Cover Crop Strategies for Annual and Perennial Forages Yvonne Lawley

Warm and cool season cover crop mixture after a frost that killed the warm season grass. Cool season cover crop still growing as understory later into the fall.

over crops are being used in new ways in a wide range of temperate cropping systems. They are a great way to incorporate the benefits and diversity of annual and perennial forages into a cropping system. Factors to consider when deciding how best to use cover crops range from choice of cover crop species to management strategies such as planting and termination methods. Successful cover cropping depends on clear objectives and understanding the resources and limitations of cropping systems. This chapter describes the range of cover crops that are available and some of the issues related to adapting cover crop strategies into cropping systems.

What are cover crops?

Cover crops are any plant grown for purposes other than harvesting grain. The diversity of names for cover crops reflects the reasons for growing them:

• **Cover crops** — protect soil from erosion

- ► Green manures enhance fertility by incorporating crop into soil often a legume
- Catch crops capture soil nutrients remaining after cash crop harvest — often to reduce risk of N leaching
- Smother crops suppress weeds with vigorous crops

Identifying goals and limitations:

Before planting a cover crop, it is important to identify the goals: multiple goals may mean tradeoffs so prioritization may be required. The main goals for cover crops:

- Prevent wind and water erosion
- Increase soil organic matter
- ▶ Improve soil quality and soil health
- Nitrogen fixation
- Weed suppression
- ► Forage and grazing
- Scavenge leftover nutrients after cash crops
- Food and habitat for soil microorganisms

 Attract pollinators and beneficial insects

The factors that may impact the effective use of cover crops:

- Soil moisture
- Heat units
- Nutrients
- Soil compaction
- Crop residues
- ► Manure
- Livestock grazing
- ► Time and labor
- Equipment
- Seed availability

Contour planting cover crops around a saline slough that was too wet for planting corn in the spring.

Many farmers in temperate zones rule out cover crops due to limited growing season and/or moisture, despite problems

with excess spring and fall soil moisture, nitrate leaching, or expanding saline sloughs. One of the most frequent limiting factors for cover crops is time and labor constraints, but this can be mitigated with planning.

Windows for cover cropping in temperate regions

The length and timing of these windows will depend upon the growing season and crop rotation:

After harvest

Cover crops can be planted following harvest of early seeded or short season crops without sacrificing a crop year. Early harvested main crops include: winter or spring wheat, barley, oats, field peas and forage crops. The challenge is to get your cover crop established quickly after harvest but this is often constrained by labor or unfavorable weather. Typically harvest occurs when conditions are dry so timely rain is needed for the cover crop to establish. Selecting cover species with frost tolerance will extend growth during fall.

Early season

When growing warm season crops that are planted later in the spring, there may be a short window to grow cool season cover crops in the early spring. Cover crops with frost tolerance could be planted very early in spring or, preferably, the previous fall (see above). Having a plan to terminate and manage the residue of these cover crops is important for the success of the following crop.



Cover crop after harvest of irrigated soybean. Cover crop was interseeded into soybean when they were 30 cm (12 in) tall.



Interseeding cover crops between 76 cm (30 in) corn rows. Seeder has been offset to plant between corn rows.

Interseeded or relay cover crops

Growing season remaining after harvest is often short, so establishing the cover crops prior to main crop harvest can maximize the cover crop growing season. Some examples of this practice are broadcasting clovers into winter wheat, aerial seeding into soybeans at leaf drop, or planting cover crops in between row crops such as corn near corn planting time. The challenge for this type of cover crop is to select a plant species that can establish beneath a crop canopy, tolerate weed control practices, survive until harvest (in shady, droughty and humid understory) without reducing crop yield or interfering with mechanical harvest of the crop and tolerating equipment traffic at harvest. Relay cropping of Italian ryegrass with corn has been practiced successfully by dairy farmers in the Pacific Northwest and



Cover crop mixture grown for the purpose of late season grazing.

BC for more than 15 years (see *www.farmwest.com*)



Root system of pasja cover crop improving the soil structure of a saline soil.

Unseeded fields

Cover crops may be used on fields that cannot be planted with the main crop usually due to weather (wet, late frost, etc.). The cover crops may improve field drying and reduce surface crusting, soil erosion, and 'fallow syndrome' (associated with decline in root colonization by arbuscular mycorrhizae in subsequent crops). Seeding of cover crops around potholes and saline sloughs may help to prevent the upward movement of salts in the soil and limit the expansion of saline areas.

Full season cover crops

Full season cover crops maximize biomass production and nitrogen fixation by legumes (tangier flat pea, 'annual' alfalfa, etc.), but sacrifice the cash crop. Full season cover crops are used in organic crop rotations, opportunistically in situations where it was not possible to plant a cash crop, or where they may be useful for livestock feed. An early termination strategy may be needed to conserve moisture or, where moisture is not limited, a complement of warm and cool season species could extend the length of the growing season. Fall seeded crops, such as winter wheat, may fit well in rotation following full season cover crops; the cover crop residues may trap snow and improve overwintering.

Cover crop species and mixture selection

Identifying the goals for your cover crop will help you make the best selection from the many choices of cover crop species (see USDA ARS Cover Crop Table and Managing Cover Crops Profitably). Considerations include:

- Cool vs. warm season
- Broadleaf vs. grass
- ► Tap root vs. fibrous roots
- Legumes to fix nitrogen vs. deep rooted scavenger crops
- Sensitive to frost, frost tolerant, vs. overwintering species (winter annuals, perennials)
- Seed availability and costs
- Persistent seeds that may become weeds
- ► Soil conditions (wet vs. dry, warm vs. cool)
- Presence of residual herbicides in the soil and the need to break soil born disease and insect cycles
- Seeding equipment and planting methods (e.g. broadcast seeding, drilling, aerial seeding)

Seeding Method

Planting cover crops with a seeder (drill) is the best way to establish a uniform stand. Broadcasting expands the seeding window (e.g. inter-seeding in growing crops and frost seeding or seeding into wet areas that will plug up a seeder) but often results in uneven stands. Cover crops may be established by slurry seeding with injected hog manure.

Cover crops are frequently planted in a monoculture or multispecies solid stand. For mixtures with competitive species, alternating rows may reduce competition (e.g. winter rye and radish). Alternating row patterns may also be used to simulate strip tillage by creating strips of high and low residue cover crops during the summer or fall, then planting low residue strips the following spring once the cover crops die and begin to decompose. Cover crops may be seeded between rows of corn, soybeans, or sunflowers by either broadcasting or by drilling if the main crops are small (corn less than 9 leaves).

Cover crops that were boradcast into soybeans at leaf drop.

Forage radish and sorghum sudangrass mixture. Radish still growing in October after frost hit sorghum sudan in mid-September.

Cover crop termination methods

Tillage

Tillage effectively terminates cover crops at a range of plant growth stages and increases the rate of nutrient release by increasing plant residue contact with soil. However, the soil physical benefits of cover crops such as soil macro pores, root channels and surface residue are reduced or eliminated by tillage.

Herbicide

There are several inexpensive non-selective herbicides that can terminate cover crop stands. The presence of associated weeds and herbicide residues need to be considered and fast acting herbicides are usually beneficial.

Mowing and shredding

Mowers and shredders are low soil disturbance methods of terminating some cover crops and produce good mulch to protect the soil and suppress weeds. The most effective time to mow is generally during the reproductive stage when the crops are most vulnerable — often a tradeoff between effectively killing the stand vs. timely field operations. A good example is delaying termination of fall seeded rye until the anthesis stage in the spring, which may delay spring seeding. Plants with belowground growing points regrow or send up new tillers after mowing.

Roller-crimper

The roller-crimper, an emerging technology in North America, was adopted from South American farmers. The crimper is similar in shape to a land roller but blades attached to the outside of the drum crimp plant residues and kill them by desiccation.

An undercutter blade will terminate cover crops and leave mulch to protect soil from erosion.

The crimper creates a residue mat that protects the soil from erosion and suppresses weeds. There are similar timing tradeoffs with the roller-crimper as with the mower shredder. Most work with roller-crimper in North America has focused on organic no-till systems that utilize winter annual cover crops planted in the fall and terminated in the spring. The implements are often designed for one-pass termination and seeding, where the roller-crimper is mounted on the front of a tractor and the seeder is mounted behind. Research is needed on cover crop strategies and species that make best use of the roller crimper in temperate areas.

Roller-crimper front mounted on a tractor to terminate fall rye at anthesis in Spring.

Frost

In temperate regions, growing cover crop species that will die in winter is a relatively easy way to achieve termination. As the cover crops will not overwinter and grow into the following season, there is lost opportunity to producing more biomass, increase N-fixation, or dry out the soil via transpiration. The C:N ratio of the cover crop residue will determine its persistence; a high C:N ratio residue will persist while a residue with a low C:N ratio will decompose quickly. Warm season annual crops will terminate sooner than cool season cover crops.

Grazing

Grazing animals can exploit cover crop herbage but there is a tradeoff between utilizing all the cover crop biomass as forage and leaving enough plant residue to cover, protect and build the soil. Species attributes are important for terminating cover crops with grazing; considerations include forage quality and height of growing points (above or below ground). Grazing intensity, frequency and timing may be used to stress and ultimately terminate the cover crop stand.

References available online at www.farmwest.com

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