International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(6): 880-884

Received: 06-09-2017
Accepted: 09-10-2017

SN Kolekar
Dr. D. Y. Patil College of Agriculture, Talsande Hatkangale Kolhapur, Maharashtra, India

Dr. AS Kadam
Department of Horticulture, College of Agriculture, Latur. Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Dnyaneshwar Gajanan Gend
M.Sc (Seed Science and Technology) Assistant Professore, Department of Agril. Botany, Bharati Vidhyapeeth's College Of Horticulture, Sonsal-Hingangaon, Tal - Kadegaon, Dist. Sangli, Kadegaon. India

Correspondence
SN Kolekar
Dr. D. Y.Patil College of Agriculture, Talsande Hatkangale Kolhapur, Maharashtra, India

Effect of different organics and chemicals treatments on germination, growth and success of softwood grafting in mango during nursery stage

SN Kolekar, Dr. AS Kadam and Dnyaneshwar Gajanan Gend

Abstract
The present investigation entitled "Studies on effect of pre-soaking treatments on germination, growth and success of soft wood grafting in mango (*Mangifera indica* L.)" was conducted under net house condition, at Department of Horticulture, College of Agriculture, Latur during 2010-2011.The experiment was laid out in Completely Randomized Design with seven treatments replicated thrice. The experiment framed was intended to assess the influence of different pre-soaking treatments on germination of mango stones and to study the influence of different pre-soaking treatments on growth of seedlings of mango under nursery condition. The experiment consists of six different pre-sowing treatments of stones viz. water soaking, cow urine, cow dung, cow urine + cow dung (1:1), GA_3 @ 100 ppm, Potassium nitrate 1 per cent and a control. The results of present investigation clearly showed that, different pre-soaking treatments have got significant effect on stone germination and growth parameters of mango seedlings. The treatment of GA_3 at 100 ppm required less number of days (12.53) for initiation of germination, potential germination (44.34), and gave maximum germination percentage (85.67) and recorded maximum (4.05) germination vigour index. The growth attributes like height of seedlings, number of leaves, leaf area and root were also maximum in), GA_3 @ 100 ppm treatment.

Keywords: Different pre-soaking treatments, GA_3, KNO_3, Germination parameters, Growth performance, survival percentage, grafting survival percentage

Introduction
Since Mango is highly cross pollinated heterozygous plant. In ancient time mango was mostly propagated by stones. The stone propagated plants have long juvenile phase and poor performance hence it needs to be propagated vegetatively to produce true to type planting materials. Rootstocks are always seedlings in origin whether they are zygotic/ nucellar. In India particularly monoembrryonic non-descriptive seedlings are generally used. The differences in germination and vigour of monoembrryonic seedlings are vast, depending upon the location and region, where they are multiplied. In arid and 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. It is reported that graft-take is high during September month in these areas. The rootstocks raised during september months will not attain desirable girth and growth of grafting, thereby reducing the success of graft take and further survivability of grafted plants. (Kumar *et al.* 2008a) [2]. Several workers have studied the effect of various pre-soaking treatments on germination, growth of mango seedlings. (Shalini *et al.* (1999) [5], Kumar *et al*. (2008a) [2]. There are certain indigenous technologies like use of water, cow dung and cow urine in enhancing the seed germination. In order to find out the exact effect of these ITK's and some chemicals like GA_3 and KNO_3 on germination, growth off mango. Therefore, research work was undertaken with the objective to study the germination and growth performance of mango stones with different presoaking treatments.

Materials and Methods
The experiment was conducted at Net house, Department of Horticulture, College of Agriculture, Latur. The present investigation was laid out in Completely Randomized Design with 7 treatments and three replications in table 1. The experiment was laid out in Completely Randomized Design (CRD) with three replications as per the procedure outlined by Panse and Sukhatme (1967).

Table 1: Treatment Details

S. No	Treatment	Treatment Details	Period (Hrs.)
1.	T1	Control	-
2.	T2	Water soaking	24
3.	T3	Cow urine	12
4.	T4	Cow dung slurry application	12
5.	T5	Cow urine + Cow dung slurry (1:1)	12
6.	T6	GA_3 100 ppm solution	12
7.	T7	Potassium Nitrate solution 1 per cent	04

Results and Discussion

Variation in germination parameters

The germination parameters *viz*., days required for initiation of germination, days required for potential germination, germination vigour index and germination percentage have been varied in different pre-soaking treatments of mango stones. (Table 2).

Table 2: Germination studies of mango stones influenced by various pre-soaking treatments

Treatment number	Treatments details	Days required for initiation of germination	Days required for potential germination	Survival (%)	Germination Vigour Index
T_1	Control	16.63	50.67	66.67	2.17
T_2	Water soaking (24 hr.)	12.57	45.33	85.00	3.33
T_3	Cow urine(12hr.)	13.06	48.34	76.67	3.68
T_4	Cow dung slurry (12 hr.)	14.80	46.66	81.33	3.12
T_5	Cow urine +Cow dung 1:1 (12hr.)	14.40	49.33	76.67	2.65
T_6	GA_3 100 ppm (4 hr.)	12.53	44.34	84.66	4.05
T_7	KNO_3 1 per cent (4 hr.)	15.80	48.67	79.33	3.97
	SE	0.27	1.31	2.44	0.13
	CD at 5 %	0.82	3.98	7.42	0.40
	CV	6.30	5.78	5.39	7.07

Days taken for initiation of germination

The data indicated that, the significant differences in respect of initiation of germination among the different treatments tried. All the treatments promoted significantly earlier germination when compared with control. The stones pre-soaked with GA_3 100 ppm required significantly lower (12.53) number of days; however, it was statistically at par with water soaking for 24 hours (12.57) and cow urine for 12 hours (13.06). The Maximum numbers of days (16.63) were required for initiation of germination in the control. Early stone germination in GA_3 100 ppm treatment might be due to increased endogenous auxin content due to application of GA_3. The pre-soaking treatment of GA_3 might have affected and altered the enzymatic reaction involved in the germination process. Thus, the increased auxin level and enhanced enzymatic reaction along with the suppression of inhibitors might have acted in the faster germination. As Gibberellins may be required during the seed germination for various process regulating enzyme and protein synthesis and conversion of starch to sugars. (Paleg, 1960) [7]. This can be supported with the findings of Rao *et al.* (1963) [8] who reported that when mulberry seeds were soaked in GA_3 in varying concentrations from 10 to 100 ppm for 24 hours after pre-soaking in water. Kumar *et al.* (2008a) [2] also reported that treatment of GA_3 @ 100 ppm for 10 minutes required minimum number of days (12.90) for initiation of germination in mango.

Days required for potential germination

The data regarding potential germination indicated that, significant differences among different pre-soaking treatments. Significantly minimum days (44.34) were required for potential germination in GA_3 @ 100 ppm treatment. However, it was at par with water soaking (45.33) and cow dung slurry (46.66). While, significantly maximum number of days (50.67) was required in control. The variation in respect of days required for potential germination might be due to stimulative effect of different organics and chemicals on emergence of seedling and the rate of different growth processes like cell elongation, cell division and cell multiplication. The osmopriming and bio-organic treatment had beneficial effect on stone germination in mango. The influence of osmopriming and organics might have attributed to faster germination process. Thus, requiring lower number of days for potential germination as compared to control. These results are in conformity with the results obtained by Kumar *et al*. (2008a) [2].

Survival Percentage

The data regarding survival percentage of mango seedlings was recorded at 90 DAS and the data revealed that the influence of different pre-soaking treatments on survival percentage was found to be significant. Significantly highest survival percentage (85.00) was recorded in water soaking treatment; however, it was statistically at par with GA_3 at 100 ppm (84.66%), cow dung slurry (81.33%), and KNO_3 at 1 per cent (79.33%). The lowest seedlings survival (66.67%) was recorded in control. Different pre-soaking treatments had positive response on survival percentage of seedlings. This could be attributed to softening of seed coat for exchange of gaseous and moisture availability of food material for early and better germination in this treatment. Early germination might have resulted in better root development, which might have supported for strong development of shoots that resulted into increased survival percentage. These findings can be supported with the results obtained by Shirol *et al.* (2005) in Khirnee, Kumar *et al.* (2008a) [2] in mango and Singh *et al*. (1989) [6] in sweet orange.

Germination Index

The data indicated that, there were significant differences in respect of germination vigour index among the different

treatments. The germination vigour index ranged from 2.17 to 4.05. The stones pre-soaked with GA_3 at 100 ppm had shown significantly highest germination index (4.05), which was statistically at par with KNO_3 1 per cent (3.97) and cow urine (3.68). The lowest germination index (2.17) was recorded in control.The pre-soaking treatments of treating the stones with chemicals before sowing have reduced the time taken for germination by removing the obstructions in embryo emergence and growth for entry of moisture and oxygen. Thus, germination index was higher in different treatments of organic and inorganic as compared to control. These results are in accordance with results obtained Kumar *et al.* (2008a) [2] who reported that mango stones gave maximum germination vigour index (4.46), when stones were pre-soaked with GA_3 at 100 ppm treatment.

Germination per cent

It is clear from the data that, different pre-soaking treatments had significant influence on germination of stones. There was no germination in any treatment up to 10 days. During initial period (up to 30days) germination percentage was lower (8.33-33.67). Maximum germination percentage (43.00 to 81.66) recorded during 40-50 days period after sowing. The treatment of soaking of stones in 100 ppm GA_3 solution produced significantly higher germination at 20,30,40 and 50 days after sowing as compared to the rest of treatments tried.The stones pre-soaked with GA_3 at 100 ppm recorded maximum (85.67%) germination, however, it was at par with KNO_3 1 per cent (81.66%), cow dung slurry (77.00%) and water soaking (76.33%). While minimum germination percentage (63.33%) in control at 50 days after sowing.The promotive effect of GA_3 on seed germination might be due to the role of GA_3 in activating enzyme alpha amylase which converts starch into simple carbohydrate and liberate chemical energy which is used in the activation of embryo. The water soaking treatment also produced the significant results over control. This might be due to activating of enzyme system, which provides energy and minerals needed for growth and development of seedlings. These results are in accordance with results obtained by Kumar *et al.* (2008a) [2].

Variation in growth parameters and survival percentage of seedlings

The growth parameters *viz.*, height of seedling, stem diameter, number of leaves per plant, leaf area, length of tap root, number of secondary roots, length of secondary roots and survival percentage of seedlings have been varied in different pre-soaking treatments of mango stones. (Table 3).

Height of seedling (cm).

At 90 DAS, the highest height of seedling (32.74cm) was recorded in GA_3 at 100 ppm treatment. While lowest height (25.21cm) was recorded in control. This might be due to fact that the GA_3 stimulates vegetative growth by cell multiplication and cell elongation which might have reflected into maximum height of seedlings in this treatment. These results are in accordance with results obtained by Shalini *et al.* (1999) [5] and Kumar *et al.* (2008a) [2].

Stem diameter (cm)

At 90 DAS, the highest stem diameter (0.67cm) was recorded in GA_3 @ 100 ppm treatment. The lowest stem diameter (0.61cm) was recorded in control. This might be due to role of Gibberellic acid increase cell division, cell elongation and cell multiplication in cambium tissues that might have reflected in increase in stem diameter. These results are in conformity with results obtained by Shalini *et al.* (1999) [5], Khobragade *et al.* (1999) [1] and Kumar *et al.* (2008a) [2].

Table 3: Effect of different pre-soaking treatments of stone on growth parameters of mango seedling at 90 days after sowing

Treatment number	Treatment Details	Seedling height (cm)	Stem diameter(cm)	Number of leaves	Leaf area (cm^2) per leaves	Tap root length (cm)	Secondary root length (cm)	Number of secondary roots
T_1	Control	25.21	0.61	12.0	33.51	17.35	12.54	20.87
T_2	Water soaking (24 hr.)	32.05	0.63	13.53	35.36	19.41	14.52	23.67
T_3	Cow urine(12hr.)	28.73	0.61	14.73	36.17	22.31	17.30	28.00
T_4	Cow dung slurry (12 hr.)	26.71	0.64	14.80	32.35	26.40	21.12	28.53
T_5	Cow urine +Cow dung 1:1 (12hr.)	25.15	0.62	13.73	35.24	21.38	15.92	27.33
T_6	GA_3 100 ppm (4 hr.)	32.74	0.67	15.63	37.89	25.38	20.45	28.73
T_7	KNO_3 1 per cent (4 hr.)	31.61	0.65	15.30	36.66	26.96	21.39	30.60
	SE	0.48	0.01	0.44	0.90	0.56	0.59	0.69
	CD at 5 %	1.47	0.04	1.33	2.72	1.72	1.81	2.09
	CV	5.91	7.49	5.36	6.41	5.58	5.88	5.45

Number of leaves

At 90 DAS, The significantly maximum number (15.63) of leaves was recorded in GA_3 @ 100 ppm treatment. The minimum number of leaves (12.00) was recorded in control. This might be due to as Gibberellic acid treatment increases cell division, cell elongation and cell multiplication which might have reflected in getting maximum leaves per seedlings. These findings are in agreement with results obtained by Shalini *et al.* (1999) [5], Kumar *et al.* (2008b) [3]. Shalini *et al.* (1999) [5] reported maximum number of leaves (16.55), when stones soaked in water for 24 hours followed by 150 ppm gibberellic acid treatment. While minimum number of leaves (12.99) was recorded in control. Kumar *et al.* (2008b) [3] also reported that the maximum number of leaves (14.77) recorded in *panchagavya* 3 per cent for 3 hours treatment. While minimum number of leaves (11.99) was recorded in control. These findings are conformity with the present findings.

Leaf Area (cm^2)

At 90 DAS, The significantly maximum leaf area (37.89 cm^2) was recorded in GA_3 @ 100 ppm treatment. Significantly the minimum leaf area (33.51cm^2) was recorded in control. This might be due to action of GA_3 on cell elongation and cell multiplication process which were pronounced, that might have resulted in producing maximum leaf area in this treatment.

Length of tap root (cm)
The maximum length of tap root (26.96cm) was recorded with KNO_3 at 1 per cent, which was statistically at par with cow dung slurry (26.40cm) and GA_3 at 100 ppm (25.38cm). Significantly minimum tap root length (17.35cm) was recorded in control. This seems to be the effect of mobilization of water and nutrients transported required for production of more photosynthate to various plant parts which might have resulted better growth of root in this treatment.

Length of Secondary root (cm)
The maximum secondary root length (21.39cm) was recorded in KNO_3 at 1 per cent which was at par with cow dung slurry (21.12cm) followed by GA_3 at 100 ppm (20.45cm). The lowest length of secondary roots (12.54 cm) was recorded in control. This might be due optimum development of KNO_3 might have helped in availability of nutrients required for rapid cell elongation process that might have resulted in development of secondary root.

Number of secondary root
The data revealed that the pre-soaking treatments had significant effects on production of secondary roots. The treatment KNO_3 1 per cent produced maximum number of secondary roots (30.60), which was statistically at par with GA_3 at 100 ppm (28.73) and which was followed by cow dung slurry (28.53). The minimum number of secondary roots (20.87) recorded in control. This could be attributed to effect of pre-soaking treatment of KNO_3 which is known to release growth substances and to enhance the growth stimulating harmones. Potassium nitrate has extensively role in stem elongation. It has direct effect on stem elongation by inducing cell wall loosening by increasing solute concentration by increasing the cell extensibility, stimulating the wall synthesis, reducing the rigidity of cell wall by increasing cell division leading to more growth. This might have helped in production of more number of secondary roots in this treatment.

Graft Parameters
Days taken for sprouting of grafts
It is clear from the data that, different pre-soaking treatments had significant effect on days taken for sprouting of grafts. Significantly minimum number of days for sprouting (11.87) was recorded in GA_3 at 100 ppm. However, it was at par with KNO_3 1 per cent (12.60) and cow dung slurry (12.93). Significantly maximum numbers of days (14.20) were required for sprouting of grafts in control. This could be attributed to accelerated meristematic activities near the softwood region of graft union leading to quicker healing and initiation of the scion sprout. The favorable nutrient supply in GA_3 treatment with the highest stem diameter of rootstock probably helped for early initiation of sprouts in this treatment.

Per cent success of graft
The influence of different pre-soaking treatments on percentage graft success was found to be significant. The maximum percentage success of graft was recorded in water soaking (73.62%) which was at par with GA_3 @ 100 ppm (72.88%) and KNO_3 at 1 per cent (72.59%), while the minimum success of graft (59.06%) was recorded in control. This treatment has produced (23.40%) more success of graft over control. This might be due to the highest diameter of graft, number of leaves and maximum leaf area produced by this treatment that leads to maximum synthesis of photosynthate might have resulted into better callus formation and healing of graft and ultimately resulted into higher percentage success of graft in this treatment. These results are in accordance with results obtained by Kumar *et al*. (2008b) [3].

Table 5: Effect of different pre-soaking treatments on days taken for sprouting, success of graft, height, diameter no. of leaves leaf area percentage graft success

Treatment number	Treatment Details	Days taken for sprouting of graft	Success of graft (%)	height of sprout (cm)	diameter of grafts (cm)	number of leaves per graft	leaf area (cm^2)	Graft survivability (%)
T_1	Control	14.20	59.06	3.33	0.70	9.40	25.28	65.33
T_2	Water soaking (24 hr.)	13.46	73.62	4.23	0.75	14.20	28.73	76.00
T_3	Cow urine (12hr.)	13.27	66.19	4.30	0.80	10.53	29.50	67.30
T_4	Cow dung slurry (12 hr.)	12.93	68.72	3.93	0.75	11.60	28.58	70.93
T_5	Cow urine +Cow dung 1:1 (12hr.)	13.67	63.02	3.91	0.73	11.93	29.23	69.17
T_6	GA_3 100 ppm (4 hr.)	11.87	72.88	4.48	0.85	15.13	30.60	75.80
T_7	KNO_3 1 per cent (4 hr.)	12.60	72.59	4.33	0.81	14.70	29.54	74.83

Height of sprout (cm)
Data clearly indicated that, the different pre-soaking treatments had a significant influence on the height of sprout at various stages of growth i.e.30, 60, 90 and 120 DAG. The seedlings produced by soaking of stones in GA_3 at 100 ppm recorded significantly maximum height of sprout and it was statistically at par with KNO_3 1 per cent solution, cow urine and water soaking treatment at all growth period. At 120 DAG, Maximum height of sprout (4.48cm) was recorded in GA_3 at 100 ppm treatment, followed by grafts on seedlings produced from KNO_3 1 per cent solution and water soaking treatment. Significantly the lowest height of sprout (3.33cm) was recorded in control. Significantly maximum height of sprout in the treatment of GA_3 and KNO_3 could be attributed to vigorous growth of stock with strong root system which increases the growth in terms of height of graft. Similar results were also obtained by Kumar *et al.* (2008a) [2] which supports present findings.

Graft diameter (cm)
The data clearly indicated that, the different pre-soaking treatments had a significant influence on the graft diameter of grafts at various stages i.e. 30, 60, 90 and 120 DAG. The grafts raised on the rootstock seedlings produced by soaking of stones in GA_3 at 100 ppm recorded significantly maximum graft diameter and it was statistically at par with KNO_3 1 per cent and cow urine at all growth stages. At 120 DAG, The maximum graft diameter (0.85 cm) was recorded in GA_3 at 100 ppm treatment which was followed by grafts on seedlings produced from KNO_3 1 per cent solution (0.81cm).

Significantly the minimum graft diameter (0.70 cm) was recorded in control. The higher graft diameter in the treatment of GA_3 might be due to the vigorous growth of stock, which has increased the growth parameters and that leads to maximum accumulation of stored metabolites at the graft union. These results are in agreement with results obtained by Kumar *et al.* (2008a) [2].

Number of Leaves

The grafts produced on seedlings raised by pre-soaking of stones in GA_3 at 100 ppm recorded significantly the maximum number of leaves and it was statistically at par with KNO_3 1 per cent and water soaking treatments. At 120 DAG, the maximum numbers of leaves (15.13) were recorded in GA_3 @ 100 ppm treatment, followed by grafts produced on the seedlings raised from the treatment of 1 per cent KNO_3 solution. Significantly the minimum numbers of leaves on grafts (9.40) were recorded in control. The production of maximum number of leaves might be due to stimulative organs leading to faster growth of grafts. These results are in accordance with results obtained by Kumar *et al.* (2008a) [2].

Leaf Area

The maximum leaf area per graft at all growth stages was observed in grafts produced on seedlings raised by soaking of stones in GA_3 at 100 ppm and it was statistically at par with KNO_3 1 per cent and cow urine. At 120 DAG, Significantly the maximum leaf area (30.60 cm^2) per graft was recorded in grafts produced on seedlings of GA_3 at 100 ppm treatment, followed by grafts produced on seedlings of KNO_3 1 per cent solution. Significantly the minimum leaf area (25.28 cm^2) per graft was recorded in control. This might be due to action of GA_3 on cell elongation and cell multiplication process which were pronounced, that might have resulted in producing maximum leaf size which leads to maximum leaf area.

Per cent survival of graft

The influence of various pre-soaking treatments on percent survival of grafts was found to be significant. The highest graft survival percentage (76.00) was recorded in the water soaking treatment, which was at par with GA_3 at 100 ppm (75.80%) and KNO_3 1 per cent (74.83%). The lowest graft survival percentage (65.33) was recorded in control. This treatment has produced (16.02%) more graft survivability over control. The maximum success in water soaking treatment could be attributed to maximum number of secondary roots produced which has helped in production of more number of leaves and leaf area which might have produce maximum photosynthate required for better development of grafts ultimately leading to maximum survival percentage of grafts in this treatment. Similar results were obtained by Sappandi (2005) [4] in woodapple.The higher survival percentage in the present investigation might be attributed to the better growth of rootstock before grafting operation. It is clear from present investigation that osmopriming treatments increase the graft success and graft growth and graft survivability as compared to control. These findings are in agreement with findings of Kumar *et al.* (2008b) [3].

References

1. Khobragade HM, Patil BN, Patil SP, Belorkar PV. Performance of mango rootstocks under nursery conditions. J soils and crops. 1999; 9(2):244-246.
2. Kumar HS, Swamy GSK, Kanmad VC, Kumar P, Sowmaya BN. Effect of organics and chemicals on germination, growth and graft - take in mango. The Asian J of Hort. 2008a; 3(2):336-339.
3. Kumar HS, Swamy GSK, Patil CP, Kanmad VC, Kumar P. Effect of pre-soaking treatments on the success of softwood grafting and growth of mango grafts. Karnataka J Agric. Sci. 2008b; 21(3):471-472.
4. Sappandi S. Survey, evaluation and softwood grafting of wood apple (*Feronia limonia* L.) genotypes. M.Sc. (Horti.) Thesis Uni. Agri. Sci. Dharwad, 2005.
5. Shalini P, Bagde TR, Bhati B. Growth of mango (*Mangifera indica* L.) seedlings as influenced by stone treatment. J Soils and Crops. 1999; 9(2):227-230.
6. Singh M, Singh GN, Singh BN. Effect of gibberellic acid on seed germination in mosambi (*Citrus sinensis* Osbeck.). Harayana J Hort. Sci. 1989; 18(1-2):29-33.
7. Paleg LG. Physiological effects of gibberellic acid II. Plant physiol. 1960; 35:902-906.
8. Rao LSP, Rao TP, Narayanon ES. Response of mulberry seeds to gibberellic acid treatment. Curr. Sci. 1963; 32:348-349.