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Sustainable Entrepreneurship in Post Harvest Horticulture: Eco- Friendly Packaging and Waste Utilisation

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Sustainable entrepreneurship in post-harvest horticulture has emerged as a transformative approach for reducing losses, enhancing value addition, and promoting environmentally responsible agribusiness models. With fruits and vegetables contributing nearly one-third of India's total agricultural output, post-harvest losses ranging from 20–40% remain a major challenge, largely due to inefficient handling, conventional packaging, and inadequate waste management systems. Eco-friendly packaging—derived from biodegradable, compostable, or edible materials such as starch, cellulose, chitosan, and plant-based polymers—offers an alternative to petroleum-based plastics while extending shelf life, improving marketability, and reducing carbon footprint. Parallel to this, agro-waste utilisation through techniques such as extraction of pectin, essential oils, natural dyes, bio-fertilizers, and functional food ingredients from peels, seeds, and pulp residues is redefining waste as a revenue-generating bio-resource. The integration of circular economy principles, green technology, and entrepreneurship creates opportunities for start-ups, MSMEs, and rural enterprises to commercialise packaging innovations and develop value-added by-products from horticultural waste. Government initiatives—such as the PM-FME Scheme, NITI Aayog's Waste-to-Wealth Mission, and Startup India—further strengthen the ecosystem for innovation, skill development, and decentralised processing. The shift from linear "produce-consume-discard" systems to regenerative "reduce-reuse-recycle-revenue" models not only addresses environmental concerns but also enhances farmer income, reduces post-harvest losses, and supports sustainable rural employment.

Keywords: Eco-friendly, Green technology, Government, Horticultural, Sustainable entrepreneurship

Introduction

In today's world, sustainability is not just a trend — it's a necessity. Agriculture, being the backbone of our economy, faces growing challenges due to post-harvest losses, environmental degradation, and inefficient resource use. Here comes the new generation of sustainable entrepreneurs who are redefining the agri-food value chain through innovation in post-harvest technology (PHT).

What is sustainable entrepreneurship in post harvest horticulture?

Sustainable entrepreneurship in post-harvest horticulture involves creating businesses that focus on reducing waste and adding value to horticultural products, while considering social and environmental impacts. Entrepreneurs in this field aim to increase farmer income, improve food security, and promote a more circular economy in the horticultural sector.

Importance: According to FAO estimates, about 30–40% of horticultural produce is lost between harvest and consumption. These losses not only waste food but also the energy, water, and labor invested in production. Sustainable post-harvest solutions can thus ensure to

reduce post harvest wastage and the waste utilization through various techniques like eco-friendly packaging.

Eco friendly packaging: Packaging plays a crucial role in maintaining quality, extending shelf life, and reducing post-harvest losses of horticultural produce. Traditional plastic packaging, although cheap and widely available, poses serious environmental challenges due to its non-biodegraded ability and contribution to micro plastic pollution. Sustainable alternatives such as biodegradable films, banana fiber crates ,molded pulp trays, edible coatings, and polylactic acid (PLA)-based films are emerging as eco-friendly solutions that ensure both product safety and environmental protection.

Eco-friendly packaging includes:-

- Biodegradable Films
- Banana Fiber Crates
- Molded Pulp and Corrugated Fiber board Trays
- Compostable Packaging
- Mycelium Packaging
- Bio-based Polymers
- Reusable Packaging
- Edible Packaging
- Aerated Packaging

Waste utilization

Sustainable post-harvest management is not only about loss reduction but also about converting waste into value-added products, ensuring circularity.

- **Optimised Packaging**: Use packaging materials that are minimal yet effective in protecting produce during storage and transportation.
- **Quality Control**: Implement rigorous quality control measures to ensure only high-quality produce is packed and shipped, reducing potential waste.
- **Inventory Management:** Utilize efficient inventory systems to prevent overstocking or understocking, which can lead to wastage.
- **Citrus Industry:** Maharashtra-based cooperatives generated nearly ₹50,000 per ton of peel waste by extracting pectin and essential oils, which are used in the food and pharmaceutical sectors.
- **Tomato Processing:** Reject-grade tomatoes are processed into puree and powder, reducing waste by 25% while providing additional farmer income.
- **Banana Pseudoste m Utilization:** Fibers extracted from om pseudo stems are used in textile, rope, and biodegradable tableware industries, reducing organic waste disposal loads.
- **Fruit Waste to Nutraceuticals:** Pomegranatepeels**,** Rich in polyphenols, are being commercialized into nutraceutical powders with high export demand (ICAR-IIHR, 2021).
- **Biochar and Composting:** Surplus horticultural residues converted into biochar enhance soil fertility while reducing methane emissions from open dumping.

Conclusion

Sustainable entrepreneurship in post-harvest horticulture represents a vital pathway toward reducing post-harvest losses, enhancing resource efficiency, and promoting a circular economy within the agri-food sector. The integration of eco-friendly packaging solutions and value-added waste utilization not only reduces environmental pollution caused by conventional plastics and unmanaged organic waste but also creates new opportunities for rural startups, MSMEs, and farmer-led enterprises. By converting what was once considered “waste” into bio-based products such as compost, pectin, biochar, nutraceuticals, and biodegradable packaging materials, entrepreneurs can establish profitable and climate-smart business models.

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