# Influence of Stalk Boring Insects on Glyphosate Efficacy on Giant Ragweed

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## Introduction

Glyphosate occasionally fails to control giant ragweed at commercially acceptable levels (Hoss et al. 2003). Control failure can be traced to several causes including inadequate rates based on plant size, poor coverage due to dense populations, and additional emergence cohorts (Tharp and Kells 1999). More recently, it is hypothesized that stalk boring insects are responsible for reduced control with glyphosate because stalk boring insects can be found in large escaped plants (Figure 1). Previous research shows that giant ragweed can serve as a host for European corn borer (Dicke 1932) and stalk borer (Decker 1931). However, there have been no published reports that address antagonism that can be attributed to stalk boring insects.

Figure 1. Giant ragweed that survived an application of glyphosate (0.87 kg ae/ha). Notice the stem tunneling and presence of insect larvae.

Purdue University entomologists have observed four stalk boring insects in insect surveys conducted throughout Indiana (Obermeyer and Gerber, unpublished data). These insects include Stalk borer [*Papaipema nebris* (Guenée)] (Figure 2), European corn borer (ECB) [*Ostrinia nubilalis* (Hüber)] (Figure 3), Celery leaftier [*Udea rubigalis* (Guenée)] (Figure 4), Cocklebur weevil [*Rhodobaenus quinquedecimpunctatus* (Say)] (Figure 5). The most common species observed was the stalk borer. From a weed science standpoint, we are interested in this interaction and its influence on the development of glyphosate resistance in arguably the most common problematic broadleaf in Indiana corn and soybean production.

Figure 2. Stalk borer. Photo by Dan Childs.

Figure 3. European corn borer.

Figure 4. Celery leaftier. Photo by John Obermeyer

Figure 5. Cocklebur weevil. Photo by John Obermeyer

## Objective

Our objective was to determine the influence of stalk boring insects, specifically European corn borer (ECB), on giant ragweed control with glyphosate.

## Materials and Methods

Giant ragweed seedlings were collected from the Purdue University Agronomy Center for Research and Education and placed individually in pots in the greenhouse under optimal growing conditions. ECB eggs were obtained from Iowa State University and placed in an incubator for three days to allow egg hatch. When the larvae were 3 mm long (neonate stage) and giant ragweed seedlings were 10 cm tall, 2 to 4 ECB neonates were placed on the leaves of selected plants with a paint brush (Figure 6). Plants were watered and fertilized as necessary and greenhouse conditions included 28° C daytime temperatures, 23 ° C nighttime temperatures and natural lighting was supplement with halide lights to maintain a 15 hour daylength.

Figure 6. On selected giant ragweed plants, 2 to 4 ECB neonates were placed on the leaves with a paint brush.

A factorial arrangement of treatments consisting of four glyphosate rates (0, 0.63, 0.87, and 1.54 kg ae/ha), two application timings (15 cm and 45 cm tall giant ragweed) and two levels of ECB infestation (0 and 2 to 4 ECB neonates per plant) were evaluated. Treatments were applied with a track sprayer in 187 L/ha carrier volume and a spray pressure of 275 kPa. Ammonium sulfate at 1.5% w/w was added to all treatments

At 21 DAT, each plant was dissected to determine presence and length of ECB tunnels, and dry weights were recorded. Data were subjected to analysis of variance and regression analysis.

## Results and Discussion

ECB tunneling had no effect on untreated (no glyphosate) giant ragweed dry weight (Table 1). ECB tunneling did not influence control of giant ragweed treated when 15 cm tall. ECB infested giant ragweed allowed to reach 45 cm before a reduced-rate glyphosate treatment was not controlled as well as infested giant ragweed treated with a full-rate of glyphosate (Figure 8 and 9). However, increasing the rate of glyphosate from 0.63 to 0.87 kg ae/ha improved control of 45 cm giant ragweed (Figure 10 and Table 1).

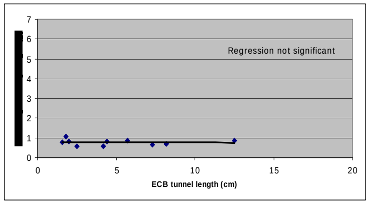



Figure 7. 15 cm tall giant ragweed infested with ECB and treated with 0.63 kg ae/ha of glyphosate.

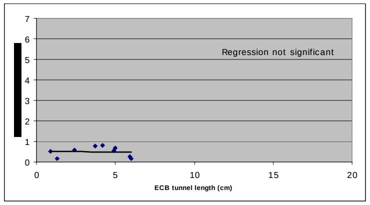



Figure 8. 15cm tall giant ragweed infested with ECB and treated with 0.87 kg ae/ha of glyphosate.

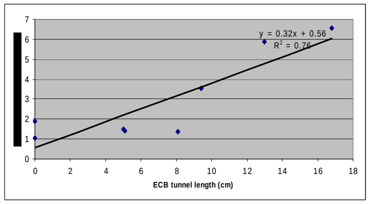



Figure 9. 45 cm tall giant ragweed infested with ECB and treated with 0.63 kg ae/ha of glyphosate.

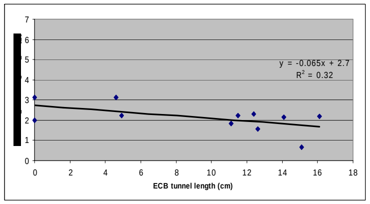



Figure 10. 45 cm tall giant ragweed infested with ECB and treated with 0.87 kg ae/ha of glyphosate.

Table 1. Influence of ECB infestation, giant ragweed size and glyphosate rate on giant ragweed dry weight.

| | Giant ragweed height | | | |
|---|---|---|---|---|
| | 15 cm | | 45 cm | |
| | ECB infestation | | | |
| Glyphosate rate | Yes | No | Yes | No |
| Kg ae/ha | dry weight (% of control) | | | |
| 0 | 100 | 100 | 100 | 100 |
| 0.63 | 55 | 59 | 100 | 79 |
| 0.87 | 58 | 46 | 81 | 86 |
| 1.73 | 44 | 55 | 62 | 69 |

LSD (0.05) = 18 For comparisons of all means.

## Conclusions

Direct correlations between length of insect tunnels and efficacy reductions were observed with 45-cm giant ragweed treated with the lowest rate of glyphosate. Similar correlations were not observed with higher rates of glyphosate.

Overall control was 21% less in infested versus non-infested 45-cm giant ragweed treated with 0.63 kg ae/ha. No significant differences were observed when higher rates of glyphosate were used.

## Future Research

Investigate the influence of spray carrier volume on insect infested giant ragweed control with low rates of glyphosate.

**References**

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