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Performance of different Gladiolus varieties under the climatic condition of Tista Meander Floodplain in Bangladesh

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Abstract

An experiment was conducted to evaluate 4 cultivars of Gladiolus BARI Gladiolus 1, BARI Gladiolus 3, BARI Gladiolus 4 and BARI Gladiolus 5at experimental farm, On Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Alamnagar, Rangpur during 2015-2016 and 2016-2017. The aim of study was to evaluate the adaptability and performance of cultivar under the climatic conditions of Tista Mendar Floodplain Agro Ecological Zone in Bangladesh. Among the varieties BARI Gladiolus-5 performed excellent in terms of spike production in 2015-2016 and BARI Gladiolus-4 performed excellent in terms of spike production in 2016-2017. Among the varieties BARI Gladiolus-4performed excellent in terms of market value in both the years. Maximum spike length was observed in cultivars BARI Gladiolus-4 and BARI Gladiolus-5 remain attractive for longer time. Keeping in view the vegetative and reproductive characteristic cultivars BARI Gladiolus-4 was performed better and recommended for general cultivation. In 2015-2016 the highest gross return (BDT. 1383800 ha^{-1}) as well as gross margin (BDT. 1005144 ha^{-1}) was recorded in BARI Gladiolus-4. In 2016-2017 the highest gross return (BDT. 1318553ha^{-1}) as well as gross margin (BDT. 927153 ha^{-1}) was recorded in BARI Gladiolus-5.The lowest gross return as well as gross margin was obtained from yield BARI Gladiolus-1 in both the yearsTherefore, it could berecommended for commercial cultivation of gladiolusBARI gladiolus 4 and BARI gladiolus 5varietiesare best for Tista Meander Floodplain Agro-Ecological Zone in Bangladesh.

Key words: Gladiolus genotypes**,** climatic condition, AEZ-3

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Introduction

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 (Ali et al., 2015). It is native to South Africa and presently has been cultivated throughout the world due to its attractive characteristics, dazzling colors, varying sizes and long vase life (Ali et al., 2016). These ornamental plants exhibit great diversity in their morphology, physiological responses to environmental factors, growth and developmental biology.

The floral industry is one of the major industries in many developing and under developed countries. Bangladesh is not an exception. In Bangladesh, floriculture brought into limelight by some innovative farmers in late seventies with tuberose on a small-scale basis. Large-scale commercial production started from

mid-eighties in Jhikargacha upazila of Jessore district (Sultana, 2003). Later it speeded largely in Jessore, Savar, Chuandanga, Mymensingh and Gazipurwhich turned to be the major flower production belt in Bangladesh.Cultivation of flower is reported to give 3-5 times and 1.5-2 times morereturns than obtained from rice and vegetable cultivation, respectively (Dadlani, 2003). At present, 10,000 hectares of land covers flower cultivation taking the lead by Jessore district. More than 5,000 resilient farmers are growing flower and foliage in the country and about 150,000 people are directly or indirectly involved in floriculture business as their sole livelihood (Chowdhury, 2010). Approximately 8,000 farmers are involved in flower cultivation and 2000 to 3000 farmers in ornamental plants on commercial basis. About 100,000 to 120,000people are directly or indirectly involved in floriculture industry for theirlivelihoods. The area coverage under commercial flower cultivation isapproximately 10,000 hectares of land while commercial nurseries have coveredapproximately 2,000 to 2,500 hectares of land (Momin, 2006).

Agro-ecological conditions such as: Light, temperature, rainfall, humidity and soil condition are important in flowering of this crop as well as water, salinity and nutrient management also affect the crop production (Ahmed et al., 2017; Datta et al., 2015, 2017). In gladiolus temperature affects all aspects of plant growth including shoot emergence, leaf area and flower development (Smith and Langhans, 1962). The suitable agro-climatic conditions of the country clearly indicate that wide range of ornamental crops can be grown, which can improve the economic conditions of the growers. The present experiment was conducted to study the effect of agro-ecological conditions on for growth, yield and quality of four Gladiolus varieties of Gladiolus.Gladiolus is one of the most important cut flower in Bangladesh. BARI developed gladiolus varieties which need to popularize among the farmers. As such On-farm trial will help popularize the varieties to the farmers.

Materials and Methods

The study area is located at 25º72´ N latitude and 89º25´E longitude with 31 m above mean sea level. The area mostly falls under high and medium high land areas of the Tista Meander Floodplain with an extent of 946,803 ha (Anowar et al., 2015, Mahamood et al., 2016). The present study was conducted under the Agro -climatic conditions of Tista Meander Floodplain Agro-Ecological Zone in Bangladesh. Four Gladiolus cultivars namely, BARI Gladiolus 1, BARI Gladiolus 3, BARI Gladiolus 4 and BARI Gladiolus 5 were used for the present research. The experiment was laid out in Randomized Complete Block Design (RCBD)with three replications. Uniform agronomic practices were applied to all four cultivars. This program was conducted at experimental farm, On Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Alamnagar, Rangpur during 2015-2016 and 2016-2017. Unit plot size was 6 m × 4 m with three replications. The total amount of fertilizer was @200-50-150-30-3-2 kg ha^{-1} N-P-K-S-Zn-B respectively and cowdung 4800 kg. The spacing was 20 cm × 20 cm. The N, P, K, S, Zn and B was applied in the fertilizer form of urea, triple super phosphate, muriate of potash, gypsum, zinc sulphate and boron. Entire quantity of cowdung, P, K, B, Zn and S were applied during land preparation. Urea was applied in two equal installments of 25 and 50 days after emergence. The corm was sown in the field on 20 November, at both the years. Irrigation was provided three times. Weeding was done twice 34 days after sowing (DAS) and 58 DAS.

***Pest incidence*:** In Gladiolus attack of tip burn was observed and mixture of Bavistin 1gm/Lwith Tilt 0.5ml/L (cocktail) was sprayed two times 45DAS and 60DAS. There was no insect infestation in gladiolus crop field.

***Data collection and statistical analysis*:** After maturing randomly 10 plants were harvested to record the yield and yield contributing characters. Mean data was analyzed statistically and was carried out to

analysis of variance (ANOVA) using the MSTAT-C (Gomez and Gomez, 1984). Further statistical validity of the differences among treatment means was estimated using the least significant difference (LSD) comparison method. The gross economic return was calculated on the basis of prevailing market price of the commodity (Ferdous et al. 2016, 2017).

Results and Discussions

***Plant height*:** The highest plant height (85.13 cm) was measured from the variety BARI Gladiolus 5 while the lowest was recorded in BARI Gladiolus 1 in 2015-2016 (Table 1). The highest plant height (107.09 cm) was measured from the variety BARI Gladiolus 4 while the lowest was recorded in BARI Gladiolus 1 in 2016-2017 (Table 2). This might be due to the soil and climatic conditions prevailing in the area. Safiullah and Ahmed (2001) evaluated the performance of 10 exotic gladiolus cultivars and observed variation in vegetative and floral characteristics. Similar results were obtained by Shaukat et al. (2008) in gladiolus cultivars under the climatic conditions of Rawalakot, Jammu & Kashmir.

***Spikes per plant*:** Considering spikes plot^{-1} significantly the highest was recorded from BARI Gladiolus 4 in both the years. Again, significantly highest number of spikesplot^{-1}was obtained BARI Gladiolus 4 which was statistically at par with that of BARI Gladiolus 5 (Table 1 and 2).

***Length of spike*:** The highest spike length was recorded in BARI Gladiolus 3 (103.0). The lowest was counted in BARI Gladiolus 1 (76.97) considering rachis length in 2015-2016 (Table 1) but the highest spike length was recorded in BARI Gladiolus 4 (150.0) and the lowest was counted in BARI Gladiolus 1 (107.0) considering rachis length in the year 2016-2017 (Table 2). The earlier findings of Safiullah and Ahmed (2001) and Shaukat et al. (2008) regarding gladiolus spike length for growth andflower characters are in conformity with our study.

***Weight of single spike*:** Weight of single spike of the tested four gladiolus varieties differed significantly and may be arranged BARI Gladiolus 5 (167.30 g) BARI Gladiolus 4 (177.81 g), BARI Gladiolus 3 (139.17 g) and BARI Gladiolus 1 (104.27 g). In 2015-2016 weight of single spike of the tested four gladiolus varieties differed significantly and the data was recorded BARI Gladiolus 5 (160 g) BARI Gladiolus 4 (100.7 g), BARI Gladiolus 3 (94.67 g) and BARI Gladiolus 1 (86.0 g) (Table 1).

***Yield*:** The highest spike yield was recorded in BARI Gladiolus 5 (28.91 t ha^{-1}) followed by BARI Gladiolus 4 (19.63 t ha^{-1}) and the lowest was obtained from BARI Gladiolus 3 (14.83 t ha^{-1}) in 2015-2016 (Table 1). In 2016-2017 the highest spike yield was recorded in BARI Gladiolus 4 (27.95 t ha^{-1}) which was statistically similar with BARI Gladiolus 5 (26.12 t ha^{-1}) and the lowest was obtained from BARI Gladiolus 3 (15.64 t ha^{-1}) which was also statistically similar with BARI Gladiolus 1 (17.73 t ha^{-1}) in 2016-2017 (Table 2). Ornamental plants show considerable diversity in their growth habits, colors, blooming structure, flower shape and size (Pasha et al., 2015) Hence the performance of a cultivar in respect of growth and yield is known to be greatly influenced by the environmental conditions particularly integrated temperature and light (Hodges, 1991). Growth and development of bulbous plants are mainly affected by seasonal thermo periodicity, constituting the basis of the techniques used to control flowering during forcing (Ali et al., 2016). Islam et al. (2006), Mojumder et al. (2007) and Karim et al. (2008) opined that optimum sowing time and best variety is very much effective for good quality seed production for different crop in Bangladesh. Several studies examining the influence of seed development on seed quality in different crops have shown that sowing time and varietal performance is one of the major factors (Rahman et al., 2008; Ferdous et al., 2008, 2014; Khatun et al., 2014).

Table 1. Yield and yield contributing characters of four gladiolus varieties at OFRD, BARI, Rangpur during 2015-16.

Treatments	Plant height (cm)	spikes plot^{-1}	Florets spike	spike length (cm)	Rachis length (cm)	Weight of single spike (g)	Spike yield (t ha^{-1})
BARI Gladiolus-1	67.83^{d}	381.7^{a}	13.20^{a}	82.80^{d}	48.37^{c}	86.00^{d}	16.42^{c}
BARI Gladiolus-3	84.20^{b}	313.3^{b}	13.17^{a}	103.6^{a}	55.33^{a}	94.67^{c}	14.83^{d}
BARI Gladiolus-4	80.47^{c}	390.0^{a}	11.20^{c}	91.90^{c}	39.97^{d}	100.7^{b}	19.63^{b}
BARI Gladiolus-5	85.13^{a}	361.0^{a}	12.10^{b}	98.57^{b}	50.57^{b}	160.0^{a}	28.91^{a}
CV %	0.66	4.11	0.7	0.66	0.86	1.09	3.81
LSD (0.05)	0.79	29.69	0.17	1.24	0.84	2.4	1.52

Table 2. Yield and yield contributing characters of four gladiolus varieties at OFRD, BARI, Rangpur during 2016-17.

Treatments	Plant height (cm)	Spikes plot^{-1}	Florets spike^{-1}	Spike Length (cm)	Rachis length (cm)	Weight of single spike (g)	Spike yield (t ha^{-1})
BARI Gladiolus-1	70.03^{b}	193.67^{b}	17.32^{a}	107.81^{c}	61.72^{a}	104.27^{b}	17.73^{b}
BARI Gladiolus-3	93.62^{a}	186.33^{c}	14.91^{a}	133.06	61.24^{a}	139.17^{ab}	15.64^{b}
BARI Gladiolus-4	107.09^{a}	213.00^{a}	19.41^{a}	150.0^{a}	60.60^{a}	177.81^{a}	27.95^{a}
BARI Gladiolus-5	97.79^{a}	212.00^{a}	12.98^{a}	129.57	52.92^{b}	167.30^{a}	26.12^{a}
CV %	7.58	10.42	21.73	7.38	4.25	17.35	17.65
LSD (0.05)	5.70	41.89	2.87	7.84	2.05	20.84	3.15

Economic analysis: In 2015-2016 the highest gross return (BDT. 1383800 ha^{-1}) as well as gross margin (BDT. 1005144 ha^{-1}) was recorded in BARI Gladiolus-4 (Table 3). In 2016-2017 the highest gross return (BDT. 1318553ha^{-1}) as well as gross margin (BDT. 927153 ha^{-1}) was recorded in BARI Gladiolus-5 (Table 4). The lowest gross return as well as gross margin was obtained from yield BARI Gladiolus-1 in both the years.

Table 3: Cost and return of BARI Gladiolus varieties at OFRD, BARI, Rangpur*.

Treatments	Number of spikes ha^{-1}	Return		Total Gross return (Tk. ha^{-1})	Total variable cost (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})
		Flower	Seed			
BARI Gladiolus-1	190850	381700	213800	595500	378656	216844
BARI Gladiolus-3	156650	939900	213800	1153700	378656	775044
BARI Gladiolus-4	195000	117000	213800	1383800	378656	1005144
BARI Gladiolus-5	180500	108300	213800	1296800	378656	918144

***Market Price:** BARI Gladiolus-1 Tk. 2 spike^{-1}, BARI Gladiolus-3, BARI Gladiolus-4 and BARI Gladiolus-5 Tk. 6 spike^{-1}

Table 4. Cost and return of BARI Gladiolus varieties at ARS, OFRD, BARI, Rangpur*.

Treatments	Number of spikes ha^{-1}	Return		Total Gross return (Tk. ha^{-1})	Total variable cost (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})
		Flower	Seed			
BARI Gladiolus-1	169886	339772	197500	537272	391400	145872
BARI Gladiolus-3	163447	980684	197500	1178184	391400	786784
BARI Gladiolus-4	185965	111578	197500	1313289	391400	921889
BARI Gladiolus-5	186842	112105	197500	1318553	391400	927153

*Market Price: BARI Gladiolus-1 Tk. 2 spike^{-1}, BARI Gladiolus-3, BARI Gladiolus-4 and BARI Gladiolus-5 Tk. 6 spike^{-1}

Conclusion

Three genotypes of gladiolus along with the check BARI gladiolus 1 were evaluated at and found that, maximum average plant height, spike length, number of spikes per plant, number of florets/spike, weight of single spike and spike yield t ha^{-1} was found in BARI gladiolus 4 and BARI gladiolus 5.From the economical point of view these two varieties are best for Tista Meander Floodplain Agro-Ecological Zone in Bangladesh. Therefore, it could berecommended for commercial cultivation of gladiolusBARI gladiolus 4 and BARI gladiolus 5variety is best for Tista Meander Floodplain Agro-Ecological Zone in Bangladesh.

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