

Fall 2012, No. 5

INTEGRATING 4R NUTRIENT STEWARDSHIP AND PRECISION AGRICULTURE

In his keynote address at the 11th International Conference on Precision Agriculture, Dr. Newell Kitchen, USDA-ARS, highlighted the significant role that nutrient management plays in the industry. “Nutrient management has been a starting point, the seedbed of a lot of the concepts where we got going [in precision agriculture].” He noted that in the early years of the conference, as many as 70% of the papers presented dealt with nutrient management. That number continues to be around 50% and may increase in coming years as options for precision nutrient management continue to grow.

The history of precision nutrient management can be thought of as having occurred in three phases: adaption, integration, and accountability. Dr. Kitchen pointed out that early on, we basically took what we knew about nutrient management and applied a spatial component to it. The precision agriculture movement really started to expand and overcome many of the short-comings of the adaption approaches when existing knowledge began to be integrated with new technologies. He cited the use of crop canopy sensors as an example of the growing options for precision nutrient management created by integrating real-time spatial and temporal information into the decision-making process.

4R Nutrient Stewardship is another example of integration in nutrient management. Dr. Kitchen acknowledged that the ideas of applying the right source at the right rate, at the right time, and in the right place have always been fundamental in our understanding and application of soil fertility and plant nutrition. However, the language, descriptiveness, and holistic emphasis put forth in the 4R’s is unique and fresh and that “precision agriculture is woven into many of the concepts of 4R stewardship”. He also said, “Precision science and technologies allow us to emphasize [the 4Rs] all at the same time; to wrap our arms around the concepts in a way that we can move forward in a meaningful way.”

Precision agriculture tools can provide the feedback and recordkeeping necessary for the accountability that is needed in nutrient management. The inclusion of accountability is another way 4R stewardship moves beyond traditional nutrient management. One of the main ways this is accomplished is through the inclusion of a dynamic feedback mechanism. In the past, nutrient management has been linear, mostly from the top down, with no feedback nor any assessment of changes in practice. 4R Nutrient Stewardship provides the framework for stakeholder involvement at the farm, regional, and policy-making levels and precision agriculture tools can provide feedback to all of these positions. The use of performance indicators as an objective evaluation of management practices, which can increase the level of accountability that is important to most all stakeholders, can also be done more accurately and effectively using precision agriculture technologies. Dr. John Fulton, Auburn University, echoed Dr. Kitchen’s feelings on accountability in nutrient management in his presentation by stating, “I really think there should be a 5th ‘R’, right recordkeeping.”

Integrating precision agriculture and 4R Nutrient Stewardship enhances our ability to meet the sustainability goals of crop production systems. As more growers adopt precision technologies for guidance, variable-rate control, data collection, and information management, their ability to apply the right nutrient source, at the right rate, at the right time, and in the right place increases considerably. This integration also enhances feedback among stakeholders and increases the confidence that the economic, environmental, and social challenges that face agricultural production can be viewed as opportunities to further advance nutrient management. When we, as an agricultural community commit to this approach, we will begin to change people’s attitudes about nutrient management and find, as Dr. Kitchen stated in his closing remarks, “a great frontier ahead of us.”

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