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+91 99405 72462



+9163819 07438



ijmrsetm@gmail.com



www.ijmrsetm.com



Influence of fertilizer Doses and Mulching on Yield Attributing Characters and Post-Harvest Shelf Life of Pointed Gourd (*Trichosanthes dioica* Roxb.)

¹Manoj Kumar Singh, ²Pradeep Kumar Mishra, ³Virendra Pratap Singh, and ⁴Ram Lakhan Singh

¹Subject Matter Specialist (Horticulture), Krishi Vigyan Kendra, Basti, India

²Subject Matter Specialist (Agro forestry), Krishi Vigyan Kendra, Mankapur, Gonda, India

³Senior Scientist & Head, Krishi Vigyan Kendra, Sultanpur, India

⁴Subject Matter Specialist (Agronomy), Krishi Vigyan Kendra, Mankapur, Gonda, India

ABSTRACT: *Trichosanthes dioica* Roxb., also known as pointed gourd, is a tropical perennial cucurbit plant with its origin in the Indian subcontinent. It is also known as parwal, palwal, potol, or parmalin in different parts of India and Bangladesh. The plant propagated vegetatively and grows with training on a support system (e.g., trellis) as pencil-thick vines (creepers) with dark-green cordate (heart-shaped) simple leaves. It is a well-developed dioecious plants having distinct male and female flowers on staminate and pistillate plants, respectively. The fruits are green with white or no stripes' and have unpalatable seeds. Size can vary from small and round to thick and long — 2 to 6 inches (5 to 15 cm). It thrives well under a hot to moderately warm and humid climate. The plant remains dormant during the winter season and prefers fertile, well-drained sandy loam soil due to its susceptibility to water-logging.

KEYWORDS: point gourd, fertilizer, mulching, shelf life, yield, water logging, harvesting, soil, climate

1. INTRODUCTION

Colloquially, in India, it is called *parwal* or *green potato*. It is widely cultivated in the eastern and some northern parts of India, particularly in Northeastern Andhra, Odisha, Bengal, Assam, Bihar, and Uttar Pradesh. It is used as an ingredient for soup, stew, curry, sweet, or eaten fried and as *potoler dorma* or *dolma* with fish, roe or meat stuffing. Parwal is also used to make *kalonji*, a deep fried cuisine filled with spices. Pointed gourd is provincially known as *potol* in both of these Bengali-speaking regions. It is a vital summer vegetable in Bangladesh and in West Bengal. It is cultivated and consumed in every part of Bangladesh and West Bengal. It is a perennial crop and sold at the end of October when there is a shortage of other alternative vegetables.^[4] Almost every part of *T. dioica* is being used in the indigenous system of medicine. The fruit constituents are minerals (Magnesium, Sodium, Potassium, Copper, and Sulphur), vitamins, tannins, saponins, alkaloids, glycosides, flavonoids, steroids, pentacyclic triterpenes, and other bioactive compounds have proven that the pointed gourd promising.^{[5][6]}

Pointed gourd is a good source of vitamins and minerals. It is a good source of carbohydrates, vitamin A, and vitamin C. It also contains major nutrients and trace elements (magnesium, potassium, copper, sulfur, and chlorine) which are needed in small quantities, for playing essential roles in human physiology. 9.0 mg Mg, 2.6 mg Na, 83.0 mg K, 1.1 mg Cu and 17 mg S per 100 g edible part.^[4]

The fifteenth-century *Hatha Yoga Pradipika* 1.61-65 recommends Parwal as one of the foods suitable for yogins.^[7]



Land preparation

Land must be plowed at least 2-3 times until the soil reaches a fine tilth stage. Apply good manure to enhance the soil fertility.

Planting

The plant thrives well under a hot or say moderately warm & humid climate. It remains inactive in the winter season & prefers a fertile, properly-drained sandy loam soil because of its susceptibility to water-logging. At the time of planting, make sure that the ratio of female and male plant is 9:1.

Planting Distance

- The distance from the queue to the queue should be 1 meter and the distance from plant to plant 50 cm.

Manures and Fertilizers

- 5 tons of rotten cow dung manure or compost 70 kg diammonium phosphate and 32 kg.
- Add potassium sulfate to the land at the rate of per acre.
- After that, apply top dressing twice at an interval of 20-25 days after planting 20 urea and after three months of planting top dressing of 32 kg potassium sulfate.

Weeding

- The area should be weed free during the entire life cycle of the crop, the work of plowing should be completed at the initial stage of the crop.

Irrigation

- Irrigation is required at intervals of 8 - 10 days in autumn.
- Irrigation is required at intervals of 4-5 days in summer.

Crop Protection

Pest Control



Red bitter beetle

- The outbreak of this insect occurs between February and April.
- For control, spray carboril at the rate of 01 ml / water.

Blister beetle

- It is used for control of pest by genal phos or methyl parathion or phosphromidan 1 ml / l.
- Spray at the rate of water.

Disease control

Scorching of leaves

- 5 g / l Spray Carbendazim at the rate of water at 10 days interval.

Harvesting

After 3-4 months of planting the harvesting work starts.

Yield

Average yield of pointed gourd 50 to 60 kg Per acre

II.DISCUSSION

Pointed Gourd or how we call it - 'Parval', is rich in minerals and vitamins such as Vitamin A, Vitamin B1, Vitamin B2 and Vitamin C, it also includes major nutrients and trace elements. It is a perennial plant which means it gives fruit twice in a cycle. Since 'Parval' is a vine plant i.e. it creeps around the ground while growing, we have used Mulching Sheets in our farming, as it can be seen in the picture. The vegetable seen in the picture is our own production at Baba Agricultural Products which has been produced using 100% organic methods and no chemical fertilizers or pesticides have been used on the soil.

- The process involves creating beds of constant size on the farm using ridger or mulching equipments and covering the beds with mulching sheets. Here we have used a mulching machine attached with tractor which has a built in sheet roller which rolls down the sheet while creating beds and locks the corner with soil.
- After that big holes in predetermined distance are made using cups or any circular tool and the stems of 'Parval' are planted. For irrigation we have used drip irrigation method where the drippers are placed specifically over the holes.



- Organic fertilizers and other bio nutrients are given to the plant directly over the holes.

Benefits and Importance of Mulching Sheets :

- Prevents water from reaching all parts of the bed which helps in preventing weeds and controls wastage of water.
- Prevents direct evaporation and thus limits water losses and conserves moisture.
- Maintains warm temperature even at night which helps seeds to germinate quickly.
- Facilitates fertilizer (organic in our case) placement & reduce the loss of plant nutrient through leaching.
- By controlling growth of weeds it provides clear and open path for vine plants to expand.

Uses:

The tender fruits of pointed gourd are, generally, consumed as cooked and fried vegetable dishes, and also used in making curries and preparing pickles. Keeping the fruits filled with milk cake in sugar syrup a famous sweet is prepared in India. The newly emerged tender shoots with leaves are also a preferred potherb in many households in India.

Medicinal Uses:

There is a popular belief that leaves of pointed gourd are a preventive antidote of bile disorders and worms. The easily digestible tender fruit helps in proper renal functions and prevents constipation. It invigorates the heart and brain, and is significantly effective in several circulatory disorders.

Climate and Soil Required for Cultivating Pointed Gourd:

It is a warmth-loving crop, thus, thrives well under hot or moderately warm and humid climate, and the optimum temperature for proper growth ranges from 25° to 35°C. Abundance of sunshine and fairly high rainfall favour good crop yield. Regeneration of new sprouts is generally impaired below 20°C and severe cold below 5°C is bullying for the crop.

Vine growth becomes highly restricted during winter, which starts again along with sprouting from fleshy root at the onset of spring, however, pointed gourd can be forced during harsh winter months (November to February) in different river-beds or river basins, familiarly called 'Diara' lands in Uttar Pradesh and Bihar, through planting of rooted vine cuttings in sand of riverbeds with required watering until they drive roots up to the water level below. Such moisture laden sandy beds get warm up quickly and wipe low temperature effect of the winter.

The pointed gourd crop can be grown in a wide variety of light textured soils having good drainage facility. However, a well-drained sandy-loam to loam soil with slightly acidic reaction (pH 6-7) is ideally suited for this crop. It can withstand low soil moisture stress but not the water logging stress.

Planting Time of Pointed Gourd:

Planting time of vine or root cuttings should be adjusted in such a manner that regeneration and sufficient vine growth may be completed in optimum temperature range of 25°-35°C before the onset of low temperature in winters, however, earlier plantings in first half of September in the Gangetic alluvial zone are not suitable due to high soil moisture conditions, causing rotting of planting materials.

The planting of root or vine cuttings after onset of winters delays sprouting and establishment of vines, and planting by the second fortnight of October in lower Gangetic plains gives vigorous growth and higher early and total yield. October- planting in this region is considered to be the best because the critical physiological vine maturity of around 100-110 days after planting for initiation of fruiting actually coincides with the rise in atmospheric temperature (February onwards), favouring both early and total yields.

Under South Indian conditions, vine cuttings are planted in either July-August or September- October in pits at a spacing of 2×2 m. In riverbed system of growing pointed gourd in north India, already rooted vine cuttings are planted in November and watered adequately until they drive roots up to the water level below.

Consecutively three successful crops can be taken from a single planting. In ratoon cropping, generally practiced in lower Gangetic plains, the vines are pruned 15 cm from the ground level during October after the fruiting is over and recommended dose of farmyard manure and fertilizers are applied by the end of winter as top dressing after loosening soil around the hills. The half dose of nitrogen is applied one month after flowering.

Planting Method:

Unlike other cucurbits, the seed is not recommended as commercial propagating material because of the following reasons:

- i. Poor seed viability and germinability.
- ii. Production of about 50% of male plants from the seeds due to segregation of male and female plants since the sex is determined by the physiological difference in one chromosome.
- iii. Long, even two years' time for initiation of flowering.

This vegetatively propagated crop through both by vine or root cuttings is generally planted directly in the main field. Sometimes, the vine cuttings are buried in sand medium to initiate rooting, particularly for planting them in riverbeds. The vine cuttings placed in sand with adequate moisture supply in October for rooting become ready for transplanting within two to three months.

Cuttings are taken from mature vines and are defoliated before planting. Very small or very big cuttings from both root and vines are never ideal, 15 cm root cuttings and 60 cm vine cuttings with 10-15 nodes being considered as the best propagating materials.

Pointed gourd can be planted on the ground, and the vines are trained over the bowers or trellises, however, the ground culture on beds is more common. After thorough ploughings, raised beds of 15 cm height, 3 m width, and convenient length are prepared maintaining 60-75 cm spacing between two beds, which serve the irrigation cum drainage channel. Digging pits and subsequent filling with soil and farmyard manure in equal proportion prepare the mounds spaced by 60 cm on both sides of the bed at the close proximity of the channel.

The fruits are less prone to rot disease and more consumers acceptable when grown on trellis made at 60 cm height with bamboo, ropes, and wires. Mounds are prepared in the same manner. However, the planting distance is reduced to 2×0.60 m to accommodate more number of plants per unit area. Harvest span and net return from the crop can also be increased through practicing trellis system of pointed gourd cultivation.

The vine cuttings may be planted on mounds following different methods:

Lachhi or Lunda (figure of eight), moist lump, straight vine or ring method. In moist lump method, a lump of moist soil is encircled with the cutting of 60-90 cm length keeping both the ends of 15 cm free and is buried in soil 10 cm deep leaving the cutting ends above the soil.

In straight vine method, cuttings are planted horizontally 15 cm deep leaving both the ends above the soil. Ring method is rather widely practised in the eastern India in which coil of a vine cutting is made and planted on mounds covering half of it with soil.

Propagating pointed gourd from vines require a definite length of cuttings requiring huge quantity of planting materials to cover the field and such inconvenience may be mitigated by micro-propagation. Rapid in vitro multiplication in pointed gourd could be possible by culturing shoot tip and nodal explants on Murashige and Scoog medium containing IAA and IBA and plantlets be acclimatised and established ex vitro with varying efficiency (75-95%) in different genotypes.

Good establishment of regenerated plantlets (over 70%) in soil medium could also be achieved using physiologically mature seeds as explants cultured in different hormones (BA, NAA, etc.) media.

Plant Population Density of Pointed Gourd:

Pointed gourd is a long duration crop of about 8 months, and so, a very high-density planting affects its growth and yield adversely. Mounds in bed at a spacing of 2×2 m is generally practiced, however, $3.0 \times 0.60-0.75$ m spacing accommodating about 9000 plants per hectare has given satisfactory yield in different clones under lower Gangetic plains.

In another study, Dash et al (2000) obtained the highest yield from female clones planted 15 plants per plot in a circular manner at 1.5 m distance from a single male plant at centre of the circle.

Pointed gourd being a dioecious crop needs some male plants in field for steady supply of pollens for proper fertilization of ovules in fruits borne in female clones since proper fertilization is obligatory for getting well-developed and marketable fruits. About 10% male plants population in field is considered enough for maximum fruit set.

Although red brown beetle (*Carpophilus dimidiatus*) contributes significantly to cross pollination but hand pollination in female flowers, widely practised now a day due to paucity of pollinator population and environmental pollution, even results in a two-fold increase in fruit set over natural pollination.

Pollens from a single male flower are generally sufficient to pollinate 7-8 female flowers simply by touching the stigma. Male and female buds take 11-16 and 7-12 days, respectively to develop and open fully. Stigma becomes receptive 6 hour before anthesis with peak receptivity at 12th hour after anthesis.

Maximum pollen germination takes place during anthesis between 6 and 11 p.m. with the peak at 9.00 to 9.30 p.m., and then, retards gradually so hand pollination must be completed as early as possible in the morning hours preferably within a time of 5.0-5.30 a.m.

Manurial and Irrigation Requirement for Pointed Gourd Cultivation:

Pointed gourd being a long duration crop responds favourably to nutrition. Farmyard manure 20- 25 t/ha applied at the time of mound preparation ensures sustained vegetative growth and satisfactory yield. Das et al. (1987) recommended a fertilizers (N : P : K) dose of 90 : 60 : 40 kg/ha for lower Gangetic plains of West Bengal. The dose of potassium fertilizer may be raised to 60 kg/ha in soils deficient in potassium. The various researchers have recommended the different doses of fertilizers presented as under in Table 14.2.

TABLE 14.2: Doses of fertilizers recommended by various scientists

Farmyard manure (t/ha)	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)	Reference
20-25	60-80	40	40-45	Seshadri (1986)
20-25	40	40	40	Nath and Subramaniam (1972)
20-25	90	60	60	More and Shinde (2001)

One third dose of nitrogen and full doses of phosphatic and potassic fertilizers are to be applied as basal application at the time of mound preparation and the rest amount of nitrogen is applied in two splits, one at the onset of flowering and the other, after one month. This plant nutrition schedule is followed for the October planted crop, however, for December planted crop, after the harvest of Kharif paddy, half of nitrogen and full dose of phosphatic and potassic fertilizers are applied as basal and rest half of nitrogen is side-dressed at flowering stage.

Pointed gourd is basically a drought hardy crop, thus, can withstand low soil moisture stress but not the water logging conditions. During monsoon season, it does not require any irrigation, but during winter and summer months, the crops should be irrigated properly particularly at sprout elongation stage for proper growth and development of the crop.

III.RESULTS

Intercultural Operation of Pointed Gourd:

i. Hoeing and Weeding:

Once the vines start growing and cover some of the available space, it becomes difficult to manage both the crop and the weeds whether the crop has been grown in beds or on bowers. Major weed species associated with pointed gourd are *Cyanodon dactylon*, *Chenopodium album*, *Echinochloa colona*, etc. Weeds do compete with the crop for water, nutrients, light and space so hoeing and weeding should be done at initial stages of crop growth.

Straw mulching can also keep the weed status low for considerable period of time. Application of herbicides, like gramoxone @ 1 litre a.i. or fernoxone @ 0.8 litre a.i. per hectare as post- emergence spray along with mulching can effectively control the weed growth and ensures maximum total yield.

Pointed gourd grown on beds is intercropped with different vegetable crops, like beet leaf, radish, coriander, fenugreek, cauliflower, pea, etc. during early stages of growth (October-January) for better land use and greater economic return, but success of the companion crop largely depends on proper weeding.

ii. Mulching:

Mulching with straw, water hyacinth, sugarcane tresses, dry grasses, sawdust, papers, or black polyethylene giving variable results is mainly intended for moisture retention, checking of weed growth and fruit deterioration. Paddy straw mulch being economical and easily available is widely used in large-scale cultivations, and it has been found to have increased fruit number and yield by 88 and 81%, respectively over unmulched cultivation. Irrigation at IW/CPE of 1.8 in combination with mulching with straw also saves 42.5 cm water.

9. Harvesting and Yielding of Pointed Gourd:

Harvesting, generally, starts 90-100 days after planting. In October planted crop of Gangetic alluvial zone of West Bengal, harvesting of fruits, generally, starts from middle of February and continues to July at frequent intervals and up to September if new flushes come with the monsoon rains. Harvesting should be done frequently when the fruits are immature, tender with soft seeds inside and 7 to 15 days' fruit after flowering depending on cultivars are ideal for both quality and yield. Delay in harvesting reduces further fruiting capacity of the vine.

Post-Harvest Management:

Fruits remain marketable for 3-4 days under ordinary storage conditions. Dipping of freshly harvested tender fruits in solution of growth substances, like kinetin (50 ppm), GA₃ (20 ppm), CCC (100 ppm) or NAA (20 ppm), or chemicals, like sodium benzoate (200 ppm) or potassium metabisulphite (1900 ppm) for 10 minutes, subsequently air drying and storing in a zero energy cool chamber at 27-31°C with 94-96% relative humidity increase the shelf life by four days with almost non-shrinkage and very low yellowing.

Som et al. (1998) also recommended fruit dipping in 250 ppm sodium benzoate or 100 ppm citric acid solution for extending the shelf life of fruits up to eight days.

Yield:

Yield generally depends on plant population and prevailing weather conditions during fruiting period. In 3.0×0.60-0.75 m spacing, accommodating about 9000 plants per hectare has given yield ranging from 131 to 170 q/ha in different clones under lower Gangetic plains. Ratooncrop, if managed properly, generally, gives higher yield compared to the first year.

Cultivated Varieties of Pointed Gourd:

Extensive clonal variation in this crop exists in West Bengal, Assam, Tripura, Bihar, and eastern part of Uttar Pradesh because heterozygous nature and asexual propagation lead to large number of diverse cultivars on farmers' field. Based on fruit shape, size and striation in them.

Singh (1989) first time assigned the female clonal diversity to four groups- 10-16 cm long, thick, dark green fruits with very faint stripes and pale green colour; 10-13 cm long, dark green fruits with white stripes; 5-8 cm long roundish, dark green fruits with stripes and small fruits but tapering towards ends, green and striped.

Elaboration of this basic grouping considering seventeen growth and fruit characters led to clustering the female clones under four groups- clones bearing small fruits of mostly oval and tapering shape, and spindle shape in some clones (Group-1), clones bearing spindle shaped fruits (Group-2), clones bearing oval fruits (Group-3), and clones bearing nearly cylindrical fruits (Group-4).

Significance of mean difference for different characters indicated Group 1, 2, and 3, however, the Group 4 as distinct ones. Only fruit characters have been found contributed significantly to the separation of clones. Fruits of cultivars are marketed under different local names without any standardization in nomenclature.

Some of such popular local cultivars in three important pointed gourd-growing states are given below:

- a. West Bengal- Damodar, Kajli, Kajli Bombai, Kajli Damodar Chandra, Sandhamani, Hilly, Guli, Shampuria, Dhanpa, etc.
- b. Uttar Pradesh- Dandali, Kalyani, Guli, Bihar Sharif, etc.
- c. Bihar- Dandali, Nimia, Hilly, Santokhwa, etc.

Asexual propagation provides unique advantages and opportunity in breeding this crop because single outstanding clone selected from a population may form the basis of a new variety.



IV.CONCLUSIONS

Some improved clonal selections developed by the State Agricultural Universities and Research Institutes are presented below:

i. Swarna Rekha:

This variety has been developed at HARP, Ranchi through clonal selection from germplasm of Champaran district of Bihar. It produces elongated, green-stripped, and soft seeded fruits. The yield potential of this variety is 15.0-20.0 t/ha.

ii. Swarna Alaukik:

This variety has also been developed at HARP, Ranchi through clonal selection from germplasm collected from Bhagalpur district of Bihar. It produces elongated fruits having long shelf life and is suitable for sweet preparation. Its yield potential is 20-25 t/ha.

iii. FP 1:

This round and green-fruited variety has been developed through clonal selection at Narendra Dev University of Agriculture and Technology, Faizabad.

iv. FP 3:

This spindle shaped and green-stripped variety has been developed through clonal selection at Narendra Dev University of Agriculture and Technology, Faizabad.

v. FP 4:

This spindle shaped and light green variety has been developed through clonal selection at Narendra Dev University of Agriculture and Technology, Faizabad.

vi. Rajendra Parwal 2:

This improved clonal selection has been developed at Rajendra Agricultural University, Bihar.

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