Efficacy of Different Formulation of Glyphosate Herbicide on Sorghum Weeds

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ABSTRACT

Background: Sorghum is susceptible to weed at its early growth stage. The aim of this efficacy trial was to ensure that efficacy of chemical Glyphosate-isopropylammonium 41% SL on sorghum weeds control non-selectively before sorghum sowing.

Methods: Thrice experiment was carried out in Humera area in Humera Agricultural Research Center, Semur farm and Desta Berhe farm during rainy growing season of 2019 using sorghum variety i.e. Brhan. Pre and post spray weed count were subjected to efficacy calculation.

Result: New product of herbicide, Glyphosate-isopropylammonium 41% SL (Gipho) at 3.00 lt a.i./ha was shown better performance than the standard check Glymax 48% SL (W/V). Therefore, the new Gipho product could be suggested as an alternative non-selective herbicide before sorghum sowing.

Key words: Efficacy, Herbicide, Sorghum, Spray, Weed.

INTRODUCTION

Sorghum [Sorghum bicolor (L.) Moench] is an important cereal crop belonging to family Poaceae. It is naturally self-pollinated monocotyledon crop with the degree of spontaneous cross-pollination, in some cases, reaching up to 30% depending on panicle type (Poehlman and Sleper, 1995). The annual domesticated sorghums are diploid (2n=2x=20) and tropical origin C4 crop (Dicko et al., 2006). Sorghum is fifth most important cereal crop globally after rice, wheat, barley and maize (FAO, 2012). It has been domesticated since approximately 3000 years B.C. in the Ethiopia region (Ayana and Bekele, 1998). Ethiopia has a wide range of geographical adaptation and the country is a center of diversity for the crop (Tesso et al., 2007). It is produced for its grain, which is used for food, feed and stalks for fodder and building materials in developing countries, while it is used primarily as animal feed and in sugar, syrup and molasses industry (Dahlberg et al., 2011). It is a major food and nutritional security crop to more than 100 million people in Eastern horn of Africa (Gudu et al. 2013) including Ethiopia, providing a principal source of energy (70% starch), proteins, vitamins and minerals (Duodu et al., 2003).

Ethiopia is the third largest producer of sorghum in Africa behind Nigeria and Sudan, which contributed about 12% of annual production (Wani et al., 2011) and the second after Sudan in the Common Market for Eastern and Southern Africa (COMESA) member countries (USAID, 2010). It is the third most important crop both in sown area (ha) and becoming third primary staple food crop in Ethiopia after teff and maize (CSA, 2015) and second most important crop for injera (common leavened flat bread) making next to teff (Adugna, 2012). Currently, sorghum is produced by 5 million small holders and its production is estimated to be 4.6 million metric tons from nearly 2 million hectares of land giving the national average grain yield of around 2.3 tons per hectare
Materials and Methods

Herbicide used

Glyphosate-isopropylammonium 41% SL (Glypho) applied before Sorghum sowing as foliar spray treatment 3 l/ha active ingredient using 300 liters of water per hectare and formulation of the chemical Soluble liquid (SL). The agro-chemical manufactured by: Yixing Yizhou Chemical Products Co.

Experimental design

The experiment was carried out in Humera area on three different farms (Semur Farm, Desta Farm and Humera Agricultural Research Center) during 2019 growing season, each experiment replicated thrice. A Sorghum variety, Bhran, was sown in rows on plots with spacing of 75 cm and 20 cm between rows and plants, respectively. The experiment was contained of in a single block plot size of 75 m² in each plot were demonstrated. Foliar spray was applied using manually operated knapsack sprayer with one hollow-cone nozzle for three treatments i.e. new product- Glyphosate-isopropylammonium 41% SL at 3.00 l/ha active ingredient, as standard check herbicide - Glymax 48% SL (W/V) at 3.50 l/ha active ingredient and untreated check. The application time was before the main crop was planted. The per treatment data were counted by randomly throwing the quadrant on dated 29/10/2011 E.C means one days before the treatment [Glypho and Glymax 48% SL (W/V)] herbicides spray. The post treatment data on weeds were collected 15 days after the treatment’s application by throwing quadrant randomly to the plots. Finally, pre and post spray weed count data were subjected to efficacy calculation using formula of (Fleming and Retnakaran 1985) as below:

% Efficacy = \[1 - \frac{(Ta \times Cb)}{(Tb \times Ca)}\] *100

Where,

- Ta=Post-treatment population in treatment, Cb= Pre-treatment population in check, Tb= Pre-treatment population in treatment, Ca= Post-treatment population in check. Data subject to excel analysis.
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**RESULTS AND DISCUSSION**

The treatments received only one spray before sorghum crop sowing. Efficacy of the candidate herbicide Glpho (Glyphosate-isopropylammonium 41% SL) was showed an excellent performance in controlling weeds before sowing a Sorghum crop as a non-selective weed control. The candidate Glpho efficacy showed a higher percentage than the check Glymax 48% SL (W/V) efficacy were recorded 93.50% and 82.0% respectively (Table 1 and Fig 1).

In general, Glyphosate-isopropylammonium 41% SL showed excellent performance in controlling weed as Table 1. The differences in absorption and translocation of the herbicide are responsible for the fluctuation in glyphosate efficacy and the variations in glyphosate tolerance among weed species (D’Anieri et al., 1990). Concerning formulation of glyphosate products, the responses of various weed species vary among the different formulations (Ilias et al., 2017). The increased efficacy of Glyphosate-isopropylammonium 41% SL versus Glyphosate 48% EC on Sorghum weeds may be due to the greater rate of absorption and subsequent translocation of Glyphosate-isopropylammonium 41% SL.

**CONCLUSION**

The new product of herbicide, Glpho, shown better performance than the standard check Glymax 48% SL (W/V). Therefore, the new Glpho herbicide product could be suggested as an alternative non-selective herbicide to destroy the weeds in sorghum before sowing. However, further research needs to be done to determine the actual mechanism of Glpho for increasing efficacy.

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| Treatment No | Products trade name | Common Pre-spray name | Post spray mean | % efficacy | Yield (Q/ha) |
|--------------|----------------------|-----------------------|----------------|------------|-------------|
| 1            | Glpho                | Glyphosate-isopropylammonium 41% SL | 138 | 9 | 93.64 | 18.6 |
| 2            | Glymax 48% SL (W/V)  | Glyphosate 48% EC      | 122 | 22 | 82.00 | 17.0 |
| 3            | Untreated Check      | -                     | 118 | 121 | -         | -         |

**Table 1:** Mean Efficacy of Glyphosate 41 % SL on weed before Sorghum sowing 2019.

**Fig 1:** The candidate Glyphosate non-selective herbicide Glpho Efficacy verification % on weed control in Sorghum crop across the standard check and untreated Bar chart.
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