

# High Yielding, Short Season Cotton Production in Arizona

*Scott Tollefson, Entomologist and Agronomist, Sundance Farms*

## INTRODUCTION

Growers in Arizona have historically produced the highest yields in the Cotton Belt, averaging between 2.0 - 2.5 bales per acre. The key to high production in the desert Southwest has been irrigation, coupled with an extraordinarily long growing season. To take advantage of the 3,800 heat units available for cotton production, growers have cultured cotton under a two fruit-set regime. Cotton planted in late March to early April will approach peak bloom in early July, cut out in mid-August and resume new bloom production early September. Two fruit-set cotton will typically require 240 to 270 days to mature out the top crop (Fig. 1).

Although two fruit-set cotton has enabled growers to obtain maximum yields, it has also resulted in rapid escalation of insect pest populations. Imperial Valley, California, was the first desert production area to be adversely affected by intensified insect pressure. Cotton acreage in Imperial Valley has declined from 100,000 acres in 1981 to just over 17,000 in 1986 as a result of pink bollworm and whitefly. Declining yields and spray bills in excess of \$200.00 per acre have not been uncommon in the last several seasons.

The fate of cotton production in Central Arizona's desert areas may not be far behind that of California. Pink bollworm populations have been on the increase the last several seasons with many control failures reported in 1986. Further complicating the insect problem has been the establishment of boll weevil pockets in many areas of the state.

At Sundance Farms, insecticide costs have increased steadily the past five years with a dramatic jump occurring in 1986 (Table 1). In the period of 1981 to 1986, definite shifts in insect populations have been observed.

To date, the pink bollworm has surpassed the *Heliothis* complex as the prominent pest species. Based on overwintering studies conducted on Sundance Farms this past fall, it is safe to assume that this trend will continue (Table 2). During light pink bollworm years, most fields will have pink bollworm carryover populations of approximately 1,000 to 3,000 pink boll worm larvae per acre. In 1986, infestations of 40,000 to 50,000 larvae per acre were not hard to find.

To cope with increased insect pressure and associated costs, cotton production strategies at Sundance Farms have radically changed over the past four seasons. The two fruit-set, maximum yield cotton regime has been completely abandoned in favor of the one fruit-set, optimum yield production. The key elements involved in one fruit-set cotton are (a) varietal selection, (2) delayed plantings, (3) early insect control, (4) intensive irrigation and fertilization, and (5) chemical termination.

## VARIETY SELECTION

Commercial upland cotton varieties in Arizona can be classed into two groups: Conventional delta types and semi-cluster varieties. Delta types such as DPL 41, 61, and Stoneville 825 characteristically fruit on a horizontal as well as vertical plane. These varieties tend to be determinate (i.e., cut out early) and as a result require two fruiting cycles to produce three-plus bale crops. At Sundance Farms, two bales were usually set on the first flowering cycle, and then after a three to four week cut out, a top crop developed which usually amounted to 1/2 to 3/4 of a bale, depending upon fall weather patterns.

In 1981 the farm started experimenting with the newly released semi-cluster variety, DPL 90 (Acala 90). From the onset, this type of cotton had a more vertical growth pattern and tended to be indeterminate. Due to DPL 90's ability to produce adequate stalk, it was discovered that with proper fertilizer and irrigation management, a three-plus bale yield could be produced on a single fruit set. With drip irrigation and intensive management, yields in excess of four bales could be achieved in less than 200 days.

Over the last two seasons, Sundance Farms has evaluated a new semi-cluster variety, DPL 775. This new release has tremendous yield potential with greater heat tolerance and a slightly more indeterminate nature than DPL 90. DPL 775 is ideally suited for one fruit-set production. Several hundred acres of full term (190 day) DPL 775 has produced between 3.6 and 4.0 bales per acre, and double crop (130 day) DPL 775 fields have produced in excess of 3 bales per acre.

### **DELAYED PLANTING**

To maintain vigorous seedling growth early in spring, plantings are often delayed until an accumulation of at least ten heat units per day. From past experience it has been found that it takes in the range of 100 to 110 heat units to complete germination of cotton seed using a soil temperature threshold of 60 degrees. A ten heat unit/day accumulation should assure a uniform stand of cotton within ten days of planting. Vigorous seedling growth is further enhanced through the addition of in-furrow applications of fungicide at planting.

### **EARLY INSECT CONTROL**

As a result of an intensive rotation program with wheat and barley, large influxes of thrips into the cotton has been experienced while combining grain in May and June. This period corresponds closely with early square formation in cotton. It has been discovered, through observation and extensive research, that semi-cluster varieties such as DPL 90 and DPL 775 can sustain considerable thrip damage during this early square period.

In order to avoid excessive stalk lodging and delayed crop maturation, it has been essential to protect these varieties from insects early. Initially, Temik was sidedressed at first square at the rate of seven to ten pounds per acre. In addition, directed spray techniques with organophosphates such as Orthene, Guthion, and Pencap were also tested.

In 1986, a combination of ground-applied directed sprays and soil applied systemics were used. Pencap applications were started at seven to eight true leaf on a six-day schedule four times for weevil, pink bollworm, and thrip control. The directed spray was followed with a sidedress of Temik at five pounds per acre for lygus, thrip, mite, and perforator control.

Total cost for the early season control amounted to under \$30.00 per acre, but we were able to delay the establishment of pink bollworm and increase yields by one-third of a bale (Tables 3 and 4).

### **INTENSIVE FERTILIZER MANAGEMENT**

In high yield, one fruit-set production, there is little room for compensation in the plant. Early insect control is essential in the establishment of a bottom crop. Once these bottom positions are set with small bolls, the stage is set to start manipulating the plant with fertilizers and irrigation. The goal at this point is to avoid premature cut out at all cost, but at the same time maintain heavy fruiting.

The delicate balance between vegetation and fruiting is constantly monitored visually in the fields. As a general rule of thumb, bloom formation is to be no closer than six internodes from the terminal. Weekly petiole testing and soil moisture probes are also tools used in decision making. Ideally, squaring is promoted for a 90 to 120 day period with final cut-out occurring some time in early to mid-September.

### **CHEMICAL TERMINATION**

After extracting all that is possible from the plant in the single fruit set, it is time to terminate the crop. Normally, watering is stopped two to three weeks after cut out and followed with an application of

Prep at one quart per acre when last harvestable boll is mature (seeds turning tan). The Prep application is then followed by an application with a conventional defoliation. Prep used in this way greatly increases the efficacy of the defoliation and increases boll opening.

The net result is an earlier harvest which usually starts seven to ten days earlier than with conventional defoliation. Utilizing three 4-row cotton pickers, in combination with three module makers, enables harvesting of 500 to 600 acres in this seven to ten day span.

Another major advantage to chemical termination with Prep is the removal of virtually all immature fruiting forms. For years it has been demonstrated on Sundance Farms that one fruit-set, short staple cotton in combination with chemical termination can have a devastating effect on overwintering pink bollworm populations (Table 5). In 1986, Prep was experimented with on Pima cotton and it was found that lighter rates in the range of one pint per acre was also very effective in reducing overwintering pink bollworms (Table 6).

## SUMMARY

The net result of one fruit set cotton is the elimination of 50 days from the production cycle with little or no effect on yield. At Sundance Farms it has been consistently shown that cotton yields in the range of 3.0 to 4.5 bales per acre can be produced economically in a 140 to 190 day period. In addition, a shortened season has resulted in higher picker efficiencies, reduced insect overwintering, and higher grades. Instead of initiating harvest in late October and finishing in January, harvesting is staged from early October to late November.

New technology coupled with ideal growing conditions has made cotton production profitable for Sundance in 1986. By incorporating what was learned in 1986 along with intensive management, we remain optimistic for the 1987 cropping season.

**Table 1. Summary of Aerial Applications on Sundance Farms, Coolidge, AZ**

Percentage of Total Applications Year	Average No. Applications			Cost Per Acre
	Heliiothis	Pink Bollworm	Per Acre	
1981	46	21	6.0	\$64.00
1982	51	10	5.3	\$50.00
1983	31	35	4.2	\$54.00
1984	51	48	6.8	\$55.00
1985	50	32	5.6	\$61.00
1986	17	68	6.3	\$84.00

**Table 2. Overwintering Pink Bollworm Populations for Pinal County, Arizona**

Area	Green Bolls Acre	PBW Damaged Bolls/Acre	PBW Larvae/ Acre	Aflatoxin Bolls/Acre
Coolidge	66,166	6,250	5,080	660
Casa Grande	102,300	48,300	49,000	8,660
Florence	23,000	17,000	10,000	-0-

**Table 3. Guthion and Pencap M Applications at Pin Head Square for Pink Bollworm Control on DPL 775**

Date of Treatment	Date of First Planting	Aerial Application	Aerial Application For Pink Bollworm	Total Aerial Application	Total Cost For Control
Check <sup>1</sup>	03/26 - 04/05	06/20	7.0	9.0	\$107
Directed Spray	03/27 - 04/07	07/11	4.2	5.8	\$ 882

<sup>1</sup>Pink Bollworm Sprays Initiated at Boll Infestation

<sup>2</sup>Aerial Sprays Totaled \$76.00; Four Directed Sprays Applied at First Square on a Six-Day Interval at \$3.00 Per Spray for Material and Application.

**Table 4. Effect of Early Season Control on Short Staple Yields**

Crop	Treatment	Yield Bales/Acre	Difference Bales/Acre
Double Crop Cotton	Temik at 5 lbs.-Split Treatment	3.02	
	Check Plot	2.92	.10
Full-Term Cotton 180-190 Days	Directed Spray Pencap/Guthion	3.64	
	Followed by Temik at 5 lbs. Check Plot	3.31	.33

Note: All Full-Term Cotton was Treated with 2.5 Gallons of Telone for Nematode Control

**Table 5. Effect of Early Season Control Coupled with Chemical Termination of Overwintering PBW**

Treatment on Short Staple	<sup>1</sup> Length of Season	Green Bolls/Acre	PBW Damaged Bolls/Acre	Pink Bollworm Larvae/Acre
One Fruit Set Temik 10 lbs/acre, Prep 1 qt/acre	180 Days	30,000	3,750	3,000
Conventional Two Fruit Set Chlorate	240 Days	218,000	164,750	247,000

<sup>1</sup>From Planting to Chemical Termination or Stalk Destruction, i.e., Removal of Hostable PBW Material

**Table 6. Effect of Early Season Control Coupled with Chemical Termination of Overwintering PBW**

Treatment on Pima Cotton	Length of Season	Green Bolls/Acre	PBW Damaged Bolls/Acre	Pink Bollworm Larvae/Acre
Early Termination, Pencap Directed Spray (4X), Prep 1 pt/acre	190 Days	1,400	375	250
Conventional Termination, Chlorate	240+ Days	94,500	47,000	48,400

- - - - Furrow Irrigated DPL 90  
 \_\_\_\_\_ Drip Irrigated DPL 90

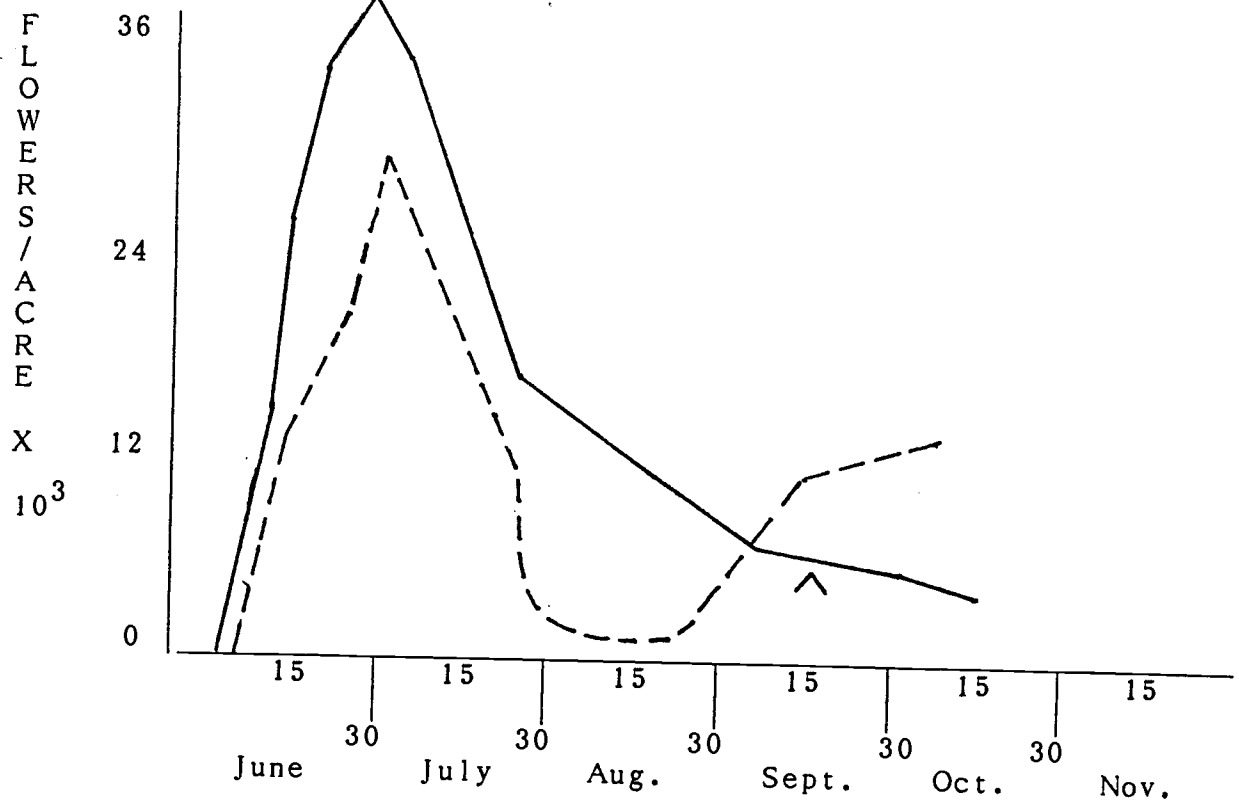


Figure 1. Flowering of Drip vs. Furrow Irrigated Cotton, 1982  
 Sundance Farms, Casa Grande, Arizona (Briggs)