Profitability of Oilseed Crops in Dryland Eastern Washington Wheat Rotations

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Enterprise budgets are useful economic tools to determine scenarios in which growers would profit from growing various spring crops in rotation with winter wheat. Rotational enterprise budgets were created for the intermediate rainfall region (12”-16”) to determine the profitability of spring canola rotations, irrespective of whether canola is sold in the food or fuel market. This was done by calculating the profits for various crop rotations by subtracting economic costs of production from the revenues a farmer would receive on a per acre basis. Given recent market prices and yields, the spring canola rotation was less profitable than the spring barley rotation by $13/ac, soft white spring wheat rotation by $20/ac, and dark northern spring wheat rotation by $33/ac annually when assuming no rotational effects from canola.

However, when considering that incorporating canola to the rotation can increase winter wheat yields, there were price and yield scenarios in which the canola rotation would be at least as profitable as the spring barley or soft white spring wheat rotations. This is the case when a 20 percent yield increase is included for winter wheat when following canola.

Table 1. Canola Rotation Profit Subtracting Soft White Spring Wheat Rotation Profit (Allowing for Canola Price and Soft White Winter Wheat Yield Flexibility)

		SWWW yield in the canola rotation (bushels*acre^{-1})								
		78	80	82	84	86	88	90	92	94
Canola price ($/CWT)	20	-26	-24	-21	-19	-16	-14	-11	-9	-6
	21	-23	-21	-18	-16	-13	-11	-8	-6	-3
	22	-20	-18	-15	-13	-10	-8	-5	-3	0
	23	-17	-14	-12	-9	-7	-4	-2	0	3
	24	-14	-11	-9	-6	-4	-1	1	3	6

Washington Oilseed Cropping System Project – Still Going Strong

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With each successive year of funding for the Washington Oilseed Cropping Systems (WOCS) project since 2007, the amount of information generated by field, lab and greenhouse studies increases. The Extension and outreach members of the WOCS team are tasked with delivering that information in timely, practical and understandable methods to growers, industry, agency, and other university oilseed faculty and staff in Washington state. Oilseed acreage has steadily increased in Washington since 2008, and tripled from 2012-2014, due in part to the efforts of the WOCS team. However, extreme weather conditions in late 2014 caused a dramatic decrease in canola acreage from 51,000 acres in 2014 to 30,000 acres in 2015 (USDA-NASS; Mar. 31, 2015 Prospective Plantings report), and with current market prices down slightly, the need for continued education about oilseed production and the value of crop rotations including oilseeds is all the more important. To address this need, the WOCS team is changing gears for 2015-16 to an increased emphasis on an electronic presence (Twitter, discussion forum, etc.), a written presence with the development of a WOCS-branded Extension publication series and a return to more localized, face-to-face meetings. Future collaboration with WSU Extension educators and industry affiliates will increase the reach to stakeholders in a larger geographic area, creating more opportunities to share oilseed information. Inclusion of growers on event planning committees will be an integral part of the process to be certain that topics are chosen that are applicable to the area where outreach is being conducted. Canola acreage may be down in 2015, but the WOCS team is dedicated to the pursuit of answers to production questions and challenges to bring the acreage above and beyond 2014 levels.

Manipulating the *AT-hook Motif Nuclear Localized* (*AHL*) Gene Family for Bigger Seeds with Improved Stand Establishment

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In low rainfall dryland-cropping areas of eastern Washington, stand establishment can have a major impact on yields of camelina and canola. During dry years these seeds need to be planted in deep furrows so that the developing seedling has access to water in the soil. One approach to facilitate stand establishment is to develop varieties with larger seeds and longer hypocotyls as seedlings while maintaining normal stature as adults. Unfortunately, few mechanisms have been identified that uncouple adult stature from seedling height. The Neff lab has identified a novel approach to improve stand establishment by uncoupling seedling and adult phenotypes through the manipulation of members of the AT-hook motif nuclear localized (AHL) family. When these proteins are over-expressed, the result is seedlings with shorter hypocotyls. When the activity of multiple genes is disrupted, the result is seedlings with taller hypocotyls, demonstrating that these genes control seedling height in a redundant manner. In the Brassica *Arabidopsis thaliana,* we have identified a unique allele (*sob3-6*) for one of these genes, *SOB3/AHL29*, that over-expresses a protein with a disrupted DNA-binding domain and a normal protein/protein interaction domain. In *Arabidopsis*, this mutation confers normal adult plants that produce larger seeds and seedlings with hypocotyl stems that can be more than twice as long as the wild type. The goal of this project is to enhance camelina and canola seedling emergence when they are planted deeply in low-rainfall dryland-cropping regions (generally less than 12"/year) or in wheat stubble. This can be achieved by manipulating *AHL* gene family members to develop varieties that have long hypocotyls as seedlings yet maintain normal growth characteristics as adult. This project includes three major sub-aims: 1) Continue characterizing the activity of *sob3-6-like* mutations in other *Arabidopsis AHL* genes; 2) Generate transgenic camelina and canola plants over-expressing wild-type and mutant forms of *Arabidopsis AHL* genes. 3) Identify, clone and characterize *AHL* gene family members from camelina. During this funding period, the Neff Lab has used a combination of molecular, genetic, biochemical, bioinformatics and biotechnological approaches to understand the role of *AHL* genes in plant growth and development. Our primary goal has been to characterize *AHL* genes from *Arabidopsis* and camelina, including an analysis of the evolution of this gene family. Generating transgenic *Arabidopsis* over-expressing *AHL* genes from complex genomes has been a powerful way to identify those genes with similar function as *SOB3/AHL29* and other family members that have been characterized previously in *Arabidopsis*. For example, as a part of our phylogenetic/evolutionary analysis we over-expressed a dominant-negative *AHL* gene from soybean (*Glycine max)* in *Arabidopsis* and demonstrated a similar long-hypocotyl phenotype to those produced when expressing various *dominant-negative sob3* alleles (Fig. 1). Zhao J, Favero D, Roalson E, Qiu J and Neff MM (2014) Insights into the evolution and diversification of the AT-hook motif containing nuclear localized gene family in land plants. BMC Plant Biology 14:266

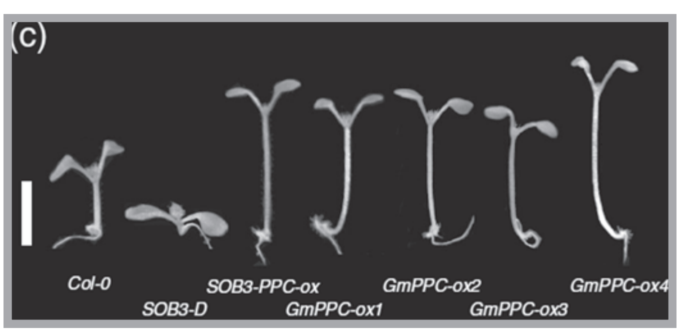

Figure 1.