Post-Emergent Herbicide Selection for Okra Oilseed Production

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Abstract

Okra (Abelmoschus esculentus) seed has garnered attention for its potential as a livestock feed, particularly in light of possible threats to soybean (Glycine max) productivity. While established weed control systems exist for okra vegetable production in the Southern USA, information is lacking on management tools for oilseed production in the North Central region. A number of promising post-emergent herbicides were evaluated for crop injury and effects on oilseed and biomass yield. Fomesafen, imazaquin, mesotrione, nicosulfuron, and pyridate were compared at single application rates. In a separate study, mesotrione and pyrithiobac-Na were each evaluated at three different application rates. Mesotrione and pyrithiobac-Na were the only herbicides not shown to reduce okra yields, and further research is warranted.

Introduction

Okra may be a complement to soybean as an oilseed component of North Central USA livestock rations. Okra and soybean have similar seed oil and protein content, and okra seed yields have regularly exceeded 2000 kg ha⁻¹ in variety trials (Phippen, 2006), while okra is unsusceptible to pathogens like soybean cyst nematode (Heterodera glycines) and Asian soybean rust (Phakopsora pachyrhizi). However, weed management practices developed for okra horticultural production do not include post-emergent herbicides suitable for broadcast use against dicot weeds (Mossler and Lamberts, 2005; Stall, 2006). Identification of active ingredients for that role would address a constraint to agronomic production of okra seed.

Introduction & Methods

‘Clemson Spineless’ okra (Figure 8) was planted 18 May 2006 at a rate of 8 kg ha⁻¹ pure live seed in an Osco silt loam (Fine-silty, mixed, superactive, mesic Typic Argudolls). Plots were 3 m wide (four 77 cm rows) and 6.1 m long. Treatments included five post-emergent and one pre-emergent herbicides (Table 1), one hand-weeded check, and one check with no weed control. The pre-emergent treatment was applied on 19 May 2006 and shallowly incorporated, and the post-emergent treatments were applied on 23 June 2006. Visual crop injury ratings were performed on 6 July 2006 on a scale from 1 (no injury) to 5 (maximum injury equivalent to that of most injured plot predawn). With the exception of one mechanical row cultivation, no additional whole-field weed control was performed. Weed pressure was heavy in July, suppressing okra growth and development, and resulting in the decision to harvest the trial for biomass rather than seed. Above ground okra biomass was collected from 1.2 m of the center two rows of each plot on 28 July 2006 for air-dried biomass yield determination. Analysis of variance was performed with treatment as a fixed effect and block as a random effect, and Fisher’s protected least significant difference was calculated as a post-hoc test. The alpha-level for hypothesis testing and mean separation was 0.05.

2006 Experiment

Results & Discussion

Mesotrione and nicosulfuron produced moderate to severe visible injury on treated okra plants (Figure 3). Plots treated with imazaquin, pyridate, and fomesafen exhibited slight to moderate injury, lesser than that caused by mesotrione but distinguishable from the unsprayed checks (Figure 7). Despite the crop injury it produced following application, mesotrione was the only post-emergent active ingredient not to reduce late July okra biomass yields relative to the no-weed-control check (Figure 4). Yields from the other four post-emergent active ingredients were less than half of those achieved by the check. Pre-emergent trifluralin did not produce crop injury or yield reduction.

2007 Experiment

Table 2: 2007 herbicide treatment levels.

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Application

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Form Applied</th>
<th>Application Rate g a.i. ha⁻¹</th>
<th>Application Rate g a.i. ha⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesotrione</td>
<td>Calstar 4EC 1</td>
<td>70</td>
<td>140</td>
</tr>
<tr>
<td>Pyridate</td>
<td>Tough 3.75EC</td>
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<td>280</td>
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<tr>
<td>Pyrithiobac-Na</td>
<td>Single 135P 1</td>
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<td>260</td>
</tr>
<tr>
<td>Nicosulfuron</td>
<td>Stale 60WP</td>
<td>105</td>
<td>210</td>
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<tr>
<td>Fomesafen</td>
<td>Reflex 2EC 1</td>
<td>70</td>
<td>140</td>
</tr>
</tbody>
</table>

Figure 5: Okra crop injury ratings (1 = no injury, 10 = death).

Results & Discussion

No visible crop injury was caused by pyrithiobac-Na at any application rate. Mesotrione produced slight to moderate levels of chlorosis on treated okra plants, and the effect increased with application rate. Neither active ingredient reduced okra seed yield at any application rate, relative to the unsprayed check. No evidence was found for okra seed yield reduction from application of moderate to high rates of mesotrione or pyrithiobac-Na. Chlorotic leaf tissue resulting from mesotrione application did not reduce subsequent seed yields.

Conclusions

In two separate, one-year trials, no evidence was apparent for suppression of okra seed yields by applications of mesotrione and pyrithiobac-Na at application rates currently labeled for other dicot crops. The visible crop injury caused by mesotrione application was not associated with any reduction in yield. Weed control research efforts in okra should include further site-years of evaluation of these promising materials. Future mesotrione trials in okra should include the use of cool oil concentrate (the primary labeled adjuvant for mesotrione), now that crop safety with non-ionic surfactant has received preliminary validation. Fomesafen, imazaquin, nicosulfuron, and pyridate displayed limited potential for post-emergent use in okra in one year of experimentation. Single-pass post-emergent weed control may be problematic in okra oilseed production, even when accompanied by row cultivation. Future research is needed on two-pass post-emergent systems, as well as pre- plus post-systems.

References


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