Science Update

Successful No-Till Requires Complete Management

Despite the many benefits of no-till farming—including lower energy costs and reduced soil erosion—farmers have not fully embraced the practice. But research is showing that, with complete management, no-till can be good for both growers and the environment.

Widespread concern about curbing losses of excess nitrogen and phosphorus from croplands has been the primary driving force toward adoption of no-till production practices. But the focus on nitrogen and phosphorus may have at least one important unintended consequence: reduced potassium availability to growing plants.

With conventional tillage, potassium that's added to the soil through fertilizer or released by decay of crop residues plowed into the soil after harvest or at planting time is easily accessed by the next crop. But with no-till, the potassium tends to accumulate closer to the soil surface, where plant roots sometimes can't capture it. That could explain the slow early-season growth and lower yields observed in some corn and soybean fields. Researchers are now experimenting with various potassium sources, including a liquid solution that can be applied at planting and thus be more available to plant roots. *Douglas L. Karlen and John L. Kovar, USDA-ARS Soil and Water Quality Unit, National Soil Tilth Laboratory, Ames, Iowa; phone (515) 294-3336 [Karlen], (515) 294-3419 [Kovar], e-mail karlen@nstl.gov, kovar@nstl.gov.*

Probing Dietary Copper's Healthy Limits

Copper is one of Earth's mineral elements critical to maintaining good health, especially of our brains, blood, and bones. We get copper from foods such as liver, nuts, sunflower seeds, and oysters. But how much dietary copper is optimal, or desirable? Research is suggesting that today's upper limit for American adults—set at 10 milligrams (mg) a day—may need to be lowered.

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Dietary copper research indicates that the upper limit currently recommended for adults may be too high. Rich sources of copper include nuts, sunflower seeds, lobster, green olives, wheat bran, liver, blackstrap molasses, cocoa, oysters, black pepper.

Work is under way to see how the body handles excess copper. Already, an analysis of blood, urine, and other samples from nine healthy male volunteers aged 27 to 48 has shown a potentially unhealthy accumulation of copper after 4-1/2 months of consuming 7.8 mg daily. It lowered one standard measure of the volunteers' antioxidant levels and also interfered with some immune system defenses. Though excretion of copper increased on this high-copper regimen, it wasn't enough to remove the excess. *Judith R. Turnlund, USDA-ARS Western Human Nutrition Research Center, Davis, California; phone (530) 752-5249, e-mail jturnlun@whnrc.usda.gov.*

Screening Weeds for Glyphosate Resistance

All plant types—including grasses, broadleaves, sedges, and perennial and woody plants—succumb to applications of glyphosate. By planting glyphosate-resistant crops, growers have been able to apply this useful herbicide to kill a wide array of weeds. But in 2000, horseweed *(Conyza canadensis)* became the first weed species known to develop resistance to glyphosate in cropland where glyphosate-resistant soybeans had been grown. Now glyphosate-resistant horseweed biotypes have been confirmed in 13 states east of the Mississippi.

It's important that growers know whether the horseweed they observe in their fields is a resistant type. This would enable them to switch to an effective herbicide and thereby reduce spread of the resistant weed while protecting their crops.

Two quick and easy new tests for glyphosate resistance have been developed that can be used singly or together. The first relies on direct observation of damage to whole leaves dipped into a glyphosate-based mixture. The other requires specialized lab equipment to measure metabolite levels in leaf tissue samples, because glyphosate inhibits plants' amino acid metabolism in what's known as the shikimic acid pathway. *Dale L. Shaner, USDA-ARS Water Management Research Unit, Fort Collins, Colorado; phone (970) 492-7414, e-mail dale.shaner@ars.usda.gov. Clifford H. Koger III, Crop Genetic and Production Research Unit, Stoneville, Mississippi; phone (662) 686-5290, e-mail ckoger@msa-stoneville.ars.usda.gov.*