

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 varieties 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

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

#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.

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.