A second component of the research is to understand when spores are moving during the growing season. Burkard volumetric spore traps (Fig. 2) have been placed at two field trials where blackleg lesions were previously identified to determine when spores of *L. maculans* are being released and if the main source of infection is from wind-blown spores (ascospores) or rain-splashed spores (conidia). These traps pump air through an orifice and deposit any particles on a piece of tape. This tape is then sectioned into daily samples and are used for direct visualization on microscope slides or can be used in conjunction with PCR to look for DNA of a target organism. As of May 2020, ascospores have not been observed on slides, suggesting that the main source of infection is from conidia or infected seed. Weather station data will be paired with these spore counts to aid in identifying the environmental conditions and time of year when spores are released, in turn contributing to the development of grower guidelines for best management practices to use preventative fungicides.

To test the effectiveness of fungicide applications to limit blackleg, field trials were planted in Moscow, Genesee, and Grangeville (Fig. 3). These trials include winter canola cultivar Mercedes (resistant to blackleg) and Amanda (susceptible to blackleg) in conjunction with a combination of fungicide seed treatment and foliar applications. Foliar fungicide treatments include a fall only, spring only, a fall and spring, and no application. These trials are being monitored for blackleg incidence and severity as well as determining seed yield and oil content. This research will aid growers in making management decisions to minimize the impact of blackleg to canola.

Figure 2. Burkard Volumetric spore trap.

Figure 3. Fungicide field trial in Grangeville, ID.

Low Erucic Acid (LowE) Camelina Breeding Lines with Potential for Public Release

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Camelina is a potential alternative crop for the sustainable intensification of dryland cropping systems due to minimal input requirements, strong adaptability to diverse environmental conditions, and its unique, “heart-healthy” fatty acid profile. Camelina is a rich source of both α-linolenic (18:3; 35-45%) and linoleic (18:2; 15-23%) acids, two essential fatty acids for human and animal health, and antioxidants called tocopherols (vitamin-E). Unfortunately, erucic acid content in camelina oil (2-5%) exceeds the 2% FDA threshold allowed for edible oil. Therefore, development of lines with less than 2% erucic acid content suitable for human consumption will greatly expand the marketability and profitability of camelina.

The WSU Camelina Breeding program has developed several elite breeding lines with low erucic content (lowE) that also exhibit good agronomic performance. During the 2019 field season, 12 advanced (lowE) breeding lines and 6 check varieties were tested in a replicated field trial in Pullman, WA. There were two seeding dates, May 10 and May 23, and at least four replicated plots (5ft x 9ft) of each genotype (16 for Calena and Suneson) per seeding date, arranged in a randomized complete block design (RCBD). Overall, the lines performed similarly in both seeding dates, so only means across seeding dates for each line is given.

Table 1 details the performance of four elite lowE lines and size check varieties, sorted from highest to lowest yield. There were two lines, #43 (0.57%) and #44 (0.46%) with significantly lower erucic acid content than any of the other lowE lines. Although #44 has the lowest erucic acid content of all, #43 had greater mean yield with significantly larger seeds (1.23 mg/seed) than #44 (1.05 mg/seed). Other promising lowE lines include #35, the highest yielding line (1339.3lbs/acre) with 1.91% erucic acid, and #38, the second highest yielding (1191.9 lbs/acre) and second highest oil content (43.22%) line with 1.56% erucic acid. Overall, #44 is inferior to the check varities in most of the agronomic categories, while #43 is competitive with the checks. Both #35 and #38 outperform the check varieties in both yield and oil content. With such low erucic acid content, we are confident #43 and #43, will maintain <2% erucic acid content across different environments/years. More testing is needed to confirm whether #35 and especially #38 will maintain <2% erucic acid content across different environments/years, but their higher yield potential may be worth that risk. Additionally, there is potential to mix lowE lines like #43 and #44 with higher erucic lines to dilute total erucic content below 2%. It is important to note that all lowE lines have significantly higher linoleic, α-linolenic, and total oil content than the checks.

Table 1. Grouped means for four elite LowE Breeding Lines and Check Lines. Lowercase letters denote significant differences (Tukey HSD) between means; "r" is the number of replicates per genotype.

r	Genotype	Yield (lbs/acre)	1SM (mg)	Oil (%)	Linoleic (%)	α-Linolenic (%)	Erucic (%)
8	LowE.44	876.8a	1.05b	41.57a	21.42ab	33.69a	0.46a
8	LowE.43	1021.1a	1.23ab	40.90ab	20.91abc	33.78a	0.57a
8	LowE.38	1191.9a	1.19ab	43.22a	22.16a	30.99b	1.56b
8	LowE.35	1339.2a	1.18ab	41.26a	18.35d	33.76a	1.91b
32	Suneson	1072.7a	1.24ab	36.04bc	21.30ab	31.37b	2.44c
8	BlaineCreek	999.7a	1.26a	35.10c	18.90cd	32.96ab	2.64cd
8	WA-HT1	1060.4a	1.24ab	35.9bc	19.06cd	33.57a	2.78cd
8	Midas	917.8a	1.32a	35.41c	19.59bcd	33.35ab	2.80cd
8	Cheyenne	1142.6a	1.33a	33.51c	18.37d	31.86ab	2.93d
32	Calena	1133.5a	1.28a	35.62c	19.54cd	33.35ab	3.00d

Biodiesel and renewable jet fuel are still good options for camelina oil, but development of lowE camelina lines suitable for human consumption will greatly expand the marketability and profitability of this crop. The WSU Camelina Breeding Program plans to publicly release lowE line(s) summer 2020.

*Note: The WSU Camelina Breeding Program released WA-HT1, a group II soil herbicide resistant variety, in 2018. All of these lowE lines have that herbicide tolerant trait and exhibit resistance to soil residual levels of group II herbicides.

Spring Canola and Chickpea Value in a Cereal Grain Rotation

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Canola (*Brassica napus* L.) has been a rotation option with wheat (*Triticum aestivum*) for farmers in the dryland cropping region of the Pacific Norwest for over 25 years, yet adoption has been limited because of market access, profitability and overall unfamiliarity with the crop. In 2014 a large-scale multi-year rotation study was initiated comparing spring wheat, canola and chickpea (*Cicer arietinum* L.) (1st year) in rotation with winter wheat (WW) (2nd year) and spring wheat (3rd year). The study was located at the WSU Wilke Research and Extension Farm which receives an average of 14 inches of precipitation. The experimental design was a randomized complete block with four replications and plot size 25x200 feet. Each crop rotation is examined over two cycles (i.e. 6 years) and was repeated in 2015 and 2016. Data presented here focuses on the three treatment crops and includes seed yield, production costs, and economic returns. Over the 6 years, spring wheat had the highest yield, averaging 2,134 lbs./ac (35.6 bu/ac), and there was no significant difference in yield between canola and chickpea 1,014 and 963 lbs./ac, respectively. Gross economic returns were calculated using local F.O.B. prices on September 15 each year, and canola and chickpea yearly