Conservation Systems Research

Termination of Cover Crops: Management Considerations for the Subsequent Cash Crop

United States Department of Agriculture

Agricultural Research Service

National Soil Dynamics Laboratory

Conservation Systems Research

Fact Sheet No. 11

May, 2014

Rev. Jan, 2016

Contact us:

USDA-ARS-NSDL
411 S. Donahue Dr.
Auburn, AL 36832
334-887-8596

www.ars.usda.gov/sea/nsdl

CONSERVATION SYSTEMS FACT SHEET NO. 11

In Alabama, cover crops are a critical part of cropping systems designed to maintain or improve soil health. Due to the climate of the Southeast (high rainfall, high temperatures, high humidity), surface residues do not persist for long periods of time. In general, the more surface residue present, the more soil health benefits are enhanced. Cover crops provide additional surface residue to protect the soil from erosion during fallow periods and throughout the growing season, while promoting soil health. However, the timing of cover crop termination does influence crop production, which is complicated by site and situation specific factors. An understanding of these factors is needed to make sound agronomic decisions.

Planting cover crops as early as possible is essential to maximizing cover crop biomass, but termination timing can also influence biomass production. Figure 1 shows two cover crops (cereal rye and wheat) planted on identical dates each year. Covers preceding corn were terminated approximately one month before covers preceding cotton. In this case, termination times were dictated by the cash crop planting date, but the figure illustrates how terminating the cover crop prematurely can dramatically reduce final biomass. More cover crop biomass will increase soil water infiltration, reduce soil evaporation, reduce weed pressure in the cash crop, and increase N fixation by legumes. Below are specific areas that growers should evaluate each year to maximize cover crop benefits, while minimizing risk to the cash crop.

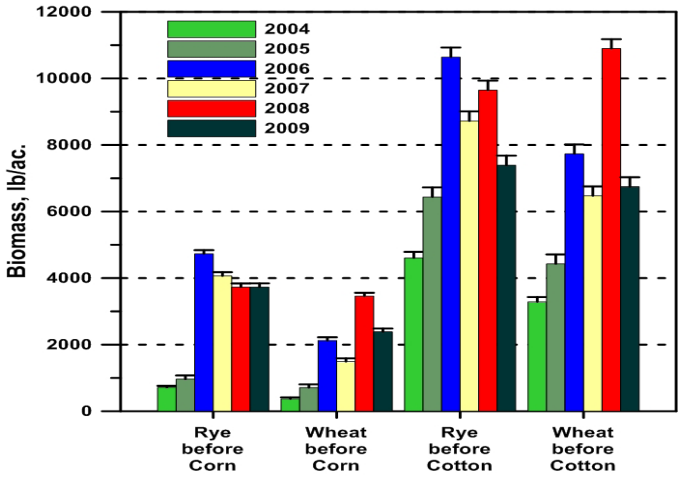

Figure 1. Biomass production for two cover crops terminated on two different dates.

Soil Moisture

Adequate soil moisture at planting is needed to ensure timely, uniform crop emergence. An actively growing cover crop can deplete soil moisture similar to how actively growing cash crops deplete soil moisture during the summer. Non-irrigated soils with low water holding capacities should be given careful consideration, in regards to timing cover crop termination. Fortunately, in Alabama, most years we get frequent spring rains to recharge the soil profile. If the cover crop is still actively growing and not terminated, it will deplete soil moisture following a rain event. If the cover crop has been terminated, cover crop residue will preserve soil moisture for longer time periods by reducing soil water evaporation. These aspects

Figure 2. Visual comparison of soil moisture contents from a terminated cover crop (Plot 142) and an actively growing cover crop (Plot 141).

are illustrated in Fig. 2. The benefits continue through the growing season by increasing soil water infiltration from rainfall and/or irrigation events and reducing soil water evaporation to potentially increase plant available water. The goal is to terminate the cover crop late enough to achieve adequate biomass production, but early enough to allow for a rain event to occur, prior to planting.

Equipment

Adequate seed-soil contact at the desired depth is the key to successful stand establishment. For high residue systems, tillage and planting equipment may require special designs and/or modifications like row cleaners to operate in the residue, and may be used in conjunction with cover crop rollers. Numerous combinations of equipment and attachments are currently used by growers to successfully operate in high residue systems. In regards to cover crop termination and equipment, allow sufficient time for the residue to become completely dry and brittle. Dry, brittle cover crop residue on the soil surface allows tillage and planting equipment to cut through the residue easier compared to semi-dry, green residue that can be tough and hard to cut. As equipment traverses the field without cutting the residue, the residue may become entangled in the equipment (Fig. 3). This can result in significant time delays to remove the residue and prevent it from being dragged across the field. Residues that are not cut can also be pushed into the soil and become trapped in the seed furrow creating a condition known as "hairpinning" (Fig. 4). "Hairpinning" can reduce seed-soil contact that reduces crop emergence. Dry residues that are moist from precipitation or morning dew can also be difficult to cut and can contribute to "hairpinning". Allowing the residue to dry more thoroughly can potentially solve this problem.

Figure 3. Removing residue that becomes entangled in equipment can waste considerable time leading to grower frustration with cover crops.

Figure 4. Typical example of poor seed-soil contact caused by "hairpinning" that reduces crop emergence.

Soil Temperature

Soil temperature should be used as a guide to determine cash crop planting dates. State Extension recommendations provide critical soil temperatures at planting for various crops to ensure adequate germination. Soils with surface residue will warm slower than soils without residue, assuming all other variables are equal. It is possible that planting into surface residue may need to be delayed compared to planting into no residue, particularly for crops planted earlier in the spring. However, using soil temperature, as opposed to calendar date, to help guide planting decisions will ensure adequate crop emergence, regardless of amounts of surface residue present. Benefits of lower soil temperatures behave similar to soil moisture benefits associated with surface residues. For example, the lower soil temperatures observed early in the season that could delay planting will also persist into the summer growing season. This early season concern translates into a benefit by reducing soil temperatures during the hot summer months.

Nitrogen Management

Cover crop termination can affect nitrogen management. The carbon/nitrogen (C/N) ratio (Fig. 5) and the amount of biomass produced are two important factors that determine how much N may become available or unavailable for the cash crop. Cover crop biomass with a low C/N ratio includes legumes or low biomass grass crops terminated when they are small. These residues release or "mineralize" N as they decompose. This process occurs quickly and the length of time these residues persist is proportional to the amount of biomass present. However, this limits the time these residues stay on the soil surface, which diminishes benefits associated with surface residue. If the cash crop is not present and growing to capture this N, then this "free" N will be subject to typical N loss pathways. High biomass cover crops like winter cereals tend to have high C/N ratios. Typical termination times for these covers correspond to flowering or later. As they decompose, any N present is consumed or "immobilized". This is the reason that typical N recommendations for crops following high residue cereals are increased 20 to 30 lb/ac. As a result, these residues tend to persist for much longer periods enhancing surface residue benefits. Delaying termination of legumes as long as possible increases biomass and N concentration, increases the potential for the legumes to re-seed, and improves synchronization between cover crop N release and cash crop uptake. Delaying termination of winter cereals enhances biomass production, allowing the residues to persist for more time, while providing soil health benefits.

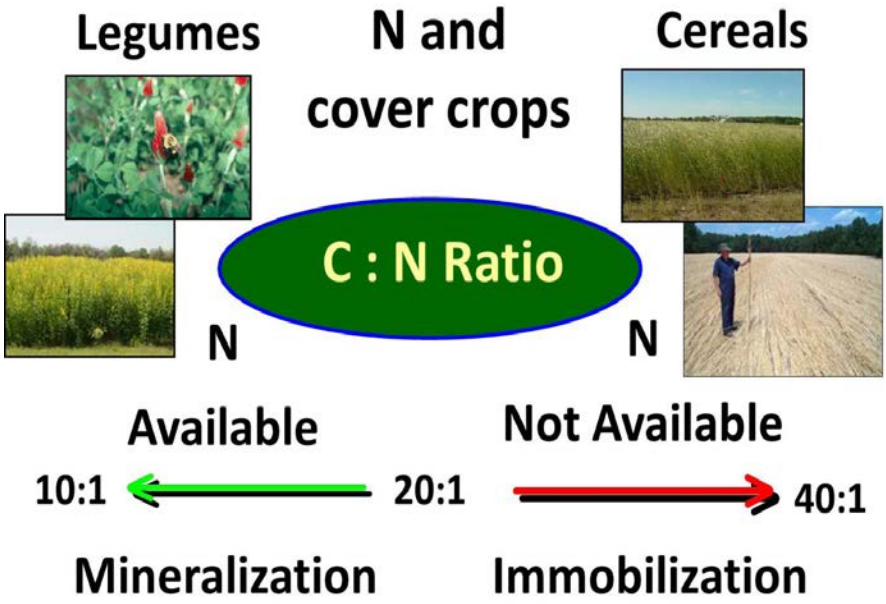

Figure 5. Carbon/Nitrogen (C/N) ratio relates to mineralization/immobilization of N contained in the cover crop residue.

Allelopathy and Weed Suppression

Cover crop residues act as mulches and most leach allelopathic compounds that also inhibit weed germination and/or growth. Experiments in Alabama showed that cover crop residue is very effective for controlling many small seeded weeds including pigweed. In general, more cover crop biomass resulted in reduced weed biomass through fewer and smaller weeds (Fig. 6). A reduction in weed density is also helpful in combating herbicide resistance because selection pressure is reduced due to fewer weeds being present. However, allelopathic compounds leached from residue are non-selective and also can inhibit germination and growth of some cash crop seeds including

cotton, depending on residue attributes and residue proximity to the row after planting. The longer the interval between cover crop termination and cash crop planting, the less likely allelopathic compounds will affect crop emergence and growth. Conversely, as allelopathic compounds leach away and residue biomass decays, subsequent weed suppressive qualities decrease. Ideal termination timing maximizes cover crop biomass while allowing for a rainfall event between termination and planting, thus leaching some of the allelopathic potential from the cover crop residue preventing seedling injury.

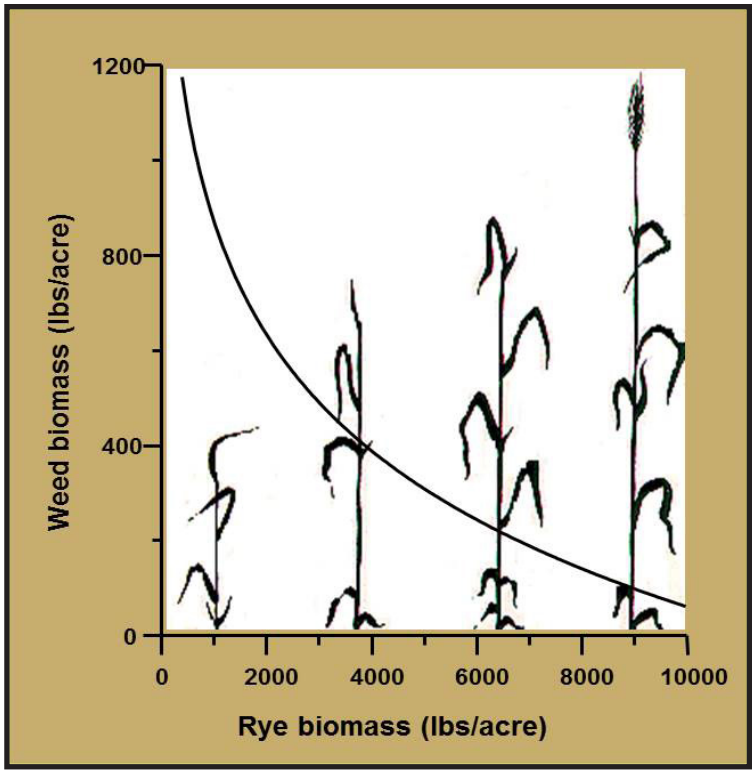

Figure 6. Increasing rye biomass amount decreases subsequent weed biomass in the cash crop.

Conclusions

Proper termination timing of cover crops is an important decision that Alabama producers face every spring. This decision is a balancing act between ensuring adequate biomass production to enhance soil health benefits and minimizing risk to cash crops that typically changes each year to accommodate different climatic patterns and/or crop rotations. All production decisions, whether related to your cover crop or cash crop, impact the profitability of your operation, and the potential for economic gains or losses should be considered during the decision making process. To find a solution that works best for your farm, please consider the factors discussed in this publication, talk with your neighbors who have similar crops and soils, and contact the USDA-ARS NSDL or your local USDA-NRCS office.