Natural Resources Conservation Service

Iowa Agronomy: Cover Crop Management

A cover crop is a plant that is used primarily to slow erosion, improve soil health, enhance water availability, smother weeds, help control pests and diseases, increase biodiversity and bring a host of other benefits to your farm.

Cover crops have also been shown to increase crop yields, break through a plow pan, add organic matter to the soil, improve crop diversity on farms and attract pollinators. There is an increasing body of evidence that growing cover crops increases resilience in the face of erratic and increasingly intensive rainfall, as well as under drought conditions. Cover crops help when it doesn't rain, they help when it rains, and they help when it pours!

COVER CROP BENEFITS

Soil Health Improvement/Weather Resiliency: Cover crops are a critical component of a successful soil health system. Proper incorporation of cover crops into the crop rotation will increase soil organic matter, improve soil structure and support soil biota. Living roots excrete compounds which bind soil particles together and feed soil organisms. In return the soil organisms provide nutrients, water and/or protection from pathogens. Stabilizing soil aggregates and increasing soil organic matter directly increases the soil root zone available moisture. Populations of beneficial organisms such as earthworms and Arbuscular Mycorrhizae Fungi (AMF) have been shown to increase with use of cover crops. AMF associates with 90% of the plants on earth and this association is critical for nutrient uptake and disease suppression for the plants. Cover crop roots penetrate compacted soil layers and open channels (macro-pores) through the soil, which increases infiltration, internal drainage, aeration, and rooting depth. Tillage to establish or terminate the cover crop greatly reduces benefits to soil organic matter, soil structure and biodiversity of soil organisms.

Erosion Control: Cover crops reduce soil erosion in several ways. They protect the soil surface from raindrop impact, increase water infiltration, trap and secure crop residues, improve soil aggregate stability and provide a network of roots which protect soil from flowing water.

Nitrate Loss Reduction: Nitrate losses from Iowa cropland can find its way to surface waters through surface runoff and tile. Studies show that as much as 80% of these losses can occur during the winter fallow period and into the spring. Many cover crops are good scavengers of nitrogen and will take up excess nitrogen and store it in plant tissues through the winter and early spring. Studies at the USDA-ARS National Laboratory for Agriculture and the Environment (NLAE) have shown that a winter cover crop of Cereal Rye can reduce the total nitrate loading in drainage systems by 55%. Some of this nitrogen will be available to the following crop and most of the rest is stored in the soil organic matter.

Phosphorus Loss Reduction: Phosphorus loss from the Iowa landscape occurs in both soluble and particulate forms (i.e. attached to soil particles or organic manure or crop residues). Particulate phosphorus loss is reduced by trapping organic residues and reducing soil erosion.

Atmospheric Nitrogen Fixation into the Soil: With proper management legume cover crops fix nitrogen which can reduce additions of nitrogen for the subsequent crop. All legumes require Rhizobium bacteria to fix nitrogen. In many cases these are Rhizobium strains specific to individual species of legumes. Assure the proper inoculant is applied to the seed just before planting. Use only fresh inoculant (check the date). See Reference: (SARE) "Managing Cover Crops Profitably, 3rd edition", page 70, Chart 3B.

Weed Suppression: Cereal grains, especially cereal rye, are very effective in providing a mulch that will create a weed barrier by blocking sunlight and producing natural chemicals which suppress weed growth. The cover crop should be allowed to accumulate at least 6,000 lbs. of Dry Matter/ac.

Cover Crop Grazing: Research has shown that cover crop grazing can improve soil health more rapidly than cover crops alone as part of a cropping system. Livestock converts above ground biomass to urine and manure, creating a beneficial environment that increases organic matter in the soil. Refer to Prescribed Grazing for guidance on grazing cover crops.

When a cover crop will be grazed, ensure the selected crop complies with pesticide label rotational crop restrictions and that the planned management will not compromise the selected conservation purpose(s). See Iowa State University publication Crop 3082 "Herbicide Use May Restrict Grazing Options for Cover Crops."

SEED SELECTION

Selection of Plant Materials: Use seed that has been cleaned and is free from noxious weeds. All seed must be tested for purity and germination by a certified seed lab. The germination test must be no older than 12 months. Select a species adaptable to the desired planting date with ample time to germinate and reach an acceptable growth stage. Select a species or mix which will meet the intended purpose and maximize the desired benefits. Utilize the "340_IA_IR_Cover_Crop_2021.xlsm" for species selection, seeding rate and approved seeding dates.

SITE PREPARATION & WEED CONTROL

Preceding crop residues should be spread evenly across the harvest swath to improve stand uniformity. Existing weeds should be eliminated by applying herbicide if it is determined that sufficient pressure exists to hinder the establishment and growth of the cover crop or perennial weeds are present. If spraying, work with an agronomy consultant or Iowa State University Extension Specialist to determine the best herbicide combination and timing. Follow the manufacturer's label rates and guidelines when applying herbicides.

Lime and Fertilizer: Fertilizer is not recommended (this includes nitrogen) for the establishment of the cover crop but may be used to increase biomass production for grazing. The cover crop may be used to sequester or trap nutrients for the subsequent crop. Lime application in conjunction with a cover crop is advantageous when soil test recommendations call for raising the pH.

TIMING OF SEEDING

Cover crops must address producer goals and fit within weather limitations. They should enhance the production system by adding diversity, living roots and biomass production into the crop rotation.

Fall Seeding: Fall weather in Iowa is challenging for good establishment and growth of cover crops. Earlier cover crops seedings increase the likelihood of establishing a successful stand. Seeding should be completed as soon as the crop is harvested or over-seeded prior to harvest.

Over-seeding via a plane, helicopter, drone or high-clearance spreader into existing vegetation or standing crops will allow an earlier seeding date. The soil surface must be moist and friable to enable the seed to settle into the surface and make good contact with the soil. Broadcasting seed requires adequate moisture for the seed to germinate and establish. This moisture needs to be present at the time of seeding or should be expected to occur within 10 days of seeding. If moisture is not present and germination is delayed, there is an increased chance of seed mortality from desiccation, insect damage, or animal predation.

The optimum time to seed into standing soybeans is when 10-20% of the leaves are turning yellow. This timing is about 10-14 days before most leaves fall which will mulch the cover crop seed. Seeding the cover crop after the soybean leaves have fallen will result in poorer establishment due to the seed landing on a layer of leaves rather than on the soil surface.

Optimum time to seed into standing corn is when the kernel milk line is at least 50% formed. For silage corn, seeding should be done about 2 weeks before cutting silage, when the corn is in early dent stage.

Spring Seeding: The seeding window in the spring provides an opportunity to get more reliable establishment of nonwinter hardy cover crops with more control on biomass production before termination. Seeding should be done in mid to late March and allowed to grow for a minimum of 5 weeks after emergence to gain enough benefit to warrant seeding the cover crop. This will be a minimum of 6 weeks after seeding if soil conditions are favorable for germination and emergence at the time of seeding.

Interseeding in early season Corn: Seeding the cover crop in early season corn must be done after the corn plant is established but early enough to allow establishment of the cover crop before crop canopy. Typically seeding between V4 and V6 is a good target and may vary by one growth stage. Seeding at this growth stage allows enough sunlight for shade tolerant species to germinate and begin growth before canopy closure. Always review the herbicide program for cover crop compatibility, both herbicides used in prior season as well as what is applied or planned for the current year.

SEEDING METHOD

Drilling: Use a drill that is designed to handle heavy crop residues and the type of seed being planted (especially important for small seeded species). Set properly, the drill will provide good seed-to-soil contact and a planting depth preferred for the desired species to be planted. This should provide for faster and more consistent emergence and is recommended over broadcasting during the final days of the approved seeding period. Depth control for most drills is not as precise as a planter, so it is important to set it for the optimum depth and check often to assure placement doesn't exceed the maximum depth for selected species.

Narrow Row Planting: Many split-row or narrow row planters (15" row width or less) can be equipped with seed plates, such as those used for wheat, sugar beets or sorghum, which work well for many cover crop species. Additional adaptation and/or calibration may be necessary due to variation of seed size among cover crop species and varieties. This method should provide the most consistent emergence and is recommended over broadcasting during the final days of the approved seeding period. This method may reduce benefits for weed control and canopy cover.

Harrow Seeding: Rotary harrows, coulter harrow type vertical tillage tools or similar tools can be used to aid in fluffing or cutting residue to allow improved seed to soil contact over broadcasting alone but will lack the depth control of a planter or drill. Air delivery seeders can be mounted to these tools to deliver the seed to the soil as the residue is lifted or cut. This will be a fast, single pass operation, that can seed many acres in a short period of time. This method is considered full width tillage.

Broadcast Seeding: Seed may be broadcast into crop residue without a seedbed preparation if completed in a uniform manner. Heavier seeds such as cereal grains are more adapted to this method when seeding into freshly harvested crop residues. Pre-mixing the seed with 200 lbs. per acre of pelletized lime or blended with the fertilizer intended for the subsequent crop is acceptable. Seed blended with fertilizer should be immediately spread to prevent damage to the seed.

Other Approved Innovations: Air delivery seeders can be mounted to combine heads to deliver the seed to the soil ahead of the residue being cut or shredded. As the residues exit the back of the combine they are spread as mulch over the seed allowing improved seed to soil contact and emergence over broadcasting alone. Mixes with smaller seed size may be preferable to reduce seed hopper filling frequency. Additional seeding innovations are likely and should be evaluated on a case by case basis.

TERMINATION

For most cropping systems, it is not desirable to allow the cover crop to produce seed. Harvest for grain is not allowed. Termination should be done as late as possible to maximize the intended benefits. If inadequate moisture is not a concern, cover crops should be left as long as possible to ensure maximum benefits.

Ensure cover crops are managed and compatible with Risk Management Agency (RMA) crop insurance guidelines/rules/requirements. The applicable version of NRCS Cover Crop Termination Guidelines at the time of this publication is Version 4: June 2019. Please refer to the RMA Cover Crop page at https://www.rma.usda.gov/en/Topics/Cover-Crops for updates.

Use of Herbicides: If the cover crop is to be terminated with herbicides, assure that timing and selection of herbicides achieve a complete kill. Translocated herbicides perform better when plants are actively growing. A minimum daytime temperature above 50° and nighttime temperature above 40° is best for good translocation. During cool weather periods, application should be made during the warmer part of the day (i.e. 9:00am-3:00pm). Avoid tank mixing herbicides or fertilizers that are antagonistic to

translocation. Consider the following crop when selecting the herbicide for termination. Follow all federal, state, and local guidelines as well as the manufacturer's label rates and guidelines when applying herbicides. For additional information on herbicide controls, contact a local consultant or ISU Extension Specialist. Always apply herbicides according to labeled directions. See references.

Mechanical: Most cereal grains are easily terminated by mowing or crimping once the cover crop maturity has progressed to anthesis with pollen shed.

Frost: Non-winter hardy species of cover crops planted in the fall are primarily terminated by cold winter temperatures. However, some species may have hard seed that will germinate the following year or growing plants may over-winter in mild winters, especially if there is snow cover.

REFERENCES

Midwest Cover Crop Council - Cover Crop Decision Tool - Cover Crop Selector for Iowa Counties www.mccc.msu.edu/selector-tool

Sustainable Agriculture Research and Education (SARE) "Managing Cover Crops Profitably" explores how and why cover crops work and provides all the information needed to build cover crops into any farming operation. https://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition

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