Effects of Various Postemergence Herbicide Treatments and Tobacco Thrips (*Frankliniella fusca*) Injury on Peanut Yields in Virginia[1]

D. A. Herbert, Jr.*, J. W. Wilcut and C. W. Swann[2]

ABSTRACT

A two-year field study was conducted in Virginia to determine the combined effects of earlyseason injury caused by certain postemergence-applied herbicides and tobacco thrips, *Frankliniella fusca* (Hinds), feeding on cv. NC 7, virginia-type peanuts. Treatments included combinations of aldicarb, applied as granules in-furrow at planting, and carbaryl, paraquat, acifluorfen, and pyridate applied postemergence. Main stem height, canopy width, tobacco thrips injury, pod weight, and value were measured. Paraquat and acifluorfen treatments significantly reduced main stem height and canopy width compared with pyridate. Thrips injured approximately 40 to 50% of untreated plant leaves. Aldicarb significantly reduced thrips injury to less than 17%. Combined early-season herbicide and thrips significantly reduced peanut main stem height and canopy width compared with plants that were protected from thrips and not subjected to herbicide stress, and differences remained apparent as late as 59 days after treatment, 79 days after planting. Although injured plants achieved normal foliar growth by harvest time, pod weight and value were significantly reduced.

Key Words: Tobacco thrips, postemergence herbicides, injury, yield.

Peanut, *Arachis hypogaea* L., is grown in Virginia and northeastern North Carolina during a relatively short growing season compared with more southerly peanut-growing areas. Planting rarely begins before May 1, and the first frost normally occurs on October 20; which results in a growing season which averages 170 days. The top yielding and most commonly grown peanut cultivars in Virginia and North Carolina require from 146 to 165 days to mature (11). Any factor that may delay crop growth is critical to both yield and quality.

Two factors that may affect growth are injury from herbicide treatment and feeding by tobacco thrips, *Frankliniella fusca* (Hinds). The United States Environmental Protection Agency's recent cancellation of dinoseb has resulted in increased usage of paraquat and acifluorfen as postemergence sprays. Both paraquat and acifluorfen are generally applied at, or within 28 days after, peanut ground crack. Both herbicides cause some degree of phytotoxicity when applied to young peanut foliage (2, 14, 15). Pyridate is being examined for potenital use in peanuts as a postemergence-applied herbicide (4). Unlike acifluorfen and paraquat, pyridate has no phytotoxic effect on peanut foliage (4).

Plants are most susceptible to injury by tobacco thrips early in the growing season (9), during the same period of time that the aforementioned herbicides are applied. Tobacco thrips perennially occur as a pest of peanuts throughout the United States (16). Tobacco thrips feed on terminal buds and young unopened leaflets causing chlorosis and deformation of leaves and leaflets, and stunting of plants (7). Severe damage can result in leaflet and leaf abscission. Thrips injury has not been reported to cause economic reductions in peanut yield or quality (10, 9, and 6), however, most studies on this pest have been conducted in southerly regions, and little current data exists from northerly areas.

The combined effect of herbicide and thrips injury to peanut is also poorly understood. Increased soybean, *Glycine max* (L.) Merrill, injury was observed when acifulorfen was applied to plants infested with soybean thrips, *Sericothrips variabilis* (Beach) (5). This two-year study was initiated to determine the effects of herbicide treatment and tobacco thrips injury on growth, yield, and value of peanut grown in Virginia.

Materials and Methods

Peanut, cv. NC 7, virginia-type, was planted at the same location in Suffolk, May 15 and May 1 in 1989 and 1990, respectively. Seed weed planted at 112 kg/ha in 91-cm spaced rows, in sandy textured soil (sand 91%, silt 9%, clay 0%, OM<1%). Plots were four rows by 12.2 m long, separated on the ends by 3.05 m of barren soil, and on sides only by the distance to the next row (plot). Treatments consisted of all combinations of the following insectivide and herbicide treatments. Insecticide treatments consisted of single in-furrow applications of aldicarb (2-methyl-2-methylthio propionaldehyde 0-methylcarbamoyloxime) at 1.12 kg (AI)/ha, carbaryl (1-naphthyl N-methylcarbamate) at 1.12 kg(AI)/ha applied as a foliar spray, and aldicarb plus carbaryl. Carbaryl was included to determine the effects of thrips feeding in the absence of possible growth effects from aldicarb. Herbicide treatments consisted of paraquat (1,1'-dimethyl-4,4'-byridinium ion) at 0.14 kg (AI)/ha, acifluorfen (5-(2-chloro-4-trifluoromethyl)phenoxyl-2-nitrobenzoic acid) at 0.28 kg (AI)/ha, and pyridate (0-(6-chloro-3-phenyl-4-pyridazinyl)-S-octyl-carbonothioate) at 1.05 kg (AI)/ha. Pyridate was included as a herbicide 'control' becasue of its known lack of phytotoxicity to peanut (4). A randomized complete block experimental design with three replicates was used. All herbicides were applied postemergence and paraquat and acifluorfen treatments included X-77 (a nonionic surfactant mixture of alkylaryl-polyoxyethylene glycols, free fatty acids, and ispropanal; Valent USA Crop., Walnut Creek, CA) at 0.125 percent of spray volume.

In-furrow insecticide treatments were applied into the seed furrow at planting with a tractor-mounted Noble metering unit. Foliar insecticide sprays were applied using a CO_2-pressurized backpack sprayer calibrated to deliver 136 L/ha at 345 kPa through three D2-13 disc-core nozzles per row, one over the top and one on each side. Herbicides were applied with CO_2-pressurized backpack sprayer, claibrated to deliver 187 L/ha at 221 kPa broadcast through 11003 flat fan nozzles, spaced 51 cm apart on the spray boom. Foliar insecticide and herbicide treatments were applied 30 and 20 days after platning, respectively. All weeds were manually removed.

Injury due to tobacco thrips feeding was determined on a weekly schedule, weather permitting, beginning approximately 30 days after planting through mid-July. A severity scale of 0 to10 was used, where 0=no injury and 10=100% leaves exhibiting typical thrips feeding injury. The effects on plant growth were determined by measuring two aspects of plant canopy architecture, i.e., main stem height and cotyledonary lateral branch length (hereafter referred to as canopy width), of five random plants per plot. Canopy measurements were taken at 44 and 59 days after herbicide treatment, or 64 and 79 days after planting, in both study years. Yield was determined by digging, combining, drying (70%, and weighing peanuts from the two center rows of each plot. A composite sample (454 g) over all replicates for each treatment was subjected to grading in accordance with Federal-State Inspection Service grading methods. This allowed for the percentages of sound mature kernels (SMK), extra large kernels (ELK),

[1]Mention of companies or commercial products does not constitute an endorsement or recommendation by VPI-CES over others not mentioned.

[2]Assistant Professor, Dept. of Entomology, VPI & SU, Tidewater Agric. Exp. Stn., Suffolk, VA 23437; Assistant Professor, Dept. of Agronomy, Univ. of Georgia, Coastal Plain Exp. Stn., Tifton, GA 31793; and Professor, Dept. Crop and Soil Environmental Sciences, VPI & SU, Tidewater Agric. Exp. Stn., Suffolk, VA 23437.

*Corresponding author.

toptal meat (TM), other kernels (OK), damaged kernels (DK), and fancy pods to be determined and used ot calculate gross value. Mean crop injury, yield, and value were subjected to analysis of variance and means separation tests using the GLM Procedure of the Statistical Analysis System (8).

Results and Discussion

Tobacco thrips injury.

Plants sustained higher levels of thrips injury in 1990 than 1989. Consequently, data were not pooled. The highest level of injury in treatments not receiving insecticide treatments was 8.3 on June 7, 1990, compared with 4.7 to 5.5 on June 27, 1989 (Table 1). In addition, thrips injury appeared earlier in 1990. On May 31, injury was about 7.0, indicating that thrips infestations had already been active for several days. Typically, the level of injury became undiscernible between treatments by about the second week in July. Injury ratings at that time indicated that thrips stayed ative longer in 1990.

With the exception of the last sample date, in both years, in-furrow aldicarb treatments provided significant control of thrips injury compared with treatments receiving no insecticide. Regardless of herbicide treatment, aldicarb consistently prevented thrips injury from exceeding 1.7. This is below economic thresholds for retreatment as recommended by the Virginia and North Carolina Cooperative Extension Services. With few exceptions (e.g., June 7, 1990), foliar-applied carbaryl did not control thrips injury to a level which was comparable to aldicarb. However, carbryl did provide significant control compared with untreated insecticide controls in several cases in 1990, i.e., when in combination with paraquat (June 19), n combination with acifluorfen (June 27), and in all herbicide combinations, except pyridate, (June 14 and 21). Some thrips activity from herbicides was indicated. Carbaryl-aldicarb combinations never reduced thrips injury significantly more than aldicarb alone (Table 1).

Plant growth

In 1989, plants receiving any insecticide treatment that included aldicarb had sifgnificantly higher main stems and wider canopies compared to treatments not containing aldicarb (Table 2). Averaged over all hervicide combinations, main stem heights increased about 5 to 7 cm, and canopy widths incrased 16 and 14 cm, at 44 and 59 days after treatment, respectively. In 1990, average plant growth increases due to aldicarb treatment were less but consistent with those recorded in 1989. Main stem heights increased across herbicide combinations by an average of about 2 cm, at 44 days after tretment (Table 3). Canopy widths increased across all herbicide combinations by an average of 9 and 10 cm, respectively, for the two measurement dates

In absence of aldicarb, in 1989, at 44 days after treatment, paraquat-and acifluorfen-treated plants had significantly shorter main stem heights, 5 to 3 cm less, respectively, and narrower canopy widths, 9 to 6 cm less, respectively, compared wiht pyridate-treated plants (Table 2). Without aldicarb, plant growth differences due to herbicide treatement were not significant at 59 days after treatment. I 1990, at 44 days after herbicide treatment, plants treated with paraquat and acifluofen had significantly narrower canopies, 6 and 4 cm less, respectively, compared with pyridate-treated plants (Table 3). At 59 days after treatment, no significant differences in architecture measurements among herbicide treatments could be detected.

Although canopy size increases were not as great with carbaryl versus aldicarb-treated plants, several were significant compared with untreated insecticide control. In 1989, cabaryl-aciflurfen-treated plants had significantly higher main stems (4 cm) and wider canopies (7 cm) at 44 days after treatment, and wider canopies (7 cm) at 59 days after treatment. In 1990, 44 days after treatment, carbaryl-acifluorfen-and carbaryl-pyridate-treated plants had significantly higher main stems. At 59 days after treatment,

Table 1. Injury to peanuts by tobacco thrips as influenced by insecticide and herbicide treatments, Suffolk, Virginia, 1989-1990.[1]

Pesticide Treatment[2]			% Injury				
Insecticide		Herbicide	1989				
In-furrow	Postemergence		19 Jun	27 Jun	3 Jul	10 Jul	
aldicarb	carbaryl	paraquat	1.0	1.3	0.5	0.5	
aldicarb	carbaryl	acifluorfen	0.4	0.7	0.5	0.3	
aldicard	carbaryl	pyridate	1.2	0.8	0.5	0.3	
Mean			*0.9*	*0.9*	*0.5*	*0.4*	
aldicarb	none	paraquat	0.3	0.8	0.5	0.5	
aldicarb	none	acifluorfen	0.8	1.0	0.7	0.3	
aldicarb	none	pyridate	0.3	0.7	0.5	0.3	
Mean			*0.5*	*0.8*	*0.6*	*0.4*	
none	carbaryl	paraquat	4.2	5.3	3.2	0.2	
none	carbaryl	acifluorfen	3.7	4.2	3.0	0.3	
none	carbaryl	pyridate	3.5	4.5	2.5	0.3	
Mean			*3.8*	*4.7*	*2.9*	*0.3*	
none	none	paraquat	3.7	5.2	3.8	0.5	
none	none	acifluorfen	4.0	5.5	3.3	0.3	
none	none	pyridate	5.2	4.7	2.7	0.5	
Mean			*4.3*	*5.1*	*3.3*	*0.4*	
LSD (P=0.05)			1.4	1.1	0.6	0.4	
			1990				
			31 May	7 Jun	14 Jun	21 Jun	7 Jul
aldicarb	carbaryl	paraquat	1.7	1.5	0.8	1.3	1.3
aldicarb	carbaryl	acifluorfen	1.7	0.8	0.7	1.2	0.5
aldicard	carbaryl	pyridate	1.3	1.0	0.7	1.2	1.0
Mean			*1.6*	*1.1*	*0.7*	*1.2*	*0.9*
aldicarb	none	paraquat	1.5	1.2	0.8	1.0	0.8
aldicarb	none	acifluorfen	1.5	1.5	1.0	1.3	0.7
aldicarb	none	pyridate	1.3	1.0	0.8	1.7	0.7
Mean			*1.4*	*1.2*	*0.9*	*1.3*	*0.7*
none	carbaryl	paraquat	7.2	6.5	5.8	6.2	2.0
none	carbaryl	acifluorfen	7.2	7.0	4.2	5.7	1.5
none	carbaryl	pyridate	6.7	6.7	6.3	6.7	2.3
Mean			*7.0*	*6.7*	*5.4*	*6.2*	*1.9*
none	none	paraquat	7.2	8.3	7.3	6.5	1.3
none	none	acifluorfen	7.2	8.3	7.7	7.0	2.0
none	none	pyridate	6.3	8.3	7.2	6.3	1.0
Mean			*6.9*	*8.3*	*7.4*	*6.6*	*1.4*
LSD (P=0.05)			0.8	0.8	0.9	0.8	0.9

[1]Injury based on a 0 to 10 severity scale, where 0 = no injury and 10 = 100% leaves injured.

[2]Application rates (kg(AI)/ha) were as follows: aldicarb - 1.12, carbaryl - 1.12, paraquat - 0.14, acifluorfen - 0.28, and pyridate - 1.05.

Table 2. Mean main stem height (cm)

Pesticide Treatment[1]			44 Days after treatment[2]		59 Days after treatment[2]	
Insecticide		Herbicide				
In-furrow	Postemergence		Height	Width	Height	Width
aldicarb	carbaryl	paraquat	23	69	32	83
aldicarb	carbaryl	acifluorfen	22	71	28	85
aldicarb	carbaryl	pyridate	28	82	33	95
Mean			*24*	*74*	*31*	*88*
aldicarb	none	paraquat	23	68	28	83
aldicarb	none	acifluorfen	21	68	27	81
aldicarb	none	pyridate	27	79	33	88
Mean			*24*	*72*	*29*	*84*
none	carbaryl	paraquat	17	52	22	74
none	carbaryl	acifluorfen	21	60	26	74
none	carbaryl	pyridate	23	65	26	77
Mean			*20*	*59*	*25*	*75*
none	none	paraquat	17	54	20	71
none	none	acifluorfen	17	53	22	67
none	none	pyridate	21	59	25	73
Mean			*18*	*55*	*22*	*70*
LSD (P=0.05)			3	5	4	6

[1]Application rates (kg(AI)/ha) were as follows: aldicarb - 1.12, carbaryl - 1.12, paraquat - 0.14, acifluorfen - 0.28, and pyridate - 1.05.

[2]Days after herbicide treatment.

Table 3. Mean main stem height (cm) and canopy width (cm) of peanuts treated with insecticides and herbicides, Suffolk, Virginia, 1990.

Pesticide Treatment[1] Insecticide In-furrow	Postemergence	Herbicide	44 Days after Treatment[2] Height	Width	59 Days after treatment[2] Height	Width
aldicarb	carbaryl	paraquat	15	49	23	78
aldicarb	carbaryl	acifluorfen	12	44	18	69
aldicarb	carbaryl	pyridate	14	49	19	71
Mean			*14*	*47*	*20*	*73*
aldicarb	none	paraquat	13	45	21	75
aldicarb	none	acifluorfen	12	44	21	73
aldicarb	none	pyridate	13	47	18	73
Mean			*13*	*45*	*20*	*74*
none	carbaryl	paraquat	12	35	21	63
none	carbaryl	acifluorfen	14	37	23	70
none	carbaryl	pyridate	14	42	20	66
Mean			*13*	*38*	*21*	*66*
none	none	paraquat	11	33	21	63
none	none	acifluorfen	11	35	18	60
none	none	pyridate	12	39	19	60
Mean			*11*	*36*	*19*	*61*
LSD (P=0.05)			2	4	3	5

[1]Application rates (kg(AI)/ha) were as follows: aldicarb - 1.12, carbaryl - 1.12, paraquat - 0.14, acifluorfen - 0.28, and pyridate - 1.05.

[2]Days after herbicide treatment.

Table 4. Yield of peanuts treated with insecticides and herbicides, Suffolk, Virginia, 1989-1990.

Pesticide Treatment[1] Insecticide In-furrow	Postemergence	Herbicide	1989 Yield[2] kg/ha	Value[3] $/ha	1990 Yield kg/ha	Value $/ha
aldicarb	carbaryl	paraquat	3957	2779	4733	3510
aldicarb	carbaryl	acifluorfen	3652	2566	4832	3685
aldicarb	carbaryl	pyridate	4296	3018	5117	3791
Mean			*3968*	*2788*	*4894*	*3662*
aldicarb	none	paraquat	3828	2690	4879	3567
aldicarb	none	acifluorfen	3890	2732	4730	3458
aldicarb	none	pyridate	4221	2964	4745	3414
Mean			*3980*	*2795*	*4785*	*3480*
none	carbaryl	paraquat	2392	1680	3612	2670
none	carbaryl	acifluorfen	3039	2213	4039	3003
none	carbaryl	pyridate	3182	2156	4004	2912
Mean			*2871*	*2016*	*3885*	*2862*
none	none	paraquat	2561	1798	4004	2838
none	none	acifluorfen	2215	1541	3713	2665
none	none	pyridate	2433	1709	3462	2497
Mean			*2403*	*1683*	*3726*	*2667*
LSD (P=0.05)			801	563	694	509

[1]Application rates (kg(AI)/ha) were as follows: aldicarb - 1.12, carbaryl - 1.12, paraquat - 0.14, acifluorfen - 0.28, and pyridate - 1.05.

[2]Yields are base on dried weight of peanuts with moisture content of 7%.

[3]Value was determined according to Federal-State Inspection Service grading methods using sound mature kernels (SMK), extra large kernels (ELK), total meat (TM), other kernels (OK), damaged kernels (DK), and fancy pods.

carbaryl-acifluorfen-treated plants were significantly higher and wider, and carbaryl-pyridate-treated plants were significantly wider (Table 3).

Yield and value.

In 1989, aldicarb treatment increased yields significantly, regardless of herbicide treatment (Table 4). Over all combinations, yield with aldicarb-paraquat was 1417 kg/ha more than no aldicarb-paraquat; yield of aldicarb with acifluorfen was 1104 kg/ha more than no aldicarb-acifluorfen; and yield of aldicarb with pyridate was 1451 kg/ha more than no aldicarb-pyridate. The highest yield was obtained with the aldicarb-pyridate combination. With one exception, the 1989 carbaryl-acifluorfen treatment, most carbaryl-herbicide treatment combinations produced yields similar to those of untreated insecticide controls (Table 4).

Treatment combinations that included pyridate had the largest canopies and had the highest yields compared with combinations that included paraquat or acifluorfen, regardless of the insecticide treatment. Although differences were not always significant, yields were consistently higher with pyridate, with increases ranging from 143 to 790 kg/ha. There were no significant difference in yield between treatments receiving either paraquat or acifluorfen, regardless of insecticide treatment.

In 1990, as in 1989, aldicarb treatment increased yields significantly, regardless of herbicide treatment. Over all combinations, yield with aldicarb-paraquat was 998 kg/ha more than no aldicarb-paraquat; yield of aldicarb-acifluorfen was 905 kg/hga more than no aldicarb-acifluorfen; yield of aldicarb-pyridate was 1198 kg/ha more than no aldicarb-pyridate. The treatment that received aldicarb and pyridate produced the highest yield. As in 1989, yield of treatments receiving carbaryl did not differ significantly from those of untreated insecticide controls. Unlike 1989, in 1990, there were no significant differences in yields among herbicide treatments, regardless of insecticide, but differences in plant growth among herbicide treatments were also less than in 1989.

In both years, crop value (gross not net) generally paralleled yield. Significant differences were detected between treatment combinations that received aldicarb versus those that did not, regardless of herbicide treatment. Paraquat, acifluorfen, and pyridate combinations with aldicarb resulted in $996, $772 and $1058/ha more repsectively, in 1989, and $785, $738, and $898/ha more, respectively, in 1990 compared with combinations without aldicarb (Table 4).

In both years, the combination of early-season treatment with paraquat and acifluorfen and thrips feeding caused significant reductions in plant growth compared with plants that were protected from thrips and not subjected to herbicide stress. Plant measurements only verified differences in plant growth that were obvious. Stressed plants had shorter main stems and narrower canopy widths as late as 59 days after herbicide treatment, or 79 days after planting. The largest differences among treatments were in canopy widths. Plants did eventually recover from early-season stress, achieving canopy heights and widths similar to those of palnts never severely stressd, but recovery did not occur until late in the growing season. In both years, yield, i.e., pod weight at 7% moisture, and value were higher in treatments with the least amount of thrips injury and the most plant growth. In the absence of aldicarb, differences among treatments and treatment combinations were not always significant. But, in some instances, such as thjose receiving pyridate versus those that did not, differences were significant.

Direct feeding by tobacco thrips, in and of itself, is not thought to cause economic loss to peanut. In a summary of this issue, Smith and Barfield (1982) concluded that existing data clearly showed that thrips control was not economical. It has also been difficult to detect economic yield effects from thrips feeding in Virginia and North Carolina (1, 3). Injury from herbicide treatment, in and of itself, has also been difficult to relate to peanut yield (14, 15). But the combination of stress factors, early in the season, appears to slow growth to the extent that severely stressed plants cannot completely compensate within the time limits of the growing season. It it possible that given a longer growing season, stressed plants could fully compensate during the last few weeks prior to harvest. Many of the studies demonstrating that early-season thrips injury was not economic were conducted in more southerly locations where growing seasons are longer or where heat units accumulate at a faster rate (i.e., 12 and 13 in Florida, 7 and 10 in Texas). In Virginia and northeast North Carolina where the growing season is typically only one week to 10 days longer than the minimum time required for plants to reach full maturity, the combination of thrips feeding and herbicide injury appear to slow growth to the extent that plants may not be capable of fully recovering.

Literature Cited

1. Brandenburg, R. L. and P. T. Hertl. 1989. Thrips control. Insecticide and Acaricide Tests. 14:118F, 261.
2. Buchanan, G. A., D. S. Murray, and E. W. Hauser. 1982. Weeds and their control in peanuts. pp. 206-249 *in* H. E. Pattee and C. T. Young (eds.), Peanut Science and Technology. Amer. Peanut Res. Educ. Soc., Yoakum, TX 77995.
3. Herbert, D. A. 1990. Tobacco thrips and potato leafhopper control in peanuts in Virginia. Insecticide and Acaricide Tests. 15:125F, 267-268.
4. Hicks, T. V., G. R. Wehtje, and J. W. Wilcut. 1990. Weed control in peanuts (*Arachis hypogaea*) with pyridate. Weed Tech. 4:493-495.
5. Huckaba, R. M., H. D. Coble, and J. W. Van Dwyn. 1988. Joint effects of acifluorfen application on soybean thrips (*Sericothrips variabilis*) feeding on soybeans (*Glycine max*). Weed Sci. 36:667-670.
6. Lynch, R. E., J. W. Garner, and L. W. Morgan. 1984. Influence on systemic insecticides on thrips damage and yield of florunner peanuts in Georgia. Agric. Entomol. 1:33-42.
7. Sams, R. L. and J. W. Smith. 1978. Evaluation of six insectivides applied at planting for thrips control on Texas peanuts. Tx. Agric. Exp. Sta. Prog. Rep. 3525. 9 pp.
8. SAS Institute. 1987. SAS/STAT(R) Guide for personal computers, Version 6 Edition. SAS Institute, Inc. Cary, NC.
9. Smith, J. W. and C. S. Barfield. 1982. Management of preharvest insects. pp. 250-325 *in* H. E. Pattee and C. T. Young (eds.), Peanut Science and Technology. Amer. Peanut Res. Educ. Soc., Yoakum, TX 77995.
10. Smith, J. W. and R. L. Sams. 1977. Economics of thrips control on peanuts in Texas. Southwestern Entomol. 2:149-154.
11. Sullivan, G. A. 1990. Peanut production practices. Pages 14-25 *in* 1990 Peanuts. N. C. Agric. Ext. Ser., North Carolina State Unversity. Publ. Ag-331.
12. Tappan, W. B. and D. W. Gorbet. 1979. Relationship of seasonal thrips population to economics of control on Florunner peanuts in Florida. J. Econ. Entomol. 72:772-776.
13. Tappan, W. B. and D. W. Gorbet. 1981. Economics of tobacco thrips control with systemic pesticides on Florunner peanuts in Florida. J. Econ. Entomol. 74:283-286.
14. Wehtje, G. R., J. A. McGuire, R. H. Walker, and M. G. Patterson. 1986. Texas Panicum (*Panicum texanum*) control in peanuts (*Arachis hypogaea*) with paraquat. Weed Sci. 34:308-311.
15. Wilcut, J. W. and C. W. Swann. 1990. Timing of paraquat applications for weed control in Virginia-type peanuts (*Arachis hypogaea*). Weed Sci. 38:558-562.
16. Young, S., R. E. Kinzer, R. R. Walton, and R. S. Matlock. 1972. Field screening for tobacco thrips resistance in peanuts. J. Econ. Entomol. 65:828-832.

Accepted June 1, 1991