Short Season Cotton Production as a Means of Managing Energy Inputs and Maximizing Returns

M.D. Cannon, W.D. Fisher, E.J. Pegelow, L.L. Patterson and W.S. Goldthwaite

This project was initiated in 1980 under the auspices of the Short Season Cotton Committee, chaired by Dr. R.P. Upchurch. Other committee memebers were: M.D. Cannon, D.D. Fangmeier, Carl Feaster, W.D. Fisher, Dale Fullerton, R.B. Hine, T.E. Russell, R.A. Selley, B.B. Taylor and T.C. Tucker. Ex-officio members were Robert Fowler and Scott Hathorn. This is obviously a task force approach, since every discipline that relates to cotton is represented.

The justification and objectives of this project are spelled out in last year's report, so they will be only briefly outlined here.

Increasing costs for all inputs, energy, credit, fertilizer, machinery, etc. makes it imperative that producers look for every means available to reduce input costs. While this has always been true, spiraling inflation and energy costs make it even more important.

Present long-season management practices afford maximum yields, but at times each additional increment of yield may cost more than it returns. The objective of this project is to determine if there is an optimum termination point for the crop that will make all inputs more cost effective.

General Procedure

Three growers cooperated in the tests during 1981; Mr. Paul Prechel of Coolidge, Mr. Bob Layton of Gilbert and Mr. William Wade of Goodyear. Plantings were also made in small plots on the Cotton Research Center.

Two irrigation cutoff dates were used on the farms of the cooperating growers, while three were used on the Cotton Research Center. The same five varieties were used at the three off-station locations. Four of the same varieties were used on the Center, with one substitution. At the Cotton Research Center half of the plots were harvested with a stripper harvester equipped with a cleaner, while the rest were spindle picked.

Twelve five-foot access tubes were installed at each of the four locations for the use of a neutron probe to monitor soil moisture throughout the season. The probe was used, when possible, immediately before and after each irrigation to establish consumptive use curves. Petiole sampling was employed to monitor nitrate levels at all locations. Leaf water potential was measured at the Cotton Research Center near the end of the season. In addition, biomass data were collected at all off station locations to determine the relationship between seed cotton production and total biomass developed for each variety.

Portable platform scales were used to measure large-plot yields at the three off-station locations. On-station short plot yields were bagged and weighed. Seed cotton samples were taken to determine lint percentages by location, variety and irrigation termination.

Following is a summary of production practices, yields and other pertinent information from each experiment.

COTTON RESEARCH CENTER - 1981
Planted: April 1 on 40-inch beds

Irrigation	Insect Control	
15 March - Preplant	29 May - Temik	25 August - Pydrin
20 May	7 July - Sevin	31 August - Pydrin
13 June	13 July - Sevin	7 September - Sevin
26 June	20 July - Sevin	14 September - Sevin
9 July	25 July - Sevin	21 September - Sevin
23 July	1 August - Sevin	28 September - Sevin
8 August (Final for Cutoff I)	7 August - Pydrin	
23 August (Final for Cutoff II)	12 August - Pydrin	
9 September	18 August - Pydrin	

Previous Crop - Alfalfa
Plant Population - 25,000-20,000 plants/acre
Fertilizer - 150# urea plowed down 9/24/80; 160# urea 6/1/81

HARVEST SCHEDULE

Cutoff I
Defoliate 10 September w/Bollseye applied with ground rig.
Stripper harvest half of plots on 6 October.
Spindle pick on 8 October and 11 December.

Cutoff II
Defoliate 21 September, Bollseye applied with ground rig.
Strip half of plots 13 October.
Spindle pick 13 October, 11 December.

Cutoff III
Defoliate 19 October, Drop by air.
Strip half of plots on 10 November.
Spindle pick 28 October and 11 December.

TABLE 1A. SHORT SEASON COTTON YIELDS, POUNDS LINT PER ACRE, COTTON RESEARCH CENTER, FIELD E-4, 1981

Irrigation Variety	Cutoff I Pick	I Strip	I Average	Cutoff II Pick	II Strip	II Average	Cutoff III Pick	III Strip	III Average	Variety
7209	1328	1446	1387	1433	1617	1525	1768	1812	1790	1567
DP 62	1510	1530	1520	1670	1638	1654	1976	1960	1968	1714
DP 70	1472	1584	1528	1649	1642	1646	1930	1872	1901	1692
DP 712	1508	1366	1437	1519	1523	1521	1662	1691	1676	1545
Stvl 825	1550	1599	1574	1689	1700	1694	1892	1891	1892	1720
Average	1474	1505		1592	1624		1846	1845		
	1489			1608			1845			
Differences			+119			+237				

TABLE 1B. VARIETY BY HARVEST METHOD INTERACTION

Variety	Harvest Method Pick	Harvest Method Strip	Differences
7209	1510	1625	+115
DP 62	1719	1709	- 10
DP 70	1684	1699	+ 15
DP 712	1563	1526	- 37
Stvl 825	1710	1730	+ 20
Average	1637	1658	≠ 21

The foregoing Tables 1a and 1b summarize the yield data by variety, irrigation cutoff and harvest pethod. The overall yield increase from additional irrigations was 119, 237 and 356 pounds between Cutoffs I and II, II and III, and I and III, respectively.

PRECHEL FARM - COOLIDGE, 1981
Planted: 25 March on 38-inch beds

Irrigation	Insect Control
25 March - watered up	11 July - Parathion
14 May	24 July - Parathion
10 June	30 July - Azodrin
23 June	8 August - Ambush and Galecron
6 July	14 August - Parathion
15 July	20 August - Azodrin
27 July	23 August - Parathion
10 August	29 August - Pydrin
21 August (Final for Cutoff I)	12 September - Pydrin
3 September	

Previous Crop: Grain sorghum
Fertilizer: 1 June, 200# 18-46-0; 22 June and 26 July, 50# N sidressed anhydrous.
Herbicides: 1.5 pints Prowl prelist.

HARVEST SCHEDULE

Cutoff I
Defoliate 19 September, DEF w/ground rig
Pick 9 October and 15 December

Cutoff II
Defoliate 20 October, sodium chlorate w/ground rig
Pick 12 November and 15 December

TABLE 2. SHORT SEASON COTTON YIELDS, POUNDS LINT/ACRE, PRECHEL FARM, COOLIDGE, AZ - 1981

VARIETY	CUTOFF I	CUTOFF II	AVERAGE	YIELD INCREASE POUNDS	YIELD INCREASE PERCENT
7209	1089 f	1732 m	1410 b	+ 643	59
Stnvl 825	1394 e	1760 m	1577 a	+ 366	26
DP 70	1375 e	1708 m	1542 a	+ 333	24
DP 41	1392 e	1824 m	1608 s	+ 432	31
DP 62	1215 e	1796 m	1505 a	+ 581	48
Averages	1293 y	1764 x		+ 471	36

The average yield for Cutoff II was significantly higher than for Cutoff I. The total growing time, from watering to defoliation, was 177 days for the early cutoff and 208 days for the later one. Average yields for the 5 varieties (averaged across cutoffs) are shown in Table 2. Yields followed by the same letter are not significantly different at the 5% level.

Deltapine 41 tended to be the strongest performer at this location, with the experimental line, 7209, consistently lower than commercial varieties. These results were in good agreement with last year's test on the same farm. The most pronounced gain, however, during the 31-day period between cutoffs in this year's study, was shown by 7209. When the 1981 yield data within the second cutoff was analyzed separately there was no significant difference between varieties, indicating that variety 7209 had essentially "caught up".

LAYTON FARMS, FIELD G-19, GILBERT, ARIZONA - 1981
Planted: 17 April on 38-inch beds

Irrigation	Insect Control
17 March, preplant irrigation 17 May 22 June 10 July 29 July 19 August (Final for Cutoff I) 9 September	1 June - Temik, 10#/A 16 July - Ambush + Fundal 6 August - Ambush + Fundal 2 September - Ambush + Fundal 12 September - Ambush + Fundal

Previous Crop: Sugar beets
Fertilizer : 10 T of manure preplant; 150# urea (69# N) 10 March
Herbicides : 1.5 pt. Treflan preplant

HARVEST SCHEDULE

Cutoff I
Defoliate 16 September DEF by air.
Pick 20 October and 18 December

Cutoff II
Defoliate 21 October DEF by air
Pick 23 November and 18 December

TABLE 3. SHORT SEASON COTTON LINT YIELDS PER ACRE, LAYTON FARMS, FIELD G-19, GILBERT, AZ 1981

VARIETY	CUTOFF I	CUTOFF II	AVERAGE	YIELD INCREASE POUNDS	YIELD INCREASE PERCENT
7209	1481 fg	1509 m	1495 bc	+ 28	1.9
Stvl 825	1634 e	1664 m	1649 a	+ 30	1.8
DP 70	1531 efg	1602 m	1567 ab	+ 71	4.6
DP 41	1438 g	1462 m	1450 c	+ 24	1.7
DP 62	1568 ef	1611 m	1589 a	+ 43	2.7
Average	1530	1570		+ 40	2.6

Letters following yield figures indicate significance at 5% level; yield values followed by the same letter are not significantly different.

The total growing time, watering up to defoliation, was 152 days for the first cutoff and 187 days for the second cutoff. Additional yield from one more irrigation and 35 additional days of growth would be more than offset by cost of water alone. The results are strikingly different from those at the other three locations, where full-season treatment resulted in substantially higher yields. Varietal differences were not exceptional and were erased, except for Deltaspine 41 in the second cutoff.

WADE FARM - GOODYEAR ARIZONA - 1981
Planted: 2 April on 38-inch beds, 17-19# seed/acre, depending on variety.

Irrigation	Insecticides
11 April - watered up	4 August - Pounce + Fundal
20 May	15 August - Pounce + Fundal
9 June	24 August - Pounce + Fundal
23 June	1 September - Ambush
3 July	12 September - Ambush + Azodrin
23 July	
3 August	
29 August (Final for Cutoff I)	
10 September	

Previous Crop: Barley - Harvested in spring of previous year.
Fertilizer : 15 T manure preplant; 20 gal. Trian 32 (77#N) on 9 June; 12 gal. Trian 32 (46# N) on 23 July.
Herbicides : Prowl, 1.2 pints/a preplant.

HARVEST SCHEDULE

Cutoff I
Defoliate 21 September, DEF by air
Pick 12 October and 3 December

Cutoff II
Defoliate 10 October, DEF by air
Pick 22 October and 3 December

TABLE 4. SHORT SEASON COTTON YIELDS, POUNDS LINT/ACRE, WILLIAM WADE FARM, GOODYEAR, AZ - 1981

VARIETY	CUTOFF I	CUTOFF II	AVERAGE	YIELD INCREASE POUNDS	YIELD INCREASE PERCENT
7209	1097 f	1212 o	1154 d	+ 115	10
Stvl 825	1360 e	1599 m	1479 a	+ 239	18
D&PL 70	1178 f	1436 n	1307 bc	+ 258	22
D&PL 41	1201 f	1504 mn	1352 b	+ 303	25
D&PL 62	1104 f	1370 n	1237 cd	+ 266	24
Averages	1188	1424		+ 236	20

The Goodyear location is characterized by light soil and saline well water (approximately 5500 ppm total salts) which was used for some of the late season irrigations. Most of the irrigation water, however, was ditch water with a salt content of about 1,500 ppm.

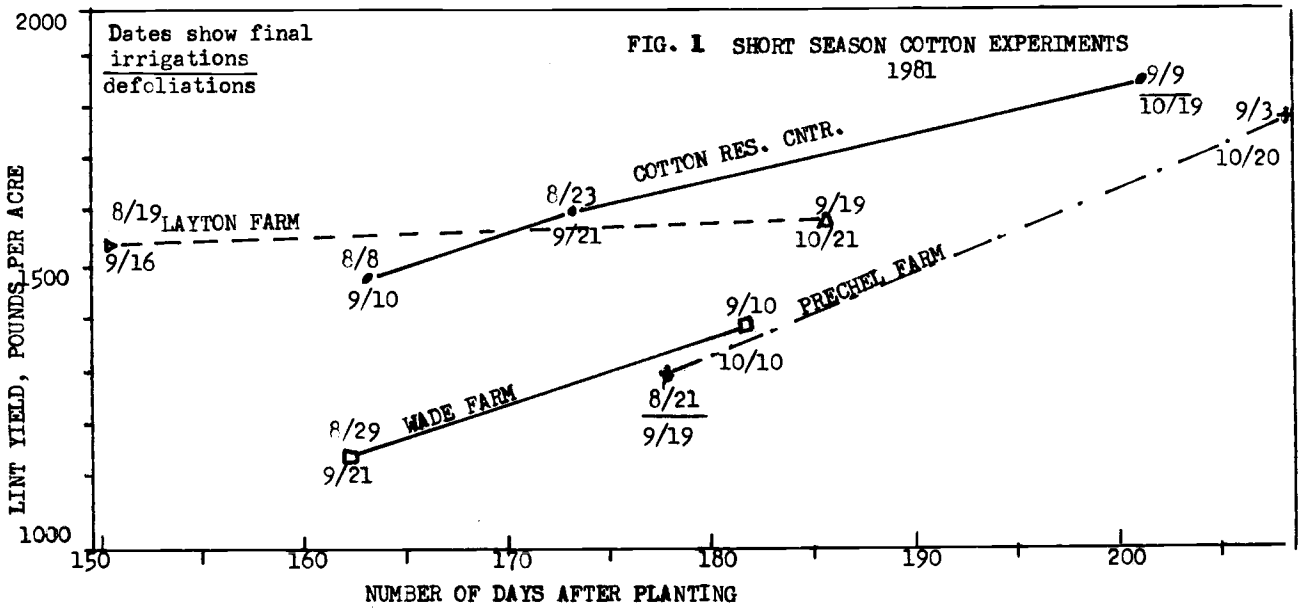

Figure 1. is a graphic display of the response of five varieties to early termination of irrigation. Four of the varieties were common to all locations, five were common to the three off-station tests. The horizontal axis shows number of days between planting and the application of defoliant, dates shown at each dasta point represent final irrigation (upper) and defoliation date (lower). It is obvious that, at all locations except the Layton farm, additional irrigations resulted in steep increases in yield. The layton yields increased very little, possibly due to the mid-April planting date; two more weeks of growing time might have made the "top crop", especially with the long growing season of 1981.

CONSUMPTIVE WATER USE, SHORT SEASON COTTON EXPERIMENT, FOR FIVE LOCATIONS DURING 1981
(All values in inches of water)

Table 5a. Cotton Research Center, Field E-4

Time Periods	Cutoff I Consumptive Use For Period	Cutoff I Daily	Cutoff II Consumptive Use For Period	Cutoff II Daily	Cutoff III Consumptive Use For Period	Cutoff III Daily
4/1 - 5/20	*3.5	0.07	*3.2	0.06	*3.6	0.07
5/21 - 6/12	4.2	0.18	4.4	0.19	4.3	0.19
6/13 - 6/26	5.0	0.36	5.0	0.36	5.0	0.36
6/27 - 7/9	4.6	0.35	4.6	0.35	4.7	0.36
7/10 - 7/23	4.7	0.34	4.8	0.34	4.4	0.31
7/24 - 8/7	4.0	0.27	*3.9	0.26	*3.9	0.26
8/8 - 9/10	6.5	0.19				
8/8 - 8/22	----	----	4.0	0.27	4.3	0.31
8/23 - 9/21	----	----	6.0	0.2	5.5	0.31
9/10 - 10/20	----	----		4.0	0.10	
Season Total	32.5		35.9		39.7	

*Extrapolated data.

Table 5b. Prechel Farm, Coolidge

Time Periods	Cutoff I Consumptive Use For Period	Cutoff I Daily Average	Cutoff II Consumptive Use For Period	Cutoff II Daily Average
3/26 - 5/14	*2.0	*0.04	*3.0	*0.06
5/15 - 6/10	2.5	0.09	2.8	0.10
6/11 - 6/23	3.6	0.28	3.2	0.25
6/24 - 7/6	3.5	0.27	3.5	0.27
7/7 - 7/15	2.4	0.26	2.2	0.24
7/16 - 7/27	*2.8	0.23	*2.7	0.22
7/28 - 8/10	2.7	0.20	2.8	0.20
8/11 - 8/21	3.0	0.27	2.8	0.25
8/22 - 9/19	5.3	0.18		
8/22 - 9/3	----	----	2.8	0.22
9/4 - 10/20	----	----	2.8	0.06
Season Totals	27.8		28.6	

Table 5c. Layton Farm, Gilbert

Time Periods	Cutoff I Consumptive Use For Period	Cutoff I Daily Average	Cutoff II Consumptive Use For Period	Cutoff II Daily Average
4/17 - 5/20	*3.3	0.10	*3.3	0.10
5/21 - 6/22	4.6	0.14	4.4	0.13
6/23 - 7/12	6.2	0.31	6.2	0.31
7/13 - 7/30	5.8	0.30	5.5	0.31
7/31 - 8/18	5.3	0.28	5.2	0.27
8/19 - 9/16	6.9	0.24	---	----
8/19 - 9/11	----	----	6.0	0.25
9/12 - 10/21	----	----	5.6	0.14
Season Totals	31.7		36.2	

*Extrapolated data.

Table 5d. Wade Farm, Goodyear

Time Periods	Cutoff I Consumptive Use For Period	Cutoff I Consumptive Use For Daily Average	Cutoff II Consumptive Use For Period	Cutoff II Consumptive Use For Daily Average
4/13 - 6/23	Insufficient Data			
6/24 - 7/4	3.5	0.32	4.0	0.36
7/5 - 7/23	6.4	0.34	5.9	0.31
7/24 - 8/3	4.1	0.37	3.3	0.30
8/4 - 8/14	*4.1	0.37	*3.5	0.32
8/15 - 8/29	5.7	0.38	5.1	0.34
8/30 - 9/21	5.0	0.22	----	----
8/30 - 9/10	----	----	2.9	0.24
9/11 - 10/10	----	----	3.1	0.10
Season Total	28.8		27.8	

*Extrapolated data

Double Cropping in Graham County

B. B. Taylor, R. E. Cluff, D. Kittock and M. L. Thatcher

The long growing season in Arizona permits maturing a crop of cotton following small grains. This advantage plus double cropping can reduce the cost of seedbed preparation and seasonally adjust demands for water, labor, machinery, and land. It also spreads fixed costs over two crops and eases cash flow problems.

The key to successful cotton following wheat or barley lies in making best use of the available growing season. We know a June 1 planting date only allows about 125 days of good growing weather. We also know it takes about 55 days from planting to first flower and another 50 days to mature a boll. This means that double crop cotton has an approximate three-week fruiting period, so quick turnaround between crops is essential.

In Canada and the northern United States, growers swath small grains and leave them to ripen in the windrow. This practice advances the harvest and avoids losses due to inclement weather. In Arizona, research shows that wheat and barley kernels accumulate dry matter until kernel moisture content declines to 35 to 40 percent. After this point, no further dry matter accumulation occurs. Yet while standing in the field, an additional 15 to 20 days are required for the grain to dry and reach natural maturity.

However, swathing grain at 35 to 40 percent kernel moisture effectively redirects those 15 to 20 days into an extended cotton production bonus. Experience shows that it takes three or four days for a swathed windrow to dry to 12 percent moisture, a safe storage level. These extra growing days that swathing provides will net about 100 pounds extra lint per acre.

For those that wish to swath small grains, there are two precautions. Swathers with auger platforms shell grain. Therefore, a swather with a canvas platform is preferred. Also, be sure and remove the crimper.

The use of high moisture grain is a new wrinkle introduced during 1981 by several extension personnel. In following it, growers combine the grain about a week earlier than is their standard practice. That is, they harvest when kernel moisture level reaches about 20 percent, a level too high for safe storage in conventional facilities. This high moisture grain is stored in an air-tight silo for use in a livestock feeding operation.

A minimum turnaround time between crops is essential. The standard steps, in order, include shredding the stubble, two diskings, preplant herbicide application and incorporation, listing, and planting. Variations in tillage operations to include minimum tillage may reduce field operations and the time required for land preparation, thereby speeding up turnaround time.

Crop residue sometimes proves troublesome during irrigations, thus making minimum tillage less attractive.