed several weeks due to wet soils which likely reduced overall yield potential as several high temperature events occurred during flowering. Full reports are available on the WOCS website (www.css.wsu.edu/oilseeds).

Yield results of 2016-17 Winter Canola Variety Trials

Variety	Odessa		Ralston		St. John	
	———lbs/acre———					
Amanda	2,424	a	3,193	a	3,370	ab
Claremore	2,249	a	2,654	b	3,125	ab
Edimax	2,337	a	3,468	a	3,519	a
Griffin	2,390	a	3,188	a	2,887	b
HyClass 225	2,333	a	3,202	a	3,121	ab
Largo	2,380	a	1,840	c	2,258	c
Mean	2,352		2,971		3,046	
Tukey HSD (0.05)	ns		425		486	
CV(%)	9.7		6.0		6.9	

Means which share a letter do not differ significantly.
ns= not significant

Yield results of 2017 On-farm Spring Canola Variety Trials

Variety	Almira		Pullman		Walla Walla	
	———lbs/acre———					
BY 5545 CL	1,162	a	2,055	a	1,563	a
BY 6080 RR	1,277	a	1,984	a	1,519	a
HyClass 930	1,002	a	2,117	a	1,588	a
InVigor L233P	970	a	2,385	a	1,500	a
Nexera 2024 CL	1,037	a	1,971	a	1,235	a
DL 1506 CL	1,182	a	1,959	a	1,363	a
Mean	1,105		2,078		1,461	
Tukey HSD (0.05)	510		617		429	
CV(%)	19.3		12.9		12.8	

Means which share a letter do not differ significantly.

We are continuing the trials for another season with winter plots at Mansfield, Ritzville, and The Dalles, OR, and spring trials at Walla Walla, Ralston, and Davenport.

Many thanks to our cooperators: David Brewer, Jesse Brunner, Rob Dewald, Jesse Brunner, Curtis Hennings, Ross Jordan, Douglas Poole, Mark & Brendan Sherry, and Traig Weishaar.

Seed provided by Bayer CropScience, BrettYoung, Caldbeck Consulting, CPS, Croplan by Winfield, Dow AgroSciences, Kansas State University, Rubisco Seeds, Spectrum Crop Development, and University of Idaho.

Selecting Nitrogen Source to Minimize Damage Caused by Free Ammonia

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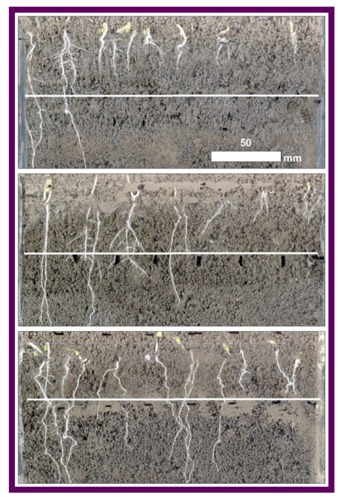
When planning N fertilizer application, the source of the fertilizer should be considered in order to optimize nutrient availability as well as to avoid damaging seedling root systems. Canola root systems have been shown to be sensitive to urea banded below the seeds. The two primary considerations when choosing a safe source of N fertilizer are the salt toxicity and ammonia/ammonium toxicity. The conversion of ammonium to free ammonia is primarily controlled by the initial pH of the fertilizer reaction. A high pH will lead to more free ammonia than ammonium. Free ammonia has been shown to be extremely toxic to plant cells. Therefore, fertilizers with a high pH would be expected to release more free ammonia and consequently have a higher level of toxicity. Urea, Anhydrous Ammonia, and Aqua Ammonia all have pH greater than 8 in solution. Fertilizers with a pH lower than 8 are Ammonium Sulfate, Mono-Ammonium Phosphate, and Di-Ammonium Phosphate. In this study we compared the application of ammonium sulfate (AS) (pH = 5-6, partial salt index = 3.52), urea (pH = 8.5-9.5, partial salt index = 1.61), and urea ammonium nitrate (UAN) (pH = 7, partial salt index = 2.22). The fertilizer was banded below the seed at incrementally increasing rates from left to right. Urea (top) showed the most damage, followed by AS (middle) and UAN (bottom). The images from this study are currently being evaluated to develop 'safe' planting guidelines for banding N fertilizers below canola seeds.



Take away points: It was determined that canola roots are more sensitive to urea than ammonium sulfate or UAN. This is likely because urea would produce higher levels of free ammonia following dissolution.

Soil Microbial Community Response with Canola Introduced into a Long-Term Monoculture Wheat Rotation

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With increasing acreage of canola (*Brassica napus* L.) in the Inland Pacific Northwest (PNW) of the USA, we investigated the effect of this relatively new rotational crop on soil microbial communities and the performance of the subsequent wheat (*Triticum aestivum* L.) crop. A relevant objective for the use of rotation crops is to increase the performance of subsequent crops. The degree of influence on soil biological properties and crop productivity is, however, crop specific. Canola plants contain glucosinolates, which upon cell rupture and during the decay of residue, hydrolyze to produce isothiocyanates. The production of isothiocyanates is the mechanism responsible for the biofumigation effect, which can reduce the inoculum of soilborne pathogens. However, the non-selectivity of isothiocyanates has potential to also impact beneficial soil organisms.