Up-to-date Calibration Research Is Vital to Site-Specific Nutrient Management

By A.E. Ludwick

Moving to higher yield levels through introduction of new varieties and implementation of new or modified management systems requires a continuing program of field calibration research to ensure accurate fertilizer recommendations. This is a formidable task considering how rapidly production agriculture is advancing.

Calibration research requires multiple sites and site-years spanning a range of soil and environmental conditions. The work is labor intensive and is frequently difficult to publish in scientific journals because of its applied nature. As a result, years or even decades pass between calibrations of many cropping systems. Frequently, a new calibration study will result in substantial increases in fertilizer recommendations since the previous calibration was done at a much lower production level.

Potassium (K) fertilization of cotton is a case in point. New guidelines from the University of California recommend up to 400 lb of K_2O/A with the soil test interpretation adjusted according to a K fixation test. Additional in-season foliar or water run K is suggested at first bloom when yield potential is good, regardless of soil test values or earlier K fertilization. Previously, state-wide K guidelines for cotton were not available. Because of a lack of in-depth research information, some questioned whether any K at all should be applied. It is now recognized that up to half of the cotton acreage in the San Joaquin Valley is K deficient.

The Cooperative Fertilizer Evaluation Program (CFEP) was initiated in 1993 through efforts of the University of Idaho and the fertilizer industry with the primary goal being to increase the scientific database from which nutrient recommendations are made. New phosphorus (P) recommendations for potatoes have been published. The recommendations have been substantially increased utilizing data generated through this program. The soil P sufficiency level has been raised from 15 to 20 parts per million (ppm) sodium bicarbonate ($NaHCO_3$)-extractable P. An adjustment in rate of P fertilization is made for each percent free lime rather than the previous increments of 5 percent, a starter of 80 to 100 lb P_2O_5 is recommended below 31 ppm, and P

Precision farming has attracted a lot of attention over the past few years. More sophisticated hardware and software are seemingly available with each passing day. Envisioned benefits are higher yields and more efficient use of inputs leading to more profit and enhanced environmental protection.

In the rush to grid fields and develop brilliant color overlays, the role traditional agronomic tools play in this process should not be forgotten. Updated soil test calibration data are essential to support the dynamic move toward precision farming.

rates are adjusted according to yield goal. Changes under consideration for K on potatoes include increasing the K sufficiency level from 150 to 175 ppm and more than doubling recommended K_2O rates for comparable soil test values.

Researchers at Utah State University are presently re-evaluating calibration data for P and K for irrigated alfalfa production. Initial results suggest that current recommendations are too low. Soil test sufficiency levels and corresponding rates of P fertilizer should be raised. Also, recommended rates of K fertilization may be too low and should be increased. These observations are based on only one year of research. Calibration will continue for at least another three years to build a sufficiently reliable database.

A 10-year P calibration study by Montana State University researchers completed in 1995 for spring wheat indicated that the previously established sufficiency level of 16 ppm $NaHCO_3$-extractable P is still valid. However, recommendations for rates of P fertilizer should be increased and a starter P application should be applied regardless of soil test. Researchers cite advances in spring wheat varieties and production technology for prompting this study and the resultant new recommendations.

These are just a few examples to illustrate the value of calibration research. Soil testing continues to be widely recognized as a diagnostic tool, but the point to be made is that soil testing programs based on outdated calibration data (or no data at all) can be counter productive. In each of the examples cited above, new research produced higher recommendations. Previous recommendations were obviously too low for optimum production. Site-specific management will best be served by current calibration information that accurately reflects the nutrient needs of today's production systems. BC

MID-SEASON K deficiency is shown in this cotton field in the San Joaquin Valley.

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optimum wheat production and that the responses were to the Cl component of the KCl fertilizer. Chloride deficiencies have since been documented in many of the Plains states and in several provinces of Canada. Both available soil test and tissue analysis procedures are calibrated for wheat, the crop most affected by Cl deficiency in North America.

There is ample opportunity to expand our understanding of fundamental agronomy and to improve the utilization of diagnostic tools. It is important that this knowledge base continues to grow in support of all new innovations, including site-specific management. BC

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