Response of Peanut to PGR-IV™ Growth Regulator[1]

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ABSTRACT

Field experiments in North Carolina in 1994 and 1995 determined virginia-type peanut (*Arachis hypogaea* L.) response to PGR-IV, a commercial hormonal growth regulator consisting of 30 mg/L of gibberellic acid, 27 mg/L of indolebutyric acid, and a proprietary fermentation broth. Treatments included PGR-IV applied once at 438 mL/ha 21, 45, 60, or 75 DAE (days after peanut emergence) or twice at 219 mL/ha at 21 and 45 DAE or 45 and 60 DAE. PGR-IV had no effect on peanut main stem or cotyledonary lateral branch length, yield, maturity, percentage of fancy pods, extra large kernels, or total sound mature kernels, or net returns.

Key Words: *Arachis hypogaea* L., gibberellic acid, indolebutyric acid, vegetative growth, yield, maturity, grade, net returns.

PGR-IV is a commercial hormonal plant growth regulator currently registered for use in peanut, cotton (*Gossypium hirsutum* L.), and a number of other agronomic and horticultural crops (PGR-IV Concentrate specimen label, Micro Flo Co., Lakeland, FL). It contains 30 mg/L of gibberellic acid, 27 mg/L of indolebutyric acid, and a proprietary fermentation broth.

Most of the reported research with PGR-IV has been with cotton. Effects of PGR-IV on cotton yield have been variable. Yield increases ranging from 8 to 18% have been observed in some studies (11, 15) although the response was sometimes inconsistent across multiple locations (15). In other studies, PGR-IV did not affect yield (7, 12). Yield decreases have occasionally been reported (1, 16).

The most effective treatment regime for PGR-IV in cotton is thought to be multiple applications of 73 mL/ha applied in-furrow followed by 292 mL/ha at the pin-head square stage and 292 mL/ha at the early bloom stage (10, 11, 14). Yield increases, when observed, are thought to be associated with increases in early season plant growth resulting from in-furrow application of PGR-IV and increased leaf photosynthesis, nutrient partitioning, and boll set resulting from the foliar applications (6, 10).

A positive cotton yield response to PGR-IV appears to be more likely when the crop experiences environmental or nutritional stresses (3, 4, 20). PGR-IV applied in-furrow increased tap root length, root dry weight, number of lateral roots, and total root length (4, 11, 20). This effect is claimed to offer insurance against poor early season growing conditions (9). In whole-plant assimilation chambers, PGR-IV increased net carbon fixation at a suboptimal temperature of 20 C but not at 30 C (4).

[1]Use of trade names in this publication does not imply endorsement by the North Carolina Agric. Res. Serv. or the North Carolina Coop. Ext. Serv., nor criticism of similar ones not mentioned.

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Under either drought stress or nitrogen deficiency in field studies, PGR-IV increased leaf photosynthesis due to increased stomatal conductance (3). Although not significantly different, there was a trend for greater yield when PGR-IV was applied to drought-stressed or nitrogen-deficient cotton whereas no trend was noted on cotton not under drought stress or nitrogen deficiency (3). In other field studies, PGR-IV increased the rate of photosynthesis and dry matter production of both flooded and drought-stressed cotton (20). PGR-IV decreased fruit abscission and increased yield of cotton subjected to shading during the flowering and fruiting period (20).

No research has been reported on use of PGR-IV in peanut. The objective of this study was to determine if PGR-IV affects growth, maturity, yield, or market quality of virginia-type peanut.

Materials and Methods

The experiment was conducted on a private farm near Woodville, NC in 1994 and on the Peanut Belt Research Station near Lewiston, NC in 1994 and 1995. Soils were Norfolk sandy loam (fine-loamy, siliceous, thermic Typic Paleudults) with 1.9% organic matter and pH 6.2 at Woodville, Goldsboro sandy loam (fine-loamy, siliceous, thermic Aquic Paleudults) with 3.0% organic matter and pH 6.0 at Lewiston in 1994, and Norfolk loamy sand with 1.5% organic matter and pH 5.8 at Lewiston in 1995.

The cultivar NC 9 was planted 17 May 1994 at Woodville and 5 May 1995 at Lewiston on conventionally prepared beds. NC 7 was planted 10 May 1994 at Lewiston. Weed, insect, and disease control and cultural practices were standard for the area. Rainfall amount and distribution were near optimal for peanut in 1994. In 1995, the crop received 18 cm of water in seven irrigation events from mid-July through August to avoid drought stress.

Treatments, suggested by the manufacturer, included PGR-IV applied once at 438 mL/ha 21, 45, 60, or 75 DAE or twice at 219 mL/ha at 21 and 45 DAE or 45 and 60 DAE. A nontreated check also was included. Treatments were applied using a CO_2-pressurized backpack sprayer delivering 177 L/ha at 207 kPa in 1994 or 156 L/ha at 172 kPa in 1995. Peanut canopy width at time of treatment was 13, 50, and 65 cm 21, 45, and 60 DAE at Woodville; 15, 40, and 60 cm 21, 45, and 60 DAE at Lewiston in 1994; and 20, 58, and 85 cm 21, 45, and 60 DAE at Lewiston in 1995. The canopy was closed at all locations 75 DAE. Peanut was in the early bloom stage 45 DAE.

The experimental design was a randomized complete block with treatments replicated three times in 1994 and four times in 1995. Plots were four rows 91 cm apart and 9 m long. Additional plots were included for equipment passage so that treated plots and the nontreated check plots received no damage from wheel traffic after planting.

Peanut was monitored at 2-wk intervals throughout the season for visible effects of treatments. Peanut main stem and cotyledonary lateral branch lengths were recorded 110 DAE from eight randomly selected plants per plot. In 1994, main stem and cotyledonary lateral branch lengths also were recorded 35, 59, and 89 DAE.

The crop was mechanically dug and inverted in early to mid-October. Within 2 hr after digging, all pods from eight randomly selected plants per plot were removed by hand. The exocarp of these pods was removed to reveal the color of the mesocarp (19). Exocarp removal was accomplished by propelling glass beads (Soda Lime Glass, DeLong Co., Atlanta, GA) immersed in water at the pods at high pressure until the color of the mesocarp was visible (18). Pods were separated into three categories (black or brown, orange, and yellow or white) based upon the color of the mesocarp. Pods having a black or brown mesocarp were the most mature; pods having a yellow or white mesocarp were the least mature (19).

After drying in the field for 5 to 7 d, peanut from the two center rows of each plot was harvested mechanically, dried for 4 to 5 d with conventional drying equipment (19), and weighed. Yields were adjusted to 7% moisture. A subsample of pods from each plot was shelled and graded according to industry standards to determine the percentage of fancy pods, extra large kernels, and total sound mature kernels (5).

An enterprise budget was prepared for each treatment using budgets developed by the North Carolina Coop. Ext. Serv. for the 1995 crop year (2), the manufacturer's suggested retail price of $52.31/L for PGR-IV, and a peanut value per kg based upon the Consolidated Farm Services price support schedule for the respective crop year.

Data were subjected to ANOVA. A treatment by location interaction was not observed for any variable. After checking for homogeneity of error variance, data were pooled over locations. Means for PGR-IV treatments were compared with the mean of the nontreated check using Fisher's Protected LSD at P = 0.05.

Results and Discussion

No visible differences in crop vigor, canopy development, or foliage color due to treatment with PGR-IV were noted at any time during the season. PGR-IV had no effect on peanut vegetative growth as determined by measurement of main stem and cotyledonary lateral branch lengths 110 DAE (Table 1). Pooled over treatments and locations, main stem and cotyledonary lateral branch lengths were 39 and 63 cm, respectively. PGR-IV also had no effect on main stem and cotyledonary lateral branch lengths 35, 59, and 89 DAE in 1994 (data

Table 1. Effect of PGR-IV on peanut vegetative growth.[a]

PGR-IV rate	Time of application	Main stem length	Cotyledonary lateral branch length
mL/ha	DAE	cm	
0		39	63
438	21	40	63
438	45	38	61
438	60	39	64
438	75	38	62
219	21 and 45	39	64
219	45 and 60	39	62
LSD (0.05)		NS	NS
Prob. > F		0.58	0.82
CV (%)		7.96	7.30

[a]Data pooled over three locations. DAE = days after peanut emergence.

not shown).

No PGR-IV treatment affected peanut yield (Table 2). Growing conditions and pest management were good, and excellent yields were produced. Pooled over treatments and locations, yield was 6030 kg/ha. Yields at individual locations, pooled over treatments, were 6150, 6400, and 5670 kg/ha at Woodville, Lewiston in 1994, and Lewiston in 1995, respectively (data not shown).

No effect of PGR-IV was noted on peanut grade factors (Table 2). Pooled over treatments and locations, percentages of fancy pods, extra large kernels, and total sound mature kernels were 92, 49, and 72, respectively. Because there was no effect of PGR-IV on grade factors, there also was no effect on unit value of peanut. Pooled over treatments, peanut unit value was $80.72, $78.77, and $80.51 per 100 kg at Woodville, Lewiston in 1994, and Lewiston in 1995, respectively (data not shown). Additionally, no PGR-IV treatment affected net returns (Table 2).

Table 2. Effect of PGR-IV on peanut yield, grade factors, and net returns.[a]

PGR-IV rate	Time of application	Yield	FP	ELK	TSMK	Net returns
mL/ha	DAE	kg/ha		%		$/ha
0		5920	92	50	72	2963
438	21	6100	91	49	72	3105
438	45	5910	92	48	72	2950
438	60	5930	92	48	72	2943
438	75	6200	92	49	73	3218
219	21 and 45	6110	92	49	72	3071
219	45 and 60	6070	92	48	72	3083
LSD (0.05)		NS	NS	NS	NS	NS
Prob. > F		0.60	0.95	0.79	0.08	0.47
CV (%)		6.85	2.36	5.29	1.04	10.81

[a]Data pooled over three locations. DAE = days after peanut emergence, FP = fancy pods, ELK = extra large kernels, TSMK = total sound mature kernels.

The hull scrape method, originally developed for runner-type peanut (17), can be used to estimate maturity of virginia-type peanut (13). PGR-IV did not affect peanut maturity as determined by mesocarp color. Pooled over locations and treatments, 44, 20, and 36% of the pods had black/brown, orange, and yellow/white mesocarps, respectively (Table 3).

In this study, the cooperating grower and the research station manager decided when to dig the crop based upon examination of the untreated check. Digging when about 60% of the pods have black or brown mesocarps generally results in greatest harvested yields of virginia-type peanut (W. J. Griffin, N. C. Coop. Ext. Serv., pers. commun., 1995). The crop in this study may have been dug too soon for optimum yield. The early digging may also have affected the percentages of extra large kernels and total sound mature kernels (8). However, this should not have affected overall conclusions because of the lack of difference in maturity among treatments.

Table 3. Effect of PGR-IV on peanut pod mesocarp color.[a]

PGR-IV rate	Time of application	Black and brown	Yellow and orange	White
mL/ha	DAE		%	
0		45	19	36
438	21	41	22	37
438	45	45	20	35
438	60	43	21	36
438	75	44	20	37
219	21 and 45	42	19	39
219	45 and 60	46	18	37
LSD (0.05)		NS	NS	NS
Prob. > F		0.78	0.41	0.95
CV (%)		15.52	22.87	19.37

[a]Data pooled over three locations. DAE = days after peanut emergence.

Results of this study show no beneficial effects of PGR-IV on virginia-type peanut. Similar conclusions were reached in Virginia in 1994 (C.W. Swann, Virginia Polytech. Instit. State Univ., unpubl. data, 1994). Good growing conditions were encountered in these experiments, as documented by the excellent yields (Table 2). In cotton, greater responses to PGR-IV have been observed under stress conditions (3, 4, 9, 20). Additional research is needed to determine if PGR-IV has an effect on peanut under stress conditions.

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