



Efficacy Trial of AgroSuper (2, 4-D Dimethyl Amine Salt 720G/L SL) on Sorghum Broad Leaf Weed

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Author's contribution

The sole author designed, analyzed, interpreted, and prepared the manuscript.

Article Information

DOI: 10.9734/AJRCS/2020/v5i230093

Editor(s):

(1) Dr. Moaed Al Meselmani, The University of Sheffield, England.

Reviewers:

(1) Umar Zeb, The University of Agriculture, Pakistan.

(2) Dodo Juliet Dingsen, University of Jos, Nigeria.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/57127>

Original Research Article

Received 20 March 2020

Accepted 27 May 2020

Published 15 June 2020

ABSTRACT

Sorghum is susceptible to weed competition at its early stage of growth. The aim of this efficacy trial was to ensure that candidate chemical AgroSuper verification on a selective and effective control of broad leaf weed on Sorghum, after sorghum germination. RCBP with three replication experiment was carried out in Humera area in Humera Agricultural Research Center and Desta Berhe farm during 2019 rainy growing season using sorghum variety called Brhan. Pre and post spray weed count were subjected to efficacy calculation. Finally, new product of herbicide, AgroSuper (2, 4-D dimethyl amine salt 720G/L SL) 1.5 liter using 200-liter water solution per hectare was shown better performance than the standard check Aura 72SL. Therefore, the new AgroSuper could be suggested as an alternative selective herbicide during post-emergency to kill broad leaf weeds of sorghum.

Keywords: Sorghum; efficacy; herbicide; spray; weed.

1. INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is an important cereal crop belonging to family

Poaceae. It is naturally self-pollinated monocotyledon crop plant with the degree of spontaneous cross pollination, in some cases, reaching up to 30% depending on panicle type

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[1]. The annual domesticated sorghums are diploid ($2n = 2x = 20$) and tropical origin C4 crop [2]. Sorghum is fifth most important cereal crop globally after rice, wheat, barley, and maize [3]. It has been domesticated since approximately 3000 years B.C. in the Ethiopia region [4]. Ethiopia has a wide range of geographical adaptation and the country is a center of diversity for the crop [5]. 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 [6]. It is a major food and nutritional security crop to more than 100 million people in Eastern horn of Africa [7] including Ethiopia, providing a principal source of energy (70% starch), proteins, vitamins and minerals [8].

Ethiopia is the third largest producer of sorghum in Africa behind Nigeria and Sudan with a contribution of about 12% of annual production [9] and the second after Sudan in the Common Market for Eastern and Southern Africa (COMESA) member countries [10]. 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 [11] and second most important crop for *injera* (common leavened flat bread) making next to teff [12]. 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 [11]. It covers 16% of the total area allocated to grains (cereals, pulses, and oil crops) and 14.58% of the area covered by cereals [11]. The crop is cultivated in all regions of Ethiopia between 400 m and 2500 m altitude, mostly at lower altitudes along the country's Western, South-Western, North Eastern, Northern, and Eastern peripheries [13] and staple food crop on which the lives of millions of poor Ethiopians depend [14]. 44% and 30% yield loss in maize and sorghum, respectively [15]. An estimated yield loss about 10% in the less developed countries and 25% in the developing countries is caused by weeds [16]. Meanwhile, weeds are also the hosts of various crop pests and pathogens [17].

Sorghum is susceptible to weed competition at its early stage of growth because the seedlings start weak and frail. Sorghum has also lower water requirement than most weeds. This means that weeds with higher water requirements tend to take up more water per unit of dry mater

produced. Weeds interfere with the growth of crop. Weeds cause yield loss during certain crop growth stages and controlling weed during such a period is essential. From a multiple type of weed management, chemical control investigation was carried out against a major weed of sorghum known as *Sonchus arvensis* in Derashe area [18]. Primagram (5 lit/ha^{-1}) and 2, 4-D (2 kg lit/ha^{-1}) were most effective herbicides. Because of superior efficacy and improved crop productivity, 2, 4-D is recommended for use against the weed.

The objectives of this study were to (i) ensure efficacy trial of candidate chemical AgroSuper (2, 4-D dimethyl amine salt 720G/L SL) on a selective and effective control of broad leaf weed on Sorghum, after sorghum germination (ii) To verify the product efficacy of selective herbicide AgroSuper (2, 4-D dimethyl amine salt 720G/L SL) in comparison with a standard check Aura 72 SL (2, 4-D dimethyl amine salt 720G/L SL).

2. MATERIALS AND METHODS

2.1 Experimental Design

Randomized complete block design with three replication experiment was carried out in Humera area in Humera Agricultural Research Center, and Desta Berhe farm during 2019 rainy growing season in North West Ethiopia. A sorghum variety, Brhan, was sown in rows on plots with spacing of 75 cm and 20 cm between rows and plants, respectively. Plot size was 75 m^2 . Foliar spray was applied 30 days after sorghum germination at 25 cm height of Sorghum using manually operated knapsack sprayer with one nozzle. The trial was done in one time application in three treatments namely AgroSuper(2,4-D dimethyl amine salt 720G/L SL) as candidate herbicide treatment applied in 1.5 lit/ha rate, Aura 72 SL(2,4- D Amine Salt720G/L SL) as a standard check applied in 1.5 lit/ha rate and untreated check. Weeds were counted by randomly throwing the quadrant as pre-treatment weed count. After 15 days of herbicide application, weed counted as a post-treatment by throwing quadrant randomly to the plots. Finally, pre and post spray weed count were subjected to efficacy calculation using formula of Fleming and [19] as follows:

$$\% \text{ Efficacy} = (1 - (Ta * Cb) / (Tb * Ca)) * 100$$

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,

symptoms were seen on the crop plants treated with this chemical.

From the efficacy analysis AgroSuper showed excellent performance in controlling weed as Table 1.

2.2 Herbicide Used

AgroSuper applied post emergency of sorghum as foliar spray treatment at 1.5 lt/ha rate and formulation of the chemical is soluble concentrate/liquid (SL). It is applied when weeds are small and actively growing prior to bud stage. The agro-chemical Manufactured: Shandong Qiaochang Modern Agriculture Co., Ltd (Add: South of Yongxin Road, Southeast of Qinhuangtai Bincheng District, Binzhou City, Shandong Province, China) and Supplied by: Shanghai Sinogreat land Industrial Co., Ltd, (Adress: m 1102, Block A, Building 2, Senlan, Meilun Plaza, No 555 Lansong Road, Pudong, New Area, Shanghai, P.R.C). The herbicide locally distributor and register company: Desta Berhe Welu (Adress: Office No-403 4th floor, Melkay Building, Megenagna, Signal RD, Addis Ababa, Ethiopia).

2, 4-D is post emergence herbicides applied after weed seedlings have emerged. It is selective herbicide that kills certain plants without affecting the growth of other plants species. Selectivity may be due to translocation, differential absorption, physical (morphological) or physiological differences between plant species. It control many broadleaf weeds but remain ineffective against turf grasses [20].

It is systemic (translocated through the plant), and foliar absorbed which is applied to portion of the plant above the ground then absorbed by exposed tissues. Avoiding spray during rain to minimize the problem of being washed off to the soil makes it ineffective. External barriers of plants like cuticle, waxes, cell wall and so on affect herbicide absorption and action [20].

3. RESULTS AND DISCUSSION

The treatments applied; one-time application at two trail site of Humera Agricultural Research Center and Desta Berhe farm. Analysis of treatment data was showed that, the weed population before and after spray. Efficacy of the candidate herbicide AgroSuper (2, 4-D dimethyl amine salt 720G/L SL) was showed an excellent performance in controlling selective broad leaf weeds of Sorghum. The efficacy of Agro Super higher percentage than Aura 2 SL was recorded 96.83% and 90.41% respectively (Table 1).

This efficacy study indicates it is one way for improving crop yield by using 2, 4-D compound for commercial purpose [21] AgroSuper shown better performance than the standard check Aura 72SL. This indicates there will be better yield using AgroSuper than Aura 72 SL. Worldwide farmers practice little to prevent herbicide resistance development, and only take action when it is a problem seen on their own farm or neighbor's. Careful observation is important so that any reduction in herbicide efficacy can be detected. Herbicide resistance can be caused due to agronomic factors influence such repeated use of similar herbicides, often associated with crop monoculture, and reduced cultivation practices. It is suggested to modify these practices in order to prevent or delay the onset of resistance or to control existing resistant populations.

Observation after spray (post-spray) of the candidate herbicide confirm no phytotoxicity

Table 1. Mean efficacy of AgroSuper on weed before sorghum sowing 2019

TRT No.	Trade name	Common name	Pre spray Mean	Post Spray mean	% Efficacy	Yield (Q/ha)
1	AgroSuper	2, 4-D Dimethyl amine salt 720 G/L SL	372	12	96.83	24.3
2	Aura 72 SL	2,4-D Amine Salt 720 g/l	335	15	90.41	22.
3	Untreated	-----	488	497	-----	-----

N.B: TRT (Treatment)

An integrated weed management (IWM) approach is required in order to make less reliance only on herbicides and so selection pressure should be reduced in order to manage resistance of herbicide efficacy [22].

4. CONCLUSION

The new product of herbicide, AgroSuper, shown better performance than the standard check Aura 72SL. Therefore, the new AgroSuper product could be suggested as an alternative selective herbicide during post-emergency to kill broad leaf weeds of sorghum.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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- DOI:10.1021/ba-1950-0001.ch045.
ISBN 978-0-8412-2442-1.

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Peer-review history:
The peer review history for this paper can be accessed here:
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