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## Tolerance of Legume Species to Postemergence Soybean Herbicides


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### ABSTRACT

Recent interest in 'Quail haven' (QH) reseeding soybean (*Glycine soja* Siebold and Zucc), Lark Selection (LS) partridge pea [*Chamaecrista fasciculata* (Michx.) Greene], and Hopefield Selection (HS) trailing wildbean [*Strophostyles helvula* (L.) Ell.] for soil conservation and wildlife habitat development have brought about questions concerning their tolerance to postemergence soybean herbicides when grown in or adjacent to fields of commercial soybeans [*Glycine max* (L.) Merrill]. Objective of this study was to determine tolerance of QH, LS and HS to 12 postemergence soybean herbicides. Herbicides were sprayed on legume species grown in the greenhouse and in field plots. Visual observations for tolerance were made 7 and 14 DAT in the greenhouse experiment and 7, 14 and 28 DAT in field experiment. All legume species responded to the herbicides with varying degrees of tolerance. QH showed the broadest tolerance to soybean herbicides followed by LS and HS.


### INTRODUCTION

QH, LS and HS are annual, warm season legumes used for soil conservation and wildlife habitat improvement. Recent interest and demand for seed of LS and QH has resulted in an increase in row crop farmers wanting to produce them commercially as an alternative cash crop. Although these legumes can be planted and managed using conventional row crop equipment many farmers have inquired as to their tolerance to soybean herbicides since production will be in or adjacent to soybean fields. Therefore, the objective of this study was to determine the tolerance of LS, QH and HS to 12 postemergence soybean herbicides.

### MATERIALS AND METHODS

Greenhouse Experiment

Initial screening of herbicides was conducted in a greenhouse at the USDA-NRCS Jamie L. Whitten Plant Materials Center (PMC) near Coffeeville, MS. One gallon containers were filled with a Oaklimeter silt loam and allowed to settle before planting. Scarified seed of LS, QH and HS were planted in liberal amounts in each pot on 1 May 1998 and 7 July 1998, and covered with ½ inch of soil. Metolachlor (Dual 8EC) was applied after both planting dates at a rate of one qt/acre using a $CO_2$ backpack sprayer. Experimental design was a randomized complete block with six replications


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(each pot served as a replication). Containers were irrigated as needed to maintain growing seedlings and fertilized using a liquid fertilizer injector system.

Field Experiment

A field study was also conducted at the PMC on an Oaklimeter silt loam. Seed of LS, HS and QH were mechanically scarified and broadcast planted in 4' by 4' plots on 30 April 1999 and lightly covered. Experimental design was a randomized complete block with 3 replications. Dual was applied after planting at a rate of one qt/acre. Phosphorus and potash were broadcast applied at 300 lb/acre using 0-20-20 fertilizer.

Herbicide Application and Data Analysis

Herbicides and rates used in the studies are presented in Table 1. Herbicides were applied with a $CO_2$ backpack sprayer at 20 gal/acre. Herbicides were applied 29 May 1998 and 5 August 1998 to the container grown plants and 4 June 1999 to the field. A non ionic surfactant was used with all herbicides at 0.25% v/v except Poast Plus in which a crop oil concentrate was used. Visual ratings for tolerance (9 = no damage, 7 = slight damage, 5 = moderate damage, 3 = severe damage, 1 = dead) were made 7 and 14 days after treatment (DAT) to plants grown in the greenhouse and 7, 14, and 28 DAT to plants grown in the field. Data from the first and second greenhouse experiment was combined for final analysis. These data along with data from the field experiment was subjected to an analysis of variance procedure in MSTAT-C (Michigan State Univ., 1988) and means that differ significantly were separated with Duncan's multiple range test (DMRT) at $P<0.05$.

Table 1. Herbicides and rates used in the experiment.

| **Trade Name** | **Common Name/Formulation** | **Rates** |
|---|---|---|
| Blazer 2EC | Acifluorfin | .50 lb ai/acre |
| Basagran 4WS | Bentazon | 1.0 lb ai/acre |
| Classic 25DF | Chlorimuron | .125 oz ai/acre |
| First Rate 84 WG | Cloransulam | .016 lb ai/acre |
| Reflex 2EC | Fomesafen | .375 lb ai/acre |
| Liberty 1.67 EC | Glufosinate | .37 lb ai/acre |
| Roundup Ultra 4SL | Glyphosate | .75 lb ai/acre |
| Scepter 70 DG | Imazaquin | .125 lb ai/acre |
| Pursuit 3/3 EC | Imazethapyr | .063 lb ai/acre |
| Cobra 2EC | Lactofen | .20 lb ai/acre |
| Poast Plus 1 EC | Sethoxydim | .25 lb ai/acre |
| Assure II .88EC | Quizalofop | .06 lb ai/acre |

## RESULTS AND DISCUSSION

The greenhouse experiment was used for initial herbicide tolerance screening of QH, LS, and HS. Containers were irrigated to maintain adequate moisture during the week, but over the weekend they were not irrigated. Visual ratings for tolerance from the greenhouse experiments were lower than those obtained from the field experiment. The greenhouse experiment was terminated after the 14 day evaluations were made because seedlings began to deteriorate.

Quail haven Response to herbicides

QH response to postemergence herbicides is presented in Table 2. QH exhibited good tolerance to many of the soybean herbicides used in this study. Since QH is related to commercial soybeans it would seem logical that they would have some degree of tolerance to many of these herbicides. QH responded similarly to herbicides applied in the field and in the greenhouse. Liberty severely injured QH in the greenhouse. Pursuit was not applied to QH in the greenhouse experiment, but in the field it caused severe damage early and the plants never fully recovered. Cobra caused moderate damage early in the field but plants recovered late. Early damage and late recovery is typical of commercial soybeans following Cobra application (Houston and Blaine, 1998). Visual observation of Cobra damage on QH was typical of symptoms exhibited by commercial soybeans (i.e., temporary leaf speckling, burns, and/or crinkling of leaves). Roundup severely damaged QH in the greenhouse experiment. Because Roundup is a non selective herbicide it is unlikely that QH would tolerant its mode of action. QH showed very good tolerance to Poast Plus. Poast Plus has been used on PMC production fields of legumes and wildflower species for control of grassy weeds.

Lark Selection Response to herbicides

LS response to postemergence herbicides is presented in Table 3. Greenhouse and field experiments gave varying differences. However, Scepter gave similar results in both environments. Poast Plus was not applied in the field experiment but like the greenhouse experiment, it has not caused any damage to LS production fields at the PMC. Liberty, Pursuit and Roundup completely killed LS. Blazer caused moderate damage. Blazer has been shown to cause significant damage to partridge pea when applied at .375 lb ai/acre (Bloodworth, 1991). Partridge pea tolerance to Basagran, Scepter and Classic agrees with Wyatt and Walker (1988) and Bloodworth (1991). Cobra damaged LS early but like commercial soybeans and QH, LS recovered by 28 DAT. LS shown excellent tolerance to Assure II and good tolerance to Reflex and First Rate in the field.

Hopefield Selection Response to herbicides

HS response to postemergence herbicides is presented in Table 4. Tolerance of HS to the herbicides tested was similar in both environments for Blazer, First Rate, and Scepter. Cobra was not used on HS in the field experiment due to poor plant stands. However, in the greenhouse experiment, Cobra caused severe damage early. It is premature to conclude that HS is tolerant to Cobra at this time because the greenhouse experiment was terminated after 14 days. Results from previous work with Cobra on commercial soybeans and in this study with QH and LS show that plants recovered from injury after 14 DAT. HS showed tolerance to Basagran, Pursuit and Assure II in the field experiment. Basagran has been effective in controlling nut sedge (*Cyperus* sp.) in seed increase fields at the PMC.

## CONCLUSIONS

QH, LS and HS showed varying degrees of tolerance to the 12 postemergence soybean herbicides with QH having the broadest tolerance of the legumes followed by LS and HS. Greenhouse and field experiments produced differing results. All legumes showed excellent tolerance to Basagran and Assure II in the field experiment.

Future Research Needs

Because of its vining habit, QH is often grown with corn (*Zea mays* L.) to support the vine so they can be combined harvested. Additional research is needed to identify herbicides that can be used on QH and corn.

Table 2. Herbicide tolerance of QH in a field and greenhouse experiment 7, 14 and 28 days after treatment (DAT).

| | Field | | | Greenhouse | |
|---|---|---|---|---|---|
| | DAT | | | | |
| **Herbicide** | 7 | 14 | 28 | 7 | 14 |
| Blazer | 6[1/] de[2/] | 7 d | 7 b | 6[1/]d[2/] | 7 cde |
| Basagran | 8 abc | 8 bc | 8 a | 8 ab | 7 cde |
| Classic | 7 bcd | 7 cd | 8 a | 7 cd | 7 cde |
| First Rate | 9 a | 9 a | 9 a | 8 ab | 8 ab |
| Reflex | 6 cd | 7 d | 8 a | 8 ab | 8 ab |
| Liberty [3/] | -------- | -------- | --------- | 3 e | 2 f |
| Roundup Ultra [3/] | -------- | -------- | --------- | 3 e | 2 f |
| Scepter | 9 a | 9 a | 9 a | 8 ab | 8 ab |
| Pursuit [3/] | 2 f | 2 f | 3 c | ------- | ------- |
| Cobra | 6 de | 7 d | 8 a | 6 d | 6 e |
| Assure II | 8 ab | 9 ab | 9 a | 7 cd | 6 e |
| Poast Plus [3/] | -------- | -------- | --------- | 9 ab | 8 ab |
| Control | 9 a | 9 a | 9 a | 9 ab | 9 a |

1 - 9 = no damage, 7 = slight damage, 5 = moderate damage, 3 = severe damage, 1 = dead.
2 - Means in columns followed by the same letters are not significantly different according to DMRT at P<0.05.
3 - Did not apply.

Table 3. Herbicide tolerance of LS in a field and greenhouse experiment 7, 14 and 28 days after treatment (DAT).

| | Field | | | Greenhouse | |
|---|---|---|---|---|---|
| | DAT | | | | |
| **Herbicide** | 7 | 14 | 28 | 7 | 14 |
| Blazer | 5[1/] cd[2/] | 6 bc | 6 abc | 3 de | 2 fg |
| Basagran | 9 a | 9 a | 9 a | 5 bc | 6 bc |
| Classic | 7 abc | 8 abc | 8 ab | 4 c | 4 de |
| First Rate | 6 bcd | 7 abc | 7 abc | 3 cd | 3 ef |
| Reflex | 6 bcd | 7 abc | 7 abc | 2 efg | 2 fg |
| Liberty [3/] | --------- | --------- | --------- | 1 g | 1 g |
| Roundup Ultra [3/] | --------- | --------- | --------- | 1 g | 1 g |
| Scepter | 7 abc | 8 abc | 8 ab | 6 b | 7 b |
| Pursuit [3/] | 1 e | 1 d | 1 d | ------ | ----- |
| Cobra | 5 bcd | 6 bc | 8 ab | 2 def | 3 ef |
| Assure II | 9 a | 9 a | 9 a | 5 bc | 5 cd |
| Poast Plus [3/] | --------- | ---------- | ---------- | 8 a | 8 a |
| Control | 9 a | 9 a | 9 a | 9 a | 9 a |

1 - 9 = no damage, 7 = slight damage, 5 = moderate damage, 3 = severe damage, 1 = dead.
2 - Means in columns followed by the same letters are not significantly different according to DMRT at P<0.05.
3 - Did not apply.

Table 4. Herbicide tolerance of HS in a field and greenhouse experiment 7, 14 and 28 days after treatment (DAT).

| | Field | | | Greenhouse | |
|---|---|---|---|---|---|
| | DAT | | | | |
| **Herbicide** | 7 | 14 | 28 | 7 | 14 |
| Blazer | 1[1/] d[2/] | 1 d | 1 d | 3 de | 2 d |
| Basagran | 8 abc | 9 a | 9 a | 6 bc | 7 b |
| Classic | 3 cd | 3 cd | 4 bcd | 6 bc | 6 bc |
| First Rate | 4 bc | 6 abc | 6 ab | 6 bc | 7 b |
| Reflex | 3 cd | 4 bcd | 4 bcd | 3 d | 2 d |
| Liberty | 1 d | 1 d | 1 d | 2 e | 1 e |
| Roundup Ultra [3/] | ---------- | ---------- | ---------- | 2 e | 1 e |
| Scepter | 5 bc | 6 abc | 6 ab | 7 b | 7 b |
| Pursuit [3/] | 7 ab | 8 a | 8 a | ------- | ------ |
| Cobra [3/] | ---------- | ---------- | ---------- | 4 d | 3 d |
| Assure II | 9 a | 9 a | 9 a | 5 c | 5 c |
| Poast Plus [3/] | ---------- | ---------- | ---------- | 8 a | 8 a |
| Control | 9 a | 9 a | 9 a | 9 a | 9 a |

1 - 9 = no damage, 7 = slight damage, 5 = moderate damage, 3 = severe damage, 1 = dead.
2 – Means in columns followed by the same letters are not significantly different according to DMRT at P<0.05.
3 – Did not apply.

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Herbicide labels should be consulted on all products before use.

# NOTES