

Agronomy # 36

Aerial Seeding of Cover Crops

Introduction

Establishing a cover crop by aerial broadcast.

A big advantage of aerial seeding of cover crops is that more acres can be seeded in less time than with ground equipment. Aerial application also allows seeding to be done when it is physically impossible to use ground equipment, such as when crops are present, or the soil is too wet for regular equipment. Seeding, germination, and growth of cover crops can begin even before the existing crop has been harvested. This is especially important in areas where there is a very small window of opportunity between crop harvest and the end of the growing season. Waiting to seed a cover crop until after crop harvest may result in poor stand establishment due to cold temperatures or moisture stress.



Ryegrass interseeded into corn.

Aerial seeding is always more risky than drilling or incorporation of the seeds, so it's important to have the right soil surface and weather conditions 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, with cracks or ample residue cover, works best. With a loose and rough surface the chances of a seed making soil contact and landing in areas with soil moisture is enhanced. Residue cover conserves the surface moisture for seed germination. A flat, hard, dry soil surface is not conducive to aerial seeding success.

Soil moisture

Aerial seeding has much higher success in areas with good soil moisture and frequent precipitation in late summer or early fall. Broadcasting seed requires enough moisture in the top ½ - 1 inch of soil to ensure 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. Seeding on hard, dry soil reduces the chances for germination and uniform establishment of the cover crop.

Seed selection

Most species of cover crops will produce adequate stands for winter and early spring

soil protection when broadcast on the soil surface, provided that the proper weather and soil surface conditions are present. Cereal grains (e.g. wheat, rye, oats, barley, triticale) may be easily established by aerial seeding if moisture and soil conditions are suitable.

It's important to understand the characteristics of different types of plants when choosing a cover crop. Large-seeded legumes, like cowpea and vetch, establish better with good seed-to-soil contact obtained by drilling or incorporation following broadcast. When these seeds germinate, their young roots don't have the ability to penetrate the soil surface as well as other species. Legumes, like most dicots, germinate and establish better when they are in direct contact with the soil. 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 the young plant needs.





Ryegrass, hairy vetch and crimson clover in collards.

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 seed legumes do poorly when broadcast, see group 5 below. Small-seeded legumes are intermediate, and can

establish when aerially seeded under good weather and soil conditions. 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 soil inoculant.

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

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

Group 2 – Ryegrass (annual, perennial) Benefits by having rain shortly after broadcasting. Aerial seeding of ryegrass requires an additional 2-3 pounds of seed per acre over drilling or incorporating.

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

Group 3b – Sorghum-sudan and millet. Requires warm, moist soil conditions with soil temperature > 65° F).

Group 4 – Small seed legumes (clovers, medics, trefoils, alfalfa) Best success if drilled ¼ to ½ inch deep into the seedbed. Will establish 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 and red clovers.

Group 5 – Large seeded legumes (beans, vetch, peas, lupine, cowpeas) and buckwheat. Best success if drilled or incorporated. Large seeds are not recommended for aerial seeding.

Brassicas for cover crops

The mustard family of crops (brassicas such as canola, turnips, rape, mustards and radishes) is being recommended for a cover crop for a number of reasons. Brassicas can suppress soil-borne diseases, nematodes, and some weeds. Brassicas have been shown to suppress



diseases such as verticillium and root rots. They also increase infiltration, carbon content and percolation rates of the soil surface. They can supplement grazing for livestock in late fall and early winter. Be aware that mustards are sensitive to broadleaf herbicide carryover, particularly 2, 4-D. 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.

Seeding rates

Seeding rates for aerial seeded cover crops need to be increased above rates recommended for drilled or incorporated seeding. An exception to this 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 25 – 50% higher than drilled rates to achieve the same stand. Higher seed rates are required because there are greater risk of insect damage, or rodents and birds eating seeds on the soil surface. Bird and rodent predation is particularly bad around the edge of the field, where these pests can move in from field borders or neighboring non-cropland. Increasing the seeding rate around field edges and along headlands helps offset some of the expected damages. This 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.

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



Airplanes can cover large areas quickly.

COVER CROPS IN OR FOLLOWING FIELD CROPS

SPECIES	RATE FOR AERIAL SEEDING	TIME OF SEEDING
Perennial Rye	15 lbs/ac	At last cultivation or Aug. 15 – Oct. 15
Sudan grass	30 lbs/ac	May 15-June 15
Soybeans	1 ½ bu/ac	May 10-July 1
Buckwheat	65 lbs/ac	June to early July
Hairy Vetch	18 lbs/ac	Sept. 10- Oct. 1
Corn	3 bu/ac	May 5 – June 5
Cereal Rye	2 bu/ac	Corn – last cult; after early silage or kernel mild line is at least 50% formed. Beans – 10% of leaf drop or Aug 15 – Oct 15. Other crops Aug 15 – Oct 15
Winter Wheat	2 bu/ac	Sept. 10 – Oct 10
Oats	3 bu/ac	Aug 15-Sept 15
Mammoth or medium Red Cover	12 lbs/ac	Early spring alone or in small grain or Aug 1-Sept 15
Sweet Clover	12 lbs/ac	Spring in small grain or Aug 1-Sept 15
Berseem Clover	22 lbs/ac	Spring in small grain
Crimson Clover	22 lbs/ac	Spring in small grain or Aug 1-Sept 15

LIVING COVER AND GREEN MANURE CROPS

SPECIES	RATE FOR AERIAL SEEDING	TIME OF SEEDING
Perennial Rye	7 lbs/ac	Spring before May1 or Aug 15-Sept 15
Timothy	6 lbs/ac	
Perennial Rye	7 lbs/ac	Spring before May1 or Aug 15-Sept 15
Red Fescue	15 lbs/ac	
Perennial Rye	7 lbs/ac	Spring before May1 or Aug 15-Sept 15
Bluegrass	7 lbs/ac	
Perennial Rye	7 lbs/ac	Spring before May1 or Aug 15-Sept 15
Red Top	4 lbs/ac	
Red Clover	12 lbs/ac	Spring before May1 or Aug 15-Sept 15
Timothy	4 lbs/ac	
Kura Clover	9 bu/ac	March 1-May 15

Aerial seeding equipment

Fixed wing vs. rotary wing aircraft for seeding cover crops – which is best? 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 the air turbulence from the blades shakes the crop canopy, preventing the seed from being caught on the leaves, and the downward pressure forces the seed onto the ground. Fixed-wing aircraft can carry heavier loads of seed and fly faster across the field. Helicopters are more maneuverable, and can do a better job on



Helicopters can maneuver better in irregular fields.

irregularly-shaped fields and along end rows and headlands. 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 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 types of will probably be cost of rental and availability of the equipment. 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.