BENEFITS AND LIMITATIONS OF UTILIZING COVER CROPS FOR IRRIGATION MANAGEMENT

S.A. Byrd
Texas A&M AgriLife Extension
Lubbock, TX
K.L. Lewis
Texas A&M AgriLife Research and Texas Tech University
Lubbock, TX

Abstract

Cover crops in conjunction with conservation tillage have been a subject of agricultural research for decades, primarily to investigate benefits in soil moisture or water availability. Over time improvement in soil water status, whether through increased soil water content, infiltration, or retention have been observed in crops grown in a system that utilizes a cover crop throughout the southeast (Daniel et al., 1999; Raper et al., 2000; Bauer et al., 2010). For cotton specifically, benefits to plant growth (Bauer and Busscher, 1996; Bauer et al., 2010) and yield (Bauer and Busscher, 1996; Raper et al., 2000; Schomberg et al., 2006; Bauer et al., 2010) have been observed with the use of a cover crop compared to no cover. A wide variety of cover crop species have been evaluated in southeastern studies, with rye (*Secale cereale*) typically providing the most biomass production (Bauer and Busscher, 1996; Daniel et al., 1999; Schomberg et al., 2006). Cotton yields have been observed to increase with the utilization of a rye cover crop compared to other cover crop species (Bauer and Busscher, 1996; Schomberg et al., 2006). There have been other benefits observed with the use of rye cover in a cotton production system, including increased weed suppression (Norsworthy et al., 2011; Sosnoskie and Culpepper, 2012), reduction in thrips populations (Manley et al., 2003; Olson et al., 2006), and reduction in root-knot nematode population (Bauer et al., 2010).

There are some considerations that need to be taken into account when adapting a cover crop system in cotton. While in general yield effects are positive when present, there is some variability and instances of no yield effects have been reported compared to conventional tillage (Raper et al., 2000). Low levels of biomass or high seasonal rainfall can also minimize or eliminate benefits observed from cover crops (Daniel et al., 1999) as there is not enough biomass present to differ from conventional tillage, or water availability is not a limiting factor. Research conducted in south Georgia in 2013 and 2014 also illustrates this. Even with a high level of biomass (10,720 lbs. acre^{-1}) there was no yield benefit in cotton grown with a rye cover compared to conventional tillage in 2013. In fact, plant height and yield was reduced in the rye cover treatment, which may be due to high seasonal rainfall saturating the soil at intermittent periods in the cotton grown with the rye cover. A more average seasonal rainfall was received in 2014, and while there was no difference in yield, plant height was increased in the rye cover treatment compared to conventional tillage at the eight leaf and 4 weeks after first bloom growth stages.

Seasonal growing conditions appear to highly influence the benefits of utilizing a rye cover crop, although in yield effects tend to be positive when taking all previous research into account. Achieving high biomass, particularly with rye, doesn't tend to be an issue in the southeast, the challenge seems to come from the environment and if conditions are present that would benefit an increase in water availability, as was observed by Bauer et al. (2010). In other parts of the country, particularly the western part of the Cotton Belt, achieving a level of biomass that would lead to these benefits appears to the greater challenge.

Conventional tillage and intensive monoculture crop production coupled with an ever-increasing demand for water has led to concerns about diminishing soil health and decreasing water and nutrient resources. The Texas Southern High Plains (TSHP) region continues to transition to accommodate less irrigated land and more deficit irrigated and dryland farming; however, enhancing soil health will likely optimize inputs and maximize nutrient and water use efficiencies possibly making dryland farming more profitable. More effective soil health promoting practices may include improved crop rotations, conservation tillage (e.g. reduced or no-tillage), and optimized fertilization and irrigation management. By implementing reduced tillage and cover crops, organic C has increased from 0.2% to 0.4% at the AG-CARES farm in Lamesa, TX. This increase has been a slow process taking nearly 18 years. While the benefits of conservation practices to soil have been observed, cotton lint yield has not been consistent from one year to the next. Water deficits at planting have not been determined, but with timely rainfall prior to planting stored soil moisture is quickly replenished where cover crops are planted. Nitrogen and P immobilization may be reason for

reduced lint yield for cotton planted into rye but not the mixed cover. Legumes have a narrower C:N ratio than rye and thus have less potential to immobilize N and P. Increasing the length of time between termination and planting cotton may have a positive impact on cotton growth and development.

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