YIELD POTENTIAL

short-season cotton in narrow

R. E. JOHNSON · R. G. CURLEY · ALAN GEORGE · O.D. MC CUTCHEON
V. T. WALHOOD · C. R. BROOKS · PAUL YOUNG

Lint yields of Acala cotton varieties were increased an average of 10.9% by planting in narrow rows. Increases were even greater in a few genotypes better adapted to the higher plant populations provided by narrow rows. This research demonstrates the potential for higher yields, harvested once over, in 180 to 200 days from planting to harvest.

During the 1960s cotton yields and income were declining. Research supported by the industry was initiated in 1970 to determine whether yields could be increased and production costs lowered by growing cotton in narrow rows. Field studies were conducted in the San Joaquin Valley during the past four seasons (1970–1973).

The early experiments with narrow-row cotton showed that the time it takes to produce a crop can be shortened. Further research was directed to: (1) determining the yield potential of a short-season system; (2) identifying the plant type and growth characteristics needed in a short-season variety; (3) determining agronomic requirements such as plant population, row spacing, irrigation, and fertility; (4) defining the short-season production system; and (5) evaluating available production and harvesting equipment. Field experiments were conducted on experiment stations in Kern, Tulare, and Fresno counties and in grower fields in all cotton producing counties in the San Joaquin Valley. This report summarizes results pertaining to the first four objectives. A subsequent report will cover mechanization.

Narrow-row yields

Twenty-nine comparisons of Acala varieties (mostly SJ-1) showed that the average lint yield for conventional 38 to 40 inch row spacing was 818 lbs/acre, while the average for narrow-row plantings was 907 lbs/acre. The average yield increase was 10.9%, a highly significant difference.

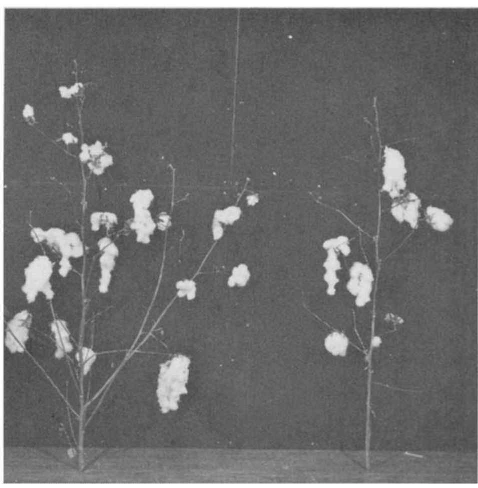
The data indicated that the increased lint yield was due to greater total production of dry matter by plants in narrow rows. Nine experiments measured dry-matter production and its distribution into various plant parts by Acala SJ-1. The measurements were taken just prior to harvest, but after defoliation, so the leaf weights were not determined. Narrow-row plantings partitioned slightly more dry matter into stems (34.9%) and a little less into seedcotton (50.6%) than did conventional row spacings (33.3% for stems and 51.6 % for seedcotton). In these comparisons lint production averaged 14% higher for the narrow-row spacing.

The increased productivity of the narrow-spaced rows was associated with a higher percent of light interception during the growing season. Light interception measurements in a few experiments showed narrow-spaced rows intercepted 10 to 15% more radiation than conventional spacings on a seasonal basis.

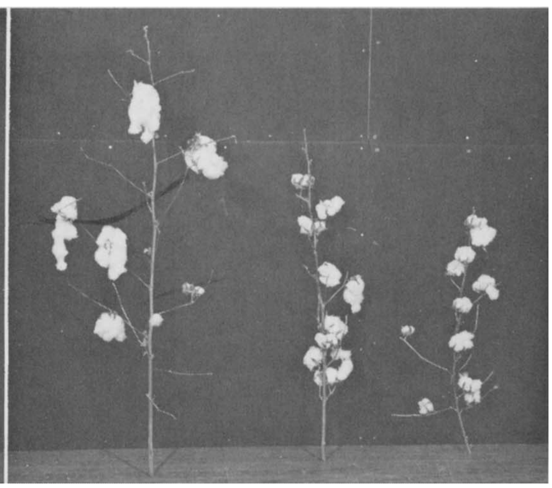
Adapted plant yields

To determine the growth and fruiting characteristics needed for a short-season system, varieties and breeding lines representing a wide range in growth and fruiting characteristics were planted in several experiments in 1972 and 1973. The number of genotypes varied with experiments, but all tests included SJ-1 as a check.

Three of the Acala types performed very similarly to SJ-1, whereas SJ-2 yielded significantly higher (104.9% of SJ-1 lint yield). Of the non-Acala types, Coker 310, DPL 6582-810, DSR 6-19, and Stoneville 213 yielded significantly more lint than SJ-1. PM 1764, PM 266, PM Dwarf and Dunn 119 were significantly lower in yield (86.1%, 90.8%, 93.5%, and 91.8%, respectively).



Effect of narrow-row plantings on plant growth (top photo). Plants of Acala SJ-1 grown 1 row/40" bed (left) anr 2 rows 14" apart on 40" bed (right).



Acala SJ-1, DSR 6-19, and Paymaster Dwarf (left to right) grown in narrow rows. Shorter statured types (center and right) are better adapted to narrow-row plantings.

of rows

Field of narrow-row cotton at the West Side Field Station being harvested with finger stripper harvester. Lint yield from this field was over 2½ bales/acre.

The significantly higher yields by some non-Acala types when compared to SJ-1 in narrow-row plantings differ from results with conventional row spacings. In conventional spacings the yields of a non-Acala type will occasionally exceed yields of SJ-1 in individual tests, but the increases have not been significant over several tests. None of the non-Acala genotypes that exceeded SJ-1 in yield possess fiber quality equal to SJ-1, and some are very susceptible to Verticillium wilt.

To obtain information on growth characteristics, the dry weight of the aboveground portion of the crop was determined at harvest in certain experiments. These resulting data illustrate yield potentials under conditions favorable for growth, including absence of Verticillium wilt.

Yield

Coker 310 and DSR 6-19, in narrow rows, each yielded 200 lbs lint per acre more than SJ-1 in narrow rows, and 300 lbs more than SJ-1 in conventional 40″ rows. Total dry weight was the same for SJ-1 and Coker 310 in narrow rows but Coker 310 partitioned more dry matter into fruit and less into stems. DSR 6-19 produced as much seedcotton as Coker 310 but less stem material. Also contributing to the higher lint yield of Coker 310 and DSR 6-19 was the higher lint percent (lint fraction of seedcotton).

Allocation of a higher percentage of dry matter to fruit, and less to stems, represents greater plant efficiency. Planting cotton in narrow rows eliminates the primary need for long lateral branches—that is, the positioning of leaves out in the row middles to intercept light. Stated another way, planting cotton in narrow rows permits the use of more efficient plant types. Semidwarf, short-fruiting-branch types use less photosynthate in the development of the plant framework. Photosynthate not used in producing stem material becomes available for producing additional fruit.

Short season

The conventional system with twice-over harvest takes seven to nine months from planting to harvest. Thirty to ninety days of this time are required to mature bolls that set late in the season (the crop picked in the second harvest). This portion, constituting 5–20% of the crop, has the highest production costs per pound of lint produced (irrigation, insecticides, harvesting, and time).

With certain plant types at higher plant populations in narrow rows, the total fruiting period can be shortened two to three weeks. Increased plant population (50,000 to 100,000 plants per acre) results in more squares and flowers during the early part of the fruiting period, and more of the crop set during this time. The graph shows the pattern of lint accumulation, with maturation curves reflecting the pattern of fruit retention during the fruiting period. Paymaster Dwarf started flowering earlier and had accumulated most of its yield by the fifth week. Coker 310 was similar to SJ-1 in pattern except that it set more fruit during the fifth and sixth weeks.

The effect of narrow rows on the pattern of fruit retention can be seen by comparing the two curves for SJ-1 grown in narrow and wide rows. Slightly more lint was accumulated in the first two weeks by the wide rows, but the narrow-row planting accumulated lint faster between the second and sixth weeks. The fruiting pattern of DSR 6-19, intermediate between that of Paymaster Dwarf (early) and SJ-1, appears to be the most desirable as both earliness and high production are attained.

A variety for the short-season system should have fiber quality equal to the presently grown varieties, fruit rapidly, have Verticillium wilt tolerance, have the growth potential equal to Acala varieties, and partition more of its growth into fruit (higher efficiency).

The short-season production system is defined as the combination of plant type and cultural practices that results in early maturity and permits a once-over harvest.

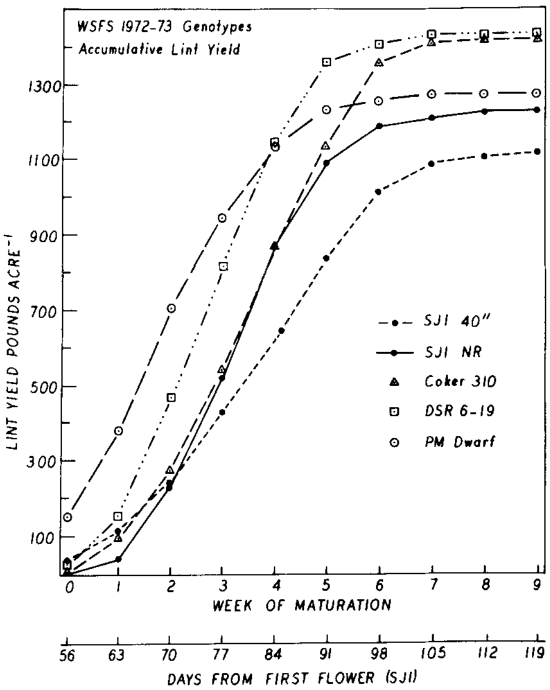
From a cultural standpoint, a system with row spacing averaging 20 inches (flat-planted or two rows on a bed) and a plant population in the range of 50,000 to 100,000 plants per acre has been the easiest to manage and the most consistent in performance. Total nutrient and water needs appear to be the same as with conventional row-spacings, though there are indications that plant types better adapted to the system show a reduction in nutrient and water requirements.

This research has demonstrated the potential of obtaining equal or higher yields than those obtained with the conventional wide-row system, with less time required to produce the crop. A plant type combining the proper growth and fruiting characteristics, fiber qualities, and disease resistance does not now exist. Also, the system of harvest (stripping) has many limitations. Adoption of this system on a wide scale will thus have to await the development of improved varieties and harvest equipment.

R. E. Johnson is Assistant Specialist, Department of Agronomy and Range Science, U.C., Davis; R. G. Curley is Engineer, U.C. Cooperative Extension, Davis; Alan George is Farm Advisor (Tulare County); O. D. McCutcheon is Farm Advisor (Kings County); V. T. Walhood is Research Plant Physiologist, ARS-USDA, Cotton Research Station, Shafter; C. R. Brooks is Assistant Development Engineer, U.C. Cooperative Extension, Davis; and Paul Young was Research Associate, U. S. Cotton Research Station, Shafter. *This research was supported by (1) California Planting Cotton Seed Distributors and (2) U. S. Department of Agriculture, with funds made available through Cotton Incorporated.*

LINT YIELD ACCUMULATION OF FOUR GENOTYPES IN NARROW ROWS AND ONE GENOTYPE IN WIDE ROWS.

Average of two experiments grown at the West Side Field Station in 1972 and 1973.



POLLEN

in

J. C. CRANE · H. I. FORI

THE COMMERCIAL PISTACHIO nut tree (*Pistacia vera* L.), like all species of *Pistacia*, produces male and female flowers on separate trees. Male trees are strategically located among females in the orchard to provide pollen at the time the female flowers are receptive. Although the bloom period of the 'Peters' cultivar (male) generally overlaps that of 'Kerman' (currently the only female cultivar being planted commercially), in some years all the pollen is shed before the last of the 'Kerman' flowers is pollinated.

It has been suggested that some of the pollen produced earlier by 'Peters' or other male trees (i.e., *P. atlantica*) be collected and stored for use later in supplementing natural pollination. It has also been suggested that effort be directed toward developing a completely controlled artificial pollination procedure, in which pollen would be collected from male trees (not necessarily only those growing within the orchard), stored, and applied mechanically with dusting or spraying equipment. Such a procedure could eliminate use of valuable orchard space by male trees that serve only as sources of pollen.

As part of a general research program on the pistachio, various aspects of pollination have been studied. One of the most important of these is pollen longevity as affected by storage conditions.

The first step in a study of pollen viability is to determine the optimum sucrose concentration to use in the sugar-agar medium on which the pollen is to be germinated. Various concentrations were tested during each of three years, using pollen from several *Pistacia* species, with the data (see graph) indicating that a medium containing 10% cane sucrose and 1% agar promoted maximum germination. That sucrose concentration, therefore, was adopted as a standard in subsequent tests. Pollen was generally obtained by picking inflorescences just prior to anthesis, spreading them on paper in the laboratory at room temperature to dehisce, screening the pollen free of foreign material the next day, and pouring it into vials which were then stoppered with cotton plugs. Germination counts were made 24 hours after the pollen was dusted on the medium.

Viability of pollen shed from inflorescences in the orchard was compared with that of pollen shed from inflorescences picked and brought to the laboratory. In the former case, pollen was dusted on agar plates in the orchard, and percent germination was determined in the laboratory 24 hours later. In the latter instance, the pollen was not available until 24 hours after the inflorescences were picked, at which time it was dusted on the sugar-agar medium for germination. It was found that viability of pollen obtained from inflorescences in the laboratory was not greatly different from that obtained directly in the orchard. The average percent germination for six different tests during the bloom period was 52% for orchard pollen and 55% for laboratory pollen. The data also indicated that pollen viability tends to decrease as the period of bloom progresses. For example, pollen germination declined from 92% early in the bloom period to 51% ten days later.

In tests with several species and cultivars of *Pistacia*, the viability of freshly dehisced pollen held at room temperature rapidly deteriorated in three to four days to zero. Since storage studies with pollen from other plant species had indicated the value of low temperatures for preserving pollen viability, samples of pollen were stored in a refrigerator and a freezer. Refrigeration prolonged pollen viability by a few days, whereas freezing prolonged it as much as several months. However, depending upon the source of pollen and