

Assessment of effect of different herbicides on morphological traits of *Gladiolus grandiflorus*Zeeshan Ali¹, Abdul Qadeer¹, Hafiz Muhammad Ahmad^{2,*}, Omar Aziz³, Muhammad Qasam¹ and Qurban Ali⁴¹ Institute of Horticultural Science, University of Agriculture Faisalabad, Pakistan² Department of Bioinformatics and Biotechnology, Government College University, Faisalabad, Pakistan³ Institute of Soil and Environmental Science, University of Agriculture Faisalabad, Pakistan⁴ Centre of Excellence in Molecular Biology, University of the Punjab, Lahore, PakistanCorresponding author's email: hafizahmad90@yahoo.com

Abstract: Floriculture is emerging as a profitable venture due to divergence of farmers towards high value floral crops and utilization of flowers in social and industrial level. Manual weeding is a very tedious and expensive labour practice of weed control that often damages the crop as well. Worldwide different weed control strategies are employed in the crops such as preventive, cultural, mechanical, biological and chemical. However, the chemical control using herbicides is one of the recent practice that is used in modern agriculture. The effectiveness of herbicide is decided by its specificity and mode of action under a soil conditions, its organic matter content, weather conditions and soil moisture prevailing at that particular area. Present study was conducted at Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan, during 2011-12 to study the effect of different herbicides on growth and yield of gladiolus plants. Pre emergence and post emergence applications of herbicides improved the growth of Gladiolus plant. Pendimethalin applied at 12ml/litre as pre emergence herbicide significantly increased plant height of white prosperity (100.78cm).

[Ali Z, Qadeer A, Ahmad HM, Aziz O, Qasam M, Ali Q. **Assessment of effect of different herbicides on morphological traits of *Gladiolus grandiflorus***. *Life Sci J* 2015;12(4s):87-93]. (ISSN:1097-8135). <http://www.lifesciencesite.com>. 12

Keywords: *Gladiolus grandiflorus*, herbicides, morphological traits, weeds, floriculture, floral crops

1-Introduction

Pakistan comprises on a variety of climates and ecological zones due to this reason it has large potential to produce all types of plants (Ahmad *et al.*, 2012). Plants express remarkable variation regarding their growth habits, size of colors, flowers shape and bloom structure (Pasha *et al.*, 2015). Gladiolus is one of the most beautiful bulbous cut flowers in the floriculture industry and occupies fifth position in the international floriculture trade (Sharma and Sharma, 1988; Butt *et al.*, 2015). Generally, weeds are defined as plants growing where they are not desired. Many weeds grow in areas where they are not well adapted because most of them are tolerant to adverse conditions of growth such as extreme heat or cold, drought or excessive moisture, saline or water-logged environments and marginal or disturbed soils. Weeds often possess hard seeds, underground root stocks or tubers, and show greater persistence (Athar and Shabbir, 2008). Agriculture production can be enhanced by developing resistant cultivars against biotic and abiotic stresses (Ahmad *et al.*, 2015ab). Weeds cause serious problems in the crops which eliminate the growth and development of plants and causes to reduce the yield. So there is need to minimize the weeds by using various available techniques which are less laborious, economical and don't effect the crop productivity. Weed control is complicated in Gladiolus because it is grown for two

purposes both for cut flowers and corm production. Herbicides are being used due to different weather circumstances that do not permit the conventional methods to control weeds during different growth stages of the crops and the period concerning with the seasonal peak labor activity leading to shortage of labor for weeding. Manual and mechanical weeding increases the cost of production, therefore appropriate weed control is necessary, herbicides may be the best choice to get better weed control and maximum productivity (Rao, 1983). Herbicide use including pre emergence and post emergence applications on crops enables economic weed control and increases productivity (Taj *et al.*, 1986). Therefore, it is essential to monitor several recently introduced herbicides and to fix optimum doses under particular agro climatic conditions for effective control over weeds in gladiolus. It must be noticed carefully that applied herbicide should have no phytotoxic effect on the plant and yield. In gladiolus herbicides may be applied 4 times during crop production (Gilreath and Bell, 1998). Herbicide applications are made on the above ground including pre emergence and post emergence applications so that they contact all the above ground portion parts to eradicate the weeds from the crop and to get more return from the crop (Gilreath, 1984). Association between yield related traits provides information regarding various yield components in manifestation of yield (Ashfaq *et al.*,

2014; Ahmad *et al.*, 2014; Puspito *et al.*, 2015; Qamar *et al.*, 2014 and Qamar *et al.*, 2015ab). Present research was planned to test different pre and post emergence herbicides, to evaluate effectiveness and to select effective herbicide for weed control in *Gladiolus grandiflorus* crop production.

2-Materials and methods

Present research was conducted at Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan, during 2011-12. The study was aimed to check the efficiency of different herbicides for pre emergence and post emergence weed control and effect of different herbicides on growth and yield of *Gladiolus grandiflorus* L. Variety White prosperity was used in the field conditions of district Faisalabad, Punjab, Pakistan. The plants were grown in randomized complete block design and all other agronomic practices were applied uniformly. There were eight treatments applied. Five corms were planted in each treatment and each treatment was replicated thrice with total of 120 corms used in the study of year. Pre emergence treatments were Metolachlor (8ml/litre), Metribuzine (2gm/litre), Pendimethalin (10ml/litre), Pendimethalin (12ml/litre) and were applied after 4 days after sowing when moisture conditions were available there. Post emergence treatments were Paraquat (10ml/litre), Glyphosate (15ml/litre) and Metribuzine (1gm/litre) and applied after one month of sowing. Data was recorded for morphological traits such as, Plant height (cm), Fresh weight of leaves (g), Number of floret spike⁻¹, Spike length (cm), Diameter of spike (mm), Fresh weight of spike (g), dry weight of spike (g) and was analyzed statistically by using analysis of variance technique and treatment means were compared according to two factorial RCBD at 5% level of significance (Steel *et al.*, 1997).

3-Results and discussion

According to the aim of research effect of different herbicides on weed control was observed and their effect on growth and yield was also studied. Data was collected and analyzed statistically as analysis of variance technique and results were subjected to Duncan's Multiple Range test. The data of herbicide treatments was presented about each morphological trait separately to check the effect of herbicides on each trait separately. Analyses of variance showed that applications of pre and post emergence herbicides depicted highly significant results for all the traits under study of *Gladiolus grandiflorus* except fresh leaf weight which expressed non-significant results due to herbicide applications (Table.1).

3.1. Plant height (cm):

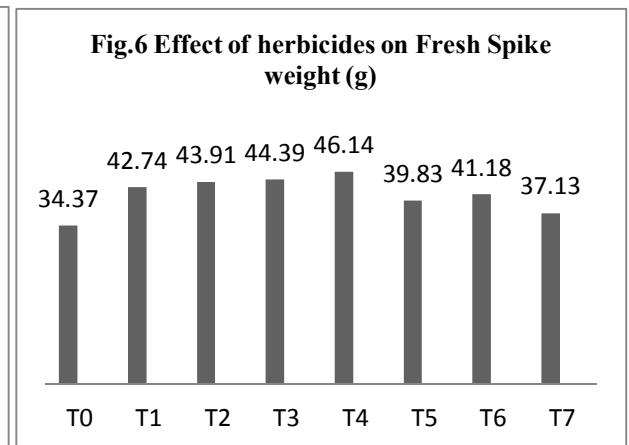
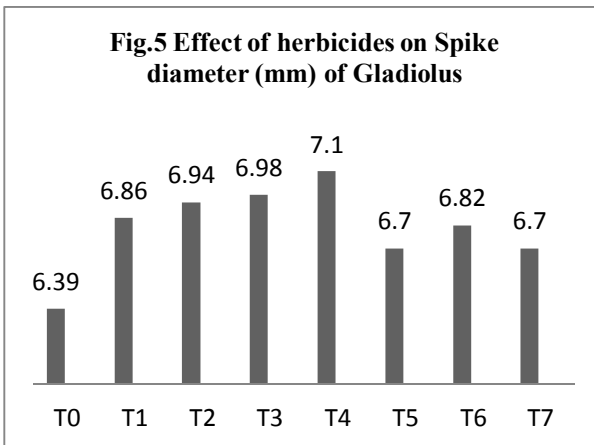
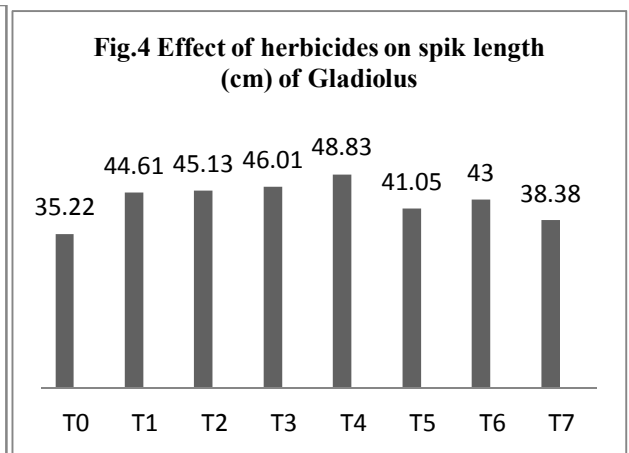
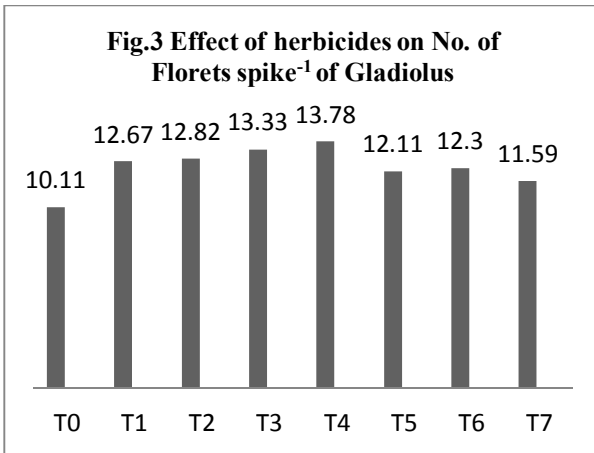
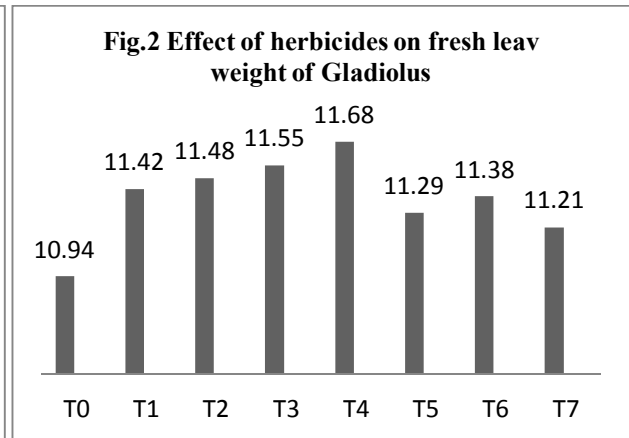
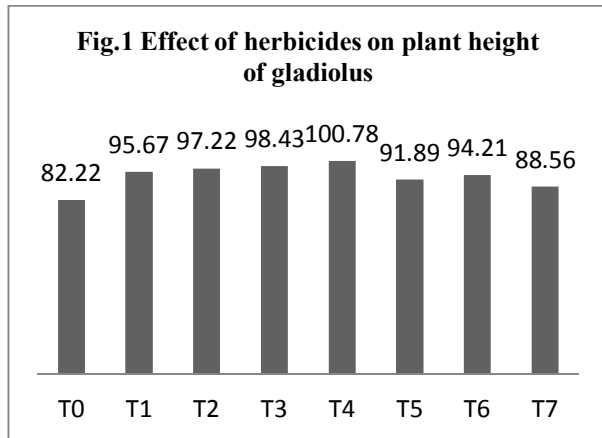
Results of table 2 expressed that Pendimethalin applied at 12ml/litre gave the best weed control and showed maximum plant height (100.78cm) than other herbicide treatments where as lowest plant height of gladiolus plants was observed in control (82.22 cm). These results are contradictory to the findings of Silva *et al.* (1982) who reported that with the application of weedicides plant height was reduced. This might be due to fact that application of Pendimethalin controlled the weeds during the early stage of crop growth therefore the available nutrients were used by the crop plants and thus received more nutrients and light which ultimately resulted in taller plants. Waheed *et al.* (2008) worked on weeds reported that applications of herbicides increases the plant height. Verma and Singh (1997) reported higher plant height than control was studied by the application of Pendimethalin. It is due to the fact that weeds were controlled in herbicide treated plots as compared to check plots and crop plants availed nutrients, moisture and light and grew taller and vigorous. Akhtar *et al.* (1998), Nawab *et al.* (1999) and Ali *et al.* (2003) also supported plant height differences attained with the applications of herbicides. They reported that plant height was increased in those plots in which weeds were controlled by the application of herbicides. Kamel *et al.* (1983) revealed that difference in plant height was attributed due to various intensities of weed competition.

3.2. Fresh Leaf Weight (g):

In pre emergence highest fresh leaf weight was observed in T₄ (Pendimethalin high) 11.68 g followed by T₃ (Pendimethalin Low) 11.55 g, T₂ (S metolachlore 11.48 g, T₁ (Metribuzine) 11.45 g when compared to T₀ (control) 10.94. In post emergence herbicide applied plots maximum fresh leaf of gladiolus was observed in T₆ (Glyphosate) 11.38g followed by T₅ (Paraquat) 11.29 g and lowest fresh weight of leaf was noticed in T₇ (Metribuzine low) 11.21 when compared to control T₀ (Control) 10.94 g. Detailed results showed non-significant increase in the fresh leaf weight of *Gladiolus grandiflorus*. Increase in the plant leaf weight was due to accumulation of more photosynthates due to less competition of weeds and the crop plants. Results indicate that only significant increase in leaf fresh weight was observed where pendimethalin was applied. All other treatments were found non-significant. However Pendimethalin applied at 12ml/litre significantly reduced weeds and maximum leaf fresh weight (11.68 g) was recorded. In other researches, Manjunath *et al.* (1989) stated that herbicide applications increased the leaf area index and leaf weight of the plant. Panjehkeh and Alamshahi (2011) reported that weed management with the

application of herbicides increases the plant leaf

weight.



3.3. No. of Florets spike⁻¹:

Results of table 2 showed that weed mangement practices improved growth of *Gladiolus grandiflous*. Numbers of florets per spike were significantly increased where weed growth was inhibited with the application of herbicides. Pre emergence herbicides treatments showed signifant superiority over post

emergence treatments. Maximum number of florets (13.78) was observed in Pendimethalin 12ml/litre dose as pre emergence herbicide provided excellent control over weed and promoted growth of the plants whereas minmum numbers of florets (10.11) were observed in control. Similar results were reported by Gilreath (1986) that application of herbicides increases number

of florets in gladiolus. Marwat *et al.*, 2005 concluded that weed management by the application of herbicides increase the number of grains per spike and spike weight. Ali (2010) reported that number of grains per

spike increases with the application of herbicides. Misra and Misra (2002) reported that application of Pendimethalin as pre emergence herbicide increases number of florets per spike in gladiolus.

Table.1 Analysis of Variance for effect of different herbicide applications on studied morphological traits in *Gladiolus grandiflorus*.

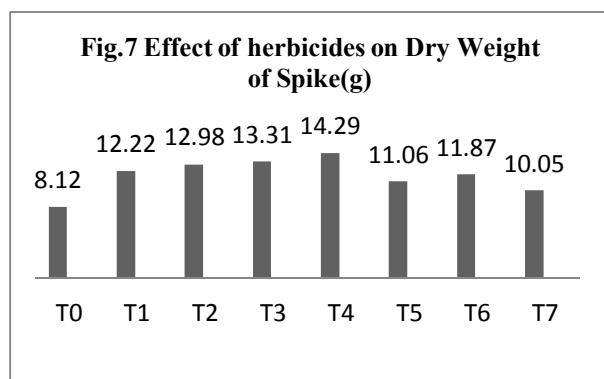
Source	DF	Plant height (cm)	Fresh leaves weight (g)	Number of floret spike ¹	Spike Length(cm)	Spike diameter (mm)	Fresh spike weight (g)	Dry weight of spike (g)
Replication	2	552.272	0.15452	20.1671	322.859	0.27458	221.823	81.0562
Treatment	7	107.345**	0.15555 ^{NS}	3.8471**	58.028**	0.15284 **	46.842**	11.6536**
Error	14	2.078	0.09891	0.1212	2.681	0.00633	2.517	0.6023
Total	23							

**=Highly significant ($p < 0.05$), NS= Non Significant

Table.2 Pre-emergence (T₀-T₄) and Post-emergence (T₅-T₇), comparison of means for effect of different herbicides application on morphological traits of *Gladiolus grandiflorus*

Treatment	Plant height (cm)	Fresh leave weight (g)	Number of floret spike ¹	Spike Length(cm)	Diameter of spike (mm)	Fresh weight of spike (g)	Dry weight of spike (g)
T ₀ (Control)	82.22 g	10.94 b	10.11 f	35.22 f	6.39 f	34.37f	8.12 f
T ₁ (Metribuzine)	95.67 cd	11.42 ab	12.67 cd	44.61bc	6.86 bc	42.74 bc	12.22 bcd
T ₂ (S-metolachlore)	97.22 bc	11.48 ab	12.82 bc	45.13bc	6.94 bc	43.91 abc	12.98 abc
T ₃ (Pendimethalin low)	98.43 ab	11.55 a	13.33 ab	46.01ab	6.98 ab	44.39ab	13.31 ab
T ₄ (Pendimethalin high)	100.78 a	11.68 a	13.78 a	48.83a	7.10 a	46.14 a	14.29 a
T ₅ (Paraquat)	91.89 e	11.29 ab	12.11 de	41.05 de	6.70 de	39.83de	11.06 de
T ₆ (Glyphosate)	94.21 de	11.38 ab	12.30 cd	43.00 cd	6.82 cd	41.18 cd	11.87 cd
T ₇ (Metribuzine low)	88.56 f	11.21 ab	11.59 e	38.38 e	6.70 e	37.13 ef	10.05 e

The values in last column followed the different letters are significantly different at 5% level of significance ($DMR_{0.05}$)



3.4. Spike length (cm)

Among pre emergence treatments maximum spike length was observed in T₄ (Pendmethalin high) 48.83 cm, followed by T₃ (Pendimethalin Low) 47.01 cm, T₂ (S metolachlore) 45.13 cm, T₁ (Metribuzine) 44.61cm, when they were compared with T₀ (Control) 35.22 cm. In post emergence treatments maximum spike length was observed in (Glyphosate) 43.0 cm followed by T₅ (Paraquat), 41.05 cm and in T₇ (Metribuzine low) 38.38 when they were compared with T₀ (Control) 35.22 cm. Detailed results showed significant effect of different herbicide application on spike length of *Gladiolus grandiflorus*. Maximum

spike length was recorded where pre emergence herbicide treatments were applied as compared to post emergence treatments. Pendimethalin 12ml/litre was found very effective against weed and significantly increased the spike length upto (48.83cm) as compared to control where lowest spike length was recorded upto (35.22cm) in gladiolus. Similar results were reported by Misra and Misra (2002) that application of Pendimethalin as pre emergence herbicide increases spike length in gladiolus. Kocira and Laskowska (2006) found that applications of Pendimethalin as pre emergence herbicide significantly increased the length of spike of the plants. Ashrafi *et al.* (2009) reported that weed management through applications of herbicides improved the spike length of the plants.

3.5. Spike diameter (mm)

In pre emergence herbicide application maximum spike diameter was observed in T₄ (Pendimethalin high) 7.10 mm followed by T₃ (Pendimethalin low) 6.98 mm, T₂ (S-metolachlore) 6.94 mm, T₁ (Metribuzine) 6.86 mm while comparing to T₀ (Control) 6.39 mm. In post emergence herbicide applications maximum spike diameter was observed in T₆ (Glyphosate) 6.82 mm followed by T₅ (Paraquat) 6.70 mm and lowest spike diameter was seen in T₇

(Metribuzine low) 6.62 mm and lowest was observed in T₀ (Control) 6.39 mm. The detailed results showed significant effect of different pre and post emergence herbicide treatments on spike diameter of gladiolus. Pendimethalin 12ml/litre applied as pre emergence reduced weed growth and showed significant superiority among all the treatments where maximum spike diameter (7.10mm) and minimum spike diameter was observed in control (6.39mm). Similar results were reported by Caballos *et al.* (2004) that crown diameter of the plant was significantly increased with the application of herbicides. Reichert (2000) reported that herbicides applications improved diameter of the plant. Studies have revealed that plant diameter increases with the application of herbicides and Pendimethalin as pre emergence herbicide significantly increased the diameter of the stalk of the plant. Gilreath *et al.* (2008) reported that plants treated with pre emergence herbicide applications (both at 0.3 and 0.6 kg/ha) performed similarly to those in the weed free control in two out of the three seasons and increased plant diameter.

3.6. Fresh Spike weight (g)

In pre emergence treatments highest fresh spike weight was observed in T₄ (Pendimethalin high) 46.14 g followed by T₃ (Pendimethalin Low) 44.39 g, T₂ (S metolachlore 43.91 g, T₁ (Metribuzine) 42.74 g when compared to T₀ (control) 34.37 g. In post emergence herbicide applied plots maximum fresh leaf of gladiolus was observed in T₆ (Glyphosate) 41.18 g followed by T₅ (Paraquat) 39.83 g and lowest fresh weight of leaf was noticed in T₇ (Metribuzine low) 37.13 g when compared to control T₀ (Control) 34.37 g. The detailed results showed significant effect regarding the applications of pre emergence and post emergence herbicide treatments on fresh weight of spike of *Gladiolus grandiflorus*. Pendimethalin 12ml/litre as pre emergence herbicide treatment was found an effective treatment in controlling weeds. Maximum fresh weight of spike was recorded in T₄ (46.14 g) where as minimum of spike was observed in control (34.37 g). Pendimethalin showed significant superiority on increasing fresh weight of spike. In other researches Ashrafi *et al.* (2009) reported that herbicides applications and weed control measures significantly increased fresh weight of spike. Similar results were reported by Naseer-ud-Din *et al.* (2011) that herbicide treatment in controlling weed increased the fresh weight of spike. Gilreath (1986) stated that herbicide application on gladiolus increases the fresh spike weight of the plants.

3.7. Dry Weight of Spike (g)

Results indicate that the highest dry weight of spike was observed in T₄ (Pendimethalin high) 14.29 g, followed by T₃ (Pendimethalin low) 13.31 g, T₂ (S-metolachlore) 12.98 g, T₁ (Metribuzine) 11.22 g when

compared to control T₀ (Control) 8.12 g. In post emergence applied after one month of sowing maximum dry weight of spike T₆ (Glyphosate) 11.87 g, T₅ (Paraquat) 11.06 g, T₇ (Metribuzine low) 10.05 g and lowest was observed in T₀ (Control) 8.12 g. Pendimethalin 12ml/litre applied as pre emergence herbicide showed significant superiority in increasing dry weight of spike because the herbicide significantly controlled weeds and showed no toxic effect to the plants in Pendimethalin treated plots, there was no competition of weeds to the crop for nutrients. So, dry spike weight was recorded significantly higher (14.29 g) than other treated and non-treated plots (8.12 g). Similar results were reported by Gilreath (1986) concluded that application of herbicides showed significant increase in the spike weight. Bose and Tripathi (1996) revealed that the increased dry matter production may be attributed to greater accumulation of photosynthates by vegetative parts in gladiolus. Khalifa *et al.* (2011) revealed that the increased dry matter production may be attributed to greater accumulation of photosynthates by vegetative parts in iris.

Conclusion

Overall pre emergence herbicides treatments were found superior to post emergence herbicides application treatments. Pre emergence and post emergence applications of herbicides improved the growth of *Gladiolus grandiflorus* (white prosperity). By comparing results of pre emergence and post emergence herbicides applications, studies clearly indicate that due to reduced competition between weed plants and crop plants, pre emergence applications applied treatments gave better results regarding weed control and effect of weed control on growth and yield of *Gladiolus grandiflorus*. Among pre emergence treatments Pendimethalin was found to be very effective treatment while in post emergence treatments. Glyphosate can be good choice but its spray should be careful and its contact with the crop plants should be avoided.

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9/22/2015