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Okra

Scientific Name : *Abelmoschus esculentus*

Family : *Malvaceae*

Chromosome number : $2n=72, 108, 130$

Origin : *Asiatic region /Ethiopea/Africa.*

Common names : *Bhendi, Lady's Finger*

Area and production

- India is the largest producer of okra in the world. The major bhendi growing states are Uttar Pradesh, Orissa, Bihar and West Bengal.

Economic importance and uses

- Okra is more remunerative than the leafy vegetables. Fresh okra fruits are important and used as vegetable in India, Brazil, West Africa and many other countries. For year round consumption sun dried (Africa, India), frozen and sterilized (USA) fruits are also important market products. Tender green fruits are cooked in curry and also used in soups. The root and stem are useful for clearing cane juice in preparation of jaggery. Its ripe seeds are roasted, ground and used as a substitute for coffee in Turkey. Matured fruits and stems containing crude fibre are used in the paper industry.
- Okra is rich in vitamins, calcium, potassium and other minerals. 100g consumable unripe bhendi fruits contain 10.4g dry matter, 3,100 calorie energy, 1.8g protein, 90mg calcium, 1.0mg iron, 0.1mg carotene, 0.07mg thiamin, 0.08mg riboflavin, 0.08mg niacin and 18 mg vitamin C. The dry seeds contain 13-22% edible oil and 20-24% protein. The seed cake is also used as an animal feed.

Description of popular varieties and hybrids

Pusa Makhmali:

- It is a pure line selection from local type collected from West Bengal. Fruits are light green tapered, attractive, 12-15 cm long with high yielding (8-10t/ha) potential but is susceptible to YVMV. It is suited for cultivation in hills and at virus free season

Pusa Sawani

- Most popular variety known throughout the country. It is a hybrid derivative selection from the cross between IC 1542 and Pusa Makhmali. It bears smooth and dark green fruits having 5 ridges and takes 45-50 days from sowing to harvest. First fruit is borne on 5th to 7th node. It is suitable for cultivation in both spring summer as well as Kharif season since it is less sensitive to temperature fluctuations. Yield is around 12-12.5 t/ha.

Pusa A-4:

- This variety has been released as substitute for Pusa Sawani. The fruits are 5 ridged, attractive, dark green 12-15 cm long having excellent shelf life. It is resistant to YVMV and tolerant to jassids and shoot and fruit borer. Yield ranges from 10-12 t/ha.

Co-1:

- It was developed at TNAU as single plant selection from a heterogenous population of Red Wonder. Plants are tall, leaves are light green and deeply lobed. The fruit starts from 5th node. It has field tolerance to YVMV but is susceptible to fruit borer and powdery mildew. Suited well for cultivation in all seasons of the year.

MDU1:

- It was evolved at TNAU as an induced mutant from Pusa sawani. The fruit bearing starts from 4th to 5th node and takes 45 days to first picking. Fruits are light green about 20cm long and weigh about 29 g each at the time

Arka Anamika (Selection 10):

- This variety has been developed as a hybrid derivative selection from inter specific cross between *A. esculentum* and *A. tetraphyllum*. The plants are tall, upright, slightly pigmented on stem and lower leaves. It takes 55 days to first picking. The variety is excellent yielder in South but with a lower performance in northern states. It is resistance to YVMV and yields around 12.5t/ha

Arka Abhay (Selection):

- An interspecific hybrid between *Abelmoschus esculentus*(IIHR 20-31) x *A. manihot* spp. *Tetraphyllum* (Res. To YVMV) followed by backcross. Plants tall, well branched. Fruits lush green, tender and long. Fruits borne in two flushes. Purple pigment present on both sides of the petal base. Green stem with purple shade. Fruits free from spines having delicate aroma. Good keeping and cooking qualities. Resistant to yellow vein mosaic virus(YVMV) Duration 120-130 days. Yield

Punjab Padmini:

- It is released by PAU, Ludhiana as a hybrid derivative selection from inter specific cross between *A. esculentus* and *A. manihot* ssp *manihot*. The plants grow fast; 180-200cm. Pigmentation is visible on stem, shoots, petiole and basal lower veins of leaves. Fruits are 15-20 cm long, dark green and 5 ridged. It is resistant to YVMV and tolerant to jassids and cotton boll worm. It yields 10-12.5 t/ha green fruits.

Punjab -7:

- This variety was developed at PAU, Ludhiana as a hybrid derivative selection of a cross between *A. esculentus* cv. Pusa sawami and *A. manihot* ssp. Manihot. Plants are medium tall. Leaves are dark green with less serrated margins. Plant is sparsely hairy. Fruits are medium long, green, 5 ridged. It yields about 10t/ha.

Punjab-8(EM 58):

- It is an induced mutant derived from Pusa Sawani by treating seed with EMS 1%. The plants are tall. Fruits are medium long, thin, tender green and 5 ridged. It is resistant to YVMV and tolerant to fruit borer.

Parbhani Kranti:

- This YVMV resistant variety was developed at Marathwada Agricultural University, Parbhani from interspecific cross between *A. esculentus* cv. Pusa Sawani and *A. manihot*. Plants are single stem, tall with dark green foliage. The first fruit is borne on 5th to 6th node. The fruits are dark green, slender, 5 ridged with long beak. Average fruit yield varies from 8.5-9 t/ha.

Gujarat Bhendi 1:

- It was developed by Gujarat Agricultural University, Ahmedabad as a pure line selection. Plant height is 60 – 90 cm. The plants are erect, purple tinge on stem. Fruit starts from 4th to 5th node and fruits are 5 ridged, tender and green in colour. It yields 7 t/ha.

Varsha Uphar (HRB 9-2):

- The variety has been developed by HAU, Hisar from the cross. Lam selection 1 X Parbhani Kranti. It is resistant to YVMV and field tolerant to leaf hopper. Plants are medium tall (90-120), fruits bearing starts from 4th node. Fruits smooth, attractive, 18-20 cm long and 46-47 days to first picking. It is a prolific bearer with an average yield of 10 t/ha.

White Velvet:

- It is a very popular local variety in Karnataka.

Hisar Unnat (HRB-55):

- Developed by HAU, Hisar from the cross Selection 12-2 x Parbhani Kranti. It is resistant to YVMV, early (first picking in 46-47 days) and high yielding (12-13 t/ha) variety. Fruits 5 ridged 15-16 cm long on full maturity. It is suitable for growing during summer as well as rainy season.

Selection 2-2:

- This variety was developed at IARI from the cross (Pusa sawani x Best one) x (Pusa Sawani x IC 7194). The plants grow to an average height of 110 cm. It takes 50 days to first harvest. Fruits are green, tender, long (16-20 cm) and 5 ridged. It is popular in Maharashtra for fresh fruit exports.

Azad Kranti:

- It is released by C.S. Azad University of Agriculture and Technology, Kanpur. The plants are fast growing; fruits are shiny green, smooth, 5 ridged with long beak. It is tolerant to YVMV and gives good yield (12.5 t/ha).

Hybrid COBh H1:

- It is an VU selection / PA 4 (T). Plants are 110 to 120 cm tall, fruits are dark green, long and tender. About 21-29 fruits are borne per plant. It is a high yielding and resistant to YVMV. Yield potential is 22.1 tonnes/ha. Crop duration is 120 days.
- A number of private sector companies bred hybrids having resistance to YVMV are also being grown in the country. Varsha and Vijay from IAHS, Adhunik and

Panhali from Century Seeds, Hybrid No. 6 and 7 from Mahyco, Nath Sobha from Nath Seeds etc. are few hybrids.

Climate and soil

- The crop is basically adapted to tropical climate and vigorous warm humid weather for best growth and production. It is susceptible to drought and low night temperatures. For seed germination optimum soil moisture and a temperature range between 25 and 35°C is required, with fast germination observed at 35°C. Seeds fail to germinate below 17°C. At temperature above 42°C flower buds in most of the cultivars may desiccate and drop causing yield losses. The optimum temperature range for growth is 20-30°C. Sunlight is equally important for bhendi crop. A 50 % reduction in sunlight during first three weeks after sowing has adverse effect on yield.
- It can be grown in all kinds of soils ranging from sandy loam to clay. However, high yields can be obtained in loose friable, well manured loamy soils having better drainage. The soil optimum pH for okra ranges from 6-6.8.

Seasons

- Sowing in plains is done in June-July for kharif and February-March for spring-summer crop. The best time is from May 25th to June 25th. The crop sown earlier in season will be less affected by YVMV than the July. In hilly region, the crop is sown from April to July.

Seed rate

- The recommended seed rate per ha is 18-22 kg for spring summer crop and 8-10 kg for kharif crop. Higher seed rate could be used if the crop is to be sown early in January as it will augment germination loss due to low temperature. Higher seed rate and lower spacing could also be opted for spring summer crop to lower the field temperature and continued fruiting under frequent light irrigation.

Cropping systems/ planting systems

- Okra could be used in different cropping systems. In sequential cropping, potato-carrot-okra, okra-potato-tomato and cauliflower-tomato-okra provides higher income per unit area. Under sequential intercropping system (Okra+French bean)-(Capsicum+onion)-(Muskmelon+radish) gave higher yield as compared with sole crops of okra-capsicum-muskmelon. Okra+radish and palak+French bean gave higher return than sole crop. Bhendi could give 300-500% crop land use efficiency as an intercrop in cassava and cucurbits. Growing in sequences like okra-cowpea-maize, maize-okra-radish reduced bacterial wilt in tomato and brinjal taken as succeeding crop.

Preparation of field

- Soil should be worked well upto a depth of 20-25 cm and made into a fine tilth before seed sowing. The plant has well developed tap root system and is a heavy feeder and as such the soil should be made rich in organic matter content. Application of 25 t/ha of FYM is needed for obtaining good crop. Solarisation during hot summer months helps to great extent in controlling weed pest population.

Spacing

- A plant distance of 60 X 30 cm accommodating 5000 plants/ha is recommended for branching types, while 45 X 30 cm accommodating 66,000 plants/ha for non branching type. During spring summer season with less plant growth these spacing is kept at 45 x 20 cm or less. The seed should be sown at a depth of 2.5cm.

Nutrition

- The quantity of manures and fertilizers depends upon the type of soil, but in normal condition 25 tonnes of FYM should be added at the time of last harrowing. In addition to this, 125kg N, 75kg P and 63 kg K/ha will be required in medium type of soils. Half of the nitrogen and full amount of P and K should be

applied as basal dose while remaining half of the N should be given as top dressing 35-40 days after sowing the seeds. Positive effects of zinc up to 2% as soil application or 2mg/litre of foliar spray of molybdenum @20mg/l foliar spray have been observed on fruit yield and appearance.

Irrigation

- During kharif, irrigate the crop as and when required. In summer season the crop should be irrigated at an interval of 5-6 days. Flooding of plants should be avoided. Drip irrigation increases considerable yield and saves 70-80% irrigation water.

Weed control

- About two weedings are required till the crop canopy covers the soil surface. Use of weedicides has helped in reducing the numbers of weeding to zero during summer and one during kharif season. Fluchloralin @1.5kg a.i/ha as pre sowing soil incorporation and alachlor @ 2kg a.i/ha as post sowing gives control of weeds. The soil surface application of weedicides is effective for 4-5 weeks.

Use of chemicals and growth regulators

- The highest average fruit set and yield were obtained with cycocel at 100 ppm as seed soaking for 24hrs on seed treatment by GA (400 ppm), IAA (200 ppm) or NAA (20 ppm) enhanced germination, ethephon (100-500ppm) reduced vegetative growth and weakened apical dominance, post harvest treatment with cycocel (100ppm) enhanced shelf life of fruits and with ascorbic acid (250 ppm) retention of chlorophyll was the best.

Harvesting and yield

- The pods should be harvested when they are immature and green and have attained edible size. In general, harvesting every alternate day is advisable. Field is divided into blocks to ease harvesting at one or two intervals. Delay in harvesting causes fibrous and matured fruits of poor edible quality. Such fruits get very poor price in the market and ultimately poor income to the growers. Ten to fifteen pickings are done during the crop period. The best length at which the pods should be harvested is 8 to 10 cm. For distant market harvesting in the late evening and transporting the produce during coolness of night is practiced.
- The yield depends upon the season, variety and cultural practices followed for the crop cultivation. An average yield of 8 tonnes green fruits per hectare during spring-summer and 12.5 tonnes during rainy season is ideal, though much higher yields have been harvested by individual farmers.