Influence of perennial rootstocks and PKM1 scion on nutritional content of grafted moringa (*Moringa oleifera*Lam.)

ABSTRACT

The investigation was undertaken at Horticultural College ad Research Institute, Coimbatore to identify the graft compatibility of seven perennial moringa rootstocks for PKM 1 Moringa scion under drought condition. Among the seven rootstocks, moolanurmoringais identified as the best rootstock for PKM 1 Scionwith wedge method of grafting as confirmed with histological method.The leaf nutritional contents were analysed in all the seven perennial rootstocks, PKM1 moringa scion and graft combinations. Among the rootstocks, Padasolai local rootstocks had highest calcium content (559.93 mg/100g).Moolanurmoringa rootstocks had highest potassium content (358.46 mg/100g) and iron content (2.54 mg/100g). Among the graft combinations highest potassium content (368.74 mg/100g) and highest iron content (2.76 mg/100g), highest C/N ratio of 24.82 and highest total nitrogen content of 1.48% were recorded in the PKM-1 moringa scion grafted on to moolanurmoringa rootstock.

Key words :Moringa, Graft, Rootstock, Calcium, Potassium, Iron, Nitrogen, CN ratio

Introduction

"Moringaoleifera Lam. belonging to the family Moringaceae is a handsome softwood tree, native of India, occurring wild in the sub-Himalayan regions of Northern India and now grown worldwide in the tropics and sub-tropics. In India it is grown all over the subcontinent for its tender pods and also for its leaves and flowers. The pod of moringa is a very popular vegetable in South Indian cuisine and valued for their distinctly inviting flavour.It is grow best in dry sandy soil and also tolerates poor soil of Semi- arid tropical and sub tropical areas. Optimum temperature for cultivation of moringa is 25- 35 ° C.India is the primary producer of tender pods with an annual production of 2.20 to 2.40 million tonnes from an area of 38,000ha leading to the productivity of around 63 tonnes per ha. In Tamil Nadu. Moringapaid its attention in export due to its nutritional value. It is called as 'Miracle tree' since all parts is exploited commercially for nutracetical, cosmetics, food and oil induxtries" (Balakumbahan and Kavitha 2019, Sidhdharth*et.al.,* 2021).Vijayakumar*et al.* (2003) mentioned"moringaasa multipurpose tree, wherein the leaves, flowers and fruits are used for culinary and medicinal purposes. Before the variety PKM 1 released by Tamil Nadu Agricultural University moringa had been grown as a perennial crops and in a limited area. Invention of annual moringa cv. PKM-1 is a milestone in the research on moringa by which the area and productivity were

greatly increased in Tamil Nadu. It has occupied considerable area in adjoining states like Karnataka and Andhra Pradesh and spred to Gujarath and parts of Rajasthan and Madhya Pradesh. Since it is a seed sown crop and annual in nature, it responds markedly to seasonal changes. The vegetative phase is extended if it is sown in a wrong season. Research findings on several horticultural crops accomplished that grafting is one of the technique to improve the nutritional composition". Hayat *et al.,* (2019) reported that "the starch content were higher in leaf and root of Red Fuji apple grafted onto M-9 rootstock compared with more vigorous rootstock". Liu *et al.,* (2012) reported that "grafting musk melon on interspecific rootstock can reduce total carbohydrate accumulation during early development and increase starch accumulation in the later developmental stage of leaves". Pulgar*et.al*., (2000) studied "the mineral nutrition in grafted water melon plant and reported that the pumpkin cultivar as rootstock showed a high capacity of N uptake". Chen *et.al*., (2000) reported that "grafted squash seedlings recorded significant increase in photosynthetic rate, chlorophyll content and soluble protein than in self-rooted seedlings after undergoing the same period of chilling stress". Zhang (2004) reported that "dry matter, protein, vitamin C and sugar content of grafted eggplant were higher than those of non-grafted eggplant".With a view on considering the nutritional importance of moringa, an investigation was undertaken to study the influence of perennial moringa rootstocks grafted with PKM 1 Annual Moringa scion at Horticultural College ad Research Institute, Coimbatore during the year 2021-2022.

Materials and Methods

Experiment on screening of perennial moringa rootstocks for grafting of PKM 1 Annual moringa (*Moringaoleifera* Lam.) scion was conducted in the College Orchard, Department of Vegetable Science, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, situated at 11^0N latitude, 77^0E longitude and at an altitude of 426.26 m above mean sea level.The materials in this present study consist of seven rootstocks *viz*., MO1 (Moolanurmoringa), MO2 (Karumbumoringa), MO3 (Kanyakumarilocal), MO4 (Kumbakonam local), MO5 (Padasolai Local), MO6 (Kallivalasu Local) and MO7 (Puthupalayam Local), whereas Annual moringa PKM 1 was utilized as a scion material. Wedge grafting method carried out in 25-30 days old seedlings.The Completely Randomized Design was followed. The recorded data was analyzed using the statistical method suggested by Panse and Sukhatme (1957). The mean difference was statistically computed by the standard error and critical difference among the treatments.

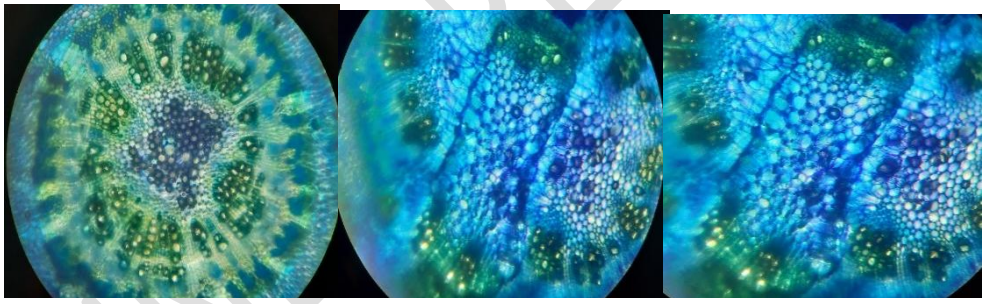
The total nitrogen content was estimated by Kjeldahl's method by Humphries (1956). The calcium and potassium content of leafwas determined by Jackson (1973).The iron content of leaf samples were determined by Atomic Absorption Spectrophotometer method (Lindsay 1988). The ratio of carbohydrate to nitrogen was calculated from total carbohydrate and total nitrogen contents.

Results and Discussion

Confirmation of Graft union with Histological studies

Among the seven rootstocks, Moolanurmoringais 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. 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.

Fig.1 Moolanurmoringa Rootstock and Graft Union



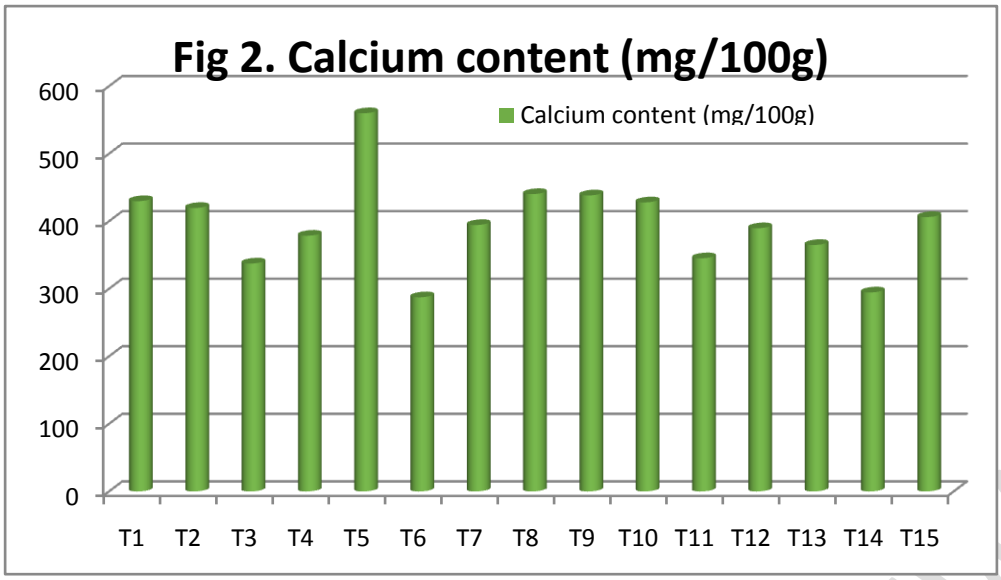
Calcium content on grafted and non-grafted moringa

The calcium content for grafted and non-grafted seedlings was found to be significantly different, ranging between 249.59 to 559.93 mg/100g. Results revealed that, Padasolai local rootstocks had highest calcium content (559.93 mg/100g) than that of PKM-1 moringa (440.25 mg/100g),Among the graft combinations PKM-1 annual moringa scion grafted on to Moolanurmoringa rootstock showed highest calcium content (438.23

mg/100g)followed by Karumbumoringa rootstock (427.94 mg/100g) and Kallivalasulocalmoringa rootstock (406.17 mg/100g) respectively.

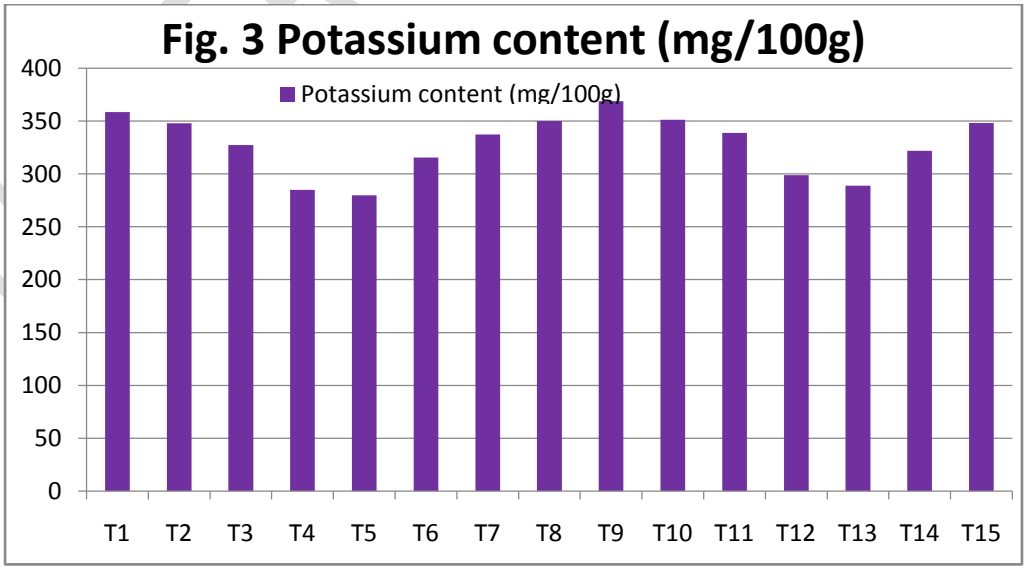
Table 1 Calcium content on grafted and non-grafted moringa leaves

Treatments	Calcium content (mg/100g)	Potassium content (mg/100g)	Iron content (mg/100g)	C/N ratio	Total nitrogen content (%)
T1 -Moolanurmoringa	429.75	358.46	2.54	21.54	1.86
T2 -Karumbumoringa	419.64	347.93	1.78	19.27	1.46
T3 -Kanyakumarimoringa	337.43	327.46	0.75	21.34	1.31
T4 -Padasolai local	559.93	279.64	0.61	23.67	1.59
T5 -Kallivalasu Local	394.38	337.23	1.73	14.35	1.28
T6 -Puthupalayam Local	287.37	315.46	0.81	13.72	1.67
T7 -Kumbakonam Local	378.57	284.89	0.69	17.61	1.21
T8 -PKM-1 moringa	440.25	349.92	1.82	22.57	1.33
T9 -PKM-1 moringa grafted on to moolanurmoringa rootstock	438.23	368.74	2.76	24.82	1.48
T10 -PKM-1 moringa grafted on to karumbumoringa rootstock	427.94	351.23	1.95	18.69	1.29
T11 -PKM-1 moringa grafted on to kanyakumarimoringa rootstock	345.15	338.76	0.83	23.65	1.20
T12 -PKM-1 moringa grafted on to padasolaimoringa rootstock	364.82	288.87	0.65	22.51	1.47
T13 -PKM-1 moringa grafted on to kallivalasu local moringa rootstock	406.17	348.27	1.79	17.96	1.31
T14 -PKM-1 moringa grafted on to puthupalayam local moringa rootstock	294.59	321.89	0.86	16.52	1.25
T1 5-PKM-1 moringa grafted on to Kumbakonammoringa rootstock	389.67	298.76	0.74	19.32	1.19
CD	22.279	18.117	0.085	1.096	0.076
SE (d)	10.820	8.799	0.041	0.532	0.037



Potassium content on grafted and non-grafted moringa leaves

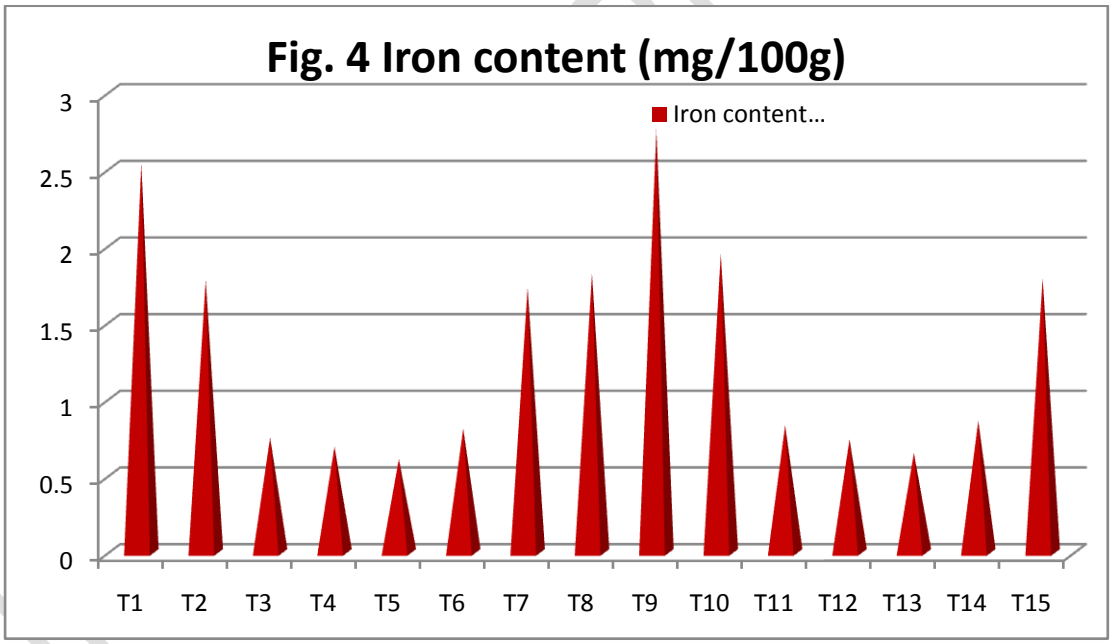
The potassium content for grafted and non-grafted seedlings was found to be significantly different, ranging between 279.64 to 368.74 mg/100g. Results revealed that, Padasolai local rootstock had comparatively lowest potassium content i.e. 279.64 mg/100g which was on par with Kumbakonamlocalmoringa (284.89 mg/100g). However, Moolanurmoringa rootstocks had highest potassium content (358.46 mg/100g) which was on par with karumbumoringa (347.93 mg/100g). Among the graft combinations of rootstocks with PKM-1 moringa grafted on to moolanurmoringa rootstock showed highest potassium content (368.74 mg/100g) which was on par with karumbumoringa rootstock (351.23 mg/100g). Rootstock padasolaimoringa had lowest potassium content (288.87 mg/100g) which was on par with Kumbakonamlocalmoringa rootstock (298.76 mg/100g).



Iron content on grafted and non-grafted moringa leaves

The iron content for grafted and non-grafted seedlings was found to be significantly different, ranging between 0.61 to 2.76 mg/100g. Results revealed that, Padasolai local rootstock had comparatively lowest iron content i.e. 0.61 mg/100g which was on par with kumbakonam1ocalmoringa (0.69 mg/100g). However, Moolanurmoringa rootstocks had highest iron content (2.54 mg/100g) than that of PKM-1 moringa (1.82 mg/100g).

Among the graft combinations of rootstocks with PKM-1 moringa grafted on to Moolanurmoringa rootstock showed highest iron content (2.76 mg/100g) followed by Karumbu moringa rootstock (1.95 mg/100g) and Kallivalasu local rootstock (1.79 mg/100g) respectively. Rootstock Padasolaimoringa had lowest iron content (0.65 mg/100g) after grafting followed by Kumbakonamlocalmoringa rootstock (0.74 mg/100g) and Kanyakumari moringa rootstock (0.83 mg/100g).



C/N ratio

Results revealed that, PKM-1 moringa (scion) had shown significantly lesser C/N ratio i.e. 22.57 than that of Padasolai local (23.67) rootstock. Among the rootstocks, Padasolai local recorded highest C/N ratio of 23.67 followed by Moolanurmoringa (21.54) and Kanyakumari local moringa (21.34) respectively. Significant difference was found to be null between Moolanurmoringa and Kanyakumari localmoringa. It was evident that Padasolai local rootstock significantly differed with rootstocks *viz*., Moolanurmoringa and

Kanyakumarilocalmoringa. However, rootstock recorded lowest C/N ratio (13.72) followed by kallivalasulocal(14.35) rootstock.

Among the graft combinations of rootstocks with PKM-1 moringa (scion), Moolanurmoringa rootstock seedlings recorded highest C/N ratio of 24.82 followed by Kanyakumari localmoringa rootstock (23.65) and Padasolaimoringa rootstock (22.51) respectively. However, after grafting with PKM-1 moringa, Puthupalayamlocalmoringa rootstock were reported to have lowest C/N ratio (16.52) followed by to kallivalasulocalmoringa rootstock (17.96) and Karumbu moringa rootstock (18.69).

Total nitrogen content

Results revealed that, Puthupalayam local rootstock had shown comparatively lesser total nitrogen content i.e. 1.67% than that of Moolanurmoringa rootstock (1.86%). Among the rootstocks, Moolanurmoringa recorded highest total nitrogen content of 1.86% followed by rootstocks *viz*., Padasolai local (1.59%) and Karumbumoringa (1.46%) respectively. It was evident that Moolanurmoringa rootstock significantly differed with rootstocks *viz*., Padasolai local and Karumbumoringa. However, Kumbakonamlocalmoringa rootstock recorded lowest total nitrogen content (1.21%) followed by kallivalasu local rootstock (1.28%). This clearly depicted that significant difference was null between rootstocks viz., Kumbakonamlocalmoringa and Kallivalasu local moringa.

Among the graft combinations of rootstocks with PKM-1 moringa (scion), Moolanurmoringa rootstock seedlings recorded highest total nitrogen content of 1.48% followed by Padasolaimoringa rootstock (1.47%) and perennial long moringa rootstock (1.31%) respectively. However, when grafted with PKM-1 moringa, rootstock Kumbakonamlocalmoringa were known to have lowest total nitrogen content (1.19%) followed by Kanyakumari moringa rootstock (1.20%) and Puthupalayamlocalmoringa rootstock (1.25%).

Conclusion

Among the rootstocks, Padasolai local rootstocks had highest calcium content (559.93 mg/100g) than that of PKM-1 moringa (440.25 mg/100g).Moolanurmoringa rootstocks had highest potassium content (358.46 mg/100g) and iron content (2.54 mg/100g). Among the graft combinations of rootstocks with PKM-1 moringa grafted on to Moolanurmoringa rootstock showed highest potassium content (368.74 mg/100g) andhighest iron content (2.76

mg/100g),highest C/N ratio of 24.82 and highest total nitrogen content of 1.48%. From this study it can be concluded that the performance of graft combinations of Moolanurmoringa on to PKM 1 Scion recorded the highest nutritional content when compared to other combinations

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