Development of a Yield Projection Technique for Arizona Cotton

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Abstract

A series of boll measurements were taken at numerous locations across the state in 1997 in an attempt to continue to develop a yield prediction model that began in 1993. Results from 1995 showed the strongest relationship between final open boll counts and yield. Based on these results, data was collected in 1997 from several locations around the state. Boll counts were made just prior to harvest and then correlated to yield. Results showed that a good estimate for lint yield could be obtained using the factor of approximately 13 bolls/row-ft./bale of lint for Upland cotton on 38 to 40 inch row spacings.

Introduction

Cotton grown in the desert southwest has the advantage of a longer growing season allowing producers at lower elevations the option of carrying the crop through a second fruiting cycle, and attempting to produce a "top-crop" to increase yield. Additional inputs are required to support a second fruiting cycle. If a producer were able to obtain a reasonable estimate of crop yield potential at the time when the decision for crop termination is to be made, it would help in deciding whether to terminate the crop or carry it through a second fruiting cycle. A reliable yield estimation technique could serve a number of useful purposes in managing cotton fields for optimum yields, efficiencies, and profits. The objective of this study was to develop a model for predicting yield as a function of easily measured plant parameters.

Materials and Methods

In an effort to continue to build upon previous boll sampling work, boll counts were taken from several experiments conducted around the state of Arizona in 1997. Data was collected either on the date of harvest or as close to that date as was reasonably possible (all within 4-5 days). Data collected included; number of open bolls per meter and number of green bolls per meter. Yield estimates were made by mechanically picking the plots from which the boll counts were taken. Percent turnout for each plot was obtained from small sub-samples that were individually ginned. Data from 1996 was combined with the data from 1997. Linear regression analysis was performed according to procedures outlined by the SAS institute (1994), on the data to determine if a linear relationship existed in the data set between open bolls per meter and final lint yield. A mean and standard deviation was calculated for the number of open bolls per meter needed to produce one bale of lint yield.

Results and Discussion

The original idea of developing a model that would assist in predicting final lint yield was based upon easily obtained boll measurements such as boll weight, boll diameter, and bolls/meter (Norton et al., 1995 and 1996). These results revealed a high degree of variability among these parameters that reduced the predictive capability of the model to a point where the model was not useful. However, data collected in 1995 showed promising results with respect to a correlation between final open boll counts (within one week of harvest) and final lint yield (Norton et al., 1996 and Norton et. al., 1997). Data collected in 1996 resulted in estimates of number of bolls needed to produce a bale of lint yield of 13 per foot and 43 per meter. Associated with these means were large standard deviations. Data collected in 1997 went to further improve that estimate by lowering the coefficient of variation of the model from 29% to 19% which is due to a much lower standard deviation associated with the mean.

Results of the data analyses in Table 1 show that a count of approximately 11 harvestable (open) bolls/foot or 36 harvestable (open) bolls/meter will result in approximately one bale of lint yield. A high degree of variability exists among varieties, plants, and within individual plants with respect to parameters such as boll size, number of locks/boll, and percent turnout. For this reason, the mean has a relatively large standard deviation associated with it. The estimate of bolls needed to produce one bale of lint may need to be adjusted, particularly in the case of varieties that tend to have small bolls (i.e. DPL 5415 and DPL 5409).

Regression analysis performed on the data revealed a linear relationship between lint yield and open boll count on a meter basis (Figure 1). It is important to note that the regression equation obtained from this analysis should not be used to estimate yield. As an example; if you estimate the number of bolls per meter needed to produce one bale (480 lbs.) of lint with this equation you will obtain 14.1 bolls per meter. This underestimates the actual mean obtained (Table 1) by approximately 40%. It is suggested that yield approximations be made using the mean obtained in Table 1.

Data collection will continue for the 1998 growing season to expand that database and to improve accuracy and precision of lint yield estimations.

Acknowledgments

This project was funded in part by the Arizona Cotton Growers Association and Cotton Inc..

References

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Table 1. Boll count estimates and associated standard deviations resulting in one bale of lint/acre, Arizona, 1996 and 1997.

	Mean	Standard Deviation
1996 and 1997 (cumulative data)		
Bolls/foot (40 inch rows)	10.93	2.79
Bolls/meter (40 inch rows)	35.86	9.16

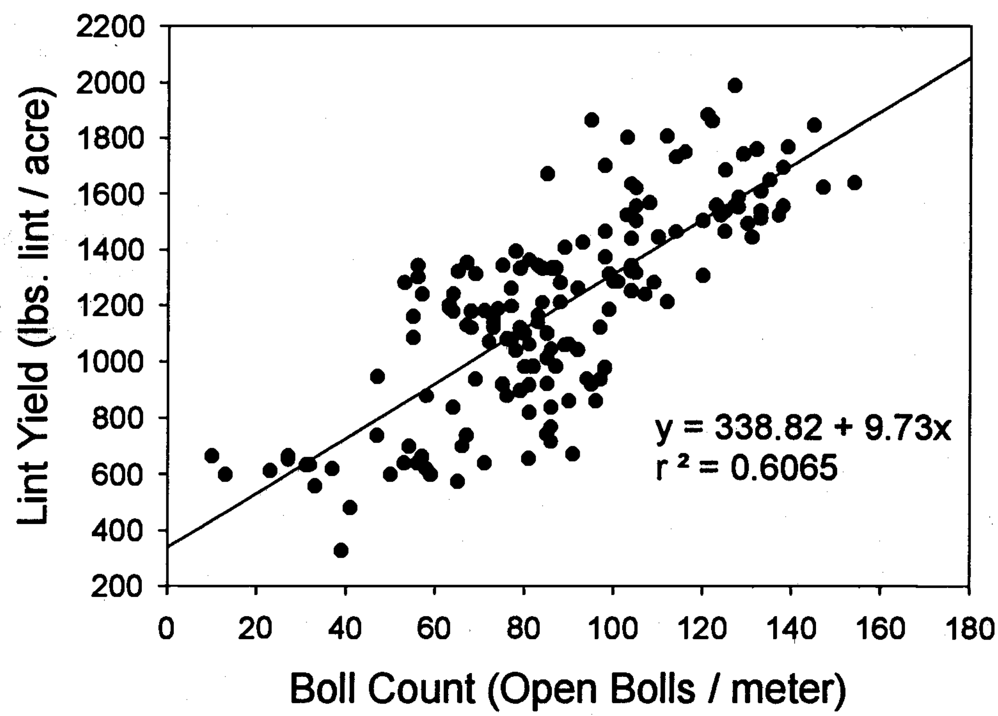

Figure 1. Regression results of lint yield data as a function of one meter open boll counts, Arizona, 1996 and 1997.