contract prices. Chickpea and wheat had the greatest gross economic return at $214 and $199/ac, respectively, compared to canola at $166/ac. Production costs considered included only seed, fertilizer, and herbicide costs. Over the six years wheat had the lowest production costs at $100/ac, and canola and chickpea both averaged $116/ac. Overall wheat and chickpea produce the greatest economic return to growers over costs at $99 and $97/ac, respectively, and canola produced $48/ac over costs. In conclusion market price is a major component of potential profitability of wheat, chickpea and canola.

Treatment	Yield (lbs./ac)	Market Price ($/lb)	Gross Economic Return ($/ac)	Cost ($/ac)	Economic Return over Costs ($/ac)
Wheat	2134 a	0.093	199 a	100	99 a
Canola	1014 b	0.162	165 b	116	48 b
Chickpea	963 b	0.222	214 a	116	97 a
LSD (P<0.05)	134		21		21

Means within columns with different lowercase letters are significant (P<0.05).

Soil Water Dynamics with Camelina in a Three-Year Rotation in Washington's Winter Wheat-Fallow Region

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Camelina of the *Brassicaceae* family is a short-season oilseed with tolerance to water stress and frost. Camelina has been promoted as a potential alternative crop for the low-precipitation (<12 inch annual) Mediterranean-like climate region of inland Pacific Northwest where a monoculture 2-yr winter wheat-summer fallow (WW—SF) rotation is practiced by the vast majority of farmers. An 8-yr field experiment was conducted at Lind, WA to compare a 3-yr WW—camelina—SF rotation to the typical 2-yr WW—SF rotation. We conducted a detailed analysis of soil water dynamics of these two crop rotations throughout the experiment. Growing camelina reduced soil water content at the beginning of the fallow period, and this reduction resulted in an average of 0.83 inches less water at the time of WW planting and a 2.5 bushel/acre reduction in grain yield compared to WW—SF. Compared to WW—SF, we found that: (i) the deep-rooted broadleaf weed Russian thistle present in camelina most years was a likely reason for significantly greater in-crop soil water use, and (ii) the limited residue produced by camelina was likely responsible for greater evaporative loss during the spring-through-late-summer segment of fallow. These are the first findings from the Pacific Northwest drylands of greater water use by a cool-season spring crop versus WW as well as greater evaporative loss during the dry summer months due to lack of residue during fallow. In this experiment, extending the crop rotation to include camelina was costly in terms of water use, surface soil residue cover, soil water storage during fallow, and WW grain yield. Read the full article here: https://acsess.onlinelibrary.wiley.com/doi/full/10.2136/sssaj2019.05.0157.

Developing Diagnosis and Recommendation Integrated System for Micronutrients in Spring Canola

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Macronutrient and micronutrient concentrations in tissue tests vary between crop species. Additionally, tissue concentrations may also vary between varieties in a single crop species. In crops such as canola (*Brassica napus*) critical values might be used from a closely related crop species such as rapeseed (*Brassica rapa*), without validating the critical values for the crop of interest. In addition to the variations between and within species there may also be wide spatial variation within fields. In order to assess some of these variations and work towards establishing critical values in the inland Pacific Northwest we collected tissue samples from winter and spring canola trials in Washington. We sampled farm scale variety trials in order to assess the variation between crop cultivars and the variation across a field within individual cultivars. The strip were 40 feet wide by 600 feet long and contained five varieties replicated four times coming to total of 11 acres. The strip trial was established near Almira, WA following winter peas. The tissue samples were taken at the 4-6 leaf stage prior to bolting. The macronutrient and micronutrient concentrations varied greatly based on both cultivar and location within the field. Of the five varieties included in this trial four varieties were napus (NCC101S, BY5545, InVigor L233P, and DG200) while one was rapa (Xceed DG X122 CL). The rapa cultivar contained significantly higher concentrations K, Fe, Zn, and B than any of the napus type cultivars (Table 1 and Table 2). This of interest to research and production as Zn and B are micronutrients of special concern in the inland Pacific Northwest. Additionally, all the macronutrients showed significant variation between napus type cultivars (Table 1). In addition to the variation between different varieties, the spatial variability of nutrient concentrations within the field was assessed. The concentrations of both macronutrients and micronutrients varied widely across strip trial. For example, N ranged from 3.35%-5.24% (Fig. 1). The Future work will focus on linking plant tissue concentration to yield.

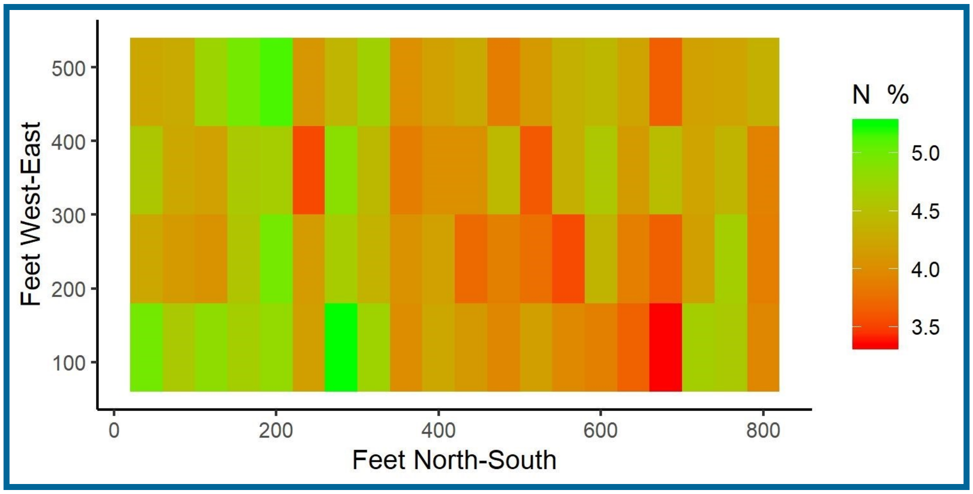

Figure 1: Nitrogen tissue concentrations vary from 3.35-5.42% across and 11 acre strip trial. Similar variations were found in other macronutrients and micronutrients. The variability in plant nutrient concentration across the field demonstrates the importance of adequate sampling density and distribution when taking nutrient samples.

Table 1.

	Macronutrients (%)											
Variety Name	N		P		K		S		Ca		Mg	
Xceed DG X122 CL	4.191	b	0.522	ab	5.411	a	0.588	bc	1.089	c	0.314	abc
NCC101S	4.006	b	0.510	b	4.317	c	0.538	c	1.166	c	0.302	bc
BY5545 CL	4.117	b	0.505	b	3.961	d	0.626	ab	1.266	b	0.301	c
InVigor L233P	4.570	a	0.547	a	5.068	b	0.577	bc	1.270	b	0.321	ab
DG200 CL	4.449	a	0.534	ab	4.442	c	0.654	a	1.384	a	0.322	a
CV	7.921		8.233		7.730		12.335		9.359		8.748	
LSD	0.238		0.030		0.253		0.052		0.081		0.019	

Table 2.

	Micronutrients (ppm)													
Variety Name	Fe		Cu		Zn		Mn		Cl		B		Mo	
Xceed DG X122 CL	317.75	a	4.60	a	35.89	a	69.06	ab	0.36	c	29.13	a	0.72	a
NCC101S	135.94	b	4.21	a	24.57	d	64.76	b	0.53	a	23.06	b	0.69	a
BY5545 CL	137.44	b	4.39	a	27.30	bc	63.39	b	0.46	b	22.25	b	0.57	b
InVigor L233P	172.38	b	4.53	a	27.92	b	64.76	b	0.46	b	22.44	b	0.75	a
DG200 CL	135.25	b	4.16	a	25.60	cd	72.83	a	0.49	ab	23.63	b	0.68	a
CV	30.11		16.17		8.64		13.27		15.58		12.96		18.46	
LSD	38.12		0.50		1.72		6.26		0.05		2.20		0.09	