

Post Harvest Handling of Exotic Vegetables



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Introduction

In India exotic vegetables include wide range of vegetables like cherry tomato, lettuce, baby potato, sweet corn, broccoli, asparagus, dill leaves, red cabbage, pak choi, red amaranthus, mint, etc. The market of exotic vegetables is growing fast throughout the world. Exotic market in India is still at a nascent stage as compared to international market of exotic vegetables. India has vast potential to compete with the emerging domestic and export market of exotic vegetables as these can bring profitability and higher returns because of their more price than indigenous vegetables. Exotic vegetables are becoming popular among consumers due to awareness of their nutrition and health benefits. Apart from providing phytochemicals in diet, it provides diversity in food and helps to create variation in Indian cuisins. These exotic vegetables are liked by the consumers due to its unique flavour, aroma and taste. The exotic vegetables are highly perishable and therefore, require best post harvest handling practices to minimize the deterioration and maintain the quality of exotic vegetables. As these are best grown in controlled environment (protected cultivation), its deterioration and quality can be maintained by keeping the produce at favourable temperatures. Post harvest handling is one of the challenge faced by growers to handle these perishables. So appropriate knowledge of its harvesting and cool chain requirement is important to preserve the quality of these high value crops. Keeping in view the importance of exotic vegetables, the booklet compiles the information regarding the harvesting, packaging and storage of exotic vegetables.

1. Artichoke (*Cynara scolymus* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** It is harvested at immature stage when the bud is compact. Overdeveloped bracts are brown, tough and stringy.
2. **Any precaution for harvesting:** Stems are generally cut 2.5 to 3.8 cm (1 to 1.5 inches) below the base.
3. **Immediate operation after harvesting for quality assurance for specific crop:** It is precooled by hydrocooling, forced air cooling or ice packaging.
4. **Type of bulk packaging:** Plastic boxes of 18kg or wood boxes of 10kg.
5. **Cool Chain requirement:** Temperature- 0°C and 90-95% Relative Humidity (RH).
6. **Time span for sending to processing centre for fresh market:** Within 48 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** Plastic film, bags or clamshell (2-4 units).
2. **Super market retail conditions:** Selling at 20°C.
3. **Any other important point:** Artichoke buds should feel heavy for their size and should be transported preferably at 0°C and 95% RH. However, temperature of 10°C is allowed for journey of 2 and 3 days.
4. **Do you know:** Artichoke is rich in fibre and contains insulin which produce fructose, assimilated by diabetic patients. It also has calcium, phosphorus and Vitamin B (B₁, B₃, B₅ and B₆).

2. Asparagus (*Asparagus officinalis* L.)

A. At point of harvest (Collection Centre)



1. **Harvesting:** Spears are cut when they reach approximately 8-9 inches. Stalk diameter is not a good indicator of proper maturity and associated tenderness. Quality, fresh asparagus will be dark **green** and firm with tightly closed, compact tips.
2. **Any precaution for harvesting:** Harvest the spears with sharp stainless steel scateur, hands bearing cotton gloves.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Grading of crop in two or three grades depending on the size.
4. **Type of bulk packaging:** Asparagus is packaged loose or in bundles in cartons, plastic crates, trays and baskets made of wood or plastic (10 kg).
5. **Cool Chain requirement:** Temperature- 2°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** 500 g (trays or bundles)
2. **Super market retail conditions:** Selling at 20°C
3. **Any other important point:** During transport, the product should be covered with perforated film, to prevent drying-out and quality impairment. The possible deposition of moisture inside the film does not impair quality, but rather assists in keeping the product fresh.
4. **Do you know:** Asparagus is high in folate (Vitamin B₉) which reduce the risk of neural tube defects including spina bifida during pregnancy.

3. Baby corn (*Zea mays* L.)

A. At point of harvest (Collection centre)

1. **Harvesting:** It is harvested 3-4 days after silk emergence when color of baby corn turn yellow.
2. **Any precaution for harvesting:** Rubber and latex gloves should be used while harvesting.
3. **Immediate operation after harvesting for quality assurance for specific crop:** De husking can be done with thin knives with pointed end to lightly slit the baby corn lengthwise. Grading can also be done according to size to fetch better price and packing.
 - Large size: 11-13 cm long and 1.4-1.5 cm diameter
 - Medium size: 7-11 cm long with 1.2-1.4-cm diameter and
 - Small size: 4-7 cm long with 1.0-1.2-cm diameter.
4. **Type of bulk packaging:** Carton boxes (2-4 kg), net plastic baskets. Dehusked baby corn can be packed in perforated poly bags or thermocool trays covered with cellophane.
5. **Cool Chain requirement:** Temperature- 5-7°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre---- preparation for fresh market

1. **Best unit size of consumer pack:** Packed in perforated poly bags (500 g to 1 kg).
2. **Commercial feasibility of MAP:** Punnets with cling wrap.
3. **Super market retail conditions:** Selling at 20° C.
4. **Do you know:** Baby corn contains a quite high amount of fiber which stimulate healthy digestion and help in weight loss.

4. Baby potato (*Solanum tuberosum* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Harvest generally begins once tubers have reached a desirable size for the variety or market. Immature potatoes are easily bruised and "skinning" leads to shrivelling or decays.
2. **Any precaution for harvesting:** Avoid cut, bruises, growth cracks and damage during uprooting.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Grading can be done according to size, color and uniformity.
4. **Type of bulk packaging:** 25 kg gunny bags.
5. **Cool Chain requirement:** For table purpose-Temperature- 7°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 2-4 days under cold chain condition and within 24-48 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** 1 kg (approx.) in polynet bag.
2. **Super market retail conditions:** Selling at 20°C
3. **Any other important point:** Harvesting, packing and handling should be done with great care to prevent damage to the highly sensitive, thin-skinned, turgid tubers. Crushing, Pressure Bruising, Brown Spot or Shatter Bruising are common defects and may lead to rapid water loss, shrivelling and decay.
4. **Do you know:** Potato is naturally gluten free which make it excellent food choice for people with celiac disease and non- celiac gluten sensitivity.

5. Bamboo shoot (*Bambusa vulgaris* Schrad.)



A. At point of harvest (Collection Centre)

1. **Harvesting:** Edible shoots should be harvested before they become tough. Shoots are normally harvested 7-14 days after the emergence from ground and height is 15-30 cm depending on species. The shoots are harvested from just above the neck of rhizome around an inch above the ground.
2. **Any precaution for harvesting:** The shoot should be harvested from the base knife to get maximum edible portion causing minimal damage to the clump. The basal part of the shoot can be retained intact and shoot buds on it may develop as shoots in the present or coming year.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Immediately after harvest the exposed portion of shoot should be covered with cling film wrap or plastic cover and rubber band tightly to prevent discoloration and loss of moisture during transportation. Sheath should be retained if stored for couple of days. The shoots can be washed to remove soil and sheath hairs and outersheaths of shoot removed and inner tender white creamy portion is edible.
4. **Type of bulk packaging:** Cartons of suitable size (2-4 kg) can be used.
5. **Cool Chain requirement:** Temperature- 5°C and 85-90% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24-48 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** 250-500 g in plastic bags.
2. **Super market retail conditions:** Selling at 20°C
3. **Any other important point:** Generally, the initial shoots and most of those produced in the summer are harvested, but those produced towards the end of the shooting period will be selected and retained as mother culms.
4. **Do you know:** Over 2.5% of the shoot is carbohydrate that can be absorbed by the human body and shoots also contain about 0.5% lipids. In addition, bamboo shoots contain the elements. Mo and Ge, which have anticancer and aging-resistant functions, and Zn, Mn, Cr and other trace elements.

6. Basil leaves (*Ocimum basilicum* L.)



A. At point of harvest (Collection Centre)

- 1. Harvesting:** For dried basil leaves, the plant is cut just prior to appearance of flowers. Basil leaves are harvested above the bottom two to four sets of true leaves for fresh and dried markets.
- 2. Any precaution for harvesting:** During the picking operation, hold the tips from the petiole to minimize contact with the fragile foliage tissues as leaves bruises easily. When harvesting basil for the fresh market, make the cuts 5 mm above a node and at a height of 10 to 15 cm, and leave sufficient foliage on the plant so that it can continue with healthy growth.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Leaves should first be washed and cleaned, removing the weeds and extraneous materials.
- 4. Type of bulk packaging:** Basil may be packed in bulk or packed in bunches, polypropylene bags placed in cardboard cartons lined with paper.
- 5. Cool Chain requirement:** Temperature- 8-10°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** 50- 100 g in plastic bags or whole plants are wrapped in plastic bags to maintain their integrity.
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Basil is susceptible to chilling injury and should not be stored below 5°C for extended periods.
- 4. Do you know:** The eugenol present in the leaves ensures anti-inflammatory action in the digestive tract. Basil helps balance acid within the body and restores the body's proper pH level.

7. Broccoli (*Brassica oleracea* L. var *italica* Plenck)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Heads should be harvested when firm and compact. If harvesting is delayed head becomes loose.
2. **Any precaution for harvesting:** While cutting include 25 cm edible portion of stem.
3. **Immediate operation after harvesting for quality assurance for specific crop:** The outer leaves are trimmed off. Heads should be precooled.
4. **Type of bulk packaging:** Corrugated box or plastic crates (5-10 kg).
5. **Cool Chain requirement:** Temperature- 0-2 °C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24-48 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** Individual Heads in cling or shrink wrap.
2. **Commercial feasibility of MAP---** Cling or shrink wrap.
3. **Super market retail conditions:** Selling at 20°C.
4. **Any other important point:** Exposure of Broccoli to ethylene causes floret yellowing and there should be no discoloration on stem.
5. **Do you know:** It has various antioxidants, sulforaphane being the abundant one which helps to protect against various types of cancer.

8. Brussel sprout (*Brassica oleracea* L. var. *gemmifera* D.C.)

A. At point of harvest (Collection centre)

1. **Harvesting:** Buds should be firm, not overmature as indicated by splitting of outer leaves.
2. **Any precaution for harvesting:** Buds should be cut carefully with hand or small knife to avoid injury which degrade its quality.
3. **Immediate operation after harvesting for quality assurance for specific crop:** In warm conditions sprouts become discoloured so it is cooled rapidly after harvest.
4. **Type of bulk packaging:** Wood, cardboard or plastic crates between 10 and 12kg. Brussels sprouts are sometimes packed in styrofoam cartons with top icing.
5. **Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Trips that last up to 2 or 3 days, temperatures at 12°C can be maintained, and for 5 to 6 days, temperatures may be 8°C. In case of absence of cold chain it should be in destination place within 12-24 hours of harvesting.



B. At the processing centre---- preparation for fresh market-

1. **Best unit size of consumer pack:** Plastic packages, polynet bags (500 g-1 kg).
2. **Super market retail conditions:** Selling at 20° C.
3. **Any other important point:** Good quality Brussels sprouts should be bright green, without yellowing or discoloration, and have a firm texture. The butt end may be slightly discolored, but should not be dark.
4. **Do you know:** Brussel sprout is rich in vitamin K, which is necessary for blood clotting and bone health. It is also good source of omega-3 fatty acids which reduce inflammation, insulin resistance, cognitive decline and blood triglycerides.

9. Carrot (European) (*Daucus carota* L. subsp *sativus* (Hoffm.) Arcang.)

A. At point of harvest (Collection Centre)

1. Harvesting:

- Typically carrots are harvested at an immature state when the roots have achieved sufficient size to fill in the tip and develop a uniform taper.
- Length may be used as a maturity index for harvest to achieve desired processing efficiency.



2. Any precaution for harvesting: Avoid cut, bruises and damage during uprooting.

3. Immediate operation after harvesting for quality assurance for specific crop:

Sorting of crop for removal of cut, damaged or blemished commodity followed by grading of crop in two or three grades depending on the size and colour.

4. Type of bulk packaging: 10 kg, 20 kg in plastic crates or polynet sacks.

5. Cool Chain requirement: Temperature- 0°C and 90-95% RH.

6. Time span for sending to processing centre for fresh market: Within 24 hours under cold chain condition and 12-24 hours under ambient conditions.

B. At the processing centre-----preparation for fresh marketing

1. Best unit size of consumer pack: 1 kg in polynet bag.

2. Super market retail conditions: Selling at 20°C

3. Any other important point:

- Firm (not flacid or limp)
 - Straight with a uniform taper from 'shoulder' to 'tip'
 - Bright orange
 - There should be little residual "hairiness" from lateral roots
 - No "green shoulders" or "green core" from exposure to sunlight during the growth phase
4. **Do you know:** Carrots contain beta carotene may reduce the risk of lung cancer and Vitamin A helps in maintaining normal vision.

10. Celery (*Apium graveolens* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Celery is harvested when reached desired size and before the outer petioles develop pithiness.
2. **Any precaution for harvesting:** Plants are cut just above the ground with the help of sharp knife to minimize abrasions or damage.
3. **Immediate operation after harvesting for quality assurance for specific crop:** After harvesting outer petioles or leaves are trimmed.
4. **Type of bulk packaging:** Cardboard boxes or wooden boxes (12-14 kg).
5. **Cool Chain requirement:** Temperature- 0-2°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and 12-24 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** Perforated polythene bags (2-3 units).
2. **Super market retail conditions:** Selling at 20°C.
3. **Any other important point:** The external thick stems are use to prepare soup, and internal stems are very young so used to prepare salad. Good quality celery have well developed light green stalks with thick and compact petioles.
4. **Do you know:** Celery is rich in Vitamin C and Vitamin A (2 stalks provide approx. 15 % of daily recommended intake of Vitamin C and Vitamin A each).

11. Cherry Tomato (*Solanum lycopersicum* L. var. *cerasiforme* Spooner)

A. At point of harvest (Collection Centre)

1. Harvesting:

Ripe for local market

Light red/yellow for distant market



2. **Any precaution for harvesting:** Harvest with hands bearing cotton gloves.

3. **Immediate operation after harvesting for quality assurance for specific crop:** Sorting of crop for removal of diseased or blemished commodity followed by grading of crop in two or three grades depending on the size and colour.

4. **Type of bulk packaging:** Plastic crates or Cardboard boxes (5 kg, 10 kg).

5. **Cool Chain requirement:** 10-13°C and 90-95% RH.

6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** 250 g & 500 g in perforated polypropylene bags.

2. **Commercial feasibility of MAP---**Shrink/cling packing

3. **Super market retail conditions:** Selling at 20°C

4. **Any other important point:** Grading particularly according to stage of maturity is beneficial to prolong shelf life as green tomatoes has longer shelf life.

5. **Do you know:** Lycopene, specifically helpful to reduce specific types of cancer, including prostate, lung and stomach cancer.

12. Coriander (*Coriandrum sativum* L.)



A. At point of harvest (Collection Centre)

1. **Harvesting:** Harvesting can be done after 30-40 days of planting when crop attained height of 20-25 cm. It is harvested as developing leaves or intact plants.
2. **Immediate operation after harvesting for quality assurance for specific crop:** Remove any diseased, damaged or yellow leaves.
3. **Type of bulk packaging:** Bunches of leaves packaged in cartons (2-4 kg).
4. **Cool Chain requirement:** Temperature 0°C and 90-95% RH.
5. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** 100-200 g bunched leaves.
2. **Super market retail conditions:** Selling at 20°C
3. **Any other important point:** Visual shelf life is longer than culinary shelf life as aroma declines after 10 days of storage but it remains marketable for 21 days under storage conditions.
4. **Do you know:** Citronellol, a component of essential oils in coriander, is an excellent antiseptic. Additionally, other components have antimicrobial and healing effects which keep wounds and ulcers in the mouth from worsening.

13. Dill leaves (*Anethum graveolens* L.)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Harvesting can be done once the fern-like leaves develop. Dill plants have a fleshy central stalk with fine, feathery foliage. Harvesting can be done by pinching off a few of the feathery leaves from each stalk.
- 2. Any precaution for harvesting:** The day before harvesting leaves, spray them with water so that they will be clean and dry the day of harvest.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Remove any diseased and yellow leaves.
- 4. Type of bulk packaging:** Packaging of bunches can be done in styrofoam boxes or waxed/ laminated cartons (1-3 kg) lined with paper.
- 5. Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre ----- for fresh marketing

- 1. Best unit size of consumer pack:** 100-200 g leaves bunched with rubber band or string.
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Damage to the leaves at harvest can lead to discoloration and increased susceptibility to decay.
- 4. Do you know:** The flavonoids and vitamin-B complex present in its essential oils, activate the secretion of certain enzymes and hormones which have calming and hypnotic effects, thereby helping people get a good sleep at night.

14. Drumsticks (*Moringa oleifera* Lam.)

A. At point of harvest (Collection Centre)

1. Harvesting: Harvesting of pods should be done before lignifications. Harvest pods when they are young, tender, and green. All shoots should be cut at the desired height, i.e. 30 cm to 1 m above ground. Harvesting can also be done by removing the leaves, picking them directly off the tree by removing at the base of the petiole. Manual harvesting of shoots and leaves with a pair of shears, a sickle or a sharp knife is recommended.



Drumstick leaves

2. Any precaution for harvesting: It is important to make sure there is no dew on the produce before harvesting, especially in the morning, to avoid rot during transport.

3. Immediate operation after harvesting for quality assurance for specific crop: Discard the yellow or damaged leaves and in case of pods grading can be done according to size and uniformity of pods.



Drumstick pods

4. Type of bulk packaging: Packed in cartons (5-10 kg) after prepackaging.

5. Cool Chain requirement: Temperature- 4-7°C and 90-95% RH.

6. Time span for sending to processing centre for fresh market: Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

1. Best unit size of consumer pack: 100-250 g packed in plastic bags.

2. Super market retail conditions: Selling at 20°C

3. Do you know: Drumstick leaves are richest source of Vitamin C among vegetables.

15. European cucumber (*Cucumis sativus* L.)

A. At point of harvest (Collection centre)

- 1. Harvesting:** It is harvested at immature stage when reached full size 5 to 8 inches size varying with the cultivar. Fruit should be harvested before yellowing at blossom end.
- 2. Any precaution for harvesting:** Cucumber fruit harvested using small knife to cut the fruit stem from the vine at a point just above the shoulder of the fruit. The fruit should never be pulled off the vine, as this will result in damage to the vine and/or fruit.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Cleaning and Grading of cucumber is done based on size, evenness of shape, firmness, and skin colour.
- 4. Type of bulk packaging:** Packed by counts of 30, 32, 36, 40, 42, or 46 per fiberboard carton. Box weights average about 25 to 30 pounds. Wooden or durable plastic containers that can be stacked without collapsing are appropriate for the domestic market. For export fiberboard cartons typically containing 25 kg of fruit are used.
- 5. Cool Chain requirement:** Temperature- 10-12°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre---- preparation for fresh market

- 1. Best unit size of consumer pack:** 500 g shrink wrapped.
- 2. Commercial feasibility of MAP:** Shrink wrap and cling wrap
- 3. Super market retail conditions:** Selling at 20° C.
- 4. Any other important point:** Often treated with edible waxes to reduce water loss and reduce abrasions. Storage of cucumbers below 10°C should be avoided, as this will result in chilling injury.
- 5. Do you know:** Besides providing cooling and soothing effect to skin it also helps to fight against cardiovascular diseases.

16. Fresh mint (*Mentha* sp.)

A. At point of harvest (Collection Centre):

- 1. Harvesting:** Harvesting is best done early in the morning when the plants are turgid and before any temporary wilting occurs. It is best cut with shears or a sickle bar mower and bunched.
- 2. Immediate operation after harvesting for quality assurance for specific crop:** Remove diseased, blemished, black or bruised leaves from fresh leaves.
- 3. Type of bulk packaging:** Packaging in cartons (2-4 kg)
- 4. Cool Chain requirement:** Temperature- 6-7°C and 90-95% RH.
- 5. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** Clamshell or plastic bags (50-100 g).
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** It should have high leaf to stem ratio and storage at temperature below 6°C cause blackening of leaves.
- 4. Do you know:** Mint has high antioxidant properties which also helps in maintaining healthy and acne free skin. It helps to freshen the breath due to presence of its germicidal properties.

17. Garlic chives (*Allium tuberosum* Rottler ex Spreng)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** It is harvested 30 days after transplanting when leaves are at least six inches tall. Cut flowers and stalks leaving 3-5 cm stalk on ground.
- 2. Any precaution for harvesting:** Cut the leaves down to base just above soil so that new growth emerges.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Damaged, blemished or diseased leaves should be removed.
- 4. Type of bulk packaging:** Cartons (10-15 kg).
- 5. Cool Chain requirement:** Temperature- 0-2°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

- 1. Best unit size of consumer pack:** 250-500g (bunch tied with string).
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Garlic chive is different from chive in respect of their solid texture, flat leaves whereas chives has soft, and hollow leaves.
- 4. Do you know:** It is high in dietary fiber and contain high content of Vitamin C and Vitamin A (beta carotene).

18. Green Capsicum (*Capsicum annum* L.)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Harvesting is done when it attains uniform shape, size and bright/dark green colour. It should be free from defects such as cracks, decay, sunburn.
- 2. Any precaution for harvesting:** Harvesting should be done with sharp stainless steel scateur, hands bearing cotton gloves.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Grading of crop in two or three grades depending on the size.
- 4. Type of bulk packaging:** 5 kg, 10 kg in plastic crates or CFB boxes.
- 5. Cool Chain requirement:** Temperature- 7-8°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 24-48 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

- 1. Best unit size of consumer pack:** 4-6 pieces in cling or shrink wrap.
- 2. Commercial feasibility of MAP---**Shrink/cling packing.
- 3. Super market retail conditions:** Selling at 20°C
- 4. Any other important point:** Firmness of peppers is directly related to water loss. So maintain proper relative humidity at storage or sale point.
- 5. Do you know:** Green bell peppers contain zeaxanthin, which keeps eyes healthy and might reduce risk of age-related eye disorders and vitamin E helps to protect cells from damage and supports a strong immune system.

19. Iceberg lettuce (*Lactuca sativa* L. var *capitata*)

A. At point of harvest (Collection centre)

1. **Harvesting:** Head is firm and crisp. Leaves should be a bright and light green color.
2. **Any precaution for harvesting:** Harvesting should be done with gloves as small injuries increases its respiration rate due to its high perishability.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Solid lettuce heads are cut, trimmed to 4 to 5 wrapper leaves. Grading can be also done according to head size. Produce is precooled by vacuum cooling.
4. **Type of bulk packaging:** Field packaged into cartons (24 units per carton). Produce is vacuum cooled in cartons.
5. **Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre---- preparation for fresh market

1. **Best unit size of consumer pack:** Packed in plastic or polythene bags upto 1 kg.
2. **Super market retail conditions:** Selling at 20° C.
3. **Any other important point:** Good quality lettuce should be crisp, free from bitterness, wilting and seediness.
4. **Do you know:** Besides containing folate it helps in dealing with issues of chronic diseases and depression. It also contains Vitamin K which aids in production of protein required by body for normal blood clotting.

20. Jalapeno (*Capsicum annuum* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Jalapenos are ready to be picked when they are firm and bright green, but you can leave them on the plant all the way until they turn red. Ripe jalapenos are 4 - 6 inches long, fat, firm.
2. **Any precaution for harvesting:** Use a scissors or snip to cut branches and harvest peppers. Do not remove by hand as plants can be easily damaged.
3. **Immediate operation after harvesting for quality assurance for specific crop:** The crop is precooled and grading can be done in case of non uniform size.
4. **Type of bulk packaging:** Fiberboard cartons (2 to 4 kg).
5. **Cool Chain requirement:** Temperature- 7-10°C and 85-90% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** Clamshell (250-500 g).
2. **Super market retail conditions:** Selling at 20°C
3. **Do you know:** Jalapenos are low in calories and good source of fibre, Vitamin C and Vitamin B₆.

21. Kale leaves (*Brassica oleracea* L. var. *acephala* DC.)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Kale is ready to harvest when the leaves are about the size of hand with hand clippers or pruning shears. Kale leaves can range in colour from light-green to dark, violet-green varying with cultivar. Plant should be around 8–10 inches (20–25 cm) high before harvesting its leaves.
- 2. Any precaution for harvesting:** The largest and oldest leaves on a kale plant are always near the bottom. Smaller and younger leaves are near the top. Hold the leaf you want to cut with hand, then use your other hand to cut the stem of that leaf with shears. Cut the stem near its base to make sure you remove the entire leaf. Avoid picking the terminal bud (found at the top center of the plant) because this will help to keep the plant productive.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Discard leaves that appear yellow or damaged.
- 4. Type of bulk packaging:** Kale is shipped in the same containers as other greens – bushel baskets, crates and cartons of varying weights (5-10 kg).
- 5. Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** Leaves can be bunched and tied with rubber strings (100-250 g).
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Do not store or transport with commodities that produce ethylene. Cracked ice around and in packages may help extend shelf life.
- 4. Do you know:** Kale contains vitamin C, which has been shown to fight cancer and it also is high in vitamin A, which contributes to healthy hair and skin. Kale has more iron per calorie than beef.

22. Leek (*Allium ampeloprasum* L.)



A. At point of harvest (Collection Centre)

- 1. Harvesting:** Leeks are harvested when their stalks reach a size of 2.5 cm or more in diameter and are tender. Harvest leeks before they start to widen too much at the base; don't allow leeks to bulb.
- 2. Immediate operation after harvesting for quality assurance for specific crop:** Leeks should be cooled immediately after harvest to near 0°C by hydro cooling, crushed ice or vacuum cooling. Discard the stems with withered yellow tops.
- 3. Type of bulk packaging:** They are usually packaged in 5 kg cartons or wire bound crates, holding 10 film bags, each 500 g. Other crates may be packaged with 18-24 bunches with a net weight up to 15 kg.
- 4. Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
- 5. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** Leeks are commonly trimmed to 12 inch length, bunched depending on diameter and often placed in polyethylene film bags (250-500 g).
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Yellowing and decay occurs rapidly at warmer storage temperatures. CA storage (1-3% O₂ and 5-10% CO₂) retards yellowing and decay.
- 4. Do you know:** It has generous amount of Vitamin K helping in the regulation of blood flow.

23. Lemon grass (*Cymbopogon citrates* DC. ex Nees)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Grass is harvested when individual tiller has 4-5 fully opened leaves.
2. **Any precaution for harvesting:** Cut the grass 10 to 15 cm above ground level. Avoid cutting too low as it will delay regrowth and prevent splitting of cutting edges by using sharp tools and machinery that make a clear cut.
3. **Immediate operation after harvesting for quality assurance for specific crop:** In case of processing the harvested grass is spread in the field and allowed to wilt for about two days.
4. **Type of bulk packaging:** Fiberboard cartons (3-5 kg)
5. **Cool Chain requirement:** Temperature- 4°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** Clamshell or poly bag (100-200 g).
2. **Super market retail conditions:** Selling at 20°C
3. **Do you know:** Lemongrass is widely used in Ayurvedic medicine for its healing effects in treating cough and cold and in prevention of skin cancer.

24. Mushroom (*Agaricus biosporus* Imbache)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Maturity is reached when the caps are well- rounded and the partial veil is completely intact. The stripe (stalk) should have a small length to thickness ratio. Stipe length should be sufficient to permit some trimming without cutting flush to the veil.
- 2. Any precaution for harvesting:** It should be plucked with hands preferably bearing disposable hand covers.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Grading of crop in two or three grades depending on the size.
- 4. Type of bulk packaging:** Mushroom is packaged loose in cartons (5-10 kg) lined with LDPE films.
- 5. Cool Chain requirement:** - Temperature- 0°C to 1.5°C and 85-90% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours after under cold chain or within 12-24 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

- 1. Best unit size of consumer pack:** 250 g in cling wrap punnets.
- 2. Commercial feasibility of MAP:** Cling wrap punnets.
- 3. Super market retail conditions:** Selling at 20°C
- 4. Any other important point:** Visible, open gills and absence of a stipe are negative factors affecting quality.
- 5. Do you know:** Selenium has also been found to improve immune response to infection by stimulating the production of killer T-cells and it is the only vegan, non-fortified dietary source of vitamin D.

25. Pak choi (*Brassica rapa* L. subsp *chinensis*)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Pak Choi plants can be harvested as salad plants after about 30 days. Pak choi is a cabbage that forms no head. Cut few leaves at a time or harvest the entire crop. Pak choi should have well-formed upright petioles tightly adhering together.
- 3. Any precaution for harvesting:** Harvesting should be done by sharp knife to cut just above the soil line avoiding damage to petiole. Care must be taken to avoid leaf tearing.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Remove any damaged or yellow leaves and handle with care as pak choi bruises easily. Wash and drain upside down. Pak choi should be continuously brought out of the heat and cooled to preserve moisture and rigidity.
- 4. Type of bulk packaging:** Pak choi cabbage should be packed in fiberboard cartons usually holding between 10 to 18 kg depending upon market preference.
- 5. Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** Pak choi may be bunched into groups of 3 to 5 plants using a string or rubber band. It can be packaged in clamshell or polyethylene bags (500 g- 1 kg).
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Harvesting should be done before bolting. Pak choi should always be picked when leaves are fresh and crisp and before the outer leaves turn yellow.
- 4. Do you know:** The iron, phosphorous, calcium, magnesium, zinc, and vitamin K in pak choi helps in building and maintaining bone structure and strength.

26. Parsley (*Petroselinum crispum* Mill. Nyman ex. AW Hill)

A. At point of harvest (Collection centre)

1. **Harvesting:** When leaf stems have three segments, parsley is ready to be harvested.
2. **Any precaution for harvesting:** Harvesting should be done preferably in the morning.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Bunches of parsley should be washed and any faded or yellow leaves discarded.
4. **Type of bulk packaging:** Hydrocooled or package iced to maintain crispness. Wooden bushels or in waxed corrugated cartons.
5. **Cool Chain requirement:** Temperature- 0° C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre---- preparation for fresh market

1. **Best unit size of consumer pack:** Bunches of suitable size 250-500 g can be made.
2. **Super market retail conditions:** Selling at 20° C.
3. **Do you know:** Parsley helps to reduce the pain and swelling associated with arthritis due to volatile oil called eugenol and helps to provide protection against acid reflux and bad breath.

27. Red amaranth (*Amaranthus cruentus* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Harvesting can be started just after 25-30 days from sowing. Tender leaves are plucked by cutting top portion for multiple cuttings or plants are pulled out with roots.

In case of seeds harvesting should be done when seeds fall readily on rubbing flower heads between hands.



2. **Any precaution for harvesting:** Pale and diseased leaves are discarded and healthy succulent leaves are bundled into bunches.
3. **Type of bulk packaging:** Wooden boxes or cartons with paper or polythene lining (10-15 kg).
4. **Cool Chain requirement:** Temperature- 0-5° C and 85-90% RH.
5. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** Packed in plastic bags or bunches of 100-200 g.
- 2 **Super market retail conditions:** Selling at 20°C.
3. **Do you know:** It is rich in iron, phosphorus and potassium.

28. Red cabbage (*Brassica oleracea* L. var. *capitata* f. *rubra*)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Red cabbage is ready for harvest once they are big enough and have deep purple color, firm and solid head.
2. **Any precaution for harvesting:** Heads are cut so that a few wrapper leaves are present to protect the head.
3. **Type of bulk packaging:** Cartons, crates, or bulk bins (15-20 kg).
4. **Cool Chain requirement:** Temperature- 0° C and 90-95% RH.
5. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** Individual heads cling wrapped.
2. **Commercial feasibility of MAP---** Cling wrapping.
- 3 **Super market retail conditions:** Selling at 20°C
4. **Do you know:** Red cabbage contains a large amount of a particular amino acid called glutamine which reduces the inflammation and pain associated with ulcers.

29. Rosemary leaves (*Rosmarinus officinalis* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Fresh shoots are cut from the tip of the shoot. No brown branches should be included as it lowers the quality of the fresh leaves.
2. **Immediate operation after harvesting for quality assurance for specific crop:** Fresh produce should be clean of foreign material with fresh and crispy appearance having good colour and flavour.
3. **Type of bulk packaging:** Bunched fresh shoots (8 – 12) tie with rubber band are put in styrofoam containers or in crates (5-10 kg).
4. **Cool Chain requirement:** Temperature- 5°C and 90-95% RH.
5. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** Can be packed in clear cellophane sachets that can be marketed directly in shops and supermarkets (100-250 g).
2. **Super market retail conditions:** Selling at 20°C
3. **Do you know:** Rosemary contains an ingredient called carnosic acid, which can fight off damage by free radicals in the brain.

30. Snow peas (*Pisum sativum* L. var *saccharatum*)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Harvesting has to be done at the right time when the pod is around 7.5 to 10 cm long and 2.5 cm wide. The pod is still flat and bright green at this stage without twisted appearance and the seeds are just starting to swell. Pods of most snow pea varieties are at the right harvesting stage approximately 10 days after flowering and have to be continually harvested at 2 day intervals for best quality.



2. **Type of bulk packaging:** 10 kg cartons, or polystyrene containers.
3. **Cool Chain requirement:** Temperature- 0 to 2°C and 90-95% RH.
4. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

1. **Best unit size of consumer pack:** Polystyrene trays or plastic bags of varying sizes from 500 g to 2 kg and covered with plastic wrapping.
2. **Super market retail conditions:** Selling at 20°C.
3. **Do you know:** Snow peas are lower in protein since their seeds are very small; however they provide twice the calcium and slightly more iron than shelled peas.

31. Spinach (*Spinacea oleracea* L.)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Young mature leaves are harvested. Older and yellow leaves are avoided when making the harvest cut.
- 2. Any precaution for harvesting:** Avoid cut and damage during uprooting.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Bruised, diseased or contaminated leaves are excluded from harvest. For bunched spinach, roots should be trimmed short to grade standards and petioles should be predominantly shorter than the leaf blade.
- 4. Type of bulk packaging:** Plastic crates lined with LDPE films (10-15 kg).
- 5. Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre ----- preparation for fresh marketing

- 1. Best unit size of consumer pack:** Approx. 250 g to 500 g bunched with rubber band or string.
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Do not mix loads such as apples, melons and tomatoes with spinach.
- 4. Do you know:** Spinach contains an antioxidant known as alpha-lipoic acid, which lower glucose levels, increase insulin sensitivity, and prevent oxidative, stress-induced changes in patients with diabetes.

32. Spring onion (*Allium cepa* L.)

A. At point of harvest (Collection centre)

1. Harvesting: Long white slender neck and hollow green tops are harvested prior to bulb formation. Pull the plants when they are 30 to 40 cm high and have a stem thickness of 8 to 15 cm prior to full bulb formation.

2. Any precaution for harvesting: Onion should be carefully harvested by hand pulling the plant from soil with thumb, forefinger and index finger clasped around the base of plant. They should not be pulled by the leaves, as it causes tissue damage.



3. Immediate operation after harvesting for quality assurance for specific crop: Damaged, broken, or partially yellow leaves should be removed from the green onion bunch prior to washing.

4. Type of bulk packaging: Well-ventilated plastic crates of 10-15 kg. Bunches of desired size 20-30 plants can be made and placed in plastic crates.

5. Cool Chain requirement: Temperature- 0°C and 90-95% RH.

6. Time span for sending to processing centre for fresh market: Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre---- preparation for fresh market

1. Best unit size of consumer pack: For domestic markets, green onions are usually wrapped into large bunches of 25 to 30 plants per bunch. For export markets, green onions are wrapped into small bunches of 6 to 9 plants, weighing about 110 g to 120 g.

2. Commercial feasibility of MAP: To reduce shipping weight for export, a semi permeable plastic film can be wrapped around the green onions instead of ice.

3. Super market retail conditions: Selling at 20° C.

4. Any other important point: Misting of onions with water should be done under ambient conditions to maintain higher relative humidity.

5. Do you know: Due to its antibacterial and antiviral properties, it is an excellent medicine to fight against viral infections and allicin present in it provides protection against skin wrinkling.

33. Sweet corn (*Zea mays* L.)

A. At point of harvest (Collection Centre)

- 1. Harvesting:** Sweet corn should be harvested at the milk stage. At this stage the silks are brown and dry at the ear tip. When punctured with a thumbnail, the soft kernels produce a milky juice. Over- mature sweet corn is tough and doughy. An immature ear will not be completely filled to the tip and the kernels produce a clear, watery liquid when punctured..
- 2. Any precaution for harvesting:** Harvest sweet corn carefully by grasping the ear at its base and then twisting downward without any injury.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Sweet corn must be moved quickly from the field to packing sheds, where it should be rapidly sorted, packed, and cooled.
- 4. Type of bulk packaging:** Wirebound crates and fiberboard boxes which can hold 4-6 dozen ears.
- 5. Cool Chain requirement:** Temperature- 0°C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.



B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** Packed in polythene bags (half to one dozen).
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** Good quality sweet corn has uniform appearance, well filled rows, plump kernels, milky kernel contents, and free from defects (discoloration, harvest injury, worm damage, live insects, decaying silks or kernels).
- 4. Do you know:** Zeaxanthin and lutein present in corn improve the eye health.

34. Snap peas (*Pisum sativum* L. var *macrocarpon*)

A. At point of harvest (Collection Centre)

1. Harvesting: Sugar snap peas are harvested when the pods are round and up to 7.5 cm long with the seeds almost at full size. These may be harvested for 4 to 6 weeks.



2. Immediate operation after harvesting for quality assurance for specific crop: Hold a paring knife in one hand and the sugar snap in the other, with the inside curve of the pod facing you. Sever the top of the pea and pull off the tough string that runs along the length of the pod.

3. Type of bulk packaging: Cartons, or polystyrene containers (10 kg).

4. Cool Chain requirement: Temperature- 0 to 2°C and 90-95% RH.

5. Time span for sending to processing centre for fresh market: Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

1. Best unit size of consumer pack: Polystyrene trays or plastic bags of varying sizes from 500 g to 1 kg and covered with plastic wrapping.

2. Super market retail conditions: Selling at 20°C

3. Do you know: Sugar snap peas have relatively few calories, no cholesterol, and is virtually fat-free.

35. Zucchini (*Cucurbita pepo* L.)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Fruit is harvested when it is about 5" to 8" long and diameter of 32-51 mm. Zucchini fruits are more desirable at 5 to 6 inches (12.5 to 15 cm) long for western markets and 7 to 8 inches (18 to 20.5 cm) long for eastern markets. Fruit should be harvested before it gets too large and seed becomes hard.



2. **Any precaution for harvesting:** It should be harvested with care by wearing gloves.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Fruit should be cooled to 10°C as soon as possible. Delaying cooling adversely affects fruit quality and shortens the shelf life. Fruit is hand-picked into containers and usually sorted, graded, and packed in the field.

Zucchini is marketed according to one of three sizes (according to U.S. #1 grade standards):

- Extra Fancy, 5" to 6" length and 1" to 1.5" width
 - Fancy, 6" to 7" length and 1.25" to 1.75" width
 - Medium, 7" to 8" length and 1.75" to 2.25" width
4. **Type of bulk packaging:** Zucchini are generally packed in 10-15 kg cartons or standard plastic crate.
 5. **Cool Chain requirement:** Temperature- 5-10°C and 90-95% RH.
 6. **Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

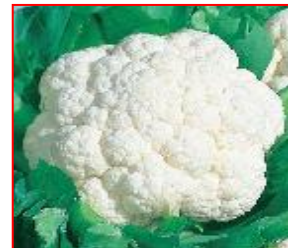
1. **Best unit size of consumer pack:** It can be packed in trays (plastic or fibreboard) 500 g to 1 kg.
2. **Commercial feasibility of MAP---** Cling or shrink wrap.
3. **Super market retail conditions:** Selling at 20°C
4. **Any other important point:** It is sensitive to ethylene and show signs of chilling injury when stored below 5°C for more than a day.
5. **Do you know:** Zucchini is low in fat and sodium, but high in fiber and potassium. These properties help to maintain healthy blood circulation.

Other Vegetables

Cauliflower (*Brassica oleracea* L. var. *botrytis*)

A. At point of harvest (Collection Centre)

1. **Harvesting:** Harvesting is done when the head is compact, white and at least 15 cm in diameter.
2. **Any precaution for harvesting:** Harvest with sharp angular knife, hands bearing cotton gloves.
3. **Immediate operation after harvesting for quality assurance for specific crop:** Separate head from the stubble depending on the market demand. Grading of crop in two or three grades depending on the size.
4. **Type of bulk packaging:** 10 kg, 20 kg in plastic crates.
5. **Cool Chain requirement:** Temperature- 0-1°C and 90-95% RH.
6. **Time span for sending to processing centre for fresh market:** Within 24-48 hours under cold chain condition and within 24 hours under ambient conditions.



B. At the processing centre-----preparation for fresh marketing

1. **Best unit size of consumer pack:** One (individual curd) in cling or shrink wrap.
2. **Commercial feasibility of MAP---**Shrink/cling packing
3. **Super market retail conditions:** Selling at 20°C
4. **Any other important point:** Cauliflower is primarily marketed with closely trimmed leaves and overwrapped with perforated film. Overwraps should provide four to six 1/4-inch holes per head to allow adequate ventilation. It must not be stored or transported along with ethylene releasing commodity.
5. **Do you know:** Besides providing protection against cancer it is also involved in brain development and the production of neurotransmitters that are necessary for a healthy nervous system due to presence of choline.

Garlic (*Allium sativum* L.)



A. At point of harvest (Collection Centre)

- 1. Harvesting:** When bulbs are well mature. Harvesting is done occurs after the tops have fallen and are dry.
- 2. Any precaution for harvesting:** Curing is done in the field for at least 2- 3 weeks.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Grading of crop in two or three grades depending on the size.
- 4. Type of bulk packaging:** Garlic cloves is packaged loose or in bundles in cartons, crates, netted sacks (10 kg, 20 kg).
- 5. Cool Chain requirement:** Temperature- 0°C and 65-70% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24-72 hours after curing operation under ambient conditions.

B. At the processing centre-----preparation for fresh marketing

- 1. Best unit size of consumer pack:** Net bags with clip (250 g, 500 g, 1 kg)
- 2. Any prescribed pre treatment for commercial practice for quality assurance—** Dry brushing to remove the loose peel covers.
- 3. Super market retail conditions:** Selling at 20°C
- 4. Any other important point:** High quality garlic bulbs are clean, white (or other colours typical of the variety), and well cured (dried neck and outer skins). The cloves should be firm to the touch. Cloves from mature bulbs should have a high dry weight and soluble solids content (>35% in both cases).
- 5. Do you know:** The sulfur compounds in garlic protect against organ damage from heavy metal toxicity and antioxidants protect against cell damage reducing the risk of Alzheimers's disease and dementia.

Ginger (*Zingiber officinale* Roscoe)

A. At point of harvest (Collection Centre)

1. Harvesting: Harvesting of ginger for vegetable purpose starts after 180 days based on the demand. Harvest rhizomes while they are still tender, low in pungency and fiber content, therefore before they are fully mature. However, for making dry ginger, the matured rhizomes are harvested at full maturity i.e. when the leaves turn yellow and start drying.



- 2. Any precaution for harvesting:** Irrigation is stopped one month before harvest and the rhizome clumps are lifted carefully with a spade or digging fork.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** The rhizomes are thoroughly washed in water two or three times to remove the soil and dirt and sun dried for a day.
- 4. Type of bulk packaging:** It can be packaged in plastic bag, carton or crate of 5-10 kg. Bulk rhizomes may be packed in jute sacks, wooden boxes or lined corrugated cardboard boxes for shipping.
- 5. Cool Chain requirement:** Temperature- 10-12°C and 85-90% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** 250-500 g in plastic bags.
- 2. Super market retail conditions:** Selling at 20°C
- 3. Do you know:** It has high gingerol, a substance with anti-inflammatory and antioxidant properties.

French bean (*Phaseolus vulgaris* L.)

A. At point of harvest (Collection Centre)



- 1. Harvesting:** Beans should be harvested in tender form. Delayed harvest makes beans fibrous and seed is developed, making them unsuitable for consumption. If it is grown for seed, beans should be allowed to mature fully and then harvested. The pods are picked by hand, with the stalks.
- 2. Any precaution for harvesting:** In case of pole types care should be taken not to pull the entire vine while harvesting pods.
- 3. Immediate operation after harvesting for quality assurance for specific crop:** Immediately after harvesting shift the harvested produce to shade. Beans are washed and culled, perforated, broken and diseased, inferior pods are destroyed and plant debris leaves and stalks also removed. Grading can be done by size of pod width.
- 4. Type of bulk packaging:** Wooden or cardboard boxes of 5-10 kg.
- 5. Cool Chain requirement:** Temperature- 5-7 °C and 90-95% RH.
- 6. Time span for sending to processing centre for fresh market:** Within 24 hours under cold chain condition and within 12-24 hours under ambient conditions.

B. At the processing centre----- for fresh marketing

- 1. Best unit size of consumer pack:** Perforated polyethylene bags, trays covered with retractile plastic or small trays covered with unsealed plastic are used for pre-packaging with 250-500 g pods.
- 2. Super market retail conditions:** Selling at 20°C
- 3. Any other important point:** At temperature below 1-2.5°C, chilling injury occurs after 10-12 days of storage.
- 4. Do you know:** It is a great source of dietary fiber and protein for human body.