Mississippi Corn Promotion Board
2023 Progress Report

Project Title: Enhancing Compatibility of Cover Crops with Corn Production Systems

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Project Summary (Issue/Response)

Cover cropping is an up-and-coming agricultural topic primarily driven by the goal of improving soil health and water quality. However, despite producing soil, water and conservation benefits, grower acceptance and adoption of cover crops remains quite low. Grower adoption is limited because cover crops produce nominal monetary return, and often reduce profitability of the primary cash-crop grown thereafter. Cover crops may hamper productivity of the subsequent crop due to impairing planting and stand establishment, introducing allelopathy and pest issues, and confounding nutrient availability. Corn is especially vulnerable to any of these issues because it is the first crop planted in the spring, is well-known to be responsive to early planting, and is also extremely sensitive to plant stand variability. The abundant spring rainfall common in our region further amplifies already significant challenges, because it severely restricts planting date opportunities and complicates issues with stand establishment and growth disparity documented by previous MCPB sponsored research to limit corn productivity. This research indicates cover crop interference dramatically reduced corn grain yield compared to where no cover crops were grown, or cover crops were terminated with herbicides at least four weeks in advance of planting. Thus, cover crops reduced economic returns at least $57.02 per acre compared to traditional cropping systems. Thus, identifying limitations and developing management strategies to mitigate these challenges are needed to successfully integrate cover crops with cropping systems.

Project Results/Outcomes

This research will help identify factors and management practices needed to successfully integrate cover crops into Midsouth corn production systems without sacrificing economic returns or increasing production risks. Substantial efforts have been directed assisting our graduate student with completing writing and defending his Master's thesis. We have also identified a new graduate student to continue enhancing cover crop compatibility with corn. Field research is focused upon evaluation of cover crop species. Twenty different species and varieties of cover crops are being evaluated to determine suitability for various purposes and environments. Cover species can generally be classified into cereal grains, cool season legumes and brassicas or other non-legume broadleaves. These three groups of plant species possess different characteristics which affect the role they serve in our agricultural cover crop systems.

Cereal grain species possess fibrous, lateral roots, emerge quickly and usually produce vigorous fall growth. Thus, cereals provide excellent soil stabilization and protection from erosion. However, cereals produce stems which have a high carbon content which is slow to decompose and thus, can produce various complications with establishment and growth of corn or other primary crops planted following a cover crop.

Project Results

Legumes are unique because they can biologically fix nitrogen through a symbiotic relationship with rhizobia bacteria in root nodules when plants are healthy and properly inoculated. Accordingly, legumes are an important component of cover crop blends. This supplemental nitrogen benefits plant growth, including companion and subsequent crops, and help improve N relations during the transition from cover crops to the primary crop. For instance, decomposition of plant organic matter produced by cover crops uses nitrogen to facilitate breakdown. Thus, nitrogen produced by legumes may aid this process and help avoid a nitrogen deficit in the soil. This immobilization process can reduce nitrogen availability for the primary crop because high carbon residue, such as from cereal cover crops, needs more nitrogen to decompose than is present. However, legumes produce less fall growth, compared to cereals, so blends are normally needed to attain sufficient cover to stabilize soil and protect from erosion during the fall and early winter. Our research shows legume adaptation can vary considerably between species depending on tolerance to wet soils, maturity and susceptibility to winterkill. Legumes are also considerably more vulnerable to winterkill than cereals.

Brassica cover crops are often grown because they can produce an underground bulb or tuber on their tap root which can relieve soil compaction. They usually produce vigorous fall leaf growth and may produce compounds which inhibit growth of other plant and weed species. However, brassicas are rather susceptible to winterkill from low temperatures. Accordingly, brassicas are best suited to serve a complimentary role in a cover crop blend of species.

Legume species can vary greatly in adaptability. Persian clover (top) and Crimson clover (bottom) growth on the same day.

Project Impacts/Benefits

Cover crop species should be selected to serve specific purposes which benefit your system and culture. Multiple cover crop species are usually grown to achieve various goals or survive diverse environments. However, you won't likely reach your potential without knowing what characteristics and traits various cover crops possess so you can select accordingly. Our research shows considerable differences in traits and characteristics, particularly among legumes, and role of the three different cover crop classifications, including cereal grains, legumes and brassica species. Selecting cover crop species which produce benefits, while minimizing interference is critical to successfully integrating cover crops with corn production systems.

Blends of cover crop species are needed to accomplish various goals.

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