Assessment of Harvested and Sequestered Nitrogen Content to Improve Nitrogen Management in Perennial Crops (17-0488)

Interim Report
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OBJECTIVES

- Assess N concentration of harvested material removed from fields (N removed [R]) for approximately 25 crops over several growing seasons. Samples of harvested material will be collected and analyzed for twelve of those crops. Data for the remaining crops will come from existing sources. As the project is evolving, it appears that more crops may be included in the study than originally planned.
- Establish values for the annual amount of N sequestered in standing biomass for seven perennial crops. Tissue samples will be collected and analyzed for one of those crops. Data for the remaining crops will come from existing sources.
- Refine crop yield (Y)-to-R conversion factors, and add N-sequestration rate estimates, for use by growers and grower advisors during nutrient management planning and by coalitions for large-scale performance assessment.
- Promote and enable expanded knowledge and appropriate use of N-removal coefficients and N-sequestration rates (as part of routine N-management planning and evaluation) by growers, grower advisors, and coalitions.

SUMMARY

This project is developing updated conversion factors for 25 crops. For some crops, information is coming from other research projects. This project includes sampling and analyzing harvested carrots, corn [grain and silage], peaches, pima cotton, pistachio, plums, pomegranates, raisins, safflower, sorghum [grain and silage], and processing tomatoes. By partnering with commodity organizations, growers, processors, and packers, it has been possible to procure hundreds of

samples that represent a range of varieties and growing environments for each crop. In most cases, substantial information about source fields, such as age of perennial crops, crop management, variety, yield, quality, and dates of bloom or planting, are acquired and related to results. In this way, some of the factors that affect N content of the harvest can be investigated and explained.

These data will be incorporated into updates of *Nitrogen Concentrations in Harvested Plant Parts - A Literature Overview* by Dr. Daniel Geisseler (2016) as part of this project. The existing Y-to-R calculator (http://agmpep.com/calc-y2r/) will be revised to reflect these findings, and the results will be used to update the assessment and planning tools available to growers, grower advisors, and coalitions.

WORK DESCRIPTION

Task 1A. Establish sampling protocols and analysis methods for six crops for which N-content data are not available from other sources / Task 1B. Acquire data from others. For Task 1A, sampling protocols and analysis methods have been developed for all crops. For Task 1B, Dr. Geisseler is coordinating with project partners to obtain sampling data for the following crops: bok choy, chives, daikon, table grapes, lemongrass, on choy, oranges, prunes, and tangerines.

Task 2. Sample and Assess Harvested and Sequestered N Content. Per our FREP proposal and grant agreement, sampling and assessment are to occur for six crops: peaches, carrots, raisins, safflower, Pima cotton, and sunflower. After further refinement of data needs, six additional crops were identified for sampling (with no change to the FREP budget): plum, tomato, corn, sorghum, pistachio, and pomegranate.

Harvested samples of the following crops were obtained in 2019 and are currently being analyzed: carrots, peach**,** and plum. Sampling for tomatoes is scheduled to begin in late July. Samples for corn, sorghum, pistachio, pomegranate, raisin and safflower are scheduled to be delivered to the UC Davis lab in late summer or early fall. Coordination to obtain sunflower and pima cotton samples is ongoing.

Task 3. Interpret results and develop and publish N-concentrations Report updates. This task will commence as results become available and continue through 2020.

Task 4. Develop and publish calculator updates. This task will commence as results become available and continue through 2020.

Task 5. Outreach to growers and advisors. The N removed coefficients being refined by the project feed into several outreach processes and tools. Outreach processes into which the N removed coefficients are directly incorporated as they are refined include the following:

- The peer-reviewed Crop Yield to Nitrogen Removed Calculator (also known as the Y-to-R Calculator) is published at https://agmpep.com/calc-y2r/. It was developed based on conversion factors developed by Geisseler (2016). The calculator can be used by growers and advisers to use anticipated or actual yield data to estimate N removed (R) and the ratio of N applied (A) to N removed (A/R). Results can be calculated on inputs for a single crop or for multiple crops. Recent updates include clarification on reporting units and plant parts, as well as plant parts in which N removal is considered. Additional updates will be incorporated as results from this project become available. The calculator is currently

available, and updates will serve results of the project to growers and grower advisors in a usable format. Also, we are planning to supplement the online calculator with an offline, paper tool for growers and advisors preferring this format.

- Nitrogen Management Plan (NMP) Summary Report yield data are processed by coalitions with N removed coefficients, and then reported back to growers so that they can check to make sure that they are properly accounting for N removal as they plan N applications. Coefficients used by coalitions will reflect updates as results from this project become available.
- NMP Summary Report data from throughout the Central Valley are analyzed from an agronomic perspective by the MPEP Team. The results are then shared with commodity groups and grower/grower advisor communities, so that they can evaluate the meaning of what growers have reported, relative to future nutrient management study and outreach. The N removal coefficients are employed directly in calculation of the N balance in this analysis. This is a key parameter that reflects the maximum mass of leachable N.

As updated coefficients are developed, the updates and their significance will be discussed with growers in dedicated presentations, and as part of other, related presentations and communications. Examples to date include:

- A project summary is posted here on the SSJV MPEP website (http://agmpep.com). The website is shared by the SSJV MPEP Committee with the over 9,000 growers in the member coalitions.
- A poster, *Nitrogen and Dry Matter Accumulation in Peaches,* was presented at the Annual Conference of the Fertilizer Research and Education Program / Western Plant Health Association, November 1-2, 2017. This poster was focused on work completed prior to the FREP award, but is nonetheless relevant to the overall project to improve N removal rates. The poster is available here.
- A poster, *Assessment of Harvested and Sequestered Nitrogen Content to Improve Nitrogen Management in Perennial Crops,* was presented at the 2018 American Society of Agronomy Plant and Soil Conference, February 6-7, 2018. The poster is available here.
- A poster, *Working with Commodity Groups, Processors, and Packers to Procure Representative Crop Samples to Assess Harvest Nitrogen Content,* was presented at the 2018 FREP Conference. Annual Conference of the Fertilizer Research and Education Program / Western Plant Health Association, October 22-24, 2018. The poster is available here.
- A poster, *Working with Commodity Groups, Processors, and Packers to Procure Representative Crop Samples to Assess Harvest Nitrogen Content,* was presented at the 2019 American Society of Agronomy Plant and Soil Conference, February 5-6, 2019. The poster is available here.

Additional outreach will commence as results become available and continue through 2020.