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COVER CROPS QUICK FACTS

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UTEXTENSION
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INTRODUCTION

Cover crops have been promoted recently as an important tool for soil health improvement. In reality, cover crops have been utilized for many years to reduce soil and nutrient loss, suppress weeds, increase water infiltration and soil water holding capacity, and increase soil organic matter. Potential negatives of dense covers include difficulty in establishing a summer crop; cooler and wetter soils in the spring, which may increase soilborne and seedling diseases; a "green bridge," which may increase insect pest issues in young crops; and nitrogen tie-up in decomposing residue.

LONG-TERM BENEFITS OF COVER CROPS AND NO-TILLAGE

No-till with cover crops can improve soil physical properties compared to no-till or conventional till without cover crops, based on results from a 34-year study in Jackson, Tennessee. Wet aggregate stability (ability of soil to withstand raindrop impact and water erosion), dry aggregate size, soil water retention, soil water infiltration and hydraulic conductivity were generally increased with cover crops in no-tillage.

- A vetch cover increased wet aggregate stability in no-till surface soil better than a wheat cover.
- Vetch or wheat covers were similarly effective in increasing soil aggregate size and hydraulic conductivity.
- During dry periods of the growing season, a vetch cover and the no-till system consistently had greater surface soil moisture compared to no ground cover or tilled plots.

Long-term vetch and wheat covers also increased initial and cumulative soil water infiltration compared with no cover when averaged over two tillage systems (Figure 1). It is believed that cover crops provide additional protective residue that prevents soil surfaces from sealing over, increasing water infiltration. Cumulative water infiltration rate was greatest with vetch followed by a wheat cover and was significantly higher in no-till than in worked ground (Figure 1).

POTENTIAL NITROGEN BENEFIT FROM COVER CROPS

Current UT recommendations allow producers to take a nitrogen (N) credit of 60 to 80 pounds per acre as plant available N (PAN) following a dense stand of crimson clover or hairy vetch that has reached early bloom. However, many cover crops are mixtures of species where the legume portion is below 50 percent. In spring 2017, replicated biomass samples were collected at time of cover termination at six sites in West and Middle Tennessee and analyzed for total and plant available N (Table 2).

TABLE 1. *Soil wet aggregate stability, water retention and hydraulic conductivity as influenced by long-term cover crop and tillage at 0-6 inch sampling depth in 2015 and 2016 (ANOVA p < 0.05) Jackson, TN; Jaehoon Lee et al., 2017.*

Treatments	Wet Aggregate stability (%)	Wet Aggregate stability (%)	Soil water retention during dry period ($cm^3\ cm^{-3}$)	Soil water retention during dry period ($cm^3\ cm^{-3}$)	Hydraulic conductivity ($mm\ h^{-1}$)	Hydraulic conductivity ($mm\ h^{-1}$)
	(2015)	(2016)	(2015)	(2016)	(2015)	(2016)
Cover Type						
Vetch	56.4 a	62.5 a	22.6 a	22.4 a	6.88 a	10.26 a
Wheat	51.7 ab	58.0 ab	17.4 ab	19.5 a	6.40 a	9.73 a
No cover	50.1 b	55.7 b	15.9 b	19.2 a	2.56 b	5.50 b
	P=.0477	P=.105	P=.0514	P=.208	P=.002	P=.005
Tillage						
Conv Till	49.1 b	55.7 b	20.2 b	18.4 b	3.35 b	5.76 b
No-till	56.4 a	61.7 a	26.2 a	22.4 a	7.21 a	11.24 a
	P=.0017	P=.027	P=<.0001	P=.022	P=.0002	P=.0001

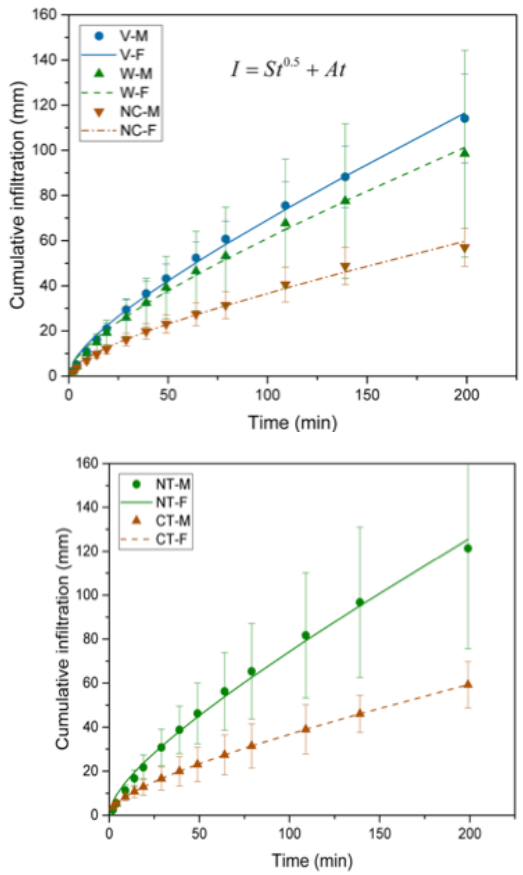

FIG. 1. *Cumulative soil water infiltration as affected by long-term cover of hairy vetch (V), winter wheat (W) or no-cover crop,treatments and no-tillage (NT) and conventional tillage (CT) in 2016. Dotted curves are measured values (M) and continuous curves represent the Philip's model estimations (F). Jaehoon Lee et al., 2017.*

- High biomass and/or a substantial legume percentage are critical if N for cash crop is desired.
- Plant available N for cash crop is greatly reduced in covers with large amounts of non-legume species as some N will be needed to break down residues.
- Nitrogen from legumes in cover blends may off-set early season N tie-up in crops like corn or cotton.

MULTISPECIES COVER CROPS: IMPACT ON WEED SUPPRESSION, VIGOR AND YIELD

In 2015 and 2016, a soil health mixture (cereal rye, oats, radish, crimson clover and vetch) and single species (cereal rye, wheat or crimson clover) cover crops were evaluated for weed control, soybean vigor and yield (Raper et al., 2016). All covers were terminated two weeks prior to soybean planting.

- Greatest cover crop biomass was associated with well-established single species grass or the soil health mix. These would have potential to replace a pre-emergence herbicide application in moderate weed pressure environments.
- When a clover single species did not achieve optimal biomass, weed pressure was similar to no cover unless a pre-emergence herbicide was applied. Presumably some N release from the legume may boost germination or rapid growth of weed seedlings. Planting a grass species with a legume usually increases biomass of the cover, enhances ground shading and improves weed suppression .
- Soybean early-season vigor and yield were similar regardless of cover treatments.

TABLE 2. *Estimated plant available N from various cover mixtures at the time grower terminated stand from 1 meter above-ground biomass samples replicated 6 times per location. McClure et al., 2017.*

**Plant available N (PAN) is estimated N that may be available to the cash crop within 10 weeks of cover termination using method from Oregon State. Amount of PAN depends on legume amount in cover, biomass and C:N ratio of cover type.*

County Location	Cover Type (lbs drilled/ac)	Visual Estimate % Legume in Cover Stand	Dry Biomass (Ton/ac)	Total N in Cover Sample (lbs/ac)	Plant available N (lbs/ac)*
			n = 6	n = 6	n = 6
Gibson 1	Cereal rye (15), black oats (15), wheat (15), crimson clover (6), balansa clover (4), buckwheat (6)	5%	1.6	37	0
Gibson 2	Cereal rye (15), black oats (15), wheat (15), crimson clover (6), balansa clover (4), buckwheat (6)	30%	1.6	46.8	14
Giles	Black oats (30), crimson clover (6), hairy vetch (3), Bayou Kale (1) and radish (1)	40%	1.4	60.6	22
Henderson	Black oats (20)	0%	1.9	33.5	0
Henry	Ryegrass (10), spring oats (10), crimson clover(2), Bayou kale (1), African cabbage(1)	15%	1.1	36	12
Madison	Cereal rye (30), annual rye (2), crimson clover (8), hairy vetch (4), winter pea (8), radish (4), buckwheat (4)	30%	3.1	127.6	43

SELECT COVER FOR INTENDED CASH CROP

Selection of cover species may depend on the desired benefit. University of Tennessee Institute of Agriculture research has shown that wheat, cereal rye, or two-way mixtures of wheat or cereal rye plus hairy vetch or crimson clover are economical and effective ground covers for weed suppression. Typically, winter annual weeds like horseweed are not an issue where cover crops have been properly established. Palmer amaranth can be suppressed so that fewer pigweeds emerge, and the Palmer amaranth that do emerge are typically delayed as much as 30 days.

Growers participating in cost-share programs requiring multispecies mixtures should follow their approved plan to be in compliance. More details on specific cover species may be found at tiny.utk.edu/TNequip. If weed suppression is the primary goal, minimize percentages of species such as Brassicas (radish, turnip), spring oats and Austrian winter pea, which are more likely to winterkill in Tennessee, leaving "holes" in the cover stand. Plant Austrian winter pea by mid-October for the most consistent establishment.

- **COVER CROPS FOR CORN OR COTTON:** Brassicas are not recommended as cover crops for cotton production. The most effective cover crop prior to planting corn or cotton is usually a balance of legume and grass species. Legumes provide nitrogen (N) and usually increase biomass of grasses in cover mixtures which may reduce or delay weed emergence. Where residual or plant-available N from a cover crop is desired for corn or cotton, the legume proportion and biomass must be increased enough so that N released will more than offset N tie-up as the cover decomposes. When a cover blend has high grass biomass, very little to no N may be credited against planned N application rates. Some N tie-up is expected following spring termination of grasses, and heavy stands of decomposing grass — or biomass in general — may affect corn or cotton growth, particularly in a wet spring where soils cannot dry out after planting or due to increased slug activity. Tie-up of N can be minimized with early termination, use of an at-planting nitrogen fertilizer and/or by planting legumes in cover mixtures.
- **COVER CROPS FOR SOYBEAN:** Nitrogen from legumes is not needed by soybean; however, legumes provide N and therefore increase biomass of grass covers in mixtures. Wheat or cereal rye sown with either vetch or crimson clover terminated closer to soybean planting will provide excellent weed control. Grass cover crops are important non-hosts for nematodes, whereas hairy vetch and crimson clover may host root knot nematode. Clover species are a poor host for soybean cyst nematode (SCN), whereas hairy vetch appears to be a good SCN host.

Cover crops should be drill seeded at an appropriate rate to ensure adequate establishment. Follow NRCS seeding guidelines for multispecies mixtures used in EQUIP (see table below).

COVER CROP TERMINATION AND PLANTING CASH CROPS

UT termination data suggest a two-pass herbicide program of glyphosate and dicamba* applied before planting the intended cash crop followed by paraquat at planting provides the most consistent control of cover crops including cereal rye and wheat.

- Terminate cover crops at least 14 to 21 days prior to planting corn or cotton and 10** to 14 days prior to planting soybeans.
- Cover termination at soybean planting** can increase weed suppression but is not recommended in a dry spring, and field must be scouted for insects.
- Apply burndown herbicides before operating a roller or roller/crimper in field.
- In most winters, tillage radish winter-kills; however, there are no effective herbicides for control if it does not.
- In some blends, canola or rapeseed has been both Roundup Ready and Liberty Link, so early termination (before bolting) of this cover is prudent with a sequential application of dicamba or 2,4-D.

No-till equipment is commonly used to plant into cover residues. A land roller or roller/crimper operated prior to planting will flatten excessively tall, dense covers and can improve crop germination and early seedling growth. Always plant in the direction of the roller and apply burndown herbicides prior to rolling a field.

- Plant corn at least 2 inches deep and soybean at 1 inch to 1 ½ inches for good seed-to-soil contact.
- Row cleaners may reduce hairpinning in no-vetch covers, but experiment to determine how aggressive to set row cleaners.
- Ripple coulters may be effective in front of cotton.

Cover Crop	Drilled seeding rate for single or two species mixtures (Per Acre)	Seeding Dates	Seed Depth	Comments
Cereal Rye	1-2 bu	Sept-early Nov	1-2"	Nutrient scavenger; see comments below on termination; biomass vigor is greater with good quality seed planted early.
Wheat	1-2 bu	Oct-early Nov	1-2"	Nutrient scavenger; plant early for cover crop; less expensive option; less total biomass compared to rye and less likely to tie up N in spring.
Hairy vetch	15 lb	Aug-Sept	½"- 1 ½"	Inoculate seed if no history of vetch in field; drill seed for maximum emergence and terminate before seed set to reduce emergence in later crops.
Crimson Clover	15-20 lb	Aug-Sept	¼" - ½"	Inoculate seed if no history of clover in field; select early-blooming variety to get spring crop in more timely.

- Cast iron closing wheels may work best in dry soils or with vetch mixtures.
- Residue is easier to cut through after dew has dried and soil is firm.

INSECT AND DISEASE MANAGEMENT

Cover crops can be hosts for both beneficial and pathogenic organisms. Grass following grass or legume after legume increases the buildup of disease inoculum. Cooler soil temperatures and increased moisture levels beneath residue may increase likelihood of seedling disease in a wet spring. Scout the cash crop at emergence and during early season for evidence of three-cornered alfalfa hopper or other insect pests that may require additional treatment.

- Plant crop seed treated with fungicide and insecticide.
- If burndown is within 10 days of planting, consider adding an insecticide.
- Consider higher rates of insecticide seed treatments or supplemental insecticide applications in corn.
- Be mindful that clover, vetch and Austrian winter pea are attractive to pollinators. Avoid applying bee-harmful insecticides to blooming cover crops if pollinators are present.

**Recommendation made assuming that dicamba is being applied at 0.25 lb ai/A. Label requires 14 d + 1 inch of rainfall prior to planting non-Xtend soybean, or 15 d + 1 inch of rainfall prior to planting non-Xtend cotton. There are no restrictions on planting interval to corn with this rate of dicamba.*

***Xtend varieties should be planted if dicamba is applied within 10 days of planting.*

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