

## **Peanut Response to 2,4-DB plus Crop Oil at Various Application Timings<sup>1</sup>**

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### **ABSTRACT**

2,4-DB is an effective post emergence herbicide for broadleaf weed control in peanut, but concerns over crop safety and its effect on yield and quality still exist. Field experiments were conducted to determine the effect of the dimethylamine salt of 2,4-DB with or without crop oil concentrate at various application timings on yield of runner peanut. 2,4-DB at 0.4 lb ae/A was applied 30, 45, 60, 90, and 120 days after planting (DAP). Sequential 2,4-DB timings included 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 and quality were not affected by 2,4-DB regardless of the addition of crop oil concentrate or application timings.

**KEYWORDS:** Application timing, *Arachis hypogaea* L., 2,4-DB, crop oil concentrate, herbicide tolerance.

**Abbreviations:** AG-CARES, Agricultural Complex for Research and Extension Center; COC, crop oil concentrate; DAP, days after planting; fb, followed by; PPI, preplant incorporated; POST, post emergence; WAP, weeks after planting; WPGRF, Western Peanut Growers Research Farm.

### **INTRODUCTION**

Peanut (*Arachis hypogaea* L.) production on the Texas Southern High Plains has increased 10-fold from approximately 18,000 acres in 1987 to 180,000 acres in 2000 (Anonymous 2000). Over this period, peanut production has increased from approximately 65 million to nearly one-half billion pounds. Yet, yield and quality are still reduced because some weeds are not controlled effectively with current weed management practices. Weeds that escape control cost producers \$20 to \$50/A due to yield reductions, \$3 to \$25/A due to quality reductions, and \$53 to \$158/A due to reduced harvest efficiency (Bridges 1992; Bryson 1989).

Control of many grass and small-seeded broadleaf weeds can be achieved with a dinitroaniline herbicide such as ethalfluralin, pendimethalin, or trifluralin applied preplant incorporated (PPI) (Wilcut et al. 1994). Bentazon, acifluorfen, pyridate, paraquat, imazethapyr, and imazapic are all used in peanut because of their post emergence (POST) activity, but weed tolerances and escapes exist with each of these herbicides (Wilcut et al. 1994). Herbicide mixtures that contain 2,4-DB provide consistent broad-spectrum weed control in the Virginia-North Carolina region, the southeastern region, and in the southwest.

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Phenoxyacetic acid herbicides are phytotoxic to both broadleaf weeds and crops. However, 2,4-DB or phenoxybutanoic acid is an inactive herbicide and must undergo beta oxidation (the removal of two carbons from butanoic acid to render acetic acid) to be activated. Leguminous crops have low beta oxidase activity, which may prevent the rapid conversion to 2,4-D (Wain and Wightman 1954). Additional tolerance is achieved in leguminous crops because of the combination of reduced spray retention and translocation and less effective absorption (Hawf and Behrens 1974). In 1997, 2,4-DB was applied to 13% of planted acres of peanuts in Texas, which totaled over 13,000 pounds of active ingredient (Smith et al. 1998). Injury to peanut with 2,4-DB is a concern to many growers in this region, especially during reproductive periods (Baughman et al. 2002). Ketchersid et al. (1978) reported that a single application of 2,4-DB at 0.8 lb ae/A (a rate that exceeds label recommendations) from maximum pegging to early pod enlargement reduced yield and affected peanut quality on Spanish-type peanut. Grichar et al. (1997) reported that runner-type peanut yield and grade was not affected by 2,4-DB during all stages of development from prebloom through early pod development. Baughman et al. (2002) reported that Virginia-type peanut yield, grade, and pod and seed weight were not influenced by 2,4-DB when applied to peanut from pre-flowering to pod maturity. There is debate as to whether differences in injury occur when 2,4-DB is used with crop oil concentrate (COC), since adjuvants enhance herbicide efficacy by increasing absorption (Wanamarta and Penner 1989). Therefore, the objective of this research was to evaluate the effects of 2,4-DB with or without crop oil concentrate at various application timing on runner-type peanut yield in West Texas.

## MATERIALS AND METHODS

Field experiments were conducted at the Agricultural Complex for Research and Extension Center (AG-CARES) in 1999 near Lamesa, TX and at the Western Peanut Growers Research Farm (WPGRF) in 2000 near Denver City, TX. The soil at AG-CARES is an Amarillo fine sandy loam (fine-loamy, mixed, super active, thermic Aridic Paleustalf; 0.4% organic matter; pH 7.8). At WPGRF, the soil is a Brownfield fine sand (loamy, mixed, super active, thermic Arenic Aridic Paleustalf; 0.1% organic matter; pH 7.8). The cultivar AT 120 was planted on May 5, 1999 and Flavor Runner 458 was planted on May 16, 2000. The seeding rate was 80 lb/A. Plot size was 13 by 30 ft in both years. Center pivot irrigation was used throughout the season in both years. Traditional production practices were used to maximize peanut growth, development, and yield. All plots were cultivated and hand-weeded throughout the growing season to maintain weed-free conditions. No fungicides or insecticides were needed in either year.

Dimethylamine salt of 2,4-DB at 0.4 lb ae/A was applied once at 30, 45, 60, 90, and 120 days after planting (DAP); or twice at 30 DAP followed by (fb) 60, 90, or 120 DAP; 60 DAP fb either 90 or 120 DAP; 90 DAP fb 120 DAP. Application timings corresponded with the following approximate peanut growth stages: pre-flowering, flowering, pegging, pod development, and pod maturity. These treatments were made with COC (paraffin-based petroleum oil (83%) and surfactant blend (17%)) at 1.25% v/v and alone (without COC). A non-treated control was also included.

All herbicide treatments were applied in 10 gallons per acre at 28 psi. Peanut injury was estimated visually throughout the growing season (approximately 3, 6, 10, and 20 weeks after planting (WAP)) at each location using a scale of 0 (no injury) to 100 (peanut death) (Frans et al. 1986). Canopy height and width were recorded 10 and 20 WAP at Lamesa. Peanut yield was determined by digging the pods based on maturity of control plots, air-drying in the field for 6 to 10 d, and harvesting individual plots with a small-plot thresher. Yield samples were cleaned and adjusted to 10% moisture. Pod, shell, and peanut kernel weight were determined from each sample at WPGRF. Grades were determined for a 200-g pod sample following procedures described by the Federal-State Inspection Service (USDA, 1986).

At each location, the experimental design was a randomized complete block with three replications. Data were subjected to an analysis of variance with partitioning appropriate for the factorial arrangement of 2,4-DB application timings and COC. If no year by application timing by COC interaction or two-way interaction was observed, then only main effects were compared. Main effect means were compared using Fisher's Protected LSD test at  $P=0.05$ .

*Table 1.* Effect of 2,4-DB applied at 0.4 lb/A on pod yield averaged over locations and crop oil.

Application	30	45	60	90	120	30	30	30	60	60	90	Untreated	LSD
Timing						fb	fb	fb	fb	fb	fb		(P#0.05)
DAP <sup>a</sup>						60	90	120	90	120	120		
Peanut Yield lb/A	3770	3689	3836	3984	3960	3818	3568	4038	3567	3694	4060	3668	NA

## RESULTS AND DISCUSSION

**Visual injury and canopy stature.** No application timing by COC interaction was observed for peanut injury; therefore, main effects were compared. Visual injury was noted following all 2,4-DB applications regardless of application timing and use of COC, but no injury exceeded 5% (data not shown). This injury consisted of a chlorotic speckling of the upper leaves and petioles and a slight but easily noticeable strapping effect common of phenoxy herbicides (Prostko and Baughman, 1999). Injured petioles remained chlorotic and speckled throughout the season. Similar injury was noted by Baughman et al. (2002) and Prostko and Baughman (1999). By 20 WAP, no injury was noted for any treatment (data not shown). Regardless of application timing, 2,4-DB did not affect canopy height (data not shown). At 10 WAP, canopy width was not influenced by 2,4-DB application timing, but was affected by the use of COC ( $p=0.0052$ ). Canopy width following 2,4-DB plus COC (12.8 in.) was less than the canopy width following 2,4-D applied alone (13.4 in.). No difference in canopy height or width was observed at 20 WAP.

**Peanut yield and quality.** No year by application timing by COC interaction or two-way interaction was observed; therefore, only main effects were compared. No differences in pod yield were noted among 2,4-DB application timings when averaged across year and COC (Table 1). Similar results were reported for runner-type (Grichar et al. 1999) and Virginia-type (Baughman et al. 2002) peanuts following 2,4-DB applications without COC. Pod yield ranged from 3789 to 3834 and was not different among COC treatments when averaged across year and application timing (data not shown). Peanut yield when averaged across application timings and COC treatments was different over years ( $p<0.001$ ) (Table 2). In 1999, peanut yield was 4780 lb/A, which was greater than the yield observed in 2000 (2839 lb/A). This difference is likely the result of the differences in seasonal temperature and poor harvest conditions due to excessive fall rainfall in 2000 compared to 1999. In fact, in seven variety trials conducted in the major production regions in Texas in 1998, Flavor Runner 458 produced similar or greater yields at all locations when compared to AT 120 (Anonymous 1999). Peanut quality was not affected by application timing when averaged across COC (data not shown) nor by COC when averaged across application timings (Table 3). Ketchersid et al. (1978) reported that a single application of 2,4-DB at 0.8 lb ae/A (above the labeled rate) during the reproductive stage reduced market grade; however, Baughman et al. (2002) reported no differences in quality factors (sound mature kernels (SMK), sound splits + SMK, other kernels, damaged kernels) as a result of 2,4-DB at 0.4 lb ae/A regardless of application timing.

Table 2. Effect of 2, 4-DB applied at 0.4 lb/A on pod yield averaged over application timings and crop oil.

Year	1999	2000	LSD (P#0.05)
Peanut Yeild lb/A	4782	2839	248

*Table 3.* Effect of 2,4-DB applied at 0.4 b/A on peanut quality averaged across application\timings.

Crop Oil Concentrate % V/V <sup>a</sup>	Quality Factors <sup>a</sup>			
	SMK	SS	Grade	DK
0	52	24	76	1
1.25	53	24	77	2
Untreated	52	23	75	1
LSD (P#0.05)	NS	NS	NS	NS

<sup>a</sup>Abbreviations: SMK = Sound mature kernels, SS = Sound split kernels, Grade = sound mature kernels + sound split kernels, DK + damaged kernels, V/V = volume per volume

## CONCLUSIONS

These experiments indicate that 2,4-DB with or without COC applied at various application timings from prebloom to pod maturity does not adversely affect two runner-type peanut varieties in West Texas. The addition of COC with 2,4-DB did not adversely affect peanut growth, yield, or quality (including enlarged and misshapen pods) and likely will improve weed control due to improved herbicide uptake.

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