wth and Yield of Cotton

fruiting, defoliation, lodging, boll opening related to available moisture

only one year's study of one soil type and nds in research development toward im- tion to yield and quality of cotton.

V. T. Walhood and B. Counts

t irrigation treatments in studies on nd yield.

TREATMENTS

treatments used in termine the effects gation and varying ture on plant re- uality of the cotton

A—the driest treat- was irrigated ap- eeks after the first s which resulted in to each irrigation.

high soil moisture, ily as once a week s, which is consid- e by some growers nfested with nema-

first sign of stress indicated by a dis- and sometimes by the late afternoon.

any color change, ge in frequency of reatments B and C.

treatment to main- el of soil moisture ll times. This treat- ed approximately ring July and Au-

B irrigated once a and to August 10, irrigation for the

treatment with the the season on Au-

irrigated once a st, and September, tion for the season

Detailed growth measurements of cotton—under the various irrigation treatments in the experiments—indicate the extent to which the plant can be manipulated by varying the time and amount of water available.

Plant height measurements were made weekly during the season, and flowering and fruiting measurements were made daily, as shown in the graph on page 8. Flowers were tagged beginning with the first on June 21 and continuing to August 19. Flowers in this period accounted for 99% of the total yield and gave precise information as to occurrence of flowering and fruiting.

Vegetative growth is a factor in limiting the fruiting of most plants; however, excess foliage—plant height—to the amounts of fruit is usual for cotton. In Treatment *A* where moisture was a limiting factor in growth, the plants were 28.7" tall and produced 573 bolls on 40 row feet. The different levels of growth are shown in the two-column table on page 11. Increasing the soil moisture—Treatment *C*—increased the plant height 23% and yield 18% over *A*. High moisture levels by frequent irrigations — Treatments *B* and *C*—gave increases in plant height up to 41% greater than Treatment *A*, while yields were not increased above those obtained in Treatment *C*, as shown in the table in column 1, page 10.

Flowering was correlated with the number of irrigations up to 12; further irrigations did not increase the number of flowers produced during the season. This correlation is plotted in the graph at the lower right of this page. While the plots receiving less frequent irrigations produced a smaller number of total flowers, the tendency was toward earlier blooms. The flowering rate in Treatment *A* was limited by plant size. Treatment *C* produced more flowers the first 30 days than *B*, and more than *E* for 35 days.

There was no difference in number of bolls set in Treatments *B*, *C*, and *E*, which outyielded *A*, as illustrated in the graph in column 2 on this page. Above seven irrigations boll set was not increased in number. Boll in Treatment *A* was limited by low flower production and plant growth. Although boll production was equal in *B*, *C*, and *E*, Treatment *C* produced 80% of the boll crop approximately six days ahead of Treatments *B* and *E*. This may be a reflection of its earlier flower production.

Within an environment extending over the summer season, cotton plants have been found to be very uniform in flower retention percentages. Only by extremes in cultural practices do percentages vary over 10%. Luxurious amounts of nutrients and water tend to reduce, and water stresses tend to increase, retention percentages. In this study less frequent irrigations resulted in more efficient flower retention; the moisture stress in Treatment *A* resulted in 42% flower retention, and Treatment *C* retained 34%, *B* 29%, and *E* 31%. The increased retention of flowers in *A* was not sufficient to make up for the low number of blooms in that treatment; in *C*, however, the increase in retention was sufficient to maintain maximum boll set even though it had 11–15% fewer flowers than Treatments *B* and *E*.

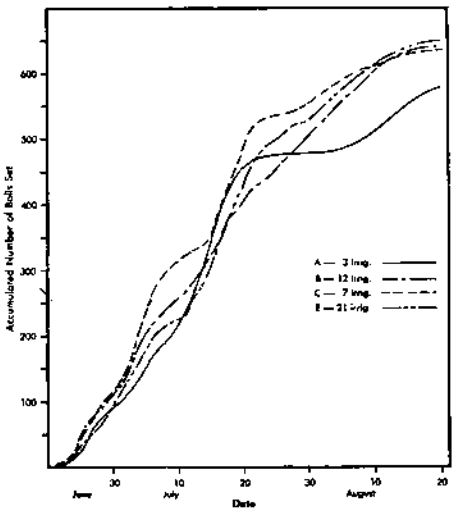
The largest bolls were produced by Treatment *B*, followed closely by *C* and *E*, while bolls from Treatment *A* were six to 11% smaller than other treatments.

The cotton plant grown under the prevailing cultural practices in the San Joaquin Valley of California is high yielding and luxuriant in growth. It has a tendency toward prolonged foliage retention, and lodging occurs. Chemical defoliation, hand and mechanical harvesting are difficult under such conditions.

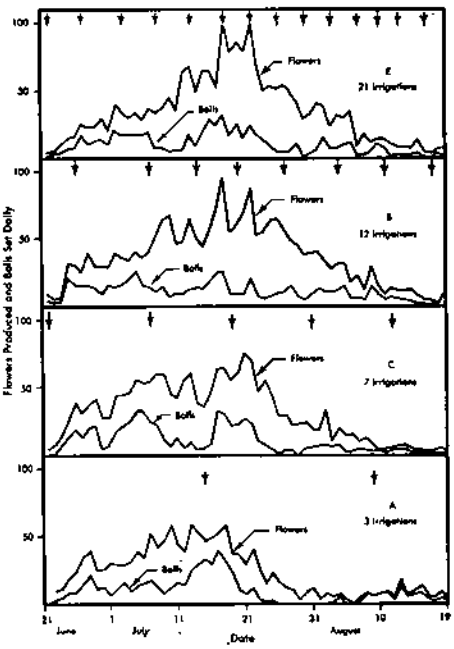
Characteristic fruiting phenomena for

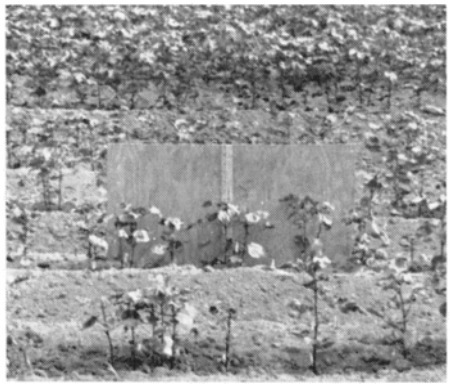
Concluded on page 11

Accumulated number of bolls set on 40 row feet of cotton from different irrigation treatments at Shafter, 1954.



Number of flowers opening daily and number of flowers retained to become bolls on 40 row feet of cotton from different irrigation treatments at Shafter, 1954. Irrigation dates indicated by arrows.





Cotton plants five weeks after emergence, without irrigation, dry plot Treatment A. Background wet Treatment B.

is also dependent upon certain other fiber characteristics that enable the closely twisted fibers to resist slippage.

Nep counts are based on the number per 100 square inches of card web. These are small tangled knots of fibers that show up as specks in cotton yarn and cloth. The chief cause of neps is considered to be a high proportion of thin wall fibers. Relative freedom from this condition is highly desirable since neppy yarns absorb dyes unevenly and detract from yarn appearance.

The yarn appearance index is based on the relative smoothness of the yarn

Effect of the Timing of the Last Irrigation on Fiber and Yarn Properties

Date last irrigation	8/10	8/31	9/27
Fiber grade	M*	M*	M*
Staple length, inches	1⅛	1⅛	1⅛
Yarn strength, lbs.	122	124	125
Nep count	23	24	20
Yarn appearance index	95	95	95

* Middling

and freedom from neps and other foreign materials.

The effect of various irrigation frequencies on these fiber and yarn properties is presented in the two-column table on page 10. Not until the extremes in irrigation frequency are considered does any appreciable effect on these properties become noticeable. Treatment *E*, the most frequently irrigated treatment, had the longest fiber and the weakest yarn. Treatment *A*, the least frequently irrigated treatment, had the shortest fiber, the highest grade, lowest nep count, and the best-appearance index. The short fiber and low nep count are due to severe stress for water, but the increase in grade and appearance index is probably due to the absence of very small trash particles that were not readily separated in cleaning the fiber. The low nep count for Treatment *A* probably was partly responsible for the increased yarn appearance index.

The effect of the intermediate irrigation frequencies on these yarn and fiber properties is insignificant, and it would appear that if extremes in the frequency of irrigation are avoided, the grower will not materially affect fiber quality.

The timing of the last irrigation as affecting fiber and yarn properties is apparently insignificant when the crop as a whole is considered. Lint samples for these tests were taken from machine-picked cotton. However, damage to many late bolls was quite evident where the water was cut off on the earliest date, and the results of fiber tests made on lint from these late bolls did show some reduction in fiber length. These pinched bolls constituted such a small fraction of the total crop that they did not measurably affect these fiber and yarn properties.

J. R. Stockton is Assistant Specialist in Irrigation, University of California, Davis.

L. D. Doneen is Professor of Irrigation, University of California, Davis.

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COTTON

Continued from page 9

the Shafter region are: *1.* Flowering beginning in late June and reaching a high rate, with usually 90% of the total flowers produced by early August in approximately 50 days. After that time, flowering is reduced to a slow rate or ceases altogether by early September. *2.* Boll setting proceeds rapidly early in the season but is reduced to a slow rate after 45 days. The rapid decrease in boll set is called the cutout, and when it occurs, the vegetative and fruiting buds do not develop. However, the large number of bolls retained preceding the cutout continue to grow. Basic causes of cutout and the physiological shedding throughout the season are not fully understood, except that they are related to the fruiting-vegetative status of the plant. Growth resumes when the bolls mature.

This study was made on the three treatments *G*, *B2*, and *I*. A number of measurements were made on the cotton plant to evaluate the timing of the last irrigation. The treatments were timed to correspond to varying degrees of cutout. Treatment *G*—last irrigation August 10—was timed for the early part of the cutout, with the last irrigation August 31; and Treatment *I*—last irrigation September 27—when complete cutout occurred.

The last irrigation at beginning of cutout, Treatment *G*—August 10—reduced yields 15% below Treatments *B2* and *I*, and the continuation of irrigation to September 27 did not increase yield. As far as fruit production is concerned, cutout occurred toward the end of August.

Effect of Time of Last Irrigation on Natural Defoliation, Boll Opening, and Lodging at Shafter, 1955.

Final irrigation treatment	Aug. 10	Sept. 10	Sept. 20	Sept. 30	Oct. 13
			Natural Defoliation—%		
G— Aug. 10	0	60	80	80	...
B— Aug. 31	0	0	20	20	...
I— Sept. 27	0	0	0	0	...
			Boll Opening—%		
G— Aug. 10		65	87	93	98
B— Aug. 31		60	78	83	89
I— Sept. 27		31	50	66	84
			Lodging		
G— Aug. 10	none	none	none	none	none
B— Aug. 31	none	some	some	some	some
I— Sept. 27	none	some	much	much	much

Natural defoliation of 80% had occurred by September 20 in Treatment *G*; 20% in *B2* and negligible in Treatment *I* when plants were still being irrigated on September 20. Moisture stresses occurred sooner following the last irrigation August 10 than for the other two treatments, due to higher temperatures in August than in September.

The continuation of irrigation after cutout commenced to August 31 or September 27 resulted in a range of lodging from some to much. Lodging was absent in Treatment *G*, with the last irrigation on August 10. Plant heights were nearly the same for all treatments at harvest.

Boll opening was hastened in proportion to the timing of the last irrigation. Treatment *G* showed 87% of the bolls opened—2.31 bales—while Treatment *B2* had 78%—2.31 bales—and Treatment *I* had 50%—1.51 bales—opened.

Ample soil moisture and lack of sunlight were probably responsible for the slow opening of the mature bolls in the late irrigated plots with dense foliage and where extensive lodging occurred by September 20.

V. T. Walhood is Agronomist, A.R.S., U.S.D.A., University of California, Los Angeles.

B. Counts is Agronomist, U.S.D.A., U. S. Cotton Field Station, Shafter.

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The Effect of Different Levels of Growth, Flower Production, Boll Retention, and Boll-Leaf Ratios in Cotton at Shafter, 1955.

Treatment	Plant height, inches	Number of flowers	Number of bolls	Per cent retention	Number leaves per boll	Bolls per lb.
A—3 irrig	28.7	1364	573	42.0	4.9	68
C—7 irrig	35.0	1876	639	34.1	4.8	63
B—12 irrig	37.4	2211	639	28.9	5.1	61
E—21 irrig	40.6	2124	651	30.6	...	64