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Studies on germination and seedlings growth of Mango (*Mangifera indica* L.) cultivars under net house conditions

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Abstract

A trial to study the germination and seedlings growth of Mango (*Mangifera indica* L.) cultivars under net house conditions was conducted at Horticulture Farm, Department of Horticulture and Post Harvest technology, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal, during the year 2016-17. The experiment was laid out in completely Randomized Design. Fully ripened mango fruits stones were collected from healthy and disease free plants of Langra, Chausa, Dashehari, Local-1, Local-2, Local-3 and Local-4 cultivars and sown in the month of August in polythene bags containing mixture of Farm soil, Sand and Farmyard manure. Among the different cultivars, Dashehari found better for germination of mango stone as well as growth of mango seedlings (height, number of leaves, girth of seedling, Fresh and dry weight of roots, fresh and dry weight of seedlings).

Keywords: Mango cultivars, seed germination, growth of seedlings

Introduction

Mango (*Mangifera indica* L.) is grown almost in 63 countries around the world and occupies a unique place among the fruits in India. It belongs to the genus *Mangifera*, consisting of numerous species of tropical fruiting trees in the flowering plant family Anacardiaceae. It is cultivated and grown vastly in many tropical regions and widely distributed in the world. The mango is indigenous to the Indian subcontinent and Southeast Asia (Fowomola, 2010) [4]. It is considered as best fruits of the world by virtue of its flavor, delicious taste, delicate fragrance, attractive colour, so it is also known as “king of fruit”. The major fruit growing states are Uttar Pradesh, Karnataka, Bihar, Andhra Pradesh, Tamilnadu, Kerala, Maharashtra, Odisha, West Bengal and Gujarat. Mango is highly cross-pollinated crop; as a result there is enormous variation in the seedlings raised from the fruits of single tree. In most of the fruit crops, rootstock influences the vigor, longevity, tree size, yield and quality (Manthri *et al.* 2017) [8]. The rootstock is a very vital component of a grafted plant and once the trees are grafted on a certain rootstock and planted in the orchard, it is not possible to change it without incurring losses. Therefore, the good rootstock should possess the qualities like high degree of compatibility with the scion variety, adaptable to the agro-climatic conditions of the proposed area, tolerant to salt, resistant to drought, endurant to frost, resistant to diseases and pests prevailing in the proposed area. So raising of good quality rootstocks is very important for future amble. Potting medium is also a most important input for better seedling production. It is responsible for healthy and uniform seedling production. Apart from the selection of proper ingredients, it is also necessary to maintain the porosity of the potting mixture so that proper development of roots takes place (Prasana *et al.* 2013) [11]. Net house structure provides totally or partially controlled environmental condition suitable for better stone germination and subsequent seedling growth. Synchronization and rapid seed emergence are the benefits of pre-sowing treatments on germination and seedling growth (Swamy *et al.* 2011) [17].

Materials and Methods

An experiment was carried out at Horticultural farm, Department of Horticulture and Post Harvest technology, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal during the year 2016-17. The experiment was laid out in completely Randomized Design with seven treatments. All treatments were replicated thrice. The treatment comprised of seven cultivars (Langra, Chausa, Dashehari, Local-1, Local-2, Local-3 and Local-4). Freshly extracted seeds were cleaned with tap water then the healthy and normally weight seeds were selected.

Seeds of each treatment were immediately sown in black polyethylene bags containing a mixture of Farm soil, sand and FYM. The data on days to germination, germination percentage, germination vigor index (GVI), height of seedling, number of leaves per plant, Seedling girth, Root fresh weight and dry weight, fresh and dry weight of seedling were recorded and statistically analyzed (Snedecor and Cochran, 1980)^[14].

Germination percentage and germination vigor index (GVI) were computed using the formulae:

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

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

Where $x_1, x_2, x_3, \dots, x_n$ were the number of stones germinated and $d_1, d_2, d_3, \dots, d_n$ days taken for germination, respectively.

Results and Discussion

Days Taken to Germination and Germination Percentage

Table 1 indicated that the minimum days taken for mango stone germination in treatment T₁ (Langra, 14.34 days) which was statistically at par with treatment T₃ (Dashehari, 15.04 days). While maximum days taken for mango stone germination was observed under treatment T₆ (Local-3, 24.25 days). The result are in agreement with the finding of Parasana *et al.* (2012), Prajapati *et al.* (2012)^[12], Supriya *et al.* (2015)^[16] in mango. The highest stone germination per cent after 30 days of sowing was observed in treatment T₃ (Dashehari, 55.59 %) while the minimum stone germination per cent was observed under the treatment T₆ (Local-3, 41.32 %). This result is in conformity with the result of Geetha *et al.* (1997)^[5], Padma and Reddy (1998)^[10], Shaban *et al.* (2010), Khan *et al.* (2017)^[7], Kaur *et al.* (2017)^[6] in mango.

Seedling Height

Dashehari recorded significantly the maximum seedling height (26.14 cm) after 1 month as shown in Table 1, followed by T₂ (Chausa, 25.27 cm) and Minimum seedling height was observed in T₅ (Local-2, 20.59 cm). The maximum height of seedling after two month of stone sowing was observed in treatment T₃ (Dashehari, 40.31 cm) followed by T₂ (Chausa, 37.03cm). While the minimum height of seedling was observed in treatment T₅ (Local-2, 26.13 cm). The maximum height of seedling after three months of stone

sowing was observed in treatment T₃ (Dashehari, 54.27 cm). While the minimum height of seedling was observed in treatment T₆ (Local-3 43.60 cm).

Number of Leaves and Seedling Girth

The girth of mango seedling was found maximum in treatment T₃ (Dashehari, 2.04 cm). While the minimum girth of seedling was recorded under treatment T₇ (Local-4, 1.09 cm). The girth of plant after two months of stone sowing was non-significant. However, the girth of mango seedling was found maximum in treatment T₃ (Dashehari, 2.5 cm). while the minimum girth of seedling was recorded under treatment T₆ (Local-3, 1.24 cm). The girth of plant after three months of stone sowing was non-significant. However, the girth of mango seedling was found maximum in treatment T₃ (Dashehari, 2.70 cm), while the minimum girth of seedling was recorded under treatment T₄ (Local-1, 2.03 cm).

The maximum number of leaves per plant after one month of stone sowing was observed under treatment T₃ (Dashehari, 6.07) followed by treatment T₂ (Chausa, 4.57). While the minimum number of leaves per plant was recorded in the treatment T₆ (Local-3, 2.01). The maximum number of leaves per plant after two month of stone sowing was observed in treatment T₃ (Dashehari, 10.04). While the minimum number of leaves per plant (6.25) was recorded in the treatment T₆ (Local-3). The maximum number of leaves per plant after three month of stone sowing was observed in treatment T₃ (Dashehari, 13.17) followed by T₂ (Chausa, 11.17). While the minimum number of leaves per plant was recorded in the treatment T₆ (Local-3, 9.02).

Germination vigor index, Fresh and Dry weight of Root, Fresh and Dry weight of Seedlings

Table 2 showed that Cultivar Local-2 recorded significantly higher germination vigor index (2.13), which was statistically at par with Langra and Dashehari as compared to control (1.81).

Dashehari recorded maximum root fresh weight (12.76 g) and dry weight (10.54g). Root fresh weight was statistically at par with treatment T₁ (Langra, 10.62). While minimum root fresh weight (6.03) and dry weight (4.08) was observed in T₆ (Local-3). Dashehari recorded significantly the maximum fresh weight (32.53g) and dry weight (27.39g) of seedlings. Seedling fresh weight was statistically at par with treatment T₁ (Langra, 31.29g), While minimum Seedling fresh weight (26.18g) and dry weight (16.02g) was observed in T₇ (Local-4). The high population facilitates better utilization of applied water and nutrient which help in maintenance of higher vigour in root stock. And directly related with photosynthesis and accumulation of more carbohydrates observed by Shiva Kumar, 2001 in mango.

Table 1: Performance of different mango varieties stone on different germination characters

Treatments	Varieties	Days taken For germination	Percent of germination	Height of Seedling (cm)			Girth of Seedling (cm)			Number of leaves per plant		
				30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₁	Langra	14.34	51.67	22.32	30.05	47.48	1.53	2.2	2.62	3.59	7.16	10.68
T ₂	Chausa	17.74	50.74	25.27	37.03	51.07	1.70	2.13	2.53	4.57	6.89	9.97
T ₃	Dashehari	15.04	55.59	26.14	40.31	54.27	2.04	2.5	2.7	6.07	10.04	13.17
T ₄	Local-1	18.43	45.22	22.28	32.41	48.71	1.44	1.69	2.03	2.48	6.70	10.78
T ₅	Local-2	19.31	52.30	20.59	26.13	47.24	1.96	2.06	2.22	4.16	7.38	11.17
T ₆	Local -3	24.25	41.32	21.06	29.26	43.6	1.13	1.24	2.12	2.01	6.25	9.02
T ₇	Local-4	19.92	45.40	24.05	31.34	50.21	1.09	1.53	2.17	2.6	6.89	10.96
CD(P=0.05)		1.74	2.49	1.03	2.37	3.75	NS	NS	NS	0.90	1.03	1.90

NS Non-significant

Table 2: Performance of different mango varieties stone on different germination characters

Treatments	Varieties	Index (GVI)	Root fresh weight	Root dry weight	Seedling fresh weight (g)	Seedling dry Weight (g)
T ₁	Langra	2.07	10.62	7.76	31.29	21.95
T ₂	Chausa	1.97	9.75	5.086	29.29	19.62
T ₃	Dashehari	2.07	12.76	10.54	32.53	27.39
T ₄	Local-1	1.83	7.67	5.95	29.63	20.01
T ₅	Local-2	2.13	8.03	6.52	30.58	20.68
T ₆	Local-3	1.9	6.03	4.08	26.85	17.22
T ₇	Local-4	1.81	8.67	7.38	26.18	16.02
CD(P=0.05)		0.06	2.77	1.27	1.35	2.58

Conclusion

From the present study, It was concluded that Dashehari mango stones recorded minimum number of days taken to seed germination with highest germination percentage, Germination vigor index, seedling height (cm), number of leaves, seedling girth (cm), fresh weight of seedling(g), dry weight of seedling(g), root fresh weight (g) and root dry weight(g). Therefore, fully ripened Dashehari mango stones sown in the black polythene bags containing a mixture of Farm soil, sand and FYM can be successfully used as rootstock for raising the healthy grafted nursery plants of mango.

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