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RESPONSE OF PSB INOCULATION AND GIBBERELLIC ACID ON VEGETATIVE GROWTH AND FLOWERING OF TUBEROSE (*POLIANTHES TUBEROSA* L.) CV. DOUBLE

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ABSTRACT

A potted experiment on response of phosphate solubilizing bectarea (PSB) and gibberellic acid (GA_3) on growth, flowering and bulb production of tuberose cv. Double was conducted at Horticulture research farm, Dept. of Horticulture, J. V. College, Baraut, Baghpat. The present experiment was investigate with optimum concentration of six treatment levels, two levels of PSB inoculation viz. P_1 (PSB 10 ml/ pot), P_2 (PSB 15 ml/pot), three levels of gibberellic acid concentration G_1 (GA_3 150 ppm), G_2 (GA_3 200 ppm), G_3 (GA_3 250 ppm), one was control (P_0G_0) and their treatment combinations appereciably improved the growth and flowering attributes. Maximum number of sprouts/bulb, number of leaves/plant, length of spike (cm), number of spikes/plant, number of flowers/spike and weight of spike (g) were recorded with the treatment of P_2 level of PSB inoculation but G_3 level of GA_3 improved better results as compare P_2 and over control. However, G_2 treatment significantly obtained the minimum days taken for sprouting, first flower initiation and highest production of bulbs/plant whereas, interection treatment significantly improved the above parameters.

Key Words **: Tuberose, PSB, GA3, Pots, Bulbs, Growth, Flowering**

Tuberose *Polianthes tuberosa* L. is an important flowering plant which is belongs to the family Amaryllidaceae. This plant is classified as a bulb crop and commonly known as Rajnigandha. The flowering stalk emerges from the centre of cluster of leaves and flower borne in pair with pure wavy white color. In India tuberose commercially cultivated in WB, TN, KN, MH, UP etc. and many tropical and sub-tropical areas and abroad. The bio-fertilizers is most important among the factors, which effects efficiency of biological phosphorus fixation. In this regards, phosphate solubilizing bectaria (PSB) as a form of phosphorus uptake was found to improve by the seed inoculation due to the formation of organic acids in root zone needed for mobilization of inorganic phosphates in soil. Apart from the nutritional aspects growth regulating chemical GA_3 are increasing by used in horticultural crops for quantitative and qualitative improvement. However, the responses of these treatments very considerably not only amongest the crops but also with the same species. The rate, time

and mode of application of these chemicals gibberellic acid are the important deciding factors for exploiting the maximum potential of the economic product of the crop.

MATERIALS AND METHODS

The present investigation on tuberose cv. Double was carried out at horticulture research farm, Department of Hoticulture, Janta Vedic College, Baraut, Baghpat. The experiment laidout in CRD with three replications in 36 pots. The main object of experiment was to assess the effect of six treatment levels of phosphate solubilizing bectaria (PSB) inoculation with two levels viz. P_1 (10 ml/pot), P_2 (15 ml/pot), gibberellic acid (GA_3) concentration with three bulbs treatment levels such as G_1 (150 ppm), G_2 (200 ppm), G_3 (250 ppm), one was control and their treatment combinations. The well developed average bulbs were used for the present experiment. The bulbs of tuberose cv. Double with 32 gm weight were obtained from division of floriculture, IARI, New Delhi. All experimental propagated bulbs inoculated by PSB treatment and treated with GA_3 application of respected doses. The pot were selected an average size 20.5×20.2×16 cm with one bottem drainage hole. The data were recorded and analysed at the vegetative growth and reproductive phases on different attributes with the help of analysis of variance and conclusion were drawn on significance differences between the treatment and mean C.D. at 5% level.

RESULTS AND DISCUSSION

A perusal of the data presented in the table 1 clearly indicated significant effect on various growth parameters. PSB inoculation showed frquently improved vegetative growth with the increasing of PSB concentration.

Table 1 : Response of PSB inoculation and GA_3 on vegetative growth behaviour of tuberose cv. Double

Treatment	Days taken for sprouting	Number of sprouts/bulb	Number of leaves/plant	Length of leaves (cm)	Days taken for first flower initiation
P_0G_0 (control)	13.49	2.67	24.58	27.87	102.50
PSB inoculation					
P_1 (10 ml/pot)	12.33	3.00	25.44	30.43	92.22
P_2 (15 ml/pot)	11.86	3.56	26.31	34.20	90.62
GA_3 conc.					
G_1 (150 ppm)	11.67	3.67	27.77	36.27	88.55
G_2 (200 ppm)	10.77	3.99	28.25	36.73	85.89
G_3 (250 ppm)	11.05	4.12	29.78	38.80	87.30
S.E. ±	0.332	0.186	0.105	0.357	0.539
C.D. (P=0.05)	0.471	0.265	1.263	1.460	1.231

Table 2 : Interaction effect of PSB and GA_3 on vegetative growth behaviour of tuberose cv. Double

Treatment	Days taken to sprouting	Number of sprout/bulb	Number of leaves/plant	Length of leaves (cm)	Days taken for first flower initiation
P_0G_0	13.49	2.67	24.58	27.87	102.50
P_1G_1	11.20	3.84	28.37	36.77	87.31
P_1G_2	10.40	4.16	29.22	37.46	83.30
P_1G_3	10.87	4.33	30.12	39.11	85.93
P_2G_1	11.05	4.00	29.56	37.43	86.42
P_2G_2	10.00	4.29	30.41	39.55	82.37
P_2G_3	10.63	4.88	31.32	40.61	84.66
SEm+_	0.016	0.239	0.382	0.019	0.834
C. D. at 5%	1.112	0.312	1.164	1.443	1.621

Minimum days taken for sprouting (11.86) were recorded over uninoculated control when plant treated with P_2 (15 ml/pot). However, very minimum days required for sprouting was obtained (10.77) uner the treatment of G_1 (GA_3 200 ppm) as compare control (13.49). Maximum number of sprouts/bulb (4.12) and more number of leaves/plant (29.78) were counted with treatment of G_1 (GA_3 250 ppm) over them all respected concentration of PSB and GA_3. These results confirmed with the findings of Tyagi, A. K. and Singh, C. N. (2006). Significantly increased maximum length of leaves were recorded (38.80 cm) as compare over control, while minimum days taken for first flower initiation (85.89) were recorded with concentration of GA_3 200 ppm.

Interaction Effect of PSB and GA_3 :

The interaction results between PSB and GA_3 was found to be significant. The recorded data presented and depicted through diagram in table 2. Interaction application marked significantly effect on vegetative growth parameters. The minimum days required for sprouting (10.00) and first flower initiation (82.37) were obtained with treatment combination P_2G_2 (PSB 15 ml/ pot and GA_3 200 ppm) as compare over control. However, maximum number of sprouts/bulb (4.88), number of leaves/plant (31.32) and length of leaves (40.61 cm) were recorded under treatment P_2G_3 (PSB 15 ml/pot and GA_3 250 ppm)over control and all other applied treatment. The tendency of PSB inoculation and GA_3 concentration promoted vegetative growth consistently.

Flowering attributes :

In the context of present investigation various flowering parameters were significantly improved and recorded data was presented in table 3. The maximum number of flowers/spike (39.54) and highest length of

Table 3 : Response of PSB inoculation and GA_3 on flowering behaviour of tuberose cv. Double

Treatment	Number of flowers/spike	Length of spike (cm)	Number of spikes/plant	Weight of spike (g)	Number of bulbs/plant
P_0G_0 (control)	26.15	66.60	1.87	61.75	8.56
PSB Inoculation					
P_1 (10 ml/pot)	32.06	75.66	2.12	64.84	10.12
P_2 (15 ml/pot)	33.65	80.62	2.34	68.72	12.36
GA_3 Concentration					
G_1 (150 ppm)	35.17	83.12	2.59	70.22	14.44
G_2 (200 ppm)	37.63	85.14	2.85	73.16	18.57
G_3 (250 ppm)	39.54	87.33	3.00	75.38	16.29
S.E. ±	0.424	0.051	0.064	0.218	0.421
C.D. (P=0.05)	1.016	0.176	0.172	1.245	1.082

Table 4: Interaction effect of PSB and GA_3 on flowering behaviour of tuberose cv. Double

Treatment	Number of flowers/plant	Length of spike (cm)	Number of spike/plant	Weight of spike (g)	Number of bulbs/plant
P_0G_0	26.15	66.60	1.87	61.75	8.56
P_1G_1	36.34	84.77	2.71	71.43	15.34
P_1G_2	38.00	86.29	2.94	74.67	19.20
P_1G_3	39.18	88.90	3.33	76.52	17.53
P_2G_1	37.51	85.45	2.83	72.25	16.71
P_2G_2	39.78	87.73	3.12	75.75	20.16
P_2G_3	40.01	89.22	3.56	77.61	18.92
S.E. ±	0.213	0.334	0.026	0.543	1.212
C.D. (P=0.05)	1.231	0.202	0.265	1.126	1.467

spike (87.33 cm) were observed with the treatment of G_3 (GA_3 250 ppm) while minimum number of flowers/ spike (26.15) and length of spike (66.60 cm) was obtained under control as compare PSB inoculation treatment level P_2 (33.65) and (80.62 cm). The application of GA_3 concentration G_3 (250 ppm) improved signiicantly number of spikes/plant (3.00) and highest weight of spike/plant (75.38 g) over control. However, PSB inoculated plant observed more number of spike/plant (2.34) and weight of spike (68.72 g) at par with P_2 (15 ml/pot). Highest number of bulbs/plant were recorded (18.57) with G_2 and (12.36) was obtained with treatment of PSB inoculation P_2 whereas, minimum number of bulbs/plant noted under control. Similar findings were also observed by Srivastava, R. and Govil, M. (2007).

Interaction effect of PSB and GA_3 :

The recorded interaction data between PSB and GA_3 clearly showed and depicted in table 4. The contrived effect was found to be significant and P_2G_3 produced more number of flower/plant (40.01), maximum length of spike (89.22 cm), highest weight of spike (77.61 g) and more number of spikes/plant (3.56) were recorded as compare control and all treatment levels of PSB and GA_3. However, more number of bulbs/plant were counted (20.16) under treatment combination P_1G_2 while, minimum number of bulbs/plant was collected (8.56) under control.

Conclusion :

According to the recorded data of present investigation it is concluded that PSB inoculation @ 15 ml/pot and GA_3 concentration @ 250 ppm was found effective in increasing the vegetative growth, flowering and bulb production of tuberose cv. Double. The G_3 (250 ppm) and P_2 (15 ml/pot) was significantly observed highest number of spike, length of spike, weight of spike, number and length of leaves etc. whereas, the treatment of G_2 (200 ppm) decreased required days for sprouting ,first flower initiation and maximum number of bulbs as compare control. The contrived effect was also found beneficial.

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