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Cool Season Cover Crop Species and Planting Dates and Techniques

Plant Materials Technical Note

Background

Cover crops have been used since ancient Greek and Roman times to improve soil condition and crop yields. In the United States, cover crops were regularly used as part of crop rotations through the 1950's. Uhland wrote in the 1948 Yearbook of Agriculture (USDA 1948), "… farmers can grow as much, or more, corn, cotton, and small grains on smaller acreages when the cropping systems include grass and legumes." However, the use of longer crop rotations with grasses and legumes was reduced as commercial fertilizers became more popular (Magdoff and Van Es. 2009, USDA-NRCS 2010). With increased fertilizer costs and water restrictions, the use of cover crops is becoming popular again for improving soil health and shading the soil from excessive heat. Some of the economic and environmental benefits of using cover crops include:

- Improving soil structure by increased soil microbial activity
- Weed suppression (by direct competition or allelopathy)
- Increases water infiltration
- Reduces soil compaction
- Increases organic matter
- Activity against bacteria, fungi, insects, nematodes, and weeds
- Reduces soil erosion from wind and rain (crop residues/mulch)
- Nutrient cycling (plants take up nutrients that may otherwise leach out of the soil profile)
- Protects soil surface solar energy, conserving soil moisture

Purpose

The purpose of this technical note is to assist conservation planners and serve as a reference in developing successful cool season cover crop plantings in the western gulf plain, southeastern Oklahoma, and southwestern Arkansas. Tables listing common cool season cover crop species with their corresponding planting date, seeding rate, and remarks are provided at the back of this technical note.

Plan Before Planting

There are three main groups of cover crops; grasses, legumes, and forbs. Grasses provide biomass for organic matter and late fall or early spring livestock grazing. While the crop is growing, grasses scavenge nutrients such as N and reduce soil profile leaching. For example, cereal rye typically scavenges 25 to 50 lb. N/ac. as it grows (Clark 2007). The upright growth of grasses provides vertical support for vining cover crop plants. After crop termination, the grass residue provides topsoil protection by forming a mulch which helps retain soil moisture and suppress weeds. Over time, the mulch is slowly broken down by soil microbes into organic matter.

Legumes provide N by atmospheric fixation, which is utilized by proceeding crops. Legumes can contribute from 15 to 200 lb. N /ac. with typical N values ranging from 50 to 100 lb. /ac. (Clark 2007). A monoculture stand of alfalfa or clovers growing under good conditions (4,000 to 5,000 lb. /ac. DM yield) provides 100 to 150 lb. N/ac. (Caddel et al. 2015). As they grow, legumes provide a source of protein for livestock when used in conjunction with cover crops. They also provide nectar for pollinating insects and cover and protein for wildlife. Legumes aid beneficial soil fungi called mycorrhizae which produce glomalin, a protein that binds organic matter, plant cells, bacteria and other fungi into soil aggregates. Soil aggregates are important for good soil aeration, resulting in improved water infiltration and retention (Clark 2007). After termination, the residue rapidly degrades because of the high nitrogen content of the plant material.

Forbs include broadleaved plants which do not fix nitrogen. Within this group, cool season cover crop species are dominated by the Brassicaceae family. This family includes plant species of the genus *Brassica* and mustards. These plants grow rapidly after fall planting and suppress weeds by shading the soil. As forbs grow, they scavenge excess soil nutrients left from the previous crop. Most mustards have a fibrous root system (like grasses) that forms a root mass near the soil surface. The tuberous roots of forage radish, Canola, and turnip penetrate and loosen soil hardpans. Also, Brassicas provide wildlife a nutritious, late winter food source with 15% to 25% crude protein in the leaves and 8-15% in the roots depending upon weather and fertilization (Allied Seed 2015). After cover crop termination, the tubers rapidly degrade and create holes in the soil for increased water infiltration.

Before planting a cover crop, identify which benefits or goals (weed suppression, fall grazing, taking up excess nutrients, reducing soil compaction, etc.) are most important. Soil samples should be taken to determine if amendments are needed for the cool season cover crop. Use the soil test results and land owner needs to best select the grasses, legumes, and/or forbs that meet the desired goals. A cool season cover crop planting can be either monotypic or a multi-species mixture. Refer to the NRCS Conservation Practice Standard Code 340-Cover Crop and consult with your NRCS agronomist for plant species compatibility and adaptation when beginning to plan a cover crop planting.

Monotypic Stands

Planting, management, and termination of a monotypic stand is easier when compared to a mixture. Seed costs per acre are usually lower, management entails only one species, and crop growth

stage is more uniform at termination. However, using only one species limits the number of possible goals and benefits of the cool season cover crop stand. A variation is to include cultivars of a single species with differing maturity dates. This extends the derived benefits over a longer period of time. (Clark 2007).

Cover Crop Mixes

One advantage of species mixtures is their ability to address multiple objectives at the same time. When deciding on species, choose plants with complementing growth forms to reduce competition between the species. For example, in the spring, tall open canopy plants such as cereal rye provide support for climbing, vining plants like Austrian winter pea. Use cover crop species that provide multiple benefits and complement each other (White et al. 2015).

Above: Using a front mounted roller crimper to terminate a cover crop. Below: Cover crop residue after rolling. The plant residue forms a mat which protects the soil.

Another advantage of mixes is their nutrient cycling activity. Combining shallow and deep rooted species in a mix allows the plants to use a greater portion of the soil profile for water and resources. Grasses take up N remaining from the previous crop and reduce leaching out of the soil profile. Deep rooted cover crop species take up calcium and potassium from deeper in the soil profile and release these nutrients into the organic matter as the cover crop dies and decomposes (Clark 2007).

Mixes are also good for weed suppression. They shade the soil surface and compete with weeds for light, nutrients and moisture. Many cover crop species release growth inhibiting substances specific to certain weed species. This suppression mechanism is known as allelopathy. These substances negatively impact seed germination, seedlings, and young plants by inhibiting their growth, damaging roots/shoots, or even killing competing plants. For instance, cereal rye is known to be allelopathic. Rye effects pigweed, lambsquarters, purslane, and crabgrass. After cover crop termination, allelopathic substances are released as mulch decomposes. As Canola and mustard (Brassicaceae family) residues break down, isothiocyanates are released which can suppress weed growth for several weeks or months (Schonbeck 2015). Therefore, planting a mixture provides a wider array of potential weed control than a monoculture. Managing a mixture is more challenging. Usually, the benefits of a mixture are greater than the disadvantages, but there are some factors to consider. Seed costs per acre may be higher when compared with a single species. If there are legumes and grasses in the mix, herbicide choices may be limited if they need to be applied. Terminating the cover crop is accomplished by either tillage, herbicide, using a roller crimper or a combination of these methods. When terminating the cover crop, the best time to kill one species may

not be ideal for another species. For further information concerning cover crop termination, see the handout NRCS Cover Crop Termination Guidelines-September 2014 Version 3.

Purchasing Cover Crop Seed

When purchasing cover crop seed, choose cover crop species adapted to local growing conditions (Bodner et al. 2010) and order seed in pure live seed (PLS) pounds per acre. Always buy good quality seed with a known germination percent from a reputable company. For further information about pure live seed and seeding rates, refer to the NRCS Plant Materials Technical Note No. 11 – Understanding Seeding Rates, Recommended Planting Rates, and Pure Live Seed (PLS), July 2009 (Louisiana).

Establishment

Cover crops are seeded either by broadcasting the seed onto the surface of a prepared seedbed, using a conventional seed drill, minimum tillage drill or no till drill. Drilling places seeds directly into the soil, providing better planting depth control and enhancing seed to soil contact. Good seed to soil contact helps protect the seeds from constant wetting and drying cycles that may hinder germination (USDA-NRCS 2005). For more information concerning seeding and seedbed preparation, refer to the following publications;

(1) NRCS Plant Materials Technical Note- Seedbed Preparation – TX-PM-10-07- (August 2012) (Texas)
(2) NRCS Agronomy Technical Notes- Recommended Cover Crop Seeding Methods and Tools (February 2012)
(3) NRCS Plant Materials Technical Note – Seedbed Preparation and Seed to Soil Contact - No. 6 (February 2005) (Washington State)

Planters

Brillion seeder for conventional prepared seedbeds.

No-till drill

Photo at right: No-till drill. From bottom-right, fluted coulters press into the crop residue and soil, v-openers in the middle open the seed furrow, and press wheels at the rear close the soil furrow after the seed is deposited.

Grasses						
Common Name	Scientific Name	Planting Depth (in.) 1*	Planting Rate (PLS lb./ac.) 2*	Planting Date (Prepared seedbed or no till)	Overseed	Remarks
Cereal rye	*Secale cereal*	0.75-2.0	56-120	09/01-10/15	09/15-11/30	Reduces soil erosion, quick forage for grazing, excellent scavenger for N and K, allelopathic activity
Winter wheat	*Triticum aestivum*	0.75-2.0	60-120	09/01-10/15	09/15-11/30	Good in rotation with vegetable crops, excellent N scavenger
Oats	*Avena sativa*	0.5-2.0	64-120	09/01-10/15	09/15-11/30	Suppresses weeds, erosion control, quick cover, primary use for vegetable crops, nurse crop for legumes
Triticale	*X Triticosecale*	0.5-1.5	50-120	09/01-10/15	09/15-11/30	Use as a double crop and erosion control on highly erodible land, good at reducing root rot in vegetables, can be sown earlier for more fall growth
Annual ryegrass	*Lolium multiflorum*	0.25-0.50	12-30	09/01-10/15	09/15-11/30	Good for erosion control, can tolerate some flooding, uses a lot of water and N, can become weedy if allowed to produce seed
Barley	*Hordeum vulgare*	0.75-2.0	50	09/01-10/15	09/15-11/30	Drought tolerance, quick growing, scavenger of excess nutrients, does not tolerate wet soils
Black oats	*Avena strigosa*	0.5-1.0	70	09/01-10/15	09/15-11/30	Tillers well, resistant to rusts, allelopathic activity
1*=Use deeper planting depth in sandy or dry soils	2*=Use higher planting rate for broadcast seeding					

Legumes						
Common Name	Scientific Name	Planting Depth (in.) 1*	Planting Rate (PLS lb./ac.) 2*	Planting Date (Prepared seedbed or no till)	Overseed	Remarks
Crimson clover	*Trifolium incarnatum*	0.25-0.5	15-20	09/15-11/30	09/15-11/30	N source, forage, soil builder.
Berseem clover	*Trifolium alexandrinum*	0.25-0.5	12-15	09/15-11/30	09/15-11/30	Good for suppressing weeds, chopped forage and grazing.
Arrowleaf clover	*Trifolium vesiculosum*	0.25-0.5	8-10	09/15-11/30	09/15-11/30	Sensitive to soil pH, does not grow well on poorly drained soils.
Ball clover	*Trifolium nigrescens*	0.25-0.5	2-4	09/15-11/30	09/15-11/30	Plant on soils with good moisture, does not have good drought tolerance. Does have high bloat potential.
Persian clover	*Trifolium resupinatum*	0.25-0.5	3-6	09/15-11/30	09/15-11/30	Found on clay and loam soils, does have a high bloat potential.
Rose clover	*Trifolium hirtum*	0.25-0.5	10-15	09/15-11/30	09/15-11/30	Good drought tolerance, good reseeder. Does not tolerate poor, wet soils.
Subterranean clover	*Trifolium subterraneum*	0.25	15-18	09/15-11/30	09/15-11/30	Tolerates close grazing by sheep, goats, and deer. Moderate bloat potential.
Red clover	*Trifolium pratense*	0.25-0.5	10-12	09/15-11/30	09/15-11/30	Adapted to loamy and clayey soils with pH of 6.5 to 8.0 and good drainage. Low bloat potential, usually acts as an annual in east Texas. N source, weed suppressor, forage.
1*=Use deeper planting depths in sandy or dry soils.	2*=Use higher planting rate for broadcast seeding.					

Legumes						
Common Name	Scientific Name	Planting Depth (in.) 1*	Planting Rate (PLS lb./ac.) 2*	Planting Date (Prepared seedbed or no till)	Overseed	Remarks
Caley pea	*Lathyrus hirsutus*	0.25-0.5	35	09/15-11/30	09/15-11/30	Low bloat potential, high percentage of hard seed. Avoid grazing seed pods due to toxicity.
Hairy vetch	*Vicia villosa*	0.25-0.5	15-20	09/01-10/15	09/01-10/15	Supplies N to soil, improves soil tilth, suppresses weeds, high P and K requirement. Cattle develop muscle problems when grazing vetch, especially when seed are forming.
Sweet clover	*Melilotus officinalis and M. alba*	0.25-1.0	12	09/15-11/30 or 03/15-04/01	09/15-11/30	Biennial, adapted to well drained clay to clay loam. Prefers pH of 6.5 to 7.5. Soil builder, subsoil aerator, weed suppressor.
Austrian winter pea	*Pisum sativum subsp. Arvense*	1.5-3.0	35	09/01-10/15	09/01-10/15	Adapted to loam and sandy loam soils with pH 6.0-8.0 with good drainage. Does not tolerate grazing very well. Weed suppressor.
1*=Use deeper planting depths in sandy or dry soils.	2*=Use higher planting rate for broadcast seeding.					

Forbs						
Common Name	Scientific Name	Planting Depth (in.) 1*	Planting Rate (PLS lb./ac.) 2*	Planting Date (Prepared seedbed or no till)	Overseed	Remarks
Forage collards	*Brassica oleracea*	0.25-0.5	8	09/15-11/30	09/15-11/30	Suppresses weeds, scavenges nutrients
Turnip	*Brassica rapa*	0.25-0.75	8	09/15-11/30	09/15-11/30	Grows very fast and decreases soil compaction. Has a low drought tolerance and high fertility requirement.
Forage radish	*Raphanus sativus*	0.25-0.50	7-13	09/15-11/30	09/15-11/30	Quick forage for grazing and high N, P, S, Ca, and B content. Significant amounts of N may be lost if next crop not planted in time to recapture N.
Canola	*Brassica napus*	0.25-0.75	5	09/15-11/30	09/15-11/30	Supplies organic matter and weed suppression. Does not perform well on poorly drained soils.
Flax	*Linum usitatissimum*	0.25-0.75	50	09/15-11/30	09/15-11/30	Use with other plant species, not recommended for haying/grazing (prussic acid), prefers well drained loam to clay soil.
Medic	*Medicago spp.*	0.25-0.75	8	09/15-11/30	09/15-11/30	N source, soil quality builder, weed suppressor
Lentil	*Lens culinaris*	1.0-1.5	80	09/15-11/30	09/15-11/30	Forage, N production, pollinators, loosens topsoil
Tame mustard	*Brassica hirta, Brassica juncea, Brassica nigra*	0.25-0.75	5	09/15-11/30	09/15-11/30	Breaks up soil hardpan and suppresses weeds. Do not use in rotations with other Brassica crops.
1*=Use deeper planting depths in sandy or dry soils	2*=Use higher planting rate for broadcast seeding.					

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