MANAGEMENT OF THREE WEED SPECIES COMMONLY FOUND IN OKLAHOMA PEANUTS *Arachis hypogaea* AND INTERFERENCE OF CROWNBEARD *Verbesina encelioides* WITH PEANUTS

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CODY JACK GRAY

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Southwestern Oklahoma State University

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Thesis Approved:

Don S. Murray
Thesis Advisor

Ronald J. Tyrl

Michael Smith

Alfred Carlozzi
Dean of the Graduate College

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INTRODUCTION

This thesis was written in a format to facilitate submission for publication in Weed Technology, a journal of the Weed Science Society of America.

Chapter I

Management of Crownbeard (*Verbesina encelioides*), Hophornbeam Copperleaf (*Acalypha ostryifolia*), and Entireleaf Morningglory (*Ipomoea hederacea* var. *intergriuscula*) in Peanuts (*Arachis hypogaea*)

Management of Crownbeard (*Verbesina encelioides*), Hophornbeam Copperleaf (*Acalypha ostryifolia*), and Entireleaf Morningglory (*Ipomoea hederacea* var. *intergriuscula*) in Peanuts (*Arachis hypogaea*)

Abstract: Two field experiments were conducted in 2000 near Ft. Cobb, Oklahoma to evaluate crownbeard control. One experiment evaluated herbicides commonly used in peanut, soybean, grain sorghum, corn, and cotton. At this location, crownbeard and hophornbeam copperleaf were predominant. Clomazone, diuron, fluometuron, diclosulam, and cloransulam applied preemergence (PRE) controlled crownbeard ≥ 94% 12 weeks after activation (WAA). Cloransulam, diclosulam, atrazine plus COC, chlorimuron plus NIS, and prosulfuron plus NIS applied postemergence (POST) controlled crownbeard ≥ 96% 8 weeks after treatment (WAT). Diclosulam, flumioxazin, and flufenacet plus isoxaflutole applied PRE controlled hophornbeam copperleaf ≥ 89% 12 WAA. Cloransulam, lactofen plus COC, and atrazine plus COC applied POST controlled hophornbeam copperleaf > 95% 12 WAA. A second experiment used herbicides currently labeled or expecting a label for use in peanuts. In this experiment, peanuts were infested with crownbeard and entireleaf morningglory. All preemergence herbicides provided ≥ 86% crownbeard control for the entire season. 2,4-DB, pyridate plus 2,4-DB, bentazon plus 2,4-DB plus COC, and acifluorfen plus 2,4-DB controlled crownbeard ≥ 93% 8 WAT. Diclosulam applied PRE controlled entireleaf morningglory 84% 12 WAA, while 2,4-DB, pyridate plus 2,4-DB, and bentazon plus 2,4-DB plus COC applied POST controlled entireleaf morningglory ≥ 93% 8 WAT.

Nomenclature: Acifluorfen; atrazine; bentazon; bromoxynil; clomazone; cloransulam; 2,4-D; 2,4-DB; dicamba; diclosulam; SAN 582 (proposed common name, dimethenamid), 2-chloro-*N*-[(1-methyl-2-methoxy)ethyl]-*N*-(2,4-dimethyl-thien-3-yl)acetamide; diuron; (proposed common name, flufenacet), *N*-(4-fluorophenyl)-*N*-(1-methylethyl)-2-[[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl]oxy]acetamide; flumetsulam; flumioxazin; fluometuron; fomesafen; glyphosate; halosulfuron; imazamox; imazapic; imazethapyr; (proposed common name, isoxaflutole), 5-cyclopropyl-4-(2-methylsulfonyl-4-trifluoromethylbenzoyl)isoxazole; lactofen; metolachlor; metribuzin; MSMA; oxyfluorfen; paraquat; prometryn; CGA-152005 (proposed common name, prosulfuron), 1-(4-methoxy-6-methyl-triazin-2-yl)-3-[2-(3,3,3-trifluoropropyl)phenylsufonyl]urea; pyridate; pyrithiobac; crownbeard, *Verbesina encelioides* (Cav.) Benth. & Hook f. ex Gray #[1] VEEEN; entireleaf morningglory, *Ipomoea hederacea* var. *intergriuscula* Gray # IPOHG; hophornbeam copperleaf, *Acalypha ostryifolia* Riddell # ACCOS; peanut, *Arachis hypogaea* L. 'Tamspan 90'.

Additional index words: Pre-mix of flufenacet plus isoxaflutole[2]; pre-mix of acifluorfen plus bentazon[3].

Abbreviations: COC, crop oil concentrate; NIS, nonionic surfactant; POST, postemergence; PRE, preemergence; UAN, urea-ammonium nitrate; WAA, weeks after activation; WAT, weeks after treatment.

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[1]Letters with this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available only on computer disk from WSSA, 810 East 10th Street, Lawrence, KS 66044-8897.

[2]Epic™ herbicide label. Bayer Corporation, 8400 Hawthorn Road, P.O. Box 4913, Kansas City, MO 64120-0013.

[3]Storm® herbicide label. BASF Corporation, P.O. Box 13528, Research Triangle Park, NC 27709-3528.

INTRODUCTION

Due to the high production costs and market value of peanuts, producers must consider several factors in order to maximize their net return. Weed control is of utmost importance in increasing yield, which in turn, maximizes net returns. If weed control is not obtained, losses can occur due to weeds competing with the crop for nutrients, water, space, and light.

Crownbeard, entireleaf morningglory, and hophornbeam copperleaf are weeds commonly found in Oklahoma peanuts. Crownbeard ranks as the fourth most common and the third most troublesome weed to control in Oklahoma peanuts (Dowler 1998). Dowler also reported that morningglory species rank as the ninth most common and hophornbeam copperleaf ranked as the sixth most troublesome weed to control in Oklahoma peanuts.

Until the last 3 yr, information regarding crownbeard control was only available in unpublished research reports. These unpublished data collected by Oklahoma State University have shown variable crownbeard control by herbicides commonly used in peanuts. For example, 4 yr of data have shown dimethenamid applied preemergence (PRE) at 1.12 kg ai/ha resulted in variable control ranging from 37 to 100% 4 wk after treatment (WAT) and 14 to 95% 8 WAT. Similar variable control was observed with metolachlor applied PRE at 2.24 kg ai/ha which resulted in 65 to 99% control 4 WAT and 20 to 93% control 8 WAT. Therefore, consistent or predictable crownbeard control cannot be ascertained from these unpublished data for the aforementioned herbicides and other herbicides, including imazethapyr, imazapic, pendimethalin, and trifluralin. Variability in crownbeard control could be due to environmental conditions; the lack of a timely activating rainfall after application; different application methods, rates, and timings; plant growth stages, size, and population at the time of application.

Grichar and Sestak (1998) have provided excellent information about the control of crownbeard for both soil-applied and postemergence (POST) herbicides. They reported bentazon or 2,4-DB alone controlled crownbeard ≥ 90%, while acifluorfen at 0.42 kg ai/ha, pyridate, and lactofen provided ≥ 80% control. Prosulfuron, if applied PRE or soon after peanut emergence, controlled crownbeard > 90%; however, if applied POST crownbeard control was < 70% (Grichar et al. 2000). They also reported peanut injury and concluded peanut did not have an adequate tolerance to prosulfuron for use in a peanut herbicide program. Hancock (2000) concluded that sulfentrazone used as a soil-applied herbicide resulted in ≥ 88% control of crownbeard, entireleaf morningglory, and hophornbeam copperleaf.

Recently, two new herbicides have been developed. Diclosulam received a label for use in peanuts in 2000 and flumioxazin was labeled for use in peanuts in 2001. Diclosulam has been reported to provide control of several broadleaf weeds including crownbeard, hophornbeam copperleaf, and morningglory species (Anonymous 2000[4]). Flumioxazin applied PRE is reported to control crownbeard, hophornbeam copperleaf, morningglory species, including entireleaf morningglory, as well as other commonly found broadleaf weeds (Altom 2000, Anonymous 1999[5], Braun 2000, Cranmer 2000).

A common practice in Oklahoma is rotating crops to use other herbicides or other herbicide families to control weeds that are generally hard to control in a particular crop. With this in mind, this research project was established to determine herbicides or herbicide combinations that can be used as a single application to control weeds

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[4]Anonymous. 2000. Storngarm® Herbicide. Indianapolis, IN: Dow AgroSciences Technical Bull. L01-044-006.

[5]Anonymous. 1999. Valor™ Herbicide. Walnut Creek, CA: Valent U.S.A. Corporation Technical Info. Bull. 9912-VLR-2000.

commonly found in Oklahoma peanuts, as well as, other crops that may be in rotation with peanuts.

MATERIALS AND METHODS

Two field experiments were conducted in southwestern Oklahoma near Ft. Cobb in 2000. One experiment was located on a producer's field and did not have a crop; therefore, it will be referred to as the non-crop experiment. The other experiment was located on the Caddo Research Station and did have a peanut crop; therefore, it will be referred to as the in-crop experiment. Both experiments were conducted on a Cobb fine sandy loam (fine-loamy, mixed, thermic Udic Haplustalfs). The non-crop experiment had a soil pH of 7.4 with 1.0% organic matter. The in-crop experiment had a soil pH of 7.1 with 0.7% organic matter.

Both experiments were arranged as a randomized complete block design with four replications. All herbicide applications were made using a tractor mounted compressed air sprayer calibrated to deliver 140 L/ha. Pendimethalin was applied PRE to both experiments on May 15, at a rate of 0.56 kg ai/ha to control small seeded broadleaf weeds and annual grasses. Crop oil concentrate[6] (COC), nonionic surfactant[7] (NIS), and urea ammonium nitrate (UAN) were applied at 2.3 L/ha, 0.25% v/v, and 2.3 L/ha, respectively, when specified in the treatment list for these experiments.

Dependent variables were analyzed using the ANOVA statistical model. Variables evaluated were visual control ratings for both experiments and peanut yield for only the in-crop experiment. Data were separated using

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[6]Agridex, a heavy range paraffin base petrolium oil, polyl fatty acid esters, and polyethoxylated derivatives. Helena Chemical Co., 6075 Poplar Ave., Suite 500, Memphis, TN 38119.

[7]Latron AG-98 contains 80% alkylaryl polyoxyethene glycol. Rohm and Haas Co., Philadelphia, PA 19106.

Fisher's protected LSD at the 5% probability level.

Non-crop Experiment. This field experiment was designed to aid producers, crop consultants, extension agents, and other personnel, who are in the position of making herbicide and cropping decisions for the control of crownbeard and hophornbeam copperleaf. A peanut crop was not planted for the purpose of being able to use herbicides commonly used in peanut, soybean, grain sorghum, corn ,and cotton. Plot size was 3 m wide by 6 m long.

Preemergence herbicides were applied on May 15, consisting of 15 treatments (Table 1). Postemergence herbicides were applied 2 wk later on June 14, consisting of 27 treatments. Two untreated checks were also included for a total of 44 treatments. Appreciable rainfall was not received to activate the PRE treatments until approximately 10 d after treatment. High soil moisture allowed some weed seedlings to emerge prior to activation of the PRE treatments (author's personal observation). Visual control ratings were taken using a scale 0 to 100%, where 0 equals no weed control and 100% equals complete weed control or death of the weed or crop. An assessment of chlorosis, necrosis, stunting, and vigor of the crop and weed were used when assigning visual control ratings. Visual control ratings were taken June 14, June 29, July 13, July 27, and August 10, for the PRE treatments that corresponded to 4, 6, 8, 10, and 12 weeks after activation (WAA), respectively. Visual control ratings for the POST treatments were taken June 29, July 13, July 27, and August 10, which correspond to 2, 4, 6, and 8 WAT, respectively. At the time of POST applications, crownbeard were approximately 1.3 to 7.5 cm tall with 2 to 8 leaves and hophornbeam copperleaf were 2.5 to 10 cm tall with 2 to 15 leaves. Crownbeard densities were 54 to 86 plants/m^2 and hophornbeam copperleaf densities were 11 to 32 plants/m^2.

In-crop Experiment. 'Tamspan 90', a Spanish peanut cultivar, was planted May 15, to a depth of 5 cm and at a seeding rate of 90 kg/ha. Plot size was 4 rows, that were 0.9 m wide and 7.6 m in length. The center two rows were dug October 6, and machine combined October 11, to obtain yield. Standard peanut harvesting equipment was used to dig and combine the peanuts to measure yield. Some plots were not harvestable due to the presence of high weed populations (Table 2). Irrigation was applied to the experiment as needed throughout the growing season.

Six PRE treatments were applied May 15 (Table 2). Clethodim at a rate of 0.28 kg ai/ha was applied over the entire experiment on June 13, to control Texas panicum (*Panicum texanum* Buckl.) and johnsongrass [*Sorghum halepense* (L.) Pers.]. Eighteen POST treatments were applied June 30, to control crownbeard and entireleaf morningglory. Two untreated checks were also included for a total of 26 treatments. Appreciable rainfall was not received to activate the PRE treatments until approximately 10 days after treatment. High soil moisture allowed some weed seedlings to emerge prior to activation of the PRE treatments (author's personal observation). Visual control ratings were taken as described above. Visual control ratings for the PRE treatments were taken June 29, July 13, July 27, August 10, and August 23, which correspond to 4, 6, 8, 10, and 12 WAA, respectively. Postemergence control ratings were taken July 13, July 27, August 10, and August 23, which correspond to 2, 4, 6, and 8 WAT, respectively. At the time POST treatments were applied, two weed species were present, crownbeard and entireleaf morningglory. Crownbeard plants were 15 to 30 cm tall with 20 to 30 leaves, entireleaf morningglory were approximately 30 cm in diameter with a 60 cm vine, and peanut plants were 25 to 36 cm and blooming. Crownbeard densities were 5 to 6 plants/m^2 and entireleaf morningglory densities were 11 to 22 plants/m^2.

RESULTS AND DISCUSSION

Non-crop Experiment. Herbicides are grouped into their respective families then summarized by weed species, family, and application method.

Crownbeard control. Twelve of 15 treatments applied PRE controlled crownbeard > 90% 4 WAA; however, only five treatments controlled crownbeard with approximately the same efficiency 12 WAA (Table 1). These five treatments consisted of cloransulam and diclosulam, members of the triazolopyrimidine family; clomazone, an isoxazolidinone; diuron and fluometuron, members of the substituted urea family.

The triazolopyrimidines, diclosulam and cloransulam, applied PRE controlled crownbeard 98% 12 WAA, while flumetsulam applied PRE provided 76% control 12 WAA (Table 1). Clomazone and the substituted ureas, diuron and fluometuron, applied PRE controlled crownbeard $\geq$ 94% 12 WAA. These data suggest a preemergence application of a triazolopyrimidine, a substituted urea, or clomazone may provide greater than 75% full-season control of crownbeard in their respective labeled crops.

Twenty of 27 treatments applied POST controlled crownbeard > 90% 2 WAT; however, at 8 WAT five treatments controlled crownbeard > 90% and five treatments provided 80 to 89% crownbeard control (Table 1). The five treatments applied POST that controlled crownbeard > 90% 8 WAT were cloransulam, diclosulam, atrazine plus COC, chlorimuron plus NIS, and prosulfuron plus NIS.

Diclosulam and cloransulam applied POST controlled crownbeard 100% 8 WAT, while atrazine, a triazine, applied POST controlled crownbeard 96% 8 WAT (Table 1). The sulfonylureas, chlorimuron and prosulfuron, applied POST controlled crownbeard $\geq$ 98%, while halosulfuron applied POST provided 78% crownbeard control 8 WAT. Our data suggested prosulfuron controlled crownbeard better than the values Grichar et al. (2000) reported. They concluded no more than 70% control of crownbeard when prosulfuron was applied POST. The differences can be explained because the crownbeard size (1.5 to 7.5 cm) at the time of our POST applications were smaller than the crownbeard size (5 to 13 cm) when their POST applications were made. However, they did publish information indicating crownbeard control when peanuts were at ground crack and their weed size was < 5 cm, which is similar to the weed size at the time of our POST applications. This information indicates crownbeard may possibly be controlled by POST applications of prosulfuron if applied at ground crack or before crownbeard height reaches approximately 7.5 cm. Chlorimuron and prosulfuron were applied with a non-ionic surfactant while halosulfuron was not; therefore, if halosulfuron plus a non-ionic surfactant is applied POST, it may control crownbeard with similar efficacies as the aforementioned sulfonylureas. These data suggest a postemergence application of diclosulam, cloransulam, atrazine, or the sulfonylureas where applicable may provide control of crownbeard for 8 WAT in their respective labeled crops.

Hophornbeam copperleaf control. Eleven of 15 treatments applied PRE controlled hophornbeam copperleaf ≥ 90% 4 WAA; however, only flumioxazin, a N-phenylphthalimide, and flufenacet plus isoaxflutole, a prepackaged mixture called Epic™, controlled hophornbeam copperleaf > 90% 12 WAA (Table 1). Flumioxazin and flufenacet plus isoaxflutole applied PRE controlled hophornbeam copperleaf 99 and 91 12 WAA, respectively. This would suggest a preemergence application of flumioxazin and flufenacet plus isoaxflutole would provide season-long hophornbeam copperleaf control.

The triazolopyrimidines, cloransulam, diclosulam, and flumetsulam, controlled hophornbeam copperleaf ≥ 99, 89, and 88% for 10, 12, and 8 WAA, respectively; however, ratings for flumetsulam declined sharply after 8 WAA (Table 1). Our data agree with that reported by Reynolds et al. (1995), who suggested after a PRE application of flumetsulam in soybean, an additional POST herbicide application maybe needed to control escaped hophornbeam copperleaf plants. However, additional POST herbicide applications may not be needed for hophornbeam copperleaf control if cloransulam or diclosulam is applied PRE.

The triazines, atrazine, metribuzin, and prometryn, controlled hophornbeam copperleaf ≥ 94, 94, and 99% for 10, 8, and 6 WAA, respectively; however, hophornbeam copperleaf control declined thereafter (Table 1). Similarly, Baldwin et al. (1974) concluded metribuzin applied PRE controlled hophornbeam copperleaf initially; however, full-season control was not observed and atrazine was the most promising triazine for the control of hophornbeam copperleaf. These results suggest an additional POST herbicide application may be needed for proper season-long control of hophornbeam copperleaf depending on which triazine is applied PRE.

Twelve of the 27 treatments applied POST controlled hophornbeam copperleaf ≥ 90% 2 WAT; however, at 8 WAT 3 treatments controlled hophornbeam copperleaf > 90% and 2 treatments provided 89 to 80% hophornbeam copperleaf control (Table 1).

Cloransulam applied POST controlled hophornbeam copperleaf ≥ 91% 8 WAT; however, diclosulam applied POST provided ≤ 65% control of hophornbeam copperleaf (Table 1). Vidrine et al. (2000) observed similar hophornbeam copperleaf control when cloransulam was applied POST. They reported hophornbeam copperleaf was controlled 90 to 95% when cloransulam was applied POST as either a single application, sequential applications of cloransulam, or cloransulam followed by glyphosate. Our data along with their observations may suggest that sequential and other applications following cloransulam applied POST may not be needed.

The diphenylethers, fomesafen plus NIS, lactofen plus COC, and oxyfluorfen plus NIS, applied POST controlled hophornbeam copperleaf ≥

80, 96, and 94% for 8, 8, and 6 WAT, respectively (Table 1). Driver and Oliver (1984) and Horak et al. (1998) reported lactofen controlled hophornbeam copperleaf ≥ 90%, which agrees with these data. Horak et al. (1998) also reported fomesafen controlled hophornbeam copperleaf 80% or more control in soybean. Acifluorfen plus NIS provided the poorest hophornbeam copperleaf control of the diphenylethers, controlling hophornbeam copperleaf only 84% 2 WAT and declining to 50% 8 WAT.

Atrazine applied POST controlled hophornbeam copperleaf ≥ 99% 8 WAT, suggesting postemergence applications of atrazine may control hophornbeam copperleaf.

Acifluorfen plus bentazon plus 2,4-DB plus COC controlled hophornbeam copperleaf ≥ 85% 8 WAT. This tank mixture is generally considered the standard POST application for broadleaf weed control in Virginia peanuts (Wilcut et al. 1990; Wilcut, J.W. 1991; Wilcut et al. 1991).

The imidazolinones, imazamox, imazapic, and imazethapyr, applied PRE or POST and the phenoxy's, 2,4-D and 2,4-DB, and the benzoic acid, dicamba, applied POST did not control crownbeard or hophornbeam copperleaf. Initial control may have been observed; however, control of the two weed species declined to an unacceptable level. This information is supported by Grichar and Sestak (1998) who concluded the use of imazapic and imazethapyr provided inconsistent crownbeard control. However, this information also disagrees with Grichar and Sestak who reported 2,4-DB applied alone controlled crownbeard at least 90%. This maybe explained by the crownbeard population Grichar and Sestak reported varied from < 4 plants/m^2 to > 8 plants/m^2 compared to our crownbeard population of 54 to 86 plants/m^2 and the size of their crownbeard was larger at the time of application than the crownbeard size at the time our POST applications. This may also be explained due to the phenoxy family being used primarily for postemergence control because of the little residual activity; therefore, more weed seedlings may have emerged giving the impression of no control. These data suggest the use of a phenoxy alone applied early in the season may not adequately provide full-season control of crownbeard and hophornbeam copperleaf; however, if applied as a tank mix with other herbicides that have residual activities, acceptable control maybe obtained.

In-crop Experiment. No crop injury was observed for any treatment (data not shown).

Crownbeard Control. All of the treatments applied PRE controlled crownbeard ≥ 86% for the entire season (Table 2). Imazethapyr applied PRE controlled crownbeard 96% 12 WAA. These data disagree with the data for the non-crop experiment. This may be explained because of the presence of irrigation in the in-crop experiment. Crownbeard control with either imazapic or imazethapyr may be affected by the amount and frequency of rainfall soon after application (Richburg et al. 1993, 1995b; Wilcut et al. 1994). The presence of irrigation may have increased the efficacy of imazethapyr; therefore, producing high control ratings.

Ten of 18 treatments applied postemergence controlled crownbeard ≥ 90% 2 WAT; however, only 4 treatments controlled crownbeard with similar efficiency 8 WAT (Table 2). All of these treatments consisted of 2,4-DB applied alone or as a tank mixture. 2,4-DB applied alone controlled crownbeard ≥ 99% 8 WAT, which agrees with data reported by Grichar and Sestak (1998). This also disagrees with data collected for the non-crop experiment. The disagreement can be explained because of the crownbeard size at application. Grichar and Sestak observed crownbeard control when the plants were > 15 cm in height, which is exactly the height of the crownbeard for the in-crop experiment. The crownbeard in the non-crop experiment were ≤ 7.5 cm tall. Therefore, crownbeard plants > 15 cm tall can be controlled by 2,4-DB alone; however, crownbeard ≤ 7.5 cm tall will not be adequately controlled by 2,4-DB alone. This may also be explained due to another population of weeds emerging after the POST application had been applied.

No significant differences in crownbeard control was observed when 2,4-DB was applied as a tank mix; however, tank mixes not including 2,4-DB provided no more than 46% control of crownbeard 8 WAT. These data suggest the addition of 2,4-DB may increase late-season crownbeard control.

Entireleaf Morningglory Control. Three of 6 treatments applied PRE controlled entireleaf morningglory $\geq$ 89% 4 WAA; however, no treatments provided > 90% control of entireleaf morningglory 12 WAA. Diclosulam controlled entireleaf morningglory 84% 12 WAA, while imazethapyr provided 71% control 12 WAA. Barnes et al. (1998) and Smith et al. (1998) observed diclosulam, when applied preplant incorporated (PPI) or PRE, controlled entireleaf morningglory, pigweed, prickly sida, and suppressed some grass species. Similar control of entireleaf morningglory was observed by Richburg et al. (1995a) and Wilcut et al. (1991), they reported imazethapyr applied PPI or PRE controlled a mixture of morningglory species.

Four of 18 treatments applied POST controlled entireleaf morningglory $\geq$ 90% 2 WAT. Three of these four treatments continued to control entireleaf morningglory > 90% 8 WAT (Table 2). Once again, all treatments contained 2,4-DB applied alone or as a tank mixture.

Pyridate, a phenyl-pyridazine, when applied alone provided 31% entireleaf morningglory control 2 WAT; however, when applied as a tank mixture, pyridate plus 2,4-DB controlled entireleaf morningglory $\geq$ 94% 8 WAT (Table 2). These data also suggest the addition of 2,4-DB to a tank mixture may increase the control of entireleaf morningglory.

These experiments have both supported and disagreed with results concluded in previous research and also has provided new information about the control of crownbeard, hophornbeam copperleaf, and entireleaf morningglory. The lack of a timely activating rainfall may have caused some of the preemergence applications to not work correctly; therefore, allowing weed escapes and appearing to not provide control.

Our data suggests crownbeard control, using a preemergence application with > 90% efficacy, would be attained by using cloransulam, diclosulam, clomazone, diuron, or fluometuron. Crownbeard control using a postemergence application can be achieved by using cloransulam, diclosulam, atrazine plus COC, chlorimuron plus NIS, prosulfuron plus NIS, or pyridate plus 2,4-DB. A preemergence application of diclosulam, flumixazin, or flufenacet plus isoxaflutole would provide full-season control of hophornbeam copperleaf. Postemergence hophornbeam copperleaf control can be achieved by using cloransulam, lactofen plus COC, or atrazine plus COC. Diclosulam applied PRE provided the best preemergence control of entireleaf morningglory. 2,4-DB, pyridate plus 2,4-DB, or bentazon plus 2,4-DB plus COC would provide entireleaf morningglory control for up to 8 WAT.

The experiments conducted in this thesis need to be repeated to ensure the conclusions made here are accurate. The conclusions made here also do not imply the herbicides will not provide control of the weed species present. Our results involve making one application; however, if the herbicides are used in a herbicide program acceptable control may be attained. However, some of the herbicides used in this thesis may be useful in making one application for the control of crownbeard, hophornbeam copperleaf, and entireleaf morningglory.

LITERATURE CITED

Altom, J. V., J. R. Cranmer, and J. A. Pawlak. 2000. Valor™ herbicide - The new standard for layby applications in cotton. Proc. South. Weed Sci. Soc. 53:159.

Baldwin, F., P. Santelmann, and H. Greer. 1974. Weed control systems for hophornbeam copperleaf control in peanuts. Agron. J. 66:789-792.

Barnes, J. W., L. R. Oliver, and J. L. Barrentine. 1998. Potential of diclosulam (Strongarm) for weed control in soybeans. Proc. South. Weed Sci. Soc. 51:61-62.

Braun, J. C., J. R. Cranmer, and J. V. Altom. Valor™ herbicide: A new preemergence herbicide in peanuts. Proc. South. Weed Sci. Soc. 53:158-159.

Cranmer, J. R., J. V. Altom, J. C. Braun, and J. A. Pawlak. 2000. Valor™ herbicide: A new herbicide for weed control in cotton, peanuts, soybeans, and sugarcane. Proc. South. Weed Sci. Soc. 53:158.

Dowler, C. C. 1998. Weed survey-Southern states: Broadleaf crops subsection. Proc. South. Weed Sci. Soc. 51:299-322.

Driver, T. L. and L. R. Oliver. 1984. Control of hophornbeam copperleaf. Arkansas Farm Res. September and October:6.

Grichar, W. J. and D. C. Sestak. 1998. Control of golden crownbeard (*Verbesina encelioides*) in peanut (*Arachis hypogaea*) with postemergence herbicides. Peanut Sci. 25:39-43.

Grichar, W. J., D. C. Sestak, K. Brewer, and B. Minton. 2000. Weed control with CGA-152005 and peanut (*Arachis hypogaea*) response. Weed Technol. 14:218-222.

Hancock, H. G. 2000. Sulfentrazone performance in peanuts. Proc. South. Weed Sci. Soc. 53:162.

Horak, M. J., Z. Gao, D. E. Peterson, and L. D. Maddux. 1998. Hophornbeam copperleaf (*Acalypha ostryifolia*) biology and control. Weed Technol. 12:515-521.

Reynolds, D. B., D. L. Jordan, P. R. Vidrine, and J. L. Griffen. 1995. Broadleaf weed control with trifluralin plus flumetsulam in soybean (*Glycine max*). Weed Technol. 9:446-451.

Richburg, J. S., III, J. W. Wilcut, and E. F. Eastin. 1995a. Weed management in peanut (*Arachis hypogaea*) with imazethapyr and metolachlor. Weed Technol. 9:807-812.

Richburg, J. S., III, J. W. Wilcut, and G. Wiley. 1993. Toxicity of foliar and/or soil applied AC 263,222 to purple(*Cyperus rotundus*) and yellow (*C. esculentus*) nutsedge. Weed Sci. 42:398-402.

Richburg, J. S., III, J. W. Wilcut, and G. Wiley. 1995b. AC 263,222 and imazethapyr rates and mixtures for weed management in peanut (*Arachis hypogaea*). Weed Technol. 9:801-806.

Smith, M. C., D. R. Shaw, and S. M. Schraer. 1998. Soybean weed control with Strongarm, Firstrate, and Frontrow. Proc. South. Weed Sci. Soc. 51:62-63.

Vidrine, P. R., D. K. Miller, J. L. Griffin, and J. P. Caylor. 2000. Utility of firstrate (cloransulam-methyl) in soybean weed control programs. Proc. South. Weed Sci. Soc. 53:236-237.

Wilcut, J. W. 1991. Economic yield response of peanut (*Arachis hypogaea*) to postemergence herbicides. Weed Technol. 5:416-420.

Wilcut, J. W., J. S. Richburg, III, G. Wiley, F. R. Walls, Jr., S. R. Jones, and M. J. Iverson. 1994. Imidazolinone herbicide systems for peanut (*Arachis hypogaea* L.). Peanut Sci. 21:23-28.

Wilcut, J. W., C. S. Swann, and H. B. Hagwood. 1990. Lactofen systems for broadleaf weed control in peanuts (*Arachis hypogaea*). Weed Technol. 4:819-823.

Wilcut, J. W., F. R. Walls, Jr., and D. N. Horton. 1991. Weed control, yield, and net returns using imazethapyr in peanuts (*Arachis hypogaea* L.). Weed Sci. 39:238-242.

Table 1. Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area in 2000.

Treatment[b]	Rate	VEEEN[a]						ACCOS				
		6/14[c]	6/29	7/13	7/27	8/10		6/14	6/29	7/13	7/27	8/10
PRE	kg ai/ha						%					
		4	6	8	10	12	WAA[d]	4	6	8	10	12
Cloransulam	0.84	100	100	99	99	98		100	100	100	99	75
Diclosulam	0.03	99	100	100	100	98		98	98	93	94	89
Flumetsulam	0.07	99	100	91	88	76		95	94	88	67	60
Flumioxazin	0.11	93	95	81	80	64		100	100	100	100	99
Atrazine	1.68	99	96	91	83	75		100	100	98	94	79
Metribuzin	0.56	99	91	83	73	49		99	98	94	79	70
Prometryn	1.68	61	43	35	23	16		98	99	66	89	74
Clomazone	0.42	100	99	100	94	94		26	25	25	25	0
Pyrithiobac	0.07	63	19	6	4	0		94	80	59	75	33
Diuron	1.68	99	98	95	96	94		58	84	68	64	70
Fluometuron	1.68	100	99	99	99	99		93	81	78	74	78
Imazapic	0.07	93	86	63	48	40		86	86	73	63	59
Imazethapyr	0.07	74	69	48	32	13		51	58	23	29	0
Dimethenamid	2.24	96	96	71	71	65		90	80	53	55	55
Flufenacet +	0.37											
isoxaflutole	0.08	100	98	85	78	68		100	100	96	94	91
POST												
		-	2	4	6	8	WAT	-	2	4	6	8
Cloransulam	0.84	-	100	100	100	100		-	91	100	100	100
Diclosulam	0.03	-	100	100	100	100		-	40	53	64	65
Acifluorfen + NIS	0.42	-	63	53	49	25		-	84	71	70	50
Fomesafen + NIS	0.42	-	88	85	81	80		-	95	95	80	84

Table 1 (cont). Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area in 2000.

		VEEEN[a]						ACCOS				
Treatment[b]	Rate	6/14[c]	6/29	7/13	7/27	8/10		6/14	6/29	7/13	7/27	8/10
POST	kg ai/ha						%					
		-	2	4	6	8	WAT[d]	-	2	4	6	8
Lactofen + COC	0.22	-	95	89	85	68		-	100	100	99	96
Oxyfluorfen + NIS	0.56	-	93	65	51	34		-	100	94	100	71
Atrazine + COC	1.12	-	100	100	98	96		-	100	100	99	100
Pyrithiobac + NIS	0.07	-	99	96	88	86		-	24	3	0	0
Chlorimuron + NIS	0.01	-	100	100	99	98		-	61	66	59	55
Halosulfuron	0.05	-	93	88	85	78		-	43	28	45	13
Prosulfuron + NIS	0.07	-	100	100	100	100		-	54	50	58	56
Imazamox + NIS	0.04	-	43	33	23	26		-	13	24	25	0
Imazapic	0.07	-	24	5	0	0		-	56	38	19	53
Imazethapyr + NIS	0.07	-	16	9	25	0		-	75	39	50	13
2,4-D	0.56	-	96	81	70	54		-	98	93	74	75
2,4-DB	0.45	-	53	65	52	39		-	34	15	3	0
Dicamba	0.56	-	93	84	74	54		-	43	11	0	11
Bentazon + COC	1.12	-	96	74	93	64		-	44	10	0	13
Bromoxynil + NIS	0.42	-	95	83	78	76		-	99	91	91	68
Glyphosate	1.12	-	98	91	81	66		-	96	90	83	70
MSMA + NIS	2.24	-	76	64	40	33		-	83	83	75	56
Paraquat + NIS	0.14	-	95	60	52	39		-	68	23	15	19
Pyridate	1.57	-	100	91	78	68		-	90	90	74	53
Bentazon +	0.56											
2,4-DB	0.14	-	100	95	93	84		-	16	8	25	0

Table 1 (cont). Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area in 2000.

Treatment[b]	Rate	VEEEN[a]						ACCOS				
		6/14[c]	6/29	7/13	7/27	8/10		6/14	6/29	7/13	7/27	8/10
POST	kg ai/ha						%					
		-	2	4	6	8	WAT[d]	-	2	4	6	8
Acifluorfen +	0.42											
2,4-DB	0.28	-	96	79	80	71		-	90	89	64	46
Acifluorfen +	0.28											
bentazon + COC	0.56	-	93	68	75	83		-	94	80	79	66
Acifluorfen +	0.28											
bentazon +	0.56											
2,4-DB + COC	0.28	-	96	86	85	80		-	98	98	95	85
Untreated check 1		0	0	0	0	0		0	0	0	0	0
Untreated check 2		0	0	0	0	0		0	0	0	0	0
LSD (0.05)		19	23	28	26	31		28	33	37	42	41

[a]VEEEN, crownbeard; ACCOS, hophornbeam copperleaf.

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate 2.3 L/ha.

[c]Dates visual ratings were taken. Dashes represent no ratings because treatment had not been applied.

[d]WAA, wk after activation; WAT, wk after treatment.

Table 2. Visual ratings for crownbeard and entireleaf morningglory control and peanut yield in 2000.

Treatment[b]	Rate	VEEEN[a]						IPOHG					Peanut yield[d]
		6/29[c]	7/13	7/27	8/10	8/23		6/29	7/13	7/27	8/10	8/23	
PRE	kg ai/ha						%						kg/ha
		4	6	8	10	12	WAA[e]	4	6	8	10	12	
Flumioxazin	0.07	85	90	90	96	95		61	43	23	0	0	2858
Flumioxazin	0.11	99	86	98	95	94		89	61	33	24	24	2828
Diclosulam	0.03	100	100	100	100	100		97	95	90	86	84	3764
Imazethapyr	0.07	100	100	100	98	96		93	93	80	74	71	3951
Dimethenamid	1.68	98	100	98	99	98		38	46	36	8	6	-
Metolachlor	1.34	86	91	90	93	89		13	21	0	0	0	-
POST													
		-	2	4	6	8	WAT	-	2	4	6	8	
Diclosulam + NIS	0.03	-	90	80	73	70		-	70	79	84	79	2751
Imazethapyr + NIS	0.07	-	46	25	24	24		-	15	29	59	53	-
Imazapic + NIS	0.07	-	69	51	20	19		-	60	68	85	78	3672
Paraquat + NIS	0.14	-	69	39	36	31		-	19	0	0	0	-
Chlorimuron + NIS	0.01	-	91	68	69	69		-	50	54	34	31	2563
Acifluorfen + NIS	0.28	-	80	53	69	68		-	58	33	25	23	-
Acifluorfen + NIS	0.42	-	94	90	69	68		-	66	26	6	6	-
2,4-DB	0.56	-	99	100	100	100		-	93	99	100	100	3616
Pyridate	1.57	-	95	89	93	89		-	31	19	13	10	-
Pyridate +	1.57												
2,4-DB	0.45	-	100	100	99	99		-	94	96	99	98	3519
2,4-DB +	0.14												
bentazon	1.12	-	83	71	86	83		-	74	79	89	85	3087

Table 2. (cont). Visual ratings for crownbeard and entireleaf morningglory control and peanut yield in 2000.

		VEEEN[a]						IPOHG					Peanut
Treatment[b]	Rate	6/14[c]	6/29	7/13	7/27	8/10		6/14	6/29	7/13	7/27	8/10	yield[d]
POST	kg ai/ha						%						kg/ha
		-	2	4	6	8	WAT[e]	-	2	4	6	8	
2,4-DB +	0.45												
bentazon + COC	1.12	-	96	98	94	93		-	93	95	96	93	3169
2,4-DB +	0.28												
acifluorfen	0.42	-	98	88	96	95		-	81	80	69	65	-
Bentazon +	0.56												
acifluorfen + COC	0.28	-	85	80	48	46		-	70	43	29	28	-
Bentazon +	0.56												
acifluorfen + NIS	0.28	-	34	25	44	41		-	50	25	16	13	2340
Bentazon +	0.56												
acifluorfen + UAN	0.28	-	66	44	40	38		-	46	19	0	0	-
Bentazon +	0.56												
acifluorfen +	0.28												
2,4-DB + NIS	0.28	-	93	90	63	60		-	65	71	59	56	2955
Bentazon +	0.56												
acifluorfen +	0.28												
2,4-DB + COC	0.28	-	95	85	80	73		-	90	74	76	71	3087

Table 2.(cont). Visual ratings for crownbeard and entireleaf morningglory control and peanut yield in 2000.

		VEEEN[a]					IPOHG					Peanut
Treatment[b]	Rate	6/14[c]	6/29	7/13	7/27	8/10	6/14	6/29	7/13	7/27	8/10	yield[d]
	kg ai/ha					%						kg/ha
Untreated check 1		0	0	0	0	0	0	0	0	0	0	-
Untreated check 2		0	0	0	0	0	0	0	0	0	0	1556
LSD (0.05)		12	29	37	44	43	21	27	29	28	28	719

[a]VEEEN, crownbeard; IPOHG, entireleaf morningglory.

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate of 2.3 L/ha; UAN, urea ammonium nitrate applied at a rate of 2.3 L/ha.

[c]Dates visual ratings were taken. Dashes represent no ratings because treatment had not been applied.

[d]Dashes represent no yield due to weeds causing the treatment to be unharvestable.

[e]WAA, wk after activation; WAT, wk after treatment.

Chapter II

Interference of Crownbeard *Verbesina encelioides* with Peanuts *Arachis hypogaea*

Interference of Crownbeard *Verbesina encelioides* with Peanuts *Arachis hypogaea*

Abstract: Interference of crownbeard with peanuts was evaluated at two locations in southwestern Oklahoma in a natural occurring population. Treatments consisted of a weed-free check and seven times of removal which were 4, 6, 8, 10, 12, 14, and 16 wk (full-season) after crop and weed emergence (WAE). In these experiments, counting crownbeard plants did not accurately predict dry weed weight or peanut yield, due to the variation of the crownbeard population among replications. As dry weed weight increased 1 kg/plot, peanut yield decreased linearly by 6.1%. Crownbeard interference decreased peanut yield by 2.6% for each week of interference resulting in approximately 42% yield reduction if allowed to interfere full-season. Crownbeard dry weed weight increased curvilinearly for each week plants were allowed to interfere with peanuts; however, crownbeard growth was minimal up to 4 WAE and increased after 6 WAE. Therefore, early-season crownbeard control programs can minimize peanut yield reduction.

Nomenclature: Crownbeard, *Verbesina encelioides* (Cav.) Benth. & Hook F. ex Gray #[1] VEEEN; peanut, *Arachis hypogaea* L.

Additional index words: Interference; competition; dry weed weight; weed population; weed density; time of weed removal, peanut yield, VEEEN.

Abbreviations: WAE, weeks after emergence.

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[1]Letters with this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available only on computer disk from WSSA, 810 East 10th Street, Lawrence, KS 66044-8897.

INTRODUCTION

Crownbeard is the fourth most common and the third most difficult weed to control in Oklahoma peanuts (Dowler 1998). It is an annual member of the sunflower (Asteraceae/Compositae) family. Although native to the southwestern United States and the Mexican Plateau (Coleman 1966; Fuller and McClintock 1986), crownbeard is reported as a principal weed in Argentina and Hawaii, as a common weed in Australia and India, and as a member of the general flora of South Africa (Holm et al. 1979). Crownbeard is also known as golden crownbeard, yellowtop, cowpen daisy , butter daisy, golden crown daisy, South African daisy, wild sunflower, American dogweed, girasolcito, and Anil del Muerto (Everist 1981; Fuller and McClintock 1986; Grichar and Sestak 1998; Lopez et al. 1996; McCoy 1987; Mitchell and Smith, Jr 1996; MHD 2000; NPWRC 2000).

Crownbeard is a taprooted annual; however, Inderjit et al. (1999) reported it to be a perennial weed in the semiarid regions of India. Plants of these species occur in deep sandy soils of disturbed sites and are extremely drought tolerant. Depending on soil and climate conditions, established crownbeard need only to be watered once a month during the growing season for survival (OALS, 2000). Leaves of the taxon are ovate, acute, coarsely serrate, with truncate to slightly cordate bases, 4 to 12 cm long, and 3 to 9 cm wide (Radford et al. 1968). The lower leaves are opposite while the upper leaves are alternate. All leaves have a grayish-green appearance due to a dense covering of white hairs on the blade surfaces and plants can reach heights of 0.5 to 1.5 m. Flower heads with yellow ray and disk florets are borne in an open inflorescence 2.5 to 4 cm wide. At maturity, the achenes (seeds) are black or dark brown, pubescent, obovate, white-winged, deeply notched at the apex, and terminate in two subulate awns (Kaul and Mangal 1987; Radford et al. 1968).

Crownbeard may possibly possess allelopathic capabilities. Inderjit et al. (1999) demonstrated the allelopathic potential of crownbeard roots and the probable involvement of allelopathy in its interference success. They reported soil containing crownbeard root leachate significantly reduced the growth of radish seedlings (*Raphanus sativus* L.) and also contributed to an increase in water-soluble phenolic compounds. They also proposed the success of crownbeard in cultivated fields with frequent irrigation was due to the presence of these compounds.

Along with its allelopathic potential, crownbeard is also considered a troublesome weed because of the toxins found in the foliage. The toxic effects of this species are well known in Australia. In the United States, the plant has been considered poisonous due to accumulation of high levels of nitrite and nitrate, but the observed pathological effects do not correspond to this type of poisoning (Lopez et al. 1996). Its toxic principal is galegine (3-methyl-2-butenylguanine), also found in *Galega officinalis* L., another poisonous plant found in the United States and Europe (Keeler et al. 1986; Keeler et al. 1992; Lopez et al. 1996). In Argentina, there have been many cases when cattle (*Bos taurus*), sheep (*Ovis aries*), and swine (*Sus scrofa*) have been forced to eat the plant due to lack of sufficient forage or being confined to an enclosure. The death of the animals is thought to be due mainly to the results of respiratory arrest (Keeler et al. 1986; Lopez et al. 1996). Crownbeard may be more toxic to animals during drought conditions, and depending upon geographic location, the level of toxicity of the plant may vary. It is a common practice for producers in Oklahoma to bale the peanut vines after harvest and then feed the hay to their livestock. If crownbeard residues are in the hay, producers could potentially poison their livestock.

Crownbeard is also susceptible to several plant viruses, including tomato spotted wilt virus, cucumber mosaic virus, dahlia mosaic virus, dogwood mosaic virus, pepper veinal mottle virus, and strawberry latent ringspot virus (Mitchell and Smith, Jr. 1996; PVO 2000). Because crownbeard is susceptible to tomato spotted wilt virus, it is thought to be a vector in spreading tomato spotted wilt virus to crops via thrips (*Frankliniella* spp.) (Mitchell and Smith, Jr. 1996). In Hawaiian lettuce (*Lactuca sativa* var. longifolia Lam.) fields, Yudin et al. (1988) found that when comparing lettuce to crownbeard in the preflowering stage crownbeard had fewer thrips than lettuce. However, when crownbeard was flowering they observed it had significantly more thrips than lettuce. In Texas field situations, Mitchell and Smith (1996) stated the inflorescence of crownbeard attracted several species of thrips. However, they concluded that the presence of crownbeard in peanut fields did not increase the incidence of tomato spotted wilt virus symptoms. Unlike Mitchell and Smith, Yudin et al. (1988) reported controlling weeds before flowering could possibly manage the spread of tomato spotted wilt virus. Mitchell and Smith (1996) hypothesised the possible differences between the Hawaiian and Texas systems were due to the number of infected crownbeard with tomato spotted wilt virus and the presence of key thrips that serve as vectors for the virus.

The allelopathic capabilities of crownbeard, its potential for poisoning livestock, and serving as a possible vector for pathogens have been investigated; however, little information is known about the interference of crownbeard with Oklahoma peanuts. Hill and Santelmann (1969) found that when annual weeds, smooth pigweed (*Amaranthus hybridus* L.) and crabgrass [*Digitaria sangunalis* (L.) Scop.], were removed within 3 wk after planting, peanut yield was not reduced, but thereafter yield reduction occurred. They also reported peanuts kept weed free for at least 6 wk after planting showed no yield loss due to competition from weeds emerging later. Therefore, this research was implemented to determine if the presence of crownbeard reduces peanut yield; and if so, to determine the amount of yield reduction and what weed measurements can be used to predict the yield reduction.

MATERIALS AND METHODS

Two field experiments were conducted in southwestern Oklahoma in 2000. One experiment was located on a producer's field near Colony, Oklahoma; therefore, it will be referred to as the Colony experiment. The second experiment was located on the Caddo Research Station near Ft. Cobb, Oklahoma; therefore, it will be referred to as the Ft. Cobb experiment. The Colony experiment was conducted on a Shellabarger fine sandy loam (fine-loamy, mixed, thermic Udic Argiustolls) with a soil pH of 6.9 and an organic matter content of 0.7%. The Ft. Cobb experiment was conducted on a Cobb fine sandy loam (fine-loamy, mixed, thermic Udic Haplustalfs) with a soil pH of 6.8 and an organic matter content of 0.6%.

Both experiments were arranged as a randomized complete block design with four replications. A Spanish peanut cultivar, 'Tamspan 90', was planted May 25, and June 5, for the Colony and Ft. Cobb experiments, respectively. Peanuts were planted to a depth of 5 cm and at a seedling rate of 90 kg/ha. Plot size was 4 rows, that were 0.9 m wide and 12 m in length. Irrigation was applied to both experiments as needed throughout the growing season to ensure survival of the crop. For the Colony experiment, the producer provided applications to control peanut diseases and pests as needed.

A natural population of crownbeard were removed at 0 (weed-free check), 4, 6, 8, 10, 12, 14, and 16 (full-season) wk after crop emergence (WAE). Crownbeard seedlings emerged as the crop emerged (author's personal observation). Crownbeard were removed from all four rows; however, between rows 2 and 3 the crownbeard were cut at soil level with hand clippers, counted, placed in a drying facility for 1 wk, and then dry weed weights were taken. After weed removal, the plots were kept weed-free for the remainder of the growing season by either chemical use, hoeing, or hand pulling. A tank mixture of metolachlor at 2.24 kg ai/ha and imazapic at 0.07 kg ai/ha was applied, using a backpack sprayer, directly to the soil surface up to 8 WAE for residual control of crownbeard. Chemical use was not used beyond 8 WAE due to canopy closure and potential herbicide injury.

In the Colony experiment, the center two rows were dug October 13, machine combined October 11, placed in a drying facility, and weighed October 27, to obtain peanut yield. Standard peanut harvesting equipment was used to dig and combine the peanuts. Combining procedures were conducted by combining the weed-free check first and then combining progressively higher removal times. For the Ft. Cobb experiment, peanut yield was lost due to white-tailed deer (*Odocoileus virginianus*) consuming the peanuts after digging. A hard freeze occurred between week 14 and week 16 killing the crownbeard; therefore, week 16 data were not included in the analysis.

Peanut yield was analyzed as percent of check. This was obtained by dividing the plot yield for each replication by the weed-free check yield for that replication. Weed density and dry weed weight were analyzed as plants per plot and kg per plot, respectively, with plot equaling 10.9 m^2 which is the area between rows 2 and 3. Weed density, dry weed weight, and peanut yield as percent of check were tested for goodness-of-fit to linear and curvilinear regression models. These regression models were analyzed using PROC GLM (SAS 2000).

RESULTS AND DISCUSSIONS

Dry weed weight increased as weed population increased for Colony (Figure 1) and Ft. Cobb (Figure 2); however, the correlation between dry weed weight and weed population was only 0.19 and 0.28 for Colony and Ft. Cobb, respectively. Therefore, the crownbeard population did not correlate well with dry weed weight. Generally, the dry weed weights for plots removed at 4, 6, and 8, WAE were < 4 kg/plot and < 7 kg/plot for Colony and Ft. Cobb, respectively, regardless of weed population. Dry weed weights for plots removed at 10, 12, and 14 WAE ranged from 2 kg/plot to 7 kg/plot for the Colony experiment and from 4 kg/plot to 15 kg/plot. Dry weed weights for the plots removed at 16 WAE for the Colony experiment were > 5.5 kg/plot. The poor correlation may be explained by the variances in the weed population; however, a general grouping of the dry weed weights, when considering time of removal, can be observed.

Dry weed weight increased curvilinearly as time of removal increased for both the Colony and Ft. Cobb experiments (Figures 3 and 4). These data suggest that crownbeard dry weed weight increases each week it is allowed to grow. Generally, crownbeard growth was minimal up to 4 WAE and increased after 6 WAE; therefore, crownbeard control may be optimal before 4 WAE. Dry weed weight at Ft. Cobb (Figure 4) was generally higher than the dry weed weight at Colony (Figure 3). These differences can be explained because the crownbeard population at Ft. Cobb was higher than the population at Colony.

Peanut yield decreased linearly as the weed density increased; however, an $R^2 = 0.35$ represents a rather weak correlation (Figure 5). Individual weed populations placed into in a group removed at 4, 6, and 8 WAE, varied from low to high weed populations. Similar results were observed with a 10, 12, and 14 WAE group and plots removed at 16 WAE. Grouping the weed densities into times they were removed proved to show no general grouping or clustering. Therefore, using weed density as a variable to accurately predict peanut yield reduction due to crownbeard interference wold likely be poor.

Peanut yield decreased linearly as dry weed weight increased; however, an $R^2 = 0.38$ represents a weak correlation, (Figure 6a).

Individual observations for dry weed weights for 4, 6, and 8 WAE are < 4 kg/plot. At 10, 12, and 14 WAE dry weed weights range from > 2 kg/plot to < 7 kg/plot. Full-season dry weed weights were > 5 kg/plot. Individual observations viewed as three groups can generally be clustered into their respective groups. Crownbeard dry weed weight early in the season was less than crownbeard dry weed weight later in the season, which would be expected. This suggests that as dry weed weight increases by 1 kg/plot, peanut yield will be reduced by 6.1%. If the variability in the replication is removed and the mean dry weed weight for each time of removal is regressed against peanut yield, we observe a similar trend (Figure 6b); however, the correlation between dry weed weight and peanut yield increases to 0.75, which is a two fold increase in the R^2 value for the individual observations. Therefore, weak correlation in the individual observations can be attributed to the variation in the replications. These data conclude that crownbeard dry weed weight can predict peanut yield reduction.

Peanut yield decreased linearly as the time of removal increased (Figure 7). These data predicted that for each week crownbeard was allowed to interfere with peanut, peanut yield was reduced by 2.6%. If crownbeard were allowed to compete with peanuts for the entire season, a 42% yield loss would be predicted. If this reduction percentage is calculated to kg/ha using the 1999 Oklahoma average irrigated peanut yield of 3230 kg/ha (Oklahoma Agricultural Statistics Service 2000), we predict a yield reduction of approximately 84 kg/ha for each week crownbeard is allowed to interfere, which is similar to previous research with weed interference in Oklahoma peanuts (Hackett et al. 1987a; 1987b). Hackett et al. (1987a) predicted a 40 kg/ha yield reduction for each week of horsenettle (*Solanum carolinense* L.) interference for a Spanish cultivar. For a runner-type cultivar, they predicted a 96 kg/ha yield decrease or an 81 kg/ha yield increase for each week of horsenettle interference or weed-free maintenance, respectively. In a similar experiment, Hackett et al. (1987b) predicted that for each week of silverleaf nightshade (*Solanum elaeagnifolium* Cav.) interference there would be approximately a 103 kg/ha decrease in Spanish peanut yield when compared to the check.

From these data, we conclude time of removal and crownbeard dry weight are the best variables for accurately predicting peanut yield reduction. Crownbeard growth is minimal for the first 4 WAE; therefore, early season crownbeard control programs can minimize peanut yield reduction. Because crownbeard rapidly grows after 4 WAE, it should be removed before that time to obtain maximum peanut yield.

LITERATURE CITED

Coleman, J. R. 1966. A taxonomic revision of section Ximenesia of the genus *Verbesnia* L. (Compositae). Amer. Mid. Nat. 76:475-481.

Dowler, C. C. 1998. Weed survey-Southern states: Broadleaf crops subsection. Proc. South. Weed Sci. Soc. 51:299-322.

Everist, S. L. 1972. Poisonous plants of Australia. Angus and Robertson Publishers, Brisbane, Australia. p. 187-190.

Fuller, T. C., and E. McClintock. 1986. Poisonous plants of California. University of California Press, Berkely, CA. p. 98-99.

Grichar, W. J. and D. C. Sestak. 1998. Control of golden crownbeard (*Verbesina encelioides*) in peanut (*Arachis hypogaea*) with postemergence herbicides. Peanut Sci. 25:39-43.

Hackett, N. M., D. S. Murray, and D. L. Weeks. 1987a. Interference of horsenettle (*Solanum carolinense*) with peanuts (*Arachis hypogaea*). Weed Sci. 35:780-784.

Hackett, N. M., D. S. Murray, and D. L. Weeks. 1987b. Interference of silverleaf nightshade (*Solanum elaeagnifolium*) on Spanish peanuts (*Arachis hypogaea*). Peanut Sci. 14:39-41.

Hill, L. V. and P. W. Santelmann. 1969. Competitive effects of annual weeds on Spanish peanuts. Weed Sci. 17:1-2.

Holm, L., J. V. Pancho, J. P. Herberger, and D. L. Plucknett. 1979. A geological atlas of world weeds. John Wiley & Sons, New York.

Inderjit, C. Asakawa, and K. M. M. Dakshini. 1999. Allelopathic potential of *Verbesina encelioides* root leachate in soil. Can. J. Bot. 77:1419-1424.

Kaul, M.L.H., and P. D. Mangal. 1987. Phenology and germination of crownbeard (*Verbesina encelioides*). Weed Sci. 35:513-518.

Keeler, R. F., A. E. Johnson, and L. D. Stuart. 1986. Toxicosis from and possible adaptation to *Galege officinalis* in sheep and the relationship to *Verbesnia encelioides toxicosis*. Vet. Human Toxicol. 28:309-315.

Keeler, R. F., D. C. Baker, and K. E. Panter. 1992. Concentration of galegine in *Verbesnia encelioides* and *Galege oficinalis* and the toxic and pathologic effects induced by the plants. J. of Environ. Pathol., Toxicol., and Oncol. 11:75-81.

Lopez, T. A., C. M. Camero, R. Chayer, B. Cosentinp, and M. Caracino. 1996. Experimental toxicity of *Verbesnia encelioides* in sheep and isolation of galegine. Vet. Human Toxicol. 38:417-419.

McCoy, D. 1987. Oklahoma wildflowers. Ebsco Graphics, Oklahoma City, OK. p. 107.

Mitchell, F. L. and J. W. Smith, Jr. 1996. Influence of *Verbesnia encelioides* (Asterales: Asteraceae) on thrips (Thysanoptera: Terebrantia) populations and tomato spotted wilt virus epidemics in south Texas peanut fields. Ento. Soc. of Amer. 89:1593-1600.

MHD. 2000. http://wwwifa.phys.unm.edu/~mledlow/HerbsLog/Herbs.html Medicinal Herbs Diary. University of New Mexico. 7 March 2000.

NPWRC. 2000. http://www.npwrc.usgs.gov/resource/literatr/wildflwr/species/vervence.html Native wildflowers of the North Dakota grasslands. United States Geological Survey. 7 March 2000.

OALS. 2000. http://ag.arizona.edu/OALS/oals/dru/LWUannuals.html Office of Arid Lands Studies. University of Arizona. 7 March 2000.

Oklahoma Agricultural Statistics Service 2000. Oklahoma Agricultural Statistics, 1999. Oklahoma City, OK: USDA-Natl. Agric. Stat. Serv. and Okla. Dep. Agric. 104p.

PVO. 2000. http://www.im.ac.cn./vide/famly044/htm Plant Viruses Online. 7 March 2000.

Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. p. 179.

[SAS] Statistical Analysis Systems. 2000. Software version 8.1. Cary, NC: Statistical Analysis Systems Institute.

Yudin, L. S., B. E. Tabashnik, J. J. Cho, and W, C, Mitchell. 1988. Colonization of weeds and lettuce by thrips (Thysanoptera: Thripidae). Ento. Soc. Of Amer. 17:522-526.

Figure 1. Effect of crownbeard density on dry weed weight for Colony experiment, $P \leq 0.05$.

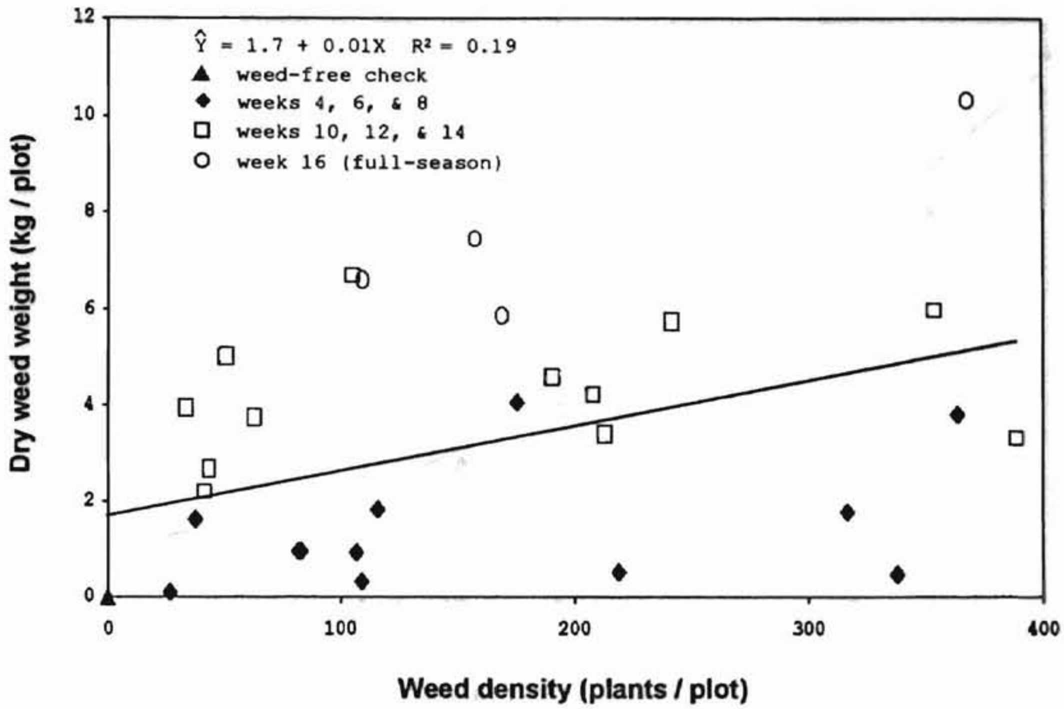


Figure 2. Effect of crownbeard density on dry weed weight for Ft. Cobb experiment, $P \leq 0.05$.

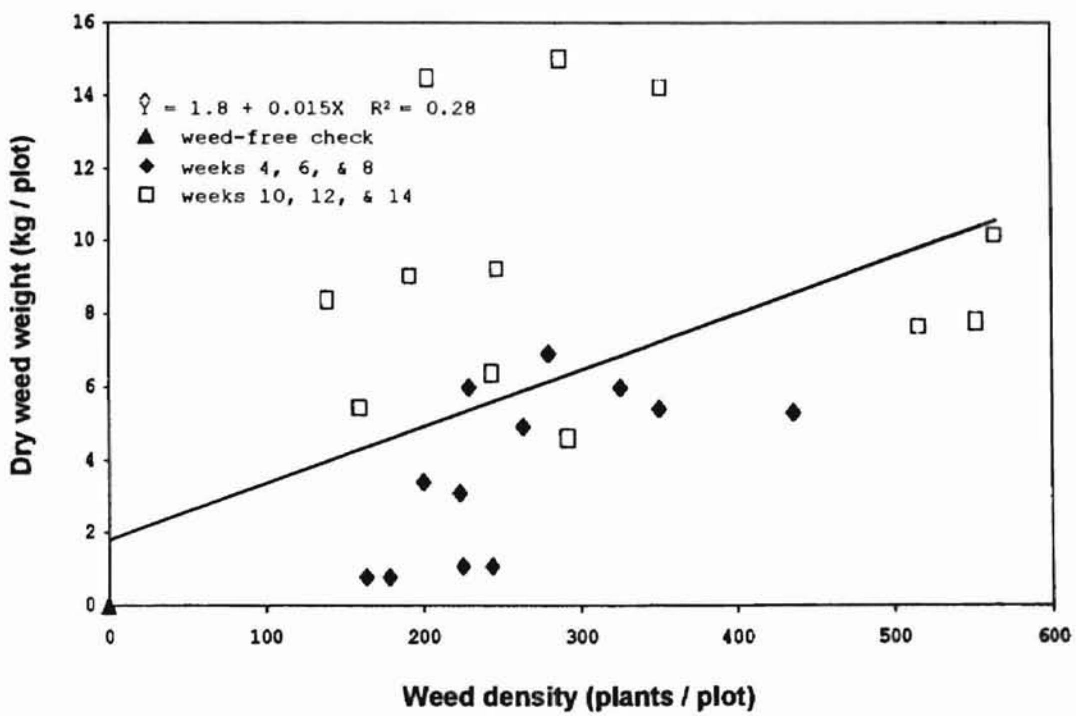


Figure 3. Effect of crownbeard duration on dry weed weight for Colony experiment, $P \leq 0.05$.

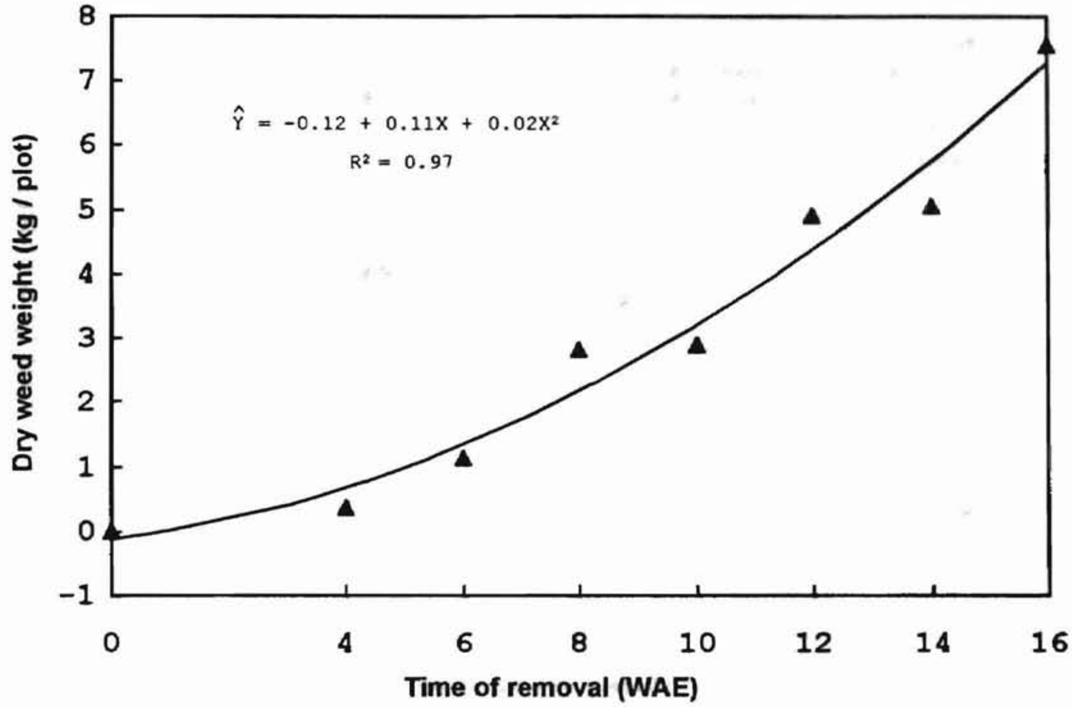


Figure 4. Effect of crownbeard duration on dry weed weight for Ft. Cobb experiment, $P \leq 0.05$.

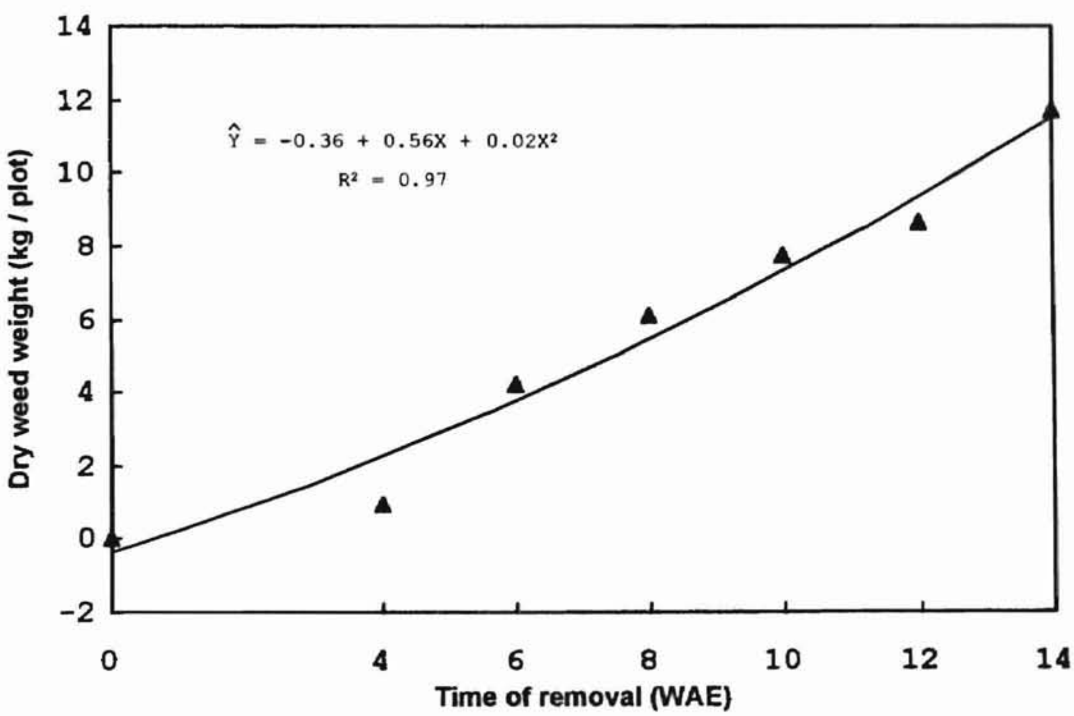


Figure 5. Effect of crownbeard density on peanut yield from Colony experiment, $P \leq 0.05$.

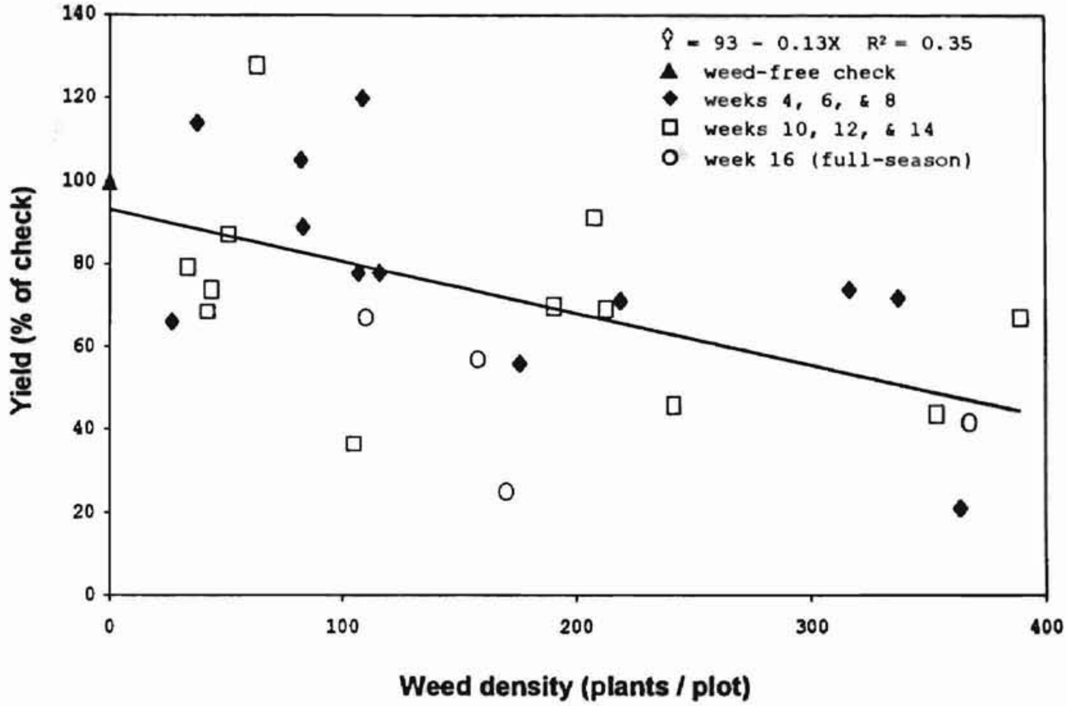


Figure 6a. Effect of crownbeard dry weed weight on peanut yield from Colony experiment, $P \leq 0.05$.

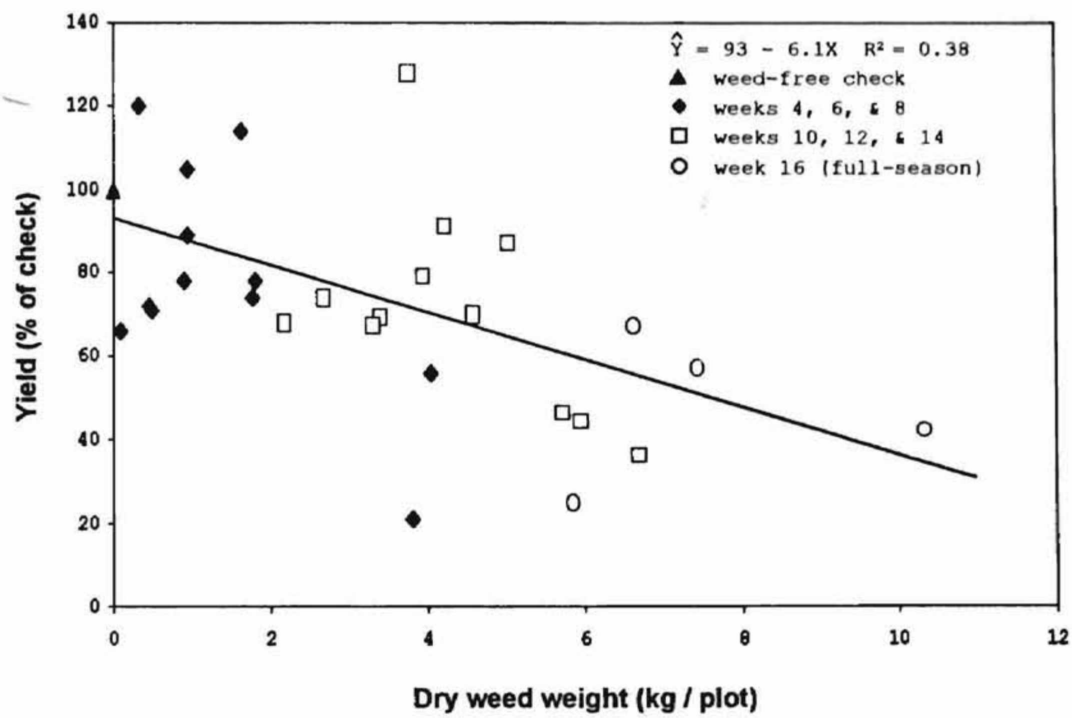


Figure 6b. Effect of crownbeard dry weed weight on peanut yield from Colony experiment, $P \leq 0.05$.

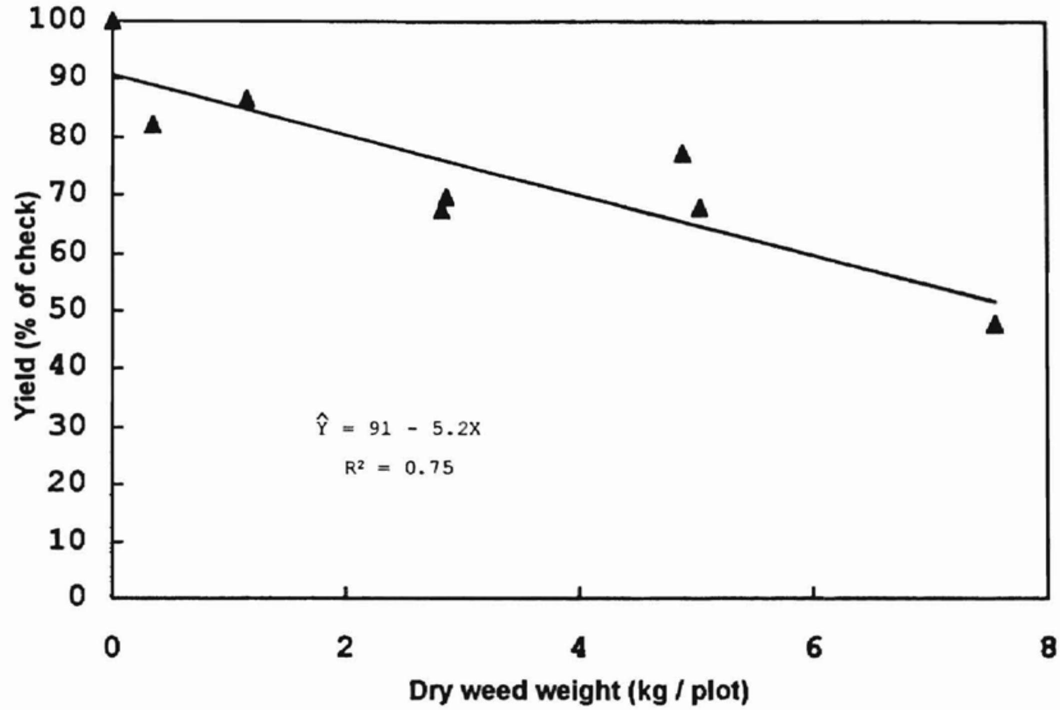
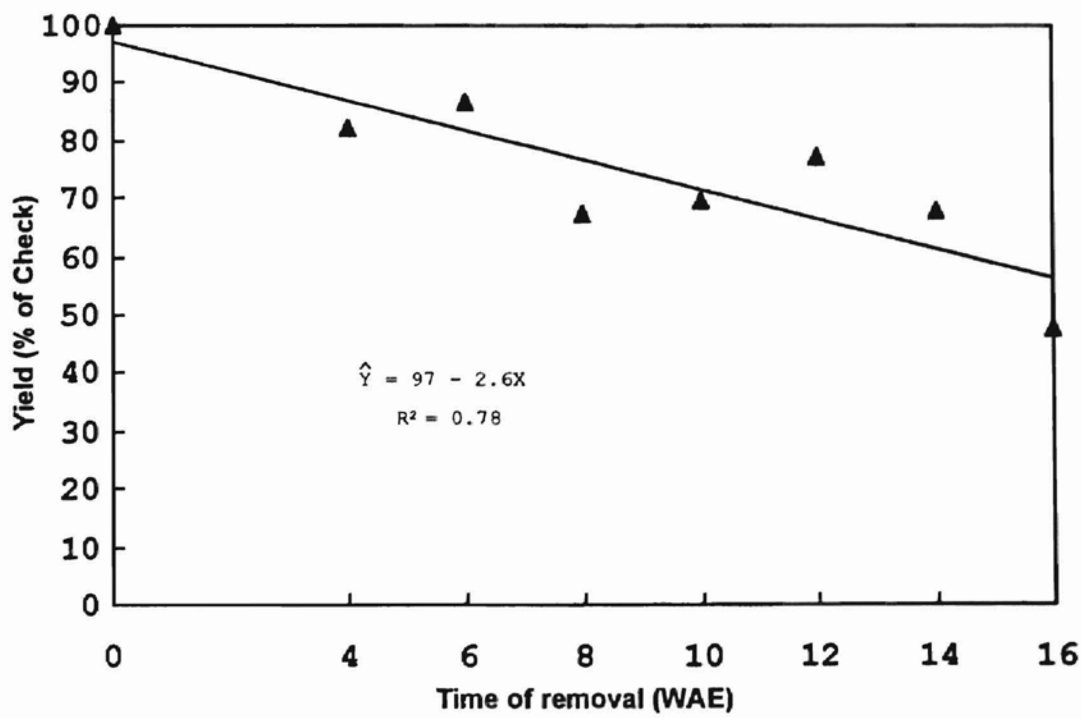


Figure 7. Percent peanut yield as influenced by duration of crownbeard interference for Colony experiment, $P \leq 0.05$.



APPENDIX

Appendix Table 3. Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (6/14/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Cloransulam	0.84	100	100	100	100	100	100	100	100	100	100
Diclosulam	0.03	100	100	95	100	99	95	100	95	100	98
Flumetsulam	0.07	100	100	95	100	99	100	95	90	95	95
Flumioxazin	0.11	100	85	100	85	93	100	100	100	100	100
Atrazine	1.68	100	100	95	100	99	100	100	100	100	100
Metribuzin	0.56	100	100	95	100	99	100	100	95	100	99
Prometryn	1.68	95	60	10	80	61	100	100	90	100	98
Clomazone	0.42	100	100	100	100	100	0	90	10	5	26
Pyrithiobac	0.07	90	65	20	75	63	95	80	100	100	94
Diuron	1.68	100	95	100	100	99	0	100	35	95	58
Fluometuron	1.68	100	100	100	100	100	100	100	90	80	93
Imazapic	0.07	100	85	85	100	93	95	95	95	60	86
Imazethapyr	0.07	100	75	25	95	74	0	90	25	90	51
Dimethenamid	2.24	100	100	90	95	96	100	85	75	100	90
Flufenacet +	0.37										
isoxaflutole	0.08	100	100	100	100	100	100	100	100	100	100
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; ACCOS, hophornbeam copperleaf

[b]Only PRE treatments were rated because POST treatments had not been applied.

Appendix Table 4. Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (6/29/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Cloransulam	0.84	100	100	100	100	100	100	100	100	100	100
Diclosulam	0.03	100	100	100	100	100	95	100	95	100	98
Flumetsulam	0.07	100	100	100	100	100	100	95	85	95	94
Flumioxazin	0.11	90	90	100	100	95	100	100	100	100	100
Atrazine	1.68	100	100	100	85	96	100	100	100	100	100
Metribuzin	0.56	100	85	85	95	91	100	100	90	100	98
Prometryn	1.68	95	10	0	65	43	100	100	95	100	99
Clomazone	0.42	100	95	100	100	99	0	100	0	0	25
Pyrithiobac	0.07	40	15	0	20	19	95	40	85	100	80
Diuron	1.68	100	90	100	100	98	80	95	65	95	84
Fluometuron	1.68	100	95	100	100	99	100	100	95	30	81
Imazapic	0.07	100	70	75	100	86	100	95	100	50	86
Imazethapyr	0.07	100	65	10	100	69	60	80	0	90	58
Dimethenamid	2.24	100	100	100	85	96	100	95	25	100	80
Flufenacet +	0.37										
isoxaflutole	0.08	100	95	100	95	98	100	100	100	100	100
POST											
Cloransulam	0.84	100	100	100	100	100	100	75	95	95	91
Diclosulam	0.03	100	100	100	100	100	5	60	50	45	40
Acifluorfen + NIS	0.42	100	70	25	55	63	100	80	90	65	84
Fomesafen + NIS	0.42	85	100	75	90	88	100	90	100	90	95

Appendix Table 4. (cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (6/29/00).

		VEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
Lactofen + COC	0.22	100	90	90	100	95	100	100	100	100	100
Oxyfluorfen + NIS	0.56	100	75	95	100	93	100	100	100	100	100
Atrazine + COC	1.12	100	100	100	100	100	100	100	100	100	100
Pyrithiobac + NIS	0.07	100	95	100	100	99	75	0	0	20	24
Chlorimuron + NIS	0.01	100	100	100	100	100	95	45	5	100	61
Halosulfuron	0.05	100	70	100	100	93	95	25	10	40	43
Prosulfuron + NIS	0.07	100	100	100	100	100	100	60	15	40	54
Imazamox + NIS	0.04	5	95	0	70	43	0	35	0	15	13
Imazapic	0.07	10	35	40	10	24	10	25	90	100	56
Imazethapyr + NIS	0.07	50	5	0	10	16	100	20	80	100	75
2,4-D	0.56	95	95	100	95	96	100	95	95	100	98
2,4-DB	0.45	20	10	100	80	53	0	95	20	20	34
Dicamba	0.56	95	95	100	80	93	25	45	20	80	43
Bentazon + COC	1.12	100	90	95	100	96	50	50	25	50	44
Bromoxynil + NIS	0.42	95	85	100	100	95	100	100	100	95	99
Glyphosate	1.12	90	100	100	100	98	100	100	90	95	96
MSMA + NIS	2.24	85	95	35	90	76	90	55	85	100	83
Paraquat + NIS	0.14	100	85	95	100	95	80	95	85	10	68
Pyridate	1.57	100	100	100	100	100	100	100	90	70	90
Bentazon +	0.56										
2,4-DB	0.14	100	100	100	100	100	10	15	5	35	16

Appendix Table 4.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (6/29/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
Acifluorfen +	0.42										
2,4-DB	0.28	100	90	95	100	96	100	85	90	85	90
Acifluorfen +	0.28										
bentazon + COC	0.56	90	90	100	90	93	80	95	100	100	94
Acifluorfen +	0.28										
bentazon +	0.56										
2,4-DB + COC	0.28	100	95	90	100	96	90	100	100	100	98
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; ACCOS, hophornbeam copperleaf

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate 2.3 L/ha.

Appendix Table 5. Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (7/13/00).

Treatment[b]	Rate	VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
		I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Cloransulam	0.84	100	100	100	95	99	100	100	100	100	100
Diclosulam	0.03	100	100	100	100	100	80	95	95	100	93
Flumetsulam	0.07	100	100	90	75	91	100	90	60	100	88
Flumioxazin	0.11	85	60	95	85	81	100	100	100	100	100
Atrazine	1.68	95	90	95	85	91	100	95	100	95	98
Metribuzin	0.56	100	65	75	90	83	100	95	80	100	94
Prometryn	1.68	90	0	0	55	35	95	100	20	50	66
Clomazone	0.42	100	100	100	100	100	0	100	0	0	25
Pyrithiobac	0.07	10	0	5	10	6	60	35	40	100	59
Diuron	1.68	100	90	100	90	95	60	100	20	90	68
Fluometuron	1.68	100	95	100	100	99	100	100	95	15	78
Imazapic	0.07	100	10	50	90	63	95	80	100	15	73
Imazethapyr	0.07	90	10	10	80	48	0	10	0	80	23
Dimethenamid	2.24	100	15	100	70	71	95	15	0	100	53
Flufenacet +	0.37										
isoxaflutole	0.08	100	80	80	80	85	95	90	100	100	96
POST											
Cloransulam	0.84	100	100	100	100	100	100	100	100	100	100
Diclosulam	0.03	100	100	100	100	100	40	20	90	60	53
Acifluorfen + NIS	0.42	90	20	40	60	53	95	50	100	40	71
Fomesafen + NIS	0.42	90	100	65	85	85	95	90	100	95	95

Appendix Table 5.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (7/13/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha			%					%		
Lactofen + COC	0.22	100	70	85	100	89	100	100	100	100	100
Oxyfluorfen + NIS	0.56	90	40	40	90	65	100	90	85	100	94
Atrazine + COC	1.12	100	100	100	100	100	100	100	100	100	100
Pyrithiobac + NIS	0.07	95	95	100	95	96	10	0	0	0	3
Chlorimuron + NIS	0.01	100	100	100	100	100	100	50	20	95	66
Halosulfuron	0.05	95	65	95	95	88	90	10	0	10	28
Prosulfuron + NIS	0.07	100	100	100	100	100	100	50	0	50	50
Imazamox + NIS	0.04	0	60	0	70	33	95	0	0	0	24
Imazapic	0.07	10	5	5	0	5	10	0	50	90	38
Imazethapyr + NIS	0.07	30	5	0	0	9	95	60	0	0	39
2,4-D	0.56	75	85	85	80	81	100	90	85	95	93
2,4-DB	0.45	70	15	95	80	65	10	0	0	50	15
Dicamba	0.56	75	80	100	80	84	0	5	0	40	11
Bentazon + COC	1.12	100	10	90	95	74	0	15	0	25	10
Bromoxynil + NIS	0.42	85	75	85	85	83	90	100	95	80	91
Glyphosate	1.12	70	100	95	100	91	100	90	80	90	90
MSMA + NIS	2.24	85	90	15	65	64	90	65	85	90	83
Paraquat + NIS	0.14	90	5	60	85	60	15	15	60	0	23
Pyridate	1.57	90	95	90	90	91	100	100	90	70	90
Bentazon +	0.56										
2,4-DB	0.14	90	100	95	95	95	30	0	0	0	8

Appendix Table 5.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (7/13/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha			%					%		
Acifluorfen +	0.42										
2,4-DB	0.28	100	30	95	90	79	95	90	85	85	89
Acifluorfen +	0.28										
bentazon + COC	0.56	25	65	90	90	68	25	100	95	100	80
Acifluorfen +	0.28										
bentazon +	0.56										
2,4-DB + COC	0.28	90	90	75	90	86	90	100	100	100	98
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; ACCOS, hophornbeam copperleaf

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate 2.3 L/ha.

Appendix Table 6. Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (7/27/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Cloransulam	0.84	100	100	100	95	99	100	100	100	95	99
Diclosulam	0.03	100	100	100	100	100	90	95	95	95	94
Flumetsulam	0.07	100	95	90	65	88	100	79	0	90	67
Flumioxazin	0.11	75	65	95	85	80	100	100	100	100	100
Atrazine	1.68	85	85	90	70	83	100	100	95	80	94
Metribuzin	0.56	100	55	50	85	73	100	90	25	100	79
Prometryn	1.68	65	0	0	25	23	100	100	90	65	89
Clomazone	0.42	90	90	95	100	94	0	100	0	0	25
Pyrithiobac	0.07	15	0	0	0	4	100	100	0	100	75
Diuron	1.68	100	100	100	85	96	65	100	25	65	64
Fluometuron	1.68	100	95	100	100	99	100	100	80	15	74
Imazapic	0.07	95	20	25	50	48	95	85	70	0	63
Imazethapyr	0.07	65	0	13	50	32	0	90	0	25	29
Dimethenamid	2.24	90	45	90	60	71	95	25	0	100	55
Flufenacet +	0.37										
isoxaflutole	0.08	100	65	85	60	78	90	85	100	100	94
POST											
Cloransulam	0.84	100	100	100	100	100	100	100	100	100	100
Diclosulam	0.03	100	100	100	100	100	50	75	80	50	64
Acifluorfen + NIS	0.42	70	65	60	0	49	90	90	100	0	70
Fomesafen + NIS	0.42	90	90	60	85	81	100	74	60	85	80

Appendix Table 6.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (7/27/00).

Treatment[b]	Rate	VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
		I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
Lactofen + COC	0.22	95	65	80	100	85	100	95	100	100	99
Oxyfluorfen + NIS	0.56	80	35	20	70	51	100	100	100	100	100
Atrazine + COC	1.12	100	96	95	100	98	100	100	100	95	99
Pyrithiobac + NIS	0.07	100	80	100	70	88	0	0	0	0	0
Chlorimuron + NIS	0.01	100	100	100	95	99	100	40	0	95	59
Halosulfuron	0.05	95	70	95	80	85	85	0	95	0	45
Prosulfuron + NIS	0.07	100	100	100	100	100	100	80	0	50	58
Imazamox + NIS	0.04	0	55	0	35	23	100	0	0	0	25
Imazapic	0.07	0	0	0	0	0	0	0	50	25	19
Imazethapyr + NIS	0.07	0	100	0	0	25	100	100	0	0	50
2,4-D	0.56	80	70	65	65	70	100	70	25	100	74
2,4-DB	0.45	40	49	50	70	52	0	0	0	10	3
Dicamba	0.56	75	65	95	60	74	0	0	0	0	0
Bentazon + COC	1.12	100	90	95	85	93	0	0	0	0	0
Bromoxynil + NIS	0.42	80	85	80	65	78	95	100	95	75	91
Glyphosate	1.12	50	95	90	90	81	100	80	70	80	83
MSMA + NIS	2.24	70	75	0	15	40	100	60	80	60	75
Paraquat + NIS	0.14	85	25	54	45	52	20	10	29	0	15
Pyridate	1.57	80	90	60	80	78	100	100	70	25	74
Bentazon +	0.56										
2,4-DB	0.14	80	100	100	90	93	0	0	100	0	25

Appendix Table 6.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (7/27/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
Acifluorfen +	0.42										
2,4-DB	0.28	95	70	75	80	80	90	50	90	25	64
Acifluorfen +	0.28										
bentazon + COC	0.56	20	90	100	90	75	25	100	90	100	79
Acifluorfen +	0.28										
bentazon +	0.56										
2,4-DB + COC	0.28	85	85	80	90	85	85	100	95	100	95
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; ACCOS, hophornbeam copperleaf

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate 2.3 L/ha.

Appendix Table 7. Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (8/10/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Cloransulam	0.84	100	100	100	90	98	0	100	100	100	75
Diclosulam	0.03	100	90	100	100	98	80	90	90	95	89
Flumetsulam	0.07	100	85	70	50	76	100	50	0	90	60
Flumioxazin	0.11	35	50	95	75	64	95	100	100	100	99
Atrazine	1.68	75	80	80	65	75	100	85	80	50	79
Metribuzin	0.56	95	0	15	85	49	100	80	0	100	70
Prometryn	1.68	65	0	0	0	16	100	0	100	95	74
Clomazone	0.42	95	85	95	100	94	0	0	0	0	0
Pyrithiobac	0.07	0	0	0	0	0	50	0	0	80	33
Diuron	1.68	100	90	100	85	94	60	95	50	75	70
Fluometuron	1.68	100	95	100	100	99	100	100	80	25	78
Imazapic	0.07	95	0	0	65	40	95	40	100	0	59
Imazethapyr	0.07	25	0	0	25	13	0	0	0	0	0
Dimethenamid	2.24	90	40	80	50	65	80	40	0	100	55
Flufenacet +	0.37										
isoxaflutole	0.08	90	50	80	50	68	85	85	100	95	91
POST											
Cloransulam	0.84	100	100	100	100	100	100	100	100	100	100
Diclosulam	0.03	100	100	100	100	100	50	70	90	50	65
Acifluorfen + NIS	0.42	50	0	50	0	25	70	50	80	0	50
Fomesafen + NIS	0.42	90	85	60	85	80	100	60	100	75	84

Appendix Table 7.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (8/10/00).

		VEEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
Lactofen + COC	0.22	95	15	65	95	68	100	85	100	100	96
Oxyfluorfen + NIS	0.56	65	15	0	55	34	100	85	0	100	71
Atrazine + COC	1.12	100	95	90	100	96	100	100	100	100	100
Pyrithiobac + NIS	0.07	85	70	100	90	86	0	0	0	0	0
Chlorimuron + NIS	0.01	100	100	100	90	98	100	0	25	95	55
Halosulfuron	0.05	90	45	90	85	78	50	0	0	0	13
Prosulfuron + NIS	0.07	100	100	100	100	100	100	60	15	50	56
Imazamox + NIS	0.04	0	80	0	25	26	0	0	0	0	0
Imazapic	0.07	0	0	0	0	0	50	60	100	0	53
Imazethapyr + NIS	0.07	0	0	0	0	0	0	50	0	0	13
2,4-D	0.56	85	50	40	40	54	100	50	50	100	75
2,4-DB	0.45	25	50	80	0	39	0	0	0	0	0
Dicamba	0.56	60	75	40	40	54	0	0	0	45	11
Bentazon + COC	1.12	95	25	85	50	64	0	50	0	0	13
Bromoxynil + NIS	0.42	85	80	85	55	76	50	90	80	50	68
Glyphosate	1.12	0	90	90	85	66	100	60	50	70	70
MSMA + NIS	2.24	50	80	0	0	33	100	25	0	100	56
Paraquat + NIS	0.14	65	0	40	50	39	0	75	0	0	19
Pyridate	1.57	50	95	70	55	68	25	100	50	35	53
Bentazon +	0.56										
2,4-DB	0.14	60	90	100	85	84	0	0	0	0	0

Appendix Table 7.(cont.) Visual control ratings for crownbeard and hophornbeam copperleaf for a non-crop area (8/10/00).

		VEEN[a]					ACCOS				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
Acifluorfen +	0.42										
2,4-DB	0.28	90	50	85	60	71	65	50	70	0	46
Acifluorfen +	0.28										
bentazon + COC	0.56	60	90	90	90	83	50	40	80	95	66
Acifluorfen +	0.28										
bentazon +	0.56										
2,4-DB + COC	0.28	70	90	70	90	80	50	100	90	100	85
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEN, crownbeard; ACCOS, hophornbeam copperleaf

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate 2.3 L/ha.

Appendix Table 8. Visual control ratings for crownbeard and entireleaf morningglory in peanuts (6/29/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Flumioxazin	0.07	60	100	95	85	85	70	60	40	75	61
Flumioxazin	0.11	95	100	100	100	99	75	85	95	100	89
Diclosulam	0.03	100	100	100	100	100	90	99	100	100	97
Imazethapyr	0.07	100	100	100	100	100	90	90	90	100	93
Dimethenamid	1.68	90	100	100	100	98	50	0	25	75	38
Metolachlor	1.34	60	90	100	95	86	0	0	0	50	13
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; IPOHG, entireleaf morningglory

[b]Only PRE treatments were rated because POST treatments had not been applied.

Appendix Table 9. Visual control ratings for crownbeard and entireleaf morningglory in peanuts (7/13/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Flumioxazin	0.07	70	100	100	90	90	40	45	20	65	43
Flumioxazin	0.11	55	90	100	100	76	20	55	75	95	61
Diclosulam	0.03	100	100	100	100	100	85	95	100	100	95
Imazethapyr	0.07	100	100	100	100	100	90	90	90	100	93
Dimethenamid	1.68	100	100	100	100	100	75	0	70	40	46
Metolachlor	1.34	85	90	100	90	91	0	25	0	60	21
POST											
Diclosulam + NIS	0.03	70	95	100	95	90	50	75	70	85	70
Imazethapyr + NIS	0.07	20	0	100	65	46	15	0	5	40	15
Imazapic + NIS	0.07	95	80	90	10	69	75	50	45	70	60
Paraquat + NIS	0.14	100	80	85	10	69	40	0	5	30	19
Chlorimuron + NIS	0.01	85	85	95	100	91	20	45	45	90	50
Acifluorfen + NIS	0.28	95	40	100	85	80	90	35	15	90	58
Acifluorfen + NIS	0.42	90	90	95	100	94	60	60	75	70	66
2,4-DB	0.56	100	100	100	95	99	95	90	95	90	93
Pyridate	1.57	100	100	100	80	95	10	5	25	85	31
Pyridate +	1.57										
2,4-DB	0.45	100	100	100	100	100	90	95	100	90	94
2,4-DB +	0.14										
bentazon	1.12	90	60	100	80	83	85	50	75	85	74

Appendix Table 9.(cont.) Visual control ratings for crownbeard and entireleaf morningglory in peanuts (7/13/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
2,4-DB +	0.45										
bentazon + COC	1.12	100	90	100	95	96	90	90	95	95	93
2,4-DB +	0.28										
acifluorfen	0.42	100	95	100	95	98	60	85	85	95	81
Bentazon +	0.56										
acifluorfen + COC	0.28	70	90	90	90	85	70	55	70	85	70
Bentazon +	0.56										
acifluorfen + NIS	0.28	95	30	10	0	34	70	45	10	75	50
Bentazon +	0.56										
acifluorfen + UAN	0.28	80	25	65	95	66	55	75	0	55	46
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + NIS	0.28	95	95	90	90	93	20	95	55	90	65
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + COC	0.28	95	95	90	100	95	85	95	85	95	90
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; IPOHG, entireleaf morningglory

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate of 2.3 L/ha; UAN, urea ammonium nitrate applied at a rate of 2.3 L/ha.

Appendix Table 10. Visual control ratings for crownbeard and entireleaf morningglory in peanuts (7/27/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Flumioxazin	0.07	85	100	100	75	90	20	0	0	70	23
Flumioxazin	0.11	100	90	100	100	98	0	0	40	90	33
Diclosulam	0.03	100	100	100	100	100	85	85	95	95	90
Imazethapyr	0.07	100	100	100	100	100	80	70	75	95	80
Dimethenamid	1.68	95	100	95	100	98	60	0	60	25	36
Metolachlor	1.34	80	90	100	90	90	0	0	0	0	0
POST											
Diclosulam + NIS	0.03	25	100	100	95	80	70	80	70	95	79
Imazethapyr + NIS	0.07	0	0	100	0	25	35	15	40	25	29
Imazapic + NIS	0.07	80	40	85	0	51	80	55	50	85	68
Paraquat + NIS	0.14	70	0	85	0	39	0	0	0	0	0
Chlorimuron + NIS	0.01	0	90	80	100	68	25	50	50	90	54
Acifluorfen + NIS	0.28	90	0	95	25	53	85	0	20	25	33
Acifluorfen + NIS	0.42	90	90	80	100	90	50	0	30	25	26
2,4-DB	0.56	100	100	100	100	100	100	95	100	100	99
Pyridate	1.57	90	95	100	70	89	0	0	0	75	19
Pyridate +	1.57										
2,4-DB	0.45	100	100	100	100	100	100	100	95	90	96
2,4-DB +	0.14										
bentazon	1.12	95	25	100	65	71	95	50	90	80	79

Appendix Table 10. (cont.) Visual control ratings for crownbeard and entireleaf morningglory in peanuts (7/27/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
2,4-DB +	0.45										
bentazon + COC	1.12	100	100	100	90	98	95	100	90	95	95
2,4-DB +	0.28										
acifluorfen	0.42	100	50	100	100	88	90	50	80	100	80
Bentazon +	0.56										
acifluorfen + COC	0.28	50	90	90	90	80	60	40	0	70	43
Bentazon +	0.56										
acifluorfen + NIS	0.28	75	25	0	0	25	50	0	0	50	25
Bentazon +	0.56										
acifluorfen + UAN	0.28	60	0	20	95	44	50	25	0	0	19
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + NIS	0.28	85	95	90	90	90	50	100	35	100	71
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + COC	0.28	95	95	50	100	85	80	85	35	95	74
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; IPOHG, entireleaf morningglory

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate of 2.3 L/ha; UAN, urea ammonium nitrate applied at a rate of 2.3 L/ha.

Appendix Table 11. Visual control ratings for crownbeard and entireleaf morningglory in peanuts (8/10/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Flumioxazin	0.07	90	100	100	95	96	0	0	0	0	0
Flumioxazin	0.11	90	90	100	100	95	0	0	0	95	24
Diclosulam	0.03	100	100	100	100	100	75	90	95	85	86
Imazethapyr	0.07	95	100	95	100	98	80	65	70	80	74
Dimethenamid	1.68	95	100	100	100	99	30	0	0	0	8
Metolachlor	1.34	85	90	100	95	93	0	0	0	0	0
POST											
Diclosulam + NIS	0.03	0	100	95	95	73	60	90	95	90	84
Imazethapyr + NIS	0.07	0	0	95	0	24	40	55	50	90	59
Imazapic + NIS	0.07	0	0	80	0	20	80	75	90	95	85
Paraquat + NIS	0.14	80	0	65	0	36	0	0	0	0	0
Chlorimuron + NIS	0.01	0	80	95	100	69	0	0	35	100	34
Acifluorfen + NIS	0.28	85	0	100	90	69	50	0	0	50	25
Acifluorfen + NIS	0.42	90	0	90	95	69	0	0	0	25	6
2,4-DB	0.56	100	100	100	100	100	100	100	100	100	100
Pyridate	1.57	90	95	100	85	93	0	0	0	50	13
Pyridate +	1.57										
2,4-DB	0.45	100	95	100	100	99	95	100	100	100	99
2,4-DB +	0.14										
bentazon	1.12	95	85	100	65	86	95	70	95	95	89

Appendix Table 11.(cont.) Visual control ratings for crownbeard and entireleaf morningglory in peanuts (8/10/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
2,4-DB +	0.45										
bentazon + COC	1.12	95	90	100	90	94	95	95	95	100	96
2,4-DB +	0.28										
acifluorfen	0.42	100	85	100	100	96	75	50	50	100	69
Bentazon +	0.56										
acifluorfen + COC	0.28	0	95	0	95	48	0	50	0	65	29
Bentazon +	0.56										
acifluorfen + NIS	0.28	95	80	0	0	44	40	0	0	25	16
Bentazon +	0.56										
acifluorfen + UAN	0.28	65	0	0	95	40	0	0	0	0	0
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + NIS	0.28	0	90	75	85	63	0	95	50	90	59
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + COC	0.28	70	100	50	100	80	90	90	25	100	76
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; IPOHG, entireleaf morningglory

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate of 2.3 L/ha; UAN, urea ammonium nitrate applied at a rate of 2.3 L/ha.

Appendix Table 12. Visual control ratings for crownbeard and entireleaf morningglory in peanuts (8/23/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
PRE	kg ai/ha	%					%				
Flumioxazin	0.07	90	100	100	90	95	0	0	0	0	0
Flumioxazin	0.11	90	85	100	100	94	0	0	0	95	24
Diclosulam	0.03	100	100	100	100	100	70	90	95	80	84
Imazethapyr	0.07	90	100	95	100	96	75	60	70	80	71
Dimethenamid	1.68	90	100	100	100	98	25	0	0	0	6
Metolachlor	1.34	80	85	100	90	89	0	0	0	0	0
POST											
Diclosulam + NIS	0.03	0	100	90	90	70	50	85	90	90	79
Imazethapyr + NIS	0.07	0	0	95	0	24	25	50	50	85	53
Imazapic + NIS	0.07	0	0	75	0	19	70	70	80	90	78
Paraquat + NIS	0.14	75	0	50	0	31	0	0	0	0	0
Chlorimuron + NIS	0.01	0	80	95	100	69	0	0	25	100	31
Acifluorfen + NIS	0.28	80	0	100	90	68	35	0	0	55	23
Acifluorfen + NIS	0.42	80	85	100	90	89	0	0	0	0	0
2,4-DB	0.56	100	100	100	100	100	100	100	100	100	100
Pyridate	1.57	85	90	100	80	89	0	0	0	40	10
Pyridate +	1.57										
2,4-DB	0.45	100	95	100	100	99	90	100	100	100	98
2,4-DB +	0.14										
bentazon	1.12	90	80	100	60	83	90	70	90	90	85

Appendix Table 12.(cont.) Visual control ratings for crownbeard and entireleaf morningglory in peanuts (8/23/00).

		VEEEN[a]					IPOHG				
		Replication				Mean	Replication				Mean
Treatment[b]	Rate	I	II	III	IV		I	II	III	IV	
POST	kg ai/ha	%					%				
2,4-DB +	0.45										
bentazon + COC	1.12	90	90	100	90	93	90	90	90	100	93
2,4-DB +	0.28										
acifluorfen	0.42	100	80	100	100	95	75	40	45	100	65
Bentazon +	0.56										
acifluorfen + COC	0.28	0	95	0	90	46	0	40	0	70	28
Bentazon +	0.56										
acifluorfen + NIS	0.28	90	75	0	0	41	35	0	0	15	13
Bentazon +	0.56										
acifluorfen + UAN	0.28	60	0	0	90	38	0	0	0	0	0
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + NIS	0.28	0	90	70	80	60	0	90	50	85	56
Bentazon +	0.56										
acifluorfen +	0.28										
2,4-DB + COC	0.28	65	100	25	100	73	80	90	15	100	71
Untreated check 1		0	0	0	0	0	0	0	0	0	0
Untreated check 2		0	0	0	0	0	0	0	0	0	0

[a]VEEEN, crownbeard; IPOHG, entireleaf morningglory

[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate of 2.3 L/ha; UAN, urea ammonium nitrate applied at a rate of 2.3 L/ha.

Appendix Table 13. Peanut yield response for the in-crop experiment.

		Peanut yield[a]				
		Replication				Mean
Treatment[b]	Rate	I	II	III	IV	
PRE	kg ai/ha	kg/ha				
Flumioxazin	0.07	2787	3011	2950	2685	2858
Flumioxazin	0.11	2970	2258	2767	3316	2828
Diclosulam	0.03	3743	3113	4862	3336	3764
Imazethapyr	0.07	3316	2848	5269	4371	3951
Dimethenamid	1.68	-	-	-	-	-
Metolachlor	1.34	-	-	-	-	-
POST						
Diclosulam + NIS	0.03	2889	2604	3174	2340	2751
Imazethapyr + NIS	0.07	-	-	-	-	-
Imazapic + NIS	0.07	3845	3845	3499	3499	3672
Paraquat + NIS	0.14	-	-	-	-	-
Chlorimuron + NIS	0.01	2319	2807	2319	2807	2563
Acifluorfen + NIS	0.28	-	-	-	-	-
Acifluorfen + NIS	0.42	-	-	-	-	-
2,4-DB	0.56	3052	3764	4313	3336	3616
Pyridate	1.57	-	-	-	-	-
Pyridate +	1.57					
2,4-DB	0.45	3764	3235	3031	4048	3519
2,4-DB +	0.14					
bentazon	1.12	2828	3031	3418	3072	3087
2,4-DB +	0.45					
bentazon + COC	1.12	3316	3336	3825	2197	3169
2,4-DB +	0.28					
acifluorfen	0.42	-	-	-	-	-
Bentazon +	0.56					
acifluorfen + COC	0.28	-	-	-	-	-
Bentazon +	0.56					
acifluorfen + NIS	0.28	2624	2624	2055	2055	2340
Bentazon +	0.56					
acifluorfen + UAN	0.28	-	-	-	-	-
Bentazon +	0.56					
acifluorfen +	0.28					
2,4-DB + NIS	0.28	2380	2950	2950	3540	2955
Bentazon +	0.56					
acifluorfen +	0.28					
2,4-DB + COC	0.28	3316	3052	3031	2950	3087
Untreated check 1		-	-	-	-	-
Untreated check 2		2197	976	1485	1566	1556

[a]Dashes represent no yield due to weeds causing the treatment to be unharvestable.
[b]NIS, non-ionic surfactant applied at a rate of 0.25% v/v; COC, crop oil concentrate applied at a rate of 2.3 L/ha; UAN, urea ammonium nitrate applied at a rate of 2.3 L/ha.

Appendix Table 14. Crownbeard density, dry weed weight, and peanut yield response for crownbeard interference for the Colony experiment.

	Weed density					Dry weed weight					Peanut yield				
	Replication				Mean	Replication				Mean	Replication				Mean
Weed duration	I	II	III	IV		I	II	III	IV		I	II	III	IV	
WAE[a]	plants/plot					kg/plot					kg/plot				
0	0	0	0	0	0	0	0	0	0	0	4.1	4.8	5.7	6.5	5.3
4	338	27	219	109	173	0.5	0.1	0.5	0.3	0.3	2.9	3.2	4.1	7.8	4.5
6	317	107	83	82	147	1.8	0.9	0.9	0.9	1.1	3.0	3.7	5.0	6.8	4.6
8	176	116	38	364	174	4.1	1.8	1.6	3.8	2.8	2.3	3.7	6.5	1.4	3.5
10	44	42	213	389	172	2.7	2.2	3.4	3.3	2.9	3.0	3.3	3.9	4.3	3.6
12	242	208	63	354	217	5.7	4.2	3.7	5.9	4.9	1.9	4.4	7.3	2.8	4.1
14	105	51	191	34	95	6.7	5.0	4.6	3.9	5.0	1.5	4.2	4.0	5.1	3.7
16	368	158	170	110	202	10.3	7.4	5.9	6.6	7.6	1.7	2.7	1.4	4.3	2.6

[a]WAE, wk after emergence.

Appendix Table 15. Crownbeard density and dry weed weight for Ft. Cobb experiment.

	Weed density					Dry weed weight				
	Replication				Mean	Replication				Mean
Weed duration	I	II	III	IV		I	II	III	IV	
WAE[a]	plants/plot					kg/plot				
0	0	0	0	0	0	0	0	0	0	0
4	164	244	225	179	203	0.7	1.1	1.1	0.8	0.9
6	200	436	264	223	281	3.4	5.3	4.9	3.1	4.2
8	229	350	325	280	296	6.0	5.4	6.0	6.9	6.1
10	160	564	244	192	290	5.4	10.1	6.4	9.0	7.7
12	292	552	516	204	391	4.6	7.8	7.6	14.5	8.6
14	140	288	352	248	257	8.4	15.0	14.2	9.2	11.7
16	256	364	344	492	364	8.7	7.1	8.3	6.9	7.8

[a]WAE, wk after emergence.

VITA

Cody Jack Gray

Candidate for the Degree of

Master of Science

Thesis: MANAGEMENT OF THREE WEED SPECIES COMMONLY FOUND IN OKLAHOMA PEANUTS *Arachis hypogaea* AND INTERFERENCE OF CROWNBEARD *Verbesina encelioides* WITH PEANUTS

Major Field: Plant and Soil Science

Biographical:

Personal Data: Born in Pawnee, Oklahoma, on August 11, 1975, the son of Robert E. and Amber E. Gray.

Education: Graduated from Pawnee High School, Pawnee, Oklahoma, in May, 1993; received the Bachelor of Arts degree in Chemistry from Southwestern Oklahoma State University, Weatherford, Oklahoma, in May 1998; and completed the requirements for the Master of Science degree in Plant and Soil Science from Oklahoma State University, Stillwater, Oklahoma, in May, 2001.

Experience: Worked on family dairy farm in Ralston, Oklahoma while in high school. Involved in feed production at Stockman's Mill & Grain in Pawnee, Oklahoma, March, 1993 to present. Employed as a Graduate Research Associate in the Department of Plant and Soil Science, Oklahoma State University, Stillwater, Oklahoma, May 1998 to present.

Professional Memberships: Southern Weed Science Society