EFFECT OF PRE-PLANTING TREATMENTS OF MINISETT CORMS WITH DIFFERENT ORGANIC AND INORGANIC SUBSTANCES ON SPROUTING AND YIELD OF ELEPHANT FOOT YAM (Amorphophallus paeoniifolius Dennst.)

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ABSTRACT

Results over two years indicated that among the different pre-planting treatments thiourea at 400 ppm (10.00 days) recorded minimum number of days to first emergence and maximum sprouting per cent (97.22 per cent) which showed 24.26 per cent increase in sprouting over control treatment. The minimum number of days to 50 per cent emergence was recorded under KNO_3 at 250 ppm (33.33) followed thiourea at 400 ppm (33.50). The pre-planting treatment of minisetts with thiourea at 400 ppm resulted highest corm yield (12.57 t ha^{-1}) and this treatment showed maximum increase in corm yield (31.07 per cent) over control treatment.

Keywords: Elephant foot yam, sprouting, yield, thiourea, KNO_3, GA_3

INTRODUCTION

Elephant foot yam (*Amorphophallus paeoniifolius* Dennst.) is one of the important tuber crops widely cultivated in sub-tropical regions for its underground food reserves. Traditionally, elephant foot yam is propagated through corms and cormels. Whole corm or cut corm pieces weighing about 500 g to 750 g with a part of apical meristem is mainly used as planting material. A great portion (about 25 per cent) of the harvested produce is lost as source of planting material. Gajendra variety of elephant foot yam is high yielding, free from acridity and it is popularly grown all over India as well as Chhattisgarh. Elephant foot yam tubers remain dormant for 2-3 months (Kay, 1987 and Anon., 1993). As a result of this, planting and harvesting are to be done at a particular time of the year. Hence it necessitates to break the dormancy by use of organic and inorganic substances so that the planting materials could be made ready for planting early in the season to ensure early yields and lucrative

market prices. However, very little information is available on the effect of dipping of seed corms (minisetts) before planting with organic and inorganic substances. Therefore, the present investigation entitled "Studies on the effect of pre-planting treatments of corms (minisetts) with different organic and inorganic substances on sprouting of elephant foot yam under agro-climatic condition of Chhattisgarh plains".

MATERIALS AND METHODS

The experiment was conducted at Research and Instructional Farm of Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during *Kharif* season of the years2010-11 and 2011-12.The experiments were laid out in Randomized Block Design (RBD) with fifteen treatments and three replications.The treatment consisted of different concentrations of organic and inorganic substances which were applied as pre-planting soaking of corms *i.e.*T_1 (cow dung 50 % + water 50 %),T_2 (cow urine 50 % + water 50 %),T_3 (cow dung 25 % + cow urine 25 % + water 50 %),T_4 (cow dung 37.5 % + cow urine 37.5 % + water 25 %),T_5 (cow dung 50 % + cow urine 50 %), T_6 (thiourea at 200 ppm), T_7 (thiourea at 300 ppm),T_8 (thiourea at 400 ppm), T_9 (KNO_3 at 250 ppm),T_{10} (KNO_3 at 500 ppm),T_{11} (KNO_3 at 750 ppm),T_{12} (GA_3 at 100 ppm),T_{13} (GA_3 at 200 ppm), T_{14}(GA_3 at 300 ppm) and T_{15} (control treatment) *i.e.* soaking of minisetts in water.

The observations on days taken to first emergence of corms from date of planting was recorded from each treatment and expressed in days. The observations on days taken to 50 per cent emergence of corms from date of planting was recorded and expressed in days. The sprouting per cent was recorded after complete crop emergence. The sprouting per cent or the plant emergence per cent was calculated with the help of following formula:

$$\text{Sprouting per cent} = \frac{\text{Total number of plants emerged}}{\text{Total number of corms planted}} \times 100$$

The observations on corm yield per plot was recorded at the time of harvesting in kilograms and average yield per hectare was computed and expressed in tonnes.

RESULT AND DISCUSSION

Table 1 indicated that the days taken to first emergence and 50 per cent emergence. The highest response in inducing early emergence (10.00 days, pooled data) was noted with T_8 (thiourea at 400 ppm) followed by T_5 *i.e.* cow dung 50 % + cow urine 50 % and T_9 *i.e.* KNO_3 at 250 ppm (10.17 days, pooled data). The lower concentration of thiourea at 300 ppm was the next best treatment which recorded 10.50 (pooled data) days to first emergence.

Nedunchezhiyan and Mohankumar (1994) and Kumar *et al*. (1998) reported that growth regulators were found to hasten sprouting in elephant foot yam. These results are in conformity with the findings of Nedunchezhiyan *et al*. (2011) 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) in elephant foot yam.

The enhanced sprouting of bottom corm setts of elephant foot yam by application of thiourea and potassium nitrate was also observed by Dhua *et al*. (1988). Das *et al*. (1995) indicated that thiourea (300 ppm) and KNO_3 (750 ppm) were found more effective to initiate sprouts over other concentrations of respective chemicals. Kumar *et al*. (2011) reported that reduction in the number of days for sprouting and sprouting percentage due to thiourea can be attributed to two reasons. The first being their effect in reducing the ABA levels, the prime factor imposing dormancy in corms and cormels and thereby changing the endogenous hormonal balance in favour of promoters. Secondly, increase in quantum of alternate respiration due to these treatments. Bhagavan (2005) 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.

Similar trend was noticed with regards to days to 50 per cent emergence. The minimum number of days to 50 per cent emergence was recorded under T_9 *i.e.* KNO_3 at 250 ppm (33.33) followed by T_8, $T_7$and T_6 (thiourea at 400, 300 and 200 ppm) *i.e.* 33.50, 34.17 and 36.00, respectively. The greater number of days to 50 per cent emergence was observed under T_{12}, T_{13} and T_{14} (GA_3at all the concentrations *i.e.* 100, 200 and 300 ppm) from 43.50 to 43.83 which were statistically at par with T_{15} (control treatment) *i.e.* 44.50.

Nedunchezhiyan *et al*. (2011) reported the variations in number of days to 50 per cent and 100 per cent sprouting due to pre-planting application of growth regulators. Kumar *et al*. (2011) showed that thiourea at 2 per cent (18.50) was highly effective in reducing the number of days to 50 per cent sprouting in gladiolus.

Appraisal of data presented in Table 2 to 4 revealed that sprouting of minisetts increased with the duration of planting and practically seized beyond 60 days after planting (DAP) *i.e.* from 15 days till 60 DAP. At final stage of observations, pre-planting treatment of minisetts enhanced sprouting (15.98 to 24.26 per cent) under all the treatments over control (soaking of minisetts in water) and the maximum sprouting per cent at 60 DAP was recorded under T_8 *i.e.* thiourea at 400 ppm (97.22 per cent, pooled data) followed by T_7 *i.e.* thiourea at 300 ppm (96.76 per cent, pooled data), T_6 *i.e.* thiourea at 200 ppm and T_9 *i.e.* KNO_3 at 250 ppm (95.37 per cent, pooled data). The minimum sprouting per cent at this stage was obtained under T_{15} *i.e.* control treatment (78.24 per cent, pooled data) followed by T_{13} *i.e.* GA_3 at 200 ppm (79.17 per cent, pooled data), T_{14} *i.e.* GA_3 at 300 ppm (79.63 per cent, pooled data) and T_{12} *i.e.* GA_3 at 100 ppm (80.09 per cent, pooled data).

Dhua *et al*. (1988) reported that different growth substances were found to increase sprouting percentage in elephant foot yam. The findings are with the agreement of Das*et al*.(1995) who reported that soaking of corm setts withthiourea and KNO_3 increased sprouting percentage in elephant foot yam. Effect of thiourea in increasing the alternate respiration might have resulted in breaking of dormancy and increasing sprouting percentage as reported by Kumar *et al*. (2011). Similar results have been reported by Bhagavan(2005), Kumar *et al*. (1998) and Basiouny (1983).

The data on corm yield (t ha^{-1}) are presented in Table 5 and revealed that the pre-planting treatments of corm setts of elephant foot yam with different organic and inorganic substances registered an increased in average corm yield from 9.41 to 31.07 per cent over control treatment (soaking of minisetts in water) and the highest corm yield (12.24 to 12.57 t ha^{-1}, pooled data) was obtained with thiourea at all the concentrations (200, 300 and 400 ppm) which were found to be statistically equal in increasing the corm yield. These were closely followed by KNO_3 at 250 ppm (12.11 t ha^{-1}, pooled data). In general, all the cow dung based pre-planting treatments (T_1 to T_5) gave better response to productivity due to enhanced sprouting but were found comparatively less superior to rest of the treatments except GA_3.

Mondal *et al*. (2005) obtained the highest corm yield of elephant foot yam with cow dung slurry treatment because of improvement in sprouting and vegetative growth of the crop plant. In the present study the corm yield did not show much improvement under cow dung

based treatment in comparison to rest of treatments which might probably be due to comparatively low percentage of sprouting.

The results in relation to thiourea and KNO_3 in increasing the corm yield are in conformity of Das *et al*. (1995) who reported outstanding performance of these substances in increasing the corm yield. The increase in corm yield in these treatments might be ascribed to comparatively greater individual growth and development of plants due to early sprouting and vigour and in the present study, corm yield plant^{-1} was greater under these treatments which resulted into total corm yield.

CONCLUSION

Thiourea at 400 ppm was best treatment to inducing early sprouting in elephant foot yam. T_7 and T_8 (thiourea at 300 and 400 ppm) and T_9 (KNO_3 at 250 ppm) were among the best pre-planting treatments which were statistically equal among each other in reducing the number of days to 50 per cent emergence. Thiourea at 400 ppm best treatment to increasing sprouting per cent and maximum corm yield (t ha^{-1}). These treatment was also increase in per cent corm yield over control treatment.

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Table 1: Effect of pre-planting treatments of minisett corms with different organic and inorganic substances on days to first emergence and days to 50 per cent emergence in elephant foot yam cv. Gajendra

Treatments	Days to first emergence			Days to 50 per cent emergence		
	2010-11	2011-12	pooled	2010-11	2011-12	pooled
T_1 : Cow dung slurry (50%) + Water (50%)	12.00	12.33	12.17	34.67	41.00	37.83
T_2 : Cow urine (50%) + Water (50%)	13.00	12.67	12.83	35.67	39.67	37.67
T_3 : Cow dung (25%) + Cow urine (25%) + Water (50%)	11.00	11.67	11.33	33.67	38.67	36.17
T_4 : Cow dung (37.5%) + Cow urine (37.5%) + Water (25%)	11.67	12.00	11.83	34.00	41.33	37.67
T_5 : Cow dung (50%) + Cow urine (50%)	10.00	10.33	10.17	33.67	38.67	36.17
T_6 : Thiourea at 200 ppm	11.00	10.67	10.83	33.67	38.33	36.00
T_7 : Thiourea at 300 ppm	10.67	10.33	10.50	31.00	37.33	34.17
T_8 : Thiourea at 400 ppm	10.00	10.00	10.00	29.00	38.00	33.50
T_9 : KNO_3 at 250 ppm	10.00	10.33	10.17	28.33	38.33	33.33
T_{10} : KNO_3 at 500 ppm	10.67	11.00	10.83	34.00	38.33	36.17
T_{11} : KNO_3 at 750 ppm	11.00	11.33	11.17	33.67	39.00	36.33
T_{12} : GA_3 at 100 ppm	13.67	14.00	13.83	42.67	44.33	43.55
T_{13} : GA_3 at 200 ppm	15.00	15.33	15.17	43.33	44.33	43.83
T_{14} : GA_3 at 300 ppm	14.67	15.00	14.83	43.00	44.00	43.50

T_{15} : Water (Control)	16.33	16.67	16.50	43.67	45.33	44.50
CD	1.66	1.63	1.30	4.22	2.40	2.68
SEm ±	0.57	0.56	0.45	1.46	0.83	0.92

Table 2: Effect of pre-planting treatments of minisett corms with different organic and inorganic substances on sprouting per cent at 15, 20, 25, 30 and 35 DAP in elephant foot yam cv. Gajendra

Treatments	Sprouting (%)														
	15 DAP			20 DAP			25 DAP			30 DAP			35 DAP		
	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled
T_1 : Cow dung slurry (50%) + Water (50%)	#12.96 (3.67)	7.41 (2.81)	10.19 (3.27)	23.15	18.52	20.83	33.33	28.70	31.02	39.81	31.48	35.65	45.37	38.89	42.13
T_2 : Cow urine (50%) + Water (50%)	9.26 (3.12)	10.19 (3.27)	9.72 (3.20)	23.15	20.37	21.76	31.48	29.63	30.56	41.67	32.41	37.04	45.37	39.81	42.59
T_3 : Cow dung (25%) + Cow urine (25%) + Water (50%)	15.74 (4.03)	13.89 (3.79)	14.81 (3.91)	25.93	22.22	24.07	35.19	29.63	32.41	43.52	30.56	37.04	51.85	40.74	46.30
T_4 : Cow dung (37.5%) + Cow urine (37.5%) + Water (25%)	14.81 (3.91)	12.04 (3.54)	13.43 (3.73)	28.70	18.52	23.61	36.11	28.70	32.41	42.59	30.56	36.57	50.00	38.89	44.44
T_5 : Cow dung (50%) + Cow urine (50%)	16.67 (4.14)	12.96 (3.67)	14.81 (3.91)	29.63	20.37	25.00	38.89	29.63	34.26	43.52	32.41	37.96	50.93	41.67	46.30
T_6 : Thiourea at 200 ppm	17.59 (4.25)	16.67 (4.14)	17.13 (4.20)	32.41	25.00	28.70	37.96	32.41	35.19	44.44	36.11	40.28	52.78	43.52	48.15
T_7 : Thiourea at 300 ppm	14.81 (3.91)	13.89 (3.79)	14.35 (3.85)	35.19	23.15	29.17	37.96	33.33	35.65	45.37	37.96	41.67	53.70	45.37	49.54
T_8 : Thiourea at 400 ppm	17.59 (4.25)	14.81 (3.91)	16.20 (4.09)	34.26	25.00	29.63	43.52	34.26	38.89	50.00	37.96	43.98	56.48	44.44	50.46
T_9 : KNO_3 at 250 ppm	17.59 (4.25)	12.96 (3.67)	15.28 (3.97)	34.26	22.22	28.24	44.44	30.56	37.50	52.78	33.33	43.06	60.19	42.59	51.39

T_{10} : KNO_3 at 500 ppm	13.89 (3.79)	12.04 (3.54)	12.96 (3.67)	24.07	21.30	22.69	35.19	29.63	32.41	44.44	32.41	38.43	49.07	42.59	45.83
T_{11} : KNO_3 at 750 ppm	9.26 (3.12)	8.33 (2.97)	8.80 (3.05)	23.15	20.37	21.76	35.19	30.56	32.87	39.81	33.33	36.57	50.93	41.67	46.30
T_{12} : GA_3 at 100 ppm	8.33 (2.97)	6.48 (2.64)	7.41 (2.81)	14.81	16.67	15.74	25.93	25.93	25.93	32.41	28.70	30.56	37.04	32.41	34.72
T_{13} : GA_3 at 200 ppm	6.48 (2.64)	5.56 (2.46)	6.02 (2.55)	15.74	16.67	16.20	26.85	26.85	26.85	33.33	28.70	31.02	36.11	31.48	33.80
T_{14} : GA_3 at 300 ppm	7.41 (2.81)	6.48 (2.64)	6.94 (2.73)	14.81	15.74	15.28	26.85	25.93	26.39	34.26	29.63	31.94	37.96	33.33	35.65
T_{15} : Water (Control)	2.78 (1.81)	2.78 (1.81)	2.78 (1.81)	13.89	14.81	14.35	25.93	25.00	25.46	30.56	26.85	28.70	34.26	30.56	32.41
CD	0.91	1.40	0.79	5.79	6.11	4.52	7.94	3.99	4.21	8.05	5.06	3.92	8.16	3.65	4.74
SEm ±	0.31	0.48	0.27	2.00	2.11	1.56	2.74	1.38	1.45	2.78	1.75	1.35	2.82	1.26	1.64

Note: # Original values of sprouting in per cent **DAP – Days after planting**
Figure in parentheses are square root transformed value.

Table 3: Effect of pre-planting treatments of minisett corms with different organic and inorganic substances on sprouting per cent at 40, 45, 50 and 55 DAP in elephant foot yam cv. Gajendra

Treatments	Sprouting (%)											
	40 DAP			45 DAP			50 DAP			55 DAP		
	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled
T_1 : Cow dung slurry (50%) + Water (50%)	52.78	44.44	48.61	67.59	56.48	62.04	88.89	77.78	83.33	92.59	90.74	91.67
T_2 : Cow urine (50%) + Water (50%)	53.70	47.22	50.46	68.52	58.33	63.43	90.74	78.70	84.72	90.74	91.67	91.20
T_3 : Cow dung (25%) + Cow urine (25%) + Water (50%)	56.48	51.85	54.17	70.37	60.19	65.28	92.59	80.56	86.57	93.52	92.59	93.06
T_4 : Cow dung (37.5%) + Cow urine (37.5%) + Water (25%)	55.56	46.30	50.93	67.59	55.56	61.57	85.19	77.78	81.48	89.81	90.74	90.28
T_5 : Cow dung (50%) + Cow urine (50%)	56.48	52.78	54.63	71.30	62.04	66.67	92.59	82.41	87.50	93.52	92.59	93.06

T_6 : Thiourea at 200 ppm	57.41	55.56	56.48	76.85	65.74	71.30	93.52	91.67	92.59	94.44	96.30	95.37
T_7 : Thiourea at 300 ppm	60.19	57.41	58.80	78.70	70.37	74.54	97.22	94.44	95.83	97.22	96.30	96.76
T_8 : Thiourea at 400 ppm	65.74	58.33	62.04	79.63	70.37	75.00	96.30	96.30	96.30	96.30	98.15	97.22
T_9 : KNO_3 at 250 ppm	64.81	55.56	60.19	80.56	69.44	75.00	94.44	92.59	93.52	95.37	95.37	95.37
T_{10} : KNO_3 at 500 ppm	56.48	53.70	55.09	72.22	64.81	68.52	92.59	89.81	91.20	94.44	93.52	93.98
T_{11} : KNO_3 at 750 ppm	56.48	51.85	54.17	73.15	64.81	68.98	93.52	87.04	90.28	93.52	91.67	92.59
T_{12} : GA_3 at 100 ppm	41.67	37.04	39.35	53.70	52.78	53.24	63.89	62.96	63.43	75.00	75.00	75.00
T_{13} : GA_3 at 200 ppm	40.74	36.11	38.43	52.78	49.07	50.93	62.04	65.74	63.89	73.15	76.85	75.00
T_{14} : GA_3 at 300 ppm	42.59	37.96	40.28	52.78	50.00	51.39	61.11	64.81	62.96	74.07	78.70	76.39
T_{15} : Water (Control)	40.74	34.26	37.50	51.85	47.22	49.54	60.19	62.04	61.11	72.22	74.07	73.15
CD	7.24	6.70	5.58	7.35	6.27	4.96	5.20	7.88	4.03	4.30	3.80	3.06
SEm ±	2.50	2.31	1.93	2.54	2.17	1.71	1.79	2.72	1.39	1.48	1.31	1.06

DAP – Days after planting

Table 4: Effect of pre-planting treatments of minisett corms with different organic and inorganic substances on sprouting per cent at 60 DAP in elephant foot yam cv. Gajendra

Treatments	Sprouting (%)			Per cent increase over control		
	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled
T_1 : Cow dung slurry (50%) + Water (50%)	92.59	90.74	91.67	17.65	16.66	17.17

T_2 : Cow urine (50%) + Water (50%)		90.74	91.67	91.20	15.30	17.86	16.56
T_3 : Cow dung (25%) + Cow urine (25%) + Water (50%)		93.52	92.59	93.06	18.83	19.04	18.94
T_4 : Cow dung (37.5%) + Cow urine (37.5%) + Water (25%)		90.74	90.74	90.74	15.30	16.66	15.98
T_5 : Cow dung (50%) + Cow urine (50%)		93.52	92.59	93.06	18.83	19.04	18.94
T_6 : Thiourea at 200 ppm		94.44	96.30	95.37	20.00	23.81	21.89
T_7 : Thiourea at 300 ppm		97.22	96.30	96.76	23.53	23.81	23.67
T_8 : Thiourea at 400 ppm		96.30	98.15	97.22	22.36	26.19	24.26
T_9 : KNO_3 at 250 ppm		95.37	95.37	95.37	21.18	22.62	21.89
T_{10} : KNO_3 at 500 ppm		94.44	93.52	93.98	20.00	20.24	20.12
T_{11} : KNO_3 at 750 ppm		93.52	91.67	92.59	18.83	17.86	18.34
T_{12} : GA_3 at 100 ppm		80.56	79.63	80.09	2.36	2.38	2.36
T_{13} : GA_3 at 200 ppm		79.63	78.70	79.17	1.18	1.18	1.19
T_{14} : GA_3 at 300 ppm		79.63	79.63	79.63	1.18	2.38	1.78
T_{15} : Water (Control)		78.70	77.78	78.24	-	-	-
CD		4.60	3.92	3.24	-	-	-
SEm ±		1.59	1.35	1.12	-	-	-

DAP – Days after planting

Table 5: Effect of pre-planting treatments of minisett corms with different organic and inorganic substances on corm yield in elephant foot yam cv. Gajendra

Treatments	Corm yield (t ha^{-1})			Per cent increase over control		
	2010-11	2011-12	Pooled	2010-11	2011-12	Pooled
T_1 : Cow dung slurry (50%) + Water (50%)	11.21	11.03	11.12	16.70	15.25	15.98
T_2 : Cow urine (50%) + Water (50%)	11.43	11.77	11.60	18.90	22.95	20.92
T_3 : Cow dung (25%) + Cow urine (25%) + Water (50%)	11.70	11.80	11.75	21.79	23.27	22.53
T_4 : Cow dung (37.5%) + Cow urine (37.5%) + Water (25%)	11.17	10.68	10.92	16.27	11.56	13.92
T_5 : Cow dung (50%) + Cow urine (50%)	11.69	11.65	11.67	21.65	21.77	21.71
T_6 : Thiourea at 200 ppm	12.43	12.04	12.24	29.32	25.84	27.58
T_7 : Thiourea at 300 ppm	12.49	12.37	12.43	30.00	29.27	29.63
T_8 : Thiourea at 400 ppm	12.75	12.39	12.57	32.64	29.48	31.07
T_9 : KNO_3 at 250 ppm	12.31	11.92	12.11	28.10	24.51	26.31
T_{10} : KNO_3 at 500 ppm	12.01	11.86	11.93	24.98	23.90	24.44
T_{11} : KNO_3 at 750 ppm	11.71	11.78	11.74	21.81	23.13	22.47
T_{12} : GA_3 at 100 ppm	10.54	10.60	10.57	9.66	10.78	10.22

T_{13} : GA_3 at 200 ppm	10.61	10.47	10.54	10.46	9.43	9.95
T_{14} : GA_3 at 300 ppm	10.53	10.46	10.49	9.56	9.27	9.41
T_{15} : Water (Control)	9.61	9.57	9.59	-	-	-
CD	0.60	0.46	0.38	-	-	-
SEm ±	0.21	0.16	0.13	-	-	-