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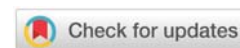
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## Research Article

# Report on Verification of Mogfeen 240EC efficacy on Garlic (*Allium sativum* L) weeds at Bale zone, South Eastern Ethiopia

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## Abstract

Garlic Herbicide verification trial was conducted at Goba and Sinana districts of Bale highlands south eastern Ethiopia. CBD was used for this experiment. Mogfeen 240EC herbicide was verified by SARC at on station and Goba in 2018 Gena season. The effects of herbicide on the growth, yield components and Yield of Garlic had determined. On the other hand, parameters such as relative weed density (RWD), Weed Index (WI) and Weed Control Index (WCI) were collected to determine the efficacy of Mogfeen 240EC on broadleaf weeds, Sedges and Grass weeds. Accordingly, 99% of Broad leaf weeds and 1% grass weeds were observed before herbicide application. Mogfeen 240EC reduces broad leaves weed by about 82.73% and grass weeds by about 63.022% within first round application. On the other hand, the efficiency of this herbicide in controlling broad leaves weeds within the first round application round was about 73.17% whereas its efficiency in controlling grass weeds was 93.22%. Within the second round application 15 days later of first round application all weeds were controlled completely. On the other hand, plots treated with the herbicide showed about 68.42%, 7.02% yield advantage over weed free and hand weeded plots respectively. Therefore, Mogfeen 240EC herbicide was verified and recommended for the production of Garlic at Bale and similar agro ecologies.

## Introduction

Garlic (*Allium sativum* L) is one of the important bulb crop grown in the world as well as in Ethiopia for a long period of time. Botanically it is known as *Allium sativum* and is a member of Alliacea family. It is native to central Asia. Garlic contains active ingredients known as Allicin which gives its pungent flavor along with ample of health benefits [1].

Garlic production spread throughout the country and has been cultivated under irrigated as well as rain fed conditions, mainly in the mid and highlands of Ethiopia [2]. According to Ethiopia central statistical agency report of 2016/2017; 15,381 ha of land was covered by Garlic and 1,386,643.07 Quintals of Garlic were produced annually. On the other hand, this report also indicated that about 90.15 Quintals of Garlic can be harvested from one hectare of land (CSA, 2016/17).

Despite the higher importance of the crop its production and productivity is very low due to different problems. There

are many Biotic and A biotic factors contributing for lower production of Garlic among which in appropriate agronomic practice especially weeding is the major problem.

Weed infestation in garlic is one of the major factors for loss in yield and bulb loss to the tune of 30-60% [3]. Weed reduces the bulb yield to the extent of 40 to 80% [4,5]. In garlic shallow root system make mechanical method of weed control difficult and sometimes causes damage to developing bulbs [3]. The predominant weed flora that hampers the growth and yield of crop vary with soil type, moisture, and other climatic factors.

Garlic is closely planted and shallow rooted bulbous crop. Therefore, intercultural practices are very difficult to undertake and manual weeding during the establishment stage of crop causes physical damage to crop plant. A most of troublesome problem faced by garlic grower is the control of weeds during early stage of crop growth. Because of higher plant density and slow growth of plant, inter-culturing is practically difficult

and crop suffers heavily from weed competition during establishment of plant. The weeds compete for moisture, space, nutrients and light which affect growth and development of crop. Therefore, it is essential to keep field weed free during critical period of crop growth.

However, manual hand weeding is a very tedious and intensive labor requiring method of weed control. Sometimes due to shortage of labor and unexpected rains, hand weeding or mechanical weed operations are delayed or left altogether. The chemical weed control in garlic has received little attention and weeds are mostly managed manually. In such situation, herbicides offer the most practical, more effective and economical method of weed control for increasing bulb yield of garlic. But there is no herbicide for weed control of Garlic in Ethiopia. Hence, present investigation was conducted to verify the efficacy of imported herbicide controlling weed growth and enhancing the bulb yield of garlic.

The Objective of the study was to verify the efficacy of Mogfeen240EC on different weeds of Garlic (*Allium Sativum* L).

## Materials and methods

The Experiment was conducted at Sinana On station and Goba to determine the efficacy of herbicide brought from abroad. Sinana is located at about 460 Km ton southeast of Addis Ababa and it has an altitude of 2400 m above sea level. Its geographical location ranges from 07° 06'12" to 07° 07'29" northern latitude and from 40° 12'40" to 40° 13'52" eastern longitude. On the other hand, Goba is located in Bale zone of Oromia regional state of approximately 446 km south east of Addis Ababa. The district has latitude, Longitude, an elevation of 7°0'N, 39°59'E, 2743m.a.s.l respectively.

Sprout seed of Garlic local variety was bought from local market and planted using 10cmx30cm spacing between plants and rows at Goba and Sinana Research station. Both NPS and UREA fertilizer was applied according to recommendation. All agronomic practices except weeding control were followed similarly for all plots of the experiment. Three weeks later of planting; one week after emergency Mogfeen240EC was sprayed to one plot according to recommendation (1litre/ha) using hand operated Knapsack sprayer and the remaining one plot remained for control (It is weed free plot). There is no standard check because this herbicide is the first to introduce for Garlic weed control. There was one hand weeded plot for comparison. Therefore, the experiments had three plots at each location. Mogfeen240EC sprayed twice within fifteen days' interval at both locations throughout the crop life cycle.

On the other hand, to determine the efficacy of the herbicide weeds were counted by throwing the 50cmx50cm quadrat three times on each plots before spraying. The average number of weeds counted from three quadrates was converted to mean number of weeds per m<sup>2</sup>. The weeds were categorized as broad leaves weeds, Sedges and Grass weeds based on their leaf morphological characteristics. This was the way of determining weed density of the crop and efficiency of herbicides to control weeds. Accordingly; Number of Broad leaves weeds per m<sup>2</sup>,

Number of grass weeds per m<sup>2</sup>, Relative weed density, Weed Index and weed control Index was determined.

## Relative weed density

Defined as the ratio of particular weed species to total weed population expressed in percentage. Therefore, it was calculated by dividing the number of particular weed species by total weed species in experimental plot.

$$RWD = \frac{\text{Number of particular weed}}{\text{Total Number of weeds}} \times 100$$

## Weed index

Is the average yield difference of hand weeded plot and treated plot divided by average yield of hand weeded plot of the experiment and calculated as the following.

$$WI = \frac{(\text{Yield of hand Weeded Plot} - \text{Yield of Treated Plot})}{\text{Yield of Hand weeded plot}} \times 100$$

## Weed control index

Is weed controlling efficiency of herbicide and calculated using the following formulae. Sometimes it was also named as weed susceptibility index

$$WCI = \frac{(\text{Weed count in weedy checkplot} - \text{weed count in treated plot})}{\text{Weed count in weedy check plot}} \times 100$$

## Statistical data analysis

All data were collected and analyzed using GenStat 15<sup>th</sup> Edition computer software. The significant difference among treatments was determined using Duncan Multiple range test (DMRT) at 5% level of significance.

## Result and discussion

To determine the efficacy of herbicide weed density was determined by categorizing them into broad leaf weeds and grass weeds since they were the main investigated types of weeds. Different Weed species were investigated at SARC on station and whereas only *Avena fatua* was observed at Goba Experimental site.

The detailed description of the observed weeds at both experimental sites is depicted in the following table 1.

Number of Broad leaves and Grass weeds per m<sup>2</sup> were determined at the time of mogfeen240EC application for each plot. Accordingly; average number of broad leaves weeds (759.43) and grass weeds (30) were observed per m<sup>2</sup> at Sinana Experimental site. The relative weed density of grass and Broad leaf weeds was also calculated. Accordingly, 99% of Broad leaf weeds and 1% grass weeds were observed before herbicide application. In weed free plot during application 92.12% of broad leaves weeds and 7.88% of grass weeds were investigated. However, at Goba experimental site Only *Avena Fatua* was investigated. On the other hand, at the same time with herbicide application hand weeding was also done for adjacent plot for comparison. Application of herbicide was continued within fifteen days' interval in similar ways with



hand weeding. The following pictures showed the efficiency of mogfeen240EC in controlling both grass and Broad leaf weeds at SARC on station Figures 1,2.

Five days later of Mogfeen240EC application, numbers of weeds were counted using the same procedure. The following data were recorded after first round spray before the second round herbicide application.

As it is indicated in the above table number of both broad leaves weed and grass weeds were reduced after application of Mogfeen240EC and this contribution enhances the crop growth parameters, Yield components and Yield of Garlic. Mogfeen240EC reduces broad leaves weed by about 82.73% and grass weeds by about 63.022% within first round application. On the other hand, the efficiency of this herbicide in controlling broad leaves weeds within the first round application round was about 73.17% whereas its efficiency in controlling grass weeds was 93.22%. This indicates the efficacy of the herbicides the requirements of second round herbicide application Table 2.

Fifteen days' later Mogfeen240EC was applied since weeds were not completely controlled and there was suitable rainfall condition which favors the growth and development of weeds. Before second round application number of weeds per Quadrate were counted; converted to average number of weed per m<sup>2</sup> and the following average number of broad leaves weeds and grass weeds were recorded. Within second round application

**Table 1:** Description of weeds observed Sinana and Goba Experimental site.

S.N	Species name of the weeds	Family name	Common name
1	<i>Amaranthus Cruentus</i>	Amaranthaceae	Amaranthus
2	<i>Datura Stramonium</i>	Solonaceae	Datura
3	<i>Avena fatua</i>	Poaceae	Avena
4	<i>Rumex acetosa</i>	Polygonaceae	Rumex
5	<i>Rumex nepalensis</i>	Polygonaceae	Rumex
6	<i>Bidens ghedoensis</i>	Asteraceae	Bidens
7	<i>Chenopodium Album</i>	Chenopodiaceae	Chenopodium
8	<i>Cyperus aterrimus</i>	Cyperaceae	Cyperus



**Figure 1:** Garlic plot before Mogfeen240EC application.



**Figure 2:** Garlic plot after Mogfeen 240EC application.

**Table 2:** Weed density before and after application of Mogfeen240EC.

Treatments	NOBLW/m <sup>2</sup> Before Appn	NOGW/ m <sup>2</sup> Before Appn	NOBLW/ m <sup>2</sup> After Appn	NOGW/m <sup>2</sup> After Appn
Mogfeen240EC sprayed	926.67	9.33	160	3.45
Weed free	592	50.67	596.33	50.86
Hand weeded	0	0	0	0

of herbicide Both Broad leaves and grass weeds were fully controlled as it is indicated in the following table. The Broad leaves weed control Index of Mogfeen240EC during the second application round is 99.85% whereas, the grass weeds control Index of the herbicide at the same application round is about 100%. This indicates the efficiency of this herbicide to control both broad leaves and grass weeds within second round spraying.

The weed control Index of herbicide of the second round application is greater than that of the first round application. This may due to the lower density of weeds during second round application and the weakness of weeds to stand against herbicide Table 3.

The reduction in number of weeds in turn have great role in increasing the yield by enhancing the growth and development of yield components of Garlic. In fact, if weeds are controlled; the competition of crop for sun light, soil moisture, and carbon dioxide will be decreased and the growth and development of yield components of the crop will be enhanced which in turn increases the yield of the crop. In similar manner with other weed controlling agents Mogfeen240EC fully controlled the weeds and favor the yield components of Garlic. The result showed that herbicide application significantly affects plant height, weight of single bulb, Number of cloves per bulb and bulb yield. The following data were recorded Table 4.

### Conclusion and recommendation

Mogfeen240EC was applied to Garlic to control all weeds



**Table 3:** Weed density during and after second round Mogfeen240EC application.

Treatments	NOBLW/m <sup>2</sup> Before Appn	NOGW/m <sup>2</sup> Before Appn	NOBLW/m <sup>2</sup> After Appn	NOGW/m <sup>2</sup> After Appn
Mogfeen240EC sprayed	160	114.67	1.01	0
Weed free	652.73	177.93	655.37	178.84
Hand weeded	0	0	0	0

**Table 4:** Effects of Mogfeen240EC application on the growth, yield and yield related parameters of Garlic.

PN	Treatments	PH	WSB	NCPB	YLD (Qt ha <sup>-1</sup> )
1	Mogfeen240EC spraying	23.8	22.4	8.8	57
2	Hand Weeding	23.6	15.3	12.4	53
3	Weed free	24.2	12.3	8	18
4	Mean	23.87	16.67	9.73	36.66

PN: Plot Number; PH: Plant Height; WSB: Weight of Single Bulb; NCPB: Number of Cloves Per Bulb; YLD: Yield

grown in the crop. There were different types of weeds observed in the experimental site at both Goba and Sinana on Station Research site. Based on the morphological characteristics of the leaves the investigated weed types can be categorized as Broad

leaves, grass and sedges. All types of weeds were controlled by applying *Mogfeen240EC* twice the crop growing cycle. On the other hand, using this herbicide gives comparable yield with that of hand weeded plot. Therefore, it is recommended to be used by Garlic producing community for effective and economical weed management.

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