Influence of Adjuvant on Nicosulfuron Efficiency on Yield and Weeds Control of Corn

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ABSTRACT

In order to study the effect of some adjuvants on Nicosulfuron efficiency on corn grain yield, and common lambsquarters (Chenopodium album) and redroot pigweed (Amaranthus retroflexus) density and biomass, a field experiment was conducted in research field of Miyaneh Islamic Azad university based on randomized complete design with three replications. Treatments included T1: atrazine, T2: nicosulfuron + volck oil, T3: nicosulfuron + ammonium nitrate, T4: nicosulfuron + ammonium sulfate, T5: nicosulfuron + citogate, T6: nicosulfuron and T7: control. Results showed that the effect of herbicide and adjuvant application was significant on corn grain yield. Among different adjuvants, ammonium sulfate was more effective on studied traits than other adjuvants. Nicosulfuron plus ammonium sulfate increased grain yield 20.7% compared to control. Furthermore, the treatments had significant effect on redroot pigweed density and dry weight. Results showed that nicosulfuron + ammonium sulfate had the least redroot pigweed density and dry weight.

INTRODUCTION

Maize is a major crop in Iran and ranks third, behind wheat and rice in hectares grown [1]. Grain yield in maize can be severely reduced by competition with weeds [9]. So that potential yield losses due to weeds in corn have been estimated at 16-80%, actual reported losses at 15-30% [10].

Adjuvants are widely employed in agriculture and chemical weed control in combination with herbicides active ingredients. Adjuvants have proven many positive effects when added to herbicides formulation or added to the tank in post-emergence herbicides. They help to overcome the physical and biological barriers [7], but do not directly affect herbicide efficacy. Nevertheless, utility adjuvants can indirectly improve herbicide efficacy by improving the spray application process [11]. Besides improving herbicide efficacy, adjuvants may also reduce variability in herbicide performance by overcoming the impediments compelled in contrary conditions; this aspect of adjuvant technology deserves much more attention considering the pressure to diminish herbicide inputs [6].

Utilizing adjuvants (e.g. vegetable oils and surfactants) can enhance the foliar activity of post emergence herbicides by decreasing the surface tension [6]. The decrease in surface tension of the spray droplets prevents the spray droplets bouncing off after leaf interception and allows for a reduced contact angle of the droplets on the leaf surface, enhancing the spread and contact area of the droplets on the leaf surface, which allows more absorption of the herbicide [11]. Consequently, the rates of active ingredient used in weed control can sometimes be reduced by combining adjuvants that is highly effective with specific herbicides [7].

The sulfonylurea herbicide nicosulfuron has been demonstrated to give post-emergence control of several difficult to control grass weeds in maize (Zea mays) and soya bean (Glycine max) crops [5,8]. It can be used post emergence to either supplement or replace certain pre-emergence treatments in maize or as an alternative to high application rates of pre-emergence herbicides on high organic matter soils. Of the main annual grass weeds present in New Zealand maize crops [13], nicosulfuron provided good control of smooth witchgrass (Panicum dichotomiflorum) and barnyard grass (Echinochloa crus-galli) and suppression of most other annual and perennial grasses as well as many broadleaf weeds [12,4]. Further field trials showed that addition of an adjuvant helped considerably improve the effectiveness of nicosulfuron on these weeds [3]. Therefore, the aim of this research was effect of some adjuvants on grain yield and some weeds characteristics of corn.

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MATERIALS AND METHODS

This experiment was done in research field of Miyaneh Islamic Azad University at 2010. The experiment based on randomized complete block design with three replications. The corn cultivar was 704 single cross.


Experimental field was prepared by moldboard plowing (30 cm depth) in earlier autumn followed by adding manure to the soil. Maize was planted by hand (3 or 4 seed per hole).

The studied traits included: grain yield, common lambsquarters density and dry weight, redroot pigweed density and dry weight. For grain yield determination, plants were harvested from each plot, dried for 72 hours in free air. Then plant components were divided for different traits. Dry weight of dominant weeds was determined for each plot.

Data normality was assessed by SPSS software. Data analysis was conducted by MSTAT-C software. Mean comparison was done by Duncan test at P<0.05.

RESULTS AND DISCUSSION

Grain yield:

The effect of treatments was significant on grain yield (P<0.05) (table 1). All nicosulfuron related treatments resulted in highest grain yield. Generally the highest grain yield belonged to nicosulfuron plus ammonium sulfate (5874.11 kg/ha) and the lowest yield obtained after atrazine application. Nicosulfuron application in mixture of ammonium sulfate increased grain yield 26.11% compared to the control (fig. 1).

Redroot pigweed density:

Effect of different treatments was significant on redroot pigweed density (P<0.01) (table 1). Results showed that nicosulfuron plus ammonium sulfate had the highest effect on redroot pigweed density reduction (5 plant per plot) compared to the control (13 plant per plot), and the lowest effect (12.33 plant per plot) belonged to atrazine application.

As shown in Fig 2, atrazine application alone had no significant effect on redroot pigweed density, but nicosulfuron application alone and in mixture of different adjuvants (Volck oil, ammonium sulfate, ammonium nitrate, and situgate) decreased weed density 17.92, 41.02, 41.02, 61.45, and 33.33 % compared to the control, respectively. Adding fertilizer specially micronutrients to sulfonylurea herbicides, reduced redroot pigweed density 10 to 21.5 % compared to the control in wheat [2]. Adding ammonium sulfate to glyphosate in addition to reducing herbicide dose, reduced significantly most of weed species density including redroot pigweed and common lambsquarters.

Redroot pigweed dry weight:

Results showed that Effect of different treatments was significant on redroot pigweed dry weight (P<0.01) (table 1). Lowest weed dry weight obtained after adding Volck oil (8.533 g) or ammonium sulfate (7.400 g) to nicosulfuron, and highest one belonged to control (14.10 g) and atrazine application (13.10 g) treatments (Fig. 3). Atrazine application alone had no significant effect on redroot pigweed dry weight, but nicosulfuron application alone and in mixture of ammonium sulfate (Volck oil, ammonium sulfate, ammonium nitrate, and situgate) decreased dry weight 24.61, 39.48, 24.33, 47.52, and 18.94% compared to the control, respectively (Fig. 3)

Common lambsquarters density:

Results showed that the effect of different treatments was no significant on common lambsquarters density (table 1).

Common lambsquarters dry weight:

Results showed that the effect of different treatments was significant on common lambsquarters dry weight (P<0.01) (table 1). Nicosulfuron plus ammonium sulfate had the highest effect on common lambsquarters dry weight reduction (Fig. 4). Atrazine application alone had no significant effect on common lambsquarters dry weight, but nicosulfuron application alone and in mixture of ammonium sulfate decreased dry weight 40.84 and 45.87 % compared to the control, respectively (Fig. 4).
Table 2: The variance analysis of studied traits

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>d.f</th>
<th>Grain yield</th>
<th>Amaranth density</th>
<th>Amaranth dry weight</th>
<th>Lambsquarters density</th>
<th>Lambsquarters dry weight</th>
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<td>Replication</td>
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<td>2.375</td>
<td>0.168</td>
<td>1.715</td>
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<td>Treatment</td>
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<td>63465.84*</td>
<td>24.492 **</td>
<td>16.657 **</td>
<td>0.851 ***</td>
<td>11.352 *</td>
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<td>Error</td>
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<td>0.730</td>
<td>0.515</td>
<td>0.513</td>
<td>3.658</td>
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<tr>
<td>CV (%)</td>
<td></td>
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</table>

*, **: Indicating significant different at P<0.05 and P<0.01, respectively; ns non significant

Fig. 1: Effect of experimental treatments on corn grain yield.

Fig. 2: Effect of different treatments on redroot pigweed density

Fig. 3: Effect of different treatments on redroot pigweed dry weight
Fig. 4: Effect of different treatments on common lambsquarters dry weight

Conclusion:

The obtained results indicated atrazine application had no significant effect on studied traits compared to control. Nicosulfuron application alone increased significantly grain yield, and also reduced significantly redroot pigweed density and dry weight, and common lambsquarters dry weight. Adding ammonium sulfate to nicosulfuron increased herbicide efficacy, improving seed weight per cob and grain yield in corn.

Adding ammonium sulfate to nicosulfuron increased corn grain yield 15.95 and 26.11 % compared to the control and nicosulfuron alone, respectively. This reveals the high importance of this adjuvant.

REFERENCES