# Development of a Yield Projection Technique for Upland and Pima Cotton

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### *Abstract*

*A series of boll measurements were taken at two locations in 1994 on 5 different varieties in an attempt to develop a yield prediction model. Measurements were taken in strip-plot variety trials at Maricopa Agricultural Center and Marana Agricultural Center over a period of approximately 2 months from peak bloom through cut-out. Measurements taken included boll weight, boll diameter, bolls/meter, plants/meter, and final yield from each specific measurement area. Stepwise linear regression resulted in a yield prediction model expressing yield as a function of heat units accumulated after planting, boll diameter or boll weight, and bolls/meter.*

## Introduction

Cotton is very responsive to both the environment and management. Throughout the entire season management decisions are made that will effect the final outcome of the crop. One such decision is when to terminate the crop and when to apply the final irrigation. 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 is 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 crops for optimum yields, efficiencies, and profits. The objective of this study was to develop a model providing yield as a function of easily measured parameters.

## Materials and Methods

In an effort to develop a yield prediction model, data was collected in 1993 and 1994 from strip plot variety trials at two different sites (Marana, AZ, and Maricopa, AZ). In 1994, three representative varieties replicated four times, were used at both sites. Table one shows the varieties sampled at each location. Data was collected on a biweekly basis from peak bloom through cut-out (2100-3600 heat units accumulated after planting, HUAP 86/55°F). Data collected included; bolls/meter, boll diameter (hard green boll), boll weight (hard green boll), plants/meter, seedcotton weight/boll, seedcotton yields from each plot, and HUAP for each sample date. Data was analyzed using stepwise linear regression as outlined by the SAS Institute (SAS, 1988) and by Neter et. al. (1983).

## Results and Discussion

Data collected early (mid-July) did not contribute to the significance of the model and was discarded. The most significant model was found by combining all varieties using data from early August through mid-September. Stepwise linear regression was used to determine the yield prediction model from the measured parameters, with HUAP being the most significant parameter, boll size or diameter being the next most significant parameter. Bolls per meter was the last parameter that was entered in according to the restrictions set by the stepwise linear regression at a minimum significance level of $P \leq 0.05$. Two models were then selected. The first model predicts seedcotton yield as a function of HUAP, boll weight, and bolls/meter (model #1). The second model predicts seedcotton yield as a function of HUAP, boll diameter, and bolls/meter (model #2). Table 2 shows the equations for both of the models. Both models are highly significant with observed significance levels of $P \leq 0.0001$, and $R^2$ values are 0.4794 and 0.4491 for both models #1 and #2, respectively. Figures 1 and 2 are graphical representations of models 1 and 2 respectively.

Research for improving this model will continue in 1995. Data collection will be expanded to more sites and varieties in order to develop a larger data base necessary for model improvement.

## Acknowledgements

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## References

Neter, J., W. Wasserman, and M.H. Kutner. 1983. Applied Linear Regression Models. Richard D. Irwin, Inc., Homewood, Illinois.

SAS Institute. 1988. SAS/STAT:Procedures. Release 6.03 ed. SAS Inst., Cary, NC.

Table 1. Varieties used in boll sampling experiments

| Location | Variety |
|---|---|
| Maricopa | HyPerformer HS 44 |
| | Sure Grow 501 |
| | Delta Pine 5409 |
| Marana | Delta Pine 5415 |
| | Delta Pine 20 |
| | Pima S-7 |

Table 2. Regression equations developed for yield predictions

Model #1

$y=-744.32+0.91X_1+112.12X_2-4.79X_3$

where:

- y=seedcoton yield
- $X_1$=HUAP
- $X_2$=Boll Weight (g)
- $X_3$=Bolls/meter

Model #2

$y=-3261.14+0.94X_1+137.06X_2-3.95X_3$

Where:

- y=seedcotton yield
- $X_1$=HUAP
- $X_2$=Boll Diameter (mm)
- $X_3$=Bolls/meter

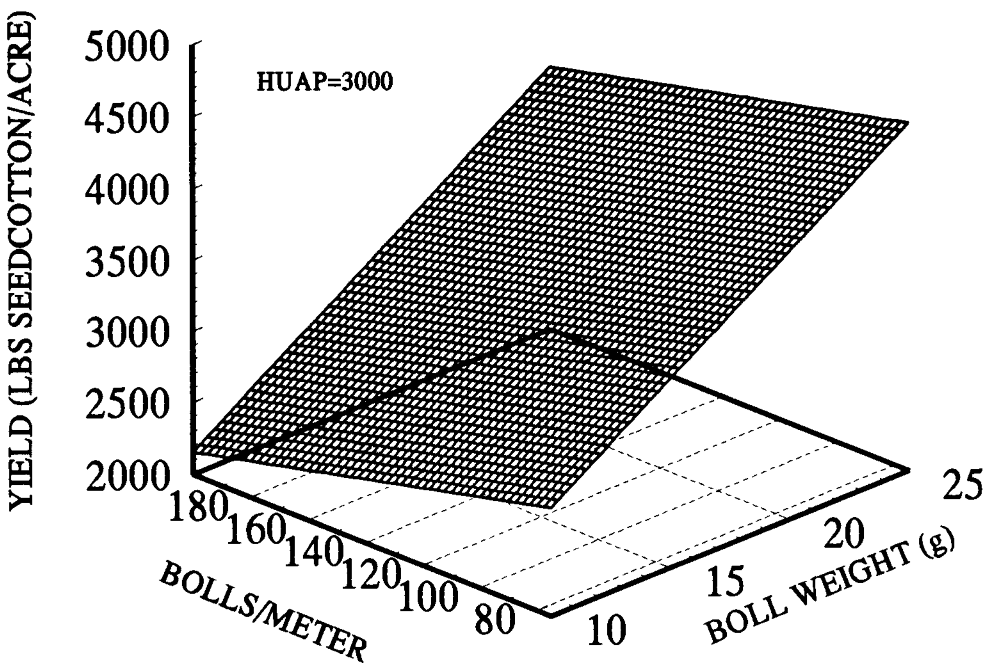


**Figure 1. Graphical representation of yield prediction model, for sampling at 3000 HUAP.**

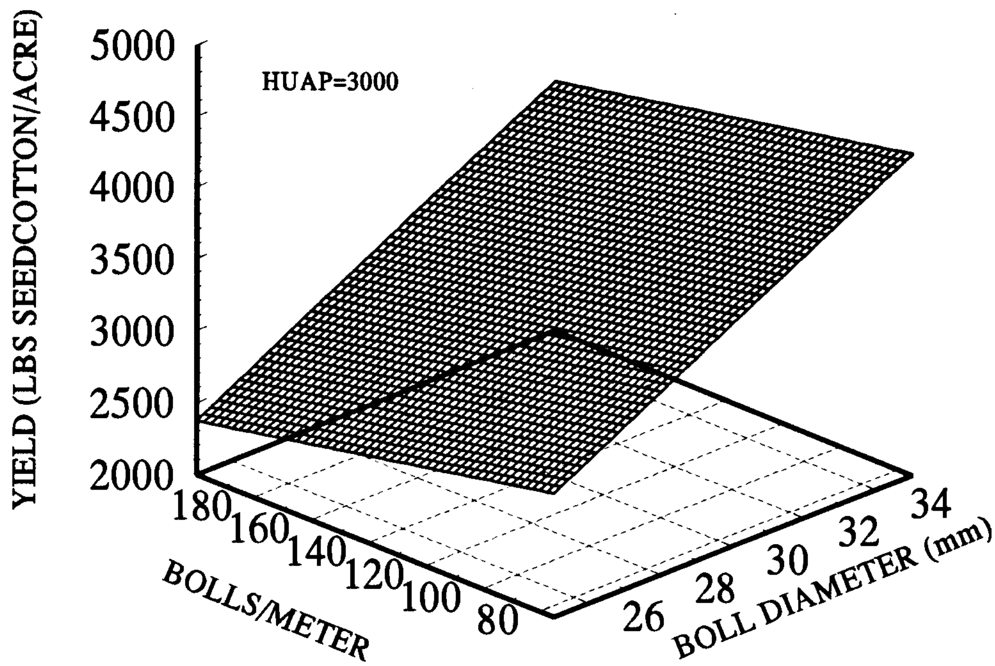


**Figure 2. Graphical representation of yield prediction model, for sampling at 3000 HUAP.**