giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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

BANANA

Banana is the second most important fruit crop in India next to mango. Its year round availability, affordability, varietal range, taste, nutritive and medicinal value makes it the favourite fruit among all classes of people. It has also good export potential. **Total production of the Banana for the year 2019-20 was 31779 ('000 MT)** out of Andhra Pradesh, Gujarat, Maharashtra & Uttar Pradesh are the major producer of Banana.

Varieties of Banana available in India

State	Varieties grown
Andhra Pradesh	Dwarf Cavendish, Robusta, Rasthali, Amritpant, Thellachakrakeli, Karpoora Poovan, Chakrakeli, Monthan and Yenagu Bontha
Assam	Jahaji (Dwarf Cavendish), Chini Champa, Malbhog, Borjahaji (Robusta), Honda, Manjahaji, Chinia (Manohar), Kanchkol, Bhimkol, Jatikol, Digjowa, Kulpait, Bharat Moni
Bihar	Dwarf Cavendish, Alpon, Chinia, Chini Champa, Malbhig, Muthia, Kothia, Gauria
Gujarat	Dwarf Cavendish, Lacatan, Harichal (Lokhandi), Gandevi Selection, Basrai, Robusta, G-9, Harichal, Shrimati
Jharkhand	Basrai, Singapuri
Karnataka	Dwarf Cavendish, Robusta, Rasthali, Poovan, Monthan, Elakkibale
Kerala	Nendran (Plantain), Palayankodan (Poovan), Rasthali, Monthan, Red Banana, Robusta
Madhya Pradesh	Basrai
Maharashtra	Dwarf Cavendish, Basrai, Robusta, Lal Velchi, Safed Velchi, Rajeli Nendran, Grand Naine, Shreemanti, Red Banana
Orissa	Dwarf Cavendish, Robusta, Champa, Patkapura (Rasthali)
Tamil Nadu	Virupakshi, Robusta, Rad Banana, Poovan, Rasthali, Nendran, Monthan, Karpuravalli, Sakkai, Peyan, Matti
West Bengal	Champa, Mortman , Dwarf Cavendish, Giant Governor, Kanthali, Singapuri

MATURITY INDICES OF BANANA

Banana fruits are produced in Bunches. Within the bunch are clusters of double rows of fruit called hands and individual banana called fingers. Generally, the crop gets ready for harvesting after 11 to 14 months of Planting and bunches attain maturity after 90-10 days of flowering. Bunch should be harvested when fingers of second hand from top are 3/4 rounded with the help of sharp sickle 30cm above the first hand .

Maturity of Banana can be identified using various internal and external characteristics such as fruit diameter, age of the bunch, angularity of the fruit, length of the fruit, and peel color.

Other Ways of estimating the maturity stage of banana

a. Determining the diameter of fingers using calipers at the midpoint of the fruit.

b. Recording the age of Bunch and marking them with different colored ribbons.

c. To measure the length of the edible pulp portion of the fruit from the fingers in the middle hand. The length should be a minimum of 15cm for the domestic market and 18cm for the export market

d. Peel Color: Peel of the fruit starts turning yellow, when it reaches maturity, however Harvesting should be done when it's still green.

POST-HARVEST HANDLING

WASHING

After harvesting the fruits are washed to remove the dirt or any other external agents attached on the surface.

GRADING

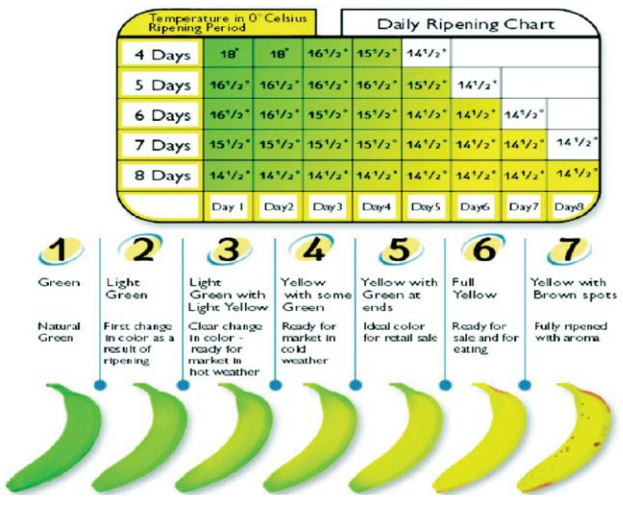
Grading of Banana is mainly based on size, color and maturity of the fruits. While grading, smaller fruits are separated from the larger ones in order to achieve uniform ripening. Immature, overripe, damaged and diseased fruits are discarded during the process of grading.

PRE-COOLING

Banana fruits can be pre-cooled by using the forced air for 2-6 hours in Cold rooms to bring down the temperature.

RIPENING & STORAGE OF BANANA

Banana is a climacteric fruit which is harvested unripe and then ripened using artificial methods. The most scientific way of ripening banana is by exposing them to ethylene @100-150 Ppm for 24-48 Hours at 15-18°C temperature. After harvesting fruits should be stored at 13-14°C Temperature. Banana is a perishable Commodity and thus fruits are disposed within 7 days of harvesting.



Harvesting should be done early in the day in summer to avoid handling when it is too hot. After harvesting the bunch should not be placed directly on the ground.

The cut to cool time period is 8 hrs in case of export.

8 HRS

STORAGE PROTOCOLS

Recommended Temperature (degree Celcius)

13-18

Recommended Relative Humidity (%)

85-90

Shelf Life

-

Product Loading Density (in Pound/cu.ft)	-
Initial Freezing Point (in degree celcius)	**-0.8**
Specific Heat Above Freezing Point in (kJ/Kg.K)	**3.39**
Specific Heat Below Freezing Point (in kJ/Kg.K)	**1.78**
Latent Heat of Fusion (in kJ/Kg)	**250**
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**