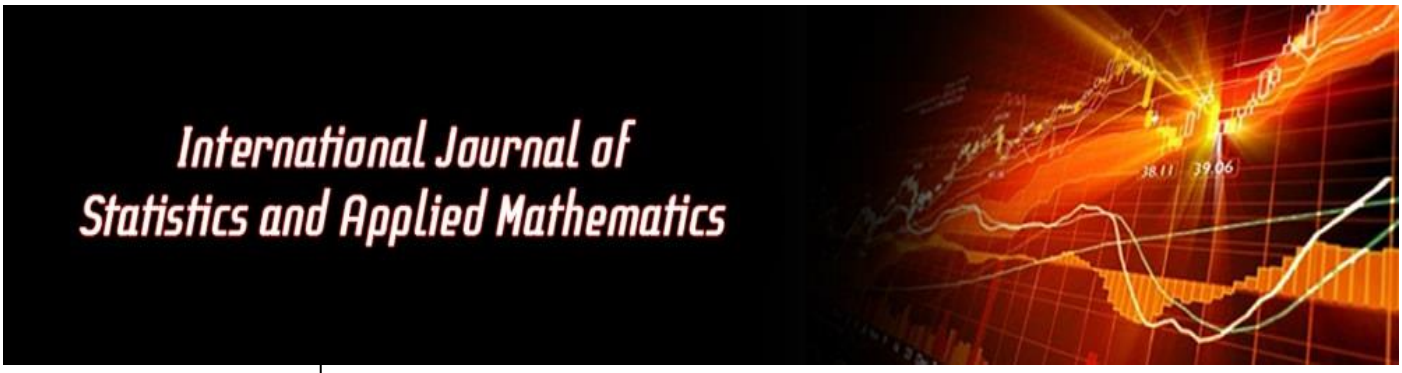

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Economic analysis on gladiolus (*Gladiolus grandiflorus*) as affected by soaking with plant growth regulators on growth, yield and quality

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Abstract
The present investigation entitled "Effect of soaking with plant growth regulators on growth, yield and quality of gladiolus (*Gladiolus grandiflorus*)'' was carried out during winter season, 2021-22 at Horticultural Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat. Experiment was laid out in randomized block design with three replications and was planted by soaking the corms for 24 hours in different plant growth regulators. *viz*. GA_3, NAA and BA. Total thirteen treatments were evaluated in the present study *viz*., T_1: without soaking; T_2: Soaking in 50 ppm GA3; T_3: Soaking in 100 ppm GA_3; T_4: Soaking in 150 ppm GA3; T_5: Soaking in 200 ppm GA3; T_6: Soaking in 50 ppm NAA; T7: Soaking in 100 ppm NAA; T_8: Soaking in 200 ppm NAA; T_9: Soaking in 300 ppm NAA; T_{10}: Soaking in 25 ppm BA; T_{11}: Soaking in 50 ppm BA; T_{12}: Soaking in 100 ppm BA and T_{13}: Soaking in 150 ppm BA. Treatments were evaluated with respect to growth, yield and quality parameters of gladiolus. Among various treatments, the highest benefit cost ratio and net realization obtained with treatment of GA_3 at 100 ppm.

Keywords: gladiolus, GA_3, NAA, BA, corm production, economics, benefit cost ratio

Introduction
Flowers are associated with mankind since the dawn of the civilization. They are symbol of love, beauty, peace and tranquility. They are intricately entwined in the social functions of our country and no function is complete without flowers. Flowers have become an integral part of our day to day life. With changing life styles and increased urban affluence, flower growing has assumed a definite commercial status in recent time. Gladiolus (*Gladiolus grandiflorus* L.) is one of the most important bulbous flower crops. It is popularly known as "Sword Lily", an ornamental cormelous plant native to South Africa. It belongs to monocot family Iridaceae, having approximately one hundred and fifty known species (Negi *et al.* 1982) [1].
The application of plant growth regulators in agriculture has started in 1930 in United States. Ethylene, a naturally occurring substance, is one of the first plant growth regulators being discovered and used successfully for enhancing flower production in pineapple. Thimann, proposed the term phytohormone as these hormones are synthesized in plants (Thimann, 1949) [2]. It is known fact that application of growth regulators such GA_3, NAA and BA have positive effects on growth and development of gladiolus plants at different concentrations. GA_3 enhance the growth, development and yield of gladiolus at different concentrations, it increases the height of plants, number of flowers and induce early flowering (Uddin *et al.* 2013) [3]. Dormancy period of the freshly harvested gladiolus corms ranges from 2 to 4 months under natural storage conditions depending on the cultivars and the temperature during storage (Gonzales, 1996) [4]. Some plant growth regulators are useful to produce flowering in off season by breaking the dormancy of gladiolus. GA_3 is very effective for germination, growth promotion, flowering and senescence inhibition. The multiplication through corms and cormels is slow. Certain plant bio-regulators such as gibberellic acid (GA_3), thiourea and ethrel have been successfully used to break the dormancy of gladiolus. Benzyl adenine is a growth regulator reported to be useful for enhancing sprouting, increasing sprout per plant and thereby yield of corms. It is very important to determine the effectiveness of

various concentration of growth regulating chemicals for its best effect on growth and flowering and also to increase the reserve food material to enhance the shelf life of the flower after harvest, which will certainly be of great benefit to the commercial growers. Mode of application of any chemical play an important role in efficient utilization for the plant growth and development. Corms soaking method is best over the spray method of application, it can achieve complete absorption of chemicals (growth regulators) by the gladiolus corms, which might have been further utilized for various physiological processes to influence the growth and yield parameters. Use of growth regulators in gladiolus as a pre-plant corm treatment is expected to reduce the long vegetative phase and enhance the flowering. Further, it may help in regulating the plant character and better quality of cut flowers production by directing the movement of organic plant metabolites.

Material and Methods

Experiment was laid out in randomized block design with three replications and was planted by soaking the corms of gladiolus (*Gladiolus grandifloras*) var. Punjab Dawn for 24 hours in three different plant growth regulators *viz.* GA_3, NAA and BA each involving four different concentration levels with thirteen treatments, *viz.*, T_1: without soaking; T_2: Soaking in 50 ppm GA3; T_3: Soaking in 100 ppm GA3; T_4: Soaking in 150 ppm GA3; T_5: Soaking in 200 ppm GA3; T_6: Soaking in 50 ppm NAA; T_7: Soaking in 100 ppm NAA; T_8: Soaking in 200 ppm NAA; T_9: Soaking in 300 ppm NAA; T_{10}: Soaking in 25 ppm BA; T_{11}: Soaking in 50 ppm BA; T_{12}: Soaking in 100 ppm BA and T_{13}: Soaking in 150 ppm BA. All the growing conditions and sowing time were evaluated on the basis of growth (Days to sprouting, Number of sprouts, plant height and number of leaves per plant), flowering attributes (Days taken to spike initiation, Days to first harvesting of spike, Spike length (cm), Rachis length (cm), Number of florets per spike, and vase life) and yield attributes (number of spikes per plant, per plot and per hectare, number of corms per plant, per plot and per hectare and number of cormels per plant, per plot and per hectare). During the crop duration period of 2021-22 temperature varied from 8°C to 40°C. the atmospheric humidity ranged from 70% to 88%. This data of weather was collected by researcher herself. Collected data were subjected to statistical analysis. The soil of experimental site is sandy loam in texture with slightly alkaline in reaction, low in organic carbon and highly available nitrogen and potassium while medium in available phosphorus. pH of soil was 7.8. Plot size in the experiment was 1.8 m × 1.0 m.

Result and Discussion

Among various treatments, the least total variable cost was found in control followed by T_7 soaking in 50 ppm NAA (₹570.75) while highest total variable cost was obtained with treatment T_{13} soaking in 150 ppm BA (₹13090). Total cost of cultivation for gladiolus crop for 1 hectare area was minimum in control treatment (₹451237) followed by T_{13} soaking in 50 ppm NAA (₹451808). While highest total cost of cultivation was obtained with T_5 soaking in 200 ppm NAA (₹466057).

Table 1: Cost of cultivation and gross realization of gladiolus

(A) Details of fixed cost

Sr. No.	Particulars	Specification/ Quantity	Frequency	Labour cost	Material cost	Total fix cost
A.	**Pre sowing operation (Field preparation)**					
1	Ploughing	3 hours	2	3600	-	3600
2	Planking	3 hours	1	1800	-	1800
3	FYM	20 t	1	-	20000	20000
4	FYM application	5 labours	1	1700	-	1700
B.	**Planting**					
1	Bed preparation	20 labours	1	6800	-	6800
2	Corm price	71433 corms	-	-	357165	357165
3	Corm planting	8 labours	1	2720	-	2720
C.	**Fertilizer cost**					
1	Urea	255.55 kg	2	-	1515.4	1515.4
2	DAP	444.44 kg	1	-	10666.6	10666.56
3	MOP	333.33 kg	1	-	6029.9	6029.9
4	Fertilizer application	6 labours		2040	-	2040
D.	**Post sowing operations**					
1	Weeding	8 labours	3	8160	-	8160
2	Earthing up	8 labours	2	5440	-	5440
3	Plant protection	2 labours	2	1360	2000	3360
E.	**Irrigation charges**					8000
F.	**Harvesting cost**					
1	Spike harvest	2 labours	8	5440	-	5440
2	Corm harvest	20 labours	1	6800	-	6800
G.	**Total fixed cost**					**451237**

Note: Rate of various items :	
Tractor charges @ Rs.600 per hour Man power charges @Rs.340 per day Price of corm @ Rs. 5 per corm Recommended dose: 200:200:200 kg N:P:K/ha	Rate of source fertilizers: FYM @ Rs. 1000 per tonne Urea @ Rs. 5.93 per kg DAP @ Rs. 24 per kg MOP @ Rs.18.09 per kg

(B) Details of variable cost

Sr. no.	Treatment	Quantity of PGR required (g/ha)	Cost of PGR (₹)	Soaking treatment application charges	Total Variable cost
1	Without soaking	0	0	0	0
2	Soaking in 50 ppm GA_3	25	3620	340	3960
3	Soaking in 100 ppm GA_3	50	7240	340	7580
4	Soaking in 150 ppm GA_3	75	10860	340	11200
5	Soaking in 200 ppm GA_3	100	14480	340	14820
6	Soaking in 50 ppm NAA	25	230.75	340	570.75
7	Soaking in 100 ppm NAA	50	461.5	340	801.5
8	Soaking in 200 ppm NAA	100	923	340	1263
9	Soaking in 300 ppm NAA	150	1384.5	340	1724.5
10	Soaking in 25 ppm BA	12.5	2125	340	2465
11	Soaking in 50 ppm BA	25	4250	340	4590
12	Soaking in 100 ppm BA	50	8500	340	8840
13	Soaking in 150 ppm BA	75	12750	340	13090

Note: Rate of plant growth regulators
GA_3= Rs.1448/10g
NAA= Rs.923/100 g
BA=Rs.850/5g

(C) Details of cost of cultivation for gladiolus crop for 1 hectare area

Sr. no.	Treatment	Fixed cost (₹)	Variable cost (₹)	Total cost (₹)
1	Without soaking	451237	0	451237
2	Soaking in 50 ppm GA_3	451237	3960	455197
3	Soaking in 100 ppm GA_3	451237	7580	458817
4	Soaking in 150 ppm GA_3	451237	11200	462437
5	Soaking in 200 ppm GA_3	451237	14820	466057
6	Soaking in 50 ppm NAA	451237	571	451808
7	Soaking in 100 ppm NAA	451237	802	452038
8	Soaking in 200 ppm NAA	451237	1263	452500
9	Soaking in 300 ppm NAA	451237	1725	452961
10	Soaking in 25 ppm BA	451237	2465	453702
11	Soaking in 50 ppm BA	451237	4590	455827
12	Soaking in 100 ppm BA	451237	8840	460077
13	Soaking in 150 ppm BA	451237	13090	464327

(D) Yield of spikes, corms, cormels and Gross realization from 1 hectare gladiolus cultivation

Sr. no.	Treatment	Yield of spike (No.)	Selling price of spike (₹)	Yield of corm (No.)	Selling price of corms (₹)	Yield of cormels (No.)	Selling price Of cormels (₹)	Gross realization (₹)
1	Without soaking	75402	301607	75402	377009	313513	44788	723404
2	Soaking in 50 ppm GA_3	138898	555593	130961	654806	654806	93544	1303942
3	Soaking in 100 ppm GA_3	158741	634963	166678	833389	674648	96378	1564730
4	Soaking in 150 ppm GA_3	126993	507970	123024	615120	611152	87307	1210398
5	Soaking in 200 ppm GA_3	146835	587341	158741	793704	599246	85607	1466651
6	Soaking in 50 ppm NAA	111119	444474	103181	515907	468285	66898	1027279
7	Soaking in 100 ppm NAA	87307	349230	107150	535750	488128	69733	954712
8	Soaking in 200 ppm NAA	99213	396852	111119	555593	507970	72567	1025012
9	Soaking in 300 ppm NAA	126993	507970	130961	654806	523844	74835	1237611
10	Soaking in 25 ppm BA	134930	404789	230174	690522	452411	64630	1159941
11	Soaking in 50 ppm BA	83339	250017	289702	869106	408757	58394	1177516
12	Soaking in 100 ppm BA	71433	214300	317481	952444	373041	53292	1220036
13	Soaking in 150 ppm BA	71433	214299	277796	833389	333356	47622	1095310

Note:

- Selling price of spike @ Rs. 4 per spike except in BA treatments (T_{10}, T_{11}, T_{12} and T_{13}) which were of poor quality and short in length with less number of florets that is why it's market price is considered to be Rs.3.
- Selling price of corms @ Rs. 5 per corm except in BA treatments (T_{10}, T_{11}, T_{12} and T_{13}) which were small in size that is why it's market price is considered to be Rs.3.
- Selling price of cormels @ Rs. 50 per kg (1 kg= 350 cormels).

Table 2: Effect of plant growth regulators on economics and benefit cost ratio

Sr. no.	Treatment	Gross realization (₹)	Total cost of cultivation (₹)	Net realization (₹)	Benefit Cost ratio (BCR)
1	Without soaking	723404	451236.9	272167	1.60
2	Soaking in 50 ppm GA_3	1303942	455196.9	848745	2.86
3	Soaking in 100 ppm GA_3	1564730	458816.9	1105913	3.41
4	Soaking in 150 ppm GA_3	1210398	462436.9	747961	2.62
5	Soaking in 200 ppm GA_3	1466651	466056.9	1000594	3.15
6	Soaking in 50 ppm NAA	1027279	451807.65	575472	2.27
7	Soaking in 100 ppm NAA	954712	452038.4	502674	2.11
8	Soaking in 200 ppm NAA	1025012	452499.9	572512	2.27
9	Soaking in 300 ppm NAA	1237611	452961.4	784649	2.73
10	Soaking in 25 ppm BA	1159941	453701.9	706239	2.56
11	Soaking in 50 ppm BA	1177516	455826.9	721689	2.58
12	Soaking in 100 ppm BA	1220036	460076.9	759959	2.65
13	Soaking in 150 ppm BA	1071500	464326.9	607173	2.31

Data (Table 2) pertaining to the economics of treatments shows that maximum gross income (₹1564730) was observed in treatment T_3 (Soaking in 100 ppm GA_3) followed by T_5 (Soaking in 200 ppm GA_3) and minimum (₹723404) in T_1 (Control). Similarly, maximum net income (₹1105913) in the treatment T_3 (Soaking in 100 ppm GA_3) and minimum (₹272167) in T_1 (Control). On the other hand, highest benefit: cost ratio (3.41) was worked out in the treatment T_3. Therefore, the treatment T_3 (Soaking in 100 ppm GA_3), rated as most effective treatment.

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