Enhancing Nitrogen Use Efficiency in Spring Canola

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Rationale:

In recent years, rising costs of fossil fuels and their other disadvantages, such as huge externalities associated with carbon emissions negatively influencing the environment, have greatly increased interest in growing biofuel crops, such as canola (oilseed rape) for production of biodiesel in Europe and North America. Canola has the potential to provide alternatives to Northeast states in diversifying their agricultural products, complementing cropping systems, and maintaining profitable and vibrant agricultural community.

Nitrogen (N) is generally the most limiting nutrient in canola production and relatively high rates of N fertilizer is needed and used to maximize yield. Our two-year studies in 2009 and 2010 confirmed that in comparison to the N supply, the N uptake by the canola plant is not high, which results in its low N Use Efficiency (NUE). This creates an increased cost associated with canola production and influences the possibility of N leaching after harvest. It also questions the sustainability of the crop as a suitable biodiesel feedstock. Improving NUE therefore, will provide economic benefits for the grower as fertilizer costs continue to rise, such that that they now may make up to 50% of the variable costs of crop production.

Research Goals: The main objectives in this study are enhancing NUE of spring canola through:

A. Establishment of a cover crop-canola cropping system, which contributes to providing N to canola and recovers unused N that would otherwise be lost to leaching.
B. Improvement of final seed yield by a) using alternative harvesting system/timing that reduces seed losses due to shattering and bird damage, and b) application of sulfur.

Treatments: In this project two approaches will be followed:

A. Enhancing NUE of canola through recovery of unused nutrients by cover crop:
   - Two canola cultivars (early and late maturity), four N application rates (0, 60, 120, and 180 lbs N/acre), and two sulfur levels (0, 35 lb/acre) are factorially combined and replicated four times.
   - Cover crop treatment includes no cover crop (control), and winter rye which will be planted in mid-August, right after the canola harvest.
   - Measurements include; N accumulation in canola, fertilizer recovery, N uptake efficiency, N utilization/or use efficiency, seed yield and yield components of canola in response to nitrogen rate, sulfur application, and harvesting method (direct harvest vs. windrowing).

B. Enhancing NUE of canola by using cover crops before planting canola:
   - Five cover crops (peas, fava beans, mixed peas/oat, mixed peas/tillage radish, and no cover crop) will be planted in mid-August.
   - Measurements include; dynamic of N status in soil with and without cover crops, N accumulation trend in cover crop, N contribution of cover crops to N need of canola, canola seed yield and yield components, favabean, green pea, and daikon yield as a potential supplemental income for the grower, energy yield efficiency of canola production for biodiesel purposes.

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