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## Screening of perennial rootstocks and graft compatibility in Moringa (*Moringa oleifera*)

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### Abstract

The study was undertaken at Horticultural College and Research Institute, Coimbatore to identify the best performing perennial rootstocks for PKM 1 Moringa under drought condition. Among the seven rootstocks, moolanur moringa is identified as the best rootstock for PKM 1 Scion. The wedge method of grafting is standardized and confirmation studies were carried out with Histological method. Moolanur moringa has taken less number of days for germination (8.2 days), maximum germination percentage (79.4%) on 30 days after sowing, less number of days taken for graft union (14.2 days), less number of days for attaining graftable size (25.4 days) and success percentage was higher on 15 days after grafting (51.2%) than other perennial rootstocks. The number of roots in grafted and non-grafted moringa plants was found to be significantly different ranging between 2.47 to 6.78. Among the rootstocks T<sub>1</sub> – Moolanur moringa produced the highest number of roots (4.65) followed by T<sub>4</sub> - Kumbakonam local (3.69). T<sub>9</sub> – Moolanur moringa produced the highest number of roots (6.78), root length (9.51 cm), highest root weight of 0.37g and highest root volume of 0.69 cc. From this study it is concluded that Moolanur moringa is the best rootstock for PKM 1 scion and also wedge method of grafting is standardized.

**Keywords:** Perennial rootstocks, graft, *Moringa oleifera*

### Introduction

*Moringa oleifera* belonging to the family of Moringaceae, *M. oleifera* is a fast-growing, deciduous tree, grown mainly in semiarid, tropical, and subtropical areas. Moringa can withstand both severe drought and mild frost conditions and hence widely cultivated across the world. With its high nutritive values, every part of the tree is suitable for either nutritional or commercial purposes. Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds which is an effective remedy for malnutrition. Severity of biotic and abiotic stresses are increasing day by day which is a major hindrance in case of vegetable crop production and incidence of soil borne pathogen and extreme climate conditions causes low productivity. To tackle such adverse situation and increase productivity is a tough challenge at farmers' field. So, moringa grafting is a sustainable technique in the field of research and development to identify potential rootstocks and its standardization and commercialization which will be tolerant/ resistant to such adverse conditions. Hence, the present study aims to identify the perennial rootstock (Dash *et al.*, 2021) <sup>[9]</sup>, Continuous change in climatic condition is the major concern of vegetable production in whole world. Now development of abiotic tolerant variety or planting materials is the utmost important with changing scenario.

### Materials and Methods

The present investigation was carried out at the Department of Vegetable Science, Horticultural College and Research institute, Tamil Nadu Agricultural University, Coimbatore, during the period of 2019 and 2022 to evaluate different perennial moringa rootstocks on success of grafting with annual moringa scion var. PKM 1. Seeds of diverse moringa ecotypes viz., Moolanur moringa, Karumbu moringa, Kanyakumari local moringa, Kumbakonam local moringa, Padasolai local, Perennial long and Perennial short were obtained from different parts of Tamil Nadu. Annual moringa PKM 1 seeds were collected from Department of Vegetable Science, HC & RI, TNAU, Coimbatore. Seven graft combinations viz., MO 1 (Moolanur Moringa) rootstock with PKM 1 scion, MO 2 (Karumbu moringa) rootstock with PKM 1 scion, MO 3 (Kanyakumari local moringa) rootstock with PKM 1 scion, MO4 (KMU moringa) rootstock with PKM 1 scion, MO5 (Padasolai local)

rootstock with PKM 1 scion, MO6 (Kallivalasu local) rootstock with PKM 1 scion, MO7 (Puthupalayam local) rootstock with PKM 1 scion was used for the study to assess the best perennial rootstock for annual moringa cv. PKM 1. The experiment was conducted in Completely Randomized Design with three replications. In each treatment, 10 plants were maintained per replication.

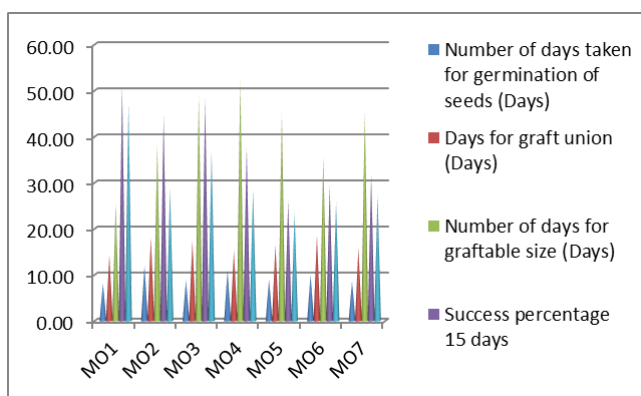
compared. Among the seven perennial moringa rootstocks, moolanur moringa has taken less number of days for germination (8.2 days), maximum germination percentage (79.4%) on 30 days after sowing, less number of days taken for graft union (14.2 days), less number of days for attaining graftable size (25.4 days) and success percentage was higher on 15 days after grafting (51.2%) than other perennial rootstocks.

**Results and Discussion**

The performance of roots stocks and scion were studied and

**Table 1:** Performance of the different rootstocks and PKM 1 scion

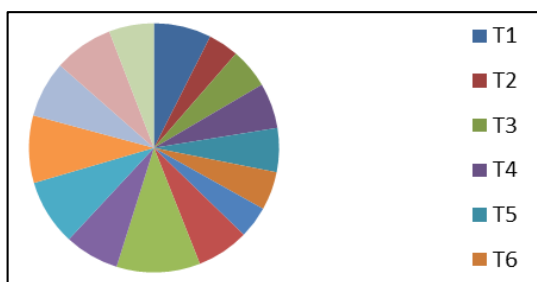
S. No.	Rootstocks/scion	Number of days taken for germination of seeds (Days)	Germination percentage on 30 days (%)	Days for graft union (Days)	Number of days for Graf table size (Days)	Success percentage	
						15 days	30 days
1	Moolanur moringa (MO1)	8.20	79.40	14.20	25.40	51.20	47.20
2	Karumbu moringa (MO2)	12.00	69.70	18.10	38.30	44.60	28.80
3	Kanyakumari local moringa (MO3)	8.80	78.60	17.40	49.10	48.30	36.70
4	Kumbakonam local (MO4)	8.60	67.80	15.80	45.30	31.80	27.20
5	Padasolai local (MO5)	11.00	48.30	15.30	52.50	37.90	28.50
6	Kallivalasu local(MO6)	9.00	55.40	16.50	45.20	26.10	23.40
7	Puthupalaym local (MO6)	10.00	53.90	18.60	35.60	29.40	25.80
8	PKM-1 moringa	6.00	85.20	-	20.50	-	-
	SE(d)	0.257	3.776	0.974	2.291	2.307	1.783
	C.D.	0.549	1.766	0.450	1.072	1.065	0.823



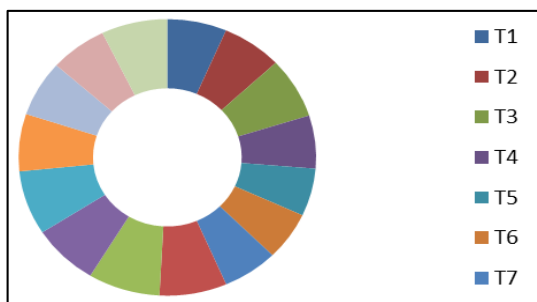
Rootstocks and PKM 1 scion

**Table 2:** Number of roots, root length, root dry weight and volume in grafted and non-grafted moringa plants

Treatments	Number of roots (No.)	Root length (cm)	Root dry weight (g)	Root volume (cc)
T1- Moolanurmoringa	4.65	7.86	0.34	0.64
T2- Karumbumoringa	2.47	7.95	0.30	0.56
T3- Kanyakumari Local	3.24	8.64	0.28	0.51
T4- Kumbakonam Local	3.69	7.54	0.21	0.43
T5- Padasolai Local	3.58	6.78	0.32	0.46
T6- Kallivalasu Local	3.12	6.85	0.29	0.49
T7- Puthupalayam Local	2.59	7.32	0.25	0.55
T8- PKM 1moringa	4.23	8.91	0.41	0.67
T9- Graft with Moolanurmoringa rootstock onto annual moringacv. PKM 1 scion	6.78	9.51	0.37	0.69
T10- Graft with Karumbumoringa rootstock onto annual moringacv. PKM 1 scion	4.42	8.78	0.33	0.58
T11- Graft with Kanyakumari Local rootstock onto annual moringacv. PKM 1 scion	5.36	9.12	0.31	0.56
T12- Graft with Kumbakonam Local moringa rootstock onto annual moringa cv. PKM 1 scion	5.47	8.15	0.24	0.55
T13- Graft with Padasolai Local rootstock onto annual moringacv. PKM 1 scion	4.57	7.93	0.35	0.49
T14- Graft with Kallivalasu Local rootstock onto annual moringacv. PKM 1 scion	4.81	7.56	0.36	0.53
T15- Graft with Puthupalayam Local rootstock onto annual moringa cv. PKM 1 scion	3.65	8.74	0.29	0.57
CD	0.229	0.448	0.017	0.030
SE(d)	0.111	0.218	0.008	0.015



Number of roots (No.)



Root length (cm)

### Number of roots in grafted and non-grafted moringa plants

The number of roots in grafted and non-grafted moringa plants was found to be significantly different ranging between 2.47 to 6.78. Among the rootstocks T<sub>1</sub> – Moolanur moringa produced the highest number of roots (4.65) followed by T<sub>4</sub> - Kumbakonam local (3.69). Whereas, T<sub>2</sub> – Karumbu moringa recorded least number of roots *i.e.* 2.47 followed by T<sub>7</sub> - Puthupalayam local (2.59). There was no significant difference between T<sub>2</sub> – Karumbu moringa and T<sub>7</sub> - Puthupalayam local. The number of roots recorded by scion T<sub>8</sub> - PKM 1 moringa was 4.23.

All the rootstocks produced significantly more number of roots after grafting rather than alone. In the graft combinations of rootstocks with PKM 1 moringa rootstock T<sub>9</sub> – Moolanur moringa produced the highest number of roots (6.78) followed by

T<sub>12</sub> - Kumbakonam local (5.47) and T<sub>11</sub> - Kanyakumari local rootstock (5.36). Whereas, T<sub>15</sub> - Puthupalayam local recorded least number of roots after grafting *i.e.* 3.65 followed by T<sub>10</sub> – Karumbu moringa (4.42) and T<sub>13</sub> - Padasolai local (4.57).

### Root length

The root length for grafted and non-grafted seedlings was found to be significantly different, ranging between 9.51cm to 6.78cm. Results revealed that T<sub>3</sub> - Kanyakumari local rootstock recorded the highest root length (8.64cm) followed by T<sub>2</sub> - Karumbu moringa (7.95cm). The scion T<sub>8</sub> - PKM 1

moringa has recorded root length of 8.91cm.

Among the graft combinations of rootstocks with PKM 1 moringa scion,

T<sub>9</sub> – Moolanur moringa rootstock recorded longest root of 9.51cm followed by

T<sub>11</sub> - Kanyakumari local rootstock (9.12cm) and T<sub>10</sub> – Karumbu moringa rootstock (8.78cm). Whereas, rootstock T<sub>14</sub> - Kallivalasu local produced least root length of (7.56cm).

### Root dry weight

Root dry weight was found to be significantly different in all the grafted, non-grafted seedlings. Among the rootstocks T<sub>1</sub> - Moolanur moringa recorded the highest root weight of 0.34g which is followed by T<sub>5</sub> - Padasolai local (0.32g). Whereas, T<sub>4</sub> - Kumbakonam local rootstocks recorded lowest root dry weight of 0.21g. The root dry weight of T<sub>8</sub> . PKM 1 moringa scion is 0.41g.

Among the graft combinations of rootstocks with PKM 1 moringa (scion),

T<sub>9</sub> – Moolanur moringa rootstock recorded the highest root weight of 0.37g followed by T<sub>14</sub> - Kallivalasu local rootstock (0.36g) and T<sub>13</sub> - Padasolai local rootstock (0.35g). Whereas, T<sub>12</sub> - Kumbakonam local rootstocks were recorded lowest root dry weight (0.24g) followed by T<sub>15</sub> - Puthupalayam local rootstock (0.29g).

### Root volume

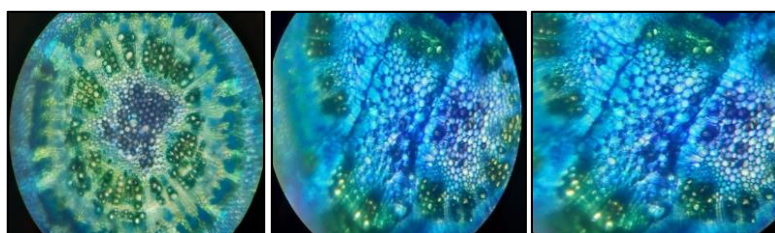
Significant variance in root volume among the mean data of grafted and non-grafted moringa seedlings were analyzed. Results unveiled that, T<sub>1</sub> – Moolanur moringa rootstock had recorded the highest root volume of 0.64 cc followed by T<sub>2</sub> - Karumbu moringa rootstock (0.56 cc). Whereas, T<sub>4</sub> - Kumbakonam local rootstock recorded the lowest root volume (0.43 cc). The scion T<sub>8</sub> - PKM 1 moringa recorded root volume of 0.67 cc.

Among the graft combinations of rootstocks with PKM 1 moringa (scion),

T<sub>9</sub> – Moolanur moringa rootstock seedlings recorded highest root volume of 0.69 cc followed by T<sub>10</sub> – Karumbu moringa rootstock (0.58 cc) and T<sub>15</sub> - Puthupalayam local rootstock (0.57 cc). Whereas, T<sub>13</sub> - Padasolai local rootstocks were recorded lowest root volume (0.49 cc).

### Confirmation of graft union with histological studies

In the present study, all processes of grafting were observed sequentially. Necrotic layer which formed as a result of cutting was seen along the cut surfaces in all the grafts. But in the course of time, necrotic layer was broken into pieces and absorbed by the newly formed callus, especially in the cortex regions of the grafts and finally necrotic layer was seen as light dark strands. It was seen that the removal of necrotic layer depended on cell division where callus was profuse.



Moolanur moringa rootstock and graft union

**Conclusion** In the present investigation, MO1 rootstock showed superiority over other perennial rootstock viz., MO2, MO3, MO4, MO5, MO6 and MO7 in the traits viz., days taken for seed germination, percentage of seed germination at 30 days, days taken for rootstocks and scion to attain graftable size, days taken for graft union and percentage of grafting success. From this experiment it can be concluded that perennial moringa ecotype MO1 (Moolanur moringa) is the best rootstock for successful grafting with annual moringa scion var. PKM 1.

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