

Peanut (*Arachis hypogaea* L.) Response to the Harpin Protein Product Messenger[®]

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ABSTRACT

Experiments were conducted from 2002 through 2004 in North Carolina and during 2004 in Virginia to determine peanut response to harpin protein applied in the formulated product Messenger[®] (3.0% harpin protein and 97.0% other ingredients). Messenger[®] at 0.16 or 0.32 kg formulated product/ha was applied 30 or 60 days after peanut emergence. A sequential application of Messenger[®] at 0.16 kg/ha (30 days after emergence) followed by 0.16 kg/ha (60 days after emergence) as well as a non-treated control were also included. Messenger[®] did not affect visual estimates of tomato spotted wilt, peanut main stem height at harvest, peanut pod yield, or percentages of extra large kernels or total sound mature kernels compared with non-treated peanut. The experiment was conducted in environments where pod yield varied from as low as 3,380 kg/ha to as high as 5,960 kg/ha with three Virginia market type peanut cultivars. These data suggest that the harpin protein product Messenger[®] applied to emerged peanut will not affect pod yield or quality parameters.

Key Words: Plant growth regulator, peanut quality, pod yield, tomato spotted wilt.

A variety of plant growth regulators have been evaluated in peanut (*Arachis hypogaea* L.). The hormonal plant growth regulators Early Harvest (Griffin LLC, Valdosta, GA) and PGR IV (Micro-Flo Co., Lakeland, FL), both containing various combinations of cytokinin, gibberellic acid, and indoleacetic acid, did not affect peanut pod yield or gross economic value (Beasley et al., 2004; York et al., 1995). The growth retardant prohexadione calcium can improve row visibility and in some cases increase pod yield and reduce pod shed of Virginia market type peanut (Beam et al., 2002;

Culpepper et al., 1997). Messenger[®] (Eden Biosciences Corp, Bothell, WA) contains a harpin protein that can induce plant defense against pathogens (Bonas, 1994; Ryals et al., 1996).

Published research evaluating efficacy of Messenger[®] is limited. Wright et al. (2000) reported that Messenger[®] applied postemergence increased cotton (*Gossypium hirsutum* L.) boll load and lint yield compared with non-treated cotton in some trials. No definitive research has been conducted to determine benefits of Messenger[®] on disease development, pod yield, and market grade characteristics of peanut. The objective of this research was to determine if a spray program for Messenger[®] recommended by the manufacturer decreased visual symptoms of tomato spotted wilt of peanut, increased pod yield, and improved market grade characteristics of three Virginia market type cultivars.

Materials and Methods

Experiments were conducted in North Carolina during 2002, 2003, and 2004 and in Virginia during 2004. The experiment was conducted during all years at the Peanut Belt Research Station located near Lewiston-Woodville on a Norfolk sandy loam soil (fine-loamy, siliceous, thermic Aquic Paleudults) and during 2002 and in to separate fields in 2003 at the Upper Coastal Plain Research Station located near Rocky Mount on a Goldsboro sandy loam (fine-loamy, mixed, semiactive, thermic Typic Hapludults). The experiment was also conducted in 2003 in a farmer's field near Tyner, NC on a Norfolk sandy loam and at the Tidewater Agricultural Research and Extension Center located near Suffolk, VA in 2004 on a Goldsboro loamy sand. The experiment was established in conventional tillage systems with the exception of one of the two experiments conducted at Rocky Mount in 2003, which was established in a strip tillage system. Plot size was two rows by 12 m. The cultivar NC-V 11 was planted during 2003 and 2004 at Lewiston-Woodville and at Suffolk. The cultivar VA 98R was planted at Rocky Mount in 2002 and in the strip tilled field in 2003. The cultivar NC 12C was planted at Lewiston-Woodville in 2002 and in the conventional tillage field at Rocky Mount in 2003. All cultivars were seeded to

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Table 1. Analysis of variance for visual estimates of percent tomato spotted wilt, main stem height, pod yield, and percentages of total sound mature kernels and extra large kernels.

Treatment factor	Tomato spotted wilt	Main stem height	Pod yield	Total sound mature	
				kernels	Extra large kernels
			p value		
Experiment (EXP)	0.0001	0.0001	0.0001	0.0003	0.0001
Treatment (TMT)	0.7555	0.8046	0.7442	0.6046	0.2412
EXP*TMT	0.1521	0.8622	0.3393	0.2484	0.5477
Coefficient of variation	38.3	7.4	10.8	3.5	10.3
Number of experiments	3	5	8	4	4

obtain a final in-row plant population of 13 plants/m.

Treatments consisted of Messenger® at 0.16 or 0.32 kg formulated product/ha applied 30 or 60 days after peanut emergence. A sequential application of Messenger® at 0.16 kg/ha (30 days after emergence) followed by 0.16 kg/ha (60 days after emergence) as well as a non-treated control were also included. Messenger® was applied in distilled water immediately after mixing using a CO₂-pressurized backpack sprayer calibrated to deliver 145 L/ha using regular flat fan nozzles (Spraying Systems Co., Wheaton, IL). Agronomic and pest management practices other than Messenger® applications were held constant over the entire test based on Cooperative Extension Service recommendations.

Height from the ground to the top of main stems was recorded in mid September. In North Carolina in three experiments (Rocky Mount and Lewiston-Woodville in 2002 and Tyner in 2003), visual estimates of the percentage of the plants expressing symptoms of tomato spotted wilt were recorded in mid September using a scale of 0 to 100 where 0 = no visible symptoms of tomato spotted wilt and 100 = the entire canopy expressing visible symptoms of

tomato spotted wilt. Peanut pods were dug and vines inverted in late September or early October based on pod mesocarp color determination (Williams and Drexler, 1982). No attempt was made to distinguish maturity among treatments. Pods were combined after air drying in the field for 5 to 8 d. A 500-g sample of pods was removed from four of the eight experiments to determine percentages of total SMK (%TSMK) and extra large kernels (%ELK) based on Cooperative Grading Service guidelines for Virginia market type peanut.

The experimental design was a randomized complete block with 4 replications. Data for percent tomato spotted wilt, pod yield, %TSMK, and %ELK were subjected to analysis of variance. Means for significant main effects and interactions where appropriate were separated using Fisher's Protected LSD Test at $p \leq 0.05$.

Results and Discussion

The interaction of experiment by Messenger® treatment was not significant for visual estimates of tomato spotted wilt, main stem height, peanut pod yield, %TSMK, or %ELK (Table 1). Additionally, the main effect of Messenger® treatment was not

Table 2. Influence of Messenger® on percent tomato spotted wilt, main stem height, pod yield, and percentages of total sound mature kernels and extra large kernels.^a

Messenger® rate ^b	Messenger® timing	Tomato spotted wilt	Main stem height	Pod yield	Total sound mature kernels	Extra large kernels
kg formulated product/ha	DAE ^c	%	cm	kg/ha	%	%
0.16	30	23	43	4,290	73	38
0.32	60	22	41	4,360	71	38
0.16	30	24	43	4,340	71	39
0.32	60	19	43	4,320	72	37
0.16 then 0.16	30 then 60	22	43	4,190	74	40
Non-treated	-	24	43	4,270	72	42
LSD (0.05)	-	NS	NS	NS	NS	NS
Number of experiments		3	5	8	4	4

^aData are pooled over experiments.

^bMessenger® contains 3.0% harpin protein and 97% other ingredients.

^cAbbreviations: DAE, days after emergence.

Table 3. Influence of experiment on percent tomato spotted wilt, main stem height, pod yield, and percentages of total sound mature kernels and extra large kernels.^a

Location	Year	Cultivar	Tomato spotted wilt	Main stem height	Pod yield	Total sound mature kernels	Extra large kernels
			%	cm	kg/ha	%	%
Lewiston-Woodville	2002	NC 12C	14	-	4,760	42	73
Lewiston-Woodville	2003	VA 98R	-	36	3,830	-	-
Lewiston-Woodville	2004	NC-V 11	-	-	4,340	42	76
Rocky Mount	2002	VA 98R	52	-	3,050	43	69
Rocky Mount	2003	VA 98R	-	33	3,380	-	-
Rocky Mount	2003	NC 12C	-	50	4,310	-	-
Suffolk	2004	NC-V 11	-	42	4,740	-	-
Tyner	2003	VA 98R	1	48	5,960	28	66
LSD (0.05)	-	-	5	1	270	3	2
Number of experiments	-	-	3	5	8	4	4

^aData are pooled over Messenger[®] treatments.

significant for these parameters (Table 1). However, the main effect of experiment was significant for all parameters (Table 1).

When pooled over experiments, main stem height was approximately 43 cm and did not differ among Messenger[®] treatments (Table 2). However, main stem height did vary by experiment, with the cultivar VA 98R having the shortest main stems during 2002 at Rocky Mount and 2003 at Lewiston-Woodville compared with height of this cultivar at Tyner in 2003 or NC-V 11 at Lewiston-Woodville or Suffolk in 2004 (Table 3). The cultivar VA 98R is generally shorter in stature than the cultivars NC-V 11 or NC 12C (Jordan, 2004).

The percentage of tomato spotted wilt ranged from 19 to 24% when data were pooled over the three locations where visual symptoms of virus were apparent (Table 2). When pooled over Messenger[®] treatments, the percentage of plants expressing visible symptoms of tomato spotted wilt was 52% (Rocky Mount in 2002), 14% (Lewiston-Woodville in 2002), and 1% (Tyner in 2003) (Table 3). There are no data in the literature indicating whether or not the harpin protein found in Messenger[®] affects development of tomato spotted wilt of peanut.

Pod yield was not affected by Messenger[®] treatment but was affected by experiment (Tables 2 and 3). When pooled over experiments, pod yield did not differ more than 170 kg/ha when comparing among Messenger[®] treatments and the non-treated control. In contrast, pod yield varied considerably among experiments with a range of 3,380 kg/ha to 5,960 kg/ha (Table 3). Differences in pod yield were most likely a reflection of differences in environmental conditions in each

experiment. Percentages of ELK and TSMK did not differ among Messenger[®] treatments, although differences were noted when comparing experiments (Table 3).

Results from these experiments indicate that the harpin protein containing product Messenger[®] does affect incidence of tomato spotted wilt, peanut main stem height, pod yield, and market grade characteristics. These experiments were conducted with three popular Virginia market type cultivars and under environmental and edaphic conditions resulting in a range of yield potentials.

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