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Effects of S-metolachlor Pre-emergence Herbicides for Broad and Grass Weeds Management in Chickpea (*Cicer arietinum* L.) in South Eastern Part of Oromia

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Abstract

Weed is the most important constraint of chickpea production in the studied area. The lowest competitive ability of chickpea provides severe yield loss caused by weeds. The experiment was done to assess and register(S-metolachlor) pre-emergence herbicides on grass and broad leaved weed control in chickpea. The experiment included 4 treatments (DualGold1.5L/ha, T-razor 4Lt/ha, weed free and weedy check plots) arranged in simple plot design. The result of analysis showed that the grain yield of weed free plot was higher than T-razor and Dual gold. However, under large production scale use of hand weeding is laborious. Therefore, T-razor is the best option herbicide for controlling grass and broad leaved weeds in chickpea as the grain yield of dual gold obtained was less than T-razor.

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Keywords

Chickpea, Pre-emergence Herbicide, Weed Management.

Introduction

Chickpea (*Cicer arietinum* L) is an important crop and provides a healthy food for increasing population of the globe and will be more valuable with climate changes Muehlbauer & Sarker (2017). Chickpea is widely grown around the world and serves as a multi-use crop. It plays a significant role in improving soil fertility by fixing the atmospheric nitrogen. It can fix up to 140 kg N ha-1 from air and meet most of its nitrogen requirement. The diverse agro-climatic conditions in Ethiopia make it very suitable for growing chickpeas. is widely grown across 1 the highlands and semi-arid regions of Ethiopia and serves as a multi-purpose crop. Its productivity is low due to low attention on chickpea production improvement technologies. Chickpea cannot compete well with weeds because it does not grow fast and its leaf develops poorly during its early stage of crop growth and development Ratnam, Rao, & Reddy (2011). Ethiopia is the biggest producer of chickpea in Africa. It is a primary source of dietary protein that supplements carbohydrate-rich sources like cassava, maize and rice. Chickpea increases soil N and breaks disease cycles of Poaceae or grass family (Rice (*Oryza sativa* L.), wheat (*Triticum aestivum* L.), corn (*Zea mays* L.), barley (*Hordeum vulgare* L.), and tef (Eragrostis tef (Zucc.) Trotter) are widely cultivated grains crops. According to Ratnam *et al.*, (2011) the yield losses reaches 40 to 87% in cases without weed control during the early stage of crop growth and development.

The major reason for the low yield of rain fed chickpea is weed interference Ahmadi *et al.*, (2013). In order to achieve the highest chickpea production and efficient harvesting requires careful attention to weed interference and the use of appropriate management methods to

remove or reduce the interference Mousavi *et al.,* (2007). Currently, attention is giving to the control of weed species and not to eradicate them. Using chemicals in controlling weeds became popular globally because it controls weeds fast and effectively. The amount of pre and post emergence herbicides used for the control of weeds in chickpea production is limited.

More research is needed to identify pre and post herbicides that provide grass and broad leaved weed control in chickpea. But, S-metolachlor is a pre-emergence herbicide used to eliminate grassy and broad leaf weeds at early and later stage of the crop growth to decrease loss of yield. Therefore, the aim of this work was to evaluate the effect of S-metolachlor and (Dual Gold) pre emergence herbicides S-metolachlor on yield and yield components of chickpea.

Materials and Methods

Field experiment was done at Gindhir and Goro on farmer's field in 2020. Land preparation and planting was done according to the recommended package for the crop. The experiment was laid out in RCBD using the farmer's as replication. The treatments consisted of four treatments Accordingly, (1) Dual Gold 1.5l/ha, (2)T-razor 4lt/ha, (3) Hand weeding and(4) weed control or no weeding. Application of pre-emergence herbicides was done two days after planting. Both broad and grass weed count was taken from all respective plots before application of pre-emergence herbicide using 0.5mx0.5m quadrant of the plants by throwing 50cmx50cm locally prepared Quadrants one each experimental plot.

Crop data collection and measurements

Phonological and growth parameters

Days to flowering

Were recorded as the number of days from sowing to when 50% of plants in a net plot produced flower through visual observation.

Days to physiological maturity

This was recorded as the number of days from sowing to the time when about 90% of the plants in a plot had mature pods in their upper parts with pods in the lower parts of the plants turning yellow. The yellowness and drying of leaves were used as indication of physiological maturity.

Plant height

It was measured as the height (cm) of ten randomly taken plants from the ground level to the apex of each plant at the time of physiological maturity from the net plot area and the means were recorded as plant height.

Number of pods per plant

Number of pods was counted from ten randomly taken plants from the net plot area at harvest and the means were recorded as number of total pods per plant.

Thousand seed weight (g)

It was determined by taking weight of 1000 randomly sampled seeds from the total harvest from each net plot area and the weight was adjusted to 10% moisture level.

Grain yield (kg ha-1)

The four central rows were threshed to determine seed yield and the seed yield was adjusted to moisture level of 10%. Finally, yield per plot was converted to per hectare basis and the average yield was reported in kg ha-1.

Biomass

Total dry matter above ground biomass (kg ha^{-1}).

Method of Data Analysis

All the agronomic data collected were analyzed using SAS statistical software, where ANOVA and mean separation will be carried out at 5% level of probability.

Results and Discussion

Weeds are the most serious problem and if unchecked, can cause 20-90 per cent yield losses in different pulse crops Pooniya *et al.,* (2015). Weeds compete with the crops for resources like light, water, space, nutrition etc. thereby reducing the crop yield. They act as alternate host sheltering pests and diseases. Chickpea treated with herbicides led to difference in all yield and yield Components compared to the control or not treated (Table1). The application of T-razor 4Lha-1was more successful in the Control of broad and grass weed as compared to weedy check. Studies showed that pre-emergence Dual Gold 2Lha-1 herbicide had better alternative in the control of broad and grass weed.

Table.1 Effect of T-razor Herbicide application on chickpea yield and Yield Components combined over locations, in the mid altitude of Bale, 2019/20 Main cropping season

Treatments	FD	MD	PH	PPP	ST%	AGBM kg ha^{-1}	Gy kg ha^{-1}	TGW
Dual Gold	66.00^{a}	109.00^{a}	81.33^{a}	22.33^{ab}	70.00^{c}	3666.23^{b}	1828.67^{c}	316.13^{a}
T-razor	68.00^{a}	112.33^{a}	80.33^{a}	26.33^{b}	78.00^{b}	5266.14^{a}	2257.71^{b}	317.73^{a}
Complete weed free	67.00^{a}	110.00^{a}	73.33^{a}	28.33^{a}	86.00^{a}	4866.62^{a}	2944.37^{a}	316.43^{a}
No weeding	68.00^{a}	112.67^{a}	65.97^{b}	8.33^{c}	42.33^{d}	2266.18^{c}	888.77^{d}	312.23^{a}
CV%	1.49	1.67	2.77	9.76	2.83	10.36	4.97	1.82
Lsd(0.05)	2.61	4.833	5.44	5.55	5.11	1120.2	257.3	6.83

Keys: FD=Flowering date, PH=Plant height, MD=Maturity date, PPP=pod per plant, ST%= stand percent, AGBM= Above Ground Biomass yield, GY= Grain yield, TGW= Thousand grain weight

However, there was no statistical difference in weed control between T-razor and Dual gold applied (Table1). Practitioners managing weeds need to regulate T-razor herbicide doses and time of application based on weed density and weed species composition.

Impact of treatments on plant height

Plant height was significantly influenced by pre-emergency herbicide treatments (Table1).Plant height is useful in the production of chickpea as shorter plants tend to have higher greater shatter loss at the cutter bar of combine during harvesting.

This leads to low harvest of seed yields. The tallest and shortest plants were observed from the Dual gold application and weedy check plots with 81.3 and 65.97cm, respectively.

There was no statistical difference in plant height among herbicide treatments. Height increase in gof chickpea plants not only competes with weeds but also shows herbicides inhibit crops. Khan *et al*., (2003) noted that some herbicide applied had no effect on plant height, but other studies Marwat *et al*., (2003) showed different herbicides significantly affected plant height.

Impact of treatments on pod number per plant

The pod numbers per plant among the treatments were significantly different (Table1).The weed free treatment had the highest (26) pod number per plant where as 22 pod per plant was recorded from T-razor application.

All herbicides treatments and weed free plot had better pod numbers than weed control. Weedy check had the least pod number per plant with (8,33) pod per plant as compared to weed free treatment.

Impact of treatments on above ground biomass yield

Biological yield determines the productivity of a crop. Producing great quantity of biomass is among the attributes of seed yield. Biological yield was significantly different (P<0.01) due to herbicide treatments. The lowest and the highest above ground biomass yields 2266.18 kg ha-1and 5266.14 kg ha-1were obtained in the weedy treatment and application of T-razor respectively (Table1).

Impact of treatments on Grain yield and 1000 seed weight

Grain yield showed a significant variation (P<0.01) due to herbicide treatments. The highest and lowest seed yield was obtained from application of T-razor followed by weed control (Table 1). In this evaluation the lowest 888.77kgha-1 seed yield was obtained from weedy treatment. The higher grain yield 2944.37kgha-1 was obtained from T-razor herbicide treated plots as compared to weedy check, this might be due to outcome of efficient weed control achieved due to the effectiveness of the herbicides.

This result is in conformation with those of Chhokar *et al*., (2008), that herbicides greatly increased crop productivity, which corresponded to their range of weed control. Behdarvandi and Modhaj (2007) stated that to control weeds and decrease their concentrations by reducing plant competition (between rape seed and weed) depends on suitable eradiation circulation in different layers of canopy and enhancement in the micro climate can elevate grains per pod, pods per plant and grain yield. The most active herbicide relative to thousand seed weight had no statistically differences with other treatment

Recommendation

Weed is the major production constraints, particularly for chickpea production in Bale Highlands, and hence its management is quite paramount important to increase the production and productivity. The result of this evaluation revealed that 4L ha-1 T-razor was given highest yield as compared with weedy check. However, application of dual gold 1.5 L ha-1 can be used as an alternative weed management in areas where labor competition is very high during critical period. Even though hand weeding is the safest method of control weeds, under commercial and large scale farming use of hand weeding is very tedious, time taking and cost, cannot be efficient method of weed control. However, further research is required to find out another pre or post-emergency herbicide which can control weed problems without supplemental hand weeding practices.

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