PIX Multiple Application Evaluations In Arizona on Upland and Pima Cotton, 1989

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INTRODUCTION

A very delicate factor in any cotton production system is that of the vegetative/reproductive balance that is achieved through management and good environmental conditions. This is particularly pertinent to Pima cotton due to its strong vegetative tendencies. When Pima is grown in a low desert production system, vegetative tendencies can be a critical factor due to the high rates of heat unit accumulations that are common, particularly when a planting date is delayed (Silvertooth, et al, 1989). As a result, a prime goal in the management of the crop is to maintain an optimum vegetative/reproductive balance in an effort to channel as much energy as possible into boll production and yield. In this regard, it is also very important to utilize the early portions of the growing season fully to one's benefit and set as much of a boll load as possible, which in itself establishes some control over further vegetative development by creating a strong sink for carbohydrates.

PIX (mepiquat chloride) is a compound used in cotton production as an agent of plant height control. Its proposed mode of action is found as a suppressant of gibberellic acid activity, thereby reducing cell elongation. In cotton production, the use of PIX is directed toward controlling vegetative growth, particularly in situations conducive to rank or excessive vegetative growth. Strategically, PIX provides a tool by which a grower can control vegetative growth at critical stages in crop development. Theoretically, the energy (essentially the carbon) that would have been used in vegetative growth and development can be allocated to other sinks, particularly fruiting forms (squares, flowers and bolls). The intention is to encourage and preserve fruiting form development that might otherwise be lost or aborted due to limitations physiologically (Guinn, 1982).

The use of PIX has been incorporated into the general management structure of many cotton production operations. The manner in which it is used varies considerably. In the past 15 years, a large number of experiments has been conducted in a variety of situations and locations across the cotton-growing areas of Arizona. The results have been quite variable and have not indicated a direct consistency in terms of predictable crop management and recommendation guidelines.

METHODS

In 1989, four experiments were conducted in Arizona to evaluate PIX multiple application strategies with an emphasis on Pima cotton. Treatments were similar to those in 1988 (Silvertooth, et al, 1989) with basic information concerning experimental design and sampling procedures outlined in Tables 1 through 7.

RESULTS

Results from the 1989 experiments were similar to those found in 1988. The plant height measurements revealed the ability to reduce the plant heights from several of the PIX treatment regimes relative to the untreated check. However, in the case of each experiment, the plant height and related plant measurement differences (such as height:node ratios) that occurred due to PIX treatments did not last long. Within a short period of time (14 days to 30 days) such differences were undetectable among any of the PIX treatments.

The yield results from the three Pima experiments in 1989 are shown in Tables 8 through 11. In Table 8, the results from one of the Yuma Valley experiments revealed no differences among treatments and no distinct yield trends as a function of PIX treatments. In Table 9, the yield results from the other Pima experiment in the Yuma Valley did reveal some differences among some PIX treatments, with the check (treatment No. 1) being significantly lower than all other treatments. One possible explanation for the response at the Telles location may be in part related to a severe storm which occurred in the Yuma area on 27 July, 1989. The high winds and rain from this storm had a very serious detrimental effect on many fields including the Telles location. A very large percentage of the existing leaves was destroyed by this storm, virtually removing the photosynthetic capability of the plants, and as a result, terminating a further development towards significant yield contributions. Therefore, the differences in carbohydrate allocation that may have occurred under some of the PIX treatments, while plant heights were reduced and fruit set and boll development was possibly enhanced, could have provided for a corresponding yield expression under these conditions. The other Pima experiment with PIX in the Yuma Valley (Cuming location) was not damaged as severely as the Telles location, and results were not as pronounced.

One explanation that has been offered concerning the lack of response to PIX of Pima (or any full season cotton in general in Arizona) has been the ability of the plant to compensate for any fruit set differences that may occur due to PIX treatments and responses. This is related to the rather short period that the plant seemingly undergoes any response due to PIX, as evidenced the plant height measurement differences and their short duration. This, in combination with the overall length of the growing season in the desert Southwest, provides for ample time in compensation over the relatively short term effects due to PIX. Another example of this type of response pattern may be seen in the yield results from the 1989 Pima and Upland experiments near Gila Bend, Arizona, shown in Tables 10 and 11. Plant height measurements taken shortly after the various PIX treatment applications revealed differences among some treatments (PIX treated plants being shorter than those in the check treatment) for only a few weeks. This experiment was taken into a full-term management, and irrigated into late September. The results shown in Tables 10 and 11, however, do not indicate any measurable differences in harvestable lint.

For future work with PIX on Pima cotton, we can see potential merit in situations where a shorter season approach in management is used. However, this isn't often the case in Pima cotton management, particularly to the extent that was imposed by the storm on the Telles location in 1989. Also, there is possibly some merit in considering PIX treatment regimes which extend past the early bloom period in Pima or full season Upland cotton production in Arizona. There will be some consideration made in this regard for experimental design for the 1990 research program.

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REFERENCES

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Silvertooth, J. C., D. R. Howell, C. R. Farr, and J. E. Malcuit. 1989. Evaluation of PIX multiple application treatments on Upland and Pima cotton in Arizona, 1988. Cotton, A College of Agriculture Report. Univ. of Arizona, Series P-77, 104-109.

Table 1. Treatment outline used in all PIX multiple application experiments in Arizona, 1989.*

	PIX Rates		
	Application Stage		
Treatment No.	match head	early bloom	early bloom + 10 d
	pts. PIX acre^{-1}		
1	---	---	---
2	1/8	1/8	1/8
3	1/4	1/4	1/4
4	1/8	1/2	---
5	1/4	1/2	---
6	---	1/2	---
7	---	1	---

* All applications made by use of a ground rig applicator.

Table 2. Basic experimental information for PIX multiple application experiments conducted in Arizona, 1989.

-- Treatments arranged in RCBD with four replications in each case.

-- All experiments furrow irrigated, 40 inch rows.

-- Plots were six to 12 rows wide, extending the full length of the irrigation runs in each case.

-- Plots were harvested by use of mechanical pickers, from the entire center four rows of each plot (experimental unit).

Table 3. Plant parameters measured in each experiment on (approximately) 14 day intervals.

-- Flower numbers per 25 ft. of row
  -- fresh blooms only

-- Plant heights
  -- from 10 consecutive plants

-- Mainstem node numbers
  -- from first five of the 10 plants measured for height

-- Heat Units (HU) accumulated since planting
  -- HU with 86/55#F thresholds, taken from nearest AZMET station.

Table 4. Basic crop information for PIX multiple experiment, Cuming's location, Yuma Valley, AZ, 1989.

Soil Type	=	Gadsden clay
Planting Date	=	15 March
Variety	=	Pima S-6
Application Date 1	=	12 May
Application Date 2	=	5 June
Application Date 3	=	21 June
Irrigation Termination	=	28 August
Harvest	=	18 October

Table 5. Basic crop information for PIX Multiple application experiment, Telles Ranch, Yuma Valley, AZ 1989.

Soil Type	=	Holtville clay loam
Planting Date	=	15 March
Variety	=	Pima S-6
Application Date 1	=	10 May
Application Date 2	=	31 May
Application Date 3	=	21 June
Irrigation Termination	=	16 August
Harvest	=	18 October

Table 6. Basic crop information for PIX multiple application experiment, Pima cotton, John's Farm, Gila Bend, AZ, 1989.

Soil Type	=	Brios sandy loam
Planting Date	=	12 April
Variety	=	Pima S-6
Application 1	=	16 May
Application 2	=	7 June
Application 3	=	27 June
Irrigation Termination	=	20 September
Harvest	=	5 December

Table 7. Basic crop information for PIX multiple application experiment, Upland cotton, John's Farm, Gila Bend, AZ, 1989.

Soil Type	=	Brios sandy loam
Planting Date	=	20 April
Variety	=	DPL 90
Application Date 1	=	30 May
Application Date 2	=	15 June
Application Date 3	=	23 June
Irrigation Termination	=	15 September
Harvest	=	5 December

Table 8. Lint yield means from PIX multiple application experiment, Pima S-6, Cuming's location, Yuma Valley, AZ, 1989.

Treatment	Lint Yield lbs acre^{-1}
1	1318
2	1439
3	1391
4	1377
5	1243
6	1307
7	1269
$LSD_{0.05}$	NS
CV(%)	11

Table 9. Lint yield means from PIX multiple application experiment, Pima S-6, Telles Ranch, Yuma Valley, AZ, 1989.

Treatment	Lint Yield lbs acre^{-1}
1	956 c*
2	1052 ab
3	1062 ab
4	1047 b
5	1100 a
6	1022 ab
7	1022 b
$LSD_{0.05}$	52
CV(%)	4

* Means followed by the same letter are not significantly different ($P \leq 0.05$) according to pairwise comparisons using a Fisher's LSD.

Table 10. Lint yield means from PIX multiple application experiment, Pima S-6, John's Farm, Gila Bend, AZ 1989.

Treatment	Lint Yield -lbs acre^{-1}-
1	1088
2	1114
3	1091
4	1113
5	1158
6	1058
7	1074
$LSD_{0.05}$	NS
CV(%)	5

Table 11. Lint yield means from PIX multiple application experiment, DPL-90, John's Farm, Gila Bend, AZ 1989.

Treatment	Lint Yield -lbs acre^{-1}-
1	1820
2	1805
3	1812
4	1903
5	1835
6	1783
7	1841
$LSD_{0.05}$	NS
CV(%)	6