Indian Farmer
Volume 8, Issue 03, 2021, Pp. 259-267.
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

POPULAR ARTICLE OPEN ACCESS

Cultivation technology of Cucurbits

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Article Received: *15 March 2021* ***Published:*** *20 March 2021*

The Cucurbitaceous or gourd family are consisting of annual or perennial herbaceous plants. Most of them are climbing or trailing vines with characteristics of tendrils.Cucurbits are those vegetables, which are consumed worldwide as food in various forms, *e.g*., salad (cucumber, long melon and gherkin), sweets (ash gourd and pointed gourd), pickles (gherkins and cucumber) and deserts (melons). These vine crops are particularly important cash crops for small land holders. These crops include Summer squash **(***Cucurbita pepo***),** pumpkin (*Cucurbita moschata*), bottle gourd (*Lagenaria siceraria*), bitter gourd (*Momordica charantia*), cucumber (*Cucumis sativus*), ridge gourd (*Luffa acutangula*), smooth gourd (*Luffa aegyptiaca*), tinda or round melon (*Praecitrullus fistulosus*), pointed gourd or Parwal (*Trichosanthes dioica*), ash gourd (*Benincasa hispida*), Long melon (*Cucumis melo var. utilissimus*), water melon (*Citrullus lanatus* L) and muskmelon (*Cucumis melo* L.). In India, a number of cucurbits are grown in several commercial cultivation systems. Furthermore, these vegetables are also popular for kitchen gardening. The FAO estimates that cucurbits in India are grown on about 4,290,000 ha with a productivity of 10.52 t/ha. Thus, cucurbits cultivation accounts for about 5.6% of India's total vegetable production.

Climatic requirement

Cucurbits are summer season vegetable crops; therefore, they cannot withstand frost except summer squash. They require relatively long growing period with high temperature. Being drought resistant crops, these can be grown successfully even in hot and dry regions. Optimum temperature range for germination is 16-35°C. Dry weather, good sunshine and dry winds during ripening of muskmelon and watermelon promote the flavor and sugar contents. Dusty winds during summer check the plant growth particularly in Bottle gourd.

Soil and its preparation

All the cucurbits can be grown successfully on various types of soil ranging from heavy sandy (riverbeds) to clay loam, but sandy loam soil rich in fertility with well drainage is best suited for them. The land should be ploughed 3-4 times followed by planking to get a fine tilth. Muskmelon is slightly tolerant to acidic soils and moderately tolerant to salinity.

CULTIVATED VARIETIES OF CUCURBITS

MUSKMELON

Punjab Sunheri: It is mid-late variety; becomes ready for harvesting in 75 days after sowing. Fruits are of flatfish round shaped with intense netting. Fruit skin is thick, leathery, and very hard. Fruit color is dirty brown and flesh color orange with green tinge towards rind. Seed cavity is small; fruit is very sweet. Its average fruit weight is 700-800 g with average yield 80-100 quintals per hectare.

Hara Madhu: It is late maturing variety. Fruits are large round with green flesh, and fruit skin is light yellow with prominent green strips on it. Average fruit weight is one kg and produces average 2 fruits per vine. Fruit is very sweet, juicy, and average yield is 75-80 quintals per hectare.

Other varieties: Punjab Rasila, Pusa Sarbati, Pusa Madhuras, Durgapura Madhu, Lucknow Sweet, Hisar Madhur, Hisar Saras, and Punjab Hybrid-1

WATERMELON

Sugar Baby: It is recommended for sowing in all watermelon-growing areas of the country. Leaves are lobed with deep cuts. Fruits small to medium in size, round in shape; having darkgreen skin with light strips. Average fruit weight is 3-5 kg with deep red flesh and very sweet (10-15% TSS). Average yield is 150 quintals per hectare.

Charleston Grey: Fruits are large with less number of seeds. Flesh is red and thick. Average yield is 100q/acre.

Other varieties: Pusa Bedana, Durgapur Meetha, Durgapura Kesar, Durgapura Lal**,** Pusa Russel, Improved Shipper,and Special No. 1

LONG MELON

Lucknow Early: It is an early variety and is prolific bearer, if harvested regularly. Fruits are long and have light green color.

Karnal Selection: It is prolific bearer. Fruits are of light green color, tender, long, and thin with good flavor.

Other varieties: Long Green, Long White, Dark Green, Faizabadi, Arka Sheetal, and Selection-3 (IIHR)

BOTTLE GOURD

Pusa Summer Prolific Long: It is suitable for growing in summer and rainy seasons, and is prolific bearer with vigorous vegetative growth. Fruits are yellowish green in color, and are 40-50 cm long with slight curved neck.

Pusa Summer Prolific Round: It is suitable for growing both in summer and rainy seasons, and is prolific bearer with good vegetative growth. Tender fruits are round with 5-18 cm diameter and green in color.
Other varieties: Punjab Local Round**,** Pusa Hybrid-3, Pusa Sandesh, Punjab Komal, Punjab Long, Punjab Long and Punjab Round

BITTER GOURD

HBGH-35: A hybrid developed at H.A.U., Hisar,bears a medium size green colour fruits, best cooking quality and less incidence of major diseases like anthracnose and cercospora, gives an average yield of 350 q/ha.
GH-22:A variety developed at H.A.U., Hisar, with broader blossom end than the stem end , green colour fruits and longer shelf life gives an average yield of 280q/ha.
Coimbatore Long: It is more suitable for growing in rainy season than summer season. Plants are spreading type and prolific bearer. Fruits are long, white in color, and tender,
Pusa Do Mausami: It is suitable for growing in both summer and rainy seasons. Vine growth is vigorous. The leaves are hairy green in color, broad and deeply lobed. Fruits are long, club-shaped, medium thick with 6-8 continuous ribs and green in color with smooth surface. It becomes ready for picking in 55-60 DAS.
Other varieties: Faizabadi, Jaunpuri, Kalyanpur Baramasi, Kalyanpur Sona, Coimbatore Green, MDU-1, Konkan Tara, CO-1, Pusa Vishesh, andCoimbatore Long White

PUMPKIN

Pusa Viswas: It has vigorous vegetative growth. Leaves are of dark green color with shining white spots. Fruits light brown, spherical in shape with thick golden- yellow flesh. Average fruit weight is 5 kg, which matures in 120 days after sowing.
Arka Chandan: It has vigorous vegetative growth. Leaves are large and of lush green color. Fruits are medium in size and round with 2-3 kg average fruit weight. Flesh is bright orange, firm with excellent flavor. It has good storage quality and gives two flushes at 20-25 days interval.
Other varieties: Solan Badami,Narendra Amrit,Arka Suryamukhi, Pusa Vikas, Pusa Hybrid-1

RIDGE GOURD

HRG-14: An early maturing variety developed at CCS H.A.U., Hisar bears long, thin, sharply edged, slightly curved, dark green fruits, with cream-white flesh. The average yield is 108 quintal per hectare.
Pusa Nasdar: A variety developed at IARI, New Delhi bears light green, medium sized and club shaped fruits and takes 60 days from sowing to first flowering. It bears 15-20 fruits per vine. The average yield is 150 quintals per hectare.
Other varieties: Pusa Superiya, Arka Sujat, Arka Sumeet and Pusa Sadabahar

SMOOTH GOURD

Pusa Chikni: It is prolific bearer, and is most suitable for growing in rainy season. Fruits are smooth, cylindrical in shape, tender, and are of green color. Average yield is 100-125 quintals per hectare.
Other varieties: Pusa Sneha, Pusa supriya

SUMMER SQUASH

Pusa Alankar: It **is**a F_1 hybrid, which is early in maturity, and has bushy growth habit. Fruits are of dark green color with light colored strips on it; 20-25 cm long and slightly tapering towards stem end. Flesh is tender and delicious.
Other varieties: Australian Green (Katrian), Early Yellow Prolific (Katrian), Punjab Chappan Kaddu,Punjab Chappan Kaddu-1, Early Yellow Prolific and Patty Pan

ROUND MELON

Bikaneri Green:A variety developed at R.A.U., Bikaner produces round and medium sized fruits with green colour. Average yield is around 150-175 quintals per hectare.
Hisar Selection:A variety developed at H.A.U., Hisar produces green color tender and soft fruits and its average yield is around 30-40quintals per acre.
Hisar Tinda (H.T.10):A variety developed at H.A.U., Hisar produces green color tender and soft fruits. Plants are spreading in nature and bear medium size green fruits. First picking can be done 50-58 days after sowing, and its average yield is around 230-240 quintals per hectare.

CUCUMBER

Japanese Long Green: It is an early variety, and its fruits are light green with white spines and 25-30 cm long with light green flesh. Its average yield is 100 quintals per hectare.
Other varieties: Solan Kheera-75, Solan Kheera-90, Straight-8, Poinsette Swarna Sheetal, Swarna Poorna, Swarna Ageti, Straight-8 and Poinsette
Method of sowing: All these cucurbits are sown 2-4 cm deep on the edges of raised beds. Per hill, 2 to 3 seeds are sown at a spacing of 3-4 cm. After germination, one healthy plant per hill is kept and rest seedlings are uprooted. Seeds of those cucurbits whose seed coat is hard, *i.e*., bitter gourd, round melon, and bottle gourd should be soaked in water overnight, whereas, seeds of muskmelon, watermelon and long melon for 3-4 hours; ash gourd and ridge gourd for 6-8 hours; round gourd for 10-12 hours and bitter gourd for 48 hoursbefore sowing for better and rapid germination. Water-soaked seeds should be sown in fields having sufficient moisture. Before sowing treat the seeds with Trichoderma viride 4g/kg or Pseudomonas fluorescens 10g/kg or Carbendazim 2g/kg of sseds.Seed rate, no. of seedlings/ha, days for germination and temperature requirement for germination of various cucurbits are given below in table.

Crop	Seed rate (kg/ha)	No. of seedlings/ha	Days for germination	Temp. required for germination (°C)
Bottle gourd	4-5	2500-3000	5	20-30
Bitter gourd	5-6	7500-8000	5	28-30
Cucumber	2-3	7500-8000	5	28-30
Round gourd	5-6	6250-7000	3	29-32
Muskmelon	3-4	5500-6250	3	28-32
Watermelon	4-5	3500-3600	4	26-28
Ridge gourd and ash gourd	4-5	3500-3600	4	26-28

Manure and fertilizers: Being poorly exhaustive, all the cucurbits require small quantity of manure and fertilizers, *i.e.*, farmyard manure 10 t, nitrogen 50 kg, phosphorus 25 kg and potassium 25 kg/ha. Farmyard manure should be incorporated in the field 3-4 weeks before sowing at the time of field preparation. Full dose of phosphorus + full of potash + ⅓ of nitrogen should be applied as basal dose at the time of sowing. Rest ⅔ dose of nitrogen is applied in furrows in the standing crop in two equal instalments at 30 days after sowing and at flowering time followed by earthing up.

Irrigation requirements: A pre-sowing irrigation is essential for quick and better germination of seeds. If moisture in fields is not sufficient, apply light irrigation after sowing. After completion of germination irrigate the field at 5-7 days interval during summer and 8-10 days interval in rainy season or as and when required depending upon rainfall. Irrigation after the application of nitrogenous fertilizer in furrows in standing crop is essential. Irrigation at flowering and fruiting stages is also very essential. However, irrigation in muskmelon and watermelon at fruit maturity must be stopped, if not it will decrease fruit sweetness.

Intercultural operations: Keep the field weed free in the initial stages of crop growth, unless the vines start spreading; one or two hoeings are enough. Earthing up should be done when rest dose of N is applied as side dressing.

Pruning in muskmelon: Muskmelon bears male flowers on main stem, whereas, secondary branches bear both male and hermaphrodite flowers. The first hermaphrodite flower in Hara Madhu variety is generally borne on 7thnode of secondary branch, therefore, the secondary branches up to 6^{th} node are pinched off at their emergence and subsequent ones are allowed to develop. Perfect flowers arising from branches on 7th node onwards are allowed to set fruits. These secondary branches are also de-topped at two leaves above the first perfect flower. In comparison to un-pruned plants, the pruned plants give more number of fruits with bigger size, thus, pruning technique is quite helpful to get higher yield (20-25%) in Hara Madhu variety.

This technique is also useful in Punjab Sunheri variety, where pinching of secondary branches is done up to 3rd node.

Pinching in watermelon and bottle gourd: It is advisable to remove the apical growing point of plants at 4-6 true leaf stage, which enhances early maturity by 10-12 days, and gives 10-20% higher yield as compared to un-pinched plants.

Use of plant growth regulators

Bottle gourd and roundmelon: Foliar spray of Maleic hydrazide 50 ppm (1 g MH/20 liters of water) or Ethrel 100 ppm (4 ml 50% Ethrel/20 liters of water) at 2- and 4- true leaf stage of plant growth enhance the number of female flowers per plant and ultimately increase the yield. Some surfactant should be added for uniform distribution of solution.

Summer squash: Foliar spray of Ethrel 250 ppm (10 ml 50% Ethrel/20 liters of water) at 2- and 4- true leaf stage of plant growth is beneficial for producing more female flowers at lower nodes, and hence, increases yield. It is advisable to leave few plants unsprayed for the purpose of effective pollination. Some sticker like Teepol or Tween-20 also should be added for proper and uniform distribution of solution.

Watermelon: Foliar spray of GA_3 25 ppm at 2- and 4-true leaf stage increases yield and sweetness. Mix 0.5g Gibberellic acid (GA_3) in small quantity of alcohol and then mix it in 20 liters of water.

Bitter gourd: In Pusa Do Mausami variety, the foliar spray of Cycocel 250 ppm (10 ml 50% Cycocel in 20 liters of water) at 2- and 4-true leaf stage increases the yield.

Ridge and smooth gourd: Foliar spray of 100 ppm Ethrel 50% (4-ml Ethrel 50% in 20 liters of water) at 2- and 4- true leaf stage increases number of female flowers, and ultimately increases 25-35%yield. Add some sticker in spray solution.

Long melon: Foliar spray of 50% Ethrel @ 250 ppm (10 ml 50% Ethrel in 20 liters of water) at 2- and 4- true leaf stage increases number of fruits per plant and fruit weight and ultimately yield.

Note: *MH and GA_3 are soluble either in hot water or in alcohol but not in ordinary water.*

Rising of seedlings in polyethylene bags for early crop: In the month of December and January polyethylene bags of' 0.5 to 1 kg (preferably 15x10 cm) size are filled with a mixture of sand, garden soil and compost in the ratio of 1: 1: 1. Poultry manure should not be used as it has inhibitory effect on germination. In the bottom of polyethylene bags, 2-3 holes are made with the help of sharp scissors or knife. Per bag, 2-3 seeds are then sown at a depth of 3-4 cm. After sowing the seeds, the bags are watered with water cane and placed where they can be protected from cold waves during night.

The bags are covered with polyethylene sheet during night to protect them from low temperature and chilling winds and for early germination of seeds. Generally, the bags are placed on the southern side of the house near the wall, so that the seeds/seedlings may get sunlight throughout the day and may get protection from cold waves; the polyethylene sheet should be removed during daytime. After germination, the polyethylene sheet should not touch the seedlings, otherwise that may cause low temperature injury to the seedlings.

The bags after completion of germination are watered with water cane as and when required. After attaining appropriate size and passing away the frost danger, the seedlings can be transplanted in the field without disturbing the earth ball since any damage to earth ball will lead to death of the seedlings. The bags before transplanting should be removed carefully without disturbing the seedling roots. Irrigation should be applied soon after transplanting seedlings in field.

HARVESTING OF CUCURBITACEOUS CROPS

Watermelon

- Dull and hollow sound is produced when the fruits are thumbed.
- Tendril accompanies the fruit gets shriveled and dried.
- The portion of fruit resting on the ground gets changed from pale white to creamy yellow.
- When fruit is pressed with hand, mature one gives crisp cracking sound/noise.

Muskmelon

- **Half-slip stage:** Fruits are not completely ready for table use, but are good for distant market.
- **Full-slip stage:** Fruits are fully ready for table use and are best for local market. Fruit itself is separated from the pedicel. Pressure is not required to separate the fruit from the stem whereas; in case of half-slip stage, slight pressure is required.
- **Musky flavour:** Fruits produce a very pleasant musky flavour on ripening.
- **Change in color:** The green pigment is disappeared due to degradative process and yellow pigments are appeared due to synthesis processes.
- **Full netting:** A net like structure is developed on the fruit surface on ripening.

Bottle gourd: Fruits are harvested when they are tender, yellowish green in color and non-fibrous, the fruits are tender if on pressing nail goes inside the fruit.

Bitter gourd: Immature fruits when they are tender and non-fibrous with light green color should be harvested.

Long melon: Fruits are harvested when they are 15-30 cm long, tender, non-fibrous & good flavored with light green color.

Pumpkin: Fruits should be harvested when they have developed fully and attained maximum size.

Ridge gourd, smooth gourd, summer squash, round melon and pointed gourd: The fruits of these crops are harvested when they are non-fibrous, tender, and green. They are considered tender if on pressing nail goes inside the fruits.The fruits of ridge and sponge gourd are harvested when they have attained ⅔ of their maximum size.

Cucumber: Fruits are harvested at immature tender stage when they have attained marketable size. The fruits are tender if nail goes inside the fruits by pressing.

INSECTS-PESTS OF CUCURBITS

Red pumpkin beetle (*Raphidopalpa fovelcollis*): An adult beetle is oblong, shining, and yellowish-red in color, and grubs are creamy-white in color. Beetles make holes in leaves and convert them into a veins skeleton. Severe attack causes death of small

plants. The grubs remain into the soil and feed on roots and underground portion of host plants.

Control

- Spray the crop with 0.2% Carbaryl.
- Where seedlings wilt due to grubs, apply monocrotophos 2.5 l/ha with irrigation water one month after sowing.

Aphid, jassid and mite: These tiny insects suck cell sap from tender leaves, hence, crop growth remains poor as a result it gives less yield.

Control

- Reflective mulches can be used to repel aphids.
- Late season plantings should be located as far away as possible from existing cucurbit crops.

Fruit fly (*Bactrocera cucurbitae*): The female lays eggs below the rind by puncturing tender fruits. Its attack spoils the fruits. The damage is more serious in long melon, ridge gourd, bitter gourd, bottle gourd, round melon, and muskmelon.

Control

- Collect and destroy the infected fruits.
- Foliar application of neem oil @0.3% is given to cure the crop from fruit fly.

DISEASES OF CUCURBITS

Powdery mildew (*Erysiphe sp. and Sphaerotheca sp.*): The fungus form white floury patches on the upper and lower surface of leaves, stem etc. particularly in dry weather. The severely affected plants turn brown. Because of its infestation, the fruits are poor in quality.

Control

- Spray the crop with 0.2% wettable sulfur (Sulfex) as and when it starts appearing.

Anthracnose (*Colletotricum capsici*): This is a serious disease of bottle gourd, sponge gourd, summer squash etc.; its symptoms differ according to host. The small spots of yellowish color are formed on leaves and fruits, which later turn into brown. The smaller spots coalesce to cause death of entire leaf. In moist weather, gum like substance is seen on these spots. Sometimes petioles are attacked and defoliation occurs.

Control

- Spray the crop with 0.2% Indofil M-45 at 10-12 days intervals.

Gummy collar rot *(**Rhizoctonia bataticola**):* Muskmelon is the most affected crop, and this disease is noticed mostly in April-May. Yellowing of stem at collar region followed by stem splitting and oozing of gum like substance are typical symptoms of this disease.

Control

- Spray the stems of affected plants with 0.1 % Bavistin solution.

Downey mildew (*Pseudoperonospora cubensis*):Angular and yellow or orange colored spots are formed, which often are restricted on veins of upper surface of leaves. During moist weather, on these spots a white or light purplish downy growth of this fungus appears on lower surface of leaves. Later on, the entire leaves are dried.

Control

- Spray the crop regularly with 0.2% Indofil M-45 at 10-12 days intervals.

Mosaic virus: The leaves of infected plants show yellow green patches and become small and chlorotic. As a result, the yield is affected adversely. The disease is transmitted by leafhoppers like aphids.

Control

- Spray systemic insecticides at 10-15 days interval to check the virus-vectors like aphids.
- Rogue out the infected plants as and when appears