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Response of elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] to different chemicals

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Abstract
An investigation was carried out to study the influence of chemicals on growth and yield parameters in elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] cv. Gajendra with soaking of setts for one hour in different chemicals. The experiment was laid out in Randomized Block Design consisted eleven treatments (Thiourea: 200 and 300 ppm; KNO_3: 500 and 750 ppm; GA_3: 100 and 200 ppm; CCC: 50 and 75 ppm; MH: 250 and 500 ppm and water soaked i.e. control) which were replicated thrice. The results showed that the minimum number of days to first emergence (20.00 days) and 50 % emergence (31.33 days) were recorded under T_1 (Thiourea - 200 ppm) and T_2 (Thiourea 300 ppm) treatments, respectively. Plant height, culm girth and petiole length showed non-significant difference at 90 DAP. Maximum plant height at 120 DAP (63.73 cm) and at 150 DAP (63.29 cm) was gained in T_1 treatment. Maximum culm girth (15.57 cm) at 120 DAP and 16.30 cm at 150 DAP was also recorded in same treatment. Similarly, petiole length at 120 DAP (52.80 cm) and at 150 DAP (53.67 cm) was found highest in same T_1 treatment. Canopy spread in both the direction was found non-significant except at 120 DAP in E-W direction, having maximum spread of 72.13 cm in T_2 treatment. Maximum corm yield (30.15 t/ha) was also recorded in T_1 treatment.

Keywords: Plant growth regulators, chemicals, soaking treatment, elephant foot yam

Introduction
Root and tuber crops are the second group of cultivated species after cereals in tropical countries. They are capable to produce higher yield with minimum inputs even in adverse climatic conditions and poor soils. Among the tuber crops, elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] belonging to family Araceae is an important tuber crop of the tropical and subtropical countries. Because of its higher yield potential, higher biological efficiency, good culinary properties, medicinal utility and therapeutic values it is referred as "King of Tuber Crops".

Different chemicals/PGRs play a regulatory role in many physiological processes associated with growth and development of plants. The use of different chemicals is of considerable interest in different fields of agriculture and horticulture. Chemicals have been used for various beneficial effects such as promoting vegetative growth, yield and increasing number of flowers. The efficiency of chemicals varies under different concentrations, methods and time of application. There are many reports which indicate that application of chemicals/PGRs enhanced plant growth and crop yield. Very less information is available in this regard, the present investigation was framed to know their effect on growth and yield of EFY cv. Gajendra.

Materials and Methods
The present experiment was carried out at Regional Horticultural Research Station, Navsari Agricultural University, Navsari (Gujarat) during the year 2017-18. The experiment was conducted in Randomized Block Design (RBD) with three replications. The setts of 250 g (± 50 g) were soaked for one hour in different solutions as per treatments *viz.*, Thiourea 200 ppm (T_1), Thiourea 300 ppm (T_2), KNO_3 500 ppm (T_3), KNO_3 750 ppm (T_4), GA_3 100 ppm (T_5), GA_3 200 ppm (T_6), CCC 50 ppm (T_7), CCC 75 ppm (T_8), MH 250 ppm (T_9), MH 500 ppm (T_{10}) and Water soaked *i.e.* control (T_{11}). The treated setts were shade dried for 3 days and planted at 60 cm x 60 cm distance on 22nd March, 2017. Intercultural operations were carried out as per requirement. FYM (25 t/ha) was incorporated at the time of soil preparation.

Recommended dose of 100: 50: 150 NPK kg/ha was applied out of which 50 % N, 50 % K_2O with 100% P_2O_5 was applied at the time of planting. Another 25% N and K_2O was applied at 30 DAP and remaining 25% of N and K_2O was applied 60 DAP.

Result and Discussion

Growth parameters like days required for first and 50 % emergence, plant height, canopy spread, culm girth, petiole length, number of leaflets per plant and days required for senescence were influenced by soaking of setts in different chemicals. Data presented in table-1, revealed significant differences in days required for first and 50 % emergence. The minimum number of days to first emergence (20.00 days) was recorded under T_1 (Thiourea - 200 ppm) treatment which was statistically at par with almost all the treatments in inducing early emergence except T_8, T_{10} and T_{11} treatments. The minimum number of days (31.33 days) to 50 per cent emergence was recorded under T_2 (Thiourea - 300 ppm) treatment which was statistically at par with T_1 and T_3 (Thiourea - 200 ppm and KNO_3 - 500 ppm, respectively) treatments. These results are in conformity with the findings of Nedunchezhiyan *et al.* (2011) [7] who reported that among the growth regulators, thiourea was most effective in inducing earliness in first sprouting. Similar results have been reported by Mukherjee *et al.* (2009) [5] and Bhagavan (2005) [1], who reported that foliar spraying of KNO_3 (1-2 per cent) and thiourea (0.5-1.0 per cent) recorded early and increased sprouting of seed corms of elephant foot yam. Naveen *et al.* (2011) [6] reported that reduction in number of days for sprouting due to thiourea can be attributed to two reasons. The first being their effect in reducing ABA levels, the prime factor imposing dormancy in corms and cormels and there by changing the endogenous hormonal balance in favour of promoters. Secondly, increase in quantum of alternate respiration mediated by alternate oxidase (AOX).

Looking to the data given in table-1 and table-2, revealed that at 90 DAP the difference in most of the growth parameters *viz.*, plant height, canopy spread in both directions, culm girth and petiole length was found non significant. The data given in table-1 on plant height at 120 and 150 DAP showed that maximum plant height (63.73 cm and 63.29 cm, respectively), was recorded in treatment T_1 which was statistically remained at par with T_2, T_3, T_5, T_4 and T_6 treatments. Similar results were reported by Ravi *et al.* (2009) [8] and Das *et al.* (1995) [2] in elephant foot yam. The maximum petiole length (52.80 cm at 120 DAP and 53.67 cm at 150 DAP) was also measured in same T_1 treatment which was remained at par with T_2, T_3, T_5 and T_4 treatments at both growth stages (Table-1). Significant effect on culm girth was observed at 120 DAP and 150 DAP (Table-1). At both growth stages maximum culm girth (15.57 cm and 16.30 cm, respectively) was recorded in T_1 treatment which was statistically remained at par with T_2, T_3, T_5 and T_6 treatments. The grand growth period involving high physiological activity synchronized with maximum nutrient uptake may have aided to increase plant height and thereafter at 150 DAP marginal increase in plant height may be attributed to the rapid increase in corm growth and also because of diversion of more photosynthates from source (leaves) to sink (corm) which is most common phenomenon in almost all root and tuber crops Ravi *et al.* (2009) [8].

Among all three growth stages *i.e.* 90, 120 and 150 DAP and from both the direction of canopy spread, the significant result was obtained only at 120 DAP in E-W direction (Table-1) where maximum spread (72.13 cm) was recorded in T_2 (Thiourea 300 ppm) treatment. These results corroborate the findings of Mondal *et al.* (2005) [4]. Canopy spread was presumably due to early sprouting and better root ramification as reported by Sen and Das (1991) [11].

Different soaking treatment had significant effect on number of leaflets per plant at all three growth stages. At the age of 90 days the maximum number of leaflets (297.53) per plant was recorded with T_1 treatment but statistically remained at par with T_2, T_3 and T_5 treatments. After 120 DAP the maximum number of leaflets (310.80) per plant was obtained from T_2 treatment which was remained at par with T_1, T_3, T_5, T_4 and T_6 treatments. The maximum number of leaflets (311.93) was recorded in T_1 treatment at 150 DAP. This was statistically remained at par with T_2, T_3, T_5, T_4 and T_6 treatments. Shanu *et al.* (2013) [12] observed that thiourea maintained large number of green leaves and this was supported by the results of Sahu *et al.* (1993) [10] also.

The maximum number of days (191.00 days) required for first senescence was recorded in treatment T_2 (Thiourea - 300 ppm) which was statistically remained at par with treatment T_1 (Thiourea - 200 ppm) which took only 0.67 less days for first senescence. The maximum number of days (200.67 days) required for 50 per cent senescence was recorded in treatment T_2 (Thiourea - 300 ppm) and was statistically remained at par with treatment T_1 (Thiourea - 200 ppm) which took 199.67 days for 50 % senescence. The longest period required for complete senescence (205.00 days) was recorded with T_1 (Thiourea - 200 ppm) treatment but it was statistically remained at par with T_2 and T_3 treatments which required 204.33 days and 204.00 days, respectively for complete senescence. It may be due to that thiourea might concomitantly increase cell metabolic rate and retard senescence by protecting and preventing chloroplasts from senescing and retarding chlorophyll destruction and/or increase chlorophyll biosynthesis this was supported by the results of Jocelyn, 1972.

The highest corm yield of 30.15 t ha^{-1} was produced by T_1 treatment but statistically remained at par with T_2, T_3, T_5, T_4 and T_6 treatments which produced 28.41 t ha^{-1}, 28.07 t ha^{-1}, 28.07 t ha^{-1}, 27.26 t ha^{-1} and 27.08 t ha^{-1}, respectively. The realization of corm yield in elephant foot yam depends on the amount of dry matter translocated to the sink which is considered as a major factor leading to final yield. Yield of elephant foot yam also relies on availability of solar radiation, photosynthetic capacity and duration. Sahu and Singh (1995) [9] opined that thiourea delay senescence and enhance photo synthetic efficiency leading to increased growth and yield of plants.

Conclusion

On the basis of present findings inferred that effect of chemicals had highly influenced on vegetative and yield parameters. The pre-planting soaking of setts in thiourea @ 200 ppm was found better for boosting up the production of elephant foot yam cv. Gajendra.

Table 1: Effect of soaking treatments on growth parameters of elephant foot yam cv. Gajendra

Treatments	Growth parameters													
	Days required for emergence		Plant height			Petiole length			Culm girth			Canopy spread E-W		
	First emerg.	50 % emerg.	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP
T_1	20.00	32.00	51.00	63.73	63.29	36.20	52.80	53.67	13.23	15.57	16.30	69.73	70.00	70.60
T_2	20.33	31.33	49.07	63.17	62.53	35.06	51.87	52.73	12.23	14.67	15.50	65.00	72.13	69.33
T_3	20.67	37.00	49.00	60.67	62.03	34.60	49.13	52.67	12.37	14.43	15.30	64.33	69.27	66.67
T_4	21.67	39.33	46.27	59.00	59.67	32.20	48.73	49.93	12.10	14.20	14.90	60.93	67.00	64.33
T_5	20.67	38.00	47.33	59.80	60.23	32.06	48.80	50.60	12.23	14.40	15.07	62.80	68.13	65.33
T_6	21.67	40.67	45.27	58.07	57.80	30.30	47.73	48.27	11.87	13.70	14.40	60.40	67.00	64.00
T_7	22.67	42.33	41.67	52.07	52.83	28.03	41.47	43.53	11.17	12.33	13.10	55.33	63.27	63.33
T_8	32.67	47.33	38.80	49.80	50.13	25.80	37.73	39.73	10.63	11.97	12.77	54.13	59.20	61.13
T_9	22.33	40.67	40.93	53.47	53.67	30.60	42.90	44.80	11.40	12.53	13.43	57.00	63.47	63.67
T_{10}	24.67	46.00	38.93	51.87	52.60	28.00	39.00	43.33	10.77	12.03	12.80	55.20	59.47	61.67
T_{11}	32.67	49.33	43.27	54.27	54.47	26.00	43.77	44.80	10.60	13.20	14.00	54.06	64.40	63.67
SEm ±	1.23	2.12	2.83	2.86	2.82	2.38	2.82	2.59	0.66	0.73	0.73	4.30	2.73	2.72
C. D. (5%)	3.62	6.26	NS	8.44	8.33	NS	8.31	7.63	NS	2.16	2.16	NS	8.06	NS
CV %	8.98	9.10	10.98	8.70	8.55	13.40	10.65	9.40	9.84	9.36	8.84	12.45	7.19	7.25

Table 2: Effect of soaking treatments on growth parameters and yield of elephant foot yam cv. Gajendra

Treatments	Growth parameters									Yield (t/ha)
	Canopy spread N-S			Number of leaflets			Days required for senescence			
	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP	1st	50 %	Complete	
T_1	68.33	71.40	73.00	297.53	301.00	311.93	190.33	199.67	205.00	30.15
T_2	63.60	70.93	72.87	294.67	310.80	303.93	191.00	200.67	204.33	28.41
T_3	64.93	70.00	72.00	293.47	285.53	288.93	187.67	197.33	204.00	28.07
T_4	62.13	66.47	69.67	241.00	279.33	283.87	188.67	198.33	201.00	27.26
T_5	62.20	68.67	70.33	286.13	283.93	286.33	185.67	195.00	202.67	28.07
T_6	60.87	68.47	68.67	252.40	275.07	283.87	186.33	196.00	201.33	27.08
T_7	54.80	64.47	67.13	233.00	246.33	253.27	188.00	197.33	202.00	25.35
T_8	54.46	61.33	65.33	204.47	242.27	244.53	188.67	198.33	202.67	24.42
T_9	56.93	64.80	67.67	233.60	258.40	262.47	188.33	198.00	203.00	26.04
T_{10}	54.80	62.87	65.33	211.13	242.33	250.60	189.00	198.67	203.33	25.29
T_{11}	53.53	65.60	68.33	199.47	274.67	271.87	185.00	194.67	200.67	23.73
SEm ±	3.84	2.72	2.94	15.07	14.94	13.49	0.32	0.35	0.40	1.24
C. D. (5%)	NS	NS	NS	44.47	44.08	39.80	0.94	1.04	1.19	3.67
CV %	11.14	7.06	7.38	10.46	9.49	8.45	0.29	0.31	0.35	8.06

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