# Manipulating the *AT-Hook Motif Nuclear Localized* (*AHL*) Gene Family for Bigger Camelina 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. The DNA-binding AHL proteins contain two functional units, the AT-hook motif and the PPC domain. Over-expression of one *Arabidopsis thaliana AHL* allele (*sob3-6*), with abolished DNA-binding capacity, leads to a long hypocotyl seedling phenotype with normal adult stature. Similarly, over-expression of the SOB3/AtAHL29 PPC domain alone, as well as alleles with specific mutations in the PPC domain, also confers similar long-hypocotyl seedlings with normal adult stature in *Arabidopsis* (Figure 1). All successful transformants with the long-hypocotyl phenotype also showed increased seed size and weight. We further over-expressed the *Arabidopsis sob3-6* allele in the oilseed crop *Camelina sativa*. These transgenic *Camelina* lines had larger seeds and seedlings with longer hypocotyls than their non-transgenic siblings. These transgenic *Camelina* seedlings can successfully emerge from deep planting in dry soil (Figure 2). These results demonstrate that transgenic manipulation of the *AHL* genes can improve stand establishment in dryland cropping systems. This approach may also be used in non-transgenic breeding strategies that employ specific mutations in members of the *AHL* gene family. We have recently been awarded a USDA/NIFA grant ($498,000/three years) to continue this project. Half of this award is for working with wheat, the other half for *Camelina*.

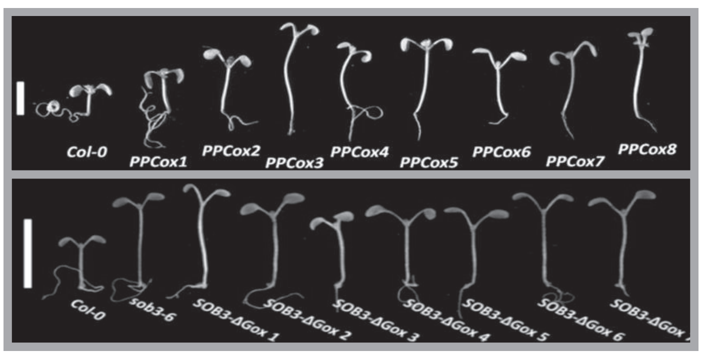


Figure 1. Over-expressing an AHL protein in Arabidopsis lacking the AT-hook domain leads to taller seedlings (top). The same phenotype can be obtained with an AHL protein that lacks six amino acids (bottom). Scale Bars= 1 cm.

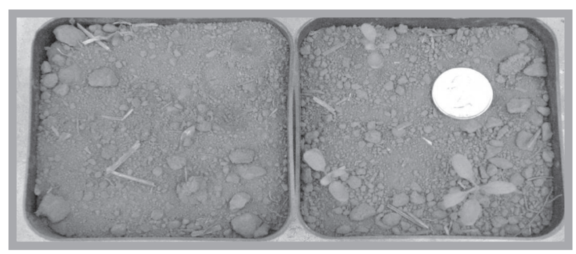

Figure 2. *Camelina* expressing the *sob*3-6 mutation emerge from deep planting in dry soil. Non-transgenic (left) and transgenic (right) seeds were planted on 1 cm of moist Palouse silt/loam and covered with 8 cm of dry silt/loam. All seeds germinated. 5 of 10 transgenic seeds emerged, 3 survived.

# Rotational Influence of Spring Grown 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 benefit of any crop should include the rotational effects on following crops.