SHORT SEASON COTTON
in the San Joaquin Valley

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LINT YIELDS have historically averaged higher in the San Joaquin Valley than in other cotton-producing areas of the United States. Contributing factors include favorable temperature for the growth of cotton over several months, availability of water, generally fertile soils, high light intensities, and the development of cotton varieties specifically adapted to that environment.

Investigations of alternative methods of producing the crop were prompted by two recent developments: decline in yield, and the threat of pink bollworm in the area.

Present methods of producing the crop are designed for full exploitation of the long growing season. Thus, the crop occupies the land 8 to 9 months of the year (longer if the time for land preparation and preirrigation is included).

If the time required to grow the crop could be reduced without yield reduction, production costs might be reduced. Shortening the growing period would also help control the pink bollworm. In areas where the insect has become established such as the Imperial Valley, early termination of the crop has been one of the best methods of reducing the severity of the problem. Early crop termination reduces the food supply (green bolls) to the insect about to go into diapause (overwintering form). Hence, fewer moths emerge in the spring, requiring more time to increase to damaging levels.

One approach to shortening the growing season would be to shorten the fruiting period. Cotton, being an indeterminate fruiting plant, produces flowers for periods of up to 10 weeks (third week of June to the first week in September). The period of boll maturation varies from six weeks (for early-set bolls) up to 10 weeks (for bolls set late in the season). Thus, if a profitable crop could be set by the first week of August, the entire crop would be ready for harvest in early October.

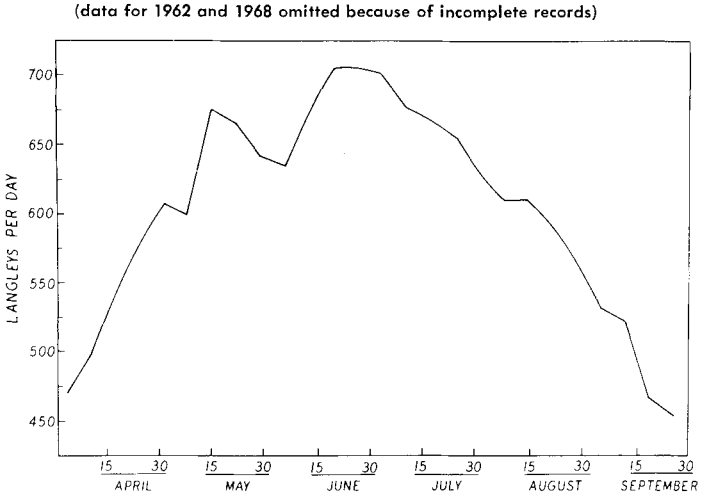
A shortened fruiting period would offer various advantages, including a shorter period to protect the crop from insects, particularly bollworms; a fiber of better quality since it would develop under more favorable temperatures; and improved chances for a once-over harvest. The present practice of a second pick to harvest cotton set late in the season is a high-cost operation (often no more than a break-even practice). An earlier, once-over harvest would allow more time for crop disposal and more timely cultural operations in preparing for succeeding crops. Additionally, areas with severe verticillium wilt would benefit from a shortened fruiting period since most of the damage that occurs late in the season would be avoided by maturing the crop early.

What are the possibilities of shortening the fruiting period? One is to make better use of solar radiation earlier in the season. Of the annual crops grown in the valley, cotton is the slowest to develop a leaf canopy that completely intercepts incoming radiation. Any radiation not intercepted by the leaf canopy can be considered lost as far as photosynthesis is concerned.

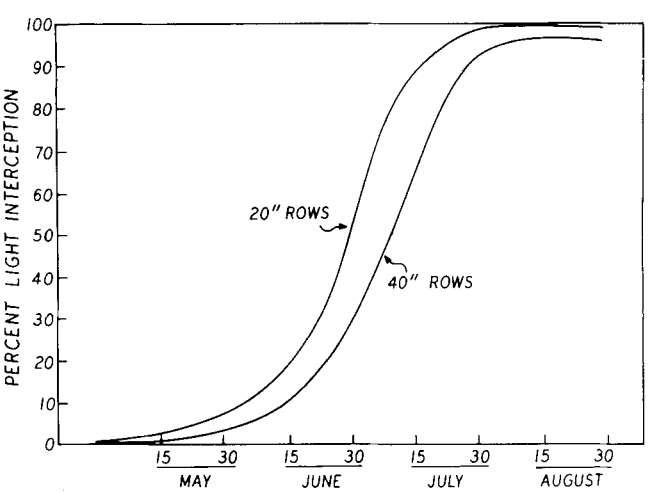
Seasonal radiation peaks in the last week of June and first week of July. Graph 1 charts the average radiation for Fresno from April 1 to September 30 for the period 1960–1971 (data for 1962 and 1968 omitted because of incomplete records). Daily radiation starts a steady decline in the second week of July. Total radiation in August is 89% of that for July, and that in September is only 74% of the July total.

With normal row spacings of 38 to 40 inches, canopy closure is not complete until mid-to-late July, a time of decreasing radiation. Increased interception earlier can be accomplished by planting the rows closer together. Graph 2 shows the percent radiation intercepted by two planting configurations. Cotton was planted at the Shafter Cotton Research

GRAPH 1. AVERAGE SOLAR RADIATION AT FRESNO FROM APRIL 1 TO SEPTEMBER 30 FOR THE PERIOD 1960–1971
(data for 1962 and 1968 omitted because of incomplete records)

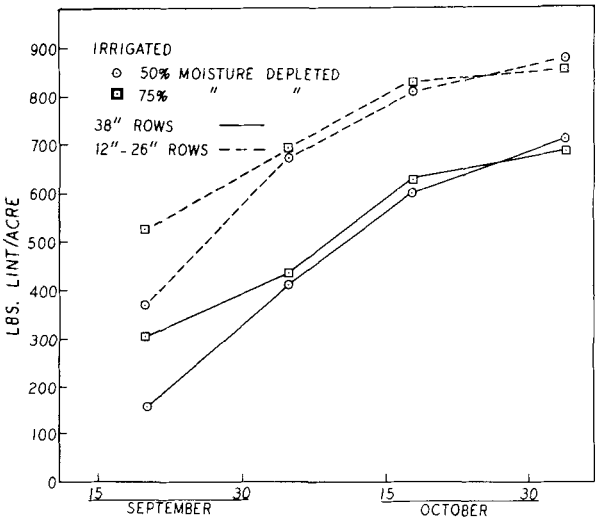


GRAPH 2. PERCENT OF SOLAR RADIATION INTERCEPTED BY COTTON PLANTED AT TWO ROW SPACINGS, SHAFTER, 1971



The threat of pink bollworm and yield decline in the San Joaquin Valley have prompted investigations into more efficient production practices to permit growing the crop in less time. Higher plant populations planted in rows narrower than the conventional 38- 40-inch row spacings have a potential for shortening the fruiting period, a requirement for reducing the time it takes to grow the crop. Preliminary studies indicate that varieties developed specifically for this system of production will be needed.

GRAPH 3. RATE OF COTTON MATURITY AND YIELDS FOR TWO ROW SPACINGS AND TWO IRRIGATION TREATMENTS, KERN COUNTY, 1971



Station in 1968 at two row spacings, 20 and 40 inches apart. Plant populations were the same for both (26,000 plants per acre). The 40-inch row spacing took 10 to 11 days longer to attain comparable interception. Lint yielded was 12% higher in the 20-inch row spacing (1151 vs. 1027 lbs). Since the plant population was the same for both treatments, the increased productivity was most likely the result of increased utilization of available radiation. In this experiment the extra radiation intercepted up to mid July by the 20-inch row spacing was equivalent to the amount of radiation intercepted in 10.4 days during August by the 40-inch spacing.

Further possibility

A further possibility for shortening the fruiting period would be an increased plant population in a narrow row planting. With more plants, fewer bolls are required per plant to attain a particular yield level. This approach is valid even though experience has shown that there is a limit. With high plant populations (over 100,000 plants per acre) problems have arisen with excessive vegetative development, increased percent of barren plants, and smaller bolls. Populations of 50,000–75,000 plants per acre have been more consistent in performance.

Graph 3 presents data from an irrigation experiment conducted in 1971 on a clay loam soil in Kern County. Two row spacings were planted, 38 inches apart (conventional spacing) and 12 and 26 inches apart (narrow row spacing). Two irrigation treatments were applied, irrigating at 50 and 75% depletion of soil moisture in the top 3 ft of soil. The 50% depletion treatments received four postplant irrigations, and the 75% depletion received three irrigations. Plant populations for the 38-inch and 12- 26-inch spacings were respectively 24,100 and 47,400 plants per acre.

Maturity rate

Graph 3 shows the rate at which the cotton matured (opened) in the fall. The main effect of the irrigation was the amount of cotton open on the first sampling date (Sept. 20)—with more cotton open on both row spacings with the 75% depletion (dry) treatments. By the second sampling date (Oct. 5), however, the 50% treatments had almost the same amounts open. The largest difference was between row-spacing treatments. On the first sampling date the 12- 26-inch spacing averaged 455 lbs per acre of lint mature vs. 228 lbs of lint mature on the 38-inch spacing, a difference of 227 lbs. On the final sampling date (Nov. 3) the 12-26-inch spacing averaged 865 lbs of lint vs. 699 lbs of lint for the 38-inch spacing, a difference of 166 lbs of lint. Most of the difference in yield was due to the greater amount of lint produced during the early part of the fruiting period, as represented by the differences found at the first sampling date. Another way of expressing the earlier maturity of the narrow-row higher-population treatments is to note the date these treatments attained the same yield (700 lbs of lint per acre) as the 38-inch plantings. This occurred on October 7, 27 days before the final harvest date on November 3.

Variety is the third factor to be considered in shortening the fruiting period. Graphs 2 and 3 show data from experiments planted with Acala SJ1. Although yields were increased in these trials, increases were not as great nor was increased, earliness obtained in many of the field trials conducted in 1970 and 1971. In spacing-population studies Acala varieties proved to be quite sensitive to crowding. In close spacings the Acala types tend to grow vegetatively and not set a good crop if mistakes have been made in cultural operations. The reason is most likely related to the indeterminate fruiting behavior of these types. They were developed to take advantage of a long growing season, and by fruiting over a longer period these types do produce high yields in conventional culture. This type of fruiting behavior does not fit into a short season concept where the objective is to shorten the fruiting period. Research results are limited in the San Joaquin Valley on genotypes grown under narrow-row short-season conditions. Data from the few evaluations made indicate that earlier faster-fruiting types are better adapted to the system. Research is curently under way to identify the growth and fruiting characteristics needed in a variety suited to the short-season system of production.

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