Analysis of Fatty Acid Content in Oilseeds

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Fatty acids obtained from oilseeds are used for several purposes including biodiesel and human consumption. Fatty acid content and abundance can be influenced by environmental factors, particularly during seed development. The objectives of our project were to determine the cold press oil yield, total oil content, and fatty acid content of oilseed crops from camelina seed samples produced in field trials across the Pacific Northwest.

Camelina seed samples of the varieties Blaine Creek, Calena, Celina, Cheyenne, and Columbia were provided by other researchers from Pendleton, Washington (2010), Corvallis, Oregon (2010), and Pullman, Washington (2009, 2010). The oil yield for each sample was determined using an oil extractor, delivering data to estimate industrial scale yields. University of Idaho determined total oil content by nuclear magnetic resonance (NMR). Fatty acid composition was determined by application of methyl-esterification process and subsequent gas chromatography/flame ionization detection (GC-FID), with verification by gas chromatograph/mass spectrometry (GC-MS).

Camelina varieties harvested in Pullman during 2010 have similar percent oil content by weight. GP48 had the lowest percent oil and Ligena had the highest. Location and variety influenced yield of acid content. The least variation was in linoleic acid content (difference of 0.2 %) in the Celina variety at Corvallis. The greatest variation was in linolenic acid content (difference of 5.25%) in the Cheyenne variety at the Pullman 2009 site. Average oleic acid content was highest (19.4%) in the Blaine Creek variety from the Pullman 2010 study, and samples taken from Pendleton in 2010 had overall highest average oleic acid content (18.92%). Camelina varieties were ranked differently in the two harvest years for the Pullman site (2009 and 2010) by order of the varieties' percent oleic acid content. Concentrations of linoleic acid were highest in the Blaine Creek variety, except at Pendleton in 2010. All varieties at Corvallis had decreased linoleic acid production (average of less than 16%) compared to other sites, possibly due to more summer moisture. The decrease is countered in the concentration of linolenic acid (highest average of 32.5%), where it is highest at Corvallis compared to other sites. Linolenic acid is present in comparatively high concentrations across all four sites. Eicosensic acid content was consistent and low across varieties and sites. Further analysis of these data will provide growers a more informed plan for optimizing fatty acid production based on variety selection and location of production.

Rotational Influence of Brassica Biofuel and Other Crops on Winter Wheat

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Growing Brassica oilseed crops in eastern Washington must fit within the regional rotational cropping systems. When grown, broadleaf crops usually precede winter wheat in rotation and studies worldwide have shown the benefit to winter wheat when following a broadleaf crop. The potential economic benefit of these crops should include the rotational effect of these crops on winter wheat.

These studies are two year crop sequence studies on eight spring crops (spring wheat, spring barley, dry pea, lentil, camelina, yellow mustard, oriental mustard, and canola) planted in year 1 followed by winter wheat (year 2) grown

2012 Rotation study spring crops planted to winter wheat for 2013 at Cook Farm, Pullman, WA

across all year 1 spring crops. The year 2 winter wheat planted within each of the previous spring crop areas is divided into sub-plots receiving fertilizer rates of 32, 64, 96, 128, 160 lbs N/acre applied in a split-plot, factorial design.
Results from five years of spring crop comparisons are in Table 1. Preliminary conclusions are:

- ⇒ Performance variability among spring crop is high and varies over years.
- ⇒ Some crops, barley and camelina, are more consistent across years.
- ⇒ Market prices and yields will guide spring crop selection for growers.
- ⇒ Winter wheat performance following spring crops is best after pea and lentil, followed by brassicas, and both are better than after wheat or barley.
- ⇒ Wheat fertilizer response is best after legumes followed closely by brassica crops.
- ⇒ With results showing wheat performance after spring crops, growers can give rotational benefits to biofuel crops from better winter wheat performance and low N fertilizer inputs.

Table 1. Spring Crop Seed Yields, 2008 Moscow, 2009 – 2012 Pullman.

Spring Crop	2008	2009	2010	2011	2012	2008-2012 Ave.	Avg. %
	---------------------- lbs/acre --------------------						Variation
Spring Wheat	3750	3915	1700	2770	3020	3030	21.2
Spring Barley	4625	5485	3520	4145	4610	4480	11.5
Dry Pea	1830	245	840	2565	1020	1300	55.2
Lentil	1075	740	480	1850	860	1000	36.9
Camelina	1895	2585	1715	1530	1820	1910	14.2
Yellow Mustard	1390	1635	695	1415	1430	1310	19.0
Oriental Mustard	915	2290	700	1750	1570	1445	35.3
Canola	700	1610	670	1395	860	1050	34.8
Average	2025	2315	1290	2175	1900	1940	28.5
LSD (0.05)	515	765	750	455	523		

Safflower Oilseed Production under Deficit Irrigation and Variable N Fertilization

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The production of oilseed crops represents a unique opportunity for PNW producers to provide a biodiesel feedstock for an emerging renewable energy industry. The inclusion of oilseeds in rotation offers producers an alternative strategy to improve farm economies and gain additional benefits that improve soil and water conservation, reduce pest cycles, and diversify cropping systems. Safflower is considered a low input and drought tolerant crop, but responds well with irrigation and fertilizers. Three safflower varieties S334, S345 and CW99OL were planted in April 2008-2011 under center pivot irrigation at the USDA-ARS field site near Paterson WA (Fig. 1). Standard irrigation and deficit irrigation were 28 and 22 inches, respectively. The difference in water applied between the deficit irrigated and the standard water treatment was 6 inches resulting in a treatment of 80% of ET in 2009 and 8 inches, 70% of ET in 2010 and 2011. Safflower oilseed

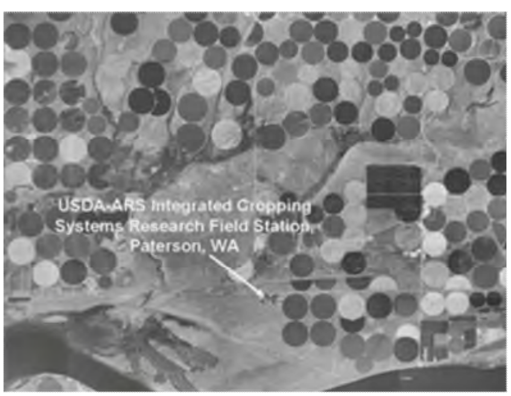

Fig. 1. USDA-ARS Paterson Field Site.

Fig. 2. Safflower ready to harvest 2011.