Weed Management Systems in Imidazolinone Tolerant Sorghum (*Sorghum bicolor*) in South Texas

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Abstract

With limited herbicide options and the lack of herbicide tolerant traits in sorghum (*Sorghum bicolor* [L.] Moench), weed management remains a challenge in many production regions. The recent development of imidazolinone-tolerant hybrids has created an opportunity for exploring the uses of herbicides previously unavailable for use in sorghum production. Three trials were conducted across three locations in South Texas; Beeville, Corpus Christi, and Kingsville in 2019. Imazamox at either 53 or 79 g ai ha^{-1} applied POST to annual grass weeds 5 to 8 cm in height resulted in the lowest amounts of late-season weed biomass among treatments. The same rates of imazamox applied POST to grass weeds 13 to 15 cm in height were not as effective. Sorghum biomass was inversely related to grass weed biomass. Atrazine PRE followed by atrazine + prosulfuron POST had little effect suppressing Urochloa texana (*Texas Panicum* (PANTE)) but with the addition of imazamox POST, weed density was significantly reduced at both 14 and 28 days after treatment. Late season PANTE control with imazamox PRE was similar to that achieved with imazamox POST. Annual grass control was greatest with atrazine + dimethenamid PRE followed by atrazine + imazamox POST.

Figure 1. Sorghum test plots at the Kingsville location two days after emergence. Note the emerging sorghum and surrounding native weed populations.

Introduction

One of the most important grain crops in the United States is grain sorghum (*Sorghum bicolor* [L.] Moench). Wiedenfeld and Matocha (2010) stated that grain sorghum has the potential to produce high amounts of biomass with its residues which improve soil properties when reincorporated into the soil. Common weed control practices used today in sorghum production include one or two shallow cultivations before planting (Carter et al. 1989). Chemical weed control is in some cases the most reliable and cost effective method of controlling weeds. Chemical control has greatly simplified weed management in various cropping systems, thus reducing the need for tillage, cover cropping, and other methods used to mitigate weed problems (Heap 1997). Unfortunately, today there are limited herbicide options available for grass control in sorghum. Atrazine can be applied preplant, preemergence, or postemergence to control many broadleaf and select grass weeds (Carter et al. 1989). The discovery and development of imidazolinone-tolerant sorghum hybrids has allowed for investigation into the use of this family of herbicides for weed control in sorghum. Imazamox is a broad spectrum herbicide currently registered for use in many legume and Clearfield® crops in the United States. With the potential option for using imazamox in imidazolinone-tolerant sorghum, research is needed to identify the best strategies for integrating this herbicide into weed management systems in sorghum.

Objectives

Objectives of this experiment were to investigate: 1) the efficacy of imazamox applied preemergence (PRE) and postemergence (POST) for controlling key weed species, and 2) the impacts of weed competition on sorghum biomass

Methods

- **Locations**: Texas A&M University AgriLife Research Stations in Beeville and Corpus Christi, TX and the TAMU – Kingsville University Farm in Kingsville, TX.
- **Planting**: An imidazolinone-tolerant grain sorghum 'ADVXG009IMI' was provided by Alta Seeds and planted flat on 97-cm row spacing at a rate of 148k seeds ha^{-1}. Plots were 4-rows wide by 9.1-m in length.
- **Plot Design**: Randomized complete block design with 4 replications.
- **Application of Hercides**: Herbicide were applied using a CO_2-pressurized backpack sprayer and handheld boom equipped with TeeJet TTI low drift nozzles with a total output of 140 L ha^{-1} at 262 kPa.

Table 1. Herbicides, rates, and size of grass weeds at application.

Herbicide Treatments	g ai ha^{-1}	Timing
Imazamox	53	5-8 cm
Imazamox	79	5-8 cm
Imazamox	53	13-15 cm
Imazamox	79	13-15 cm
Atrazine	454	PRE
Atrazine + prosulfuron	1120 + 20	5-8cm
Nontreated Check		

- **Data**: Weed densities were collected at 0, 7, 14, 21, 28 days after treatment (DAT) using a randomly placed 929-cm^2 quadrat. Sorghum and weed biomass data was collected from the Beeville location only. Samples were collected for 1-m^2 of grass weeds and sorghum using a sickle-bar mower with a blade height of 3-cm. Samples were dried and biomass was calculated for both grass and sorghum.
- Data were subjected to analysis of variance in SAS, and means were separated via Fisher's LSD.

Results

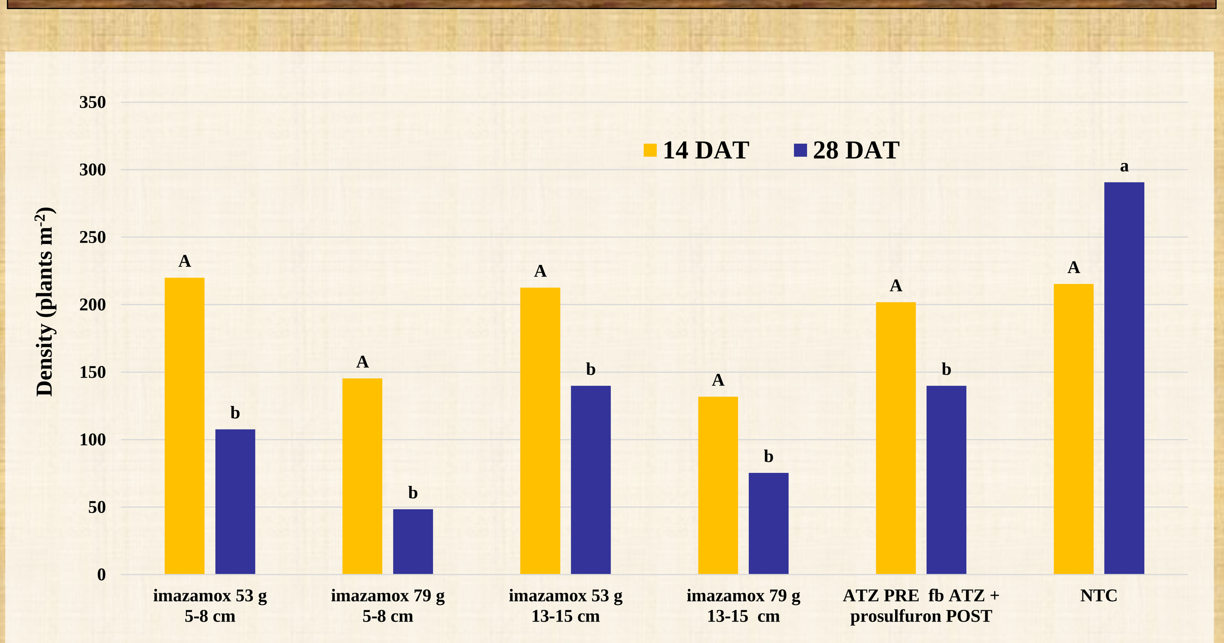

Figure 3. Post-treatment Texas panicum (PANTE) density at 14 and 28 days after treatment (DAT) at Kingsville, TX in 2019.

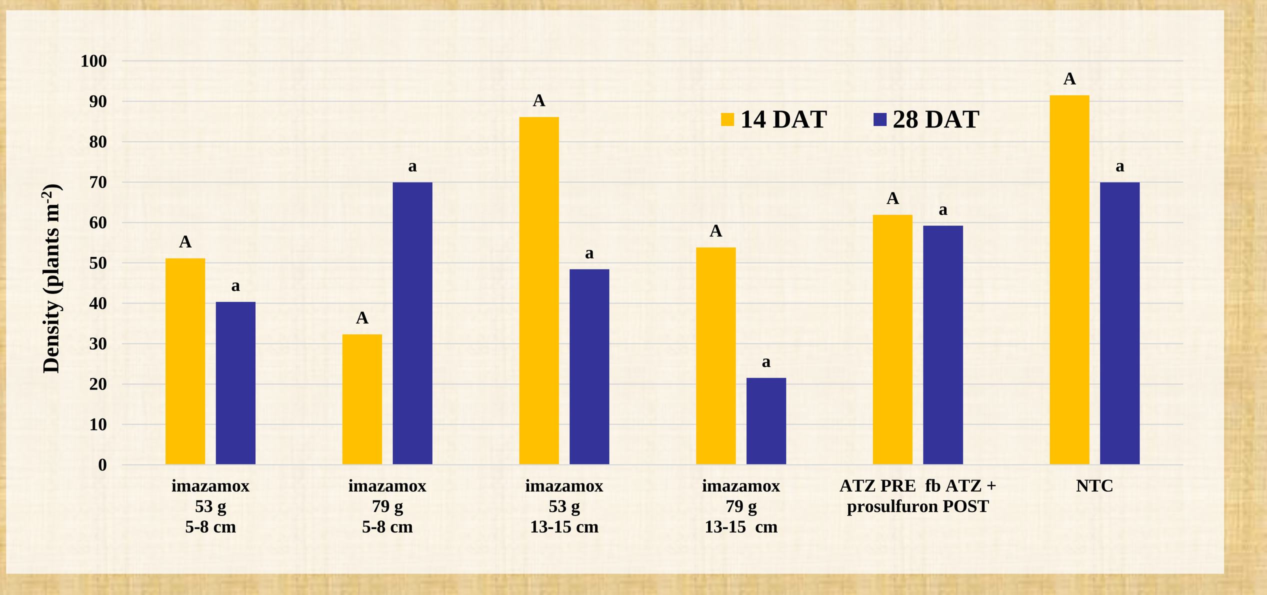

Figure 4: Post-treatment Texas panicum (PANTE) density at 14 and 28 days after treatment (DAT) at Corpus Christi, TX in 2019.

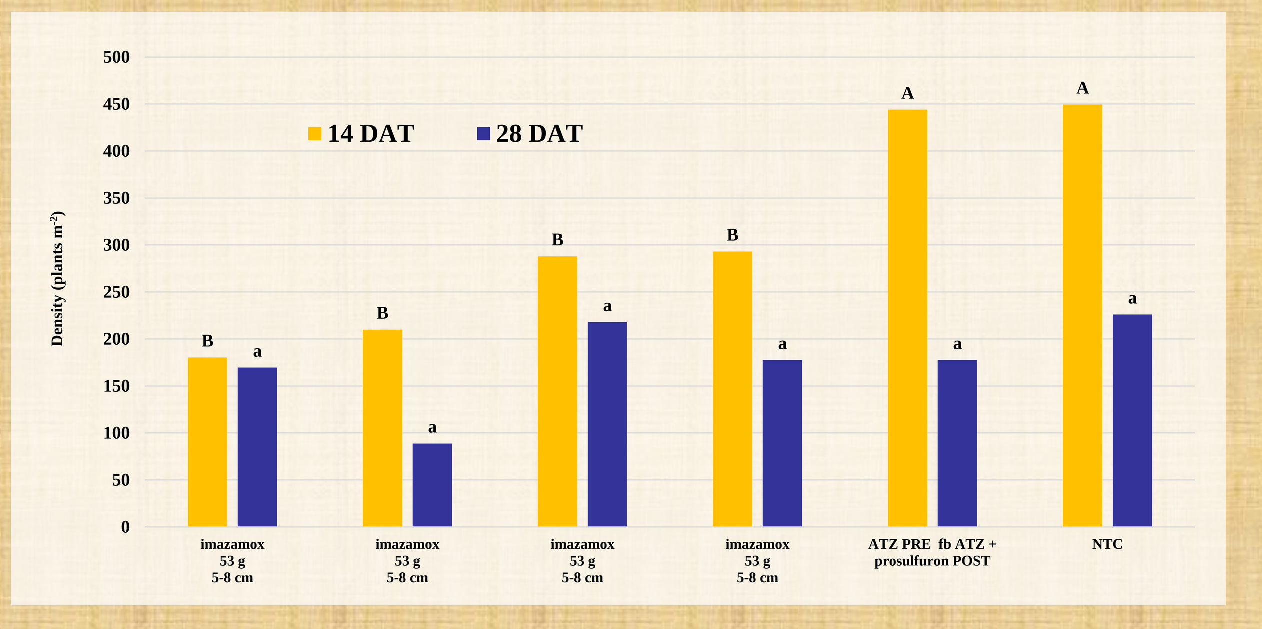

Figure 5: Post-treatment browntop panicum (PANRA) density at 14 and 28 days after treatment (DAT) at Beeville, TX in 2019.

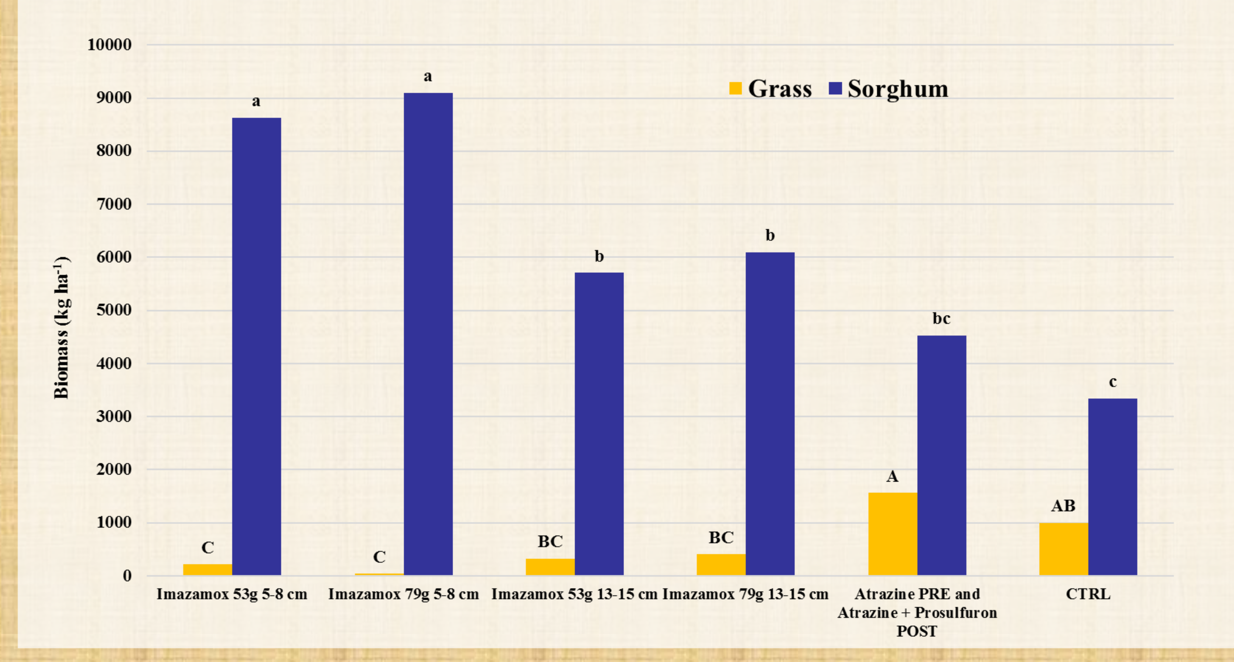

Figure 6: Sorghum and grass weed biomass at Beeville, TX in 2019.

Summary

As shown in Figure 3, there were no differences in PANTE density among treatments at Kingsville at 14 DAT. At 28 DAT, PANTE density was lower than the nontreated check following all herbicide treatments. There were no differences in PANTE density among treatments at Corpus Christi at 14 and 28 DAT (Figure 4). This may be due to variability in PANTE pressure across the study site. At Beeville, browntop panicum (PANRA) was the predominant grass weed species. Regardless of rate or timing, imazamox significantly reduced PANRA density 14 DAT compared to atrazine PRE followed by atrazine + prosulfuron POST and the NTC (Figure 5). At 28 DAT, there were no difference among treatments. Early applications of imazamox resulted in the lowest late-season grass weed biomass and allowed for greater sorghum biomass production at Beeville (Figure 6).

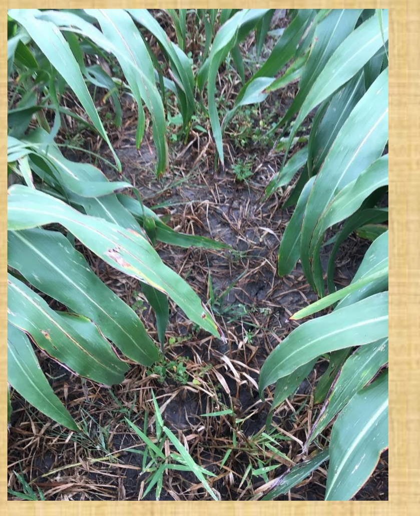

Figure 7: Kingsville plot 102 with imazamox POST at 79 g a.i. per hectare 5-8 cm weed height 14 DAT

Figure 8: Corpus Christi plot 102 with imazamox POST at 79 g a.i. per hectare 5-8 cm weed height 14 DAT.

Figure 9: Beeville plot 102 with imazamox POST at 79 g a.i. per hectare 5-8 cm weed height 14 DAT.

Literature Citations

- Wiedenfeld, B. and J. Matocha (2010) Planting date, row configuration and plant population effects on growth and yield of dryland sorghum in subtropical South Texas. Archives of Agronomy and Soil Science, 56:1, 39-47.
- Carter, P.R., D.R. Hicks, and E.S. Oplinger. (1989) Grain sorghum (milo). Alternative Field Crops Manual. University of Wisconsin-Extension, Cooperative Extension: 252-259.
- Heap, I.M. (1997), The occurrence of herbicide-resistant weeds worldwide. Pest Management Science, Vol 51: 235-243.

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