Effects of Early Harvest PGR on Peanut (*Arachis hypogaea* L.) Growth, Yield, and Quality

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ABSTRACT

Field studies were conducted from 1996 to 1999 to determine peanut response to Early Harvest PGR, a commercial hormonal growth regulator consisting of 0.09% cytokinins as kinetin, 0.03% gibberellic acid, 0.045% indole butyric acid and 99.835% inert ingredients. Early Harvest was applied either as a seed treatment, an in-furrow treatment, and as a foliar spray. Regardless of application timing, Early Harvest did not improve peanut yield across any varieties and resulted in increased peanut plant height or grade in only one year of the study.

KEYWORDS: Grade, groundnut, growth, plant growth regulator.

Early Harvest PGR is a commercial hormonal plant growth regulator registered for us in peanut (*Arachis hypogaea* L.), corn (*Zea mays* L.) grain sorghum [*Sorghum bicolor* (L.) Moench], cotton (*Gossypium hirsutum* L.), and a number of other agronomic and horticultural crops (Early Harvest PGR specimen label, Griffin Corp., Valdosta, GA). Early Harvest contains 26.8 mg cytokinins, 13.4 mg indole butyric acid, and 8.9 mg gibberellic acid per fluid ounce.

Other reported research with hormonal plant growth regulators on various crops has been with PGR-IV (Micro Flo Co., Lakeland, FL), which contains 0.9 mg gibberellic acid and 0.8 mg indole butyric acid per fluid ounce. Most of the reported research has been with cotton. Effects of PGR-IV on cotton yield have been variable. Yield increases ranging from 8 to 18% have been reported in several studies. (Cothren, 1995; Oosterhuis and Zhao, 1994 a,b; Weir et al., 1995; Hickey and Landivar, 1997). Hickey and Landivar (1997) reported that 2 oz/A at pinhead square, early bloom, and early bloom plus 2 wk has shown a trend for increased cotton yields.

The cotton response has sometimes been inconsistent across locations (Weir et al., 1995). In other studies, PGR-IV did not affect yield (Locke et al., 1994; Robertson and Cothren, 1995) while yield decreases have occasionally been reported (Abaye et al., 1995; Weir et al., 1994).

Yield increases are thought to be associated with increases in early season plant growth resulting from in-furrow applications of PGR-IV and increased leaf photosynthesis, nutrient partitioning, and boll set resulting from foliar applications (Hickey 1994; Oosterhuis and Zhao, 1993). Other physiological responses attributed to PGR-IV include enhanced root growth and more efficient carbohydrate translocation (Oosterhuis and Zhao, 1994b; Cadena and Cothren, 1996).

Cotton yield increases associated with PGR-IV applications appear to happen most often when the crop experiences nutritional or environmental stresses (Cadena and Cothren, 1995; 1996; Cadena et al.,1994; Zhao and Oosterhuis, 1995). Application of PGR-IV in-

furrow increased tap root length, root dry weight, number of lateral roots, and total root length (Cadena et al., 1994; Oosterhuis and Zhao, 1994a; Zhao and Oosterhuis, 1995). This increased root growth is claimed to offer insurance against poor early season growing conditions (Oosterhuis et al., 1995).

Under either drought stress or nitrogen deficiency, PGR-IV increased leaf photosynthesis due to increased stomatal conductance (Cadena and Cothren, 1995). There was a trend for greater yield when PGR-IV was applied to drought-stressed or nitrogen-deficient cotton; however, there was no trend observed when cotton was not under drought stress or nitrogen deficient (Cadena and Cothren, 1995). In other field studies, PGR-IV increased the rate of photosynthesis and dry matter production of both flooded and drought-stressed cotton (Zhao and Oosterhuis, 1995).

In peanut, York et al. (1996) reported PGR-IV had no effect on peanut main stem or cotyledon lateral branch length, yield, maturity, percentage of fancy pods, extra large kernels, total sound mature kernels, or net returns with Virginia-type peanut. No research has been reported on the use of Early Harvest in peanut. The objective of this study was to determine if Early Harvest effects growth, yield or market quality of runner-type peanut.

MATERIALS AND METHODS

Field studies were conducted from 1996 to 1999 at the Texas Agricultural Experiment Station near Yoakum, TX. In 1996 through 1998 the soil was a Tremona loamy fine sand (clayey, mixed thermic Aquic Arenic Paleustalfs) with less than 1% organic matter and a pH of 6.8 and in 1999 soil was a Denhawken-Elmendorf complex (fine, motmorillonitic, hyperthermic Vertic Ustochrepts-Argiusfolls) with less than 1% organic matter and a pH of 8.0. Each year a small grain cover crop was shredded and the land was moldboard plowed prior to disking.

Fertilizer was applied each year to the small grain cover crop according to soil test recommendations. The runner peanut variety 'GK-7' was planted at 90 lbs/A in 1996 to 1998, while Georgia Green and Tamrun 96 were planted at 95 lbs/A in 1999. A tank mix of Prowl (pendimethalin) at 2.0 pt/A and Pursuit (imazethapyr) at 1.44 oz/A were applied and incorporated 2 in deep with a tractor-driven power tiller prior to planting. This herbicide combination provides control of annual grasses, broadleaf weeds, and yellow and purple nutsedge. Other management practices recommended by the Texas Agricultural Extension Service for peanut production were followed. Irrigation was applied as needed to supplement rainfall.

The experimental design was a randomized complete block with four replications. Plot size was 2 rows (36 in spacing) by 25 ft long. Early Harvest was sprayed at planting in a 2 in band immediately behind the seed drop-tube. Early Harvest seed treatment was mixed with commercial seed at the rate of 40 g/50 lb seed until seed was lightly coated. Foliar sprays of Early Harvest were applied when peanut were at the 3 to 4 leaf stage (approximately 20 d after planting), pegging (approximately 60 d after planting), 14 d after pegging application, and at pod fill (approximately 90 to 100 d after planting). Foliar sprays were applied with a CO backpack sprayer calibrated to deliver 20 gpa at 30 psi using Teejet 11002 flat fan nozzles (Spraying Systems Co., Wheaton, IL).

Plant height measurements were taken in 1996, 1998, and 1999 seven to eight wk after planting (WAP). Five plants per plot were measured from the ground line to tip of the growing point. Peanuts were dug when mature according to the untreated check. Peanut yields were obtained in 1996, 1997, and 1999. Although peanuts were dug in 1998, substantial rains (approximately 15 in) soon after digging prevented entry into the field in a reasonable time period to harvest pods before deterioration. Yields were obtained by digging each plot separately, air-drying in the field for 5 to 8 d, and harvesting peanut pods from each plot with a combine. Weights were recorded after soil and foreign material were removed from the plot samples. Grades were determined from a 200-g pod sample from each plot following procedures described by the Federal-State Inspection Service (USDA, 1986).

Peanut plant height, yield, and grade were subjected to ANOVA and means were compared using Fisher's protected LSD test at the 5% level of probability. Peanut height data were separated by years in 1996 and 1998 because of treatment by year interaction. Height data were separated in 1999 by variety due to varietal differences. Peanut yield data were combined over years or variety since no year or variety by treatment interactions were observed. Peanut grades were separated in 1996 and 1997 because of a treatment by year interaction while grades were separated by variety in 1999 due to a varietal response.

RESULTS AND DISCUSSION

Peanut height. In 1996, Early Harvest applied in-furrow at planting increased height by 8% over the untreated check while Early Harvest applied in sequential applications in- furrow at planting, three to four leaf stage, 14 d after peg, and pod fill resulted in a 6% decrease in height 7 weeks after planting (WAP) (Table 1). In 1998, no difference in peanut height was noted. When Georgia Green and Tamrun 96 were treated with Early Harvest in 1999, no differences in Early Harvest treatments were observed within variety (Table 2). Only varietal differences in peanut height were observed. York et al. (1996) working with Virginia market types reported that PGR-IV had no effect on peanut main stems and cotyledon lateral branch lengths.

Table 1. Response of GK-7 peanut to Early Harvest applied at various times during the growing season.

Treatment	Rate/A	Appl. timing[a/]	Height (7WAP[b/]) 1996	1998	Yield	Grade[c/] 1996	1997
			----inches----		lbs/A	-----%-----	
Check	-	-	7.1	8.7	1877	76.3	63.6
Early Harvest PGR	2.0 fl oz.	Plant	7.7	8.5	2192	76.3	64.8
Early Harvest PGR	2.0 fl oz.	Plant	6.7	8.3	1993	78.1	65.5
	3.2 fl oz	4-5 ls, peg, 14 d after peg					
	4.8 fl oz	pod fill					
Early Harvest PGR	3.2 fl oz	3-4 ls, peg, 14 d after peg	7.2	8.7	2027	77.6	66.9
	4.8 fl oz.	pod fill					
LSD (0.05)			0.3	NS	NS	1.7	NS

[a/] Plant = in-furrow with seed, ls = leaf stage
[b/] WAP = weeks after planting
[c/] Grade = sound mature kernels (SMK) + sound splits (SS)

Peanut yield. None of the Early Harvest treatments significantly affected peanut yield in any year of the study (Tables 1 and 2). Peanut yields in 1999 with Georgia Green and Tamrun 96 were much higher than GK-7; however, peanuts were free from significant environmental and pest stress development in all years. Our findings with runner market types are in agreement with York et al. (1996) who reported no difference in Virginia-type peanut yield with any PGR-IV treatments. Cotton yield increases with PGR-IV have occurred most often when cotton has experience some type of stress (Cadena and Cothren, 1995; 1996).

Peanut grade. In 1996, Early Harvest applied at plant and during the growing season increased grade over the untreated check (Table 1). In all other years no grade differences were noted. York et al. (1996) reported no grade differences with PGR-IV. They reported that their study may have been dug too soon for optimum yield. However, they concluded that the early harvest should not have affected overall conclusions because of the lack of difference in maturity among treatments.

Table 2. Response of Georgia Green and Tamrun 96 to Early Harvest applied at various times during the 1999 growing season.

Treatment	Rate/A	Appl. timing[a/]	Height (8WAP[b/]) GA. Green	Height (8WAP[b/]) T-96	Yield	Grade[c/] GA. Green	Grade[c/] T-96
			---- inches----		lbs/A	--------%--------	
Check	-	-	11.1	14.9	4287	68.8	66.8
Early Harvest PGR	40 g/50 lb	Seed	11.3	13.9	4282	70.1	69.1
Early Harvest PGR	40 g/50 lb 3.2 fl oz	Seed 3-5 ls, peg	2.5	14.4	4541	69.9	67.6
Early Harvest PGR	3.2 fl oz	3-5 ls, peg, 14 d after peg	11.1	14.4	4485	71.8	69.3
LSD (0.05)			NS	NS	NS	NS	NS

[a/] Plant = in-furrow with seed, ls = leaf stage
[b/] WAP = weeks after planting
[c/] Grade = sound mature kernels (SMK) + sound splits (SS)

The results of this study show no significant benefit to using Early Harvest on runner-type peanut. Supplemental irrigation was applied whenever needed and the peanuts were never moisture stressed. Since the greatest response in cotton has been seen when cotton is stressed, the same may be true for peanut.

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