

Controlled Atmosphere Technology for Storage of Fresh Fruits & Vegetables



**Aman Ullah Malik, Muhammad Amin, Omer Hafeez Malik,
Ahmad Sattar Khan, Abdul Rehman, Rabia Hameed,
M. Umair and M. Imran**

Institute of Horticultural Sciences,
University of Agriculture, Faisalabad



Horticultural produce are highly perishable. Maintaining quality and shelf life extension is always challenging. Due to this reason, fruits and vegetables have a limited market window, and their prices fluctuate from low to very high depending upon their season and supply. Recent advancements in storage technology have provided option of the controlled atmosphere (CA) storage system which extends the useful marketing period of the fresh commodities during storage, transport and distribution with maintained quality and nutritive or market value. CA storage involves precise control of gaseous composition (oxygen and carbon dioxide, ethylene), besides low temperature and high humidity control around the fresh produce to reduce rate of respiration and ethylene production. Normally, we have around 21% Oxygen and 0.03% CO₂ in atmosphere (air) which is manipulated (usually O₂ < 5%, CO₂ up to 10% or even higher) according to crop type and maturity. Good handling practices along with the use of CA storage certainly help to extend shelf life. However, it is important to understand that the quality of fruits and vegetables at the time of storage is extremely important since CA-storage can only maintain quality and reduce the deterioration. So, good quality fruits and vegetables should be selected which are free from injuries, and insect pest or disease attack etc. and processed, packed as per standard procedures. Institute of Horticultural Sciences introduced the modern controlled atmosphere technology in collaboration with a Dutch company (Van Amerongen CA Company) and conducted necessary R&D under Punjab Agricultural Research Board (PARB) Project.



CA system (L-R): Nitrogen generator, Compressor, Cold store with temperature and relative humidity control

Recommendations

Apple cv. Kala Kulu and Shin Kulu (Golden)

Worldwide apples are predominantly stored using controlled atmosphere technology and are available almost round the year with good quality. We have excellent quality apples, but under ordinary cold storage, they quickly lose crunchiness due to heavy loss of moisture (weight loss) and also start developing rots, within couple of months. CA experiments on mature apple cv Kala Kulu and Shin Kulu (Golden) suggest that optimum range of gaseous condition for these cvs is $1-1.5\% \text{ O}_2 + 5\% \text{ CO}_2$ at $1 \pm 1^\circ\text{C}$, RH 85%, for long term storage up to 9 months (tested limit) followed by 2 weeks shelf life at ambient conditions.



Mango cv. Sindhri and Sufaid Chaunsa

Fresh mangoes at ambient conditions, have short shelf life (7-8 days) which limits its market potential. Use of controlled atmosphere technology helps extend its market opportunities.

- Optimum atmosphere for mango cv. Sindhri: 2-3% O₂ + 3-5% CO₂ at 11-12°C, provided storage up to 4 weeks followed by 5-6 days of shelf life (storage temperature should be 12°C for early season harvest while reduced to 11°C for late season harvest fruit).
- Experiments on mango cv. Sufaid Chaunsa suggested that optimum range of gaseous condition for this cv is 2.5-5% O₂ + 5% CO₂ at 11°C in which fruit can be stored up to 4 weeks with 5-6 days of shelf life. Postharvest disease especially, stem end rot needs to be managed with pre & postharvest management for its successful shipment to markets requiring more than three weeks of overall postharvest life (harvest to retail).

Chillies

Among the tested CA conditions at 10°C, chillies fruit performed better under CA conditions at 3% O₂, 2% CO₂ with storability up to 2 weeks followed by shelf life of 2 days at 20±1°C.



**CA Stored
Sindhri**



**CA Stored
Sufaid Chaunsa**



**CA-Stored
Chillies**

Other Crops with good CA-storage potential: CA storage is being commercially used worldwide to store a number of other crops including pomegranate, cabbage, garlic, pear, etc.