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Effect of organics and chemicals on germination, growth and graft-take in mango

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ABSTRACT

An experiment was conducted to know the effect of pre-soaking treatments on germination, growth and graft-take in mango. All the treatments promoted significantly earlier germination when compared with control. The stones pre-treated with Panchagavya 3 per cent recorded significantly lower number of days for the initiation of germination (12.25 days), completion of germination (46.18 days), maximum germination percentage (75.22 %), rootstock diameter (7.35 mm), number of leaves (14.77), highest graft success (76.15 %), graft survival percentage (92.04 %), sprout height (5.96 cm) and number of leaves per graft (17.80). GA_3 at 100 ppm had showed highest germination index (4.46) and rootstock height (36.43cm), which was at par with KNO_3, and water soaking.

Key words : Panchagavya, GA_3, Germination index, Graft-take, Amrit pani.

The mango (*Mangifera indica* L.) is one of the important fruit liked by all sections of people in India. It occupies a pre-eminent place among the fruit crops grown in India. Since mango is highly cross-pollinated crop, there is an enormous variation in the seedlings raised even from the fruits of a single tree. Rootstocks are always seedlings in origin whether they are zygotic/ nucellar. In India particularly monoembryonic non-descriptive seedlings are generally used. The differences in germination and vigour of monoembryonic seedlings are vast, depending upon the location and region, where they are multiplied. In semi-arid regions the mango stones are available during the drier parts of the year (April-June) because of which the germination percentage and vigour in these localities is very low.

The synchronization and rapid seed emergence are the commonly reported benefits of pre-sowing treatments on germination and seedling growth. Gibberellins, cytokinin, thiourea, potassium nitrate and other organics are used to enhance the germination and these have been successfully used for breaking the dormancy (Annon, 1980). The significant enhancement of germination was also noticed in different pre-soaking treatments by Padma and NarayanaReddy (1998), Shalini *et al*. (1999), VenkatRao (2002) and Venkatrao and Reddy (2005) in mango and Reddy and Khan (2001) in Khirni. The better germination per cent of mango stones is the main criterion and strong base for successful grafts. Keeping these points in view, an investigation was conducted to study and enhance the germination, growth and graft parameters by using different pre-soaking treatments like organics and chemicals.

MATERIALS AND METHODS

The present investigation was carried out at the department of Pomology, Kittur Rani Channamma College of Horticulture Arabhavi, during 2006–2007. A completely randomized design with five replications and eight treatments were employed *viz*. Control, Water soaking (12 hours), KNO_3 1per cent (10min), GA_3 100ppm (10min), cow dung (12hours), cow urine (12 hours), Amrit pani (3% for 3hrs) and Panchagavya (3% for 3hrs). Monoembryonic variety of Sindhur mango stones obtained from single lot from a processing unit were washed thoroughly and dipped in water. The stones were washed and spread over ground. After surface drying, the stones were treated with bavistin at one per cent and stones were sown in flat bed as per treatment details. Then rootstocks are transferred to polythene bags after one month of germination. Panchagavya and Amrit pani were prepared as per Pathak and Ram (2004). Germination percentage and vigour index (GVI) was computed using the formula

$$\text{Germination percentage} = \frac{\text{Number of stones germinated}}{\text{Number of stones sown}} \times 100$$

$$\text{GVI} = \frac{x_1}{d_1} + \frac{x_2}{d_2} + \frac{x_3}{d_3} + \ldots\ldots + \frac{x_n}{d_n}$$

where x_1, x_2, x_3, … …, x_n are the number of seeds germinated on d_1, d_2, d_3, … …, d_n days taken for germination, respectively.

The vigorous grown four months old rootstocks in container were selected and top growth was decapitated with sharp knife. Care was taken while selecting the scion material to match the girth of the stock. Necessary plant protection measures were taken to combat the pest problems as and when required. The observations were recorded daily for germination parameters, monthly for

growth parameters, three months after grafting (MAG) for graft success and graft survival percentage and monthly interval for graft growth parameters

RESULTS AND DISCUSSION

Out of eight soaking treatments used for germination of mango stones, there existed varied response on germination and growth. While control stones had 56.18 per cent germination, Panchagavya three per cent increased the germination up to 75.22 per cent followed by GA_3 (72.15 %). Initiation of germination with the soaked treatments was also earlier compared to control. They had helped for early germination (attained 50 per cent and 100 per cent germination earlier) compared to control (Table 1). The germination index ranged from 3.11 to 4.46. The stones pre-soaked with GA_3 at 100 ppm had shown significantly highest germination index (4.46), which was statistically at par with Panchagavya 3 per cent (4.36), while stones pre-soaked with cow dung recorded significantly lowest germination index (3.11). This could be due to that seedling emergence is primarily function of moisture available to stone and temperature affects. The relative advantage of treating the mango stones, with chemicals before sowing to reduce the period taken for germination and to remove the obstructions in embryo growth had been reported in mango by Padma and NarayanaReddy (1998) and Shalini *et al.*(1999). This pre-soaking treatment might have affected and altered the enzymatic reaction involved in germination process. Thus, the enhanced enzymatic reactions along with suppression of inhibitors might have acted in the faster germination. The variation in germination in pre-soaking osmoprimed stones may be due to the simulative effect of these chemicals and organics.

The osmopriming and bioorganic treatments had beneficial effect on mango rootstocks. These effects were evident from increase in the vegetative parameters *viz.*, rootstock height, stock diameter and number of leaves compared to control. (Table 2). The influence of osmopriming and organics might have attributed in the

Table 1 : Germination characters of mango stones as influenced by various pre-soaking treatments

Treatment	Number of days taken for germination			Germination per cent	Germination index
	Initiation	50 per cent	Completion		
T_1 – Control	17.31	27.20	50.4 9	56.18	3.17
T_2 – Water soaking (12 hour)	13.33	22.98	47.47	67.92	3.80
T_3 – KNO_3 (1 % for 10 min)	16.69	24.98	52.26	61.55	4.06
T_4 – GA_3 at 100ppm(10 min)	12.90	21.20	46.87	72.15	4.46
T_5 – Cow dung (12 hr.)	14.85	27.85	49.29	53.40	3.11
T_6 – Cow urine (12 hr.)	15.16	32.96	50.32	59.41	3.05
T_7 -Amritpani (3 % for 3 hr.)	13.63	28.51	48.91	64.42	3.40
T_8 -Panchagavya (3 % for 3 hr.)	12.25	21.69	46.18	75.22	4.31
S.E.±	0.38	0.66	0.71	1.13	0.08
C.D. (P=0.05)	1.08	1.91	2.05	3.26	0.24

Table 2 : Effect of pre-soaking treatments on progressive rootstock height, root stock diameter and number of leaves of mango rootstock at different stages of growth

Treatment	Rootstock height (cm)				Rootstock diameter (mm)				Number of leaves			
	Days after sowing											
	30	60	90	120	30	60	90	120	30	60	90	120
T_1 – Control	21.19	24.30	26.61	29.10	5.17	5.20	5.33	6.31	5.50	9.12	8.11	11.99
T_2 – Water soaking (12 hour)	24.02	29.03	32.19	34.58	5.34	5.40	5.91	6.92	5.66	7.80	9.68	12.51
T_3 – KNO_3 (1 % for 10 min)	22.54	28.83	31.76	35.22	5.55	5.49	5.98	7.23	6.39	11.17	9.25	14.02
T_4 – GA_3 at 100ppm(10 min)	24.74	31.25	33.69	36.43	5.27	5.84	6.33	7.07	6.59	10.73	9.98	14.22
T_5 — Cow dung (12 hr.)	19.51	26.32	26.82	29.73	4.98	5.52	6.00	6.77	6.24	8.00	9.68	11.45
T_6 – Cow urine (12 hr.)	18.78	25.45	28.51	30.48	5.28	5.53	5.98	6.84	6.03	7.76	9.70	12.85
T_7 -Amritpani (3 % for 3 hr.)	21.41	28.12	29.42	31.63	5.20	5.50	6.28	7.01	7.09	9.38	10.35	12.26
T_8 -Panchagavya (3 % for 3 hr.)	23.99	29.54	32.38	35.06	5.44	5.69	6.47	7.35	7.07	10.59	12.39	14.77
S.E.±	0.62	1.88	0.59	0.63	0.09	0.09	0.10	0.09	0.52	0.53	0.46	0.73
C.D. (P=0.05)	1.77	5.42	1.71	1.83	0.27	0.27	0.29	0.27	NS	1.52	1.33	2.10

beneficial effect on vegetative parameters. At 30 days after sowing in the growth response GA_3-100 ppm exhibited highest rootstock height (24.74 cm) followed by water soaking (24.02 cm). During 120 days after sowing maximum root stock height was exhibited with GA_3 100ppm, KNO_3 one per cent and panchagavya three per cent (36.43, 35.22 and 35.06 cm, respectively), where as minimum rootstock height was recorded in control (29.10 cm). The stock diameter was maximum in panchagavya three per cent, KNO_3 one per cent and GA_3 – 100 ppm (7.35, 7.23 and 7.07 mm, respectively) while control showed minimum diameter of 6.31 mm. The maximum number of leaves was observed in panchagavya (3%), GA_3 and KNO_3 (1%) and the results being 14.77, 14.22 and 14.02, respectively, whereas it was minimum in control (11.99) (Table 2).

The higher vegetative parameters and rootstock growth observed in the present investigation can be attributed to effect of pre-sowing treatments which is known to release growth substances to enhance the growth stimulating hormones. KNO_3 and GA_3 react almost exclusively in the stem elongation properties. They have direct effect on stem elongation by inducing cell wall loosening, by increasing the solute concentration by increasing cell wall extensibility, stimulating the wall synthesis, reducing the rigidity of cell wall by increasing cell division leading to more growth. The indirect effect of these chemicals on stem elongation is by increasing the synthesis of IAA (Leopold and Kriedemann, 1983). The increase in seedling height and girth by application of gibberllic acid and potassium nitrate was also reported by earlier workers, Padma and Narayana Reddy (1998), Shalini *et al.* (1999) and Khobragade *et al.* (1999) in mango and Reddy and Khan (2000) in Khirni. Hence, it is clear that the pre-soaking treatments had increased the vegetative growth parameters compared to control.

The stones pre treated with Panchagavya 3 per cent, recorded significantly highest germination and growth parameters may be due to Panchagavya, which is a blend of five products obtained from cow, which works on with cosmic energy and with a production of certain plant growth stimulants, *viz*., hormones, and enzymes with enormous increase in beneficial microorganisms (Natarajan, 2002).

There were significant differences observed among the different bio-organics and chemical treatment son graft success and growth parameters. Maximum graft success was noticed in panchagavya three per cent (76.15%) followed by water soaking and GA_3 – 100 ppm (74.17 and 73.74%, respectively). Significantly least graft success was noticed in control. Similar trend was also noticed for graft survival (Table 3). The influence of weather parameters like humidity and temperature on grafting and graft survival has been observed by (Patel and Amin, 1981). In their experiment they found that temperature range of 23.15 and 25.87^0 C was the most favorable for success. Same reason may lead to higher success in the present investigation also.

The pre-soaking treatments were found to be significant at all stages of the growth with respect of sprout height and number of leaves. Panchagavya three per cent noticed maximum sprout height (5.96 cm) followed by KNO_3 at one per cent (5.64 cm) while control recorded least sprout height (4.28 cm). Probably due to better growth of grafts and weather condition like temperature and humidity, this useful played important role in growth

Table 3 : Effect of pre-soaking treatments on graft success, graft survivability, progressive sprout height and Number of leaves of mango at different stages of growth

Treatment	Graft success (%)	Graft survivability (%)	Sprout height (cm)				Number of leaves			
	Months after grafting		Days after grafting							
	3 MAG	6 MAG	30	60	90	120	30	60	90	120
T_1 – Control	64.07	67.12	2.11	2.96	3.42	4.28	5.22	7.27	7.65	10.69
T_2 – Water soaking (12hour)	74.17	87.05	2.44	3.51	3.72	4.88	6.21	7.91	9.74	13.31
T_3 – KNO_3 (1 % for 10 min)	73.15	80.44	2.64	3.75	4.22	5.64	6.09	8.25	13.29	15.71
T_4 – GA_3 at 100ppm(10 min	73.73	73.29	2.70	3.56	4.01	5.51	5.98	8.11	12.21	14.02
T_5 — Cow dung (12 hour)	61.50	85.11	2.17	3.20	3.78	5.36	5.31	6.90	8.71	11.58
T_6 – Cow urine (12 hour)	58.98	80.74	2.57	3.42	3.95	5.42	5.47	5.90	8.35	11.12
T_7 Amritpani (3 % for 3 hour)	66.15	84.43	2.35	3.24	4.04	5.55	6.15	7.78	11.34	13.47
T_8 – Panchagavya(3 % for 3 hr)	76.15	92.04	2.95	3.55	4.06	5.96	5.89	8.53	14.41	17.80
S.E.±	1.17	0.39	0.15	0.13	0.09	0.16	0.28	0.30	0.65	0.93
C.D. (P=0.05)	3.38	1.12	0.43	0.38	0.25	0.47	NS	0.86	1.87	2.68

of grafts. The treatments with Panchagavya produced maximum number of leaves (17.80) followed by KNO_3 (15.71). This might be related to vigorous growth of grafts induced by simulative organs and also influenced by maximum number of sprouts leading to maximum number of leaves. Similar results were observed by (Sappandy, 2005) in wood apple and (Devechandra, 2006) in jamun. The higher graft-take observed in the present investigation may be attributed to the better growth of rootstock before grafting operation. It is clear from this experiment that the osmopriming treatments with bio-organics increased the graft success, survivability and graft growth parameters compared to control.

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