IMPERIAL VALLEY COTTON FIELDS SURVEYED WITH PLANT MAPPING

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Abstract

We introduced the University of California Plant Mapping Program to growers in the Imperial Valley for the first time for the 1993 cotton season. Because the equations used in the program were derived from data collected in the San Joaquin Valley for Acala varieties, many potential users questioned the validity of applying the program to Upland cotton fields growing in the low desert (i.e. Imperial Valley). They wanted to know if the program could make accurate predictions for varieties other than Acalas in an environment other than the San Joaquin. Could they trust their management decisions to a program developed from another region's database?

In order to address these concerns and to help convince the growers of the value of plant mapping, we collected both in-season and final plant map data from thirty Imperial Valley cotton fields during the 1993 season. Height to node ratios vs. age (as number of nodes) for Imperial Valley plants followed the same pattern, but were slightly lower than, the curve for San Joaquin fields. Some fields came closer to the line representing the San Joaquin database than others. Nodes above white flower values from Imperial Valley fields followed the same relationship to days after first flower as the San Joaquin fields. Growers actively making management decisions with the aid of the programs picked over 2242 kg lint/ha. Those not guiding their decisions brought in less than 1121 kg lint/ha. We determined two factors critical to good cotton production in the low desert: timing of early season irrigation and early retention of first position fruits. We conclude that the UC Plant Mapping Programs served as useful guides in an area quite different from the San Joaquin.

Introduction

The steady improvement in yield and quality of cotton crops in California's San Joaquin Valley over the last decade stands in marked contrast to cotton production in the Imperial Valley where cotton area has dropped from 56,657 hectares to a low of 1,619 hectares in the 1992 season. This acreage loss is cause for concern. The Imperial Valley currently produces barely enough bales of cotton to keep its one remaining gin open. If that gin were to close, cotton would disappear as a cropping alternative for growers in the Imperial Valley where the economy is fueled by year-round farming. Cotton fills a valuable niche as a summer-season crop to use in rotations with winter-season produce and small grains.

Whereas plant mapping is commonly used by growers in the San Joaquin to guide their management decisions, no such tool was being used in the Imperial Valley. As agronomists we believed that plant mapping also could help the Imperial Valley growers in making decisions ranging from irrigation to pest management.

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potential users questioned the validity of applying the program to Upland cotton fields growing in the low desert (i.e. Imperial Valley). They wanted to know if the program could make accurate predictions for varieties other than Acalas in an environment other than the San Joaquin. Could they trust their management decisions to a program developed from another region's database?

Our objectives were threefold in surveying thirty cotton fields. First, we would demonstrate the validity (or lack thereof) of the UC programs in a location other than the San Joaquin. Second, we would develop a database specifically for the Imperial Valley. Third, we would pinpoint any management practices that could be changed to make cotton more profitable again in the Imperial Valley.

Methods

We surveyed thirty commercial cotton fields from throughout the Imperial valley by using plant mapping to assay the effect of current management practices on crop growth, progress, and final yield. We chose fields representative of different soil types, geographic locations, cotton varieties, and management practices ranging from 'top-notch' to poor. We used the University of California Plant Mapping Programs to do in-season plant maps every other week, as well as end-of season plant maps as described previously (Wrona and Kerby; 1993, 1994).

Results

The solid line in Figure 1 represents the performance of San Joaquin-grown, nonstressed Acalas (Kerby and Hake, in press). Height to node ratios (HNR) versus age (number of nodes) followed the same S-shaped pattern, but were slightly lower than those for the San Joaquin fields. This graph is an indication of how close the plants came to being the proper size for their age. Some fields came closer to the solid line representing the performance of idealized plants in the San Joaquin database than others.

A low HNR for a plant with less than seven nodes does not reflect a reduced yield potential (Kerby and Hake, in press). Leaves capable of supporting bolls can still develop. However, changes in HNR after a plant has seven nodes determine the carrying capacity of the plant. Stresses during development of nodes seven to 18 are reflected in lower HNR's, limited leaf area, and premature aging of these leaves, the sources of carbohydrates for the developing boll load - all factors potentially impacting final yield. The HNR's from the Imperial Valley for nodes seven to 18 are indicative of a stress response for many of the fields (Fig. 1).

Nodes above white flower values from Imperial Valley fields followed the same relationship to days after first flower as the San Joaquin fields (Fig. 2). The solid line reflects the rate at which Acala cotton moves toward cutout in the San Joaquin. The Imperial Valley fields took a little longer to approach cutout.

A plot of first position fruits retained on the bottom five fruiting branches (FP1's in 1st 5) multiplied by the number of fruiting branches in the 95% zone (#FB's 95% Zone) versus the lint yield in kilograms per hectare shows a pattern similar to that seen in the San Joaquin (Fig. 3). Although there is a good correlation between retention of the bottom five and yield, there is much more scatter in the data from Imperial. Overall an average of 49% of first position fruits were retained on the bottom five fruiting branches in the Imperial Valley. Usually good yields are dictated by having over 65% of first position fruits retained in the San Joaquin. Another

notable difference is that there were an average of 13.2 fruiting branches in the imperial Valley in the 95% zone. The San Joaquin averages just eleven fruiting branches.

A plot of bolls retained per node versus main stem node number shows greater retention of first position fruits in those fields with high overall retention (Fig. 4) compared to those fields with low retention (Fig. 5). Furthermore, the fields with high retention averaged 1,984 kg lint/ha compared to the low retention fields (1,202 kg lint/ha).

Discussion

Delayed irrigation early in the season could result in a decreased HNR (Fig. 1), earlier cutout (Fig. 2), and decreased yield (Kerby *et al.*, 1993). Alternatively, the harsh desert environment could create greater stress because of excessively high evapotranspirational demands. Even with adequate soil moisture, high evaporative demand may limit plant production in the low desert.

Imperial Valley fields retained fewer early squares and had more fruiting branches in the 95% zone than fields in the San Joaquin (Figs. 3, 4, 5). Both a loss of early squares and an increase in the number of fruiting branches in the 95% zone have been shown to delay maturity of cotton (Kerby and Hake, in press). Delayed maturity was not a good strategy in 1993 as populations of the silverleaf whitefly (*Bemisia tabaci*) on cotton increased as the season progressed. Consequently, the earliest planted fields in the 1993 survey were under less whitefly pressure at the end of the season during boll-filling than the late planted fields. In fact, the latest-planted Imperial Valley field (April 20th) was defoliated before it had a chance to set and fill all of its bolls (Wrona, personal observation). It yielded 336 kg lint/ha - a dismally low value compared to the average for the Valley of 1569 kg lint/ha with an average planting date of March 16th. These findings from the 1993 data indicate a good strategy is for the grower to plant early, get a crop set, and get out at the earliest possible date.

The most interested growers became actively involved with the UC Plant Mapping Programs. In guiding their management decisions with the program, they were able to pick over 2242 kg lint/ha - a feat beyond any of our expectations before the season began. (The average yield in the Imperial Valley the previous year (1992 season) was only 1177 kg lint/ha.)

Based on the 1993 survey results we know that water needs to be pushed early in the season to assure adequate vegetative growth so that the plants will be big enough to support the later-developing reproductive growth. We also know that first position fruits account for most of the lint yield and must be retained early in the season. Consequently, growers must scrutinize their crops during the critical period of square development and fruit set to be sure that adequate pest management efforts are employed.

We feel our results indicate that the UC Plant Mapping Programs are useful guides to cotton management decisions in the Imperial Valley.

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