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Economics of cut gladiolus (*Gladiolus grandiflorus* L.) production with application biostimulants

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Abstract
The present experiment entitled "Economics of cut gladiolus (*Gladiolus grandiflorus* L.) production with application Biostimulants" was carried out at the Floricultural Research Station, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad during September 2017 to February 2018. The experiment was laid out in Randomized Block Design replicated thrice with eleven treatments. The results indicating that economic evaluation of different treatments of bio stimulants on gladiolus spikes, corms and cormels yield shows that highest cost of cultivation (Rs 6.30 lakh ha^{-1}) was recorded with the treatment of Biozyme at 4ml/L *i.e* T_6, highest net income (8.35 lakh Rs) and benefit cost ratio (2.34:1) were obtained when Humic acid at 4ml/L *i.e* T_8 applied as a presoaking and foliar spray at 30 and 45 days after corm sowing.

Keywords: Gladiolus, economics, biostimulants, Humic acid and B:C ratio

Introduction
Floriculture has a long tradition in India references to flowers and gardens are found in ancient Sanskrit scriptures. Floriculture as a sunrise industry identified has Government of India. Due to change in lifestyle, the demand for flowers is increasing day by day. Steady increase in demand of flowers, floriculture has become one of the important commercial trades in our country. In recent years, Indian floriculture industry is shifting from traditional flowers to commercial cut flowers which are the important component of floriculture trade. They are widely used as artistic garlands, floral ornaments, bouquets etc. The long flower spikes are excellent as cut flower for table decoration when arranged in vases. Being an important bulbous ornamental plant, it occupies a prime position among commercial flower crops which has high demand in both domestic and international markets. Gladiolus (*Gladiolus grandiflorus* L.) also known as "Queen of the bulbous flowers" generally called as "Glad" and Sword lily due to its sword shaped leaves. A member of family Iridaceae, originated from South Africa. It has great economic value and social appeal for cut flower trade and much valued by the aesthetic world for beauty and loving people because its prettiness and unparallel elegance (Sadhu and Bose, 1973) [8] thus became a symbol for force and victory. It is grown in the plains as well as hills up to elevation of 2400 m from mean sea levels (Singh *et al*. 2012) [9].

Gladiolus is one of the most important among the bulbous ornamentals for cut flower trade in India. It is also ideal both for garden display and floral arrangements for table and interior decoration as well as making high quality bouquet (Lepcha *et al.* 2007) [6]. Florets open sequentially from the base of the rachis and extension of longevity of these florets helps in maintaining the economic value of these flowers for a longer time, commercially propagated by corms. Major gladiolus producing countries are the United States (Florida and California), Holland, Italy, France, Poland, Bulgaria, Brazil, India, Australia and Israel. States in the country are Uttar Pradesh, West Bengal, Odisha, Chhattisgarh, Haryana & Maharashtra, also grown in states like Uttarakhand, Karnataka, Andhra Pradesh and Sikkim. Amongst the cut flowers, gladiolus occupied third position in terms of both area and production. In India the total area and production under flower crops was 3.06 lakh ha and 23.92 lakh metric tonnes with loose and cut flowers production at 16.99 and 6.93 lakh metric tonnes respectively (NHB 2016-17). The total area of gladiolus in India is 11,160 ha with production of 48,320 MT loose flowers and 54.59 lakh number of cut spikes (Anon, 2014-15). Highest area under flower crops cultivation was recorded in Karnataka (52,370 ha) followed by Jammu & Kashmir (49,580 ha) and Tamil Nadu (32,367 ha). West Bengal ranks first in the production of cut flowers with yield of (2,01,570 MT). Chhattisgarh ranks second in production with (93,583 MT) yield. Uttar Pradesh ranks third in production with (64,160 MT) yield. In Telangana total area under flower crops was 2,950 ha with production of loose and cut flowers 10,055 and 9,000 MT

respectively (NHB, Data base 2016-17). It was observed that about 80-90% of demand in Telangana for flowers was met by importing flowers from the neighbouring states. The growing demand for food, feed, fuel, fiber, and raw materials and the increasing resource depletion and ecosystem degradation impose the use of more sustainable methods in the agriculture production systems. Several organic products called "biostimulants" are now available in the market to make agriculture more sustainable (www.biostimulants.eu). Plant biostimulants contain substance(s) and/or micro-organisms whose function when applied to plants or the rhizosphere may stimulate natural processes to enhance/benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, and crop quality (Kauffman *et al.* 2007) [5]

Material and Methods

The experimental site is located at Floricultural Research Station (Agricultural Research Institute), Rajendranagar, Hyderabad. Located at an altitude of 542.3 m above mean sea level with geographical bearing of 17.19° N latitude and 78.23° E longitude. The experimental site falls under subtropical climate zone with an average rainfall of 800 mm per annum, red sandy loam soil with good drainage facility and low water holding capacity. Meteorological data pertaining to temperatures maximum and minimum (30.18˚C and 15.25˚C respectively), relative humidity (AN 42.56 %, FN 88.95 %) and sunshine hours (7.56) in monthly averages recorded during the investigation period. The experiment was laid out in a Randomized Block Design (RBD) with eleven treatments replicated thrice. The field lay out and randomization of treatments with 1.5×1.5 m (2.25 m^2) plots were used per treatments carried out as per the statistical methods given by Panseand Sukhatme (1985).

Organic manure like well decomposed farmyard manure 5 $kg.plot^{-1}$ were incorporated into all the experimental plots uniformly as basal application and N, P and K @ 25:35:35 $kg.acre^{-1}$ were applied in form of Ammonium sulphate, Single super phosphate and Murate of potash respectively mixed well. Ammonium sulphate applied in 3 split doses, the first dose as basal application and other two split doses at 3 leaf stage and 6 leaf stage. Solutions of 2ml and 4ml of biostimulants were prepared in 1000 ml volumetric flask by dissolving calculated quantity of biostimulants in 0.998 and 0.996 litre distilled water respectively. The Biostimulants are applied three times i.e pre soaking of corms (1hr) before planting and foliar application on 30 and 45 days after corm sprouting. Uniformly growing five plants at random from each plot were tagged in each replication for recording different observations. Recommendation and adoption of any practices by cultivators depends upon its economics. Therefore, it becomes essential to work out economics of the treatments tested for judging the best treatments under study, for getting higher net profit per hectare. The cost of cultivation in each treatment will be worked out based on the actual expenditure incurred on each item viz. cost of corms, manures, chemical fertilizers, pesticides, fungicides, labour wages and all the cultural practices including harvesting will be worked out based on the prevailing prices and wages during the cropping season and will be expressed as cost of cultivation per hectare. The gross income was calculated on the basis of income generated by sale of gladiolus spikes, corms and cormels obtained from the experiment during the study period. From the total yield 20 per cent was deducted from total yield of gladiolus spikes as a result of damage due to handling and transportation. The total yield of gladiolus cut flowers, corms and cormels was multiplied with the average price prevailed in the market and expressed as a gross income ha^{-1}. Net income was calculated treatment wise. The total cost of cultivation per hectare was subtracted from the gross income for computing net returns of each treatment. Net income (Rs/ha) = Gross income (Rs/ha) – Total cost of cultivation (Rs/ha). Benefit: Cost ratio was calculated treatment wise. The gross income per hectare of each treatment was divided by the total cost of cultivation of respective treatments. Benefit: Cost ratio was worked out by using the formula.

$$\text{Benefit : Cost ratio} = \frac{\text{Gross returns (Rs. ha}^{-1})}{\text{Total cost of cultivation (Rs. ha}^{-1})}$$

The details of the observations recorded during course of investigation were given in tables. Observations on growth and floral parameters were recorded at fixed interval and the mean data were subjected to statistical analysis. The treatment details are furnished below

T_1-Triacontanol @ 2ml/L, T_2-Triacontanol @ 4ml/L, T_3-Cytozyme @ 2ml/L, T_4-Cytozyme @ 4ml /L, T_5-Biozyme @ 2ml/L, T_6-Biozyme @ 4ml/L, T_7-Humic acid @ 2ml/L, T_8-Humic acid @ 4ml/L, T_9-Fulvic acid @ 2ml/L, T_{10}-Fulvic acid @ 4ml/L, T_{11}-Control.

Results and Discussion

Application of treatments of bio stimulants had shown profound influence on yield of cut gladiolus Cv. Arka amar which in turn was reflected on economics of gladiolus production. Data corresponding to benefit cost ratio was presented in table.1 and fig.1. Among different treatments the cost of cultivation of gladiolus was highest (Rs 630098 ha^{-1}) treated with Biozyme at 4ml/L-T_6, followed by Fulvic acid at 4ml/L (Rs 627445 ha^{-1}), however, the lowest was with control i.e T_{11} (Rs 589353 ha^{-1}). Higher cost of production with Biozyme and Fulvic acid were due to the higher cost of the purchase of the chemicals. Maximum gross returns were obtained with Humic acid at 4ml/L (Rs 1455495.33ha^{-1}) followed by Humic acid at 2ml/L (Rs 1318128.10ha^{-1}), Fulvic acid at 4ml (Rs 1186040.33ha^{-1}) and control recorded minimum gross returns of (Rs 1002030.60 ha^{-1}). Maximum Net returns were obtained with Humic acid at 4ml/L (Rs 835443.33ha^{-1}) followed by Humic acid at 2ml/L (Rs 706890.10ha^{-1}), Fulvic acid at 4ml/L (558595.33ha^{-1}) and control recorded minimum net returns of (Rs 412677.60ha^{-1}). A critical examination of the data revealed that highest B: C ratio with Humic acid at 4ml/L (2.34:1) followed by Humic acid at 2ml/L (2.15:1) and Fulvic acid at 4ml/L and Biozyme 2ml/L (1.89:1). The control has recorded the lowest B: C ratio of (1.70:1). The higher gross returns, net returns and B: C ratio with Humic acid 4ml/L which might be attributed to higher early and total yield. These results are in line with the findings of Fathima and Denesh (2013) [3] in chilli; Harshad *et al.* (2013) [4] in sunflower; Brownell *et al.* (1987) [2] reported that foliar application of HA promoted growth and increased yield by 10.5% in processing tomatoes over untreated controls.

Table 1: Economics (Benefit cost ratio ha^{-1}) of different pre soaking and foliar sprays of bio stimulant treatments of cut gladiolus Cv. Arka amar.

Treatments	yield (ha^{-1})			Revenue (Rs.)			Gross returns	Total cost of cultivation	Net returns	B:C ratio
	Spike (No.)	Corm (No.)	Cormel (Kg)	Spike	Corm	Cormel				
T_1	138370.23	134814.70	80.99	659258.60	44443.89	2429.70	1098724.95	600182	498542.95	1.83:1
T_2	138518.36	140740.60	81.06	666666.00	45332.70	2431.80	1117245.40	601081	516164.40	1.85:1
T_3	139259.13	143703.56	81.30	696295.60	42177.30	2439.00	1129845.33	610900	518945.33	1.84:1
T_4	140740.6	140740.60	81.56	703703.00	42221.58	2446.80	1128371.60	619021	509350.60	1.82:1
T_5	143703.56	152592.46	81.16	718517.80	44777.19	2434.80	1178729.98	622586	556143.98	1.89:1
T_6	148148.00	148148.00	86.62	740740.00	45332.70	2598.60	1187782.60	630098	557684.60	1.88:1
T_7	165925.76	161481.30	135.18	888888.00	53777.19	4055.40	1318128.10	611238	706890.10	2.15:1
T_8	183703.53	177333.16	165.94	1007406.4	60443.70	4978.20	1455495.33	620052	835443.33	2.34:1
T_9	137777.66	138518.36	100.07	688888.20	42032.88	3002.10	1107445.48	610182	497263.48	1.81:1
T_{10}	152592.43	139999.86	102.62	762962.20	42332.70	3078.60	1186040.33	627445	558595.33	1.89:1
T_{11}	124444.32	125925.80	67.72	622221.60	36332.88	2031.60	1002030.60	589353	412677.60	1.70:1

Note: **T_1**-Triacontanol @ 2ml/L, **T_2**-Triacontanol @ 4ml/L, **T_3**-Cytozyme @ 2ml/L, **T_4**-Cytozyme @ 4ml/L, **T_5**-Biozyme@ 2ml/L, **T_6**-Biozyme@ 4ml/L, **T_7**-Humic acid @ 2ml/L, **T_8**-Humic acid@ 4ml/L, **T_9**-Fulvic acid @ 2ml/L, **T_{10}**-Fulvic acid @ 4ml/L, **T_{11}**-Control

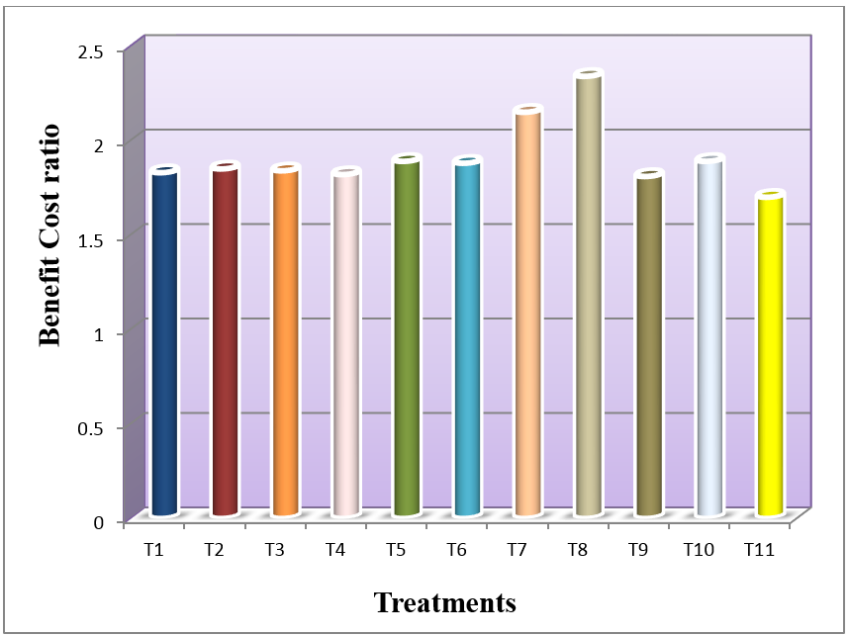

Fig 1: Economics (Benefit cost ratio ha^{-1}) of different pre-soaking and foliar sprays of bio stimulant treatments of cut gladiolus Cv. Arka amar.

Over all view of the field experiments

Gladiolus spikes yield per plant

Corms and cormels yield per

Conclusion

Economic evaluation of different treatments of bio stimulants shows that highest net income (8.35 lakh Rs) and benefit cost ratio (2.34:1) were obtained when Humic acid at 4ml/L i.e T_8 applied as a pre soaking and foliar spray at 30 and 45 DACS.

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