FARM Assistance Focus

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Economic Comparison of Cover Crop Use in Texas High Plains Cotton

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Conservation tillage coupled with winter cover crops may reduce wind erosion in the Texas High Plains (THP). Although farmers recognize the benefits of conservation practices, their decision to use cover crops is often based on the farm's operating budget. In semi-arid ecoregions, like the THP, crops are dependent on deficit irrigation from limited groundwater resources, which creates additional challenges for cover crop systems.

Cotton production on the THP traditionally involves frequent disturbance of the soil surface, resulting in less residue remaining after harvest compared to other crops such as corn or grain sorghum. By incorporating greater biomass producing crops into the system, either through rotation or implementation of a cover crop, would result in greater protection from harsh, semi-arid conditions seen in the region. No-till is the practice of leaving the soil generally undisturbed throughout the year, except for fertilizer application. Conservation tillage systems such as no-till can help reduce evaporative water loss by protecting the soil from excess sun and wind exposure. Under no-till management systems, weeds are exclusively managed with herbicides, as cultivation is not an option. This can present a challenge as herbicide resistance is becoming more of an issue throughout region and state.

The objective of this research is to quantify the long-term impact of conservation tillage and cover crop use on the profitability of cotton production in the THP. Conservation tillage and a no-till, rye cover system was implemented in 1998. A mixed species cover of rye, hairy vetch, radish, and winter pea was seeded in 2014 into half of the rye cover crop plots.

Assumptions

A field study was conducted from 1998-2018 at the Agricultural Complex for Advanced Research and Extension Systems (AG-CARES), a cooperative between Texas A&M AgriLife Research and Extension Center at Lubbock and the Dawson County Cotton Growers Association, near Lamesa, TX.

The Financial and Risk Management (FARM) Assistance strategic planning model was used to illustrate the individual financial impacts of conventional vs. no-till, cover crop farming practices in the THP. Three scenarios were evaluated: 1) conventional cotton with no cover (CT); 2) no-till cotton with a rye cover (R-NT); and 3) no-till cotton with a mixed species cover (M-NT). Based on the yield and cost data obtained from the long-term AG-CARES trial, a case study 125-acre farm was developed to project the profit potential of conventional and no-till cover crop strategies in cotton over a ten-year period (2019-2018). The estimated 2019 crop yields for each system were based on the 2014-2018 average research yields. The remaining years (2020-2028) of the forecast period are gradually increased on the assumption of improved varieties across time (Table 1). The 4 years of research trial data provides an estimate of yield risk for each system. It is important

Table 1: CT, R-NT, and M-NT Yields Per Acre

Year	CT	R-NT	M-NT
2015	792	806	761
2016	823	671	753
2017	1104	831	932
2018	698	652	645
4-year Average	**854**	**740**	**773**
Case Study Projected Average Yields			
2019	854	740	772
2020	895	776	809

to remember although we only have 4 years of yield data, the systems have been in-place for nearly 20 years, with the half of the R-NT plots shifting to M-NT plots prior to the 2015 crop.

Budgets were created for all variable costs associated with each cropping system. Tables 2 and 3 illustrate the cost differences for each cropping system. The costs for tillage operations in the CT system were obtained from the 2016 Texas Agricultural Custom Rates survey for the North Region. CT production practices included sand fighting (x2), cultivator (x2), rotary hoe, rod weeding, listing, and Treflan incorporation. For the R-NT and M-NT systems, the seed costs were obtained from the MBS Seed company in Denton, TX. All other associated variable costs were obtained from the 2016 Texas Agricultural Custom Rates survey for the North Region. Variable costs associated with both no-till cover systems include drilling, termination of the cover crop, and 2,4-D application. Other variable costs associated with all three systems were the same and are summarized in Table 4.

Table 2:
2019 Conventional Tillage Variable Costs

Expense	($/Ac.) CT
Sandfighter (2x)	16
Cultivator (2x)	16
Rotary hoe	10
Rodweed	10
Listing	10
Treflan/Incorp.	10
Crop Insurance	35
Total	**107**

The base year for the 10-year analysis is 2019 and projections are carried through 2028. The projections for commodity price trends follow projections provided by the Food and Agricultural Policy Research Institute (FAPRI, University of Missouri) with costs adjusted for inflation over the planning horizon. Net cash farm income (NCFI) per acre was used to measure profitability, illustrating the trend and risk associated with the case study's farm financial performance expectations throughout the 10-year planning horizon under each cropping system.

Table 3: 2019 R-NT and M-NT Variable Costs

Expense	($/Ac.)	
	R-NT	M-NT
Seed-Cover	12	39
Drilling	15	15
Termination	9	9
2, 4-D	9	9
Crop Insurance	31	32
Total	**76**	**104**

Table 4:
Variable Costs for All Systems

Expense	($/Ac.) All Systems
Seed	51
Fertilizer	61
Herbicide	45
Irrigation	68
Cash Lease	125
Total	350

*Harvest cost: $0.08/lb.
**LOC Int. Rate: 6%

Table 5: 2019-2028 Projected Profitanility of Conventional Vs. No-Till Cotton			
	10-year Annual Averages		
Scenario	Total Cash Receipts ($/Ac.)	Total Cash Costs ($/Ac.)	Net Cash Farm Income ($/Ac.)
CT	618	553	65
R-NT	536	511	25
M-NT	559	551	8

Results

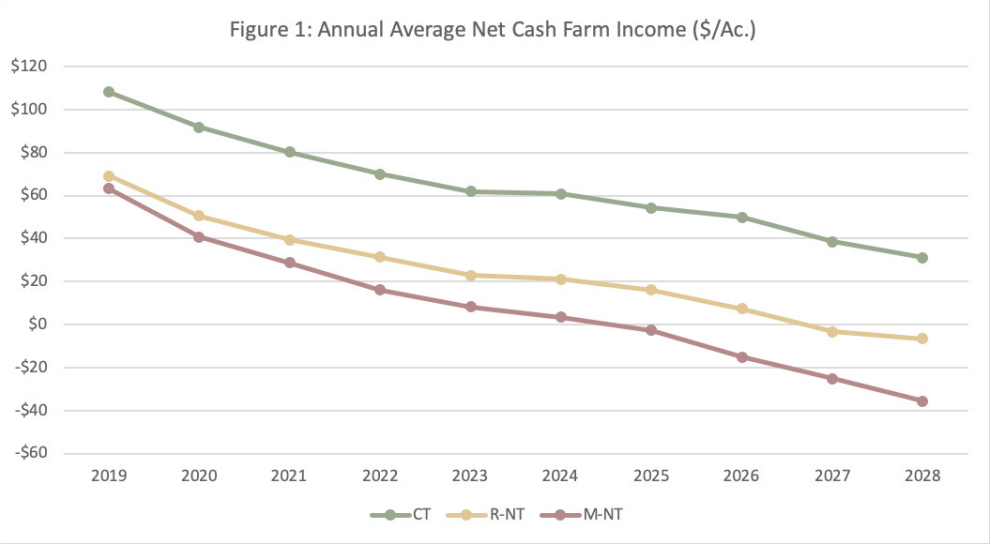
Financial projections for each cropping system are given below in Table 5. The results represent the average outcomes for total receipts, costs, and net cash farm income for 2019-2018. Total receipts consist of only revenue from cotton lint. Cottonseed income was assumed to be net zero after ginning costs and potential ARC/PLC payments were not included in this analysis. A 10-year net cash farm income (NCFI) analysis reflects the impact of possible yield fluctuations, and changes to input costs and crop prices likely to occur over time. Figure 1 illustrates the NCFI trend comparing the CT system to the R-NT and M-NT systems over the 10-year period.

On average, the CT treatment was more profitable than both no-till treatments because of greater lint yield and revenue. The CT cotton system outperformed both the R-NT and M-NT by an average of $40/Ac. and $57/Ac., respectively, over the 10-year horizon. While the R-NT systems enjoys substantial cost savings, yields underperform the CT system enough to minimize this advantage on the bottom line.

Summary

With consistent winds and the semiarid environment of the THP, cover crops and conservation tillage can improve ecosystem services by reducing soil erosion and cotton seedling damage while maintaining or possibly increasing other soil health characteristics. Although, other studies across the region and state have shown the ability of cover crops to improve yields when compared to conventional systems, our research fails to demonstrate the economic feasibility of using rye and mixed species cover crops with no-tillage due to reduced lint yield.

There are both numerous advantages and challenges to adopting conservation tillage practices in the THP. Advantages include improved soil health properties, protection of crops from early season weather effects, and potential cost savings on equipment related expenses. Challenges presented to producers adopting no-till and cover crops in the THP include possible yield loss due to increased water demand from cover crop and potentially increased herbicide costs when compared to a conventional cropping system, which can utilize mechanical controls. For these reasons, adoption of conservation practices in the THP region has been slower than other parts of the state and country as producers already facing tight margins are hesitant to adopt production practices that not been able to demonstrate equivalent returns when compared to current practices.



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