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From Scientific Staff of the
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FERTILIZATION AFTER DROUGHT

Much of the Southern and Central Great Plains Region has been severely affected by drought in 2011. In some areas crops have failed altogether, while in other areas crops will be harvested, but at yields far below average. These conditions raise questions about how to handle fertility programs going into 2012.

The majority of the fertilizer applied to failed crops in 2011 should still be there in 2012—either in the soil or in crop residue. However, growers still need to soil test to determine the nutrient status of fields where corn and other crops failed. It is also good to have some idea of the amount of nutrients present in the residue remaining, and how quickly those nutrients will become available to crops. Nutrients carried over from 2011 into 2012 may include:

- Mobile nutrients such as nitrate, sulfate, and chloride in the soil profile
- Immobile nutrients such as P, K, and Zn in the surface soil
- Nutrients in crop residues

A large portion of the mobile nutrients that were not taken up by the 2011 crop in drought affected areas are likely to remain in the top foot or two of soil. With the low rainfall in most of the Southern and Central Great Plains very little of the N will have been lost. For example, the K-State Soil Testing Lab is seeing higher-than-normal soil test levels for N, reflecting an accumulation of unused nitrate-N in soils (Mengel, 2011, K State Extension Agronomy e-update No. 315). Any unused S or Cl^- will also likely remain in the top foot or two of the soil profile. Nevertheless, among the first tools farmers should think about when planning their 2012 fertilizer program is a deep profile soil test for N, S, and Cl^-.

When immobile nutrients such as P, K, and Zn are applied to the soil, they interact with different constituents of the soil and are retained. Phosphorus reacts with the clay surfaces and the Fe and Al coatings found on soil particles and is sorbed to those surfaces. Sorption reactions occur in stages, and the initial stages are highly reversible. This is part of a buffering system which maintains a constant small quantity of P in the soil solution and supplies P needed for good crop growth. Phosphorus applied in 2011 that was not taken up was likely sorbed onto clays and other minerals creating a new equilibrium in the soil and to some extent increasing soil test values for P. The carryover and probable resulting higher soil test P values should be considered going into 2012.

Potassium is a charged cation (K^+) which is attracted to and retained on the soil's CEC. Exchangeable K maintains a constant supply of K in the soil solution to support plant growth, and like P it is a part of a highly buffered system. Potassium applied and not taken up by the 2011 crop should remain available for 2012, and should be reflected in a somewhat higher K soil test value.

With Zn, a third mechanism, chelation, occurs and retains applied Zn. Soil organic matter is a strong natural chelating agent. Zinc sulfate added to soil slowly dissolves. A portion reacts with the organic matter and is retained in soluble, natural organic matter chelates. The vast majority of the Zn that moves to plant roots for uptake is present as a natural soil organic matter chelate.

The bottom line for drought affected areas is that it is likely that there will be carryover of nutrients applied in 2011 into 2012. Soil testing is an important tool in determining the extent of carryover. The mobile nutrients (N, S and Cl^-) need to be measured using a deep profile test (at least 2 ft. depth), while the immobile nutrients (P, K, and Zn) can be measured using a surface sample (6 to 8 in. depth). For an expansion of this topic see the recent IPNI Insights newsletter for the South and Central Great Plains at: http://www.ipni.net/insights.

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Abbreviations: N = nitrogen, P = phosphorus, K = potassium, S = sulfur, Cl^- = chloride, Zn = zinc, CEC = cation exchange capacity, Fe = iron, Al = aluminum.

Note: ***Plant Nutrition TODAY*** articles are available online at the IPNI website: www.ipni.net/pnt