



Package of Practices for Okra

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Introduction

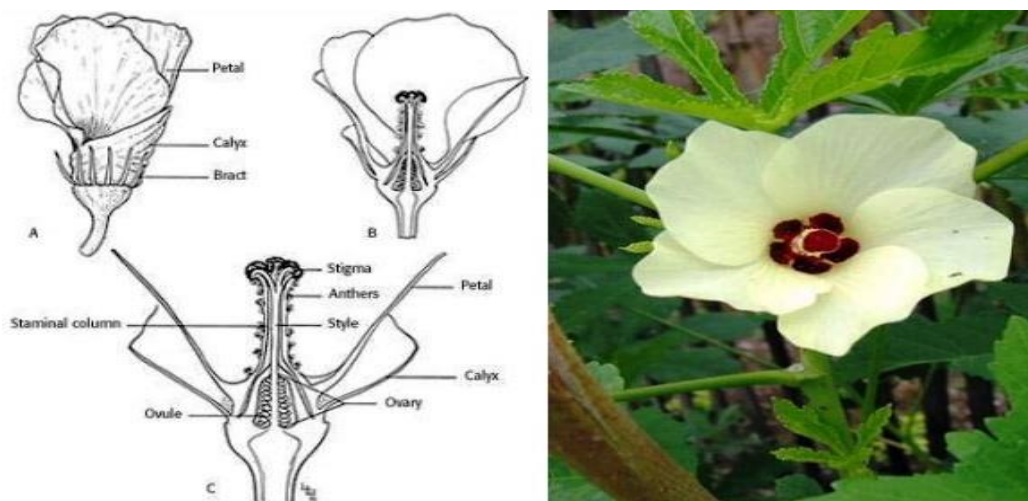
India, a densely populated country with approximately one-fifth of the world's population and over 70 percent of farming households, faces a significant challenge. While the annual population growth rate is approximately 1.8 percent, the demand for food is expected to grow by 3 percent or more per annum in the upcoming years. Consequently, there is a pressing need to increase food production annually by 3.5 percent. Vegetables play a vital role in a balanced human diet, providing essential nutrients, vitamins, and minerals, and are crucial to global nutritional security. In India, vegetables account for 58.73 percent of the total horticultural production, as per the research conducted by (Jena *et al.* 2018). In the year 2019-20, India produced 188284 thousand MT of vegetables from an area of 10310 thousand hectares. Additionally, India produced 63,55,000 MT of Okra from an area of 5,21,000 hectares, as per the report published by (Anonymous, 2020). Okra (*Abelmoschus esculentus* L. Moench) commonly known as lady's finger or *bhindi* which belongs to the family Malvaceae. It is widely adopted vegetable in Indian kitchens and can be grown round the year. Besides the utility of its tender green pods as a vegetable, it is used in soups and curries. Green Fingers are canned or dried for off-season use by army at high altitudes and are being exported for earning of foreign exchange. Okra pods are excellent source of minerals which imparts resistance against many diseases. It is also good for patients suffering from cardiac disorders. Ripped seeds are used as substitute of coffee. The roots, stems and plant fibre are used as a sugarcane juice clearing agent during the preparation of jaggary. Paper industries also demand this plant's fibre.

Origin

Okra is native to north eastern Africa in the general area of Ethiopia and Sudan. Existence of a large number of related species with wide variability and dominant characters suggest possible role of India as a secondary center of origin. Now, its cultivation is widespread in tropical, subtropical and warm temperate regions, but is particularly popular in West Africa, India, the Philippines, Thailand and Brazil. In India, major okra growing states are Uttar Pradesh, Bihar and West Bengal.

Taxonomy and botany

Earlier placed under *Hibiscus esculentus* L., cultivated bhendi belonging to Malvaceae was renamed as *Abelmoschus esculentus* L. due to the fusion of its calyx, corolla, and staminal column that fall down at anthesis (caduceus), while in *Hibiscus*, the calyx is persistent. This annual herb has a duration of 90-100 days and its flowers, which are bisexual and often cross-pollinated, bloom between 8.00-10.00 a.m. Anther dehiscence occurs 15-20 minutes after anthesis and completes in 5-10 minutes, with maximum pollen fertility occurring in the period between one hour before and after the flower opens. Fertilization takes 2 to 6 hours after pollination, and bud pollination is not effective in okra since the stigma is receptive at the opening of the flower. The fruit is a capsule, and usually, fiber development begins from the fifth to the sixth day.



Most of the cultivated varieties of *Abelmoschus esculentus* are amphidiploids with a chromosome number of $2n=130$. However, *A. esculentus* is known for its chromosome polymorphism, with a $2n$ range of 72 to 144. It can tolerate the addition or deletion of a few chromosomes. The $2n$ number of *A. esculentus* was achieved by crossing *A. tuberculatus* ($2n=58$) with *A. ficulneus* ($2n=72$) to create an F1, which was then treated with colchicine to produce an amphidiploid with $2n=130$.



Similarly, *A. caillei*, a complex polyploid, can be obtained by treating the F₁ of a cross between *A. manihot* and *A. esculentus* with colchicine.

Four species, namely *A. esculentus*, *A. manihot*, *A. caillei*, and *A. moschatus*, include both cultivated and wild forms.

Major Varieties

The number of varieties of okra has been released by private and public sector in India. The various varieties and cultivars differ in growth habit, plant height, fruit characteristics, presence of purple pigmentation on plant parts, color and number of ridges of fruit etc. Arka Anamika, Arka Abhay, Susthira, Anjitha, Manjima (All green fruited) are resistant to yellow vein mosaic.

The characteristics of some varieties cultivated in India are:

1. **Punjab Padmini:** This variety has been developed by PAU, Ludhiana. Fruits are quick growing, dark green smooth, thin, long with five ridged and retentive of tenderness. Fruiting starts 55-60 days after sowing. It has field resistance to yellow vein mosaic virus. This variety is suitable for cultivation under spring season and yields 110 q ha⁻¹.
2. **Pusa Sawani:** This is released from IARI, New Delhi. It is an old variety which is resistance to yellow vein mosaic. It is suitable for cultivation under both spring and rainy seasons. Fruits are five ribbed, dark-green in color and free from bristles.
3. **Punjab-8:** This variety has been released from PAU, Ludhiana. The plants are medium tall with splashes of purple pigmentation on stem. Fruits are thin, long, dark green and five ridged. It is highly resistant to yellow- veins-mosaic virus. Moreover, it is tolerant to jassid and borer. Average market yield is 135 q ha⁻¹.
4. **Pusa Sawani:** This is released from IARI, It is suitable for cultivation in both summer and rainy seasons. Fruits are dark green, smooth with 5 ridges and about 10-12 cm long. But, this variety is susceptible to yellow vein mosaic virus. Crop matures within 50 days from sowing. The yield potential ranges from 120 to 150 q ha⁻¹.
5. **Susthira:** The Susthira variety has been released from Kerala Agricultural University. It is a high yielding perennial type okra producing 180 q ha⁻¹ green okra fruits. It is resistant to yellow vein mosaic virus and is recommended for rainy season.
6. **Arka Anamika:** It is released from IIHR, Bangalore. Fruits are spineless with 5-6 ridges, delicate aroma and good keeping quality. It is resistant to YVMV. Average yield is 200 q ha⁻¹ and can be harvested in 130 days.



7. **Arka abhay:** Again, it is released from IIHR, Bangalore. Fruits are green in colour. Resistant to YVMV.
8. **Parbhani Kranti:** Released from MKV, Parbhani in Maharashtra. Fruits are medium-long with tender smooth surface at marketable stage. Fruits have good keeping quality. Average yield is 85-115 q ha⁻¹ and mature within 120 days. This variety has resistance against YVMV.
9. **CO 1:** It is a high yielding variety released from the Tamil Nadu Agricultural University. Red fruited variety suitable for cultivation in Kerala.
10. **Salkeerthi:** Likewise, CO 1, it is a high yielding variety released from the Kerala Agricultural University (KAU). Fruits are long having light green appearance. This variety yields 160 q ha⁻¹.

Climate and Soil

Warm humid tropical conditions are ideal for luxurious growth and high yield of okra. It grows best within a temperature range of 24-27°C. It is highly tolerant to high temperature and drought condition but, highly sensitive to frost and temperature below 12°C. Seeds germinate poorly at ground temperature of 20 °C or less. The crop can be successfully grown in rainy season even in heavy rainfall area. In India, it is grown in summer months and during the rainy season. Okra can be grown in a wide range of soils. However, it grows best in loose, friable, well-drained sandy loam soils rich in organic matter. It also gives good yield in heavy soils with good drainage. A pH range of 6.0-6.8 is considered as optimum. Alkaline, saline soils and soils with poor drainage are not good for this crop.

Agronomic Practices:

Field Preparation

To prepare the field for raising okra, it is recommended to plough the land twice, followed by planking to create a fine tilth. During land preparation, it is advisable to incorporate well-decomposed farmyard manure (FYM) at a rate of 20 t ha⁻¹. For heavy soils, sowing on ridges is preferable to sowing on flat beds. The application of organic manures such as neem cake, poultry manure, or vermicompost can significantly improve plant growth and productivity. Furthermore, the use of neem cake and poultry manure can help reduce the need for chemical fertilizers.

Season of Planting

Okra is typically planted in India during two main seasons: February-March and June-July. However, the ideal time for seed sowing can vary significantly based on factors such as climate, variety, and temperature requirements for growth. In the northern plains of India, for instance, the



spring/summer crop is usually sown in February-March, while the rainy season crop is sown in June-July.

Seed rate and spacing

During summer, vegetative growth is relatively less and seeds are sown at a closer spacing of 45 x 20 cm or even less. Seed rate required is 18-20 kg / ha. During kharif, plant grows vigorously with more branching and seeds are sown at wider spacing of 60 x 30 cm for branching types and 45 x 30 cm for non-branching types. Seed rate recommended for kharif crop is 8-10 kg/ha. For harvesting smaller fruits for export, three rows planting with a spacing of 20-30 cm between rows and 20 cm within a row is advantageous. Distance between two sets is kept as 60 cm. This system has the unique advantage of easiness in inter cultural operations, harvesting, application of plant protection chemicals, *etc.* Soak seeds for 6-12 hours before sowing to enhance germination during summer. The seed rate generally varies with germination percentage, spacing and season. The seeds should be soaked in a solution of Bavistin (0.2%) for 6 hours before sowing followed by drying in shade. The seeds are dibbled on the either side of the furrows at recommended spacing.

Manures and fertilizers

Okra is a heavy feeder of nutrients. Doses of manures and fertilizers vary from place to place depending upon fertility level. In general, 20-25 t of FYM, 100-120 kg nitrogen, 50-60 kg phosphorus and 40-60 kg potash per hectare is recommended. Half of nitrogen and full dose of phosphorus and potash is applied at the time of land preparation and remaining half of nitrogen is applied in two equal splits, one at 4 weeks of sowing and second at the intimation of flowering and fruiting stage.

In acid soils region, high P fixation/low P mobility is an important limiting factor in crop production. Moreover, high cost of phosphatic fertilizers further hinder the resource poor farmers to apply recommended P doses. So, the use of AM (*Arbuscular mycorrhizal*) fungi, which is an expensive and ecofriendly input, is capable of enhancing P use efficiency of crops in above region. Moreover, AM inoculation lead to economy of about 25% soil test based P₂O₅ dose in okra, improve soil quality and overall crop productivity (Kumar 2012). The actual inoculation of okra seeds with AM culture should be performed by preparing soil slurry of above culture and dipping the seeds into it for half an hour followed by shade drying for making seed pallets and then sowing in the field.

Irrigation

The frequency of irrigation depends upon the climatic condition and also frequency of rain. There should be enough soil moisture in the field at the time of seed sowing. Irrigation is important



during flowering and fruit development. The irrigation should be given 4-6 days interval in summer season. For rainy season crop, irrigation is given if there is prolonged dry spell. In black soils, irrigation is done at 5-6 days interval.

Weed Management

The Integrated Weed Management System (IWMS) involves the integration of practical and reliable weed management practices, including cultural, mechanical, chemical, and biological approaches that are economically feasible for producers to implement as part of their overall farm management strategy. For effective weed control, a pre-emergence application of Pendimethalin at a rate of 1.00 kg a.i./ha in 870 litres of water is recommended.

Intercultural Operations

Weeding, thinning and earthing up are important intercultural operations in okra. It is necessary to keep the crop weed free during the first 20-25 days of plant growth. During rainy season weeding should be done regularly and earth up rows. Pre emergence application of Stomp (Pendimethalin) @ 1-2 liter per ha in 750 lt. water followed by one hand weeding at 20-25 days after sowing should also be practiced for the effective control of weed.

Plant Protection

The important pests and diseases of okra crop are given below:

Major insect-pests

1. Jassids/Leaf hopper (*Amrasca biguttula biguttula*)

Wedge shaped pale green jassids suck sap from undersurfaces of leaves causing marginal yellowing, cupping and drying of leaves. Due to intense hopper burn, defoliation also occurs. Infestation is serious during summer. Prophylactic spray of neem oil-garlic mixture at fortnightly intervals is advantageous for avoiding pest incidence.

2. Shoot and fruit borer (*Earias vittella*, *E. insulana*)

Borer infestation results in toppling and death of young seedlings, withering and drying up of individual leaves and central shoot. Fruits will be damaged severely. Spray of carbaryl or thiodan or endosulfan or fenvalerate or cypermethrin or deltamethrin is effective for control of borer. Summer ploughing and clean cultivation are also helpful in reducing pest infestation.

3. Nematodes

Root knot nematode infects roots causing galls premature leaf fall, wilting and decline in growth and fruit production. Symptoms in the field generally appear as well-defined patches. Crop rotation with



non-host plants like wheat, rice and corn should be practiced as a regular measure. Successive deep ploughing during summer and soil solarisation gives very good control. Treating field with nematicides also can be adopted.

Diseases

1. Yellow Vein Mosaic Virus Disease

This is the most serious disease of bhendi. Characteristic vein clearing is the typical symptom and yield loss may be up to 100% depending on stage of occurrence of the disease. Fruits of virus affected plants turn to cream or white in colour. Virus is transmitted through a whitefly *Bemisia tabaci*. Removal of weeds susceptible to mosaic from nearby fields, control of white fly, uprooting and burying of affected plants, adjusting time of sowing and cultivation of resistant varieties like Arka Anamika, Arka Abhay, Susthira etc. are recommended for raising a disease-free crop. Recently, a hybrid COBH 1 has been released from HC & RI, TNAU Coimbatore which is resistant to YVMV.

2. Cercospora leaf spot

This disease is serious when there is high humidity in atmosphere and is common in a seed crop. Sooty, black mouldy growth of pathogen appear as under surface of leaves and finally leaves dry off and fall down. Mature pods are also attacked and show blackish spots. Spraying with Bavistin (0.1 g /l) or Bordeaux mixture at fortnightly interval will control the disease.

3. Powdery mildew

This is caused by a fungus *Erysiphe chioracearum* under prolonged humid conditions. White powdery pustules appear on lower surface of leaves resulting in yellowing and death of leaves. Spraying of wettable sulphur (2g/l) at fortnightly interval is recommended for control.

Integrated pest and disease management

- Soil solarisation can be done with the help of white polythene mulch.
- Crop rotation should be followed
- Use of resistant varieties like Arka Anamika, Varsha Uphar, Kashi Kranti *etc.* can be grown
- Removal of alternate and collateral host from the field and the bunds
- Use of yellow sticky traps @ 10 ha⁻¹
- For control of pest spray Imidachloropid @ 1-1.5 ml l⁻¹.

Harvesting and yield

The first picking is often after 40-45 days after sowing or a little later depending on the variety. Harvest fruits when they attain maximum size but still tender. Fruits of 6-8 cm long are preferred for



export purposes. This is usually attained by 5-6 days after opening of flower. Harvesting is done in alternate days with a knife or by bending pedicel with a jerk. For harvesting, cotton cloth hand gloves should be used to protect fingers from stinging effect. It is advisable to harvest in morning hours since fruit hairs will be soft. Sprinkling water on pods during night will keep them cool and fresh for market. A total number of 12-15 pickings can be made.

Spring-Summer crop: 6.0 – 8.0 t / ha

Kharif crop: 10 – 12.5 t / ha

Post-harvest management

Fruits after harvesting are graded and filled in jute bags or baskets or perforated paper cartons and sprinkled with water. Pre-cooling of fruits before packing maintains turgidity of fruits and will save it from bruises, blemishes and blackening. Okra fruits can be stored at 7-10°C temperature and 90-95% RH for 7-10 days without much loss in colour, texture or weight. This is usually done before packing fruits in perforated cartons of 5-8 kg before transporting to refrigerated van for export.