

# STATUS OF PRODUCTION AND UTILISATION OF MORINGA IN SOUTHERN INDIA

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## CHARACTERISTICS OF PKM-1 ANNUAL MORINGA

Evolved through pure line selection  
Seed propagated  
Medium, dwarf stature  
Pods are 60-70 cm long with 6.3 cm girth weighing 120g  
Bears 220-250 fruit per tree  
The estimated yield is 50-54 tonnes/ha  
Suitable for ratoon crop  
Low incidence of insect pest and disease  
Suitable for varied soil types (freely drained) in tropical plains

## SEEDS AND SOWING

Moringa is propagated either by stem cuttings (limb cutting) or by seed. In perennial types, limb cuttings 100-150cm in length with a diameter of 14-16 cm are planted *in situ* during the rainy season. Elite trees are cut down, leaving a stump with a 90cm head from which 2 to 3 branches are allowed to grow. From these shoots, cuttings 100 cm long and 4 to 5 cm in diameter are selected and used as planting material (Seemanthini, 1964; Peter, 1978).

In the Kanyakumari district of Tamil Nadu, shield budding has been found to be successful, and the budded trees begin to bear fruit in 6 months and continue to give good crops for about 13 years. September and December is found to be the best season for budding (Sundaraj *et al*, 1970).

Seeds do not show any dormancy periods and can be sown as soon as they are extracted. At the present time, annual moringa occupies about 70 per cent of the total area under moringa cultivation in southern India, propagated solely by seed. In Andhra Pradesh State (India) alone, over 90% of the total area under moringa cultivation involves seed-propagated annual types.

## SEASON AND PLANTING

The limb cuttings are planted in pits of 60x60x60 cm at a spacing of 5x5 m, during the months of June to August. The monsoon rains during the period facilitate easy rooting and further growth. While planting, one-third of the cutting should be kept inside the pit. Under moderate clay situations, watering should be done just to optimum levels to avoid root rot.

The seeds of annual moringa may be directly dibbled in the pit to ensure accelerated and faster growth of the seedlings. The best suited season for sowing the seeds is September under Southern Indian conditions. The time of sowing has to be strictly adhered to because the flowering phase should not coincide with monsoon seasons, which results in heavy flower shedding. A plant spacing of 2.5 x 2.5 m between rows and seeds should be adopted, giving a plant population of 1600 plants/ha. Pits of 45x45x45 cm in size are dug out and then the seeds are sown in the centre of the pit. The seed germinates 10 to 12 days after sowing. The seed requirement per hectare is 625g. When planted in single rows along with irrigation channels, a spacing of 2m is sufficient.

Treatment of moringa seeds with Azospirillum cultures at the rate of 100 g per 625 g of seeds before sowing resulted in early germination, and increased seedling vigour, growth and yield.

## AFTER CARE

Pinching the terminal bud on the central leader stem is necessary when it attains a height of 75cm (two months after sowing). This will promote the growth of many lateral branches and reduce the height of the tree. In addition, pinching reduces the damage due to heavy wind and makes harvesting much easier. Vijayakumar *et al.* (2000) found that early pinching of growing tips carried out 60 days after sowing is better than pinching 90 days after sowing for obtaining a higher yield.

Moringa trees are generally grown successfully without fertilizers. In Kerala (Southern India), ring trenches are dug about 10 cm from trees during the rainy season and filled with green leaves, manure and ash, and then covered with soil. This is said to promote higher fruit yields (Ramachandran *et al.*, 1980).

If fertilisers are applied, the crop requires 44 : 16 : 30 g NPK/ tree at the time of pinching (75 days after sowing). Nitrogen @ 44g / tree must be applied as top dressing at first flowering (150-160 days after sowing) stage (Suthanrapandian *et al.*, 1989).

Beulah (2001) integrated nutrient management in annual moringa encompassing organic manures, bio-fertilizers and varying levels of N, P and K. The results obtained a positive response from moringa to the application of manures and fertilizers. Initial vigour was higher in treatment with poultry manure (500 g / pit) + Neem cake (250g/pit)+ panchakavya (2%) spray along with 150:150:100g NPK/tree. In ratoon crops, similarly, the same treatment resulted in early and vigorous growth confirming the superiority of integrated nutrient management in moringa.

Growing moringa plants may not require watering except during hot weather when they may be irrigated once a week. Annual moringa responds well to irrigation and the yield can be doubled (vegetable moringa fruit) by drip irrigation as compared to rain-fed crops. Rajakrishnamoorthy *et al.* (1994). Drip irrigation at the rate of 4 lit/day can enhance yields by 57 per cent as compared to rain-fed crop Rajakrishnamoorthy *et al.* (1994).

Vijayakumar (2000) found that spray application of GA<sub>3</sub> @ 20 ppm on 90th day of sowing increased all the pod characters, such as length, specific gravity, number of seeds, flesh content and pulp, more than untreated check.

## **RATOONING**

In annual moringa, when the harvest is in, the trees are cut down to a height of one metre above ground level for ratooning. These ratoon plants develop new shoots and start bearing four or five months after ratooning. Three ratooning operations are recommended during the production cycle (at month n<sup>o</sup> 9, 17 and 25), after each harvest is over. During each ratooning operation, the plants are supplied with the recommended level of N, P and K nutrients along with 20-35 kg of FYM.

Perennial types are also pollarded back to a height of 0.3-0.45m from ground level during October November, followed by manuring with organic matter (25kg) and the recommended input of fertilizers.

## **HARVEST AND YIELD**

Perennial types raised by cuttings take nearly a year to bear fruit. The yield will generally be low (80-90fruit/year) in the first two years of fruit-bearing. This gradually increases to 500-600 fruit/tree/ year in the fourth and fifth years. The pods are harvested mainly between March and June. A second crop is normally harvested from September to October.

Annual moringa types are seasonal in terms of fruit- bearing and the crop sown during September comes to harvest within six months. Fruit of sufficient length and girth are harvested before they develop fibre. The harvest period extends for 2-3 months and each tree bears 250-400 fruit depending on the type.

## **INSECT PESTS AND DISEASES**

Developing fruit are damaged by the fruit fly *Gitona distigmata* which can be effectively managed by adopting integrated pest management (IPM) measures. The package includes (i) Application of Fenthion 80 EC 0.04 per cent during the vegetative and flowering stage. (ii) Application of Nimbecidine 0.03 per cent at 150 ppm during 50 per cent fruit set and 35 days after (iii) soil application of Neem seed kernel extract (NSKE) @ 2 lit per tree at 50 per cent fruit set and (iv)

weekly removal of affected fruit (Anjaneya *et al.*, 1992 ; Ragumoorthi *et al.*, 1998 ; Sivagami *et al.*, 1965).

No major disease in India has been reported as affecting the economics of the crop. However, a new disease has developed in the Maharashtra region. Pods reaching maturity showed extensive rot. The disease symptoms are observed all over the surface of the pods, more conspicuously at the stigmatic end. On green pods, elliptical or elongated sunken spots with reddish brown raised margins can be observed. Diseased pods are shrunken to thinner dimensions at their stigmatic ends, than healthy ones. In advanced stages of the disease development, the pods are rotten and dried up pre-maturely leaving uneven raised spots over them. The causal organism was identified as a fungus *Drechslera haraiiensis*. This disease appears to be newly recorded for moringa in the country.

### **SEED PRODUCTION, PROCESSING AND STORAGE**

Harvesting of brown coloured moringa fruits at 20 days after anthesis led to recovery of good quality seeds with high germination potential from the proximal and middle portion of the fruit compared to the distal portion. Black followed by brown coloured seeds were superior with higher seedling quality attributes--i.e. germination and vigour index--than white seeds. Harvested pods must be dried for one or two days under shade with good ventilation. The seeds are extracted manually by opening the pods using gentle pressure on them. On opening, the seeds are separated freely. Small, shriveled and damaged seeds are removed.

Grading is carried out with the specific gravity separator. The fraction from 2 and 3 gives higher seedling emergence and vigour. Seed treatment with Azospirillum @ 100g /625g seeds is found to increase the seedling weight and vigour. The optimum temperature range is 20-25°C. For seed testing, sowing seeds at a depth of 1cm in a sandy medium with 80 per cent moisture-retaining capacity represents the ideal conditions.

Annual moringa seeds can be stored for up to 12 months, when freshly harvested seeds are dried to 8 % moisture content and treated with captan @ 2g/kg of seeds and packed in 700 gauge polythene bags (Palanisamy *et al.*; 1995). The black and brown seeds treated with carbendazim 2g/kg of seeds and stored in 700 gauge polythene bags maintained more than 84% germination up to 12 months (Sivasubramanian *et al.*, 1997).

### **PKM -1 ANNUAL MORINGA - AN INSIGHT INTO IMPROVED CULTIVATION**

Seed rate – 500 grams per acre

Spacing - 2.5 meter row to row and 1.80 M plant to plant distance along the rows

No of plants per acre –  $4000 / 2.5 \text{ M} * 1.80 \text{ M} = 888$  plants

Season of planting – June – July

Pit size – 45 cms length 45 cms width 45 cms depth pit is made ( if soil is black and clay soil ) for easy growth and development of roots

Manure – 5-10 kgs of farmyard manure per pit or 5 MT of poultry manure per acre . And mix these farmyard manure with Azospirillum and phosphobacteria and pseudomonas and VAM fungi and apply this mix to planting pit

For 888 pits you need 4.40 – 8.80 MT of farmyard manure @ 5-10 kgs per pit .This 3-6 MT of farmyard manure is mixed with each 5 kgs of azospirillum and phosphobacteria and pseudomonas and 10-25 kgs of VAM culture and sprinkled with water and covered in a wet gunny bags for a week or 10 days time .

Seed treatment – Soak moringa seeds in 5% panchagavya solution ( 30 ml panchagavya in 1 lit water .. take 1 lit water and pour 50 ml panchagavya into the water and mix it well and then put moringa seeds inside the panchagavya water solution for 1-2 hours in the evening and by around 7 PM take out all the moringa seeds from the solution and place it over the wet cotton cloth , tie the cotton cloth loosely and hang it overnight . Next day morning open the cloth bag and add 50 grams each azospirillum and phosphobacteria to the seeds and mix it thoroughly and keep it under shade for 30 min to one hour before sowing into the pit .

Planting – fill the pits with top soil and then add the above manure bio fertilizer mix @ 5-10 kgs in each pit . Sow one seed in each pit and after sowing seeds apply 50-100 grams super phosphate to each pit and then give irrigation or if drip irrigation system is available , run the drip after sowing seeds in the pits

In about 50-60 days the moringa will have grown 60-80 cms height . Pinch the terminal shoot to the height of 60-75 cms from ground level . This will produce side branches . when this side branches grows 60 cms long , cut each side branch to half length say 30 cms ( 60 cms long side branches are cut back to 30 cms long ) . Again many branches are growing from these side branches . Again these side branches from earlier side branches are cut back to half of its length . Like this you need to do pruning ( cutting of branches to half of its length ) 3-4 times before flowering .

Flowering – Flower will be produced in about 4.5 to 5.5 months after sowing ( so you will be pruning the plant until flowers are shown up .) once flowering is noticed you should not cut any of the branches . The plant will not be allowed to grow high toward sky . All the branches should be bent down

Fertilizers – When pinching is done ( cutting terminal shoot at about 2 months period ) apply 44 grams nitrogen , 16 grams phosphorus and 30 grams of potash to each moringa plant .. This will need you to buy 85 kgs of urea, 89 kgs of super phosphate and 44 kgs of Muriate of potash

In about 150 -160 days apply 50 -100 grams ammonium sulphate per plant . This will need you to buy 45- 90 kgs of Ammonium sulphate per acre

GA3 ( gibberalin hormone ) 20 ppm ( 1 ml in 50 lit water ) is sprayed on 90 th days ( completion of 3 months after sowing ) . you may need 250 lit water to cover entire area . so you may need 5 ml GA 3 for a spray

If GA 3 is costly , dissolve 5 lit of sour butter milk and 5 lit of tender coconut water together and mix 1 lit of this tender coconut butter milk mix in 10 lit water and spray over moringa leaves 2- 3 times from 3rd month of sowing after pinching of terminal shoot . This will produce more flowering

Flowering and pod formation – in about 4.5 to 5.5 months after sowing the plant will start showing flowers . And in about 8-9 months after sowing the moringa fruits/ pods will be ready for harvest and harvest will continue for 3 months .

Yield – Each tree will produce 225 fruits per tree . For 888 trees it will be 1,99,800 fruits / At an average fruit weight of 100 grams the total yield will be around 20 MT( 20,000 kgs )

Income – At selling price of 25 rupees per kg , it will produce Rs.5 ,00,000 per acre per

year

After harvest trees are cut back to 75 cms height from ground level and allowed for second crop ( ratooning )

Water should not stagnate in the field . If soil is clay you should give drainage along the slope. In summer per tree needs 4 lit water . You can give water once in a week in summer . If water scarcity exist , mulch the field around each tree with paddy straw or other organic waste

For present condition – just cut the central shoots that is grown high into the sky and spray buttermilk coconut water solution two times at weekly interval and GA 3 once after cutting the central shoots .

Technical details about flowering mechanism

Flowering initiation – 150 – 180 days

Pod formation – 210 – 240 days

Pod length – 37 to 45 cms

Pod girth – 6.3 cms

Pod weight – 80-100 grams

Plant height – 4.0 meter

No of pods per tree – 220 to 250

FLOWER – zygomorphic and gullet type

Flowering two times a year- February – April , September – November

Pollination – Geitonogamous ( self pollination ) , Xenogamous pollination ( cross pollination )

Flower opening – 3.00 hours to 19.00 hours

Insect visit ( Bee ) – 6.00 to 15.00 hours

Length of flowering in February – may – 51 days

Length of flowering in September – November – 60 days

Flower drop – 30 % during Feb – May, and 40 % during Sep- Nov

Anther dehiscence – Open flowers available – 5.00 to 9.00 hours in association with temperature range of 27.3 to 29.3 degree Celsius , RH – 68-78 %

Overcast sky and rainy weather delay the process by 30 minutes .Flower is viable for 72 hours

Stigma become receptive 24 hours after anthesis , continues to be so for 48 hours and then turn light brown

Hence right season and method of cultivation will produce good yield