Chapter 15

Cover Crop Management in Cotton

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Cover crops are most beneficial in conservation tillage systems in areas with long growing seasons and mild winters and in cropping systems with a high proportion of low-residue producing crops. Much of the cotton in the southern United States is either grown continuously or in rotation with soybeans, and both cotton and soybeans are low residue crops. Cover crops are often needed on erodible land for effective erosion control in conservation tillage or no-till cotton systems.

No-tillage cotton acreage in Tennessee and much of the southern United States increased rapidly between 1990 and 1994. This was partly a result of Conservation Compliance requirements to maintain subsidy program participation. No-tillage cropping is one of the most effective ways to control soil erosion, but its effectiveness is greatly reduced by inadequate crop residue. No-tillage cotton cropping results in less surface residue to control soil erosion as compared to corn or soybeans doubled-cropped with wheat (Denton and Tyler, 1997). On steeper slopes, gully erosion has been a problem in no-tillage cotton due to the lack of adequate soil cover.

Residue Cover Measurements in No-tillage Cotton

A survey of Tennessee cotton fields by Denton and Tyler (1997) indicated that continuous no-tillage cotton without a cover crop on 1 to 4% slopes averaged 34% residue cover at planting, barely enough to meet the 30% level required for Conservation Compliance. On slopes greater than 5%, the average residue did not reach the 30% level. Signs of soil erosion were clearly visible on slopes of 5% or more.

Winter cover crops would seem to be ideally suited for this situation. The use of a winter cover crop of wheat in the no-tillage system increased residue levels in surveyed fields, especially in the second and third season of cover crop use. However, increases in residue from cover crop use were smaller than expected with average residue after two or more years of cover crop use increasing on steeper slopes only from 29 to 36%. This smaller-than-expected increase was due to a number of factors including method of establishment, time of seeding, seeding rate, and seed quality. All of these factors are important in successful management of cover crops.

Problems with Cover Crops in Cotton Production

To be effective in erosion control, cover crops must be planted early enough in the fall for successful stand establishment, and must be allowed to grow long enough in the spring to produce adequate biomass for significant surface residue cover enhancement. In the southeastern and Gulf Coastal Plain and in the lower Mississippi Delta, long growing seasons and mild winters allow adequate time for fall establishment after harvest and provide for vigorous growth in the spring before normal planting times. In the northern parts of the cotton belt, harvest is often not completed until well after the optimum establishment dates for cover crops. This problem can be largely overcome by overseeding in the standing cotton before harvest. However, this system is more risky than other methods of establishment and requires special attention to overseeding date, seeding rate, seed distribution, and seed quality.

The planting system used in most of the fields studied by Denton and Tyler (1997) was overseeding of the wheat cover crop in November. Observations indicated that overseeding this late in the season resulted in about a fourth of the fields having stand failures with a number of other fields having poor stands. Even with good stands, growth was limited in the winter periods. Overseeding is much more successful if done before or shortly after defoliation in September or early October. Even then, dry conditions may result in poor germination.

In many cases, the overseeding was done with inadequate seeding rates with one bushel per acre or less seed used. Experience indicates that 1.5 to 2 bushels per acre are needed. In some cases, bin-run seed with low germination was used. There also were problems with seed distribution, especially when seeded by high-clearance ground equipment.

Another observed problem was carryover of persistent grass herbicides used in no-tillage cotton. This was accentuated on greater than 5% slope areas that tended to be more eroded and had lower soil organic matter resulting in less breakdown and/or buffering of residual herbicide. Other problems observed on slopes greater than 5% included cover crop seed washing downslope, and poor establishment in row middles as compared to near the old row. This was mainly due to much

of the cotton residue being concentrated near the row providing protection from seed movement and possibly conserving some additional soil water. It is possible to establish good cover with overseeded wheat or rye since in some fields 50 to 75% cover was achieved. This was a result of better management. The most important factors are early overseeding, proper seeding rates, good seed distribution, and good seed.

Other seeding management practices for seeding a winter cover crop include use of a no-tillage grain drill or surface broadcasting and disking after cotton harvest. The use of a drill for seeding after harvest is an excellent way to establish a cover crop. It is less risky than overseeding, especially for later-than-optimal establishment dates. Drilling ensures good seed-to-soil contact, good seed distribution, and good probability of stand establishment. It also leaves as much cotton residue intact as possible. Tillage to incorporate seed destroys residue and leaves the soil vulnerable to erosion. This may be a reasonable option on flat land. Minimum tillage should be used in this situation.

These same methods of cover crop establishment, overseeding, drilling, or soil incorporation can be used for legume cover crops. In areas where the growing season is long enough to allow completion of harvest before optimal planting dates have passed, placement of the seed in the soil by no-till drills or by minimum tillage is a much surer way to establish a cover crop than overseeding. In areas of shorter growing season, proper overseeding early is better than drilling late.

The need to plant as early as possible in the northern parts of the cotton belt has sometimes led producers to kill cover crops before enough biomass was produced for erosion control. This can be prevented by earlier cover crop overseeding to promote more vigorous early growth and by waiting as long as possible before applying burndown herbicides. Some producers have used systems in which the burndown herbicide is applied in strips in the row zone prior to planting, with the cover crop in the inter-row allowed to continue to grow until after cotton emergence. At this point, the inter-row cover is killed by appropriate herbicides using a hooded sprayer, or by use of glyphosate with a glyphosate resistant variety.

Small Grain Cover Crops

Wheat and rye are the most commonly used cover crops for cotton. They can be seeded later than legumes and are less susceptible to disease and winter kill. A disadvantage of small grains, especially rye, is the very large amount of biomass they may produce in the spring if planting of cotton is delayed. This can result in cold soils and slow early emergence and growth in no-till. This problem can be largely overcome by timely desiccation of the cover two to three weeks prior to planting and the use of row cleaners.

Another disadvantage of small grain covers is immobilization of nitrogen. This problem is most likely to occur if desiccation is delayed and large amounts of high-carbon biomass are produced. Research has shown that 30 pounds per acre of additional nitrogen may be needed to reach optimal cotton yield when small grain cover crops are used.

Legume Cover Crops

The two most commonly used legumes for use as cover crops in cotton in the southeastern United States are hairy vetch and crimson clover. Crimson clover is the best choice for the Coastal Plain and Southern Piedmont. Hairy vetch is better adapted to more northern areas of Tennessee, Alabama, Mississippi, and Georgia.

A good legume cover crop can provide 70 to 100 pounds per acre of nitrogen to a succeeding cotton crop. Research has indicated that seeding rates for these legumes can be reduced by about one-third of that recommend for forage production when used as cover crops without sacrificing biomass or nitrogen accumulation. In Tennessee this drops the rate from 20 to about 15 pounds per acre for crimson clover and from 30 to about 20 for hairy vetch.

An evaluation of 13 legume species for seedling vigor for establishment in crop residue and for cold tolerance to survive mid-South winters, indicated that Ball clover, berseem clover, red clover, buttonclover, and common vetch were not suited for cover crop use. Arrowleaf clover, subterranean clover, and Austrian winter pea were marginally acceptable, with bigflower vetch, hairy vetch, caley pea, and crimson clover being well-adapted for cover crop use. Seed availability and costs are problems with bigflower vetch and caley pea. All of the legumes need to be planted earlier than rye or wheat.

Advantages and Disadvantages of Cover Crops

Various aspects of cover crop use, both grass and legume, are discussed by Reeves, et al. (1995). The benefits of maintaining soil cover for erosion protection, productivity improvement, and water quality enhancement are well documented (Bruce, et al., 1987; Langdale, et al., 1991; Sharpley and Smith, 1991). Cover crops also result in improvements in soil physical properties such as increased soil organic matter, enhanced microbial activity, better soil aggregation, and less soil compaction (Bruce, et al., 1991; Reeves, et al., 1992).

Disadvantages of cover crop use include time and costs of establishment, negative impacts on crop nitrogen use efficiency, lower soil temperatures, and soil water depletion by the cover crop. To promote vigorous seedling growth, the cover crop vegetation must be controlled before the cotton emerges, Figure 15-1.

Establishment costs of cover crops can vary greatly depending on seed costs, establishment method, and individual farmer management relative to time and acres farmed. The potential economic benefits of legume cover crops are usually higher than with grass cover crops, since the legume cover crops can supply fixed nitrogen to the crops that follow. The average nitrogen from legume cover crops in the aboveground material can be as high as 100 pounds of nitrogen per acre, and could supply the entire nitrogen needs for a following cotton crop. In contrast, in some situations a grass cover crop such as wheat or rye can immobilize nitrogen, resulting in the need for more fertilizer nitrogen.

The problem of soil water depletion by cover crops varies greatly depending on the soil type and rainfall patterns in the spring. In medium textured soils, such as silt loams and silty clay loams in the upper southeast United States, soil water depletion is usually not a problem; however, on more droughty, sandy soils such as in the Coastal Plain areas it can be a significant problem. This risk can be reduced by desiccating the cover crop a minimum of 10 to 14 days ahead of planting. This desiccation has commonly been done using recommended rates of glyphosate or paraquat. This also has been found to be beneficial for cotton planting since the cover crop residue wilts and dries resulting in easier cutting of the planting slot by the no-till coulter and more effective press-wheel closure over the planted row.

Figure 15-1. Young cotton seedlings in killed winter cover. Complete control of existing vegetation before cotton emergence is necessary for vigorous seedling growth.

Cover crop residue also can result in lower soil temperatures in the seed zone. This can be a problem relative to seedling emergence and the incidence of seedling disease. In most cases, the early desiccation of the cover crop allows the soil to warm before cotton planting. In some heavy cover crop residue situations, row cleaners have been effective in exposing soil in the immediate vicinity of the row allowing for more warming and drying. However, in some cases this cleaned area was more vulnerable to excessive drying and crusting. The consequences of using row cleaners vary depending on the weather conditions during the planting season. Row cleaners should operate so as not to disturb the soil, but only to move excessive residue from the row zone.

Summary

1. Cover crops can be effective in many cropping systems, including no-tillage cotton.
2. For maximum benefits from cover crops, they require management.
3. Seeding methods should ensure good seed distribution, timely planting if overseeded, and good seed-to-soil contact if drilled or broadcast and then soil incorporated.
4. Recommended seeding rates should be used with seed of reasonable germination.
5. Cover crops should be killed about 10 to 14 days before planting, especially when used in cotton systems.

6. Adjustments in nitrogen fertilizer should be made with cover crops. With a grass cover such as wheat or rye, nitrogen fertilizer may need to be slightly increased or a split application used. Depending on the growth of legume covers, nitrogen fertilizer may need to be reduced by 70 to 100 pounds of nitrogen per acre.
7. Planters must be adjusted to properly cut through residue, properly place seed at the appropriate depth, and effectively close the planting slot.
8. Soil temperature should be measured in heavy cover crop residue to avoid planting too early and not getting a good stand. In some cases row-cleaners have been use effectively to improve stands.

References and Suggested Readings

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