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On behalf of: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany

Cold Chain Logistics Resource Centre

Confederation of Indian Industry

Post-Harvest Management Protocols

OKRA

Lady Finger or Okra, which is also known as ' Bhindi is one of the important vegetable crops of India. It is grown throughout the tropical and sub-tropical regions and also in the warmer parts of the temperate regions. Okra or Lady Finger (Abelmoschus esculentum (L.) Moench.) plant belongs to the family Malvaceae. The nutritional value of 100g of edible okra is characterized 1.9 g protein, 0.2 g fat, 6.4 g carbohydrate, 0.7 g minerals and 1.2 g fibers. Okra or Lady Finger has a good potential as a foreign exchange. **Total production for the year 2019-20 was 6371 ('000 MT)** and Gujarat, West Bengal, Bihar, Madhya Pradesh and Odisha are the major producing state.

The crop varieties are:

- Kamini
- Pusa Mukhamali
- Parbhani Kranti
- Pusa sawani
- Vaishali
- Vagmi
- Padmini

MATURITY INDICES OF OKRA

Okra pods are harvested within 6-7 days after flower opening/pod set. The pods are harvested when the pods are

- young, green, tender, crisp, and with less fibre content (not higher than 7%)
- Not more than seven days after pod set
- Pod tips (blossom ends) snap readily when bent

The pods have to be harvested every one or two days due to the rapid rate of growth and specific pod size requirements.

GRADING AND PACKAGING

Okra pods are commonly harvested by hand with approximately 0.5 to 1 cm of pedicel and placed in a suitable container.

- Sacks or bags should not be used as these incur damage and cause heat build-up as the respiration rate of okra is very high.
- Bamboo baskets damage the pods and cause blackening of edges.
- Clean ventilated shallow crates should be used for collecting the pods and place them in the shade.

Polyethylene film liners are used in filled containers to reduce the rate of dehydration. Okra should not be harvested in the rain or when excessively wet.

The pods should be harvested by clipping instead of pulling, to avoid damage and darkening of pod edges. Pods should be handled with care and rubber hand gloves can be used while harvesting and handling to avoid mechanical injury which later show up as dark discolouration of pod edges lowering the marketing quality.

Oversize and damaged pods are to be removed from the plant and sorted out in the field. Pods showing discolouration, bruising (blackening of the ridges), chemical residue or insect damage, are sorted out while grading. Okras are graded by hand on moving conveyors or standard grading tables.

- The pods should be fresh, green, firm, free from debris.
- Should have tender tips that snap readily
- Length of the pod should be 8-12 cm
- Free from dark discoloration
- Free from disease, bird or insect damage
- Should have stalks cut cleanly

PACKAGING

Okra pods can be loosely packed into one or two-piece self-locking flbre board cartons having a bursting strength of 200 to 2501b/in2. However, the pods packed without film liners shrivel very fast and become unmarketable within 2 days. The pods can be pre-packed in polyethylene bags of 100 gauge thickness having 0.5% ventilation and master packed in CFB boxes using paper shreds as cushioning at the bottom for storing at ambient temperature.

Optimum Packaging Standards:

- Length x width x height of CFB box: 40 x 30 x 10-15 cm
- Net weight: 3-5 to 4.5kg

STORAGE

Okra are sensitive to both high and low temperatures during storage and marketing resulting in rapid deterioration of the pods. At high temperature okra exhibit high rates of respiration resulting in rapid production of heat and subsequent deterioration. Fiber content of pods also increases with increase in duration at higher storage temperatures.

The optimum temperature for storage of okra is 10°C with a relative humidity of 85 to 90%. Chilling injury is observed at 7°C within a week. Unless okra are rapidly cooled soon after harvesting, the heat build-up will accelerate spoilage and cause pod blackening.

Forced air cooling with high humid air is essential for quick cooling without causing desiccation. Hydro cooling should not be used as it causes water spotting.

Storage life of okra could be extended to 10 days by pre-packing in non-perforated flexible films and storing at 10°C. Precooling to 10°C before packing extends the storage life to 12 days. Packing of okra pods in anti-fog films also helps to overcome this problem.

In order to maintain high quality of okra from harvesting to the destination, the minimum handling method of picking and field packaging in CFB boxes, retains freshness, firmness and quality of okra upto 13 days at 8 ± 1 °C, 90–95% RH, without the use of postharvest chemical treatments.

STORAGE PROTOCOLS

Recommended Temperature (degree Celcius)

7-10

Recommended Relative Humidity (%)

90-95

Shelf Life

7 to 10 days

Product Loading Density (in Pound/cu.ft)	-
Initial Freezing Point (in degree celcius)	**-1.8**
Specific Heat Above Freezing Point in (kJ/Kg.K)	**3.85**
Specific Heat Below Freezing Point (in kJ/Kg.K)	**1.97**
Latent Heat of Fusion (in kJ/Kg)	**300**
Thermal properties of Banana	
Initial Freezing Point (in degree celcius)	**-1.1**
Specific Heat Above Freezing Point in (kJ/Kg.K)	**3.65**
Specific Heat Below Freezing Point (in kJ/Kg.K)	**1.89**
Latent Heat of Fusion (in kJ/Kg)	**278**