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Fact sheet

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On-Farm Leaf Mulching: Effects on Soils, Crop Yield, and Pests

Daniel Kluchinski, Mercer County Agricultural Agent; Joseph R. Heckman, Ph.D., Extension Specialist in Soil Fertility; Joseph Ingerson-Mahar, Field Crop IPM Agent; and Fred Kelly, Resource Conservationist, USDA-NRCS

Introduction

In New Jersey, 5 million cubic yards of leaves are collected each year. State regulations ban disposing of leaves into landfills, and their local burning or central incineration. Municipalities can either compost or leaf mulch the leaves. Leaf mulching is the application and incorporation of leaves on agricultural land. The effects of leaf mulching on soil physical properties, pH and nutrient management, crop yield, and pests are discussed in this fact sheet. These results are based on a three-year study conducted by Rutgers University.

Soil Physical Properties

The leaf residue remaining on the soil surface after incorporation reduces soil erosion over winter. A 3-inch leaf depth incorporated twice with a chisel plow provided at least 40% surface residue. Leaves improve soil structure and aggregation, as the soil in leaf mulched areas tends to be more friable and more easily worked with tillage equipment.

Leaf mulched areas also retain more moisture in the spring and after rainfall. During dry, hot summer weather, crops in leaf mulched plots often show reduced drought stress. However, cool, wet conditions in the spring may delay ground preparation and seed germination, particularly in fields with 6-inch leaf applications. Under such conditions, growers may want to delay planting leaf mulched fields until they have dried and warmed. Therefore, increased water holding capacity may be beneficial or detrimental, depending on weather conditions and quantity of leaves mulched.

pH and Nutrient Management

Soil analysis shows no significant effect of leaf mulching on soil pH. Therefore, additional agricultural limestone is not necessary. Over time, especially with annual applications of leaves, it is expected that soil nutrient levels and organic matter content will increase.

Leaves delivered to New Jersey farms were analyzed for nutrient content. The mixed species leaves contain between 0.66 and 1.62% nitrogen, 0.02 and 0.29% phosphorus, and 0.09 and 0.88% potassium. Although these nutrient concentrations may appear low, 6 inches of leaves would apply between 265 to 650 pounds of N, 8 to 117 pounds of P, and 36 to 353 pounds of K per acre.

Although leaves add substantial amounts of nitrogen, the high C/N ratio of leaves (average at 50:1) would likely cause the immobilization (unavailability) of soil nitrogen. This can cause crop nitrogen deficiency, and if severe enough, may affect crop growth or yields. In research trials,

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nitrogen deficiency symptoms occurred on corn and soybean plants shortly after germination. However, side-dressing the corn with nitrogen fertilizer remedied the problem. For soybean, nitrogen-deficiency symptoms dissipated once the plants began to form nodules and fix atmospheric nitrogen.

Eventually, the decomposed leaves should slowly release nitrogen, phosphorus, and potassium, contributing to long-term soil fertility. Crop production can be successful with proper N management, keeping in mind the potential for nitrogen deficit caused by immobilization and the potential long-term benefit when this bound nitrogen is released. For additional information, consult RCE fact sheet FS824: Plant Nutrients in Municipal Leaves.

Weeds, Soil Arthropods, Nematodes and Disease

Weeds, insects, nematodes, and disease occurrence were monitored throughout the study. Summer annual grass and broadleaf weed populations increased as leaf application rates increased. It appears that increased soil moisture retention led to increased or prolonged weed seed germination. Herbicide tie-up in the leaf residue may also be a cause. Although weed populations did not significantly reduce yields, slight increases in herbicide application rates or the use of postemergence herbicides may help to improve weed control.

Weekly Integrated Pest Management (IPM) scouting determined no differences in aboveground insect pest populations or disease occurrence. Pitfall insect trap samples showed an increase in both pest and beneficial insects as leaf depth increased, while pest nematode populations were significantly less in leaf-amended plots. No economic thresholds for insects or disease were reached.

Corn and Soybean Yield Response

Field corn and soybean yields generally increase as leaf amendment rates increase. The benefit of increased soil water holding capacity may have helped to maintain yields, especially during dry periods and on drought- prone soils. Cool, wet conditions in spring may reduce corn germination, plant population, and yield. Under such conditions, growers may want to delay planting until soil warms or increase seeding rate slightly to offset any germination problems.

In addition, corn and soybean yields were generally greater when grown in rotation compared with the same leaf and nitrogen (N) fertilizer treatments in continuous corn or continuous soybean rotations.

Conclusion

Leaf mulching can be easily integrated into any crop production system with proper planning and management. Through this partnership with local municipalities, agriculture can help solve a leaf management problem that affects all of society by using a technique that improves on-farm income, reduces municipal disposal costs, reduces soil erosion, and increases the productivity of farms. It should be noted that already composted leaves and other organic sources that are sometimes available from municipalities offer similar advantages with less likelihood of causing nitrogen immobilization.

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