

EVALUATION OF MORINGA (*Moringa oleifera*.Lam) GENOTYPES FOR SEED OIL YIELD AND QUALITY

Abstract :

A study was carried out at the Department of Vegetable Science, Horticultural College and Research Institute, Periyakulam, during 2022 in ten moringa genotypes to assess pod, seed characters, seed oil yield and quality. In pod characters, among ten genotypes PKM MO-3 recorded the highest pod length (75 cm) & fresh pod weight (154g), PKM MO 7 recorded the highest dry pod weight (37g), PKM MO 2 recorded the highest pod girth (7.7 cm) and PKM MO 9 recorded the lowest pod length, fresh pod weight, Number of seeds per pod and pod yield per tree. In seed characters PKM MO 3 registered the highest seed length (0.92cm), seed width (0.79cm), seed diameter (1.20cm) and PKM MO 10 recorded the lowest highest seed length (0.72cm), seed width (0.64cm) and seed diameter (0.96cm). The moringa seed oil composition extracted with different methods such as expeller pressed method, soxhlet extraction method, and clevenger extraction method were compared. The oil yield obtained by expeller, soxhlet and clevenger was 27.84, 26.1 and 25.35 per cent respectively. Also specific gravity, density, viscosity, refractive index was measured by different method of oil extraction in ten genotypes. These results promoted the use of expeller pressed method for the extraction of high quality moringa oil.

Keywords : Genotypes, Pod characters, Seed characters, Extraction methods, Expeller pressed method, Soxhlet apparatus, Clevenger apparatus, Oil yield.

Introduction

Moringa (*Moringa oleifera* Lam.) is well known to the ancient world, but only recently it has been rediscovered as a multipurpose tree with a tremendous variety of potential uses. Moringa tree belongs to the family “Moringaceae” with genus “Moringa Adans” and species “*M.oleifera* Lam”. This species originally comes from North India but now has spread worldwide in the tropics and subtropics (Enwaet *al.*, 2013). In some parts of the world, *M. oleifera* is referred to as the ‘Drumstick tree’ or the ‘Horse radish tree’, whereas in others, it is

known as the Kelor, Marango, Mlonge, Moonga, Mulangay, Nebeday, Saijhan and Sajna or Ben oiltree (Prabhuet *al.*, 2011). India is the largest producer of moringa with an annual production of about 5 million tonnes of tender pods from an area of 6160 ha. In India, Andhra Pradesh leads in both area (18,000 ha) and production (7,20,000 MT), followed by Karnataka (12000 ha and 4,56,000 MT). Tamil Nadu ranks third with an area of 8,00,000 ha and production of 2,80,000 MT (Farook *et al.*, 2023). The moringa seeds have many bioactive compounds, which are used in anti-microbial, anti-genotoxic, anti-inflammatory and anti-tumour promoting activities (Prabhuet *al.*, 2011). Moringa seed oil is considered equivalent to olive oil in terms of its chemical properties and contains a large quantity of tocopherols, and also for edible purpose (Middleton *et al.*, 2000). Moringa seed kernel oil is called as ben oil, is more stable than canola oil, soybean oil, and palm oil when used for frying of foods (Abdulkarim *et al.*, 2005). Blending ben oil with sunflower oil and soybean oil enhances the oxidative stability of the mixture (Mani *et al.*, 2007). Comparing its chemical properties, moringa seed oil is considered equivalent to olive oil and may be used for human consumption. India is known to be the place of origin of moringa and lot of diversity is available in India. In Tamil Nadu, perennial and annual moringa genotypes are commercially cultivated. Identification of genotype with high oil yield is important for commercial exploitation. Hence, the present study was conducted at HC&RI Periyakulam, to identify the suitable genotypes for higher oil yield and quality.

Materials and methods

The present study was conducted at Horticultural College and Research Institute (HC & RI) Periyakulam during 2022. Moringa genotypes maintained at HC&RI Periyakulam were used for the present investigation. The following pod and seed characters *viz.*, pod length, pod girth, fresh pod weight, dry pod weight, number of pods per tree, number of seeds per pod, pod yield per ha, seed length, seed width, seed diameter and seed yield per ha. A randomly Block design was used for the experiment with 10 genotypes distributed among two replications. For oil yield and quality, Factorial Completely Randomized Design with two replications was used and physiochemical properties *viz.*, oil yield, Specific gravity, density, viscosity refractive index was observed.

Table.1. Different moringa genotypes used for the present study

Accessions No.	Name of the genotypes
PKM MO 1	Vadipatti Moringa
PKM MO 2	Mulanur Moringa
PKM MO 3	PKM-1 Moringa
PKM MO 4	Valaiyapatti Moringa
PKM MO 5	Kannivadi Local Moringa
PKM MO 6	Kappalpatti Moringa
PKM MO 7	Aravakuruchi Local Moringa
PKM MO 8	Karumbu Moringa
PKM MO 9	Nattu Moringa
PKM MO 10	Oddanchathram Local moringa

Processing of Moringa Seeds

Moringa kernels were cleaned to remove stones, dirt, sand and other extraneous materials. The cleaned kernels were cracked by hand to remove the shell from the nuts. The seeds were divided into three equal parts; a part of the seeds were dried in the cabinet oven at 60°C for 2 hours; after which it was milled to flour in an attrition mill to obtain a smooth Moringa seeds flour. Another portion was sun dried at the normal atmospheric temperature for 4 days and milled to obtain the flour while the last part was not subjected to any drying method (serves as control sample).

Methods of Extraction

1. Expeller - pressed method

Expeller pressing (also called **oil pressing**) is a mechanical method for extracting oil from raw materials. The raw materials were squeezed under high pressure in a single step. As the raw material was pressed, friction caused it to heat. In the case of harder nuts (which require higher pressures) the material can exceed temperatures of 200°F.

2. Soxhlet apparatus method

The soxhlet extraction was carried out from powdered seed samples using ethanol and the temperature was set at 50-60°C. The Soxhlet apparatus was operated for 6 h to recover the oil

followed by removal of solvent in rotary evaporator. The residue oil was kept in colored vials at -18°C till analysis

3.Clevenger apparatus method

The seeds were washed thoroughly and the seed coats were removed. The separated seed kernels were crushed using pestle and mortar to make into fine coarse powder. The powder was subjected to hydro distillation for 7 h using Clevenger apparatus. The essential oil was collected and dried over sodium sulphate (anhydrous) and it was kept at 4°C for further study.

Result and discussion

Table 2. Pod characters of different moringa genotypes

S.No	Pod length (cm)	Pod girth (cm)	Fresh pod weight (g)	Dry pod weight (g)	No. of pods/tree	No. of seeds/pod	Pod yield / tree (kg)
PKM MO 1	61	6.5	128	28	345	16	50.56
PKM MO 2	59	7.7	110	34	375	18	46.75
PKM MO 3	75	7.0	154	24	175	14	34.65
PKM MO 4	57	6.8	146	28	360	20	59.86
PKM MO 5	58	6.1	125	25	385	23	54.37
PKM MO 6	56	5.8	116	26	325	19	43.50
PKM MO 7	52	7.5	118	37	377	20	50.38
PKM MO 8	72	5.2	124	27	302	12	43.64
PKM MO 9	40	7.5	70	26	313	10	25.41
PKM MO 10	55	6.6	139	23	362	19	57.26
Mean	58.5	6.67	123	27.8	332	17.1	46.6407
SE(d)	1.0545	0.0931	2.8999	0.8229	7.4691	0.2197	0.7309

From this study it was found that the length of the pod was highest in the genotype PKM MO 3 (75 cm) followed by PKM MO 8 (72cm) and PKM MO 1 (61cm). The lowest pod length was observed in the genotype PKM MO 9 (40cm).The girth of the pod was highest in the genotype PKM MO 2 (7.7cm) followed by PKM MO 7 & 9 (7.5 cm) and the lowest girth was observed in the genotype PKM MO 6 (5.8 cm). The pod weight was highest in the genotype PKMMO 3 (154g) followed by PKM MO 4 (146g), the lowest pod weight was recorded in the genotype (70g). The dry pod weight was highest in the genotype PKM MO 7 (37g) followed by

PKM MO 2 (34g) and the lowest was in the genotype PKM MO 10 (23g) . No of pods per tree was highest in the genotype PKM MO 5 (385) followed by PKM MO 7 (377) and the lowest in the genotype PKM 1 (175) . No.of seeds per pod was highest in the genotype PKM MO 5 (23) followed by PKM MO 4 & 7 (20) and least in the genotype PKM MO 9(10).The pod yield per tree was highest in the genotype PKM MO 4 (59.86 Kg) followed by PKM MO 10 (57.26 Kg) the lowest in the genotype PKM MO 3 (34.65 Kg).The similar findings results were observed by Balaguru *et al.*,(2020).

Table 3.Seed characters of different moringa genotypes

S.No	Seed length (cm)	Seed width (cm)	Seed diameter (cm)	Seed yield / tree (kg)
PKM MO 1	0.75	0.66	1.04	1.766
PKM MO 2	0.85	0.73	1.18	2.565
PKM MO 3	0.92	0.79	1.24	0.894
PKM MO 4	0.78	0.68	1.02	2.160
PKM MO 5	0.84	0.75	1.14	2.833
PKM MO 6	0.86	0.72	1.09	1.883
PKM MO 7	0.90	0.78	1.20	2.827
PKM MO 8	0.75	0.69	1.06	1.268
PKM MO 9	0.76	0.65	1.07	1.126
PKM MO 10	0.72	0.64	0.96	2.372
Mean	0.813	0.709	1.1	1.9694
SE(d)	0.0260	0.0177	0.0350	0.0293

From this study it was found that the length of the seed was highest in the genotype PKM MO 7 (0.92 cm) followed by PKM MO 3(0.90 cm) and the lowest seed length was observed in the genotype PKM MO 10 (0.72 cm).The width of theseedwas highest in the genotype PKM MO 3 (0.79 cm) followed by PKM MO 7 (0.72 cm) and the lowest width was observed in the genotype PKM MO 10 (0.64) The seed diameter was highest in the genotype PKM MO 3(1.24cm) followed by PKM MO 7 (1.20 cm) , the lowest seed diameter observed in the genotype PKM MO 10 (0.96 cm) . The seed yield per tree was highest in the genotype PKM MO 5 (2.833 kg) followed by PKM MO 7 (2.827 kg) the lowest in the genotype PKM MO 3 (0.89 Kg) .Similar results were observed by Adejumo Bo (2012).

Table.4:Comparison of physio chemical properties of moringa oil extracted different methods

S.No	Parameters	Expeller pressed method	Soxhlet extraction	Clevenger extraction
1.	Oil yield (%)	27.847	26.1	25.35
2.	Specific gravity (kg/m ⁻³)	0.9335	0.8790	0.8972
3.	Density (Kg/m ³)	0.9165	0.9130	0.8930
4.	Viscosity (mPa.s)	296.65	285.25	290.35
5.	Refractive index	1.2711	1.3446	1.2462

In this study the seed oil yield was highest in the expeller pressed method (27.85%) followed by soxhlet extraction (26.1%) and lowest oil yield was observed in clevenger extraction method (25.35%) for PKM1. Similar results were observed by Elsorady and Muhammad, (2020). The specific gravity was highest in the expeller pressed method (0.9335 kg/m⁻³) followed by soxhlet extraction (0.8790kg/m⁻³) and lowest in the clevenger extraction method (0.8972kg/m⁻³). The density was highest in the expeller pressed method (0.9165kg/m³) followed by Soxhlet extraction (0.9130 Kg/m³) and lowest in the clevenger extraction method (0.8930 kg/m³). The viscosity was highest in the expeller pressed method (296.65mPa.s) followed by clevenger extraction (290.35mPa.s) and lowest in the soxhlet extraction method (285.25mPa.s). Refractive index was highest in the soxhlet extraction method (1.3446) followed by expeller pressed method (1.2711) and lowest in the clevenger extraction method (1.2462). Similar results were obtained by Ogunsina *et al.*, (2014).

Conclusion :

An experiment was conducted to evaluate different moringa genotypes for pod, seed and oil characters. Among the ten genotypes, PKM MO-3 recorded the highest pod and seed characters followed by PKM MO 7 and PKM MO 9 recorded the lowest pod and seed characters. Though the seed yield per tree was highest in the genotype PKM MO-3, because of less population, the over all yield per hectare was found to be less compared to PKM MO 3. Expeller pressed method showed technical viability in the extraction of moringa oil from seeds. The lowest

oil yield was obtained by Clevenger extraction. The expeller pressed method produced highest oil quality compared to Soxhlet and Clevenger extraction methods with its higher specific gravity and density because there are no chemicals used. Hence, expeller method may be used for the extraction of moringa oil.

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