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EVALUATION OF THE USE OF NITROPHENOLS ON COTTON

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Abstract

Several products are on the commercial market listed as plant growth regulators or stimulators of plant growth. Evaluation of new products within a region is important to determine if application can enhance cotton quantity or quality. Use of a newly introduced chemical, Chaperone, in New Mexico was reviewed within the Mesilla Valley near Mesquite, New Mexico as well as across several other states in other projects to record if the product does indeed enhance boll load or fiber quality and if the product was effective under different environments. Working with limited background data on the plant growth stimulator, several farmer trials were established at two rates along with a check to determine if activity of the chemical could be seen in the semi-arid environments of New Mexico. Final evaluation of the product was determined by boll count at replicated sites within fields and by harvest yield and lint quality. Finding were that no repeatable improvement results were found when using Chaperone in 2004 and that either the specific nature of the chemical lessened the window when application should be made or that the chemical did not provide as good as results in the semi-arid conditions of New Mexico as shown in earlier run coastal studies in Texas or that the perennial nature of cotton may supersede any lasting or consecutive results from applications at the five or ten ounce rates used in comparison to a check.

Introduction

Over the years, many different growth regulators or growth regulator "like" chemicals such as growth stimulators have been used to try to enhance crop growth, development and yield or allow an earlier, bountiful harvest. A new chemical emerged within the United States in the last few years and made its appearance as a commercial product in 2004 in New Mexico. This product known as Chaperone is listed as a chemical that is used in the stimulation of plant growth (Asahi Chemical Man. Co., Ltd., 2002). The product is the water solution of 3 sodium nitrophenolates with three sodium salt formulations that include sodium para-nitrophenolate, sodium ortho-nitrophenolate and sodium 5-nitroguaiacolate. The manufacturer of the product is Asahi Chemical Manufacturing Co., Ltd out of Nara Prefecture, Japan. Handling and storage of the product is standard with only the suggestion of storing in a cool place out of sunlight in order to maintain activity and to prevent activity loss from freezing or other extreme external conditions. It is a liquid but stable and not an eye or skin irritant with low toxicity to wildlife and non-toxic to plants. It is not regulated by the Department of Transportation and is registered by the Environmental Protection Agency as a biochemical and non-hazardous.

Use of the product as explained in handouts from the dealer suggests that application will increase yields by 333 pounds more lint in cotton than foliar feed alone. Other company promotional results suggest that at only five ounces per acre, cotton yields can be increased by 75 pounds per acre on 1000 to 1200 pound per acre cotton grown in Texas. Chaperone is also advertised as producing more (four to five percent) harvestable bolls with a total yield advantage of eight to ten percent. Such claims and limited/mixed scientific data presented from universities has lead to a need to test this plant growth stimulator under field conditions and evaluate if further study is warranted.

Other plant growth regulators and stimulators have been used in crops with some success. Unfortunately, more of the growth regulators have been successful in cotton growth and harvest ability than any of the growth stimulators. Timing, amount and environmental conditions greatly affect such growth stimulators that have been documented for use in crops such as corn with Aca—a product used in the last 15 to 20 years--and other growth stimulator products, thus often year end and year out results vary greatly and must be tested to determine usefulness and economics.

Growth regulators, unlike growth stimulators, have been successfully used in cotton and include those that limit crop growth and allow better leaf drop at the end of the season. Much research has been well documented on chemicals such as mepiquat-chloride, coumarin and others (Bull et al., 1980; Gard et al., 1979; Shaver et al., 1979; Melville et al., 1977; Willard, 1978; Wiese et al., 1970; Oliveira et al., 1982; Mulder et al., 1981; Babaev et al., 1981; Schott et al., 1982; Cathey et al., 1982; Sawan et al., 1981; Nageswara Rao et al., 1981; Snow et al.,1981; Cathey et al., 1980; Heydendorff-Scheel et al., 1983; Silva et al., 1981; Varela et al., 1982; York, 1983; Kariev, 1981; Reddy et al., 1988; Cothren, 1987; Hope et al., 1987; Malm et al., 1987; Schulteis, 1985; Mulrooney et al., 1985; Reddy et al.,

1992; Faircloth, 2004; Norton et al., 2004; Coccaro et al., 2004; Coccaro et al., 2003); however, growth stimulators have not been as successfully researched and have shown mixed results in university trials while still maintaining support in industry (Townsend, 2004).

Materials and Methods

This strip plot design utilized a commercially available stacked cotton variety throughout the field area with the replicated first treatment being a check, the second treatment receiving five ounces of the Chaperone per acre at early bloom and the third, replicated treatment receiving ten ounces of the Chaperone per acre at early bloom. A John Deere field sprayer was used to apply the chemical to the treatments where it was needed between 9AM and 11AM on July 19, 2004 as required according to the chemical label. No rain occurred within a week before or after the spray application was made. The corner of the field utilized in this trial was located at 32°03.93North, 106°40.45West at an altitude of 1185 meters and the diagonal marker across the field was at 32°03.82North, 106°40.21West at 1159 meters. Several readings were taken including total boll count, boll number open and lint quantity and quality at harvest.

Results and Discussion

The trial was checked through the season after spraying and no leaf damage or differences among treatments were visually seen. Total number of bolls on three plants was taken at three locations within each treatment to determine if Chaperone had any affect on total boll number on October 29, 2004.

Table 1. Total boll count taken across three plants within each treatment and replication.

Check	Total boll number on Selected Plants			Total	Average Boll Number	Average	
rep 1	5	12	18	35	11.67	12.33	NS
rep 2	5	16	19	40	13.33		
rep 3	4	13	19	36	12.00		
5 ounce							
rep 1	6	15	18	39	13.00	11.00	NS
rep 2	6	10	16	32	10.67		
rep 3	5	10	13	28	9.33		
10 ounce							
rep 1	11	12	16	39	13.00	11.89	NS
rep 2	5	11	18	34	11.33		
rep 3	5	12	17	34	11.33		

Again on October 29, 2004, randomized, collected data among the treatments was taken on open boll count per ten plants.

Table 2. Open boll count taken across ten plants within each treatment and replication.

Check	Open boll number on Selected Plants										Total	Average Boll Number	Average	
rep 1	8	3	5	4	4	8	7	7	9	6	61	20.33	25.67	NS
rep 2	2	10	6	12	14	7	8	4	3	3	69	23.00		
rep 3	5	7	19	13	11	13	8	8	10	7	101	33.67		
5 ounce														
rep 1	6	17	8	10	12	0	8	2	5	11	79	26.33	21.22	NS
rep 2	5	5	0	4	6	5	6	6	4	5	46	15.33		
rep 3	4	5	8	10	6	11	2	12	0	8	66	22.00		

10 ounce														
rep 1	6	10	11	2	6	5	6	8	5	0	59	19.67	25.11	NS
rep 2	10	2	10	5	2	1	6	9	1	10	56	18.67		
rep 3	10	15	9	12	16	0	13	18	10	8	111	37.00		

These counts were recorded across the treatments and replicates and then harvest samples were taken. Samples were taken of 25 bolls across each treatment in three replications to determine lint quality before mechanical picking of the field.

Table 3. Sample weights taken from 25 open bolls within a 10 foot length of row.

Check	Weight (grams)	Average	
rep 1	83	78.33	NS
rep 2	76		
rep 3	76		
5 ounce			
rep 1	74	82.00	NS
rep 2	91		
rep 3	81		
10 ounce			
rep 1	84	84.00	NS
rep 2	74		
rep 3	94		

Table 4. Lint quality of lint samples taken just before harvest.

Treatment	Lint % %	Micronaire	Length Inches 50% span length	Length Inches 2.5% span length	Strength HVI	Elongation %
Trial Mean	43.24	3.84	0.71	1.46	30.32	7.56
Check	43.66	3.20	0.71	1.45	29.41	7.33
5 ounce	43.22	4.31	0.73	1.48	30.97	7.58
10 ounce	42.83	4.00	0.70	1.45	30.59	7.75

Conclusions

Variability within the open boll count across plants and across treatments as well as no significance differences among lint quality or yield lead to a conclusion that application of Chaperone at either the five or ten ounce per acre rates was not helpful for boll retention or yield in 2004 at the Mesilla Valley location near Mesquite, New Mexico. Scattered rains and early fall conditions as well as less than average growing degree days during 2004 occurring after August in the season did lead to more variability among plants. But, even with weathering affects on open cotton bolls, little was lost from the bolls with the commercial variety used and if indeed early boll retention before August conditions was affected by chemical treatment, the advantage should have been seen. However, no significant advantage was seen with use of Chaperone on Upland cotton at either the five or ten ounce rates as compared to the check.

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