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Role of bioagents and substrate combinations in improving survival and vigour of mango (*Mangifera indica* L.) Grafts cv. Dashehari

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Abstract
The present investigation aimed to find out the "Role of Bioagents and Substrate Combinations in Improving Survival and Vigour of Mango (*Mangifera indica* L.) Grafts cv. Dashehari" was carried out at the Instructional Farm (Horticulture), Career Point University, Alaniya, Kota during 2024-2025. The experiment was laid out in Randomized Block Design withthree replication including 13 treatment combinations, comprising T_1 Control, T_2 FYM +Soil +Biomixes 2% (1:2), T_3 Soil+Biomix 2%, T_4 Soil +FYM +Sand +Biomixs 2% (1:2), T_5 Cocopeat + Vermicompost +Black Soil +Biomixs 2%, T_6 Laterite Soil + Vermicompost.+Biomixs 2%, T_7 Soil+FYM+Vermivompost (1:1:1)+Biomixs 2%, T_8 Sand +Soil +Biomixs 2%, T_9 Vermicompost+ Soil(1:1) +Biomixs 2%, T_{10} FYM+ Cocopeat (1:1) +Biomixs 2%, T_{11} Soil+FYM(1:2)+PSB. 1%, T_{12} FYM+Soil(2:1)+PSB 2% and T_{13} Cocopeat +FYM (2:2).

Keywords: Bioagents and substrate, mango grafts cv. Dashehari

Introduction
The tropical fruit known as the "King of Fruits," the mango (*Mangifera indica* L.), is a member of the Anacardiaceae family and is produced practically everywhere in the world.
According to reports, (S.K. Mukherjee, 1951). this species originated in the continental regions of Thailand, Burma, Indo-China, and the Malaysian peninsula. It has been grown in the Indian subcontinent for well over 4,000 years. Mangoes are the most popular fruit in tropical and subtropical regions, which are located between 23° North and 23° South latitude.
The supply of good quality and sufficient planting materials of mango in the tropics hinges on the development of good nursery management practices which include propagation methods and media. Generally, improvement in the supply of good quality planting materials would ensure good tree survival and establishment in the field (Bally, 2006) [3]. Mango is highly cross-pollinated and heterozygous, in which grafting is common and preferred vegetative propagation to produce true to type. The vegetative propagation method i.e. grafting has been adapted for commercial propagation methods such as inarching, veneer grafting.
The most crucial component for producing healthy, consistent, and high-quality rootstock seedlings is nursery potting material. To ensure that roots develop properly, maintaining the potting mixture's porosity is just as important as choosing the right components. Before an orchard can be planted, better rootstock of superior quality must be produced. Therefore, when planted in the main field, seedlings grown on high-quality nursery media will guarantee better establishment and development. To guarantee optimal seedling growth, the potting mixture should have adequate nutrients, a good ability to hold water, and adequate drainage.
To guarantee optimal seedling growth, the potting mixture should have adequate nutrients, a good ability to hold water, and drainage. (Noble l993) [11]. Now days, there is necessity of reducing the production cost of planting stock by utilizing locally available material for raising quality nursery plants. Vermicompost is commonly used as plant growth media and soil amendments. In the nursery activities, the preparation of media, should receive considerable attention of the nursery owners. The present day nursery practices involve high cost and risks with respect to raising of grafts.

Materials and Methods

An experiment entitled Role of Bioagents and Substrate Combinations in Improving Survival and Vigour of Mango (*Mangifera indica* L.) Grafts cv. Dashehari during the Rainy season at the Instructional Farm (Horticulture), School of Agricultural Sciences, Career Point University, Kota.

- **Days taken to sprout**
- **Success rate (%)**
  The total number of successful grafts was recorded at 30, 60, 90 and 120 DAG

$$\text{Success rate} = \frac{\text{No. of Grafts Sprouted}}{\text{No. of total plants grafted}} \times 100$$

- **Survival percentage (%)**
  The total number of survived grafts were recorded at 30, 60, 90 and 120 DAG

$$\text{Survival percentage} = \frac{\text{No. of grafts remained alive}}{\text{Number of total plants grafted}} \times 100$$

- **Mortality (%)**
  The total number of failed grafts were recorded at 30, 60, 90 and 120 DAG

$$\text{Mortality} = \frac{\text{No. of failed grafts}}{\text{No. of total plants grafted}} \times 100$$

- **Plant height (cm)**
  The height of the graft was measured from the collar region of the rootstock to the tip (terminal bud) of the graft and recorded at 30, 60, 90 and 120 DAG

- **Graft girth (cm)**
  The total girth of successful grafts was measured in center of graft joint with the help of Vernier calliper and recorded at 30, 60, 90 and 120 DAG

Results

Days taken to sprout

The combination of bio agent and substrate showed significantly was observed with respect to days taken to sprout. The minimum days required to days take of sprout (11.43) was recorded in treatment T_7 (Soil + FYM + Vermicompost(1:1:1)+Biomixs 2%) respectively, which was par with T_9 and T_{10}. While maximum days required to days take of sprout (16.65) in treatments T_1 control.

Success rate

The grafting success rate was recorded significantly in all stage. Highest graft success rate (95.50, 88.70, 75.50 and 65.40%) were noted at 30, 60, 90 and 120 DAG in treatments T_7 (Soil + FYM+ Vermicompost (1:1:1) + Biomixs 2%) respectively, which was par with T_9 and T_{10}. Whereas lowest graft success rate (56.40, 47.60, 38.70 and 32.30%) were recorded at 30, 60, 90 and 120 DAG in control.

Survival

The grafting survival rate was recorded significantly in all stage. Maximum graft survival rate (97.10, 88.60, 77.60 and 68.60%) were noted at 30, 60, 90 and 120 DAG in treatments T_7 (Soil + FYM + Vermicompost (1:1:1) + Biomixs 2%), respectively, which was par with T_9 and T_{10}. Whereas minimum graft survival rate (58.70, 48.60, 38.70 and 28.90%) were recorded at 30, 60, 90 and 120 DAG in control.

Mortality

A bio agent brought about significantly variation in mortality of graft. The minimum mortality (2.90, 11.40, 22.40 and 31.40%) were recorded in treatment T_7 (Soil + FYM + Vermicompost (1:1:1) + Biomixs 2%), which was par with T_9 and T_{10}.wherears maximum mortality (41.30, 51.40, 61.30 and 71.10%), respectively were recorded in treatment T_1 (Control).

Plant height (cm)

A bio agent brought about significantly variation in plant height. The highest plant height (58.19, 60.41, 62.42 and 65.28 cm) respectively, were recorded in treatment T_7 (Soil + FYM + Vermicompost (1:1:1) + Biomixs 2%), which was par with T_9 (Vermicompost + Soil (1:1) Biomixs 2%) and T_{10} (FYM + Cocopeat (1:1) Biomixs 2%).whereas lowest plant height (39.63, 42.31, 45.8 and 49.09 cm), respectively were recorded in treatment T_1 (Control).

Stem girth (cm)

Stem girth was recorded that bio agent and substrate combination significantly in all stage. Maximum stem girth (0.65, 0.68, 0.73 and 0.76 cm) were noted at 30, 60, 90 and 120 DAG in treatments T_7 (Soil + FYM+ Vermicompost (1:1:1) + Biomixs ×-2%) respectively, which was par with T_9 and T_{10}. Whereas minimum stem girth (0.41, 0.45, 0.49 and0.53 cm) were recorded at 30, 60, 90 and 120 DAG in control.

Conclusion

Growth characters

The maximum sprouting and success rate in media containing (Soil + FYM + Vermicompost (1:1:1) + Biomixs 2%). A good graft union depends on a number of factors, including temperature, humidity, moisture, nutrients in the medium, rootstock quality, and the condition of the scion wood. (Litz, 1997) [9]. Use of FYM in combination with vermicompost + biomixs showed at par result with grafts raised in combination with soil. This could be attribute to availability of nutrient and moisture, proper gas exchange near root zone and higher photosynthesis activity through undetached leaf of past season growth. The Similar findings were obtained by (Amin 1974) [2] who recorded 91.5 per cent sprouting in mango. (Panicker 1986) [12] recorded 86 percent sprouting in mango in soil + FYM (3:1) media, (Qayom 2011) [13] recorded early sprouting in Totapuri grown in soil: sand: compost (1:2:1), (Gholap and Polara 2015) [6] in mango softwood grafting in media containing soil + FYM + leaf mould (1:1:1) Vermicompost improves physical characteristics and water-holding capacity while offering sufficient nutrients. 2% of soil, FYM, vermicompost (1:1:1), and biomixes are applied together. have shown a significant effect on the number of nodes, plant height, number of leaves, scion length, and root stock length.

Nitrogen is fixed and made accessible to the plant by the plant growth-promoting vermicompost and FYM + Biomixes ×-2% in the medium. (Sahni *et al.*, 2007) [14] opined that, performance of plant growth promoting

rhizobacteria is enhanced by vermicompost in cashew. Similar results were noticed by (Abirami *et al.,* 2011) [1], More leaves in a given treatment may result from improved nutrient availability, which raises the production of photosynthetically active leaves, and improved seedling girth brought on by growth medium reported by (Kaur 2017) [8] in mango Combined application of vermicompost and cocopeat showed significant effect on seedling growth parameters. It may be due to better nutrient availability leading to higher production of photosynthetically functional leaves in these treatments finally resulting in better girth of seedling, Similar results were also obtained by (Parasana *et al*., 2012) in mango and (Meena *et al*., 2017) [10] in papaya. Because vermicompost and soil simultaneously increase the plants' capacity to hold water and release available nutrients to the growing zone, which increases the production of auxin, gibberellins, and cytokinins, as well as because inoculated roots have a higher proportion of younger roots and exhibit root elongation, which results in an increase in the length and number of root hairs, the combined treatments produced better results. As a result, the plant's roots and shoots will absorb more nutrients from the soil, increasing its fresh weight.

This was observed by (Jain *et al.,* 2018) [7] in moringa, (Abirami *et al*., 2011 in nutmeg, Bhardwaj, 2013 in papaya, Chiranjeevi *et al*., 2018) [1, 4, 5] in aonla.

Table 1: Role of Bio agents and Substrate Combinations on Days Taken to sprout and Success rate of Mango Grafts cv. Dashehari

Sr. No.	Treatments	Days taken to sprout	Success rate (%)			
			30 DAG	60 DAG	90 DAG	120 DAG
T_1	Control	16.65	56.40	47.60	38.70	32.30
T_2	FYM +Soil +Biomixes 2% (1:2)	13.23	88.60	81.20	72.70	59.80
T_3	Soil + Biomix 2%	13.43	88.50	80.50	72.60	53.50
T_4	Soil +FYM + Sand +Biomixs 2% (1:2)	13.53	87.60	79.80	72.20	52.10
T_5	Cocopeat + Vermicompost +Black Soil +Biomixs 2%	13.68	87.30	78.40	68.90	48.70
T_6	Laterite Soil + Vermicompost.+Biomixs 2%	16.11	75.40	71.20	62.40	43.60
T_7	Soil + FYM+ Vermicompost (1:1:1)+ Biomixs 2%	11.43	96.50	88.70	75.50	65.40
T_8	Sand +Soil + Biomixs 2%	15.64	79.60	72.20	63.80	46.70
T_9	Vermicompost + Soil (1:1) + Biomixs 2%	11.45	95.40	88.40	74.50	63.40
T_{10}	FYM+ Cocopeat (1:1) + Biomixs 2%	11.48	93.40	87.80	74.20	62.50
T_{11}	Soil + FYM (1:2)+PSB 1%	11.76	91.20	87.30	73.90	61.30
T_{12}	FYM + Soil (2:1)+PSB 2%	12.43	90.50	86.90	73.50	60.50
T_{13}	Cocopeat + FYM (2:2)	12.65	90.20	86.50	73.20	60.00
S.Em.±		0.20	1.19	1.06	1.21	0.80
C.D. at 5%		0.59	3.49	3.08	3.52	2.34

Table 2: Role of Bio agents and Substrate Combinations on Survival of Mango Grafts cv. Dashehari

Sr. No.	Treatments	Survival (%)			
		30 DAG	60 DAG	90 DAG	120 DAG
T_1	Control	58.70	48.60	38.70	28.90
T_2	FYM +Soil +Biomixes 2% (1:2)	88.80	81.60	73.50	63.20
T_3	Soil + Biomix 2%	88.80	80.80	72.50	61.20
T_4	Soil +FYM + Sand +Biomixs 2% (1:2)	88.70	80.40	72.10	61.00
T_5	Cocopeat + Vermicompost + Black Soil +Biomixs 2%	88.40	79.80	69.60	59.70
T_6	Laterite Soil + Vermicompost + Biomixs 2%	76.40	68.70	65.40	58.70
T_7	Soil + FYM+ Vermicompost (1:1:1)+ Biomixs 2%	97.10	88.60	77.60	68.60
T_8	Sand +Soil + Biomixs 2%	79.70	71.10	67.60	65.50
T_9	Vermicompost + Soil (1:1) + Biomixs 2%	96.50	89.10	76.40	68.30
T_{10}	FYM+ Cocopeat (1:1) + Biomixs 2%	94.50	88.30	76.30	66.50
T_{11}	Soil + FYM (1:2)+ PSB 1%	92.50	88.20	75.80	65.30
T_{12}	FYM + Soil (2:1)+ PSB 2%	91.50	87.50	75.60	64.30
T_{13}	Cocopeat + FYM (2:2)	91.20	87.50	74.50	61.20
S.Em.±		0.93	1.12	0.94	0.88
C.D. at 5%		2.69	3.25	2.74	2.56

Table 3: Role of Bio agents and Substrate Combinations on Mortality of Mango Grafts cv. Dashehari

Sr. No.	Treatments	Mortality			
		30 DAG	60 DAG	90 DAG	120 DAG
T_1	Control	41.30	51.40	61.30	71.10
T_2	FYM +Soil +Biomixes 2% (1:2)	11.20	18.40	26.50	36.80
T_3	Soil + Biomix 2%	11.20	19.20	27.50	38.80
T_4	Soil +FYM + Sand +Biomixs 2% (1:2)	11.30	19.60	27.90	39.00
T_5	Cocopeat + Vermicompost + Black Soil +Biomixs 2%	11.60	20.20	30.40	40.30
T_6	Laterite Soil + Vermicompost + Biomixs 2%	23.60	31.30	34.60	41.30
T_7	Soil + FYM+ Vermicompost (1:1:1)+ Biomixs 2%	2.90	11.40	22.40	31.40
T_8	Sand +Soil + Biomixs 2%	20.30	28.90	32.40	34.50
T_9	Vermicompost + Soil (1:1) + Biomixs 2%	3.50	10.90	23.60	31.70
T_{10}	FYM+ Cocopeat (1:1) + Biomixs 2%	5.50	11.70	23.70	33.50

T_{11}	Soil + FYM (1:2)+ PSB 1%	7.50	11.80	24.20	34.70
T_{12}	FYM + Soil (2:1)+ PSB 2%	8.50	12.50	24.40	35.70
T_{13}	Cocopeat + FYM (2:2)	8.80	12.50	25.50	38.80
S.Em.±		0.27	0.30	0.37	0.66
C.D. at 5%		0.81	0.88	1.09	1.94

Table 5: Role of Bio agents and Substrate Combinations Plant height and Stem girth (cm) of Mango Grafts cv. Dashehari

Sr. No.	Treatments	Plant height (cm)				Stem girth (cm)			
		30 DAG	60 DAG	90 DAG	120 DAG	30 DAG	60 DAG	90 DAG	120 DAG
T_1	Control	39.63	42.31	45.8	49.09	0.41	0.45	0.49	0.53
T_2	FYM +Soil +Biomixes 2% (1:2)	50.88	53.76	56.52	60.07	0.50	0.53	0.58	0.62
T_3	Soil + Biomix 2%	49.08	51.17	54.7	58.04	0.48	0.51	0.57	0.59
T_4	Soil +FYM + Sand +Biomixs 2% (1:2)	48.3	51.194	54.185	57.87	0.47	0.49	0.55	0.57
T_5	Cocopeat + Vermicompost + Black Soil +Biomixs 2%	46.89	49.88	51.68	56.67	0.45	0.48	0.54	0.56
T_6	Laterite Soil + Vermicompost + Biomixs 2%	43.62	47.29	49.77	54.67	0.43	0.45	0.53	0.55
T_7	Soil + FYM+ Vermicompost (1:1:1)+ Biomixs 2%	58.19	60.41	62.42	65.28	0.65	0.68	0.73	0.76
T_8	Sand +Soil + Biomixs 2%	45.31	47.73	50.32	54.97	0.44	0.46	0.52	0.56
T_9	Vermicompost + Soil (1:1) + Biomixs 2%	57.10	59.39	60.19	62.77	0.63	0.66	0.71	0.74
T_{10}	FYM+ Cocopeat (1:1) + Biomixs 2%	56.34	58.86	61.05	62.46	0.61	0.65	0.69	0.71
T_{11}	Soil + FYM (1:2)+ PSB 1%	55.49	57.66	60.17	62.35	0.56	0.62	0.67	0.69
T_{12}	FYM + Soil (2:1)+ PSB 2%	54.79	57.11	59.28	61.32	0.54	0.58	0.63	0.67
T_{13}	Cocopeat + FYM (2:2)	52.97	55.85	57.98	59.97	0.52	0.56	0.59	0.64
S.Em.±		3.54	2.65	2.14	2.24	0.12	0.23	0.19	0.26
C.D. at 5%		10.61	7.95	6.40	6.70	0.35	0.68	0.56	0.78

Conclusion

In the light of results summarized above, it may be concluded that for higher success and survival rate of mango graft of T_7 (Soil + FYM + Vermicompost (1:1:1) + Biomixs 2%) should preferred over other combination bio agent and substrate combination. The observations are based on one season data, to get more precise information, it is suggested that the experiment.

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