CSREES National Water Quality Program

Title: Application of SIMPOTATO model for Nitrogen Management of Potato in Sandy Soils to Minimize Nitrate

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Theme: Nutrient and Pesticide Management

Situation: Pacific Northwest (PNW; WA, ID, OR states) supports a wide range of agriculture production systems with annual farm gate receipts of over $13 billion. Increased scrutiny of impact of agricultural production practices on the environment could influence the economic sustainability. This region produces up to 55% of the Nations total Potato production (20 M metric tones). Groundwater nitrate levels in the Columbia basin potato production region has increased, thus, the need to develop nitrogen and irrigation best management practices.

Objectives: The objective of this project was: 1) to improve and validate an existing crop simulation (i.e. SIMPOTATO); 2) application of this model to estimate the transport of water and nitrogen below the root zone of Potato plants under different levels of nitrogen management; 3) use this model to predict the yield potential of Ranger Russet potato cultivar; and 4) compare model simulations with the measured values of nitrogen transport and losses, as well as tuber yield responses.

Methods: Ranger Russet cultivar was grown in a sandy soil in the Columbia basin region with different rates of pre plant nitrogen for a total N application for the whole season of 336 or 448 kg N/ha. The in season N was applied in frequencies ranging from 2 to 10. Extractable N concentrations were measured at various depths during the growing period. Nitrate levels in the soil solution were measured at 120 cm depth using suction lysimeters.

Partnerships: This research was conducted in a commercial field in cooperation with a commercial producer. i.e. AgriNorthwest Company. The research is a partnership between the ARS scientists in Prosser, WA, and Beltsville, MD, as well as Washington State University scientists. Results are discussed in annual field day, which brings about 150 industry and agribusiness partners.

Research: This research will lead to development of web-based decision aid tools that will be useful to the growers to optimize their production system by choosing the appropriate combination of inputs to optimize the production and quality of tubers, while minimizing the negative effects on the environment. Extension personnel and crop consultants will use new information and recommendations that result from this research. We have organized a Cropping Systems Support Group, which includes agribusiness, growers, university researchers, and extension specialists in the PNW. This support group meets regularly to discuss research results and obtain input in planning new research. Considerable cooperation has been developed with the Center for Precision Agriculture studies (Washington State University) scientists. We sponsor an Annual Field Day at the field site to provide technology transfer and solicit feedback from area growers.

Resources: The ARS Prosser and Beltsville budgets support the field research costs and a Postdoc for the project to work on the modeling and development of decision support aids. The Washington State University provides some expertise and support for these efforts. AgriNorthwest Company supports some components of the field research operation including the field site and irrigation.

Results: Field experiments have shown no yield or quality increase with increasing the N rate above 336 kg/ha. The results also show that delivery of most of N through irrigation (in season) with only about 56 kg/ha applied at pre plant appears to be the optimal N management for high yields of high quality tubers. The data from three years field study have been used for simulation of N transport and losses, as well as crop yields. The simulated data will be compared with the actual measurements in the field to validate the SIMPOTATO model. This model will be incorporated in the decision support system to improve the potato production system to optimize the production, while minimizing the potential negative effects on the water quality.