Effects of Various Timings of 2,4-DB on Runner-Type Peanut Development and Yield

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ABSTRACT

Field experiments were conducted to determine the effect of the dimethylamine salt of 2,4-DB at 0.45 kg ae/ha applied at various times during the growing season on runner peanut growth, development, and pod yield. The herbicide was applied once at 30, 45, 60, 90, or 120 d after planting. Additional treatments included 2,4-DB at 0.45 kg/ha applied twice beginning at 30, 60, or 90 d after planting or applied three times beginning at 30, 45, or 60 d after planting. The dates of application were selected to expose plants to the herbicide during all stages of development from prebloom through early pod development. Peanut yield and grade were not affected by 2,4-DB regardless of application timing or numbers of applications.

Key Words: Application timing, *Arachis hypogaea* L., grade, herbicide, postemergence.

Phenoxy herbicides are generally toxic to broadleaf weeds and crops. However, legumes tolerate 2,4-DB [4-(2,4-dichlorophenoxy)butanoic acid] because they do not convert the butyric acid side chain into acetic acid as readily as most broadleaf plants (Fertig *et al.*, 1964; Wathana *et al.*, 1972; Buchanan *et al.*, 1982). Ketchersid *et al.* (1978) reported that 2,4-DB was not readily absorbed by peanut (*Arachis hypogaea* L.) leaves, was not accumulated in the seed at harvest, and was very slowly metabolized to 2,4-D [(2,4-dichlorophenoxy) acetic acid]. In contrast, redroot pigweed (*Amaranthus retroflexus* L.) readily absorbed 2,4-DB and rapidly converted it to 2,4-D. The 2,4-D was subsequently translocated to the apical regions of the pigweed plant and caused severely reduced growth and death (Ketchersid *et al.*, 1978).

Southwestern peanut producers commonly use 2,4-DB for broadleaf weed control because of its low cost and broad spectrum of control. It controls many broadleaf weeds, including common cocklebur (*Xanthium strumarium* L.), *Ipomoea* morningglory species, sicklepod [*Senna obtusifolia* (L.) Irwin and Barneby], and smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.] (Buchanan *et al.*, 1982). Growers commonly mix 2,4-DB with other postemergence broadleaf herbicides to improve the spectrum of control (Wilcut *et al.*, 1994). In the Southeast, 2,4-DB is commonly applied with foliar fungicides to avoid the expense of separate applications (Wilcut *et al.*, 1995).

Although peanut tolerates 2,4-DB, growers are concerned about possible adverse effects to peanut when applied at various times through the growing season. A single application of 2,4-DB at 0.9 kg/ha to the spanish-type cultivar Starr during the reproduction stage (the most herbicide-sensitive period) reduced both yield and market grade and resulted in enlarged pods (Ketchersid *et al.*, 1978). These enlarged pods many times contain only a small seed and are commonly called "pops." However, repeated application at 0.45 kg/ha had no effect. The normal use rate in the Southwest is 0.28 kg/ha.

Since most peanuts now grown in Texas are runner types, Texas growers are concerned that 2,4-DB will result in enlarged pods if used during the reproductive stage of growth. No data are available on the effect of 2,4-DB on runner-type peanut when applied at various growth stages. Therefore, the objectives of this study were to determine the effect of timing of 2,4-DB applications on yield and grade of runner-type peanut and to determine if enlarged pods were produced following application of 2,4-DB.

Materials and Methods

Field studies were conducted at the Texas Agric. Exp. Stn. near Yoakum, TX in 1991, 1992, 1993, and 1995 on a Tremona loamy fine sand soil (thermic Aquic Arenic Paleustalfs) with less than 1% organic matter and a pH of 6.9 to 7.2. Pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine] at 1.1 kg/ha was applied preplant incorporated. Weeds escaping pendimenthalin were removed by hand.

The cultivar Florunner was planted on 12 June 1991, 1 May 1992, and 7 June 1993. The cultivar GK-7 was planted on 1 May 1995. The seeding rate was 100 kg/ha. Plot size was two 9-m rows spaced 91 cm apart. Treatments were arranged in a randomized complete block and replicated four times. Plots were irrigated as needed during the growing season. Disease and insect control was consistent with Extension Service recommendations.

In addition to a nontreated check, treatments included the dimethylamine salt of 2,4-DB at 0.45 kg/ha applied once 30, 45, 60, 90, or 120 d after planting (DAP), twice beginning 30, 45, or 60 DAP or three times beginning 30, 45, or 60 DAP (Table 1). The herbicide was applied in water using a compressed-air bicycle sprayer equipped with flat fan nozzles and calibrated to deliver 190 L/ha at 180 kPa. Peanut was in the prebloom, flowering, pegging to early pod development, pod-filling, and pod maturity stages at 30, 45, 60, 90, and 120 DAP, respectively.

Peanut was dug at maturity and allowed to dry in the field for 4 to 6 d before mechanical threshing. Harvested pods were dried to 10% moisture and cleaned of pegs, stems, and inert matter by hand before weighing. Peanut grade was determined from a 250-g pod sample following procedures described by the Federal-State Inspection Service (USDA, 1986). A 400-g pod sample was observed visually to determine if abnormal pods had developed. One hundred mature pods were selected at random, weighed, and shelled. Seed and shell weights were taken to determine differences in development.

Data were subjected to an analysis of variance. A year-by-treatment interaction was not observed, and data were

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pooled over years. Means of 2,4-DB treatments were compared with the nontreated check using Fisher's Protected LSD Test at P = 0.05.

Results and Discussion

No differences in peanut plant growth or pod shape or size were noted (data not shown). Additionally, no differences in seed weight were observed among 2,4-DB application timings (Table 1). Ketchersid *et al.* (1978) noted that they found enlarged pods at harvest in plots treated 40, 44, 48, and 54 DAP with 2,4-DB at 0.9 kg/ha.

No differences in pod yield or grade were noted between the nontreated check and any 2,4-DB herbicide treatment (Table 1). Ketchersid *et al.* (1978) reported that 2,4-DB at 0.45 or 0.90 kg/ha applied once at 21, 35, or 49 DAP or applied sequentially at 21 and 35 or 21, 35, and 49 DAP did not affect the yield of spanish-type peanut. However, lower percentages of sound mature kernels and total kernels and higher percentages of other kernels were observed when 2,4-DB at 0.9 kg/ha was applied at the post-bloom stage 55 DAP. Ketchersid *et al.* (1978) concluded that spanish-type peanut was most susceptible to 2,4-DB between the period of maximum pegging and early pod development (60 to 75 DAP). These researchers also reported the activity of 2,4-DB to be increased by high relative humidity following herbicide application.

Table 1. Effect of 2,4-DB applied at 0.45 kg/ha on peanut growth, yield, and grade[a].

Application timing	100 pod weight			Peanut yield	Grade[b]
	Total	Seeds	Hulls		
DAP	g			kg/ha	%
30	128.7	99.8	28.8	2580	64.5
45	129.6	100.8	28.8	2560	64.3
60	129.3	100.2	29.7	2320	64.3
90	129.0	99.7	29.2	2310	65.1
120	127.6	98.6	28.8	2340	65.1
30,60	128.2	98.8	29.2	2580	65.4
30,90	126.7	97.8	28.8	2500	65.7
30,120	124.6	97.1	27.5	2610	65.9
60,90	131.2	100.7	30.3	2380	64.1
60,120	125.0	96.2	29.0	2310	65.1
90,120	128.0	98.9	28.9	2400	64.8
30,60,90	128.9	99.1	29.7	2360	65.0
30,90,120	125.6	96.7	28.8	2500	64.9
60,90,120	128.7	99.5	29.1	2420	66.4
30,60,120	130.5	100.3	30.1	2440	65.2
45,60	130.3	100.8	29.3	2480	65.6
45,60,90	128.5	99.0	29.4	2330	64.7
Untreated	128.3	99.5	28.7	2500	66.4
LSD (0.05)	NS	NS	NS	NS	NS

[a]Data pooled over 4 yr.

[b]Grade = sound mature kernels + sound split kernels.

The maximum labeled use rate for 2,4-DB on peanut in the Southwest is 0.45 kg/ha applied two times during the growing season (Anon., 1997). In our study, no adverse effects of 2,4-DB were noted on runner-type peanut yield or grade regardless of time of application or number of applications when the maximum use rate of 0.45 kg/ha was applied. The normal use rate of 2,4-DB in the Southwest is 0.28 kg/ha with up to two applications per season, which is approximately 60% of the rate evaluated in this 3-yr experiment. Our results indicate runner-type peanut should not be adversely affected by 2,4-DB applied any time from prebloom through pod maturity.

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