COVER CROP AND CROP ROTATION EFFECTS ON COTTON PRODUCTION

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Abstract

Soil health promoting practices have received renewed interest in recent years. While some regions of the country have high adoption rates of such practices, cotton acreage in Texas tend to have some of the lowest adoption rates of conservation tillage practices. Soil moisture is often the most limiting factor in crop production within this environment and practices that are perceived to reduce the capability of soils to capture rainfall will hinder adoption. We evaluated conservation tillage and cover crops under three different continuous cotton systems in the Texas Rolling Plains. These systems included dryland, pivot irrigation, and subsurface irrigation. Various conservation practices were evaluated for at least four years. Under dryland conditions, there were no significant difference in lint yields among treatments over a four-year period. Under pivot irrigation, lint yields were increased by at least 6.5% with no-till plus cover crop treatments over conventional tillage. A terminated wheat cover crop increased lint yields by 10% over a 6-year period compared to conventional tillage under subsurface drip irrigation. When averaged over 4 to 6 year period, lint yields were not significantly reduced under any of the evaluated systems in the Texas Rolling Plains. Along with crop yields, economics and ecosystem services should be considered when implementing cover crops.

Introduction

Cotton under conservation tillage in the Southern Great Plains is less than 30% compared to nearly 70% in the Southeastern US (Claassen et al., 2018). This is much lower than adoption rates for other major crops grown in the US. In addition, over 60% of planted cotton acres followed a low-residue crop, evident of continuous cotton cropping systems. Cover crops have also not been widely adopted in this region, as loss of stored soil moisture is a concern. Studies have concluded that winter cover crops do not appear to be a viable option in the Rolling Plains due to limited soil moisture for establishment and the removal of soil moisture by cover crops will likely hinder subsequent crop yields due to increased moisture deficit at planting (Dozier et al., 2008; Baughman et al., 2007). We evaluated cover crop and conservation systems in continuous cotton cropping systems in the Texas Rolling Plains.

Materials and Methods

Studies were conducted at the Texas A&M AgriLife Chillicothe Research Station (CRS) near Chillicothe, TX. Three systems were evaluated, dryland, pivot irrigation, and subsurface drip irrigation. The dryland system was initiated in Fall 2011 and consisted of seven treatments: 1) conventional tillage without a cover crop; 2) no-till without a cover crop; and no-till with cover crops consisting of 3) crimson clover; 4) Austrian winter pea; 5) hairy vetch; 6) wheat, and 7) legume/grass mixture. Plots were 8 rows (40" spacing) and 40 ft long. Treatments were replicated four times in a randomized complete block design. The pivot system was initiated in Fall 2012 and consisted of four treatments: 1) conventional tillage without a cover crop; 2) no-till without a cover crop; 3) no-tillage with a wheat cover crop; and 4) no-till with a legume/grass cover crop mixture. Tillage treatments in the subsurface drip system included: 1) conventional tillage; 2) strip-tillage; 3) no-till; and 4) no-till with a terminated wheat cover crop. Tillage treatments were implemented in 2008 except for the strip-till treatment which was incorporated in 2011. A new irrigation strategy began in 2013 and will be used as starting point of data interpretation. Treatments are replicated three times in a randomized complete block design. For all systems, cover crops are planted after cotton harvest each fall and chemically terminated in mid to late April each spring. Cotton is harvested using mechanical equipment. Lint yields are determined after ginning of cotton samples.

Results and Discussion

There were no significant differences in lint yield among treatments in a dryland system over a four-year period (Figure 1). Lint yields ranged from 568-630 lb lint/ac. Compared to non-cover crop treatments, lint yields were increased by 5.6% for hairy vetch, 4.1% for Austrian winter peas, and 2.4% for the mixed species cover crops. When using yield as a sole evaluator, cover crops did not hinder lint yields. While cover crop costs may easily be incorporated into economic budgets, other ecosystem services should be considered as well.

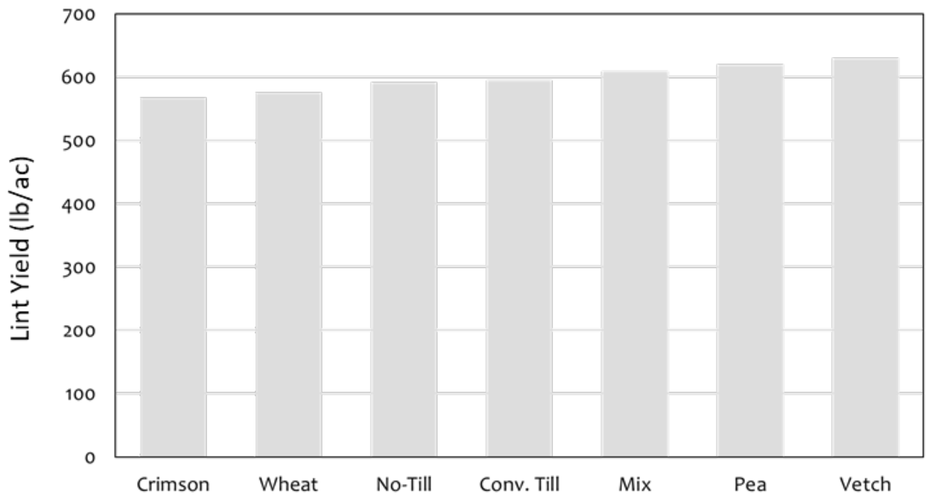

Figure 1. Mean lint yield in a continuous dryland cotton system under various cover crops at Chillicothe Research Station for 2013-2016.

Mean lint yields over a 6-year period under pivot irrigation are provided in Figure 2. As observed under dryland conditions, there were no significant differences in lint yield among treatments. Over a 6-year average, lint yields were 6.5% higher for the wheat cover crop system and 6.7% higher for the mixed cover crop systems compared to conventional tillage.

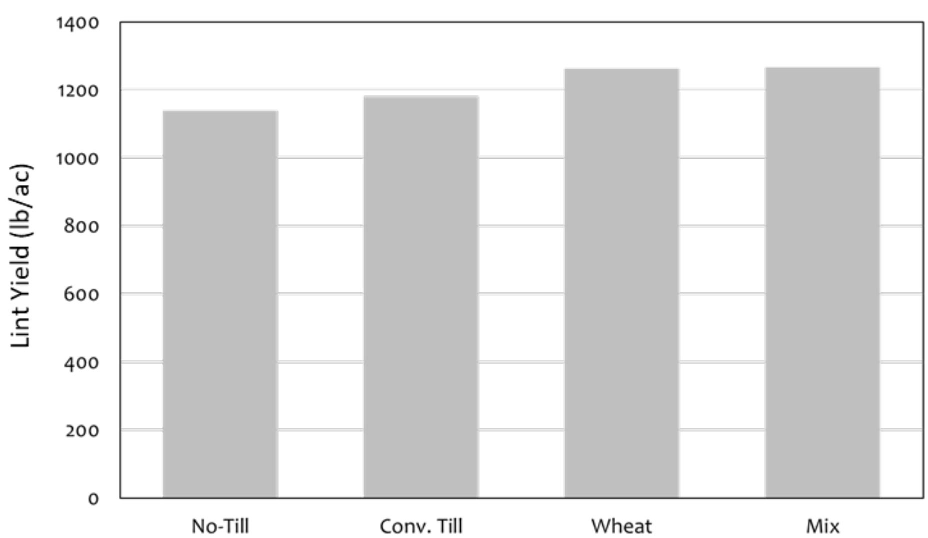

Figure 2. Mean lint yield in a continuous pivot irrigated cotton system under various cover crops at Chillicothe Research Station for 2013-2018.

Mean lint yields over a 6-year average within the subsurface drip system are shown in Figure 3. No-till with a terminated wheat cover crop produced significantly higher lint yields than strip-tillage and conventional tillage. There were no differences between no-till without a cover crop and strip-tillage. No-till with a cover crop increased yields by 10% over conventional tillage and 7.3% over strip-tillage. These data represent means from years 6-11 of the tillage system. Thus, the subsurface drip system has been in place longer than the other systems evaluated.

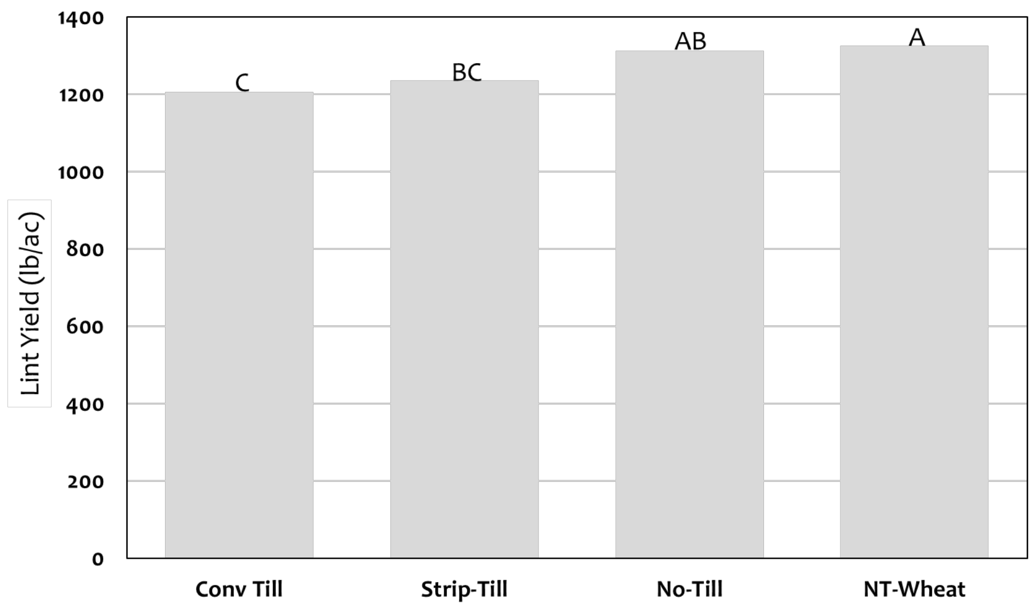

Figure 3. Mean lint yields in a continuous subsurface irrigated cotton system under various cover crops at Chillicothe Research Station for 2013-2018. Different letters represent significant difference at $P<0.05$.

Summary

Lint yields did not significantly differ among treatments in a dryland system over a four-year average, although exceptional drought conditions were endured during the evaluated time period. During the first 6 years of implementation, cover crop increased lint yields by at least 6.5% over conventional tillage in a pivot irrigated system. No-till with a terminated wheat cover crop significantly increased lint yields compared to strip-tillage and conventional tillage under subsurface drip irrigation over a 6-year average. In evaluated studies in the Texas Rolling Plains, cover crops did not reduce lint yields under dryland and irrigated continuous cotton systems.

References

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