Growth Regulator Effects on the Market Quality of Five Virginia-Type Peanut Cultivars[1]

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ABSTRACT

The growth regulator succinic acid 2, 2-dimethylhydrazide (SADH) was applied to the foliage of five virginia-type peanut (*Arachis hypogaea* L.) cultivars in 1980, 1981, and 1982 in Martin County, North Carolina, and Suffolk, Virginia. Treated and untreated peanuts at each location were harvested on two dates each year. Market grade, yield, and value/ha evaluations were made on the cultivars Florigiant, NC 6, NC 7, VA 81B, and NC 8C. Yield and value/ha within each cultivar were statistically different across years and locations. The growth regulator significantly reduced the percentage of fancy pods for all cultivars except VA 81B while significantly increasing the percentage of extra large kernels for all cultivars except NC 8C. The percentage of total kernels was not affected with Florigiant or NC 7, but significant reductions were observed with growth regulator application to NC 6, VA 81B, and NC 8C. The yield and value/ha of Florigiant and NC 6 increased significantly with growth regulator applications. Yield/ha of NC 7 increased with growth regulator application but was not statistically different; however, the NC 7 value/ha increased significantly. Growth regulator applications on NC 8C and VA 81B affected neither yield nor value/ha. Thus, applications of the growth regulator SADH can be a beneficial peanut production practice for some cultivars; however, the response within cultivars was inconsistent across years and locations.

Key Words: *Arachis hypogaea* L., groundnut, market grade, succinic acid 2, 2-dimethylhydrazide.

Succinic acid 2, 2-dimethylhydrazide (SADH) is a synthetic growth retardant which has been shown to reduce the vegetative growth of peanut (*Arachis hypogaea* L.) (1-4). Peanut yield response to SADH application has been inconsistent, ranging from reduced yields in some experiments to no response or increased yields in others (1-6, 8-10). Daughtry et al. (5) reported yield increases were more likely to occur if growing conditions were conducive to abundant vine growth. Yearly variations in environmental conditions were postulated by Brown and Ethredge (3) as causing the erratic yield responses. Reduced peanut pod size has been associated with SADH applications in some experiments (1, 3, 4, 10). Wynne et al. (10) reported a reduction in the pod size of both NC 17 and NC 5 virginia-type peanut cultivars when treated with SADH; however, pod yield was not affected for NC 5 but was reduced for NC 17.

New cultivars have been developed since the above studies were conducted. This study was conducted to determine the effects of SADH on yield, value, and market quality of these recently released virginia-type cultivars.

Materials and Methods

A growth regulator, succinic acid 2, 2-dimethylhydrazide (SADH) sold under the trade name Kylar, was applied to the foliage of five virginia-type peanut cultivars grown in 1980, 1981, and 1982 in Martin County, North Carolina, and Suffolk, Virginia. The Martin County location was on the D. G. Mathews farm and the Suffolk location was at The Tidewater Research and Continuing Education Center. The cultivars used were Florigiant, NC 6, NC 7, NC 8C, and VA 81B. NC 6 and NC 8C are considered to be comparable to Florigiant in maturity (requiring approximately 150 days after planting in the Virginia-Carolina area) while NC 7 and VA 81B mature 7 and 10-14 days earlier than Florigiant, respectively (7,11). Treated and untreated peanuts were harvested on two dates each year at both locations. The first harvest each year was when the earliest maturing cultivar, VA 81B, was considered at its optimum maturity based on visual inspection of the inner pericarp. The second harvest was approximately 2 weeks later.

Production practices were those in customary use in the Virginia-Carolina area, except for the SADH treatments. In the treated plots, SADH was applied at 1.12 kg/ha (85% active ingredient, water soluble powder formulation) about mid-July of each year or just before plant growth reached the middle of the 0.91 m row (Table 1). In 1982 an additional 0.56 kg/ha of material was applied on August 6 due to renewed plant growth. SADH application was by ground spray equipment using three D2-13 nozzles per row applying 224 L of water/ha as a foliar spray.

Table 1. Growth regulator application date, days after planting, rate, and plant width data from Martin County, North Carolina, and Suffolk, Virginia, 1980 to 1982.

Growth regulator application			Plant width (cm) at time of application[1]				
Date	Days after planting	Rate (kg/ha)	Florigiant	NC 6	NC 7	VA 81B	NC 8C
			Martin County, N. C.				
7/11/80	63	1.12	71.1	63.5	63.5	53.3	66.0
7/13/81	61	1.12	81.3	78.7	76.2	71.1	73.7
7/12/82	68	1.12	91.4	86.4	86.4	81.3	83.8
8/06/82	93	0.56					
		Mean	81.3	76.2	75.4	68.6	74.5
			Suffolk, Va.				
7/25/80	78	1.12	71.1	66.0	63.5	55.9	66.0
7/13/81	69	1.12	86.4	81.3	78.7	68.6	71.1
7/19/82	73	1.12	91.4	88.9	86.4	71.1	86.4
8/06/82	91	0.56					
		Mean	83.0	78.7	76.2	65.2	74.5

1 Each cultivar mean for each year is an average of 12 measurements.

The experimental design was a randomized complete block with split-split plots and three replications. Whole plots were harvest dates with treated and untreated splits. Cultivars were randomized within each harvest date and treated or untreated replications. Each cultivar plot (1.82 m x 10.67 m) was harvested with a modified combine to insure uniform clean-out between each plot, and pods were artificially dried. Pod yields were corrected to a uniform 8% moisture level.

Samples from each plot were graded according to USDA peanut marketing procedures. Grade data reported are percentage of fancy

[1]Contribution from the Tidewater Research and Continuing Education Center and the Agronomy Department, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, and the Agricultural Research Service, U.S. Department of Agriculture, Suffolk, VA 23437. Mention of trade names does not imply that they are endorsed or recommended by Virginia Polytechnic Institute and State University nor the U.S. Department of Agriculture over similar trade products not mentioned.

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pods (FP) (inshell fruits that rode a 1.35 cm roller spacing on the presizer), extra large kernels (ELK) (seed that rode a 0.85 x 2.54 cm slotted screen), and total kernels (TK) (sound mature kernels, sound splits, other kernels, and damaged kernels). Market value ($/ha) was calculated according to peanut loan schedules for each respective year. Analyses of variance for yield, market quality factors, and market value were computed across years, harvest dates, and locations within each cultivar since cultivar growth habit and yield potential were different.

Results and Discussion

Mean squares from the analysis of variance for yield for the five cultivars studied during 1980 to 1982 are shown in Table 2. Highly significant ($P<0.01$) differences between years and locations were observed within each of the five cultivars. Growth regulator and other interaction differences are discussed in the following paragraphs.

Table 2. Mean squares x 10^{-3} from analysis of variance for yield (kg/ha), 1980 to 1982.

Source	df	Cultivar				
		Florigiant	NC 6	NC 7	VA 81B	NC 8C
Years (Y)	2	30,289**	44,181**	47,870**	38,745**	33,586**
Error A	6	168	315	190	196	197
Locations (L)	1	11,533**	2,710**	11,811**	7,455**	8,677**
L x Y	2	406*	322	119	233	133
Error B	6	59	69	176	108	220
Dig Date (D)	1	901*	657*	0	653	1,382**
D x Y	2	97	7	226	901*	787**
D x L	1	15	983**	455*	1,351*	52
D x Y x L	2	1,114**	1,020**	440*	2,449**	144
Error C	12	118	84	72	187	71
Growth Regulator (G)	1	2,188**	1,625**	675	211	31
G x Y	2	1,213**	1,246**	705*	65	1,234**
G x L	1	343	17	470	445	1
G x D	1	447	285	3	19	2
G x L x Y	2	1,324**	167	257	242	487**
G x D x Y	2	29	284*	297	173	9
G x D x L	1	3	11	55	795*	17
G x D x Y x L	2	25	46	43	834**	54
Error D	24	142	69	169	141	59

*,** Indicate 0.05 and 0.01 significance level, respectively.

The effects of SADH on market quality, yield, and value for the five cultivars studied during 1980-82 are presented in Table 3. The percentage of FP was significantly reduced by the application of SADH for all cultivars except VA 81B which showed no significant difference. These results agree with previous reports (1, 3, 4, 10) with different cultivars. Conversely, the percentage of ELK was significantly increased by SADH application for all cultivars except NC 8C which showed no significant difference. These results agree with Daughtry et al. (5) who showed an increase in kernel size of Florunner cultivar with SADH application at the 12-week stage. Wynne et al. (10) reported that SADH applications decreased the ELK percentage of NC 17 but increased the kernel size for NC 5. Our results suggest, as did Wynne et al., that pod and kernel size response to SADH applications vary with cultivars.

No difference was observed in the percentage of total kernels from treated and untreated plots for the cultivars Florigiant and NC 7. However, the percentage was significantly reduced with SADH application for the cultivars NC 6, VA 81B and NC 8C.

Table 3. The effects of a growth regulator on market quality, yield and value for five virginia-type peanut cultivars, 1980 to 1982.

Cultivar	Growth Regulator	Fancy Pods %	Extra Large Kernels %	Total Kernels %	Yield kg/ha	Value $/ha
Florigiant	Treated	72.0 b[1]	33.2 a	70.9 a	4275 a	2385 a
	Untreated	76.1 a	28.6 b	71.2 a	3926 b	2170 b
NC 6	Treated	73.4 b	39.9 a	70.1 b	4327 a	2414 a
	Untreated	80.0 a	38.7 b	71.7 a	4025 b	2256 b
NC 7	Treated	78.1 b	52.5 a	73.3 a	4400 a	2592 a
	Untreated	83.4 a	50.0 b	73.5 a	4207 a	2454 b
VA 81B	Treated	72.0 a	37.6 a	70.3 b	3768 a	2073 a
	Untreated	72.1 a	35.4 b	71.4 a	3875 a	2130 a
NC 8C	Treated	41.5 b	21.1 a	72.4 b	3783 a	2105 a
	Untreated	46.4 a	21.3 a	72.9 a	3825 a	2150 a

[1] Within a cultivar, means in a column followed by the same letter are not different at the 0.05 significance level according to Duncan's new multiple range test.

Significant yield increases were obtained from the SADH treatment for the cultivars Florigiant and NC 6. An apparent yield increase also was obtained with SADH applications to NC 7; however, it was not significantly different. Likewise, no significant yield differences were observed for the cultivars VA 81B and NC 8C when treated with SADH.

The value of the crop per unit of land area, which includes the various grade factors plus yield, was significantly greater for the SADH treated Florigiant, NC 6, and NC 7 plots. No crop value differences were observed between the treated and untreated VA 81B and NC 8C plots.

Pod yields varied among years with 1980 producing lower yields than 1981 or 1982. The precipitation in 1980 was the lowest recorded in 50 years and contributed to these low yields. The precipitation in the 1981 and 1982 growing seasons was nearer the 50 year average; hence, an expected variation among years was observed for yield, value, and market quality.

The year x growth regulator interaction for yield (kg/ha) of the five cultivars also reflects the variation among years mentioned above (Table 4). SADH application had no significant effect on any of the cultivars studied in the dry year of 1980. In 1981, NC 6 with a significant increase and NC 8C with a significant decrease were the only cultivars affected by SADH application. In the 1982 growing season, with better rainfall distribution and where a second application of 1/2 rate of SADH was applied to reduce renewed growth, all cultivars except VA 81B responded with significant yield increases. As a result of the variations mentioned above, the year x growth regulator interaction was significant ($P<0.05$) within all cultivars except VA 81B (Table 2).

These interactions and findings are in agreement with those of Brown and Ethredge's (3) that yearly variations in environmental conditions play a significant role in the variable response of peanut cultivars to a growth regulator. These findings also agree with Daughtry et al.

Table 4. Year x growth regulator interaction means for yield (kg/ha) of five virginia-type peanut cultivars.

Year	Growth Regulator	Cultivar				
		Florigiant	NC 6	NC 7	VA 81B	NC 8C
		Yield (kg/ha)				
1980	Treated	2802	2523	2664	2297	2629
	Untreated	2807	2704	2715	2512	2726
1981	Treated	4891	5234	4925	4808	3469
	Untreated	4695	4880	4879	4910	3932
1982	Treated	5131	5220	5610	4197	5255
	Untreated	4276	4493	5024	4204	4817
LSD (0.05)		318	222	347	316	205

(5) that yield increases are more likely to occur if conditions are conducive to abundant vine growth. The environmental conditions in 1981 and 1982 were more conducive to vine growth than in 1980.

A significant growth regulator x location x year interaction was obtained for yield (kg/ha) for the cultivars Florigiant and NC 8C (Table 2). With the Florigiant cultivar a significant increase in yield was obtained at Martin County in 1982 with SADH application. Although small increases in yields were obtained at Suffolk each year and at Martin County in 1981 and a small yield decrease at Martin County in 1980, none of these differences were significant. These variations between locations and years resulted in this significant interaction for Florigiant.

Yield variations between locations and years were also obtained for the NC 8C cultivar. Application of SADH resulted in significant yield reductions at Martin County in 1980 and 1981 and at Suffolk in 1981. No significant differences were recorded at Suffolk in 1980 or 1982; however, a significant yield increase was obtained at Martin County in 1982. No significant growth regulator x location x year interaction was obtained for the NC 6, NC 7 or VA 81B cultivars.

Close examination of the data suggests that location within a particular year may be as important as years for the cultivars in their response to application of SADH. Rainfall during the growing season varies between locations within years. The total rainfall during the growing season in Martin County was 26.6, 48.5, and 55.0 cm compared to 31.1, 59.6, and 69.2 cm in Suffolk for the years 1980, 1981, and 1982, respectively. In 1980 at the Suffolk location, 5.1 cm of this total was applied by irrigation during a critical drought stress period in August. The combination of rainfall distribution and accumulation, plus other environmental conditions before and after the application of SADH, probably contributed to its variable response.

Another factor in these results was the growth habit of the cultivars. Florigiant and NC 8C were vigorous runner growth types; whereas, NC 6 and NC 7 were intermediate and VA 81B was a sparse bunch. The growth regulator x location x year interaction significance for the cultivars with vigorous runner growth habits suggests that the response to SADH on these cultivars varied more with rainfall and environmental conditions than applications on cultivars with intermediate or bunch growth habits.

This study indicates that SADH application can be a beneficial peanut production practice for some cultivars in some environments. From these results the application of SADH to the VA 81B cultivar with a sparse bunch growth habit was not highly beneficial; while Florigiant, NC 6, NC 7, and NC 8C did show beneficial response in some environments studied, especially with favorable rainfall distribution. Therefore, production decisions concerning SADH application should be based upon the cultivar planted and the environmental conditions or amount of vine growth during the growing season.

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