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Growing, Establishing & Managing Cover Crops

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This fact sheet gives some applied research based tips on successfully growing, establishing, and managing cover crops and provides a basic understanding of soil ecology in continuous no-till and cover crop systems. For more information, read the publications in the reference section.

Tip 1: Use cover crop blends or mixtures composed of at least one grass, one legume, and one brassica or other diverse cover crop species with differences in plant height and leaf architecture, growth, and rooting depth. Mix summer annuals with fall and winter annuals to increase biomass production and residue diversity and improve soil resiliency to adverse environmental weather conditions.

Tip 2: Select combinations of partially shade and light tolerant species with narrow and broad leaves, taproots and fibrous roots to maximize sunlight and rainfall interception.

Tip 3: Cover crop species blends should be at least 60% short height (clover, cowpea, radish, winter pea, etc.), another 20% intermediate height (buckwheat, rye, oats, etc.), and 20% tall (Pearl millet, sunflower, sorghum) to utilize 100% of available sunlight and moisture and to minimize direct competition for space, nutrients and water.

Tip 4: To determine initial seeding rate in cover crop mixtures, divide the full rate of seed needed for each cover crop in a monoculture and divide by the number of cover crop species planted. For example, a simple cover crop mixture is oats, crimson clover and radish. The full rate for oats is one bushel per acre or 32 pounds (#) divided by 3 or 10-11# in a three-way mix. Crimson clover is 15# or 5#/A and radish is 3-5#/A or 1-2# in a three-way mixture.

Tip 5: Small seeded cover crops should be planted shallow, large seeded cover crops deeper. Set the planter or drill for the largest seed in the mixture. Cover crop seed mixtures will generally not separate unless the seed box is not full or excessive bouncing occurs during planting or drilling.

Tip 6: Most fall cover crops need a minimum of 1 inch of rain and at least 60-90 days of growth to survive the winter. Due to reduced day length (light availability) and declining soil temperatures, planting or drilling earlier is beneficial for establishing fall cover crops successfully.

Figure 1: Daikon radish are a brassica cover crop that may be planted to reduce soil compaction, increase water infiltration, reduce weed emergence, increase earthworm numbers, and improve soil organic matter levels. Photo courtesy of David Brandt.

Tip 7: Legumes in a cover crop mix may reduce the need for adding nitrogen (N) fertilizer since legumes share biologically fixed N among other species while non-legumes recycle N.

Tip 8: Legume cover crops need to be inoculated with the proper inoculant. Do not buy pre-inoculated seed because high temperatures under storage and light kill the inoculant. Each legume or clover species requires a specific inoculant.

Tip 9: Add manure or fertilizer to cover crops to help increase biomass production. Most applied fertilizer or manure will become available to the next crop after it is decomposed. Add 40-50# N/A to grass or brassica cover crops to double biomass production, if manure is not available. See Figure 1.

Tip 10: Drilling is preferred to broadcasting seed to improve seed-to-soil contact. Increase the seeding rate by 10-20% if broadcasting to compensate for reduced germination. Large seeded cover crops generally should not be flown on or broadcast. For corn production, broadcast seed when you can see at-least 50% light penetration between the rows; for soybeans, when 25% of soybeans leaves turn yellow.

Tip 11: Use cover crops to increase soil organic matter (SOM), to control soil erosion, to provide mulch, and to improve nutrient- and water-use efficiency. Each 1% SOM is associated with about 1,000# N, and 100# of P, K, and S. The majority of the SOM comes from roots. Growing two sets of roots (grain crop + cover cover) increases SOM levels.

Tip 12: Mycorrhizae fungus (1/10 the size of a root hair) move transport nutrients and water efficiently to grain crops and 80% of all plants utilize mycorrhizae fungus. Oats and crimson clover are cover crop species that stimulate mycorrhizae development along with long-term no-till. High P soil levels and tillage decrease mycorrhizae fungus spores.

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Tip 13: Soil water holding capacity increases by 1-2 inches per acre-foot of soil for every 1% increase in SOM (Hudson, 1994). Increasing SOM levels improves crop drought resistance.

Tip 14: Soil microbes (especially bacteria) are considered soluble bags of nutrients and enzymes and directly feed the plant. There is about 1,000-2,000 times more soil microbes associated with live roots than bare soil. The plants supply 25-40% of their total carbohydrate root reserves just to feed the soil microbes since microbes fix and recycle soil nutrients efficiently. The rhizosphere around the plant root is the most biochemically active zone in the soil profile.

Tip 15: To check for poor soil structure and compaction, use a shovel to look for soil layers. In good healthy soil, a shovel should easily penetrate the soil (even clay soils) and should crumble. As a reference, compare soil in a fence row that has been undisturbed to soil that has been tilled.

Tip 16: Grass cover crops like Sorghum Sudan, annual ryegrass, cereal rye, and oats have fibrous root systems to improve soil structure Brassicas like radish reduce deep soil compaction while buckwheat and phacelia reduce surface compaction. Sunflower, hairy vetch, crimson clover, red clover, sweet clover and cowpeas have long taproots for deep compaction.

Tip 17: Cover crop roots decrease soil compaction, increase porosity, and improve soil structure. Soil structure improvements may take 2-3 years, but the changes will be more permanent with cover crops than doing tillage, which destroys SOM and ruins soil structure.

Tip 18: All cover crops improve soil structure, however; cover crops that turnover roots quicker and/or have larger total root biomass will increase SOM levels faster.

Tip 19: If soil is too wet in the spring, let cover crops grow to dry the soil. If soils are starting to dry out, terminate the cover crop sooner and plant the main crop. See Figure 2.

Tip 20: For most cover crops, it is easier to plant the main crop, then kill the cover crop (unless the soil is drying to fast). Killing cover crops one week before planting may cause problems with hair-pinning, twisting, and wrapping. A planter or drill can slice through a live crop easier than a dead or dying crop. For crop insurance, make sure the cover crop is terminated within an acceptable time period.

Tip 21 & Summary: Keeping soils covered with live plants mimics Mother Nature. Live plants supply the energy needed to stimulate a diversity of soil microbes. Healthy soil microbes and soil fauna, in turn, recycle nutrients to the plants and together they improve the soil environment and to create a healthy place for all organisms to live.

Figure 2: Sowing soybeans in a cereal rye cover crop. Benefits include improved weed, insect, and disease control, drier soils, and 5-7 bushel soybean yield increases per acre. Photo courtesy David Chance, Indiana.

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