Evaluation of Sharpen Herbicide in Grain Sorghum

Wayne Keeling, and Jacob Reed; Professor and Senior Research Associate, Texas AgriLife Research, Lubbock, TX

Introduction

Several selective herbicides may be used preplant-incorporated (PPI) or preemergence (PRE) in sorghum but concerns about plant-back intervals, weed control spectrum, and crop safety limit their use in sorghum. Sharpen (saflufenacil) is a new herbicide from BASF for PRE burndown and selective broadleaf weed control in several agronomic crops including corn, soybean, cotton and grain sorghum. Sharpen provides rapid foliar burndown of weeds as well as soil residual activity. It can be used with other burndown and residual herbicides but allows for rotational crop flexibility. Studies were conducted in 2008, 2009 and 2010 to evaluate Sharpen in sorghum.

Objectives

1) Evaluate Sharpen as a burndown treatment for annual and perennial weeds in grain sorghum.
2) Examine Sharpen as a PRE for treatment in grain sorghum.
3) Determine grain sorghum tolerance to Sharpen was applied PRE in sorghum and in combination with Outlook (Verdict).

Methods and Materials

Herbicide treatments evaluated for kochia and Russian thistle burndown included Sharpen at 0.8 oz/A and 3.2 oz/A, Verdict at 18.4 oz/A and glyphosate at 22 oz/A. Field studies also compared Sharpen to dicamba, 2,4-D, and glyphosate to control woollyleaf bursage, Texas blueweed, and field bindweed. Herbicide treatments consisted of Sharpen at 0.8, 1.2, 3.2, and 6.0 oz/A; dicamba at 8.0 oz/A; 2,4-D at 32 oz/A; and Roundup at 32 oz/A. Palmer amaranth control using Sharpen was evaluated 14 days before planting (DBP) and PRE. 14 DBP herbicide treatments included Sharpen at 0.8, and 3.2 oz/A, Verdict at 18.4 oz/A and glyphosate at 22.0 oz/A. PRE treatments included Sharpen at 2.4 and 3.2 oz/A, Verdict at 15.5 and 18.4 oz/A, Sharpen + atrazine at 3.2 + 16.0 oz/A, and G-Max Lite at 40.0 oz/A.

Field experiments were conducted to evaluate sorghum tolerance to Sharpen on three different soil types at Lubbock, Halfway, and Lamesa, TX. In each study, Pioneer 85G01 and Dekalb 44-20
were planted. All herbicide treatments were applied PRE at planting and were kept weed-free by cultivation and hand-hoeing. Rates at each location were based on soil texture. Herbicide treatments at Lubbock included Sharpen at 1.6 and 3.6 oz/A; Verdict at 9.2 and 18.4 oz/A, and Outlook at 14.8 and 30.0 oz/A. Herbicide treatments at Halfway included Sharpen at 2.0, and 4.0, Verdict at 10.3 and 20.5 oz/A, and Outlook at 17.1 and 34.0 oz/A. Herbicide treatments at Lamesa included Sharpen at 1.2 and 2.4 oz/A, Verdict at 6.0 and 12.0 oz/A, and Outlook at 9.7 and 19.2 oz/A.

**Results**

**Kochia and Russian thistle control**

At 14 days after treatment (DAT), both Sharpen treatments controlled kochia ≥ 99%, while the glyphosate-only treatment controlled kochia 96%. A rate response was not observed between Sharpen at 0.8 and 3.2 oz/A. Sharpen controlled Russian thistle 100% at both rates while glyphosate controlled Russian thistle 95 to 97%.

![Kochia control - 14 DBP](image)

![Russian thistle control - 14 DBP](image)

**Perennial weed control**

In 2009, woollyleaf bursage control ranged from 47 to 99% 7 DAT. All Sharpen treatments controlled this weed at least 98%, which were more effective than dicamba, 2,4-D, or glyphosate. 14 DAT, woollyleaf bursage control from 87-99% was maintained. At 42 DAT, control with Sharpen declined to <25% while Clarity and 2,4-D controlled woollyleaf bursage 60-82%. At 7 DAT, Texas blueweed was controlled 90 to 93% with Sharpen which was more effective than all other treatments. At 14 DAT, Sharpen controlled this weed at least 96%. At 42 DAT, Texas blueweed control with Sharpen was <20%, while glyphosate controlled this weed 80%. Sharpen controlled field bindweed 96 to 99% 7 DAT, which was more effective than dicamba, 2,4-D, or glyphosate. At 14 DAT, Sharpen controlled this weed at least 90%. At 42
DAT, dicamba and 2,4-D controlled field bindweed 92 to 96%, which was more effective than glyphosate and Sharpen. These results indicate that Sharpen can provide rapid burndown control of these perennial weeds but little to no long-term control is achieved.
Palmer amaranth control

Residual Palmer amaranth control from treatments applied 14 DBP in 2008 ranged from 48 to 100% 28 DAT. Increasing Sharpen rates increased residual Palmer amaranth control. Verdict provided more effective control than Sharpen. All Sharpen containing treatments provided greater control than glyphosate alone in 2008. In 2009, residual Palmer amaranth control ranged from 13 to 100% 28 DAT. Similar to 2008, Verdict controlled Palmer amaranth better than Sharpen or glyphosate alone at 28 and 56 DAT.

Palmer amaranth control after PRE applications of Sharpen ranged from 96 to 100% 37 DAT in 2008. Palmer amaranth control was similar across treatments. In 2009, all herbicide treatments controlled Palmer amaranth greater than 95% 37 DAT. Sharpen applied alone was less effective at controlling Palmer amaranth when compared to Sharpen + atrazine, Outlook, and G-Max Lite. No differences were observed between treatments and when compared to the nontreated control (data not shown).
Crop tolerance

No treatment affected yields at Lubbock or Halfway in 2008 (Table 1). At Lamesa in 2008, above label rates of both Sharpen and Verdict decreased yields of ‘Pioneer 85G01’ compared to the nontreated control. ‘Dekalb 44-20’ was not affected by above label rates of Sharpen or Verdict indicating variable tolerance to Sharpen between different sorghum hybrids. In 2008 at Lamesa, a significant rainfall event occurred within 10 days after treatment, possibly causing more injury with above label rates of Sharpen. In 2009, no treatment affected yields at Lubbock. However, above label rates of Sharpen decreased yields of both ‘Pioneer 85G01’ and ‘Dekalb 44-20’ at Halfway and Lamesa that year. Significant rainfall in 2009 at Halfway and Lamesa 10 days after treatment also seemed to cause injury with above label rates of Sharpen just as occurred in 2008 at Lamesa.

These results suggest that when applied at labeled rates, Sharpen or Verdict can be applied PRE in sorghum without injuring sorghum or affecting yields. Injury from above labeled rates has been observed, especially when heavy rainfall occurs within 10 days after application. Sharpen or Verdict (which is not currently registered in sorghum) can be valuable new tools for preplant burndown and early-season weed management in grain sorghum.
Table 1. Grain sorghum yield as affected by PRE herbicide treatments.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate (oz/A)</th>
<th>Lubbock</th>
<th>Halfway</th>
<th>Lamesa</th>
<th>Lubbock</th>
<th>Halfway</th>
<th>Lamesa</th>
<th>Lubbock</th>
<th>Halfway</th>
<th>Lamesa</th>
<th>Lubbock</th>
<th>Halfway</th>
<th>Lamesa</th>
<th>Lubbock</th>
<th>Halfway</th>
<th>Lamesa</th>
<th>LSD 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PN</td>
<td>DK</td>
<td></td>
<td>PN</td>
<td>DK</td>
<td></td>
<td>PN</td>
<td>DK</td>
<td></td>
<td>PN</td>
<td>DK</td>
<td></td>
<td>PN</td>
<td>DK</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Nontreated</td>
<td></td>
<td>6490</td>
<td>5975</td>
<td>5002</td>
<td>4934</td>
<td>5302</td>
<td>5555</td>
<td>3027</td>
<td>3794</td>
<td>5611</td>
<td>6379</td>
<td>4223</td>
<td>5589</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1383</td>
</tr>
<tr>
<td>Sharpen</td>
<td>1.6</td>
<td>6355</td>
<td>6198</td>
<td>4569</td>
<td>4863</td>
<td>4715</td>
<td>6473</td>
<td>2058</td>
<td>4709</td>
<td>4732</td>
<td>7147</td>
<td>3602</td>
<td>5402</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1407</td>
</tr>
<tr>
<td>Sharpen</td>
<td>3.6</td>
<td>6047</td>
<td>5916</td>
<td>4188</td>
<td>5579</td>
<td>3307</td>
<td>6966</td>
<td>2341</td>
<td>3014</td>
<td>1407</td>
<td>4036</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1383</td>
</tr>
<tr>
<td>Verdict</td>
<td>9.2</td>
<td>6778</td>
<td>6050</td>
<td>6003</td>
<td>5864</td>
<td>4704</td>
<td>6991</td>
<td>2893</td>
<td>3323</td>
<td>6392</td>
<td>7074</td>
<td>4554</td>
<td>5030</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1407</td>
</tr>
<tr>
<td>Verdict</td>
<td>18.4</td>
<td>6954</td>
<td>6505</td>
<td>5025</td>
<td>5772</td>
<td>2727</td>
<td>5262</td>
<td>3067</td>
<td>2826</td>
<td>4989</td>
<td>5867</td>
<td>4906</td>
<td>5154</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1407</td>
</tr>
<tr>
<td>Outlook</td>
<td>14.8</td>
<td>7307</td>
<td>6573</td>
<td>5942</td>
<td>5574</td>
<td>5783</td>
<td>6145</td>
<td>3902</td>
<td>3270</td>
<td>7172</td>
<td>6538</td>
<td>2981</td>
<td>5134</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1407</td>
</tr>
<tr>
<td>Outlook</td>
<td>30.0</td>
<td>6935</td>
<td>6266</td>
<td>5692</td>
<td>5058</td>
<td>5411</td>
<td>4985</td>
<td>3013</td>
<td>3525</td>
<td>6257</td>
<td>5379</td>
<td>2794</td>
<td>4968</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>1407</td>
</tr>
</tbody>
</table>

Abbreviations: DK, Dekalb 44-20; LSD, least significant difference; NS, not significant; PN, Pioneer 85G01. Yields with boxes are significantly different than the untreated control.
- Sharpen at 0.8 oz/A controlled kochia and Russian thistle greater than 99%
- Sharpen and Verdict provided greater than 95% Palmer amaranth
- Sharpen provided rapid burndown and control for 2 weeks after treatment on perennial weeds – limited control at 4 weeks
- Above label rates of Sharpen and Verdict increased sorghum injury at all 3 locations
- Above label rates of Sharpen injured sorghum more than Verdict at comparable rates
- Pioneer 85G01 was less tolerant than Dekalb 44-20
- At all locations Sharpen and Verdict at 1X rates did not affect yield in any trials

Conclusions
- Sharpen will be a valuable tool in sorghum weed control
- Has potential to control many problematic weeds in grain sorghum
- Good crop safety when using labeled rates