Crop Protection 29 (2010) 1034–1038

Contents lists available at ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Peanut variety response to postemergence applications of carfentrazone-ethyl and pyraflufen-ethyl

W. James Grichar [a,*], Peter A. Dotray [b], T.A. Baughman [c]

[a] Texas AgriLife Research, 3507 Hwy 59E, Beeville, TX 78102-9410, United States
[b] Texas AgriLife Research, 1102 E FM 1294, Lubbock, TX 79403, United States
[c] Texas AgriLife Extension Service, 11708 Hwy 70S, Vernon, TX 76384, United States

ARTICLE INFO

Article history:
Received 10 December 2009
Received in revised form
10 May 2010
Accepted 11 May 2010

Keywords:
Arachus hypogaea L.
Carfentrazone-ethyl
Groundnut
Herbicide injury
Peanut tolerance
Postemergence
Pyraflufen-ethyl
Visible injury
Yield

ABSTRACT

Field experiments were conducted in the south Texas and Texas High Plains area in 2005 and 2006 to evaluate peanut variety tolerance to carfentrazone-ethyl and pyraflufen-ethyl. Lactofen was used as the standard. Carfentrazone-ethyl at 0.03 and 0.04 kg ai/ha, pyraflufen-ethyl at 0.003 and 0.004 kg ai/ha, and lactofen at 0.22 kg ai/ha were applied 35 days after planting (DAP) in south Texas and 51–56 DAP in the High Plains area in weed-free plots. Peanut cultivars selected for evaluation were those normally used in each area. In south Texas, Tamrun 96, Tamrun OL 01, and Tamrun OL 02 were evaluated while in the High Plains area, Flavor Runner 458, GP-1, and Tamrun OL 02 were evaluated. No peanut cultivar by herbicide interaction was observed in south Texas but an interaction did occur in the High Plains. In south Texas, peanut stunting was 10% or less with both herbicides and rates. In 2005, carfentrazone-ethyl at 0.04 kg/ha resulted in a yield reduction when compared with the untreated check while in 2006 both rates of carfentrazone-ethyl and the high rate of pyraflufen-ethyl reduced yield compared to the untreated check. No grade differences were noted among herbicide treatments. In the High Plains area, the high dose of both carfentrazone-ethyl and pyraflufen-ethyl caused the greatest peanut injury (at least 25%) compared with lactofen (6% or less). In 2005, the high dose of pyraflufen-ethyl and lactofen reduced yield compared with the untreated check while in 2006 both carfentrazone-ethyl and pyraflufen-ethyl reduced yield compared with the untreated check.

1. Introduction

Peanut (*Arachis hypogaea* L.) production in the U.S. increased from 582,000 ha in 1968 to 605,000 ha in 2008 (Anonymous, 2008a). Peanut yield increased nearly 2-fold over this 40-year period in part due to effective herbicides coupled with other cultural practices. However, weeds continue to be a major pest problem in all peanut growing regions. Weeds can reduce peanut yield 60– 80% through competition and reduced harvest efficiency (Buchanan et al., 1982; Wilcut et al., 1995).

Peanut has several unique features that contribute to challenging weed management. Most peanut cultivars grown in the United States require a 140–160 d growing season, depending on cultivar and geographical region (Henning et al., 1982; Wilcut et al., 1995). Because of this extensive growing season, soil-applied herbicides may not provide season-long control and mid-to-late season weed problems are common. Peanut has a prostrate growth habit, a relatively shallow canopy, and is slow to shade inter-rows allowing weeds to be more competitive with the peanut plant (Walker et al., 1989; Wilcut et al., 1995). Additionally, peanut fruit develops underground on pegs originating from branches that grow along the soil surface. This prostrate growth habit and pattern of fruit development restricts cultivation to an early season control option (Brecke and Colvin, 1991; Wilcut et al., 1995). With conventional row spacing (91–102 cm), complete ground cover may not be attained until 8–10 wk after planting. In some areas of the U.S. peanut growing region, complete canopy closure may never be attained.

Weeds compete with the peanut plant for sunlight, moisture, and nutrients throughout the growing season. However, weeds can also reduce harvesting efficiency. Weeds are particularly troublesome during digging and inverting procedures (Young et al., 1982). Weed biomass slows field-drying of peanut vines and pods and increases the likelihood of exposure to rainfall, which can also increase harvesting losses (Young et al., 1982; Wilcut et al., 1995). The fibrous root system of annual grasses is extremely difficult to separate from the peanut (Wilcut et al., 1994a).

Control of annual grasses and small-seeded broadleaf weeds can be achieved with a dinitroaniline herbicide applied preplant

* Corresponding author.
E-mail address: w-grichar@tamu.edu (W.J. Grichar).

0261-2194/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.cropro.2010.05.003

incorporated (PPI) (Wilcut et al., 1994a); however, control of larger-seeded weeds such as *Ipomoea hederacea* must occur by other means. Imazethapyr applied postemergence (POST) provided broad-spectrum and most consistent control when applied within 10 d of weed emergence (Cole et al., 1989; Grey et al., 1995; Grichar et al., 1992; Wilcut et al., 1991a,b; Wilcut et al., 1994b,c). Imazapic applied POST controls all the weeds controlled by imazethapyr (Nester and Grichar, 1993; Grichar et al., 1994; Wilcut et al., 1993, 1994c, 1995). In addition, imazapic provided control and suppression of *Desmodium tortuosum* (S.W.) D.C. and *Senna obtusifolia* (L.) Irwin & Barneby, which are not adequately controlled by imazethapyr (Grey et al., 2001). The limiting factors on the use of imazethapyr and imazapic are the rotational restriction (18 months) to rotational crops such as cotton (*Gossypium hirsutum* L.) and sorghum (*Sorghum bicolor* L. Moench) and the potential development of weeds resistant to the ALS-inhibiting class of herbicides (York and Wilcut, 1995).

Herbicides with different modes of action that are as efficacious as the imidazolinone herbicides without the rotation restrictions would be useful in peanut. In 2004, sulfentrazone was registered for use in peanut in the southeast (Alabama, Georgia, North Carolina, South Carolina, Virginia, and Mississippi), but this label excluded states like Texas because significant injury has been observed. Since 2004, peanut has been removed from the label (Anonymous, 2008c). Carfentrazone has a U.S. label for use in peanut and is efficacious on several annual broadleaf weeds including *Ipomoea* species, but only as a burndown treatment prior to planting and as a directed (hooded) application in-crop any time during the growing season (Anonymous, 2008b). Both sulfentrazone and carfentrazone belong in the protoporphyrinogen oxidase (PPO) family of herbicides. Pyraflufen-ethyl, another PPO inhibitor, may be effective if used POST in peanut. This herbicide, utilized primarily in cereal crops, is registered for use in cotton as a harvest aid/defoliant and POST-directed spray, with potato (*Solanum tuberosum* L.) as a harvest aid/defoliant, and as a burndown/preplant herbicide for cotton, soybean (*Glycine max* L.), and corn (*Zea mays* L.) It is also registered for use in soybean from crop emergence to the V6 growth stage for control of certain broadleaf weeds (Anonymous, 2004). Until 2004, few data had been collected on the use of carfentrazone-ethyl or pyraflufen-ethyl in peanut. The objective of this research was to evaluate peanut tolerance to carfentrazone-ethyl and pyraflufen-ethyl applied POST at various locations in the peanut growing regions of Texas.

2. Materials and methods

2.1. Experimental locations

Peanut tolerance studies were conducted in south Texas near Yoakum (29.0369° N, 97.2616° W; elevation, 1153 m) and in the Texas High Plains near Lamesa (32.7563° N, 101.9202° W; elevation, 9455 m). The soils at Yoakum were a Denhawken sandy clay loam (fine, smectitic, hyperthermic, Vertic Haplustepts, 1.6% organic matter, pH 7.6) and at Lamesa the soils were an Amarillo fine sandy loam (fine-loamy, mixed, superactive, thermic Aridic Paleustalf, 0.4% organic matter, pH 7.8). Planting date, application dates, and other variables for each study are given in Table 1.

2.2. Plot design and herbicide treatments

Treatments consisted of a factorial arrangement of four herbicide treatments (carfentrazone-ethyl at 0.03 or 0.04 kg ai/ha and pyraflufen-ethyl at 0.003 or 0.004 kg ai/ha) and three peanut cultivars. Lactofen at 0.22 kg ai/ha was applied as a standard and an untreated check was included in each study. Each study was replicated three to four times depending on location. At the south Texas location, these herbicides were applied 35 days after planting (DAP) in 2005 and 36 DAP in 2006. At the High Plains location, herbicides were applied 51 DAP in 2005 and 56 DAP in 2006. At Yoakum, Agridex (blend of 83% paraffin-based petroleum oil and 17% surfactant; Helena Chemical Company, Suite 500, 6075 Poplar Avenue, Memphis, TN 38137) at 1.25% v/v was used with carfentrazone-ethyl, pyraflufen-ethyl, and lactofen treatments while at Lamesa crop oil concentrate (85% mineral oil and 15% polyoxyethoxylated polyol acid ester and polyol fatty acid ester; Helena Chemical Company, 225 Schilling Boulevard, Suite 300, Collierville, TN 38017) at 1.0% v/v was used with carfentrazone-ethyl and crop oil concentrate at 0.5% v/v was used with pyraflufen-ethyl and lactofen.

Table 1
Weather conditions at time of herbicide application in south Texas and the High Plains of Texas.

Variable	South Texas		High Plains	
	2005	2006	2005	2006
Planting date	June 7	June 12	April 26	April 24
Application date	July 12	July 18	June 16	June 19
Time of application	6:40 AM	8:15 AM	10:30 AM	9:30 AM
Air temperature (°C)	23.9	26.1	27.7	31.7
Relative humidity (%)	90	90	45	38
Soil temperature (*C*)	26.7	26.7	25.6	27.2

2.3. Peanut cultivars

Peanut cultivars evaluated were those commonly grown in each production area. In south Texas, Tamrun 96 (T 96), Tamrun OL 01 (OL 01), and Tamrun OL 02 (OL 02) were evaluated while in the High plains area, Flavor Runner (FLV) 458, GP-1, and OL 02 were evaluated.

2.4. Plot size and production practices

Individual plot size was 1.9 by 7.6 m at Yoakum and 2 by 9.1 m at Lamesa. Seasonal rainfall at Yoakum (June through Oct) was 31.7 mm in 2005 and 29.7 mm in 2006 while at Lamesa seasonal rainfall (May through Oct) was 42 mm in 2005 and 26.4 mm in 2006. Supplemental irrigation was supplied as needed at both locations. Traditional production practices were used to maximize peanut growth, development, and yield. All plots received a dinitroaniline herbicide applied preplant incorporated and were cultivated and hand-weeded throughout the growing season to maintain weed-free conditions. Insecticides were not needed at any location in any year.

2.5. Herbicide application

Herbicides were applied using water as a carrier with a CO_2-pressurized backpack sprayer using Teejet 11002 DG flat fan nozzles (Teejet Spraying Systems Co., P.O. Box 7900, Wheaton, IL 60188) that delivered 190 L/ha at 180 kPa at Yoakum or Teejet 80015 flat fan nozzles that delivered 140 L/ha at 207 kPa at Lamesa.

2.6. Data collection

Peanut injury (leaf burn) was estimated visually 6–8 d after herbicide application at Yoakum and these ratings were taken 14 d after application in the High Plains. Peanut stunting was rated 60–65 d after herbicide application. Peanut injury and stunting were based on a scale of 0–100 (0 = no peanut injury or stunting to 100 peanut death). Peanut yield was determined by digging the