Tolerance of Virginia-Type Peanut to Different Application Timings of 2,4-DB

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ABSTRACT

Field studies were conducted to determine the effects of 2,4-DB application timings on yield and market quality of virginia-type peanut. Trials were conducted at three locations in Texas and one location in North Carolina in 1997, 1998, and 1999. 2,4-DB at 0.45 kg ae/ha was applied 30, 45, 60, 90, and 120 d after planting (DAP). Additional timings included combinations of 30 DAP followed by (fb) 60, 90, or 120 DAP; 60 DAP fb 90 or 120 DAP; and 90 DAP fb 120 DAP. Peanut yield, market grade factors, and pod and seed weight were not influenced by various application timings of 2,4-DB.

Key Words: Crop tolerance, market grade, yield.

The herbicide 2,4-DB [4-(2,4-dichlorophenoxy)butanoic acid] has provided inexpensive broadleaf weed control in peanut for many years (Buchanan *et al.*, 1982; Wilcut *et al.*, 1995; Grichar *et al.*, 1997). In 1999, 38% of the peanut hectares were treated with 2,4-DB (USDA-NASS, 2000). Many problem broadleaf weeds including common cocklebur (*Xanthium strumarium* L.), golden crownbeard [*Verbesina encelioides* (Cav.) Benth. & Hook f. ex Gray], morningglory species [*Ipomoea* spp.], and sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby] are controlled by 2,4-DB (Buchanan *et al.*, 1982; Wehtje *et al.*, 1992; Grichar and Sestak, 1998). Applications of 2,4-DB have been shown to inhibit horsenettle (*Solanum carolinenese* L.) fruiting (Banks *et al.*, 1977). Growers often apply 2,4-DB with other herbicides or with foliar fungicides to improve weed control, broaden weed spectrum, and/or reduce cost of multiple applications (Wilcut, 1991; Wehtje *et al.*, 1993, 1994, 1995).

In susceptible broadleaf weeds, 2,4-DB is rapidly converted to 2,4-D [2,4-(dichlorophenoxy) acetic acid] through beta oxidation (Cobb, 1992). Most legumes, however, lack or show reduced beta oxidation, thereby imparting a degree of tolerance through a reduction in active 2,4-D within the plant. Further tolerance of legumes to 2,4-DB is through a combination of reduced spray retention, less effective absorption, and reduced translocation (Hawf and Behrens, 1974). Visual injury symptoms of 2,4-DB can be observed in the form of rolled or elongated foliage (Ketchersid *et al.*, 1978; Prostko *et al.*, 1999). However, peanut producers have been concerned about potential peanut yield or grade reductions from 2,4-DB, especially if applied during reproductive periods. A study conducted in Texas on spanish-type peanut indicated 2,4-DB applied between maximum pegging and early pod (fruit) enlargement reduced yield and affected quality and pod size (Ketchersid *et al.*, 1978). However, these yield reductions occurred when 2,4-DB was applied at 0.9 kg/ha, which is more than the registered rate. Multiple applications at 0.45 kg/ha did not affect spanish peanut (Ketchersid *et al.*, 1978). Grichar *et al.* (1997) reported that single and multiple applications of 2,4-DB at 0.45 kg/ha did not affect runner-type peanut yield or market grade characteristics.

Limited data are available documenting the effect of 2,4-DB on virginia-type peanut yield and grades when applied at various times throughout the growing season. Jordan *et al.* (2001) suggested that late season applications of 2,4-DB did not affect pod yield or market grade characteristics. Therefore, the objective of this research was to evaluate the effects of 2,4-DB at various timings on yield and grade of virginia-type peanut.

Materials and Methods

Field studies were conducted at four locations near Rayland, TX (1997, 1998); Yoakum, TX (1997); and Lewiston, NC (1998). Soil at Rayland was a Miles loamy fine sand (mixed, thermic Udic Paleustalfs) with a pH of 7.4 and organic matter of 0.1%; at Yoakum, the soil was a Tremona loamy fine sand (thermic Aquic Arenic Paleustalfs) with a pH of 6.9 and organic matter content of 1.0%; and in North Carolina the soil was a Norfolk sandy loam (fine-loamy, siliceous, thermic, Aquic Paleudults) with a pH of 6.2 and organic matter content of 2.3%. Pendimethalin, [N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] at 1.1 kg/ha was applied preplant incorporated to the entire plot area at each location for control of annual grasses and small seeded broadleaf weeds. The entire trial area was maintained weed free for the duration of the studies through hand weeding.

The peanut cultivar NC 7 was planted at Rayland on 2 May 1997 and 1998 at 100 kg/ha; at Yoakum on 16 June 1997 at 90 kg/ha; and at Lewiston on 9 May 1998 at 130 kg/ha. Plot size was two rows by 7.6 to 9 m in length with 91-cm row spacing. The trial in North Carolina was rainfed while the sites in Texas were irrigated as needed.

The experimental design was a randomized complete block with three or four replications. Treatments included the dimethylamine salt of 2,4-DB at 0.45 kg ae/ha applied once at 30, 45, 60, 90, or 120 DAP; or twice at 30 DAP followed by (fb) either 60, 90, or 120 DAP; 60 DAP fb either 90 or 120 DAP; 90 fb 120 DAP. Application timings corresponded with the following approximate peanut growth stages: pre-flowering, flowering, pegging, pod development, and pod maturity. All herbicides were applied in water at 187 L/ha at 83 to 193 kPa with either a compressed-air bicycle sprayer or a CO_2 pressurized backpack sprayer.

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Visual injury (0 = no crop injury and 100 = crop death) was evaluated throughout the growing season.

Peanuts were dug, inverted and allowed to air dry for 5 to 14 d before combining. Harvested pods were weighed and a 250-g sample was collected to determine market grade characteristics. Peanut grades [which included sound mature kernels (SMK) and sound split kernels (SS)] were determined using the procedure described by the Federal-State Inspection Serv. (USDA, 1986). Percentage of other kernels (OK) was collected at all locations and percentage of damaged kernels (DK) was collected at all Texas locations. Peanut pod, nut, and hull weights were collected from 100 mature pods from both locations in 1997. Data were subjected to analysis of variance and means compared using Fisher's protected LSD (P = 0.10). Lack of a location by treatment interaction allowed pooling of data over locations and years.

Results and Discussion

No significant visual injury or differences in pod shape were observed for any of the treatments or locations (data not shown). Occasional symptomology characteristics of 2,4-DB were noted at each location but never exceeded 5% (Prostko *et al.*, 1999). Peanut yields and quality factors (including SMK, OK, and DK) with the exception of SS were not affected by 2,4-DB regardless of application timing (Table 1). While there were differences between treatments in SS, this did not result in differences in grade. Also, no treatment reduced SS when compared to the control. Hull, pod, and seed weight also were not affected at the two locations in Texas in 1997 (Table 2).

This research was in agreement with Grichar *et al.* (1997) in which runner-type peanut were not affected by various application timings of 2,4-DB. Ketchersid *et al.* (1978) indicated that, with spanish-type peanut, applications made at registered rates did not reduce yields. However, they did observe a reduction in other kernels when 2,4-DB was applied at 0.45 kg/ha during the post-bloom state.

Table 1. Effect of 2,4-DB application timings on peanut yield and quality.[a]

Application timing	Peanut yield	Quality factors[b]				
		SMK	SS	Grade	OK	DK
DAP[b]	kg/ha	%				
Control	3400	60	7	67	3	2
30	3250	60	7	67	3	2
45	3160	59	8	67	3	2
60	3520	61	7	68	3	2
90	3410	59	8	67	4	2
120	3440	61	8	69	3	2
30 + 60	3100	60	7	67	3	2
30 + 90	3250	59	7	66	3	3
30 + 120	3350	58	8	66	3	2
60 + 90	3500	60	8	68	2	2
60 + 120	3300	58	9	67	2	2
90 + 120	3490	59	9	68	2	3
LSD (0.10)	NS	NS	1	NS	NS	NS

[a]Data are pooled over four locations, except DK that was pooled over three locations.

[b]Abbreviations: SMK = sound mature kernels, SS = sound split kernels, Grade = sound mature kernels + sound split kernels, OK = other kernels, DK = damaged kernels, DAP = days after planting.

Table 2. Effect of 2,4-DB application timing on pod and seed weight[a].

Application timing	Pod weight	Seed weight	Hull weight
DAP[b]	g		
Control	227	162	64
30	225	160	63
45	221	148	64
60	244	172	70
90	224	160	63
120	234	171	63
30 + 60	219	156	63
30 + 90	226	161	64
30 + 120	226	162	63
60 + 90	226	176	67
60 + 120	234	171	68
90 + 120	223	161	62
LSD (0.10)	NS	NS	NS

[a]Data based on 100 pods. Data are pooled over two locations in 1997.

[b]Abbreviations: DAP = days after planting.

Our research indicates that 2,4-DB applied at various timings (from prebloom to pod maturity) does not adversely affect virginia-type peanut. The maximum registered use rate for 2,4-DB on peanut is 0.45 kg/ha in the Southwest and 0.28 kg/ha in the Southeast (Anon., 2001). In addition, applications made 120 DAP, which is beyond that allowed by the label (100 DAP), did not affect peanut. The normal use rate for 2,4-DB is 0.28 kg/ha with two applications frequently made (authors' pers. observations). Therefore, under these conditions, injury or yield reductions from applications of 2,4-DB on virginia-type peanut should not occur.

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