

# THE BASIS FOR AND VERIFICATION OF UNIVERSITY OF MISSOURI SOIL TEST RECOMMENDATIONS

David Dunn and Gene Stevens  
University of Missouri-Delta Center  
Portageville, MO

## Introduction

Most of the soil test calibration curves for cotton in Missouri were developed in the 1960's. Field experiments were conducted in five locations in Southeast Missouri by a team of scientists including Dr. Jim Brown, Jim Roth and Jake Fisher. In 1997, we began experiments to reevaluate cotton soil test recommendations. This project was funded by the Missouri State Support Committee and Cotton Incorporated.

## pH and Soil Acidity

In Missouri soil acidity is measured on the basis of Salt pH ( $pH_s$ ). The  $pH_s$  indicates the need to apply lime. The lime requirement is measured by the Woodruff Buffer method. Missouri lime recommendations are given in lbs. of Effective Neutralizing Material (ENM) per acre. ENM is an estimate of how much soil acidity the lime will neutralize in a 3 year period.

Most other locations in the world use Water pH ( $pH_w$ ) to measure soil acidity. The  $pH_w$  of a soil is generally 0.5 units higher than the  $pH_s$ .  $pH_s$  is less sensitive to seasonal changes and additions of fertilizers. Some herbicides have pH restrictions on their labels; these restrictions are stated in terms of  $pH_w$ . A comparison of  $pH_s$  and  $pH_w$  for 30 Missouri cotton soils is presented in Figure 1.

A three-year evaluation of University of Missouri liming recommendations was undertaken in 1996. In this study the recommended rate was compared to rates both higher and lower. The recommended rate was found to be the highest average producer over the three years of the study (Table 1).

## Nitrogen (N)

Nitrogen recommendations (NR) are based on CEC and cotton yield goal. The equation used for determining NR is:

$$NR = 0.1 \times (\text{yield goal} - 500) + CEC + 50$$

With a lowest recommendation of 50 lb N/a If CEC is less than 5.0 or the yield goal is above 800 lb lint/a apply 1/2 N at planting and 1/2 at first bloom.

A three-year evaluation of University of Missouri soil test recommendations for N in cotton was undertaken in 1997. In this study the recommended rate was compared to rates both higher and lower. Rotations with corn and soybeans were also evaluated. The optimum N rate for cotton was found to be between 80 and 120 lb N/a regardless of previous crop. Although rotating cotton with other crops did not effect N response, cotton yields were generally higher in rotations other than continuous cotton. The best rotation was cotton following soybeans (Table 2).

## Phosphorus (P)

The soil test used to determine P levels is the Bray 1 method. Results are expressed in lbs P/a. Phosphorus recommendations are based on a target level of 45 lbs P/a. A crop removal factor is included for soils testing between 45 and 70 lb P/a. Recommendations are given in lbs of  $P_2O_5$  per acre.

A three-year evaluation of University of Missouri soil test recommendations for P in cotton was undertaken in 1997 at three locations. In this study the recommended rate was compared to rates both higher and lower. A low P testing location could not be found. Consequently, response to different P rates was not significant.

## Potassium (K)

The soil test used to determine K levels is an extraction with neutral, one normal ammonium acetate. Results are given in lbs K/a. Potassium recommendations are based on a target level of 220lbs K/a + 5X CEC. A crop removal factor is included. Also for low testing soils a factor for buildup is added in. Recommendations are given in lbs of  $K_2O$  per acre.

A three-year evaluation of University of Missouri soil test recommendations for K in cotton was undertaken in 1997. In this study the recommended rate was compared to rates both higher and lower at three sites. Yields were increased dramatically when the soil test values for K were below the target levels. In all cases no significant yield increases were obtained by K applications when the soil test value was at or above the target level. A typical yield response curve is presented in Figure 2.

## Conclusions

The current University of Missouri soil test recommendations for lime, N, P, and K are appropriate for cotton production in Missouri.

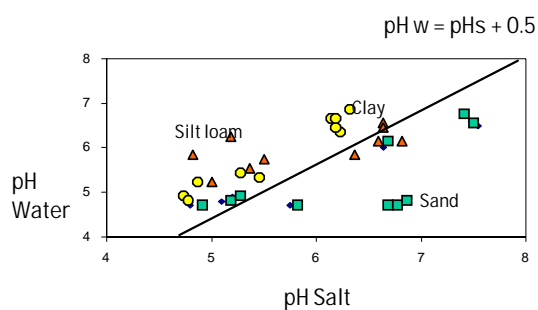


Figure 1. Relationship between pH<sub>s</sub> and pH<sub>w</sub> for 30 Missouri cotton soils.

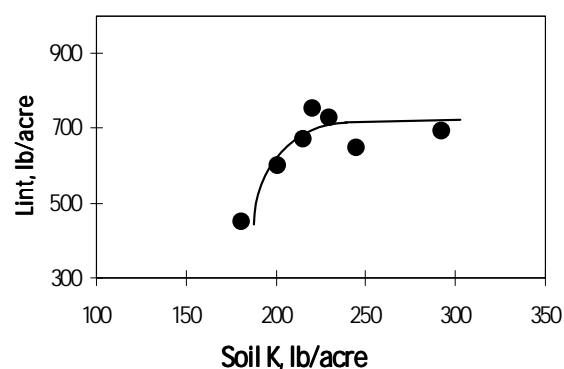


Figure 2. Relationship between soil test K values and cotton lint yields in 1998.

Table 1. Cotton lint yields for liming study 1996-1998. Soil test recommendation is 3-ton lime/a.

Ag lime Ton/a	1996 lb lint/a	1997 lb lint/a	1998 lb lint/a	3-year average lb lint/a
0	833	779	479	697
1	841	795	531	722
2	910	739	455	701
3	921	750	540	737
4	733	968	429	620
5	723	641	424	596

Table 2. Effect of N rate and rotation with corn and soybeans on cotton lint yields in 1998.

Lb N/a	After corn lb lint/a	After soybeans lb lint/a	After cotton lb lint/a	Average lb lint/a
0	521	766	733	674
25	621	897	793	770
50	746	932	854	844
75	708	973	903	861
100	781	913	929	874
125	723	962	-----	-----