RESPONSE OF SOYBEAN (*Glycine max* (L.) Merrill) TO POSTEMERGENCE GRASS CONTROL HERBICIDES AND VOLUNTEER CORN (*Zea mays* L.) AND VOLUNTEER WHEAT (*Triticum aestivum* L.) CONTROL.

by

FELIX AYALA CHAIREZ

Ing. Agr., ITESM-Obregon, Mexico, 1978

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

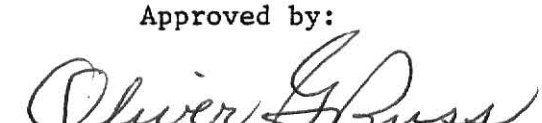
MASTER OF SCIENCE

Department of Agronomy

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1982

Approved by:



Major Professor

ACKNOWLEDGMENTS

The author wishes to express his gratitude and sincere appreciation to his major advisor, Mr. Oliver G. Russ, for his advice and suggestions in the research and preparation of this thesis, and for assistance in planning the Master's program.

The author also wishes to express his appreciation to the members of his graduate committee, Dr. Loren J. Moshier and Dr. William T. Schapaugh for their valuable suggestions in preparing this manuscript.

Also, the author expresses his thanks to CONACYT, ITESM and LASPAU for financing his graduate study at Kansas State University.

The author also wishes to thank Mrs. Marguerite Russ for her careful review of this manuscript.

Finally, the author dedicates this thesis to his parents, his sisters and brothers, his wife Yolanda and his son Félix, to whom he owes his desire for improving his education.

El autor desea expresar su más profundo agradecimiento a sus padres Juan y Antonia y a todos sus hermanos por su gran apoyo. De la misma manera agradece a su esposa Yolanda y a su hijo Félix a quienes dedica cariñosamente este trabajo.

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX

LIST OF FIGURES

INTRODUCTION

Soybeans (Glycine max (L.) Merr.) are one of the most important crops around the world. In the past five years, United States soybean production has been 60 to 65% of the world soybean production (1,49). The United States produced 51,624,500 metric tons from 27,008,640 hectares harvested in 1981 (2).

Weeds cost soybean producers more than all other pests combined (39). More than 60 individual weed species infest soybean fields in the United States. Major losses are caused in all regions by annual broadleaf and grass weeds. Sixty-two percent of the major weeds are dicotyledons while 38% are monocotyledons (37). Among the monocotyledons, giant foxtail (Setaria faberi Herrm.) with approximately 160 plants/m of row can reduce soybean yields 28% (33), and wild oat (Avena fatua L.) with 30 plants/m of row can reduce soybean yields 51% (39).

Volunteer corn (Zea mays L.) and volunteer wheat (Triticum aestivum L.) plants are often found growing as weeds where their presence is detrimental to the profitable production of some crops that are used in a double cropping system that has been advocated for increasing feed and food production efficiency. Uncontrolled volunteer corn (clumps 2.4 m apart in the row) reduced soybean yields an average of 31% (3).

The six postemergence grass control herbicides used in this study are relatively new and their effect on soybeans, volunteer corn and volunteer wheat have not been fully studied.

The objectives of this study were: 1) to evaluate the effect of three rates of six postemergence grass control herbicides on soybean height, yield and foliar injury, and 2) to determine which of these herbicides might provide acceptable control of volunteer corn and/or volunteer wheat.

REVIEW OF LITERATURE

Postemergence weed control can be used when preplant incorporated and preemergence herbicides fail or can not be applied for various reasons.

In 1973, Wax (51) mentioned that although broadleaf weeds may predominate in some areas, few soybeans were grown in the United States in areas where annual grasses were not a problem, and that the postemergence herbicide treatments available at that time did not provide effective control of annual grasses.

Recently, several postemergence herbicides which can be used to control grasses in soybeans have been developed (4,5,6,7,8,20). Some of these herbicides in combination with postemergence broadleaf control herbicides have shown good control of a broad spectrum of grasses and broadleaf weeds (12,21,24,27,32,38).

CGA-82725(2-propynl 2-(4-(3,5-dichloro-2-pyridyloxy)-phenoxy)-propanoate) is a new herbicide synthesized in the laboratory of CIBA-GEIGY Limited, Basle, Switzerland. Soybeans have shown excellent tolerance to CGA-82725 used in rates of 1.12 kg/ha or lower, applied over the top and controlling annual grasses within the range of 0.12 to 0.5 kg/ha. Use of an oil concentrate allows reduced rates and gives more consistent control under adverse environmental conditions (6,28,48).

DOWCO 453 ME (Methyl 2-(4-((3-chloro-5-(trifluoromethyl)-2-pyridinyl)oxy)phenoxy)propanoate) is a new postemergence herbicide being investigated and developed by the Dow Chemical Company. DOWCO 453 has been demonstrated to be a highly active, systemic

graminicide with selectivity for soybean, cotton and other broadleaf crops. Effective rates for postemergence annual grass control are 0.07 to 0.28 kg/ha. Perennial grasses are controlled by 0.14 to 0.58 kg/ha. Use of a nonionic surfactant is recommended (7,45).

Fluazifop-butyl (Butyl 2-(4-(5-trifluoromethyl-2-pyridyloxy) phenoxy)propionate) is a selective graminicide under worldwide development by ICI Plant Protection Division and in the United States by ICI Americas, Inc. It is being developed mainly in soybeans and cotton. Fluazifop has been shown to be safe on all broadleaf crops tested to date (5,15,47). Therkilsen et al. (47) reported that soybeans appeared completely free of fluazifop injury at every rate tested, 1.12 kg/ha being the highest rate tested. Adding a nonionic surfactant to the spray tank may enhance post-emergence activity (5).

HOE-33171 (HOE-00581) (chemistry not released) a new post-emergence herbicide, developed in the laboratories of Hoechst AG is selective for the control of annual and perennial grasses in broadleaf crops. Suggested rates for testing are 0.11 to 0.22 kg/ha. The use of 0.28 kg/ha should be evaluated in semi-arid areas from West Texas to California. Major attention to date has been given to the inhouse evaluation of HOE-33171 on soybeans and cotton (8).

Mefluidide (N-(2,4-dimethyl-5-(((trifluoromethyl)sulfonyl) amino)phenyl)acetamide) is a labelled herbicide recommended to control johnsongrass (Sorghum halepense), shattercane (Sorghum

bicolor), volunteer corn, and volunteer wheat in soybeans at rates from 0.28 to 0.56 kg/ha plus a nonionic surfactant. Mefluidide use is limited to some areas of the United States.

Gates in 1975 (19) reported mefluidide as a new plant growth regulator. Harrison et al. (26) reported that mefluidide was promising for selective weed control in soybeans when applied alone or in combination with other herbicides, but that crop injury and lodging of soybeans followed treatments. They also noticed some delay in maturity at all rates (0.28, 0.56 and 1.12 kg/ha plus a surfactant) and dates of application (second, fifth, tenth trifoliate leaf stage and seven days before bloom). Height of mature soybeans was reduced by all treatments at the second leaf stage, and the 0.56 and 1.12 kg/ha rates at the fifth leaf stage. Reductions in grain yield were obtained from the 1.12 kg/ha rate at each treatment date and the 0.56 kg/ha rate applied 7 days before bloom.

McWhorter and Barrentine (36) found that the use of a nonoxynol surfactant caused soybean injury, and injury increased as the mefluidide rate increased from 0.56 to 1.12 kg/ha. Similar results were reported by Bloomberg and Wax (11) who found that the addition of a surfactant to mefluidide at 0.55 kg/ha generally increased the injury sustained. They tested 25 soybean cultivars in the glasshouse by applying 0.44 kg/ha of mefluidide at the first trifoliate leaf stage, and finding that all the cultivars showed symptoms of injury. Cultivars Chippewa 64, Beeson, Hark, Wirth and Williams were the most tolerant cultivars in a field screening.

Wyse (53) observed excessive soybean injury due to mefluidide application. Glenn and Rieck (22) noted that applications of mefluidide at 1.12 kg/ha plus surfactant caused 25 to 35% soybean damage. They also noticed in another study (23) that mefluidide at 0.28, 0.56 and 1.12 kg/ha increased the yield of soybeans when applied for the control of johnsongrass (Sorghum halepense) but the 1.12 kg/ha rate caused some injury and resulted in lower yields than those obtained with 0.56 kg/ha.

Simkins and Doll (44) reported substantial soybean injury resulted from application of mefluidide at 0.25 kg/ha. They mentioned that soybean yield reductions occurred whenever quackgrass control was poor or where soybean injury occurred.

Rogers and Worthington (41) noticed that mefluidide damaged the soybeans by reducing plant height and crinkling of the leaves. Similar results were observed by Jersey and Glenn (29) who reported that mefluidide injury consisted of plant stunting and leaf crinkling of the soybeans ranging from 10 to 30%.

Sethoxydim (2-(1-(ethoxyimino)-butyl)-5-(2-(ethylthio)-propyl)-3-hydroxy-2-cyclohexene-1-one) is a postemergence grass herbicide being developed by BASF Wyandotte Corporation in the United States. It is active against annual and perennial grasses. Excellent selectivity has been demonstrated in soybeans (4).

Several workers (31,34,43,50) have reported no phytotoxicity on soybeans with sethoxydim at rates ranging from 0.28 to 1.12 kg/ha.

Cranmer and Nalewaja (16) evaluated the effect of sethoxydim alone and in combination with various oil additives, and they found that soybeans were not injured by sethoxydim at 0.21 or 0.42 kg/ha alone or in combination with any additive evaluated.

Westra and Wyse (52) evaluated sethoxydim at rates 0.56, 0.84, 1.12, and 1.68 kg/ha, and they found increasing soybean injury (up to 6%) with increasing rates, but yield and maturity were not significantly affected.

VOLUNTEER CORN CONTROL

Clark and Fawcett (13) concluded that diclofop gave excellent control of volunteer corn in soybeans and that glyphosate applied with a rope wick applicator at the proper time (early in the season) controlled volunteer corn, but when applied late in the season to tall corn did not result in higher yields. In addition, they noted that mefluidide at 0.28 kg/ha plus a surfactant was not effective in controlling volunteer corn. On the other hand, the mefluidide label recommends controlling volunteer corn 25 cm tall by using 0.28 kg/ha plus a surfactant followed in 3 weeks by 0.28 kg/ha plus a surfactant.

Andersen et al. (3) concluded that diclofop and glyphosate were highly effective in controlling corn, but when corn densities were high, diclofop treated areas often had greater soybean yields than did glyphosate treatments. According to them, the corn interfered with the soybeans for a longer time before glyphosate was applied.

Samir and Russ (42) reported that sethoxydim appeared to be superior to diclofop, especially on taller corn; and that although sethoxydim at 0.28 kg/ha showed less activity on taller corn, rates at 0.56 and 1.12 kg/ha did satisfactorily control volunteer corn.

Harker and Andersen (25) reported that 4 to 5 leaf stage corn was controlled with sethoxydim at 0.28 kg/ha.

Beguhn et al. (10) reported excellent control of volunteer corn in soybeans with fluazifop at 0.07 to 0.28 kg/ha in small plot testing.

Kern and Stahlberg (30) reported that CGA-82725 at rates from 0.14 to 0.28 kg/ha can control volunteer corn and that the addition of oil concentrate increased volunteer corn control 10 to 50%.

VOLUNTEER WHEAT CONTROL

Volunteer wheat in soybeans can be controlled by sethoxydim (4), DOWCO 453 (7) and mefluidide at 0.28 kg/ha plus a surfactant applied to 10 cm tall wheat, according to the mefluidide label.

MATERIALS AND METHODS

I. SOYBEAN RESPONSE EXPERIMENTS

1) GREENHOUSE EXPERIMENTS

Williams soybeans were grown in the greenhouse using 15 cm diameter pots. Six postemergence grass control herbicides (Table 1) were sprayed over the top at the V1 to V2 stage (18). A completely randomized design for 19 treatments with three replications was used. The experimental unit consisted of three soybean plants in each pot.

Herbicide treatments were applied using a moving belt sprayer with a single flat fan nozzle, attached to a fixed boom. The sprayer was calibrated to deliver 187 L/ha with a pressure of 1.45 kg/cm^2. The nozzle was placed about 45 cm above the soybeans.

Soybean injury was visually evaluated. Fresh weight and dry weight of the foliage were measured two weeks after the herbicides were sprayed.

An analysis of variance and a Duncan's Multiple Range Test for fresh and dry weight were carried out using Statistical Analysis System (SAS) (9).

Each experiment was repeated three times.

2) WEED FREE FIELD EXPERIMENT

This field experiment was carried out at the Ashland Unit of the Agronomy Research Farm, K.S.U. (14 Km south of Manhattan, Kansas) in 1982. The soil was a Reading Silt Loam with 2.6%

organic matter and pH of 6.3

Williams soybeans were planted at a rate of 33 seeds/m on June 18. Immediately after planting, a combination of 2.24 kg/ha of alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) and 2.24 kg/ha chloramben (3-amino-2,5-dichlorobenzoic acid) was applied to aid in keeping weed free conditions. In addition, the experiment was hand weeded through the season to eliminate the possibility of reduced yields due to competition with the crop.

A randomized complete block design for 19 treatments (Table 1) with 3 replications was used. Plots consisted of 4 rows 0.76 m apart and 9.1 m long. Treatments were made on July 9 when soybeans were at the V2 to V3 stage (18).

Herbicides were applied using a tractor-mounted, compressed air sprayer equipped with flat fan stainless steel nozzles. The sprayer was calibrated to deliver 187 L/ha with a pressure of 1.2 kg/cm^2. The boom was placed about 45 cm above the soybeans.

Soybean injury was visually evaluated. The height at maturity and yields were measured.

An analysis of variance for height and yield were carried out using SAS (9).

II. VOLUNTEER CORN AND VOLUNTEER WHEAT CONTROL EXPERIMENT

This experiment was conducted at the Ashland Unit of the Agronomy Research Farm, K.S.U. (14 Km south of Manhattan, Kansas) in 1982. The soil was a Muir Silt Loam with 2.4% organic matter and a pH of 6.1.

Williams soybean seeds were mixed with corn seeds at a ratio 3:1 to simulate a volunteer corn infestation. Planting was done at 33 seeds/m rate in rows; and wheat was drilled between rows on July 26.

A randomized complete block design for 19 treatments (table 1) with 3 replications was used. Plots consisted of 2 rows 0.76 m apart and 9.1 m long. Treatments were made on August 16 when soybeans were at the V2 to V3 stage (18), corn with 3 to 4 leaves (30 cm and under) and wheat with 0 to 2 tillers (about 15 cm tall). Herbicides were applied using same procedures as in soybean response field experiment.

Three weeks after treatments, volunteer corn and volunteer wheat control was evaluated and expressed as percent control based on number of controlled plants (0 percent = no control, and 100 percent = complete control). Soybean injury was visually evaluated.

An analysis of variance and a Duncan's Multiple Range Test for volunteer corn and volunteer wheat control were carried out using SAS (9).

Table 1. List of Treatments Used in Greenhouse and Field Experiments, Manhattan, Kansas, 1982.

Treatment	Rate (kg/ha)
Sethoxydim*	0.28
Sethoxydim*	0.56
Sethoxydim*	1.12
Fluazifop*	0.28
Fluazifop*	0.56
Fluazifop*	1.12
DOWCO 453**	0.07
DOWCO 453**	0.14
DOWCO 453**	0.28
HOE-33171 (HOE 00581)	0.17
HOE-33171 (HOE 00581)	0.34
HOE-33171 (HOE 00581)	0.68
CGA-82725*	0.28
CGA-82725*	0.56
CGA-82725*	1.12
Mefluidide	0.14
Mefluidide	0.28
Mefluidide	0.42
No treatment	----

*Crop oil was used at the rate of 2.3 L/ha.

**Atplus 411F was used at the rate of 0.94 L/ha.

RESULTS AND DISCUSSION

I. SOYBEAN RESPONSE EXPERIMENTS

1) GREENHOUSE EXPERIMENTS - Average of three experiments is presented.

a) Fresh weight. The analysis of variance for fresh weight (Table 1, appendix) shows highly significant differences between treatments. According to Duncan's Multiple Range Test (Table 2), the two higher rates of mefluidide (0.28 and 0.42 kg/ha) were significantly different compared to the no treatment, and fresh weight reduction due to mefluidide was 16 and 22% at 0.28 and 0.42 kg/ha, respectively. All other treatments did not reduce fresh weight.

b) Dry weight. Highly significant differences occurred in dry weight between treatments (Table 2, appendix). All the rates of each herbicide were the same as the no treatment except mefluidide at 0.28 and 0.42 kg/ha which reduced dry weight 21 and 22%, respectively (Table 3).

c) Foliar injury. Slight to moderate foliar injury was apparent within 24 hours after applications of 0.56 and 1.12 kg/ha of sethoxydim, CGA-82725, and fluazifop. Burning of the leaves was a characteristic injury due to sethoxydim and CGA-82725 (Figures 1 and 2), while fluazifop injury was detected as leaf chlorosis (Figure 3).

Leaf speckling was the injury shown by soybeans treated with any rate of HOE-33171 (Figure 4). No apparent injury was observed when DOWCO 453 was applied at any rate.

Injury due to all mefluidide rates was apparent about 3 days after applications. Injury consisted of leaf crinkling and leaf cupping on the younger leaves which increased with time after treatment (Figure 5).

Injury caused by applications of sethoxydim, fluazifop, CGA-82725, HOE-33171, and the lower rate of mefluidide was not reflected on fresh weight or dry weight of soybeans as shown in Tables 2 and 3; on the other hand, injury due to the higher rates of mefluidide apparently was responsible for reducing fresh weight and dry weight up to 22% in both cases.

2) WEED FREE FIELD EXPERIMENT

a) Height at maturity. No significant differences in height occurred between treatments (Table 3, appendix), even though mefluidide at 0.28 and 0.42 kg/ha reduced height of soybeans at about 8% compared to the no treatment (Table 4).

b) Yields. Soybean yields were measured harvesting the two middle rows in each plot. No significant differences in yields were found between treatments (Table 4, appendix).

c) Foliar injury. Soybeans showed the same type of injury as in the greenhouse experiments; however, mefluidide caused less injury to soybeans in the field than in the greenhouse.

Herbicide injury occurred soon after applications but disappeared after 3 weeks.

II. VOLUNTEER CORN AND VOLUNTEER WHEAT CONTROL EXPERIMENT

a) VOLUNTEER CORN CONTROL. The analysis of variance table for volunteer corn control is presented in Table 5 (appendix).

Excellent volunteer corn control was achieved with all rates of each herbicide except mefluidide (Table 5).

Stunting and some twisting of corn leaves were caused by mefluidide at the higher rates mainly, but the injury was not enough to satisfactorily control corn. The poor corn control by mefluidide can be explained, because according to the label, mefluidide should be applied to corn no more than 25 cm tall using 0.28 kg/ha plus a surfactant followed in 3 weeks by 0.28 kg/ha plus a surfactant. Volunteer corn in this study was sprayed at about 30 cm, with one single application of mefluidide and no surfactant was used.

b) VOLUNTEER WHEAT CONTROL. The analysis of variance for wheat control (Table 6, appendix) shows highly significant differences between treatments. The two higher rates of DOWCO 453, the two higher rates of sethoxydim and all rates of fluazifop gave excellent volunteer wheat control (Table 6). Acceptable wheat control was achieved with the lower rate of sethoxydim and the 2 higher rates of mefluidide. Some control was obtained with the lower rate of DOWCO 453. The lower rate of mefluidide did not control wheat satisfactorily. CGA-82725 and HOE-33171 had very little or no effect on wheat.

DOWCO 453 is reported to control volunteer wheat (7). According to our experiment, higher rates than 0.07 kg/ha of DOWCO 453 are required to satisfactorily control volunteer wheat in soybeans.

Mefluidide is recommended to control wheat 10 cm tall using 0.28 kg/ha plus a surfactant. In our experiment, wheat was about 15 cm tall and no surfactant was used.

c) Foliar injury (soybeans). In this experiment, injury due to herbicide applications was very similar to that observed in greenhouse experiments (see page 13). In addition, plant stunting due to mefluidide treatments ranged from 13 to 27% compared to the no-treatment.

Comparing the soybean injury observed in all the experiments, we can see that each herbicide injured soybeans in the same way in each experiment except mefluidide which proved to be less active in the weed free field experiment. This loss of activity of mefluidide could possibly be due to 22 mm rainfall within 8 hours after applications were made. This idea is supported by the mefluidide label which states that loss of activity is expected if rainfall occurs within 8 hours following application.

Table 2. Effect of Treatments on Fresh Weight of Soybeans, Greenhouse Experiments, Manhattan, Kansas, 1982.

Treatment	Rate kg/ha	Fresh Weight gr/plot*
No Treatment	----	57.24 ab
Sethoxydim	0.28	61.53 ab
Sethoxydim	0.56	59.30 ab
Sethoxydim	1.12	57.67 ab
Fluazifop	0.20	63.20 a
Fluazifop	0.56	57.01 ab
Fluazifop	1.12	58.76 ab
DOWCO 453	0.07	62.18 ab
DOWCO 453	0.14	63.02 a
DOWCO 453	0.28	55.21 b
HOE-33171	0.17	60.95 ab
HOE-33171	0.34	59.96 ab
HOE-33171	0.68	60.17 ab
CGA-82725	0.28	59.97 ab
CGA-82725	0.56	58.28 ab
CGA-82725	1.12	57.14 ab
Mefluidide	0.14	55.67 b
Mefluidide	0.28	48.43 c
Mefluidide	0.42	44.50 c

*Means followed with the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 3. Effect of Treatments on Dry Weight of Soybeans, Greenhouse Experiments, Manhattan, Kansas, 1982.

Treatment	Rate kg/ha	Dry Weight gr/plot*
No Treatment	----	9.15 ab
Sethoxydim	0.28	10.20 a
Sethoxydim	0.56	9.32 ab
Sethoxydim	1.12	9.25 ab
Fluazifop	0.28	9.86 a
Fluazifop	0.56	9.01 ab
Fluazifop	1.12	9.09 ab
DOWCO 453	0.07	9.73 ab
DOWCO 453	0.14	9.97 a
DOWCO 453	0.28	8.51 b
HOE-33171	0.17	10.19 a
HOE-33171	0.34	9.60 ab
HOE-33171	0.68	9.70 ab
CGA-82725	0.28	9.09 ab
CGA-82725	0.56	9.25 ab
CGA-82725	1.12	9.19 ab
Mefluidide	0.14	8.54 b
Mefluidide	0.28	7.20 c
Mefluidide	0.42	7.10 c

*Means followed with the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Figure 1. Soybeans one week after application of Sethoxydim at 1.12 kg/ha.

Figure 2. Soybeans one week after application of CGA-82725 at 1.12 kg/ha.

Figure 3. Soybeans one week after application of Fluazifop at 1.12 kg/ha.

Figure 4. Soybeans one week after application of HOE-33171 at 0.68 kg/ha.

Figure 5. Soybeans one week after application of Mefluidide at 0.42 kg/ha.

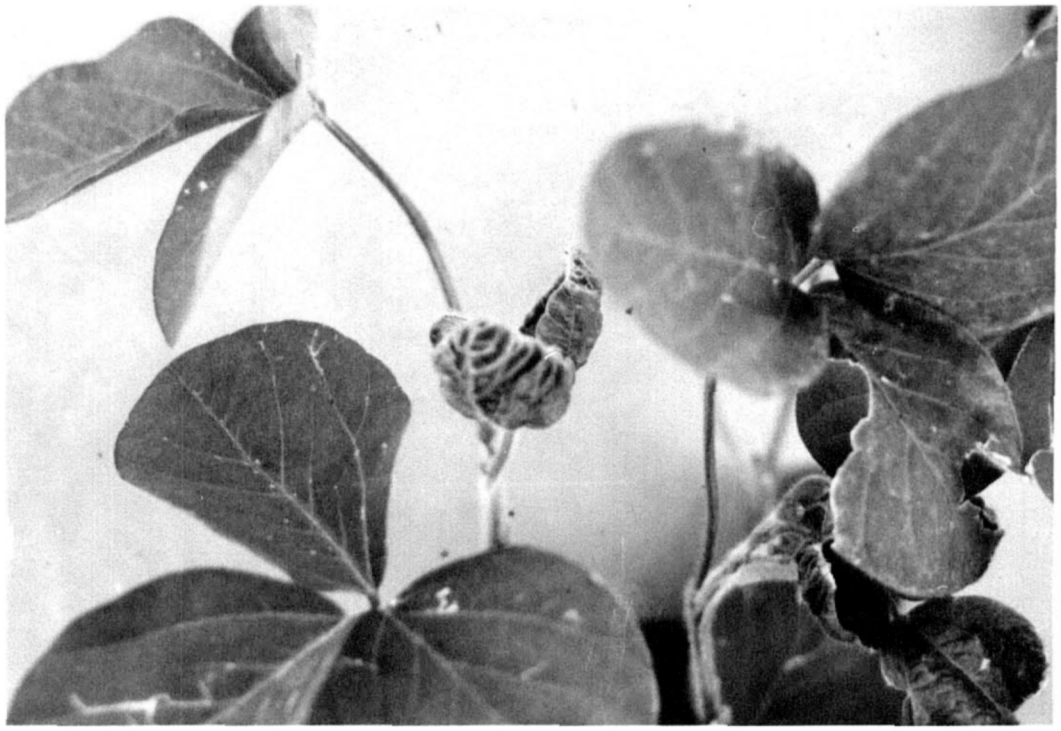


Table 4. Effect of Treatments on Soybean Height at Maturity, Weed Free Field Experiment, Manhattan, Kansas, 1982.

Treatment	Rate kg/ha	Soybean height at Maturity (cm)
Sethoxydim	0.28	112.67
Sethoxydim	0.56	109.67
Sethoxydim	1.12	109.33
Fluazifop	0.28	112.00
Fluazifop	0.56	110.67
Fluazifop	1.12	107.33
DOWCO 453	0.07	112.67
DOWCO 453	0.14	109.67
DOWCO 453	0.28	108.33
HOE-33171	0.17	111.33
HOE-33171	0.34	110.33
HOE-33171	0.68	110.67
CGA-82725	0.28	106.33
CGA-82725	0.56	108.33
CGA-82725	1.12	109.33
Mefluidide	0.14	109.33
Mefluidide	0.28	104.00
Mefluidide	0.42	104.33
No Treatment	----	110.33

Table 5. Volunteer Corn Control with Six Postemergence Herbicides, Manhattan, Kansas, 1982.

Treatment	Rate kg/ha	Volunteer Corn Control %*
Sethoxydim	0.28	100.00 a
Sethoxydim	0.56	100.00 a
Sethoxydim	1.12	100.00 a
Fluazifop	0.28	100.00 a
Fluazifop	0.56	100.00 a
Fluazifop	1.12	100.00 a
DOWCO 453	0.07	100.00 a
DOWCO 453	0.14	100.00 a
DOWCO 453	0.28	100.00 a
HOE-33171	0.17	100.00 a
HOE-33171	0.34	100.00 a
HOE-33171	0.68	100.00 a
CGA-82725	0.28	100.00 a
CGA-82725	0.56	100.00 a
CGA-82725	1.12	100.00 a
Mefluidide	0.14	10.00 c
Mefluidide	0.28	43.33 b
Mefluidide	0.42	43.33 b
No Treatment	----	00.00 d

*Means followed with the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 6. Volunteer Wheat Control with Six Postemergence Herbicides, Manhattan, Kansas, 1982.

Treatment	Rate kg/ha	Volunteer Wheat Control %*
Sethoxydim	0.20	89.00 bc
Sethoxydim	0.56	96.00 ab
Sethoxydim	1.12	97.33 ab
Fluazifop	0.28	93.00 ab
Fluazifop	0.56	97.66 ab
Fluazifop	1.12	99.33 a
DOWCO 453	0.07	73.33 d
DOWCO 453	0.14	98.66 ab
DOWCO 453	0.28	100.00 a
HOE-33171 (HOE 00581)	0.17	10.00 fg
HOE-33171 (HOE 00581)	0.34	10.00 fg
HOE-33171 (HOE 00581)	0.68	10.00 fg
CGA-82725	0.28	1.66 gh
CGA-82725	0.56	10.00 fg
CGA-82725	1.12	16.66 f
Mefluidide	0.14	40.00 e
Mefluidide	0.28	81.66 cd
Mefluidide	0.42	89.00 bc
No Treatment	0.00	00.00 h

*Means followed with the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

CONCLUSIONS

1) No effect on fresh weight (measured 2 weeks after treatments) of soybean was found with any rate of each herbicide except mefluidide at 0.28 and 0.42 kg/ha which reduced fresh weight 16 and 22%, respectively.

2) No effect on dry weight of soybeans was found with any rate of each herbicide except mefluidide at 0.28 and 0.42 kg/ha which reduced dry weight 21 and 22%, respectively.

3) Foliar injury of soybeans was apparent soon after applications of the treatments, especially the two higher rates of all the herbicides except DOWCO 453 which did not injure soybeans at any rate tested.

4) Soybeans had outgrown almost all the injury after three weeks and no significant effect in height at maturity or in yields was found in the weed-free experiment.

5) In the volunteer corn and volunteer wheat control experiment, 13 to 27% in soybean height reduction was observed four weeks after mefluidide applications.

6) One more weed free study is recommended in order to be sure that mefluidide injury does not cause soybean yield reduction.

7) Volunteer corn was controlled with all the rates of each herbicide tested except mefluidide.

8) The two higher rates of DOWCO 453 and sethoxydim and all the rates of fluazifop gave excellent volunteer wheat control. Acceptable wheat control was obtained with the lower rate of sethoxydim and the 2 higher rates of mefluidide. HOE-33171 and CGA-82725 had little or no effect on wheat.

LITERATURE CITED

1. American Soybean Association. 1982. Final 1981 U.S. Soybean Production. In: Soybean Update. ASA. Vol. 6. No. 4.

2. _____. USDA World Crop Production (Soybeans). In: Soybean Update. ASA. Vol. 6. No. 7.

3. Andersen, R. N., J. H. Ford, and W. E. Lueschen. 1982. Controlling volunteer corn (Zea mays) in soybeans (Glycine max) with diclofop and glyphosate. Weed Sci. 30:132-136.

4. Anonymous. 1979. BAS-90520H experimental herbicide. Technical data sheet. BASF Agricultural Chemicals.

5. Anonymous. Fusilade TM experimental herbicide. Technical information. ICI Americas Inc.

6. Anonymous. Experimental herbicide CGA-82725. Technical release. Agricultural Division/CIBA-GEIGY Corporation.

7. Anonymous. 1982. DOWCO 453 Me Experimental herbicide. Technical information. Dow Chemical U.S.A.

8. Anonymous. 1982. Technical information bulletin HOE 33171 (HOE 00581). American Hoechst Corporation.

9. Anonymous. 1979. SAS User's Guide. 1979 Edition. SAS Institute Inc. 494 p.

10. Beguhn, M. A., M. R. Ekeh, and C. L. Foresman. 1981. Fluazifop (PP-009) for control of volunteer corn in soybeans in the North Central Region. Proc. North Cent. Weed Control Conf. 36:113.

11. Blomberg, J. R. and L. M. Wax. 1977. Response of several soybean cultivars to mefluidide. Proc. North Cent. Weed Control Conf. 32:32.

12. Chen, Y. Z. and D. Penner. 1981. Combination effects of Acifluorfen, Crop Oil Concentrate, and postemergence grass herbicides. Proc. North Cent. Weed Control Conf. 36:36.

13. Clark, D. E. and R. S. Fawcett. 1979. Volunteer corn control in soybeans. Proc. North Cent. Weed Control Conf. 34:32.

14. Cochran, W. G. and G. M. Cox. 1957. Experimental Designs. 2nd edition. John Wiley and Sons. 611 p.

15. Colby, S. R., J. R. Bone, and A. A. Akhavein. 1982. Abstr. Weed Sci. Soc. Am. p. 14-15. PP009, a selective herbicide for control of perennial and annual grasses.

16. Cranmer, J. R. and J. D. Nalewaja. 1981. Additives and BAS 9052 OH phytotoxicity. Proc. North Cent. Weed Control Conf. 36:96.

17. Crosbie, S. and M. McKeague. 1981. Sethoxydim (Poast) EVP results for wild, proso millet control in soybeans. Proc. North Cent. Weed Control Conf. p. 115-116.

18. Fehr, W. R., C. E. Caviness, D. T. Burmood, and J. S. Pennington. 1971. Stage of development descriptions for soybeans (Glycine max (L.) Merrill). Crop Sci. 11:929-930.

19. Gates, D. W., and D. R. Pauly. 1975. MBR-12325. A new plant growth regulator. Proc. South. Weed Sci. Soc. 28:339.

20. Gates, D. W. and D. J. Prochoska. 1979. New developments from 3M Company. Proc. South. Weed Sci. Soc. 32:359.

21. Gibson, S. W., T. G. Hargroder, and D. W. Gates. 1981. Increased soybean weed control with mefluidide used in combination with acifluorfen or bentazon. Proc. North Cent. Weed Control Conf. 36:95.

22. Glenn, S., and C. E. Rieck. 1977. Selective postemergence johnsongrass herbicides for soybean production. Proc. North Cent. Weed Control Conf. 32:30.

23. Glenn, S., and C. E. Rieck. 1977. The activity of mefluidide on johnsongrass and shattercane. Proc. South Weed Sci. Soc. Am. 30:54.

24. Hargroder, T. G., J. K. Calhoun, and D. W. Gates. 1982. Enhanced weed control in soybeans with combinations of mefluidide and acifluorfen. Abstr. Weed Sci. Soc. Am. p. 5.

25. Harker, K. N. and R. N. Andersen. 1981. Volunteer corn and giant foxtail control in soybeans with BAS 9052 and RO-13-8895. Proc. North Cent. Weed Control Conf. 36: 97-98.

26. Harrison, H. F., Jr., B. J. Gossett, and H. L. Musen. 1976. Response of soybeans and weeds to MBR-12325 alone and with bentazon and chloroxuron. Proc. South. Weed Sci. Soc. 29:103.

27. Hartzler, R. G., and C. L. Foy. 1982. Evaluation of BAS 90520H alone and in combination with acifluorfen or bentazon for control of large crabgrass (Digitaria songuinalis L.). Abstr. Weed Sci. Soc. Am. p. 5.

28. Hill, E. R. and V. W. Peek. 1982. CGA-82725-A new grass herbicide for broadleaf crops. Abstr. Weed Sci. Soc. Am. p. 16.

29. Jersey, J. J. and S. Glenn. 1982. Selected herbicides for johnsongrass (Sorghum halepense (L.) Pers.) control in soybeans. Abstr. Weed Sci. Soc. Am. p. 7.

30. Kern, C. L. and L. A. Stahlberg. 1981. Volunteer corn control in soybeans with CGA-82725. Proc. North Cent. Weed Control Conf. 36:114.

31. Kinsella, J. 1981. Sethoxydim (Poast) EVP results for annual grasses control in soybeans. Proc. North Cent. Weed Control Conf. 36:114.

32. Klauzer, J., and W. E. Arnold. 1981. Annual grass and broadleaf control as influenced by diclofop-methyl, difenopenten and sethoxydim herbicide combinations with bentazon. Proc. North Cent. Weed Control Conf. 36:99.

33. Knake, E. L. and F. W. Slife. 1962. Competition of Setaria faberi with corn and soybeans. Weeds.10:26-29.

34. McKeague, M., S. Crosbie, and B. Wisdom. 1981. Sethoxydim (Poast) EVP results for quackgrass control in soybeans. Proc. North Cent. Weed. Control Conf. p. 115.

35. McWhorter, C. G., and G. D. Wills. 1978. Factors affecting the translocation of ^{14}C-mefluidide in soybeans (Glycine max), common cocklebur (Xanthium pensylvanicum) and johnsongrass (Sorghum halepense). Weed Sci. 26:382-388.

36. McWhorter, C. G., and W. L. Barrentine. 1979. Weed control in soybeans (Glycine max) with mefluidide applied post-emergence. Weed Sci. 27:42-47.

37. McWhorter, C. G. and O. T. Patterson. 1979. Ecological factors affecting weed competition in soybeans. p. 371-392. In. F. T. Corbin (Ed.) Proc. World Soybean Res. Conf. II, Westview Press, Inc.

38. Nalewaja, J. D., and S. D. Miller. 1980. Postemergence herbicide combinations for grass and broadleaf weed control. Proc. North Cent. Weed Control Conf. 35:43-44.

39. Rathmann, D. P. and S. D. Miller. 1981. Wild oat (Avena fatua) competition in soybean (Glycine max). Weed Sci. 29:410-413.

40. Report of the ARS, USDA. Research Planning Conference on Weed Control in Soybeans. 1976. Tifton, GA. 54 p.

41. Rogers, S. A., and J. P. Worthington. 1979. Evaluation of BAS 9052 and 9021 for johnsongrass control in soybeans. Proc. North Cent. Weed Control Conf. 34:10.

42. Samir, S. H., and O. G. Russ. 1981. Response of volunteer corn and soybeans to diclofop or sethoxydim as influenced by corn height, carrier volume, herbicide rate and corn cultivars. Proc. North Cent. Weed Control Conf. 36:25.

43. Sciarappa, W. J., Jr. 1979. Postemergence grass control in soybeans with BAS-9052 OH. Proc. North East Weed Sci. Soc. 33:10.

44. Simkins, G. S., and J. D. Doll. 1981. Quackgrass control with selective postemergence herbicides in soybeans. Proc. North Cent. Weed Control Conf. 36:116.

45. Smith, L. L., Jr., H. Johnston, B. C. Gerwick, and E. A. Egli. 1982. DOWCO 453-A new postemergence herbicide for selective annual and perennial grass control in broadleaved crops. Abstr., Weed Sci. Soc. Am. p. 107.

46. Snedecor, G. W., and W. G. Cochran. 1980. Statistical Methods. 7th edition. The Iowa State University Press. 507 p.

47. Therkilsen, J. A., M. K. Eken, W. (Butch) H. Palmer, and J. P. Herberger. 1981. Fluazifop (PP-009): Control of quackgrass in soybeans in the North Central Region. Proc. North Cent. Weed Control Conf. 36:112-113.

48. Threewitt, T. B., T. D. Taylor, M. L. Juby, C. L. Kern, and L. A. Stahlberg. 1981. CGA-82725-A new postemergence grass herbicide for soybeans. Proc. North Cent. Weed Control Conf. 36:113-114.

49. U.S. Department of Agriculture. 1979. Agricultural Statistics. USDA. p. 131-134.

50. Veenstra, M. A., J. F. Vesecky, and L. W. Hendrick. 1978. BAS 9052 OH a new postemergence grass herbicide for soybeans. Proc. North Cent. Weed Control Conf. 33:69.

51. Wax, L. M. 1973. Weed control, p. 417-457. In B. E. Caldwell (Ed.) Soybeans: Improvement, Production, and Uses. Am. Soc. Agron., Madison, WI.

52. Westra, P. and D. L. Wyse. 1979. Quackgrass control in soybeans with BAS 9052 and KK-80. Proc. North Cent. Weed Control Conf. 34:34.

53. Wyse, D. L. 1976. Quackgrass control in soybeans with post-emergence herbicides. Proc. North Cent. Weed Control Conf. 31:92-93.

APPENDIX

Table 1. Analysis of Variance for Fresh Weight, Greenhouse Experiments, Manhattan, Kansas, 1982.

Source	DF	Sum of Squares	F-Value	P-Value
Treatment	18	3467.02	4.70**	0.0001
Time	2	36372.02	443.34	0.0001
TRT * Time	36	2142.46	1.45	0.0727
Error	112	4594.28		
Total	168	46575.78		

C.V. = 11.05

Table 2. Analysis of Variance for Dry Weight, Greenhouse Experiments, Manhattan, Kansas, 1982.

Source	DF	Sum of Squares	F-Value	P-Value
Treatment	8	117.25	5.12**	0.0001
Time	2	421.16	165.47	0.0001
TRT * Time	36	51.10	1.12	0.3258
Error	112	142.53		
Total	168	732.03		

C.V. = 12.32

Table 3. Analysis of Variance fo Soybean Height at Maturity in the Weed Free Field Experiment, Manhattan, Kansas, 1982.

Source	DF	Sum of Squares	F-Value	P-Value
Treatment	18	323.72	1.73	0.079
Block	2	35.37	1.70	0.197
Error	36	373.96		
Total	56	733.05		

C.V. = 2.95

Table 4. Analysis of Variance for Soybean Yields in the Weed Free Experiment, Manhattan, Kansas, 1982.

Source	DF	Sum of Squares	F-Value	P-Value
Treatment	18	1.63	1.47 NS	0.1607
Block	2	0.49	3.93	0.0285
Error	36	2.23		
Total	56	4.35		

C.V. = 5.01

Table 5. Analysis of Variance for Volunteer Corn Control, Manhattan, Kansas, 1982.

Source	DF	Sum of Squares	F-Value	P-Value
Treatment	18	5903.86	134.61**	0.0001
Block	2	5.61	1.15	0.3274
Error	36	87.72		
Total	56	5997.19		

C.V. = 5.87

Table 6. Analysis of Variance for Volunteer Wheat Control, Manhattan, Kansas, 1982.

Source	DF	Sum of Squares	F-Value	P-Value
Treatment	18	9423.64	190.63**	0.0001
Block	2	10.47	1.91	0.1634
Error	36	98.86		
Total	56	9532.97		

C.V. = 8.94

RESPONSE OF SOYBEAN (*Glycine max* (L.) Merrill) TO POSTEMERGENCE GRASS CONTROL HERBICIDES AND VOLUNTEER CORN (*Zea mays* L.) AND VOLUNTEER WHEAT (*Triticum aestivum* L.) CONTROL.

by

FELIX AYALA CHAIREZ

Ing. Agr., ITESM-Obregon, Mexico, 1978

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Agronomy

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1982

Three rates of six postemergence grass control herbicides were sprayed over the top of Williams soybeans at the V2 to V3 stage in the greenhouse and field experiments. A completely randomized design with three replications was used for each of three greenhouse experiments. Two field experiments were conducted on the Ashland Unit, K.S.U. in 1982. In one of the field experiments, weed free conditions were kept to eliminate the possibility of reduced yields due to competition with the crop. Randomized complete block designs were used in both field experiments. In the other field experiment, soybean seeds were mixed with corn seeds at a ratio 3:1 to simulate volunteer corn; planting was done at 33 seeds/m in rows; and wheat was drilled between rows.

Fresh weight and dry weight measured two weeks after applications were not reduced at any rate of each herbicide except mefluidide at 0.28 and 0.42 kg/ha. Foliar injury was present soon after applications of all herbicides (especially the two higher rates) except DOWCO 453. Soybeans had outgrown all the injury after three weeks and no effect on height at maturity and yield was found. Excellent volunteer corn control was obtained with all the rates of each herbicide except mefluidide. DOWCO 453, sethoxydim, and fluazifop gave excellent volunteer wheat control. Acceptable wheat control was achieved with mefluidide. HOE-33171 and CGA-82725 had little or no effect on wheat.