



Punjab Horticultural Postharvest Technology Centre
Punjab Agricultural University, Ludhiana

PHPTC Newsletter

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Message from Chairman

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Horticulture has been identified as one of the economically viable and sustainable alternatives to wheat- paddy rotation, which not only promotes efficiency in land use, but also creates opportunities for employment particularly for youth and woman in rural areas. Over the years a marked increase in production of fruits and vegetables is witnessed in Punjab State due to scientific interventions like breeding of new varieties, modern production technologies such as drip irrigation, fertigation, protected cultivation, precision farming etc but the postharvest issues particularly development of postharvest infrastructure have not been strategically addressed for safe handling of produce. Horticultural crops are highly perishable in nature and need proper care immediately after harvest; otherwise losses are bound to occur. If there is glut of perishable produce, the storage is the only option for efficient market during off season. Storage of horticultural crops at optimum temperature not only reduce postharvest losses and maintains acceptable quality of produce but also help the farmers and traders in inventing the market strategies.

I hope this Newsletter exclusively on "Storage of fruits and vegetable" will further update the knowledge of extension workers, entrepreneurs, farmers and traders. I convey my best wishes for the success of this Newsletter and hope PHPTC would strive hard to develop protocols for postharvest management of fruits and vegetable and provide new business opportunities for entrepreneurs.

STORAGE OF FRUITS AND VEGETABLES

All fruits and vegetables are living tissues and have the tendency to respire even after harvest. Therefore, the management of temperature and relative humidity are the most important factors determining storage life of horticultural produce. The natural means like ice, cold water, and night temperature have been used for long time for protecting food materials from spoilage and these are still common. However, with the development of innovative technologies, it is possible to achieve optimal environments in the insulated refrigerated stores.

Objective of storage

- Regulate the market in an orderly manner.
- Avoid glut and distress sale in the market, thus prolonging the market period.
- For long term storage, making the food available in off-season, however, long-term storage is costly and requires technical knowledge.
- For short-term storage, helping earning profits during low market price.

Lowering the temperature to the lowest safe handling temperature is of paramount importance. Even if you cannot provide the exact recommended conditions, any efforts to lower temperature will be rewarded by longer shelf life, reduced losses and higher quality during marketing. Always, handle produce gently and never store produce unless, it is of the best quality. Damaged produce will lose water faster and have higher decay rates in storage when compared to undamaged produce.

General Do's and Don'ts for storage of high quality horticultural produce

- Store only high quality produce, free of damage, decay and of proper maturity (not over-ripe or under-mature).
- Know the requirements for the commodities you want to put into storage, and follow recommendations for proper temperature, relative humidity and ventilation.

- Don't handle crops for storage when they are wet.
- Cure root, tuber and bulb crops before storage.
- Avoid lower than recommended temperatures in storage, because many commodities are susceptible to damage from freezing or chilling.
- Do not over load storage rooms or stack containers too close together.
- Provide adequate ventilation in the storage room.
- Provide shade for storage structures or paint buildings white or silver to reflect heat.
- Overhanging roof extensions on storage structures are very helpful in shading the walls and ventilation openings from the sun's rays, and in providing protection from rain. An overhang of at least 1-meter (3 feet) is recommended.
- Keep storage rooms clean.
- Storage facilities should be protected from rodents by keeping the immediate outdoor area clean, and free from trash and weeds.
- Containers must be well ventilated and strong enough to withstand stacking. Do not stack containers beyond their stacking strength.
- Monitor temperature in the storage room by placing thermometers at a variety of locations.
- Don't store onion or garlic in high humidity environments.
- Store crops in a dark room. This is especially important for potatoes, since light will stimulate solanine production (a toxic compound not destroyed by cooking).
- Avoid storing ethylene sensitive commodities with those that produce ethylene.
- Avoid storing produce known for emitting strong odors (apples, garlic, onions, turnips, cabbages, and potatoes) with odor-absorbing commodities.
- Inspect stored produce regularly for signs of injury, water loss, damage and disease. Remove damaged or diseased produce to prevent the spread of problems.

Recommended storage temperature / relative humidity

We should be very careful not to store chilling sensitive crops at low temperature. Damage symptoms will usually show up within a few days after you take the crop out of low temperature storage.

Prevent chilling injury by keeping these crops at their lowest safe temperature.

The symptoms of chilling injury are as follows:

Commodity	Lowest safe temperature °C	Chilling injury symptoms
Apple	0-1	Soft scald, brown core
Asparagus	0-1	Dull, grayish, limp tips
Bananas	12-13	Dull colour when ripened
Cucumber	10-12	Pitting, water soaking, decay
Brinjal	10-12	Surface scald
Guavas	5-10	Pulp injury, decay
Lemon	11-13	Pitting, membrane staining
Mango	10-13	Uneven ripening, grayish skin
Okra	7-10	Discoloration, water soaked area, pitting, decay
Tomato ripe	10-13	Water soaking, poor colour softening, decay

Storage of compatible groups

- 1) Store only those fruits and vegetables together, which have same temperature and RH requirement.
- 2) Some of the crops produce odors or ethylene, should be kept away from commodities sensitive to these compounds.

Compatible groups of fruits and vegetables for storage

Group	Temperature	Crops	Status of commodities
Group 1	0-2°C and 90-95% RH	Apple, Apricot, Asian, Pear, Grapes, Litchis, Plum, Prunes, Pomegranate, Mushroom Turnip Peach.	Produce ethylene.
Group 2	0-2°C and 90-95% RH	Asparagus, Leafy greens, Beans, Broccoli, Peas, Spinach, Cabbage, Carrot, Cauliflower, Cherries, Strawberry	Sensitive to ethylene.
Group 3	0-2°C and 65-70% RH	Garlic, Onions dry.	Moisture will damage these crops.
Group 4	4-6°C and 90-95% RH	Cantaloupes, Mandarin, Tangerines.	
Group 5	8-10°C, 85-90% RH	Beans, Potatoes, Cucumber, Brinjal, Okra Pepper.	
Group 6	13-15°C, 85-90% RH	Mango, Banana, Tomato	

Produce	Undesirable effect of ethylene
Carrot	Bitterness
Cabbage / Cauliflower	Loss of green colour
Cucumber	Degreening
Strawberry	Increased rotting, softening
Peas	Formation of the toxin pisatin
Potatoes	Sprouting
Tomatoes	Softening, rotting, accelerated ripening

Recommended conditions

Name of commodity	Temp (°C)	RH (%)	Approximate Shelf-Life
Apricot	0-1	90-95	1-3 weeks
Asian pear	0-1	90-95	2 months
Banana	13-15	90-95	1-4 weeks
Ber	7-8	90-95	2 weeks
Cabbage	0-1	90-95	3 months
Carrots (topped)	0-1	90-95	3-6 months
Cauliflower	0-1	90-95	2-3 weeks
Cucumber	10-12	90-95	10-14 Days
Eggplant	10-12	90-95	1-3 weeks
Garlic	0-1	65-70	6-7 months
Grape	0-1	90-95	2-8 weeks
Guava	5-10	90-95	2-3 weeks
Lemon	10-13	90-95	1-6 months
Mandarin (Kinnow)	5-7	90-95	6-8 weeks
Mango	10-13	90-95	2-4 weeks
Mushrooms	0-1	90-95	1 week
Okra	7-10	90-95	7-10 days
Onion	0-1	65-70	3-5 months
Papaya	7-13	90-95	1-3 weeks
Peach	0-1	90-95	2-4 weeks
Pear	0-1	90-95	2 months
Peppers	7-10	90-95	2-3 weeks
Plum	0-1	90-95	2-4 weeks
Spinach	0-1	90-95	10-14 days
Tomato	10-13	90-95	1-3 weeks



testing of Fludoxanil against postharvest diseases and shelf life management of Kinnow fruit. This trial is being conducted at Punjab Horticultural Postharvest Technology Centre for shelf life studies of Kinnow fruits and Department of Entomology, PAU Ludhiana for residual studies of Fludoxanil.

Training of Apka Family Farmers - Farmer Producer Company

PHPTC conducted a training programme on postharvest management of horticultural produce from February 18 to February 20, 2021 for "Apka Family Farmer"- a Farmer Producer Company from Himachal Pradesh. During the training programme the participants were apprised of how to increase profits by reducing losses at the receiving end, and delivering best quality fruit-vegetables to the consumer. Mr Ashish Gupta, CEO of the FPC explained that 'Aapka Family Farmer' has been formed by a group of farmer entrepreneurs who are practicing natural farming in districts of Sirmaur, Shimla and Kinnaur. He informed that this training programme is supported by NABARD and Deptt of Agriculture (ATMA) Himachal Pradesh.

PHPTC News

Evaluation of Scholar 230SC (Fludioxanil) for postharvest shelf life management in Kinnow

Syngenta India Ltd has sponsored a registration trial for



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Producers and regulators must ensure that active compounds are at levels expected. Authenticity testing is also needed especially where it goes beyond the active compounds which can be spiked into non-authentic products. Geographic origin, freshness and production-type can affect health benefits hence require testing. LC and GC methods focus on known compounds of importance with many outlined by reference bodies like IOC, ISO, and USP. UHPLC is now speeding up testing and improving selectivity. FTIR provides even faster identity tests where applicable and is often referenced by USP for assessment of active components. Its speed is complimented by a reduced need for sample preparation and its suitability for portable testing. Fingerprinting using mass spectrometry and spectroscopy can deliver a more comprehensive authenticity test and can also address commodities without established markers. New markers can be detected at low levels and identified ensuring they are not a passing contamination. Finding new markers of difference, needs statistical software to process spectral data from many samples. Agilent's Mass Profiler Professional takes data directly from Agilent systems to achieve this.

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