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Effect of seed treatments, nursery beds and growing media on germination behavior on mango (*Mangifera indica* L.)

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Abstract

The present investigation entitled “Effect of seed treatments, nursery beds and growing media on germination behavior on mango (*Mangifera indica* L.) cv. Kesar” was carried out at Fruit Research Station, Lalbaug, Junagadh Agricultural University, Junagadh during June -2020 to March -2021. Thirty six treatment combinations arising from four levels of seed treatments (S1: Water soaking, S2: GA3 100 ppm, S3: GA3 200 ppm and S4: GA3 300 ppm), three levels of nursery beds /growing conditions (G1: Raised bed, G2: Sunken bed (poly bag) and G3: Poly bags and three levels of growing media (M1: Soil + FYM, M2: Soil + Sand and M3: Soil + Sand + FYM) were allocated in Completely Randomized Design with factorial concept in three replications.

The result on the effect of seed treatments indicated that GA3 300 ppm executed significantly the minimum days to germinate and the highest germination percentage. The result on the effect of nursery beds (growing conditions) indicated that raised bed executed significantly the lowest days to germinate and the highest germination percentage. The result on the effect of growing media indicated that media mixture of Soil+ Sand +FYM, executed significantly the lowest days to germinate and the highest germination percentage.

Among the interaction effect of different treatment combinations GA3 300 ppm and Raised bed recorded significantly early germination and minimum days taken to germination (16.20 days) and maximum germination percentage (73.60%). Whereas S4M3 GA3 300 ppm and media mixture of Soil+ Sand+ FYM recorded significantly minimum days to germinate (16.38 days) and maximum germination percentage (72.09%). The treatment combination of Raised bed and growing media mixture of Soil+ Sand+ FYM recorded significantly minimum days to germination (17.12 days) and maximum germination percentage (68.59%). Combined effect of all three combinations noted significant result and the S4G1M3 (GA3 300 ppm and Raised bed and Soil+ Sand+ FYM) recorded significantly minimum days taken to germination (16.18 days) and maximum germination percentage (74.82%).

Keywords: Mango, GA3, nursery beds, growing media, germination and days taken to germinate

Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae and originated in the continental region of Burma or Indo-Myanmar origin, Thailand, Indo-China and Malaysia peninsula (Mukherjee, 1953). It is considered as one of the best fruits of the world by virtue of its flavour, delicious taste, delicate fragrance, attractive colour, so it is also known as “King of fruit”.

Nowadays plant growth regulators are widely used in increasing the seed germination percentage and to get vigorous and healthy seedlings. During seed germination, the role of GA3 in the induction of synthesis of α – amylase and other hydrolytic enzyme in monocots and certain dicots is well documented. GA3 appears mainly to induce the activity of the gluconeogenic enzyme during early stage of germination.

However, pre-soaking of mango stones with Gibberellic Acid (GA3) significantly enhanced the germination, seedling growth and graft success through its pivotal role in activating alpha amylase enzyme which converts starch into simple carbohydrate and liberate chemical energy which is used in the activation of embryo (Prakash *et al.*, 2010; Kolekar *et al.*, 2017; Patel *et al.*, 2017; Reshma and Simi, 2019) [15, 10, 14, 16].

Growing of seedlings in nursery beds resulted in good seedlings which provides better planting material. In raised bed water movement will be uniform and drainage of excess water is possible it avoids water stagnation and nursery diseases like damping off. Sunken beds are used against the heavy wind and rain and also to maintain the temperature. It also improves the

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micro climatic conditions for the germination and survival of seedlings. It is found very economical to hold the seedlings for a longer period.

Mango is deeply tap rooted fruit crop requires sufficient growing area during seedling growth which determines the subsequent establishment and growth of the seedlings in field conditions (Bhud *et al.*, 2017) ^[3]. Currently, different types of growing beds like raised bed, sunken bed and flat bed are being followed by nurserymen commercially to establish the seedlings in the nursery. Nowadays, nursery men are using the poly bags as it is highly convenient for handling and maintenance in addition to the creation of micro climatic conditions for the germination and survival of seedlings with strong undisturbed root system. In this background, three different nursery beds were evaluated to understand their impact on seed germination, seedling growth and success rate of grafts in mango.

Potting medium is another most important input which should have enough nutrients, good water holding capacity and drainage to ensure healthy and uniform seedling production. Apart from the selection of proper media ingredients, it is also necessary to maintain the porosity of the potting mixture so that proper development of roots takes place (Shrivastava *et al.*, 1998) ^[17]. Soil enriched with FYM exhibit positive effects on various growth characters like seed germination, seedling vigour index, shoot length, root length, plant fresh weight and plant dry weight (Khare *et al.*, 2018) ^[9]. Sand is another primary potting media with high porosity, aeration and well water drainage capacity. Hence, in the present study combination of these growing media were undertaken to evaluate its effects on seed germination, seedling growth and success rate of grafts in mango.

Material and Methods

The research experiment was carried out at carried out at Fruit Research Station, Lalbaug, Junagadh Agricultural University, Junagadh during June -2020 to March -2021. The experiment was laid out in a Completely Randomized Design (Factorial) with three replications and thirty six treatment combinations arising from four levels of seed treatments (S1: Water soaking, S2: GA3 100 ppm, S3: GA3 200 ppm and S4: GA3 300 ppm). Seeds were soaked in water and GA3 solution separately for 24 hours, before sowing as per the allocation of treatments. Three levels of nursery beds /growing conditions (G1: Raised bed, G2: Sunken bed (poly bag) and G3: Poly bags. Raised bed of 10 to 15 cm height from ground level is prepared by mixing necessary media according to treatments. The sunken bed is prepared 10 to 15 cm downwards from the soil surface. The poly bags filled with different media treatments were put into sunken bed and black polyethylene bags of 12 inch x 10 inch size with 300 gauges thickness were used for rising of mango seedling and three levels of growing media (M1: Soil + FYM, M2: Soil + Sand and M3: Soil + Sand + FYM). The media was prepared by mixing soil, sand and FYM (1:1:1). It was mixed properly and filled in black polyethylene (before filling the black polyethylene, small holes were made at the base of poly bags by using punching machine. This soil mixture was sieved and removed all the debris, hard particle and lumps. After that all the containers were filled with this prepared media mixture (propagation media were taken on the basis of v/v.). After surface drying, the stones were sown vertically in raised bed, sunken bed and polyethylene bags and arranged properly in the field after due

randomization. Twenty stones were taken for each treatment and observations on germination, growth of seedling and grafting parameters were recorded accordingly.

Results and Discussion

Days taken to germination (Days)

Among the seed treatments early germination 16.42 days and the highest percentage of germination (71.43%) was found in treatment S4 (GA3 300 ppm). This might be due to GA3 play important role in two stage germination; one at initial enzyme induction and other in activation of reserve of food mobilizing system which help in enhancement of germination. Above result are in conformity with Barche *et al.* (2010) ^[2] in papaya, Maiti *et al.* (2002) ^[11] in jackfruit, Gawade. (2008) ^[7] in custard apple, Farheen *et al.* (2017) ^[6] in fruit crops.

Among the nursery beds minimum number of days taken to germination (17.29 days) and the maximum germination percentage (67.90%) was observed in treatment G1 (Raised bed). This might due to fact that, in raised gives enough space so that air can circulate in media and also more moisture holds by more soil.

The different growing media exerted their significant influence on days taken to germination. Significantly the minimum number of (17.49 days) taken for germination and the highest percentage of germination (67.18%) was observed in treatment M3 (Soil+ Sand+ FYM) and maximum number of days were taken for germination (17.78 days) was recorded in treatment M2 (Soil+ Sand). It might be because of media containing organic manure possess organic acid within them. Therefore, more available moisture and some acids may have helped percentage. Parasana *et al.* (2013) ^[13] reported similar results in mango and Bisla *et al.* (1984) ^[4] reported in ber.

Interaction of seed treatment and different growing condition exerted significant effect on days taken to germination. The minimum number of days taken to germination (16.20 days) and maximum germination percentage (73.60%) was found in treatment S4G1 (GA3 300 ppm and Raised bed). This might be due to the fact that, GA3 plays an important role in two stages of germination one at initial enzyme induction and other in activation of reserve food mobilizing system which help in enhancement of germination and raised beds improved soil drainage Barche *et al.* (2010) ^[2] in papaya, Meera solanki *et al.* (2018) ^[12] in papaya cv. Madhubindu.

Interaction of seed treatment and different growing media exerted significant influence on days taken to germination. The early germination (16.38 days) and maximum germination percentage (72.09%) was found in treatment S4M3 (GA3 300 ppm and Soil+ Sand+ FYM). The promising effect of GA3 on seed germination might be due to its participation in the activity of alpha-amylase, which catalyzes the starch conversion into simple carbohydrates and chemical energy is liberated which is used in the activation of embryo. The results are in conformity with the findings of several workers, Babu *et al.* (2010) ^[1] in papaya. This might be due to mixture of sand and FYM which provide high amount of organic matter and sand responsible for improving the water holding capacity as well as porosity of media. Kaur and Malhi (2004) ^[8] reported that organic matter also possibly helped in maintaining relative high temperature, which further seems to have assisted in the stone coat weakening and absorption of water for improving germination in mango.

Interaction of growing condition and different growing media exerted significant effect on days taken to germination. The

early germination (17.12 days) and maximum germination percentage (68.59%) was found in treatment G1M3 (Raised bed and Soil+ Sand+ FYM). The seeds are sown during rainy season such a nursery bed is prepared during the rainy season more effective and early germination in Soil+ Sand + FYM due to propagating media containing organic manures that possessed organic acid within them. Therefore, more available moisture and some acids might helped in minimum days to germination.

The interaction between seed treatment, growing condition and growing media was also observed significant on days taken to germination. The minimum days taken for germination (16.18 days) and maximum germination percentage (74.82%) was recorded in treatment combination S4G1M3 (GA3 300 ppm with Raised bed and Soil + Sand+ FYM). The accelerated and enhance germination in Rangpur lime under GA might have been due to increased enzyme activities and better supply of nutrients. The property of GA to induce better and quicker germination has been already reported by various workers Witter and Buckovac (1958) [18] and in raised gives enough space so that air can circulate in media and also more moisture holds by more soil. Potting media ingredients, their proportion and physical and chemical properties plays significant role in the growth and development of seedling growth. The results are in seed treatment conformity with the findings of several workers, Dadhaniya *et al.* (2019) [5] in custard apple.

Table 1: Effect of seed treatment, growing conditions and growing media on days taken to germination and germination per cent in mango

Treatments	Days taken to germination (days)	Germination (%)
Factor A: Seed treatments		
S1 - Water soaking	19.56	63.26
S2- GA3: 100 ppm	17.61	64.52
S3- GA3: 200 ppm	16.96	67.51
S4- GA3: 300 ppm	16.42	71.43
S.Em.±	0.061	0.279
C.D. at 5%	0.17	0.79
Factor B: Nursery Beds/Growing condition		
G1: Raised beds	17.29	67.90
G2: Sunken bed	18.04	65.44
G3: Poly bags	17.59	66.87
S.Em.±	0.053	0.242
C.D. at 5%	0.15	0.68
Factor C: Growing Media		
M1: Soil+ FYM	17.65	66.68
M2: Soil+ Sand	17.78	66.35
M3: Soil+ Sand + FYM	17.49	67.18
S.Em.±	0.053	0.483
C.D. at 5%	0.15	1.36
Interaction S×G		
S.Em.±	0.105	0.242
C.D. at 5%	0.30	0.68
Interaction S×M		
S.Em.±	0.105	0.483
C.D. at 5%	0.26	1.36
Interaction G×M		
S.Em.±	0.091	0.418
C. D at 5%	0.26	1.18
Interaction S×G×M		
S.Em.±	0.183	0.837
C.D. at 5%	0.51	2.36
C.V. %	4.38	2.21

Table 2: Interactions effect of seed treatment and growing conditions on days taken to seed germination and germination per cent in mango

Treatments	Days taken to germination (days)			Germination (%)		
	G1	G2	G3	G1	G2	G3
S1	18.73	20.51	19.46	64.41	62.20	63.16
S2	17.45	17.79	17.60	65.05	64.08	64.43
S3	16.78	17.16	16.95	69.07	65.99	67.47
S4	16.20	16.70	16.36	73.60	69.49	71.90
S.Em.±	0.105			0.242		
C.D. at 5%	0.30			0.68		
C.V. %	4.38			2.21		

Table 3: Interactions effect of seed treatment and growing media on days taken to seed germination and germination (%) in mango

Treatments	Days taken to germination (days)			Germination (%)		
	M1	M2	M3	M1	M2	M3
S1	19.66	19.88	19.15	63.17	62.61	64.00
S2	17.58	17.70	17.54	64.49	64.44	64.63
S3	16.96	17.04	16.88	67.65	66.88	67.98
S4	16.39	16.48	16.38	71.69	71.47	72.09
S.Em.±	0.105			0.483		
C.D. at 5%	0.26			1.36		
C.V. %	4.38			2.21		

Table 4: Interactions effect of growing conditions and growing media on days taken to seed germination and germination per cent in mango

Treatments	Days taken to germination (days)			Germination (%)		
	M1	M2	M3	M1	M2	M3
G1	17.34	17.40	17.12	67.63	67.50	68.59
G2	18.02	18.24	17.86	65.19	65.12	66.01
G3	17.58	17.70	17.49	67.24	66.43	66.93
S.Em.±	0.091			0.418		
C.D. at 5%	0.26			1.18		
C.V. %	4.38			2.21		

Table 5: Interactions effect of seed treatment, growing conditions and growing media on days taken to seed germination in mango

Interaction (S x G x M)									
Treatments	G1			G2			G3		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
S1	18.99	19.03	18.15	20.54	20.88	20.10	19.44	19.73	19.21
S2	17.42	17.52	17.40	17.72	17.98	17.65	17.60	17.61	17.58
S3	16.77	16.79	16.76	17.13	17.35	17.00	16.96	16.99	16.89
S4	16.19	16.24	16.18	16.69	16.73	16.68	16.31	16.47	16.29
S.Em.±				0.183					
C.D. at 5%				0.51					
C.V. %				4.38					

Table 6: Interactions effect of seed treatment, growing conditions and growing media on germination per cent in mango

Interaction (SXGXM)									
Treatments	G1			G2			G3		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
S1	63.91	64.39	64.95	62.19	61.03	63.37	63.41	62.40	63.68
S2	65.04	65.01	65.08	64.06	64.03	64.16	64.35	64.27	64.66
S3	69.06	68.65	69.49	66.18	65.44	66.35	67.72	66.57	68.11
S4	72.49	73.48	74.82	68.31	69.98	70.18	71.93	72.50	71.26
S.Em.±				0.837					
C.D. at 5%				2.36					
C.V. %				2.21					

Conclusion

On the basis of research results and interpretation can be concluded that for the preparation of mango grafts in nursery, sowing of mango stones by soaking in GA3 300 ppm for 24 hours and sowing in raised bed provided with growing media as combination of Soil+ Sand+ FYM. Attained the early germination of seeds and maximum germination percentage.

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