Sinapis alba: Potential oilseed rotation crop for the Willamette Valley

Willamette valley agriculturalists need rotation crops, especially on soils that have few alternatives. The well-publicized conflict over canola is one manifestation of this unmet need for crops that diversify cropping enterprises. *Sinapis alba*, known by the common names yellow or white mustard, is a potential oilseed feedstock crop that will not cross with *Brassica* spp. vegetable crops. Other cultivated mustards are members of the genus *Brassica* and will cross with *Brassica* spp. vegetables or canola. Because of this distinction, *S.alba* is not regulated by current ODA administrative rules nor by proposed legislation.

One criticism of canola is that it shares many of the pests found in *Brassica* spp. vegetable seed crops and so it thought by critics to be a potential host for these pests, but unlike *Brassica* spp. vegetable seed crops or canola, *S. alba* is either resistant or tolerant to *Sclerotinia* stalk rot and white mold, black leg disease, flea beetle, cabbage seed pod weevil, cabbage aphid, and more pests. Unlike canola, *S. alba* has essentially no seed shattering losses so the crop is less likely to contribute to soil seed banks. Rotation with *S. alba* may improve grass seed grower's ability to control grass weeds and other pests. The crop is very competitive and has less need for weed control than many other potential crops.

Seed from *S. alba* is the prime ingredient in the condiment yellow mustard and serves as a water-binding agent in the production of processed meats and meat products. As a cover crop, *S. alba* has demonstrated that it can reduce weed populations in vegetable crop production, vineyards, and in other applications. While oil concentration in *S. alba* seed is low (26 to 30%) compared to canola (40%+), it is still better than the US's most widely grown oil seed crop – soybean, which checks in at 20% oil concentration. The oil can be a high quality feedstock for production of biodiesel. The crop produces about 60 gallons/acre of oil, slightly higher than the US average for soybean oil yield (57 gallons/acre). High glucosinolate content in meal makes this product unsuitable for animal feed, but the meal is marketed in the natural pest control market as a weed suppression agent and has shown promise in controlling weeds in container-grown ornamentals.

To be an economically competitive crop here, yield will need to be increased. Our previous work with *S. alba* was conducted with 50 lbs/acre of applied nitrogen and so the 1700 lb/acre seed yield level was never exceeded. University of Idaho trials show that seed yields exceeding 3000 lbs/acre are possible at high rainfall sites.

Objectives of our study include:

1. Determine the biological effects of applied nitrogen on seed yield and yield components of *Sinapis alba*.
2. Ascertain the impact of applied nitrogen on carbon partitioning in *Sinapis alba*.
3. Identify the optimum nitrogen management practices for production of *Sinapis alba* in the Willamette Valley.

Experimental approach:

Objective 1. Seed Yield and Yield Components

The study will consist of two field trials at OSU's Hyslop Farm: Trial 1 has been planted on March 11, 2013 and Trial 2 will be planted in early spring 2014. The cultivar IdaGold is being used to examine the effects of applied nitrogen on seed yield and yield components. Nitrogen treatments will be 0, 50, 100, 150, and 200 lbs/acre and these treatments will be applied post-planting (April 3, 2013) by using an orbit-air applicator. Baseline soil samples will be taken in each year prior to planting to characterize soil nutrient status. A blanket application of sulfur will be applied to all plots in order to remove this nutrient and its potential impacts from crop responses.

Measurements of seed yield components will be made on plant samples taken from each of the plots prior to seed harvest. These seed yield components include: weight of harvested seed, number of seed produced per pod, the number of pods per plant, and the number of branches per plant. The plots will be harvested by using a plot combine and seed yield will be determined on the cleaned seed.

Objective 2. Carbon Partitioning

The goal here is to learn how nitrogen applications affect the preferential partitioning of carbon in *Sinapis alba* plants. Several characteristics will be measured to determine whether carbon is more likely to be moved to the seed or to vegetative organs of the plant such as leaves and stems with increased nitrogen levels applied to the system. These characteristics include plant nitrogen and carbon concentrations, oil and protein concentration in the seed, harvest index (ratio of seed yield to total plant weight), leaf area index (ratio of leaf area to ground area), leaf chlorophyll concentration, nitrogen use efficiency (ratio of seed yield to total nitrogen available), and water use efficiency (ratio of seed yield to water available).

Plant carbon and nitrogen concentrations will be ascertained during vegetative or rosette (BBCH scale 30) and reproductive or full flowering (BBCH scale 65) developmental stages by use of a LECO CNS analyzer. Seed oil and protein concentration will be determined by using NMR (nuclear magnetic resonance) spectroscopy on harvested seed. Leaf area index will be ascertained by using a leaf area meter and leaf chlorophyll concentration will be determined by using a portable chlorophyll meter at the rosette and full flowering stages. Soil samples will be taken to measure the total nitrogen available in the soil while total above-ground dry weight will be taken near harvest to calculate harvest index.

Objective 3. Dissemination of Research Results

One of the expected benefits of this study is the identification of optimum nitrogen management application rates for the production of *Sinapis alba* in the Willamette Valley, and the rapid dissemination of these results to the crop production and scientific communities. Research results and photos from the field trials will be posted periodically on OSU's Seed Production Blog site for public viewing as they become available.

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