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Field Evaluation of Herbicides on Small Fruit, Vegetable, and Ornamental Crops, 1997

Ron Talbert
University of Arkansas, Fayetteville

Lance A. Schmidt
University of Arkansas, Fayetteville

Jennifer A. Wells
University of Arkansas, Fayetteville

Jeff S. Rutledge
University of Arkansas, Fayetteville

Dolores A. Parker
University of Arkansas, Fayetteville

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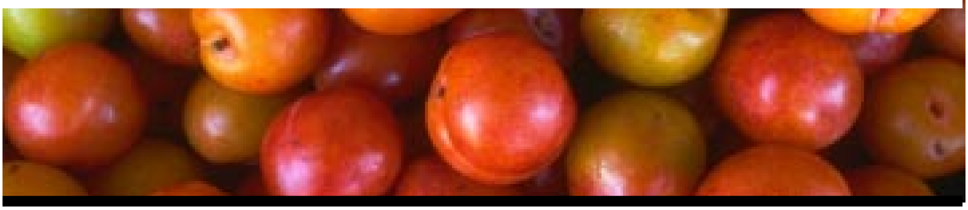

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Ron Talbert
University Professor

Lance A. Schmidt
Research Specialist

Jennifer A. Wells
Graduate Assistant

Jeff S. Rutledge
Graduate Assistant

Dolores A. Parker
Undergraduate Assistant

Authors are all in the Department of Crop, Soil, and Environmental Sciences

Arkansas Agricultural Experiment Station
Fayetteville, Arkansas 72701

SUMMARY

Growers generally use herbicides to efficiently produce high-quality fruit and vegetables for processing or fresh market sales. Due to the smaller acreage of these crops compared to major field crops, fewer herbicides are registered for use in fruit and vegetable crops than for field crops. Each year, new herbicides are evaluated under Arkansas growing conditions with the objective of improving the herbicide technology for the grower, processor, and ultimately the consumer. This report includes studies on the control of many of the more serious weed problems in important crops of this region, including snapbeans, spinach, southern pea, watermelon, cantaloupe, tomato, blackberry, and grape. In addition, the report includes information on the tolerance of selected bedding plants to some effective herbicides.

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INTRODUCTION

Field evaluations of herbicides provide the chemical industry, governmental agencies such as IR-4, and the Arkansas Agricultural Experiment Station with an evaluation of herbicide performance on small fruit, vegetable, and ornamental crops grown under Arkansas conditions. This report also provides a means for disseminating information to interested private and public service weed scientists.

Experiments at the Arkansas Agricultural Research and Extension Center in Fayetteville were conducted on blackberry, grape, summer squash, tomato, watermelons, cantaloupe, bell peppers, okra, southern pea, and ornamentals. At the Vegetable Substation near Kibler, experiments were conducted on fall spinach, southern pea, and watermelon. A snapbean trial was conducted on a private farm near Lowell.

The chemical names and formulations of the herbicides used in these experiments are listed in Appendix Table 1. A table for converting metric units to English units can be found on page 36.

At Fayetteville, trials were conducted on a Captina silt loam with 1 to 2% organic matter and pH of 5.9. Soil at Lowell was a Perridge silt loam with 1.5% organic matter and pH of 5.3. At the Vegetable Substation, trials were conducted on a Roxana silt loam with 1% organic matter and pH of 6.9. Unless stated otherwise, the experimental design for all experiments was a randomized complete block with four replications. Preplant-incorporated, preemergence, delayed preemergence, cracking, postemergence, and postemergence-directed treatments were applied in 187 L/ha of water. Liquid herbicides were applied with a hand-held, carbon-dioxide pressurized sprayer.

Treatments involving timing and incorporation were (1) preplant incorporated (PPI), applied to the soil and incorporated prior to planting; (2) preemergence (PRE), applied to the soil surface soon after planting; (3) cracking (CRAC), applied 3 to 5 days after planting prior to emergence; (4) delayed-preemergence (DPRE) applied 5 to 7 days after planting prior to emergence, (5) over-the-top of transplants preemergence to weeds (POST-TP); (5) postemergence (POST), applied over-the-top to emerged crops and weeds at various stages — determined either by days after planting or by crop and weed growth stage; and (6) postemergence-directed (POST-DIR), applied to basal portion of the crop. The following environmental conditions were recorded for each application: air temperature (C); soil temperature (C) at 8 cm deep; soil surface moisture as wet, moist, or dry; and percent relative humidity (RH).

Percentage of weed control by species was visually estimated: 0 represents no effect, and 100 represents complete control. Ranges for weed control are as follows: 70 to 79%, fair; 80 to 89%, good; and 90 to 100%, excellent. Weed control less than 70% is considered to be poor. Crop injury was assessed by visual estimation of percent injury: 0 represents no effect, and 100 represents complete plant kill. Crop injury ratings of less than 30% indicate crop tolerance. Crop yields are reported in metric tons per hectare unless stated otherwise. Least Significant Difference (LSD) values at the 0.05 level of significance were calculated for each set of treatment means.

Climatological data for 1997 at Fayetteville are presented in Appendix Table 2, and for the Vegetable Substation in Appendix 3. Standardized Plant (Bayer) Codes, as recognized by the Weed Science Society of America for weeds, appearing in this report are presented in Appendix Table 4.

METHODS AND RESULTS

Pertinent experimental details and a brief discussion of the results of these studies follow, and tabulated results are shown in Tables 1 to 16. Additional abbreviations are used in the tables: cm, centimeter; COC, crop oil concentrate; cv, cultivar; DAT, days after treatment; fb, followed by; kg/ha, kilograms active ingredient per hectare; NS, not significant; pl, plants; TM, tank mix; V2, first trifoliolate stage of legume; var, variety; v/v, volume per volume; WA, wetting agent; WAE, weeks after emergence; WAP, weeks after planting; and wk, week(s).

Evaluation of Herbicides for Snapbeans (*Phaseolus vulgaris*), Lowell (Table 1).

Snapbeans (cv. Endurance) were planted May 5, 1997, in 3- by 6-m plots with four rows spaced 76 cm apart. PPI and PRE treatments were applied the same day as planting (air 24EC; soil 21EC, moist; RH 62%). Cracking treatments were applied May 10, 1997 (air 22EC; soil 20EC, moist; RH 67%), and POST treatments were applied June 6,1997 (air 27EC; soil 24EC, moist; RH 70%). Weed control and crop injury evaluations were made 5 and 7 WAP. Plots were harvested 8 WAP on July 2, 1997.

The treatment providing the most outstanding, full-season control of common lambsquarters, Palmer amaranth, and Italian ryegrass and greatest yield was clomazone, 0.56 kg/ha, PRE fb fomesafen (Reflex®), 0.21 kg/ha + AG-98, 0.25% v/v, POST. Treatments providing good to excellent season-long control of common lambsquarters and Palmer amaranth were metolachlor, 1.12 kg/ha, applied PRE fb fomesafen (Flexstar® HL), 0.21 kg/ha + AG-98, 0.25 % v/v, POST or tank-mixed with fomesafen (Flexstar® HL), 0.28 kg/ha, applied at the CRACKING stage; and lactofen, 0.28 kg/ha, PRE. Lactofen at 0.14 and 0.21 kg/ha, PRE, provided excellent early-season control of common lambsquarters and Palmer amaranth, but control began to break by the 7-wk rating. The standard POST treatments that normally provide excellent weed control were not as effective this season due to the larger weed size at time of application.

Slight bleaching of snapbeans due to clomazone application was evident early in the season; however, no bleaching was noticed by 8 wk. Yield differences between treatments were directly influenced by the weed control that each treatment provided.

Evaluation of Herbicides for Fall Spinach (*Spinachia oleracea*), Kibler (Table 2).

Spinach (cv. Fall Green) was planted September 19, 1997, in plots 1.3 by 5 m with six rows spaced 20 cm apart. PPI and PRE treatments were applied the same day (air 31EC; soil 27EC, moist; RH 82%). POST treatments were applied October 10, 1997 (air 24EC; soil 22EC, moist; RH 90%). Plots were not harvested due to the severe frost that occurred in the area.

Henbit was the most predominant and competitive weed in the experiment. Metolachlor at 1.12 or 2.24 kg/ha applied PRE; dimethenamid at 0.56 or 1.12 kg/ha applied PRE; and phenmedipham at 0.28 kg/ha + metolachlor at 1.12 kg/ha applied POST gave excellent control of henbit and provided good to excellent control of sibara and shepherdspurse by 10 wk. Chlorpropham at 2.24 kg/ha + phenmedipham at 0.28 kg/ha applied POST; and cycloate at 2.24 kg/ha applied PPI followed by either clorpyralid at 0.08 kg/ha or phenmedipham at 0.28 kg/ha applied POST gave good to excellent control of sibara and shepherdspurse by 10 wk, but did not effectively control henbit. Dimethenamid at 1.12 kg/ha PRE caused severe injury to spinach at 3 wk but had begun to grow out of the injury by 5 wk. Spinach injury at the 10-wk rating was caused by frost.

Yellow Nutsedge (*Cyperus esculentus*) Control in Southern Pea (*Vigna unguiculata*), Kibler (Table 3).

Southern pea (cv. 92-551) was planted June 5, 1997, in plots 2 by 3 m with three rows spaced 50 cm apart. PPI and PRE treatments were applied the same day (air 27EC; soil 28EC, moist; RH 75%). Cracking treatments were applied June 9, 1997 (air 22EC; soil 24EC, moist; RH 95%). POST treatments were applied June 30, 1997 (air 31EC; soil 26EC, moist; RH 83%). Visual ratings of percent injury to southern pea and percent control of yellow nutsedge were taken at 3, 6, and 9 WAT. Yield was taken September 9, 1997.

Yellow nutsedge was the most predominant and competitive weed in all test plots. All rates of sulfentrazone applied PRE and PPI provided season-long control of yellow nutsedge. These treatments caused slight injury to southern pea early in the season with no effect on final yield. Sulfentrazone applied at cracking significantly injured southern pea all season long. Metolachlor and fomesafen applied PRE provided fair yellow nutsedge control with slight injury to southern pea early in the season. Dual® applied PPI alone provided season long control of 83% at 9 WAT with no southern pea injury. Halosulfuron applied POST provided fair control of yellow nutsedge with 30 to 43% injury to southern pea observed.

Yellow Nutsedge (*Cyperus esculentus*) Control in Southern Pea (*Vigna unguiculata*), Fayetteville (Table 4).

Southern pea (cv. Encore) was planted June 26, 1997, in plots 2 by 3 m with three rows spaced 50 cm apart. PPI and PRE treatments were applied the same day (air 30EC; soil 32EC, dry; RH 65%). Cracking treatments were applied July 1, 1997 (air 31EC; soil 26EC, dry; RH 90%). POST treatments were applied July 23, 1997 (air 30EC; soil 30EC, moist; RH 90%). Visual ratings of percent injury to southern pea and percent control of yellow nutsedge were taken at 2, 4, 6, and 8 WAT, and southern pea yield was evaluated.

Yellow nutsedge was the most predominant and competitive weed in all test plots. Metolachlor and fomesafen applied PRE provided good yellow nutsedge control all season with slight injury to southern pea early in the season. Metolachlor applied PPI alone provided season-long control of yellow nutsedge with slight injury to southern pea. All rates of sulfentrazone applied PRE and PPI provided fair control of yellow nutsedge. These treatments caused slight injury to southern pea early in the season with no effect on final yield. Sulfentrazone applied at cracking significantly injured southern pea all season. Halosulfuron applied POST provided fair control of yellow nutsedge with some observable injury to southern pea.

Cultivar Tolerance of Southern Pea (*Vigna unguiculata*) to Sulfentrazone, Fayetteville (Table 5).

Five cultivars of southern pea were evaluated for their tolerance to sulfentrazone. These included Coronet and Mississippi Silver, which are indeterminate growth types, and Encore, Early Acre, and Early Scarlet, which are determinate growth types.

All cultivars were planted and sprayed with sulfentrazone PPI at 0, 0.21, 0.42 and 0.63 kg/ha on June 26, 1997 (air 31EC; soil 32EC, dry; RH 65%). Plot size was 0.5 m by 3 m with one row per plot and four replications. Response was assessed by percent visual injury at 3, 6, and 9 WAT and final yield.

Mississippi Silver and Coronet, the indeterminate types, were the most tolerant cultivars to sulfentrazone. Mississippi Silver showed no significant injury at any sulfentrazone rate, at any of the ratings. Coronet showed significant injury of 18% at 3 WAT with 0.42 and 0.63 kg/ha of sulfentrazone, but showed no significant injury at 6 or 9 WAT with any of the rates. The determinate type peas were less tolerant to the herbicide. Encore showed significant injury at all three rates until 6 WAT; however, there was no significant injury at 9 WAT. Early Scarlet showed significant injury of at least 31% at 3, 6, and 9 WAT to 0.42 kg/ha of sulfentrazone. Finally, Early Acre showed significant injury of up to 28% at rates of 0.42 and 0.63 kg/ha of sulfentrazone at 3, 6, and 9 WAT.

The study was planted in an area of a heavy yellow nutsedge infestation of 200 to 500 plants/m^2. This was impossible to maintain weed-free without herbicide treatments; therefore, yield increased with rate of sulfentrazone.

Bensulide Study in Watermelon (*Citrullus lanatus*), Kibler (Table 6).

Watermelon seeds (cv. Crimson Sweet) were planted May 1, 1997, in plots 3.5 by 9 m with one row per plot. PRE and PPI treatments were applied the same day (air 23EC; soil 21EC, moist; RH 68%). PRE applications were immediately followed by irrigation with 0.2 in. of water. Evaluations for weed control were made at 2, 4, and 8 WAE.

The predominant weed species were goosegrass, johnsongrass, and eclipta. Bensulide at both rates provided better control of purslane and eclipta when immediately irrigated than when applied PPI. Overall, bensulide provided fair to good control of all weed species until 4 WAE. At 8 WAE control of all weed species was poor. Yield was not taken due to severe weed infestation.

Watermelon (*Citrullus lanatus*) Study for Yellow Nutsedge Control, Fayetteville (Table 7).

Watermelon seeds (cv. Crimson Sweet) were planted May 21, 1997, in 2- by 3.5-m plots with one row per plot. PRE treatments were applied the same day (air 21EC; soil 23EC, moist; RH 62%) and POST treatments were applied June 27, 1997 (air 31EC; soil 31EC, moist; RH 75%). Evaluations of yellow nutsedge control and crop injury were made at 3, 6, and 9 WAT, and final yield was evaluated.

Yellow nutsedge was the most predominant and competitive weed in all test plots. All rates of halosulfuron applied PRE provided fair to good control of yellow nutsedge through 9 wk. Both rates of halosulfuron applied POST provided good control of yellow nustedge. PRE applications of bensulide and ethalfluralin provided very poor control.

PRE and POST applications of halosulfuron caused slight injury early in the season but did not affect final yield. There was no injury to watermelon from applications of bensulide or ethalfluralin.

Cantaloupe (*Cucumis melo*) Study for Yellow Nutsedge Control, Fayetteville (Table 8).

Cantaloupe seeds (cv. Mission Hybrid) were planted May 21, 1997, in 2- by 3.5-m plots with one row per plot. PRE treatments were applied the same day (air 21EC; soil 23EF, moist; RH 62%) and POST treatments were applied June 27, 1997 (air 31EC; soil 31EC, moist; RH 75%). Evaluations of yellow nutsedge control and crop injury were made at 3, 6, and 9 WAT, and final yield was evaluated.

Yellow nutsedge was the most predominant and competitive weed in all test plots. All rates of halosulfuron applied PRE provided fair to good control of yellow nutsedge through the 9 wk. Both rates of halosulfuron applied POST provided good control of yellow nustedge. PRE applications of bensulide and ethalfluralin provided very poor control.

PRE and POST applications of halosulfuron cased slight crop injury early in the season but did not affect final yield. There was no injury to cantaloupe from applications of bensulide or ethalfluralin.

Primocane Suppression in Blackberries (*Rubus* spp.), Fayetteville (Table 9).

Established blackberry (cv. Cheyenne) plots were 1 by 2 m with 1 row per plot. POST-dir treatments were applied to 13-cm primocanes on May 15, 1997 (air 18EC; soil 17EC, moist; RH 72%), May 29, 1997 (air 20EC; soil 18EC, moist; RH 65%) and June 12, 1997(air 24EC; soil 23EC, moist; RH 74%). The standard included a mowing treatment that was performed on the same dates as the herbicide applications. Evaluations of raspberry injury and primocane suppression were taken at 1, 2, 3, 4, and 5 wk after the first POST-dir application.

Three POST-dir applications of 1.12 kg/ha of lactofen caused slight injury to blackberries and suppressed primocanes fairly well throughout the fourth week of the experiment. Three POST-dir applications of 2.24 kg/ha of lactofen caused slightly more injury than the 1.12 kg/ha rate and initially suppressed primocanes better. No significant differences in yields were observed among treatments.

Weed Control in Grapes (*Vitis labrusca*), Fayetteville (Table 10).

Grape (cv. Concord) plots were 2.5 by 12 m with three vines per plot. All test plots were treated May 14, 1997 (air 18EC; soil 16EC, moist; RH 55%) with a POST-dir application of oryzalin, 2.24 kg/ha + diuron, 2.24 kg/ha for residual control. POST-dir applications of glufosinate, glyphosate, and paraquat were compared in a May 28, 1997, application (air 25EC; soil 23EC, moist; RH 55%), June 18, 1997 (air 31EC; soil 27EC, moist; RH 95%), and July 15, 1997 (air 32EC; soil 28EC, moist; RH 80%). Small trees found in the plots were clipped and treated with glyphosate on each application date.

The POST-dir applications of glufosinate, 1.12 kg/ha + ammonium sulfate, 3.36 kg/ha; glyphosate, 1.12 kg/ha; or paraquat, 0.56 kg/ha + AG-98, 0.25 % v/v provided excellent control of bermudagrass and common dandelion by 8 wk. Applications of glufosinate and glyphosate provided good suppression of trumpet creeper by the end of the season, but never killed it. All three herbicides were effective in controlling grape suckers at the base of the vines. No injury to the grape vines was evident throughout the experiment. Yields did not differ significantly among treatments, except for the paraquat treatment which had significantly lower yields.

Weed Control in Tomato (*Lycopersicon esculentum* Mill) with Rimsulfuron, Fayetteville (Table 11).

Tomatoes (cv. Mt. Spring) were transplanted into 1- by 2.5-m plots (one row per plot, four plants per row) on May 13, 1997. Plants were spaced 61 cm apart. PPI and post-transplant PRE treatments were applied the day of transplanting (air 24EC; soil 20EC, moist; RH 80%). POST treatments were applied June 12, 1997 (air 27EC; soil 26EC, moist; RH 82%). Ratings were taken 9 wk after the PPI and PRE applications.

Rimsulfuron at 0.017, 0.026 and 0.035 kg/ha applied at the PRE, POST, or PRE fb POST timings provided excellent control of Palmer amaranth, and good to excellent control of yellow nutsedge at the 9-wk rating. Control of goosegrass with rimsulfuron was poor at any rate or timing. The standard program of metribuzin at 0.28 kb/ha + sethoxydim at 0.21 kg/ha + COC at 1% v/v applied POST effectively controlled Palmer amaranth, yellow nutsedge and goosegrass. There was no significant injury observed from any treatment. No differences were found in average number of fruit or average weight of fruit per plant.

Mixed Cover Crop Verification in Tomato (*Lycopersicon esculentum* Mill), Fayetteville (Table 12).

Tomatoes (cv. Mt. Spring) were transplanted into 4.5- by 6-m plots (2 rows per plot, 12 plants per row) with mixed cover crops of rye plus vetch, black plastic, and no cover on May 13, 1997. Tomato plants were staked, fertilized, and irrigated as recommended.

The entire test area was planted in September, 1996, with two parts rye (39 kg/ha) plus one part vetch (14 kg/ha). The black plastic and no cover plots were burned down (chemically desiccated) in October, 1996, with glyphosate (Roundup Ultra) (air 15EC; soil 13EC, moist; RH 65%). Cover crop plots were desiccated with 0.84 kg/ha paraquat plus 0.4 kg/ha metribuzin (air 18EC; soil 14EC, moist; RH 55%) on April 30, 1997. One week prior to transplanting, black plastic and no cover plots were treated with trifluralin, 0.84 kg/ha, PPI (air 22EC; soil 18EC, moist; RH 80%). Black plastic was also laid on the appropriate plots at this time. On July 9, 1997, all plots were POST-dir with 0.28 kg/ha metribuzin (air 27EC; soil 20EC, moist; RH 80%).

The total number of tomato fruits and the average fruit weight per plant were similar in plots with mixed cover crops, black plastic, and no cover.

Quinclorac Drift Simulation on Okra (*Abelmoschus esculentus* L. Moench), Tomato (*Lycopersicon esculentum* Mill) and Bell Pepper (*Capsicum annuum* var. *annuum* L.), Fayetteville (Table 13).

Four okra (cv. Clemson Spineless), four tomato (cv. Mt. Spring), and three bell pepper (cv. Renegade) plants were transplanted into 1- by 5.5-m plots on May 13, 1997. Okra and tomatoes were spaced 46 cm apart, and bell peppers were spaced 61 cm apart within each plot. Drift simulated rates of quinclorac were 1, 0.2, 0.04, 0.008, and 0.0016% of 0.42 kg/ha, the labeled rate in rice production. As a standard treatment, 2, 4-D amine was applied at 0.2% of the 1.12 kg/ha rate. All treatments were applied June 21, 1997 (air 27EC; soil 25EC, moist; RH 78%) to 28- to 35-cm okra (blooming), 50- to 67-cm tomatoes (2 weeks after first bloom) and 14- to 25-cm bell peppers (blooming). Plots were fertilized and irrigated according to normal production practices and maintained weed-free.

No significant differences in average number of fruit per plant or average weight of fruit per plant were found in this study. Following the drift simulated applications, there were noticeable changes in the development of new growth.

Evaluation of Herbicides for Dianthus (*Dianthus* spp.), Fayetteville (Table 14).

Dianthus plants were transplanted on September 2, 1997, into 15-cm standard pots. Sunshine Potting Soil Mix™ was used as the growing medium. Plot size was one pot, with one plant per pot. There were four replications.

All herbicides were applied POST-TP on October 2, 1997 (air 28EC; soil 31EC, moist; RH 75%). Sprayable formulations were applied using a laboratory spray chamber. Granular applications were applied using a shaker jar applicator. The dianthus were 10 cm tall at the time of application.

There were no weeds present in any of the plots during the experiment. Oryzalin + oxyfluorfen applied at 13.46 kg/ha and oxyfluorfen + pendimethalin applied at 13.46 kg/ha caused significant injury at 10 DAT, but plants recovered and showed no significant injury at 28 or 56 DAT. Oryzalin alone caused significant injury at 4.49 kg/ha and 8.98 kg/ha early, but the plants recovered, and no injury was observed at 28 or 56 DAT.

Evaluation of Herbicides for Salvia (*Salvia splendens*), Fayetteville (Table 15).

Salvia plants were transplanted September 2, 1997, into 15-cm standard pots. Sunshine Potting Soil Mix™ was used as the growing medium. Plot size was one pot, with one plant per pot. There were four replications.

All herbicides were applied POST-TP on October 2, 1997 (air 28EC; soil 31EC, moist; RH 75%). Sprayable formulations were applied using a laboratory spray chamber. Granular applications were applied using a shaker jar applicator. The salvia were 15 cm tall at the time of application.

There were no weeds present in any of the plots during the experiment. Oryzalin and oryzalin + oxyfluorfen caused no injury at any rate or any rating time. Dithiopyr applied at 1.12 and 2.24 kg/ha caused stunting at 10, 28, and 56 DAT. Prodiamine applied at 3.37 and 6.73 kg/ha caused significant injury at all three rating times.

Evaluation of Herbicides for Geranium (*Geranium* spp.), Fayetteville (Table 16).

Geranium plants were transplanted on September 2, 1997, into 15-cm standard pots. Sunshine Potting Soil Mix™ was used as the growing medium. Plot size was one pot, with one plant per pot. There were four replications.

All herbicides were applied POST-TP on October 2, 1997 (air 28EC; soil 31EC, moist; RH 75%). Sprayable formulations were applied using a laboratory spray chamber. Granular applications were applied using a shaker jar applicator. The geraniums were 10 cm tall at the time of application.

There were no weeds present in any of the plots during the experiment. Oryzalin + oxyfluorfen applied at 3.37, 6.73, and 13.46 kg/ha did not cause any injury at any rating time. Stunting was observed at both 28 and 56 DAT with prodiamine applied at 6.73 kg/ha. Oryzalin at 4.49 and 8.98 kg/ha caused injury at 10 and 28 DAT but the plants recovered and no injury was observed at 56 DAT. Dithiopyr caused injury at 10 DAT at rates of 0.56, 1.12, and 2.24 kg/ha. The plants treated with the low rate of 0.56 kg/ha recovered and showed no injury at 28 or 56 DAT. The plants treated with 1.12 kg/ha showed injury at 10 and 28 DAT but recovered by 56 DAT; however, plants treated with the high rate of 2.24 kg/ha showed significant stunting at 10, 28, and 56 DAT.

Table 1. Evaluation of herbicides for snapbeans, Lowell, 1997.

	Weed control[a]						Effect on snapbeans		
	CHEAL		AMAPA		LOLMU		Injury		
Treatment description[b]	4 wk	8 wk	4 wk	8 wk	4 wk	8 wk	4 wk	8 wk	Yield
(kg ai/ha)	(%)								(mt/ha)
Weedy check	0	0	0	0	0	0	0	0	1.7
Hand-weeded check	100	100	100	100	100	99	0	0	8.6
Clomazone, 0.56, PRE fb fomesafen (Flexstar®), 0.21 + AG-98 (0.25%), POST	95	96	86	93	85	96	23	9	10.4
Metolachlor, 1.12, PRE fb fomesafen (Reflex®), 0.14, CRAC	88	75	94	95	55	81	10	3	8.8
Metolachlor, 1.12, PRE fb fomesafen (Reflex®), 0.28, CRAC	87	73	95	95	73	93	9	1	7.8
Metolachlor, 1.12, PRE fb fomesafen (Flexstar®), 0.28, CRAC	90	85	95	94	73	94	13	3	9.3
Metolachlor, 1.12, PRE fb fomesafen (Flexstar®), 0.21 + AG-98 (0.25%), POST	83	81	95	95	52	90	13	8	10.4
Metolachlor, 1.12, PRE fb halosulfuron, 0.03 + AG-98 (0.25%), POST	88	78	95	91	78	73	13	3	9.0
Trifluralin, 0.56, PPI fb halosulfuron, 0.03 + AG-98 (0.25%), POST	63	76	87	80	54	69	20	11	8.2
Trifluralin, 0.56, PPI fb imazethapyr, 0.03 + AG-98 (0.25%), POST	83	70	78	85	69	80	15	4	6.8
Trifluralin, 0.56, PPI fb bentazon, 0.42 + fomesafen (Reflex®), 0.21 + AG-98 (0.25%), POST	78	70	51	78	68	56	24	4	7.6
Trifluralin, 0.56, PPI fb imazethapyr, 0.03 + bentazon, 0.42 + AG-98 (0.25%), POST	73	78	54	80	60	78	10	1	9.3

continued

Table 1. Continued.

	Weed control[a]						Effect on snapbeans		
	CHEAL		AMAPA		LOLMU		Injury		
Treatment description[b]	4 wk	8 wk	4 wk	8 wk	4 wk	8 wk	4 wk	8 wk	Yield
(kg ai/ha)	- - - - - - - - - - - - - - - - - - -	(%)	- - - - - - - - - - - - - - - - - - -						(mt/ha)
Lactofen, 0.14, PRE	91	70	94	81	30	40	13	8	7.4
Lactofen, 0.21, PRE	90	69	95	83	43	34	18	6	8.0
Lactofen, 0.28, PRE	86	80	94	91	33	38	16	5	8.8
Bentazon, 0.42 + fomesafen (Reflex®), 0.21 + sethoxydim, 0.22 + AG-98 (0.25%), POST	—	43	—	51	—	49	—	8	7.5
Halosulfuron, 0.03 + quizalofop, 0.07 + AG-98 (0.25%), POST	—	36	—	43	—	81	—	0	6.9
Halosulfuron, 0.03 + sethoxydim, 0.22 + AG-98 (0.25%), POST	—	34	—	46	—	51	—	0	2.8
LSD (0.05)[c]	9	9	9	7	16	8	9	5	1.7

[a] Evaluations were made 4 and 8 wk after planting. The 8-wk evaluation corresponds to 4 wk after POST applications.

[b] PPI = preplant incorporated, PRE = preemergence immediately after planting, CRAC = cracking stage, and POST = postemergence over-the-top of foliage.

[c] LSD values may be used to compare means within the same column.

Table 2. Evaluation of herbicides for fall spinach, Kibler, 1997.

	Weed control[a,b]											
	LAMAM			CAPBP			SIBVI			Spinach injury		
Treatment description[c]	3 wk	5 wk	10 wk	3 wk	5 wk	10 wk	3 wk	5 wk	10 wk	3 wk	5 wk	10 wk
(kg ai/ha)	(%)											
Untreated check	0	0	0	0	0	0	0	0	0	0	5	47
Cycloate, 2.24, PPI	98	34	72	81	84	90	84	68	78	8	1	35
Cycloate, 2.24, DPRE	86	41	67	78	75	84	86	78	75	9	4	43
Metolachlor, 1.12, PRE	99	85	92	90	91	88	97	95	92	10	10	52
Metolachlor, 2.24, PRE	100	93	95	94	95	92	83	94	89	25	16	66
Chlorpropham, 2.24, POST	—	40	78	—	34	65	—	33	56	—	4	26
Phenmedipham, 0.28 + sethoxydim, 0.28, POST	—	35	88	—	81	73	—	79	81	—	1	23
Chlorpropham, 2.24 + phenmedipham, 0.28, POST	—	53	74	—	86	92	—	88	89	—	11	46
Cycloate, 2.24, PPI fb clopyralid, 0.08, POST	96	40	78	89	90	80	89	86	92	16	4	44
Halosulfuron, 0.02, POST	—	44	68	—	48	78	—	48	74	—	29	68
Halosulfuron, 0.04, POST	—	41	59	—	43	83	—	43	76	—	13	67
Dimethenamid, 0.56, PRE	99	91	90	90	90	92	90	91	92	15	8	65
Dimethenamid, 1.12, PRE	100	93	92	97	89	95	90	91	90	56	23	73
Phenmedipham, 0.28 + metolachlor, 1.12, POST	—	96	95	—	94	83	—	93	95	—	1	27
Cycloate, 2.24, PPI fb phenmedipham, 0.28, POST	97	93	84	91	96	89	86	96	89	9	3	42
Fluroxypyr, 0.14, POST	—	35	68	—	38	73	—	43	82	—	6	38
Fluroxypyr, 0.14 + AG-98 (0.25%), POST	—	54	72	—	54	78	—	46	79	—	19	52
LSD (0.05)[d]	3	17	26	5	13	32	7	11	29	8	10	NS

[a] Evaluations were made 3, 5, and 10 wk after planting. The 5- and 10-wk evaluations correspond to 2 and 7 wk after POST applications.
[b] The 10-wk ratings were taken following a severe frost that hit the area.
[c] PPI = preplant incorporated, PRE = preemergence immediately after planting, POST = postemergence over-the-top of foliage, and DPRE = delayed-preemergence.
[d] LSD values may be used to compare means within the same column.

Table 3. Yellow nutsedge control in southern peas, Kibler, 1997.

	Weed control[a]			Effect on southern pea			
	CYPES			Injury			
Treatment description[b]	3 wk	6 wk	9 wk	3 wk	6 wk	9 wk	Yield
(kg ai/ha)	(%)						(mt/ha)
Untreated check	0	0	0	0	0	0	0.5
Bentazon, 0.84 + COC							
(Agri-Dex, 1.25% v/v), POST	0	88	53	0	10	5	0.4
Imazethapyr, 0.07, PPI	73	93	85	3	3	3	0.5
Metolachlor, 2.24, PPI	80	95	83	13	10	8	0.6
Sulfentrazone, 0.42, PRE	78	88	80	30	15	10	0.6
Sulfentrazone, 0.42, PPI	78	83	70	20	23	18	0.5
Sulfentrazone, 0.21, PRE	65	83	73	10	10	10	0.5
Sulfentrazone, 0.21, PPI	76	85	83	15	15	3	0.5
Metolachlor, 2.24 +							
fomesafen, 0.14, PRE	58	88	68	10	10	3	0.4
Metolachlor, 2.24 +							
fomesafen, 0.28, PRE	38	65	68	18	3	3	0.5
Halosulfuron, 0.039 + WA							
(AG-98, 0.25%), POST	0	83	40	0	33	30	0.5
Halosulfuron, 0.019 + WA							
(AG-98, 0.25%), POST	0	43	50	0	13	10	0.5
Sulfentrazone, 0.21, CRAC	80	90	53	40	43	43	0.4
Sulfentrazone, 0.42, CRAC	78	88	70	38	33	30	0.5
LSD (0.05)[c]	23	30	35	12	12	12	0.1

[a] Evaluations were made 3, 6, and 9 wk after planting. The 6- and 9-wk evaluations correspond to 2 and 5 wk after POST applications.
[b] PPI = preplant incorporated, PRE = preemergence, CRAC = cracking stage, POST = postemergence.
[c] LSD values may be used to compare means within the same column.

Table 4. Yellow nutsedge control in southern pea, Fayetteville, 1997.

Treatment description[b]	Weed control[a] CYPES				Effect on southern pea Injury				Yield
	2 wk	4 wk	6 wk	8 wk	2 wk	4 wk	6 wk	8 wk	
(kg ai/ha)	(%)								(mt/ha)
Untreated check	0	0	0	0	0	0	0	0	0.7
Bentazon, 0.84 + COC (Agri-Dex, 1.25% v/v), POST	0	0	82	76	0	0	13	8	0.9
Imazethapyr, 0.07, PPI	68	80	88	85	0	3	0	0	1.1
Metolachlor, 2.24, PPI	86	83	91	88	10	15	11	5	1.0
Sulfentrazone, 0.42, PRE	60	68	74	68	13	8	8	5	1.1
Sulfentrazone, 0.42, PPI	50	58	80	68	23	20	9	8	1.1
Sulfentrazone, 0.21, PRE	50	68	61	58	13	10	0	0	1.0
Sulfentrazone, 0.21, PPI	55	60	60	58	15	18	3	0	0.8
Metolachlor, 2.24 + fomesafen, 0.14, PRE	83	80	78	68	8	3	4	2	0.9
Metolachlor, 2.24 + fomesafen, 0.28, PRE	86	86	91	85	13	13	9	5	1.0
Halosulfuron, 0.039 + WA (AG-98, 0.25%), POST	0	0	78	72	0	0	46	26	0.5
Halosulfuron, 0.019 + WA (AG-98, 0.25%), POST	0	0	64	72	0	0	36	25	0.6
Sulfentrazone, 0.42, CRAC	45	53	45	35	50	60	0	7	0.6
Sulfentrazone, 0.21, CRAC	55	63	58	45	23	35	0	0	0.8
LSD (0.05)[c]	17	13	28	22	14	20	8	1	0.4

[a] Evaluations were made 2, 4, 6, and 8 wk after planting. The 6- and 8-wk evaluations correspond to 2 and 4 wk after POST applications.

[b] PPI = preplant incorporated, PRE = preemergence, CRAC = cracking stage, POST = postemergence.

[c] LSD values may be used to compare means within the same column.

Table 5. Cultivar tolerance of southern peas to sulfentrazone, Fayetteville, 1997.

	Weed control[a]			Effect on southern pea			
	CYPES			Injury			
Treatment description[b]	3 wk	6 wk	9 wk	3 wk	6 wk	9 wk	Yield
(kg ai/ha)	(%)						(mt/ha)
ENCORE:							
Untreated check	0	0	0	0	0	0	0.6
Sulfentrazone, 0.21, PPI	70	70	71	10	23	9	0.8
Sulfentrazone, 0.42, PPI	80	73	83	20	23	10	1.1
Sulfentrazone, 0.63, PPI	70	80	90	20	18	13	1.5
CORONET:							
Untreated check	0	0	0	0	0	0	0.3
Sulfentrazone, 0.21, PPI	73	83	84	13	13	3	0.7
Sulfentrazone, 0.42, PPI	60	70	76	18	15	5	1.1
Sulfentrazone, 0.63, PPI	73	85	74	18	16	9	1.3
EARLY SCARLET:							
Untreated check	0	0	0	0	0	0	0.7
Sulfentrazone, 0.21, PPI	58	48	79	8	15	15	0.8
Sulfentrazone, 0.42, PPI	75	83	88	33	48	31	0.8
Sulfentrazone, 0.63, PPI	78	85	90	23	13	9	1.0
EARLY ACRE:							
Untreated check	0	0	0	0	0	0	0.5
Sulfentrazone, 0.21, PPI	73	75	91	10	13	14	0.6
Sulfentrazone, 0.42, PPI	70	83	93	20	28	21	0.6
Sulfentrazone, 0.63, PPI	75	78	89	25	28	21	0.7
MISSISSIPPI SILVER:							
Untreated check	0	0	0	0	0	0	0.4
Sulfentrazone, 0.21, PPI	78	70	93	3	5	4	0.8
Sulfentrazone, 0.42, PPI	78	80	86	13	10	4	0.3
Sulfentrazone, 0.63, PPI	80	85	93	10	8	13	0.4
LSD (0.05)[c]	18	18	13	14	17	16	0.5

[a] Evaluations were made 3,6, and 9 wk after PPI applications.

[b] PPI = preplant incorporated.

[c] LSD values may be used to compare means within the same column.

Table 6. Bensulide study in watermelon, Kibler, 1997

	Weed control[a]								
	SORHA			AMAPA			ECLAL		
Treatment description[b]	2 wk	4 wk	8 wk	2 wk	4 wk	8 wk	2 wk	4 wk	8 wk
(kg ai/ha)					(%)				
NON-IRRIGATED:									
Untreated check	0	0	0	0	0	0	0	0	0
Bensulide, 5.0, PPI	78	28	13	81	38	30	65	0	0
Bensulide, 6.0, PPI	68	25	13	88	35	28	60	0	0
IRRIGATED:									
Untreated check	0	0	0	0	0	0	0	0	0
Bensulide, 5.0, PPI	70	28	15	58	23	14	78	0	0
Bensulide, 6.0, PPI	78	23	13	65	20	6	78	0	0
Ethalfluralin, 1.5, PPI	83	65	48	70	43	23	83	3	0
LSD (0.05)[c]	14	10	5	20	12	8	13	3	0

Table 6. Continued.

	Weed control[a]							Effect on watermelon		
	ELEIN			DIGSA			POROL			
Treatment description[b]	2 wk	4 wk	8 wk	2 wk	4 wk	8 wk	2 wk	2 wk	4 wk	8 wk
(kg ai/ha)						(%)				
NON-IRRIGATED:										
Untreated check	0	0	0	0	0	0	0	0	0	0
Bensulide, 5.0, PPI	70	25	15	68	28	13	0	0	0	0
Bensulide, 6.0, PPI	70	23	13	68	25	10	0	0	0	0
IRRIGATED:										
Untreated check	0	0	0	0	0	0	0	0	0	0
Bensulide, 5.0, PPI	60	18	11	63	20	13	70	0	0	0
Bensulide, 6.0, PPI	75	15	9	73	25	11	83	0	0	0
Ethalfluralin, 1.5, PPI	73	40	21	65	48	30	78	0	0	0
LSD (0.05)[c]	12	14	7	13	9	6	16	0	0	0

[a] Evaluations were made 2, 4, and 8 wk after emergence.

[b] PPI = preplant incorporated.

[c] LSD values may be used to compare means within the same column.

Table 7. Watermelon study for yellow nutsedge control, Fayetteville, 1997.

	Weed control[a]			Effect on watermelon			
	CYPES			Injury			
Treatment description[b]	3 wk	6 wk	9 wk	3 wk	6 wk	9 wk	Yield
(kg ai/ha)	(%)						(mt/ha)
Untreated check	0	0	0	0	0	0	2
Ethalfluralin, 1.68, PRE hand-weeded	0	0	20	0	0	0	4
Bentazon, 0.84 + COC (Agri-Dex, 1.25% v/v), POST	0	35	28	0	8	3	15
Sulfentrazone, 0.28, PRE	33	58	45	88	15	10	12
Halosulfuron, 0.039 + WA (AG-98, 0.25%), POST	0	85	75	0	20	10	24
Halosulfuron, 0.018 + WA (AG-98, 0.25%), POST	0	84	80	0	20	8	29
Halosulfuron, 0.027, PRE	70	68	35	0	15	5	23
Halosulfuron, 0.053, PRE	80	70	23	13	3	0	22
Bensulide, 6.73, PRE	0	5	0	0	0	0	14
LSD (0.05)[c]	13	14	28	10	13	8	20

[a] Evaluations were made 3, 6, and 9 wk after PRE applications. The 6- and 9-wk evaluations correspond to 1 and 3 wk after POST applications.

[b] PPI = preplant incorporated, PRE = preemergence immediately after planting, POST = postemergence over-the-top of foliage.

[c] LSD values may be used to compare means within the same column.

Table 8. Cantaloupe study for yellow nutsedge control, Fayetteville, 1997.

	Weed control[a]			Effect on cantaloupe			
	CYPES			Injury			
Treatment description[b]	3 wk	6 wk	9 wk	3 wk	6 wk	9 wk	Yield
(kg ai/ha)	-----	-----	----- (%)	-----	-----	-----	(mt/ha)
Untreated check	0	5	0	0	8	0	1
Ethalfluralin, 1.68, PRE	0	0	0	0	0	0	1
Bentazon, 0.84, COC (Agri-Dex, 1.25%), POST	0	28	25	0	10	3	4
Sulfentrazone, 0.28, PRE	55	58	45	53	30	15	2
Halosulfuron, 0.039, WA (AG-98, 0.25%), POST	0	83	78	0	18	10	7
Halosulfuron, 0.019, WA (AG-98, 0.25%), POST	0	78	78	0	13	8	4
Halosulfuron, 0.027, PRE	53	43	30	33	3	0	4
Halosulfuron, 0.053, PRE	45	68	48	55	10	0	3
Bensulide, 6.73, PRE	0	0	0	0	0	0	3
LSD (0.05)[c]	25	13	15	29	13	9	4

[a] Evaluations were made 3, 6, and 9 wk after PRE applications. The 6- and 9-wk evaluations correspond to 1 and 4 wk after POST applications.

[b] PRE = preemergence immediately after planting, POST = postemergence over-the-top of foliage.

[c] LSD values may be used to compare means within the same column.

Table 9. Primocane suppression in blackberry, Fayetteville, 1997.

	Effect on blackberries[a]										
	Injury					Primocane control					
Treatment description[b]	1 wk	2 wk	3 wk	4 wk	5 wk	1 wk	2 wk	3 wk	4 wk	5 wk	Yield
(kg ai/ha)	(%)										(mt/ha)
Untreated check	0	0	0	0	0	0	0	0	0	0	4.5
Lactofen, 1.12, POST-DIR1 fb lactofen, 1.12, POST-DIR2 fb lactofen, 1.12, POST-DIR3	11	14	13	13	14	65	68	69	63	74	4.6
Lactofen, 2.24, POST-DIR1 fb lactofen, 2.24, POST-DIR2 fb lactofen, 2.24, POST-DIR3	19	16	21	13	16	85	76	84	83	84	4.4
LSD (0.05)[c]	5	5	4	3	5	5	9	9	6	6	NS

[a] Evaluations were made 1, 2, 3, 4, and 5 wk after POST-DIR1 applications. The 3-, 4-, and 5-wk evaluations correspond to 1, 2, and 3 wk after POST-DIR2 applications. The 5-wk evaluation also corresponds to 1 wk after POST-DIR3 applications.

[b] POST-DIR = applied postemergence and directed to the base of the crop plant.

[c] LSD values may be used to compare means within the same column.

Table 10. Weed control in grapes, Fayetteville, 1997.

	Weed control[a]								
	CYNDA			CMIRA			TAROF		
Treatment description[b]	3 wk	6 wk	9 wk	3 wk	6 wk	9 wk	3 wk	6 wk	9 wk
(kg ai/ha)	(%)								
Untreated check	0	0	0	0	0	0	0	0	0
Glufosinate, 1.12 + ammonium sulfate, 3.36, POST-DIR fb glufosinate, 1.12 + ammonium sulfate 3.36, POST-DIR fb glufosinate, 1.12 + ammonium sulfate 3.36, POST-DIR	84	95	93	59	68	84	86	89	91
Glyphosate, 1.12, POST-DIR fb glyphosate, 1.12, POST-DIR fb glyphosate, 1.12, POST-DIR	83	94	98	64	80	88	86	94	96
Paraquat, 0.56 + AG-98 (0.25%), POST fb paraquat, 0.56 + AG-98 (0.25%), POST-DIR fb paraquat, 0.56 + AG-98 (0.25%), POST-DIR	87	91	96	74	63	73	89	89	96
LSD (0.05)[c]	9	5	6	14	18	17	8	5	8

continued

Table 10. Continued.

Treatment description[b]	Effect on grapes: Injury 3 wk	Injury 6 wk	Injury 9 wk	Suckers 3 wk	Suckers 6 wk	Suckers 9 wk	Yield
(kg ai/ha)	(%)						(mt/ha)
Untreated check	0	0	0	0	0	0	0.35
Glufosinate, 1.12 + ammonium sulfate, 3.36, POST fb glufosinate, 1.12 + ammonium sulfate 3.36, as needed fb glufosinate, 1.12 + ammonium sulfate 3.36, as needed	0	0	0	74	93	96	0.41
Glyphosate, 1.12, POST fb glyphosate, 1.12, as needed fb glyphosate, 1.12, as needed	0	0	0	55	93	95	0.53
Paraquat, 0.56 + AG-98 (0.25%), POST fb paraquat, 0.56 + AG-98 (0.25%), as needed fb paraquat, 0.56 + AG-98 (0.25%), as needed	0	0	0	80	89	93	0.39
LSD (0.05)[c]	0	0	0	8	7	9	0.1

[a] Evaluations were made 3, 6, and 9 wk after the first POST-DIR treatments. The 6- and 9-wk evaluations correspond to 3 and 6 wk after the second POST-DIR treatment. The 9-wk evaluation corresponds to 3 wk after the third POST-DIR application.

[b] POST-DIR = applied postemergence and directed to the base of the crop plant.

[c] LSD values may be used to compare means within the same column.

Table 11. Weed control in tomato with rimsulfuron, Fayetteville, 1997.

	Weed control[a]			Effect on tomato		
Treatment description[b]	AMASS	ELEIN	CYPES	Fruit	Weight	Injury
(kg ai/ha)	– – – – – – – (%)	– – – – – –		(no./pl.)	(g/pl.)	(%)
Hoed check	98	89	88	10	55.9	9
Rimsulfuron, 0.035, PRE	100	65	89	9	58.1	8
Rimsulfuron, 0.017 + AG-98 (0.25%), POST	100	20	89	9	54.2	8
Rimsulfuron, 0.026 + AG-98 (0.25%), POST	100	43	87	9	66.7	8
Rimsulfuron, 0.035 + AG-98 (0.25%), POST	100	4	83	9	54.5	10
Rimsulfuron, 0.035, PRE fb rimsulfuron, 0.017 + AG-98 (0.25%), POST	98	61	83	10	60.0	5
Rimsulfuron, 0.035, PRE fb rimsulfuron, 0.026 + AG-98 (0.25%), POST	100	18	91	9	68.7	5
Rimsulfuron, 0.035, PRE fb rimsulfuron, 0.035 + AG-98 (0.25%), POST	100	39	85	10	72.2	4
Metribuzin, 0.28 + sethoxydim, 0.21 + COC (1%), POST	98	89	88	10	55.9	9
LSD (0.05)[c]	6	21	17	NS	NS	NS

[a] Evaluation was made 9 wk after PPI and PRE applications. The 9-wk evaluation corresponds to 4 wk after POST applications.

[b] PRE = preemergence immediately after planting, POST = postemergence over-the-top of foliage.

[c] LSD values may be used to compare means within the same column.

Table 12. Mixed cover crop verification in tomatoes, Fayetteville, 1997.

Treatment description	Tomato Fruit	Tomato Avg. Fruit Weight
	no./plant	g/plant
Rye and vetch cover	10	75.0
Black plastic with cover	10	73.0
No cover	10	75.0
LSD (0.05)	NS	NS

Table 13. Quinclorac drift simulation on okra, tomato, and bell pepper, Fayetteville, 1997.

Treatment description[b]	Okra Fruit	Okra Weight	Pepper Fruit	Pepper Weight	Tomato Fruit	Tomato Weight
(kg ai/ha)	no./pl.	g/pl.	no./pl.	g/pl.	no./pl.	g/pl.
Untreated check	22	4.6	5	30.7	10	79.8
Quinclorac,1%[a], POST[b]	30	4.7	6	40.1	12	70.3
Quinclorac, 0.2%, POST	23	5.0	6	33.8	10	65.6
Quinclorac, 0.04%, POST	21	4.8	4	32.8	12	65.9
Quinclorac, 0.008%, POST	26	4.9	6	33.2	10	78.9
Quinclorac, 0.0016%, POST	25	4.7	5	35.9	13	69.5
2,4-D (amine), 0.2% of 1.12 rate, POST	22	4.6	5	31.8	12	72.0
LSD (0.05)[c]	NS	NS	NS	NS	NS	NS

[a] Percentages refer to the percent of the labeled rate of 0.42 kg/ha quinclorac.
[b] POST = treatments applied postemergence.
[c] LSD values may be used to compare means within the same column.

Table 14. Evaluation of herbicides for dianthus, Fayetteville, 1997.

Treatment description[b]	Effect on dianthus[a]		
	10 DAT	28 DAT	56 DAT
(kg ai/ha)	– – – – – – – (%) – – – – – – –		
Untreated check	0	0	0
Oryzalin, 2.24, POST-TP	5	3	3
Oryzalin, 4.49, POST-TP	15	5	3
Oryzalin, 8.98, POST-TP	28	5	3
Oryzalin + oxyfluorfen, 3.37, POST-TP	5	0	0
Oryzalin + oxyfluorfen, 6.73, POST-TP	10	5	5
Oryzalin + oxyfluorfen, 13.46, POST-TP	15	8	8
Oxyfluorfen + pendimethalin, 3.37, POST-TP	0	0	0
Oxyfluorfen + pendimethalin, 6.73, POST-TP	5	5	3
Oxyfluorfen + pendimethalin, 13.46, POST-TP	25	10	3
LSD (0.05)[c]	14	10	7

[a] Evaluations were made 10, 28, and 56 days after treatment.
[b] POST-TP = over-the-top of transplants preemergence to weeds.
[c] LSD values may be used to compare means within the same column.

Table 15. Evaluation of herbicides for salvia, Fayetteville, 1997.

Treatment description[b]	Effect on salvia[a]		
	10 DAT	28 DAT	56 DAT
(kg ai/ha)	– – – – – – – (%) – – – – – – –		
Untreated check	0	0	0
Dithiopyr, 0.56, POST-TP	5	3	3
Dithiopyr, 1.12, POST-TP	23	15	5
Dithiopyr, 2.24, POST-TP	25	35	18
Oryzalin, 2.24, POST-TP	0	8	8
Oryzalin, 4.49, POST-TP	0	8	10
Oryzalin, 8.98, POST-TP	0	5	9
Oryzalin + oxyfluorfen, 3.37, POST-TP	0	0	3
Oryzalin + oxyfluorfen, 6.73, POST-TP	0	3	3
Oryzalin + oxyfluorfen, 13.46, POST-TP	0	5	3
Prodiamine, 1.68, POST-TP	5	3	3
Prodiamine, 3.37, POST-TP	10	13	10
Prodiamine, 6.73. POST-TP	15	15	13
LSD (0.05)[c]	6	10	11

[a] Evaluations were made 10, 28, and 56 days after treatment.
[b] POST-TP = over-the-top of transplants preemergence to weeds.
[c] LSD values may be used to compare means within the same column.

Table 16. Evaluation of herbicides for geranium, Fayetteville, 1997.

Treatment description[b]	Effect on geranium[a]		
	10 DAT	28 DAT	56 DAT
(kg ai/ha)	– – – – – – – (%) – – – – – – –		
Untreated check	0	0	0
Dithiopyr, 0.56, POST-TP	8	8	0
Dithiopyr, 1.12, POST-TP	23	28	0
Dithiopyr, 2.24, POST-TP	38	35	15
Oryzalin, 2,24, POST-TP	0	10	3
Oryzalin, 4.49, POST-TP	15	23	3
Oryzalin, 8.98, POST-TP	25	25	5
Prodiamine, 1.68, POST-TP	0	5	3
Prodiamine, 3.37, POST-TP	0	5	5
Prodiamine, 6.73, POST-TP	0	15	15
Oryzalin + oxyfluorfen, 3.37, POST-TP	0	0	0
Oryzalin + oxyfluorfen, 6.73, POST-TP	0	5	0
Oryzalin + oxyfluorfen, 13.46, POST-TP	0	0	0
LSD (0.05)[c]	8	11	8

[a] Evaluations were made 10, 28, and 56 days after treatment.
[b] POST-TP = over-the-top of transplants preemergence to weeds.
[c] LSD values may be used to compare means within the same column.

Appendix Table 1. Common, trade and chemical names of herbicides used.

Designation and trade names	Chemical name and formulation
2,4-D amine (Weedar 64®)	(2,4-dichlorophenoxy)acetic acid, 456 g/L
bensulide (Prefar®)	*O,O*-bis(1-methylethyl) *S*-[2-[(phenylsulfonyl)amino]ethyl]phosphorodithioate, 480 g/L
bentazon (Basagran®)	3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide, 480 g/L
chlorpropham (Furloe®)	1-methylethyl 3-chlorophenylcarbamate, 480 g/L
clomazone (Command®)	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone, 360 g/L
clopyralid (Stinger®)	3,6-dichloro-2-pyridinecarboxylic acid, 360 g/L
cycloate (Roneet®)	*S*-ethyl cyclohexylethylcarbamothioate, 720 g/L
dimethenamid (Frontier®)	2-chloro-*N*-[(1-methyl-2-methoxy)ethyl]-N-(2,4-dimethyl-thien-3-yl)-acetamide, 720 g/L
dithiopyr (Dimension®)	S,*S*-dimethyl 2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoromethyl)-3,5-pyridinedicarbothioate, 25% GR
ethalfluralin (Curbit®)	*N*-ethyl-*N*-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine, 360 g/L
fluroxypyr (Starane®)	[(4-amino-3,5-dichloro-6-fluoro-2-pyridinyl)oxy]acetic acid, 200 g/L
fomesafen (Reflex®, Flexstar®)	5-[2-chloro-4-(trifluoromethyl)phenoxy]-*N*-(methylsulfonyl)-2-nitrobenzamide, 240 g/L
glyphosate (Roundup Ultra®)	*N*-(phosphonomethyl)glycine, 360 g ae/L
glufosinate (Finale®)	2-amino-4-(hydroxymethylphosphinyl)butanoic acid, 120 g/L
halosulfuron (Permit®)	5-[2-chloro-6-fluoro-4-(trifluoromethyl)phenoxy]-*N*-(ethylsulfonyl)-2-nitrobenzamide, 75% W
imazethapyr (Pursuit®)	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid, 240 g/L
lactofen (Cobra®)	(+)-2-ethoxy-1-methyl-2-oxoethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate, 240 g/L
metolachlor (Dual®, Pennant®)	2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide, 960 g/L, 936 g/L, 5 G
metribuzin (Sencor®)	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4*H*)-one, 75 DF
napropamide (Devrinol®)	*N,N*-diethyl-2-(1-naphthalenyloxy)propanamide, 50 WP
oryzalin (Surflan®)	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide, 480 g/L
oryzalin + oxyfluorfen (Rout®)	see oryzalin and oxyfluorfen
oxyfluorfen (component of Rout® and OH II®)	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
oxyfluorfen + pendimethalin (OH II®)	see oxyfluorfen and pendimethalin, 2 + 1% GR
paraquat (Gramoxone Extra®)	1,1'-dimethyl-4,4'-bipyridinium ion, 300 g/L

continued

Appendix Table 1. Continued.

Designation and trade names	Chemical name and formulation
pendimethalin (component of OH II®)	*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
phenmedipham (Spin Aid®)	3-[(methoxycarbonyl)amino]phenyl(3-methylphenyl)carbamate, 156 g/L
prodiamine (Barricade®)	2,4-dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine, 65% WG
quinclorac (Facet®)	3,7-dichloro-8-quinolinecarboxylic acid, 75% DF
quizalofop-P (Assure II®)	(*R*)-2-[4-[(6-chloro-2-quinoxaliny)oxy]phenoxy]propanoc acid, 96 g/L
rimsulfuron (Basis ®)	*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(ethylsulfonyl)-2-pyridinesulfon amide, 25 % DF
sethoxydim (Poast®)	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one, 180 g/L
sulfentrazone (Authority®)	*N*-[2,4-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol-1-yl]phenyl]methanesulfonamide, 75% DF
trifluralin (Treflan®)	2,6-dinitro-*N*,*N*-dipropyl-4-(trifluoromethyl)benzenamine, 480 g/L

Appendix Table 2. Climatological data, Arkansas Agricultural Research and Extension Center, Fayetteville, 1997.

	April			May			June			July		
	Temp.		Rain-	Temp.		Rain-	Temp.		Rain-	Temp.		Rain-
Day	Max	Min	fall	Max	Min	fall	Max	Min	fall	Max	Min	fall
	(⁰C)	(⁰C)	(cm)	(⁰C)	(⁰C)	(cm)	(⁰C)	(⁰C)	(cm)	(⁰C)	(⁰C)	(cm)
Fayetteville												
1	7	18		3	23		9	26		22	32	
2	11	24		14	24	0.41	9	24		24	32	
3	8	23		9	18		10	23		22	32	
4	14	20	0.05	2	24		12	23		17	29	0.99
5	12	21	2.21	12	27		9	24	0.03	11	26	0.10
6	6	19	0.20	9	27		9	28		14	27	
7	-1	17		13	25		13	29		14	29	
8	7	14	0.89	16	25	1.50	13	29		20	30	0.30
9	3	14	3.20	12	23		17	25		20	31	0.51
10	5	19		2	22		17	22	0.03	18	27	0.33
11	7	19	1.30	5	24		16	26	1.19	18	31	
12	-1	6	0.13	12	20	0.03	17	29	1.50	21	32	
13	-2	11		6	23		18	27	0.79	20	32	
14	-3	17		13	23	0.41	15	29		21	33	
15	0	20		9	23		16	26	1.60	22	34	
16	6	16	0.33	3	24		18	27	1.80	21	32	
17	-1	18		10	28		17	25	4.80	21	32	
18	2	25		17	29		14	29	0.03	20	32	
19	14	24		14	25	0.51	17	30		19	34	
20	8	27		11	23		22	31		18	33	
21	12	23	0.03	7	23		23	30		20	33	
22	8	18	0.20	7	23		18	31		22	34	0.61
23	6	15	0.05	9	23		18	30		22	26	0.03
24	1	18		17	23	0.30	21	31		21	34	
25	7	18	0.10	16	27	0.20	17	31		21	34	
26	10	16	0.05	21	29		16	31	0.05	21	35	
27	9	13	0.89	17	26	1.40	19	30		21	35	
28	7	21		13	22		20	26	0.05	22	36	
29	4	24		9	25		19	28		22	30	0.89
30	15	22		17	22	1.32	18	31	1.19	19	28	
31				9	23					17	29	

Appendix Table 3. Climatological data, Vegetable Substation, Kibler, 1997.

Day	April			May			June			July		
	Temp.		Rain-	Temp.		Rain-	Temp.		Rain-	Temp.		Rain-
	Max	Min	fall	Max	Min	fall	Max	Min	fall	Max	Min	fall
	(°C)	(°C)	(cm)	(°C)	(°C)	(cm)	(°C)	(°C)	(cm)	(°C)	(°C)	(cm)
Kibler												
1	11	21		6	25		12	28		23	34	
2	12	26		16	28	0.03	13	28		23	35	
3	12	25		11	21	0.20	14	27		24	34	
4	13	24	0.71	5	24		17	26		21	33	0.05
5	14	23	3.40	10	26		16	27		16	28	
6	9	22	0.10	13	29		14	29		17	27	
7	2	19		16	27		16	32		18	31	
8	9	18	0.20	18	27	0.79	17	32		22	32	
9	7	15	0.71	15	26	0.79	19	28	0.41	23	34	
10	5	24		6	23		19	24	1.09	22	32	
11	8	23	1.09	8	26		17	27	0.05	22	33	
12	2	8		14	25		18	32	0.03	23	34	
13	-1	12		7	28		9	31	0.71	23	35	
14	0	17		15	27	0.03	18	31		23	36	
15	4	22		13	26		21	29	0.99	26	35	
16	6	22		9	26		19	29	1.32	24	34	
17	3	21	0.10	13	31		20	26	2.69	24	34	
18	6	26		17	32		17	31	0.03	23	34	
19	12	27		19	29		19	32		23	35	
20	11	29		16	20		21	32		23	36	
21	14	24	0.51	14	24		23	33		23	37	
22	13	21	0.41	13	24		21	33		23	36	
23	9	19	0.30	16	24		21	33		23	36	
24	5	18		19	24	0.51	22	33		23	37	0.10
25	11	17		17	29	0.71	20	34		23	37	
26	11	16	0.89	21	33	0.71	21	33		24	37	
27	11	14	0.79	21	31	0.03	21	33		24	37	
28	9	23		16	25		21	31	1.50	26	38	
29	8	26		14	28		21	28	0.08	24	37	2.39
30	14	25		19	26	0.30	21	33	7.39	23	32	0.10
31				15	27					20	31	

Appendix Table 4. Standardized plant (Bayer) codes, Weed Science Society of America, for weeds appearing in this report.

Code	Scientific Name	Common Name
AMAPA	*Amaranthus palmeri* S. Wats.	Palmer amaranth
AMASS	*Amaranthus* spp.	pigweed species
CAPBP	*Capsella bursa-pastoris* L.	shepherdspurse
CHEAL	*Chenopodium album* L.	common lambsquarters
CMIRA	*Campsis radicans* (L.) seem. ex Bureau	trumpetcreeper
CYNDA	*Cynodon dactylon* (L.) Pers.	bermudagrass
CYPES	*Cyperus esculentus* L.	yellow nutsedge
DIGSA	*Digitaria sanguinalis* (L.) Scop.	large crabgrass
ECLAL	*Eclipta prostrata* L.	eclipta
ELEIN	*Eleusine indica* (L.) Gaertn.	goosegrass
LAMAM	*Lamium amplexicaule* L.	henbit
LOLMU	*Lolium multiflorum* Lam.	Italian ryegrass
POANN	*Poa annua* L.	annual bluegrass
POROL	*Portulaca oleracea* L.	common purslane
SIBVI	*Sibara virginica* (L.) Rollins	sibara
SORHA	*Sorghum halepense* (L.) Pers.	johnsongrass
TAROF	*Taraxacum officinale* Weber in Wiggers	dandelion

Conversion Table

U.S. to Metric			Metric to U.S.		
to convert from	to	multiply U.S. unit by	to convert from	to	multiply metric unit by
length			length		
miles	kilometers	1.61	kilometers	miles	.62
yards	meters	.91	meters	yards	1.09
feet	meters	.31	meters	feet	3.28
inches	centimeters	2.54	centimeters	inches	.39
area and volume			area and volume		
sq yards	sq meters	.84	sq meters	sq yards	1.20
sq feet	sq meters	.09	sq meters	sq feet	10.76
sq inches	sq centimeters	6.45	sq centimeters	sq inches	.16
cu inches	cu centimeters	16.39	cu centimeters	cu inches	.06
acres	hectares	.41	hectares	acres	2.47
liquid measure			liquid measure		
cu inches	liters	.02	liters	cu inches	61.02
cu feet	liters	28.34	liters	cu feet	.04
gallons	liters	3.79	liters	gallons	.26
quarts	liters	.95	liters	quarts	1.06
fluid ounces	milliliters	29.57	milliliters	fluid ounces	.03
weight and mass			weight and mass		
pounds	kilograms	.45	kilograms	pounds	2.21
ounces	grams	28.35	grams	ounces	.04
temperature			temperature		
F	C	5/9(F-32)	C	F	9/5(C+32)

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