The Influence of Cultivar and Chlorimuron Application Timing on Spotted Wilt Disease and Peanut Yield

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ABSTRACT

The effects of chlorimuron application timing on the development of spotted wilt disease of peanut caused by tomato spotted wilt tospovirus was studied in fifteen field trials in Georgia from 2000 through 2007. Chlorimuron at 9 g ai/ha was applied to new peanut cultivars at various intervals ranging from 60 to 105 days after emergence (DAE) under weed-free conditions. When averaged over chlorimuron application timings, AP-3, and Georgia-02C had less spotted wilt incidence than Georgia Green but only AP-3 produced yields equivalent to Georgia Green. AT-201 had significantly higher levels of spotted wilt and 44% lower yields when compared to Georgia Green. Spotted wilt incidence of Georgia-03L did not differ from Georgia Green but the yields of GA-03L were 24% lower than Georgia Green. Differential tolerance of peanut cultivars to chlorimuron was not observed. When averaged over cultivars, chlorimuron applied at 60–69 DAE, 70–79 DAE, or 90–99 DAE increased the incidence of spotted wilt by 6–9%. However, peanut yields were not reduced by any application of chlorimuron.

Key Words: *Arachis hypogaea* L., herbicide/disease interaction, cultivar tolerance.

Florida beggarweed [*Desmodium tortuosum* (Sw.) DC] is listed among the four most common and troublesome weeds in Alabama, Florida, and Georgia (Webster 2005). A single Florida beggarweed plant reduced peanut yield 19% within 60 cm of the weed (Cardina and Brecke 1991), while a maximum yield loss from a density of 8 weeds/m^2 approached 36% (Hooper 1978; Webster and Cardina 2004). Chlorimuron is a postemergence, broadleaf herbicide labeled for use in the Southeast U.S. to control Florida beggarweed (Anonymous, 2008). It was registered for use on peanut in 1989 (Hammes *et al.*, 1990). Currently, chlorimuron is used on approximately 10% of the peanut hectares grown in Georgia (N. L. Smith, unpubl. data, 2006). Chlorimuron applications will not recover crop yield losses associated with early-season Florida beggarweed interference, but will improve harvest efficiency (Webster and Cardina, 2004).

Previous research indicated that the tolerance of peanut to chlorimuron was acceptable when applied no earlier than 60 days after emergence (DAE) (Brown *et al.*, 1993; Colvin and Brecke, 1988; Hammes et al., 1990). The tolerance of peanut at this time is based upon a reduction in absorption, translocation, and more extensive metabolism of the herbicide (Wilcut *et al.*, 1989). Despite the peanut tolerance observed at 60 DAE, chlorimuron can suppress growth by reducing the lengths of the cotyledonary lateral branches and main stem (Mitchem *et al.*, 1995). Newer research has shown that chlorimuron poses a yield-reducing risk only when the crop has been stressed by other factors (Grey and Wehtje 2004).

Spotted wilt disease, caused by tomato spotted wilt tospovirus, was first observed in peanut in Brazil in 1941 (Sherwood and Melouk, 1995). Since the early 1990's, spotted wilt has become the most damaging disease in the southeastern U.S. peanut production region (Brown *et al.* 2005, Todd *et al.*, 1998). In response to this problem, a risk index of management strategies, including cultivar, planting date, seeding rate, and others was developed to help producers minimize the potential impact of this disease (Brown *et al.* 2008). Although the risk index has been very successful and widely adopted, there is some concern that other management factors not presently accounted for in the index, such as herbicide use, may also affect the incidence of spotted wilt disease.

Observations from commercial peanut fields since 1999 suggested that chlorimuron may influence the incidence of spotted wilt. Earlier studies conducted on the interaction of chlorimuron with certain plant diseases indicated that a correlation does not exist (Johnson and Brown, 1990; Johnson *et al.*, 1994). However, the cultivars used in these studies are no longer commercially available. Thus, the objective of this research was to evaluate the effects of chlorimuron, applied at various timings,

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on the development of spotted wilt disease on currently used peanut cultivars.

Materials and Methods

Field trials were conducted at fifteen locations (15 site-years) in Georgia from 2000 through 2007. A complete description of the cultivars, planting, and harvesting dates can be found in Table 1. Common production practices and Cooperative Extension recommendations were used at all locations.

Chlorimuron at 9 g ai/ha was applied at various intervals ranging from 60 to 105 DAE and were grouped into the following six categories: 1) non-treated control; 2) 60–69 DAE; 3) 70–79 DAE; 4) 80–89 DAE; 5) 90–99 DAE; and 6) 100+ DAE. A non-ionic surfactant (Nonionic surfactant, 80/20, United Agri Products, Inc., P.O. Box 1286, Greeley, CO 80632-1286) at 0.25% v/v was included with all treatments. At all locations, treatments were arranged in a randomized complete block design with 3 or 4 replications. The treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 140 to 187 L/ha at 220 to 275 kPa. The plot areas were maintained weed-free using a combination of mechanical cultivation, hand-weeding, and commonly used preemergence and postemergence peanut herbicides on an as needed basis.

Incidence of spotted wilt was measured just prior to peanut inverting by counting the number of disease loci per linear row in 31 cm sections and transforming the data to percentage infection based upon total row length. Peanut yield data were obtained using commercial inverting and harvesting equipment. Peanut yields are adjusted to 10% moisture. Data were subjected to analysis of variance (Proc GLM) with site-year as a random effect. Prior to analysis, spotted wilt incidence data were arcsine transformed. However, there were no differences in the conclusions of the analysis when the non-transformed data were analyzed, therefore, original means are presented.

There were no significant peanut variety by chlorimuron timing interactions, but main effects for variety and chlorimuron were significant. Due to the differences in replication among site-years, a Dunnett's Test for each treatment mean was calculated for comparison to a standard treatment ($P = 0.05$) (Lentner and Bishop, 1993; Steel and Torie, 1980). Treatment means for the significant main effects were compared to Georgia Green (Branch, 1996) for the variety main effect and to the nontreated control for main effect of chlorimuron application timing. Georgia Green is currently considered to be the industry standard and is grown on approximately 60% of the hectarage in the southeast (J.P. Beasley, pers. commun., 2008).

Table 1. Peanut cultivars, locations, planting, and harvest dates.

Cultivar	Location	Planting Date	Harvest Date
AP-3	Attapulgus	05/02/2005	09/14/2005
AP-3	Tifton	05/10/2006	09/25/2006
AT-201	Midville	05/06/2002	10/04/2002
C-99R	Tifton	05/08/2000	10/02/2000
C-99R	Tifton	05/10/2001	09/24/2001
C-99R	Tifton	05/23/2002	10/09/2002
Georgia Green	Tifton	05/08/2000	10/02/2000
Georgia Green	Doerun	05/25/2001	—[a]
Georgia Green	Tifton	05/10/2001	09/14/2001
Georgia Green	Doerun	05/02/2002	10/01/2002
Georgia Green	Tifton	05/23/2002	09/30/2002
Georgia Green	Doerun	05/26/2003	10/16/2003
Georgia-02C	Tifton	05/10/2006	10/09/2006
Georgia-02C	Tifton	05/08/2007	10/16/2007
Georgia-03L	Tifton	05/08/2007	10/08/2007

[a]Yield data were not collected from this location.

Results and Discussion

Peanut Cultivar.

The influence of peanut cultivar on spotted wilt disease incidence and yield is presented in Table 2. AP-3 had significantly less spotted wilt and produced yields equivalent to Georgia Green. AT-201 had significantly higher levels of spotted wilt and 44% lower yields when compared to Georgia Green. C-99R had similar levels of tomato spotted wilt but 12% lower yields than Georgia Green. Georgia-02C had less spotted wilt but produced 20% lower yields when compared to Georgia Green. Spotted wilt incidence of Georgia-03L did not differ from Georgia Green. However, the yields of this variety were 24% lower than Georgia Green. Despite having a high level of spotted wilt incidence (38%), Georgia Green yields were excellent (>5000 kg/ha). This may be one of the reasons that Georgia Green continues to be grown on a majority (60%) of the hectarage in the southeast (J.P. Beasley, pers. commun., 2008).

Chlorimuron Timing.

The influence of chlorimuron application timing on spotted wilt disease incidence and peanut yield is presented in Table 3. All applications of chlorimuron, except those made between 80–89 DAE and 100+ DAE, caused significant

Table 2. The influence of peanut cultivar on the incidence of spotted wilt disease and peanut yield.[a]

Variety	Spotted Wilt			Yield		
	n[b]	Incidence[c]	Dunnett's	n[b]	kg/ha[c]	Dunnett's
			%			
AP-3	32	7*	6	30	4780	380
AT-201	16	48*	7	16	2800*	485
C-99R	48	34	5	48	4440*	320
Georgia-02C	40	32*	5	39	4030*	346
Georgia-03L	20	42	7	20	3810*	440
Georgia Green	38	–		79	5020	–

[a]Averaged over five chlorimuron timings and fifteen site-years. Chlorimuron applied at 9 g ai/ha.
[b]n = number of observations.
[c]Treatment means are compared to the industry standard (Georgia Green) using Dunnett's Test ($P < 0.05$). Asterisk indicates significance.

increases in spotted wilt incidence (6–9%). A difference between the non-treated control and the 80–89 DAE interval could not be detected. However, this interval had a lower sample size number (n = 11) and thus, a higher Dunnett's value relative to the rest of the intervals. These results contradict the results of earlier research that suggested that chlorimuron does not have an influence on the incidence of spotted wilt disease (Johnson and Brown, 1990). Other herbicides have not been found to have an influence on the incidence of spotted wilt virus in peanut (Dotray *et al.*, 2006; Faircloth and Prostko, 2006). Peanut yields were not reduced by any timing of chlorimuron ($P = 0.3321$). Previous research has shown that peanuts have acceptable tolerance to chlorimuron (Brown *et al.*, 1993; Colvin and Brecke, 1988; Grey and Wehtje, 2004; Hammes *et al.*, 1990).

Summary and Conclusions

The results of this research confirms on-farm observations that chlorimuron has the potential to increase the incidence of spotted wilt disease of peanut. However, peanut yields appear to be unaffected by this increase. Thus, the effects of chlorimuron on spotted wilt are minimal in comparison to the many other production practices that influence this disease such as cultivar, planting date, plant population, tillage, soil insecticide, and row spacing (Brown *et al.* 2005, 2008). Consequently, late-season Florida beggarweed populations that have the potential to reduce peanut harvest efficiency and fungicide spray deposition should continue to be managed with chlorimuron. Additionally, the peanut cultivars evaluated in these tests did not exhibit differential tolerance to chlorimuron.

Table 3. The influence of chlorimuron timing on the incidence of spotted wilt disease and peanut yield[a]

Timing[b]	Spotted Wilt			Yield[e]	
	n[c]	Incidence[d]	Dunnett's	n[c]	kg/ha
			%		
Control	58	28	–	54	4690
60–69	55	35*	5	53	4310
70–79	51	37*	5	46	4180
80–89	11	35	9	11	5400
90–99	56	34*	5	52	4470
100+	16	30	8	16	4110

[a]Averaged over six peanut cultivars and fifteen site-years. Chlorimuron applied at 9 g ai/ha.
[b]DAE = days after peanut emergence.
[c]n = number of observations.
[d]Treatment means are compared to the non-treated control using Dunnett's Test ($P < 0.05$). Asterisk indicates significance.
[e]F-test for yield was not significant ($P = 0.3321$).

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