ECONOMICS OF LIME IN ALTERNATIVE COTTON COVER CROP AND TILLAGE SYSTEMS

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ABSTRACT

Soil acidity and cotton yields are influenced by cover crop, nitrogen, and tillage method. Applying half the University of TN Extension recommended lime rate resulted in cotton lint yields and net revenues that were either comparable or greater than the full lime rate for both conventional and no tillage systems. Hairy vetch was associated with the largest net revenue and lint yield among the cover crop options, while crimson clover had the lowest lint yield and net revenue.

INTRODUCTION

Conservation tillage practices such as no tillage and winter cover crops have been shown to improve soil quality by increasing organic matter, reducing erosion, and improving waterholding capacity. Grass covers immobilize excess nitrogen in the soil during winter thus preventing nitrogen leaching into groundwater. Legumes provide nitrogen to the next crop while reducing the need for commercial nitrogen fertilizer. Winter cover crops increase production costs due to establishment costs combined with changes in nitrogen requirements.

The build up of plant materials and surface placement of fertilizer can influence soil properties such as soil pH. No tillage in combination with surface applied nitrogen can result in the top few inches of the soil becoming more acidic due to nitrification. As a result, the productivity of nitrogen fertilizers in a no tillage system may be affected by lower soil pH levels, requiring additional liming and increasing production costs.

Lime has long been viewed as a crop production input providing certain benefits, but those benefits come with a cost. If crop yields are increased with lime application and the cost of the lime and its application is less than the increase in total revenue from the additional yield, lime can be viewed as profitable. The objective of this research was to determine cotton profitability and lint yields for lime applied at the full University of Tennessee Extension recommended rate and half the recommended rate for various cover crop, nitrogen rate, an tillage alternatives.

MATERIALS AND METHODS

Cotton yield data for 1995 through 2001 were obtained from a long-term winter cover crop experiment at the West TN Experiment Station, Jackson, TN. Cotton was planted on conventional and no tillage plots after four cover crop alternatives and four nitrogen fertilizer rates. After letting pH deteriorate by delaying the regular application of lime for several years, plots were split into blocks that were randomly assigned two lime rates in 1995 - 100% of the recommended University of TN Extension lime rate and one-half the recommended lime rate.

A quadratic yield response function was estimated using the data for each winter cover

alternative. Estimated yield response functions were used to predict profit-maximizing nitrogen fertilizer rates, yields, costs, and net revenues above variable and fixed production costs.

RESULTS AND DISCUSSION

Nitrogen significantly increased yields for all cover crop alternatives except crimson clover. No tillage was significantly different from zero for hairy vetch and crimson clover and positively influenced yields. The time variable included to represent the long-term effects of lime was significant for the no cover and wheat alternatives. However, the interaction term for time and tillage was significant for all four cover crop alternatives.

No tillage consistently produced higher lint yields and net revenues compared to conventional tillage for all four cover crop options; however, profit-maximizing nitrogen rates were about the same among the two tillage methods. Overall, the legume covers required the least amount of nitrogen fertilizer with crimson clover requiring no application of nitrogen in a no tillage system. The profitability of the half and full rates of lime were about the same.

CONCLUSION

When using hairy vetch and crimson clover covers, no tillage was significant in increasing lint yields compared to conventional tillage. Among the cover crop options, hairy vetch resulted in the largest net revenue and lint yield when using the half rate of lime and no tillage. Using a winter cover of crimson clover did not require nitrogen fertilizer, but resulted in the lowest net revenues and lint yields among the tillage methods and lime rates. Cotton lint yields and net revenues achieved with one-half the University of TN Extension recommended rate of lime were either comparable or greater than the full rate of lime for both tillage methods.