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# Effect of pinching and nutrient spray on seed yield and quality of annual moringa cv. PKM 1

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**Abstract**
An investigation was carried out to study the effect of pinching and foliar spray of nutrients on seed yield and quality of annual moringa (*Moringa oleifera* Lam) cv. PKM 1 at Horticultural College and Research Institute, Periyakulam. Treatments consisted of pinching at 30 and 60 cm height and foliar spray of potassium nitrate (0.5%) and boric acid 0.2% were given at 100 days after planting for both first crop and ratoon crop. Results revealed that days to 50% flowering (153.7 and 150.2), no. of pods / panicle (1.09 and 1.07), pod set percentage (2.18 and 2.19), no. of pods / tree (112 and 132.1) and seed yield / tree (525.4 and 542.4g) were found to be higher in pinching at 60 cm height from ground level and with foliar spray of 0.2% boric acid, followed by pinching at 60 cm height with a foliar spray of 0.5% potassium nitrate in both first and ratoon crop.

**Keywords:** Moringa, pinching, foliar spray, potassium nitrate, boric acid

## Introduction
*Moringa oleifera* Lam is a valuable vegetable crop belonging to the family Moringaceae (Olson, 2002) [8]. It is also known by several synonyms as The Spinach Tree, Mother's Best Friend, Miracle Tree, Horse Radish Tree, Drumstick Tree, West Indian Ben *etc*., (Ramachandran *et al*., 1980) [9]. It is indigenous to North West India and Africa. Now it is grown worldwide in the tropics and sub-tropics. The genus Moringa has more than 13 species of which two species *viz., M. oleifera* and *M. concanensis* are available in India and the former is the vegetable type. *Moringa oleifera* is an important food commodity having enormous attention as the 'natural nutrition of the tropics'.

India is the prime producer of moringa (Drumstick) with an annual production of 2.2 to 2.4 million tonnes of tender fruits leading to a productivity of 51 tonnes per hectare. Tamil Nadu is the largest producer of moringa with an annual production of 6.71 lakh tonnes of tender fruits from an area of 13250 ha (Sekhar *et al*., 2018) [12]. It is known as a multipurpose tree as it is grown for its nutritious pods, edible leaves and flowers and also it provides a good source of food, medicine (all plant parts), gum (from tree trunks), green manure (free leaves), biogas (from leaves), cosmetic oil, pulp (wood), rope (bark) forage for livestock and water purification (powdered seeds) (Paliwal *et al.*, 2011). The edible seeds have high oil content of about 42 per cent.

Moringa is one of the commercial vegetables of Tamil Nadu. Earlier, perennial moringa occupied the major area and after the introduction of the varieties PKM 1 and PKM 2, the seed moringa types have become very popular due to the factors like ease of propagation, convenience in transport and high yield potential. Though moringa produce lush flowering in seasons, percentage of pod set is just around one per cent (Sadasakthi, 1995) [11]. Hence to meet the growing demand, there is a need to improve the pod set per cent and to achieve higher productivity in moringa, the plants could be supplemented with nutrients through foliar spray, which will reduce the loss through adsorption, leaching and other processes associated with soil application (Harris and Mathuma, 2015) [6]. Hence, there is a great scope for improvement of seed yield by adopting agronomic practices like pinching and foliar application of nutrients. This study has aimed at improving the pod set per cent of moringa through foliar spray of nutrients combined with different levels of pinching of PKM 1 annual moringa.

## Materials and Methods
The experiment was conducted in the Western block farm of Horticultural College and Research Institute, Periyakuam during 2018-20 using the annual moringa variety PKM 1.

The experiment was laid out in factorial randomized block design with four replications. The treatments consisted of two levels of pinching *viz.*, pinching at a plant height of 30 cm from ground level (P1) and pinching at a plant height of 60 cm from ground level (P2) for first crop. Pruning and pinching were carried out in ratoon crop at a height of 30 and 60 cm from ground level and at 30 and 60 cm in the side branches respectively. The foliar spray of water (S1), $KNO_3$ at 0.5% (S2) and boric acid 0.2% (S3) was scheduled. Spray treatments were imposed at 100 days after planting. The observations such as days to 50% flowering, no. of florets per panicle, no. of pods per panicle, pod set percentage, no. of pods per tree, no. of seeds per pod, seed yield per tree and 100 seed weight were recorded in six randomly tagged trees. The observations recorded were statistically analyzed using AGRESS software. The results were subjected to analysis of variance and treatment differences tested for significance (P = 0.05) as per Gomez and Gomez (1984) [5].

**Table 1:** Effect of pinching and nutrient spray on growth and yield parameters of annual moringa cv.PKM1

| Treatments | Days to 50% flowering | | No of florets/ panicle | | No of pods / panicle | | Pod set % | | No of pods / tree | | No of seeds / pod | | Seed yield/ tree (g) | | 100 seed weight (g) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First crop | Ratoon crop | First crop | Ratoon crop | First crop | Ratoon crop | First crop | Ratoon | First crop | Ratoon crop | First crop | Ratoon crop | First crop | Ratoon crop | First crop | Ratoon crop |
| P1S1 | 159.3 | 154.0 | 41.30 | 52.85 | 0.90 | 0.94 | 1.91 | 1.90 | 87.0 | 115.3 | 15.6 | 16.44 | 387.8 | 482.2 | 29.8 | 30.80 |
| P1S2 | 156.6 | 153.2 | 46.60 | 48.23 | 0.89 | 0.86 | 1.90 | 2.01 | 92.0 | 120.4 | 15.80 | 17.50 | 402.1 | 509.4 | 29.6 | 30.10 |
| P1S3 | 155.0 | 151.2 | 51.10 | 53.58 | 1.01 | 1.04 | 1.98 | 2.03 | 102.0 | 123.7 | 15.80 | 18.08 | 450.1 | 521.7 | 30.0 | 31.70 |
| P2S1 | 158.0 | 154.4 | 43.30 | 52.24 | 0.87 | 1.01 | 2.01 | 2.10 | 96.0 | 110.5 | 16.20 | 18.06 | 442.4 | 486.1 | 30.1 | 30.60 |
| P2S2 | 154.6 | 152.4 | 45.10 | 50.13 | 0.91 | 1.02 | 2.02 | 2.13 | 102.0 | 124.6 | 16.30 | 18.02 | 490.9 | 522.3 | 30.2 | 31.20 |
| P2S3 | 153.7 | 150.2 | 55.60 | 53.89 | 1.09 | 1.07 | 2.18 | 2.19 | 112.0 | 132.1 | 16.30 | 18.77 | 525.4 | 542.4 | 30.3 | 31.80 |
| Mean | 156.2 | 152.56 | 47.16 | 51.82 | 0.95 | 0.99 | 2.00 | 2.06 | 98.50 | 121.1 | 16.00 | 17.81 | 449.78 | 510.3 | 30.0 | 31.03 |
| | SEd | CD | SEd | CD | SEd | CD | SEd | CD | SEd | CD | SEd | CD | SEd | CD | SEd | CD |
| P | 0.856 | 1.712 | 1.245 | 2.49 | 0.199 | 0.424 | 0.017 | 0.037 | 2.964 | 6.319 | 0.17 | 0.33 | 4.982 | 10.619 | 0.13 | 0.27 |
| S | 1.048 | 2.235 | 1.524 | 3.25 | 0.243 | 0.519 | 0.021 | 0.045 | 3.631 | 7.739 | 0.11 | 0.22 | 6.10 | 13.005 | 0.16 | 0.32 |
| P x S | 1.483 | NS | 2.156 | NS | 0.345 | 0.735 | 0.30 | NS | 5.135 | NS | 0.29 | 0.51 | 8.62 | 18.39 | 0.23 | 0.46 |

## Results and Discussion

Number of inflorescence is the prime factor that decides the ultimate yield of a crop. Pinching and growth promoting nutrient spray significantly influenced the days to 50% flowering, flowers per panicle and other pod related characters. Spraying 0.2% boric acid induced earlier panicle initiation (153.7 and 150.2 days in first and ratoon crop respectively) and increased number of flowers per panicle (55.6 and 53.89) in first and ratoon crop. This might be due to the adequate availability of boron for the development of new meristem cells. Also, boron plays a vital role in maintenance of carbohydrate movement in a suitable manner to the flowering meristematic cells as reported by Rashid *et al*., 2004 [10]. Boron effect on IAA metabolism and phosphorous uptake might have increased the number of flowers per panicle (Day, 2000).

The impact of pinching and nutrient spray on number of pods per panicle was notable when pinching done at 60 cm height from ground level with 0.2% boric acid spray (1.09 and 1.07 in both crops), compared to other treatments. Modulation of flowering and fruit set can be influenced by several factors that can affect the pollination and fruit set in very early stages of flowering. Boron availability also affects fertilization by affecting the pollen producing capacity of anthers and pollen grain availability (Dell and Huang, 1997) [4]. Increased number of fruits per panicle by spraying boron was also reported by Vijay *et al.* (2016) [14] in mango. The pod set percentage ranged from 1.90 to 2.18% in first crop and 1.09 to 2.19% in ratoon crop. The highest pod set was recorded in pinching at 60 cm and 0.2% boric acid spray. Deficiency of boron causes abnormality in development of reproductive organs (Huang *et al.*, 2000) [7]. Application of boron prior to flowering increases fruit set was opined by Wojcik and Wojcik (2003) [15].

The highest number of pods per tree (112 and 132.1 in first and ratoon crop respectively) was also recorded in pinching at 60 cm height and boric acid (0.2%) spray. This result is attributed to the easy availability of boron by foliar spray and role of boron in cell integrity, sugar transport, RNA metabolism and enhancing respiration rate, increasing uptake of certain nutrients and metabolic activities. This result is in accordance with the findings of Ali *et al.* (2013) [2] in tomato and Suganiya *et al.* (2015) [13] in brinjal.

Seed yield (525.4 and 542.4 g/tree in both crops) was also enhanced by pinching above ground level and boric acid spray. The increased number of seeds per pod (16.3 and 18.77 in first and ratoon crop) and 100 seed weight (30.3 and 31.8g in both crops) might have contributed to the increment in seed yield. The prolonged photosynthetic activity during flowering and improved partitioning assimilates for biomass accumulation favoured by boron availability (Al-Amery *et al.*, 2011) [1] might have resulted in enhanced seed yield and other seed quality parameters.

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