



Enhancing Berry Preservation in India

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Berries hold significant nutritional and economic value in the Indian Subcontinent, contributing to both local diets and agricultural revenue. With over 8 million tonnes of berries produced annually in the region, their importance in food security and economic livelihoods cannot be overstated. However, post-harvest handling poses formidable challenges, with up to 30% of berry produce lost due to inadequate preservation and transportation methods. This article explores innovative approaches to mitigate such losses and enhance the sustainability of berry production in the Indian Subcontinent.



Climate and environmental factors affecting berry shelf life and quality

The Indian Subcontinent's climate profoundly affects berry shelf life and quality. High temperatures and humidity accelerate berry spoilage, compromising their freshness and nutritional content. Seasonality presents challenges, with peak production varying across regions and time frames. For example, strawberry production peaks from November to March, while blueberries are primarily harvested in the summer months. Despite seasonal fluctuations, the Indian Subcontinent annually produces over 4 million tonnes of berries. However, inefficient post-harvest practices contribute to significant losses, estimated at approximately 1.2 million tonnes per year. Addressing these challenges with innovative solutions tailored to local climates and production patterns is crucial for enhancing the sustainability of berry farming in the region.

Advanced storage techniques

A) **Cold storage facilities and solutions adopted for Indian conditions:** Cold storage facilities like "Snowman Logistics," "ColdStar Logistics," and "Bigbasket Cold Storage" have been tailored for Indian conditions to preserve berries. These facilities employ advanced technologies such as computerized temperature monitoring, energy-efficient refrigeration units, and insulation materials to maintain optimal storage temperatures ranging from 0°C to 4°C, crucial for preserving the quality and freshness of berries. With India boasting over 32 million metric tons of cold storage capacity, these facilities play a pivotal role in reducing post-harvest losses and extending the shelf life of berries.

B) **Controlled atmosphere storage (CAS) tailored for Indian conditions:** Controlled atmosphere storage (CAS) systems are customized to suit the specific requirements of berry storage in India. These systems regulate temperature, humidity, and gas composition to slow down the ripening process and minimize spoilage. Studies indicate that CAS can extend the shelf life of berries by 20-40%, improving marketability and reducing food wastage.

C) Solar-powered cooling systems for remote areas: Solar-powered cooling systems, such as "SunDanzer Solar-Powered Refrigerators" and "Ecofrost Solar-Powered Cold Rooms," are increasingly utilized in remote areas for berry storage. These systems harness solar energy to power refrigeration units, ensuring consistent and sustainable cooling for preserving berries. By reducing dependence on grid electricity and minimizing carbon footprint, solar-powered cooling systems offer environmentally friendly storage solutions for remote berry-growing regions, promoting both economic and ecological sustainability.

Innovative packaging methods

A. Eco-friendly packaging options tailored for Indian markets: Eco-friendly packaging options tailored for Indian markets include "Biodegradable Berry Clamshells," "EcoBags," and "GreenPack Bioplastics." These packaging solutions are made from sustainable materials such as recycled cardboard, plant-based plastics, and biodegradable films, addressing environmental concerns while maintaining the freshness and quality of berries.

B. Modified atmosphere packaging (MAP) suitable for berry transportation: Modified atmosphere packaging (MAP) is ideal for berry transportation, extending shelf life by regulating gas composition within the packaging. Solutions like "BerryGuard MAP Packaging" and "FreshPac Berry Bags" create an optimal atmosphere by adjusting oxygen and carbon dioxide levels, slowing down berry respiration and delaying decay during transit.



C. Packaging designs to minimize physical damage and extend shelf life: Packaging designs such as "shockproof berry boxes" and "soft touch berry punnets" are engineered to minimize physical damage and extend the shelf life. These containers feature cushioning materials and protective structures to prevent bruising and crushing during handling and transportation, preserving the appearance and texture of berries for long periods.

Utilization of natural preservatives

A) Indigenous plant extracts and traditional preservation methods: Indigenous plant extracts like neem oil, tulsi (holy basil) extract, and amla (Indian gooseberry) extract are commonly used in traditional preservation methods for berries. These extracts possess antimicrobial properties that inhibit the growth of spoilage microorganisms, extending the shelf life of berries. Traditional preservation methods such as sun drying and salt curing are also employed to preserve berries for longer durations, ensuring availability during off-seasons.

B) Use of spices and herbs for natural antimicrobial properties: Spices and herbs like cinnamon, clove, and turmeric are known for their natural antimicrobial properties and are used to preserve berries in Indian households. These spices are either sprinkled directly on berries or incorporated into preservation solutions to inhibit microbial growth and delay spoilage, enhancing the shelf life of the fruit. In addition, we can incorporate ginger (natural antimicrobial properties), cardamom and black pepper (it contains piperine which exhibits antimicrobial activities), fenugreek (antioxidants), ajwain seeds, mustard seeds (allyl isothiocyanate) enhance the preservation and flavour of berries in traditional Indian house



holds. Ground black pepper is occasionally sprinkled over berries for inhibit microbial growth and enhance preservation.

C) **Biocontrol agents for reducing post harvest losses:** Biocontrol agents such as *Trichoderma harzianum*, *Bacillus subtilis*, and *Pseudomonas fluorescens* are utilized to reduce post-harvest losses in berries. These beneficial microorganisms compete with spoilage pathogens for nutrients and space, suppressing their growth and preventing decay in berries. By harnessing the natural antagonistic interactions between microorganisms, bio-control agents offer a sustainable and effective solution for preserving berry quality and freshness.

Market access and distribution

A. Challenges in distributing berries in diverse Indian markets include:

1. Limited cold chain infrastructure in rural areas.
2. Seasonal fluctuations leading to oversupply or shortages.
3. High perishability and short shelf life of berries.
4. Varied consumer preferences and purchasing power.
5. Lack of standardized packaging and labeling regulations.

B. Strategies for maintaining quality during transportation and storage for berries:

1. Use of refrigerated trucks and cold storage facilities.
2. Proper handling and packaging to prevent physical damage.
3. Implementing modified atmosphere packaging (MAP) to control gas composition.
4. Quick and efficient transportation to minimize transit time.

Conclusion

These techniques are crucial for preserving berry quality and reducing food losses. Sustainable handling is essential for industry growth, ensuring economic prosperity and meeting customer demands. Stakeholders must prioritize investment in innovative solutions to sustainably advance the berry sector.

References

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