Aerial Seeding of Cover Crops

Illinois Agronomy Technical Note No. 21 *March 2010*

Introduction

Aerial broadcast seeding is not the ideal method of establishing a cover crop. Drilling, or broadcasting with a shallow incorporation of the seeds establishes the cover crop more consistently. However, aerial seeding offers enough positive aspects to merit consideration.

Ryegrass interseeded into corn.

One advantage of aerial seeding cover crops is that more acres can be seeded in less time than with ground equipment. Aerial application also allows seeding to be performed when it is physically impossible to use ground equipment, such as when crops are present, or when the soil is too wet for regular equipment. Seeding, germination, and growth of a cover crop can begin before an existing crop has been harvested, which is especially important in areas where there is a very small window of opportunity between crop harvest and the end of the growing season. In the northern two thirds of Illinois, planting a cover crop after crop harvest often results in poor stand establishment due to cooler temperatures. Since aerial seeding is generally more risky than drilling or broadcast seeding and incorporation, it is important to ensure the right soil surface and weather conditions exist at seeding time.

Soil Surface Conditions

The surface soil must be moist and friable to enable the seed to settle into the surface and make good contact with the soil. A surface that is loose and rough, or that has cracks or ample residue cover is optimal. The chances of the seed making adequate soil contact and landing in areas with soil moisture is enhanced and the residue cover conserves surface moisture for effective seed germination. A flat, hard, dry soil surface is not conducive to aerial seeding success.

Soil moisture

Harvesting soybeans releases previously seeded cover crop.

Cover crop aerial seeding is more successful in areas where good soil moisture and frequent precipitation is present during late summer or early fall. The top ½ - 1 inch of soil must be consistently moist in order for seeds to germinate and establish. Moisture must 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 and seedling mortality from desiccation, insect

damage, or animal predation. Seeding when the soil is dry soil reduces the chances for successful germination and uniform establishment of the cover crop.

If sprinkler irrigation is available, it can be used to start the cover crop under dry conditions. One timing sequence to consider is flying on the cover crop seed just before the last irrigation. It is important to note that excessive shade from an existing crop canopy which lasts for more than 30 days after germination could shade out young cover crop seedlings. Another irrigation option is to aerial seed the cover crop just before harvest, allow harvest traffic to provide better seed-to-soil contact, and then irrigate immediately after harvest to germinate the cover crop seeds.

Cover crop seed selection

It is important to understand the characteristics of different types of plants when choosing a cover crop. Most species of cover crops will produce adequate stands for winter and early spring soil protection when broadcast on the soil surface, provided that proper weather and soil surface conditions allow for full establishment.

Cereal grains (e.g. wheat, rye, oats, barley, triticale, spelt) normally establish easily by aerial seeding.

Ryegrass, hairy vetch, and crimson clover in collards.

Large-seeded legumes, such as cowpea, establish better with good seed-to-soil contact obtained by drilling or incorporation following broadcast. When large seeds germinate, young roots do not have the ability to penetrate the soil surface as well as other species. Legumes, like most dicots, germinate and establish better when in direct contact with the soil. Another reason adequate moisture and soil contact is important for legumes is the seed inoculant. Lack of soil contact and soil moisture will reduce the effectiveness of the inoculant. Grasses are more adapted to germinate on the soil surface. Their young roots are smaller than those of legumes, so they can penetrate the surface crust easier. Grass roots multiply quickly once they enter the soil, creating a root mass that can absorb the water and nutrients for the young plants. Intermediate sized seeds, such as hairy vetch, can be established by aerial seeding if planted into a crop where the senescing canopy provides a mulch cover.

The mustard family of crops (brassicas such as canola, turnips, rape, mustards and radishes) is becoming increasingly recommended as a cover crop for a number of reasons. Brassicas can suppress soil-borne diseases such as verticillium and root rots, nematodes, and some weeds. Turnips and radishes also increase infiltration, carbon content and percolation rates

of the soil surface. The brassicas provide excellent supplemental grazing for livestock in late fall and early winter. Be aware however, that mustards are sensitive to broadleaf herbicide carryover, particularly 2,4-D and ALS inhibitors. Some canola varieties are glyphosate-tolerant, while other non-resistant varieties of brassicas are very sensitive to the herbicide. The small size of seed, spherical shape, and ability to germinate under cool temperatures makes the brassicas well-adapted for aerial seeding. The small seed size means there is a large number of seeds sown per acre, and the seeds roll upon impact with ground, which increases the chance they will end up in a crack or crevice where the conditions for germination and seedling growth are better.

Below are some general groupings of cover crop species, grouped by their suitability for aerial broadcast seeding. Small grains, grasses, and brassicas establish well by aerial seeding. Large seeded legumes do poorly when broadcast, as they germinate best when drilled or incorporated ½-2 inches into the soil. Small-seeded legumes are intermediate, and can establish when aerially seeded under good weather and soil conditions.

A general grouping of seed selections suitable for aerial seeding of cover crops. Local conditions and species adaptation must be applied.

Group 1 – Small grains (rye, wheat, barley, oats, triticale, spelt). Seed sources are plentiful and relatively inexpensive. Seeds germinate readily on the soil surface when soil moisture is present.

Group 2 – Ryegrasses (annual, Italian, perennial). Seeds germinate the best when receiving rain shortly after broadcasting. Aerial seeding of ryegrass requires an additional 2-3 pounds of seed per acre over drilling or incorporating. Seeding with rotary wing aircraft should be considered only when seeding small fields.

Group 3a – Small seeded brassicas (mustards, rape, canola, turnips, radishes) must be established early, at least 4 weeks before the average date of a 28° F freeze. Soil temperatures must be greater than 45° F. Small seed size allows for good soil contact.

Group 3b – Sorghum-sudan and millet are warm season species that require warm, moist soil conditions with soil temperatures greater than 65° F.

Group 4 – Small seed legumes (clovers, medics, trefoils, alfalfa) achieve best success if drilled ¼ to ½ inch deep into the seedbed. Many can be established in late winter/early spring as “frost seeding” when the soil surface is moist and conditions allow freezing and thawing to provide good seed-to-soil contact. Best success with sweet, red, and ladino clovers.

Group 5 – Large seeded legumes (beans, vetch, peas, lupine, cowpeas) and buckwheat. For the best success, these species need to be drilled or broadcast and incorporated. The seeds are relatively expensive often require nearly double seeding rates for aerial broadcasting.

Oilseed radish cover crop (MSU photo)

Seeding rates

Seeding rates for aerial seeded cover crops need to be increased above rates recommended for drilled seedings. An exception is the brassicas, which generally

have the same recommendation rate for aerial seeding as for drilled or incorporated seeding. Generally, aerial seeding rates need to be 1.5-2 times higher than drilled rates in order to achieve the same stand. Higher seed rates are required because of the greater risk of insects, rodents, and birds eating seeds on the soil surface. Bird and rodent predation is particularly bad around edges of the field, where these animals can move in from field borders or neighboring non-cropland areas. Increasing the seeding rate around field edges and along headlands helps offset the expected damages. Aerial seeding increases seed cost, but that may be offset by the fact that more acres can be seeded in less time, and planted when growing conditions are more favorable. Seeding rates for different cover crop species are contained in the Illinois Cover Crop (Practice Code 340) Practice Standards and Specifications.
http://efotg.nrcs.usda.gov/treemenuFS.aspx

Timing of aerial seeding

As a general rule, aerially-seeded cover crops should be sown at least 7 – 10 days earlier than drilled cover crops, because they are somewhat slower to establish a stand. Seeding into standing soybeans should be done before the soybeans have dropped more than 10% of their leaves. The leaf fall that occurs after seeding will act as mulch and provide good soil protection and moisture conservation. Aerial seeding into standing corn should be delayed until the kernel milk line is at least 50% formed.

Airplanes can cover large areas quickly.

For silage corn, aerial seed several weeks before cutting silage, when the corn is in early dent stage. Sowing into other standing crops should consider current weather and temperature conditions.

Helicopters can maneuver better in irregular fields.

Aerial seeding equipment

Fixed wing or rotary wing aircraft can be used for seeding cover crops. Both types of aircraft are capable of quickly spreading seed above the crop canopy. Anecdotal evidence gives a slight advantage in cover crop establishment to helicopters, because air turbulence from the blades shakes the crop canopy, preventing the seed from being caught on the leaves, and the downward pressure forces seed onto the ground. On the other hand, recent experience in Northern Indiana with helicopter seeded annual ryegrass suggests that rotary wing aircraft should be used only when the fields are small. Helicopters are more maneuverable, and can do a better job on irregularly-shaped fields and along end rows and headlands. Fixed-wing aircraft can carry heavier loads of seed and fly faster across the field. Optimum seed drop is from a height of 50 to 60 feet above the canopy.

A third method of above-canopy seeding is a high clearance vehicle, such as a high clearance sprayer. These vehicles are slower than aerial seeding and will cause some crop damage when turning at the end of a field.

Some may not have enough clearance for tall crops like corn, and their use is limited by wet soil conditions. The advantages of high clearance sprayers are: many farms now own or can rent this equipment; it is available during the best time for seeding cover crops; the farmer can operate the equipment himself; and it may be less expensive than custom aerial seeding. The main criteria for choosing between equipment types are rental costs and equipment availability. However, delaying seeding in order to get the cheapest seeding method may mean poor establishment due to moisture conditions or shortened growing season. Timing of seeding is a crucial aspect of cover crop success.

Further Reading

Clarke, A. (ed.). 2007. Managing Cover Crops Profitably. Sustainable Agriculture Network handbook series; bk. 9.

Magdoff, F., and H. van Es. 2000. Building Soils for Better Crops (2nd ed.). Chap. 10: Cover Crops. Sustainable Agriculture Network handbook series: bk. 4.

Singer, J., T. Kaspar, and P. Pedersen. 2005. Small Grain Cover Crops for Corn and Soybeans. Extension Publication PM-1999. Iowa State University.

Taylor, E., K. Renner, and C. Sprague. 2008. Integrated Weed Management: Fine Tuning the System. Chap. 2: Cover Crop Systems. Extension bulletin E-3065. East Lansing, Mich. Michigan State University.

http://web.extension.uiuc.edu/carbondalecenter/nr.html