Spring Canola and Chickpea Value in a Cereal Grain Rotation

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Canola (*Brassica napus* L.) in rotation with wheat (*Triticum aestivum*) has been an option 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 experimental design is a randomized complete block with four replications and plot size 8 x 61 meters. Each crop rotation is examined over two cycles (i.e. 6 years) and was repeated in 2015 and 2016. The study is located at the WSU Wilke Research and Extension Farm which receives an average of 350 mm of precipitation. Data collected included seed yield, costs of production, economic returns, and subsequent crop production yields and quality. Gross economic returns are calculated using local F.O.B. prices on September 15 each year, and canola and chickpea yearly contract prices. Cost of production is the input costs (seed, fertilizer, herbicides, etc.) only. Spring wheat had the greatest yield averaging 2,311 kg ha^{-1}, and there is no significant difference in yield between canola and chickpea at 1,035 and 1,003 kg ha^{-1}, respectively. Over the first three years, subsequent WW yields were greatest following chickpea at 3,978 kg ha^{-1}, second following canola at 3,734 kg ha^{-1}, and lowest following wheat at only 3,399 kg ha^{-1}. Over the two -year cropping sequence economic return over costs with chickpea/WW has averaged \$254 ha^{-1}, wheat/WW at has averaged \$208 ha^{-1} and canola/WW has averaged \$164 ha^{-1}. Overall, canola and chickpea both show positive rotation effects on following WW yield. Grower profit will vary according to grain prices which will fluctuate over years.

Improving Seed Size and Seedling Emergence in Transgenic *Camelina sativa* by Overexpressing the *Atsob3-6* Gene Variant

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Seed shape and size are important agronomic traits because they can affect yield, ease of harvesting, and seedling establishment, especially under adverse conditions (e.g. drought, weed and pest pressure). The development of crop varieties that have large seeds and long hypocotyls as seedlings, yet maintain normal growth characteristics as adults, is challenging for traditional breeding because the regulation of seed/seedling size is complex and can be linked to other agronomic traits such as heading date or flowering time.

Based on our previous findings, some of the *AHL (AT-Hook Containing, Nuclear Localized)* genes play crucial roles in determining seed size and hypocotyl length in *Arabidopsis thaliana*, a model brassica plant. When we express particular mutant form, *Atsob3-6,* of the *AHL* gene *AtAHL29/SOB3* (*Suppressor of Phytochrome B-4 #3*) the resulting transgenic *Arabidopsis thaliana* plants have normal adult growth that give rise to larger seeds and seedlings with longer hypocotyls than the wild type. *Arabidopsis thaliana* and *Camelina sativa* are from same family (Brassicas) and both have similar genomes. *Camelina sativa* is an emerging oilseed crop in dryland cropping systems.

Based on our preliminary results, we proposed: (1) to compare seed size of different mutations of *AtAHL29/SOB3* to identify the specific mutations that confer bigger seeds and longer hypocotyls than the wild type and; (2) translate the finding from *Arabidopsis thaliana* to the oil seed crop *Camelina sativa*.

In this study we have generated transgenic lines of *Arabidopsis thaliana* overexpressing *Atsob3-6*. We have then generated transgenic *Camelina sativa* plants overexpressing *Atsob3-6* as well as a similar gene variant from *Camelina sativa* (*Cssob3-6*). Seedling hypocotyl length, seed size, seed weight and seedling emergence from deep-planting assays were then measured. Our results show that transgenic plants expressing *Atsob3-6* confer bigger seeds and taller