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Scientific Perspectives on Sustainable Horticulture in India

Banojini Parida[1], Varanasi Adarsh[1] and Aditya Pratap Singh[2*]
[1]Undergraduate Student, School of Agriculture, GIET University, Gunupur- 765022, Rayagada, Odisha, India.
[3]Assistant Professor, Department of Plant Breeding and Genetics, School of Agriculture, GIET University, Gunupur-765022, Odisha, India.
*Email of corresponding author- adityapratapbckv@gmail.com

Abstract

Horticulture, constituting 30.4% of agricultural GDP, witnesses a shift from traditional crops to fruits, vegetables, and flowers, reflecting evolving farmer preferences. However, concerns arise regarding production growth aligning with productivity. A study evaluates growth trends in area, production, and productivity of these crops, emphasizing an instability index to gauge risk. Results indicate production growth driven primarily by productivity and area expansion, especially noticeable in flower cultivation, signaling potential land stress. Flower production carries higher risk compared to fruits and vegetables. Despite substantial contributions from both area and productivity, available technologies seem insufficient to boost yields, challenging researchers and extension agencies to innovate and disseminate effective solutions. In the Indian context, cultivating horticultural crops offers lucrative returns, particularly through exports, besides addressing societal needs for nutritious food and recreational activities. However, global challenges such as rising labor and land costs, coupled with local factors like technological accessibility and workforce knowledge, impact horticultural production dynamics. Meeting consumer demands for diverse, affordable, and year-round produce requires ongoing innovation. Yet, sustainability concerns loom amid increasing demand, necessitating holistic approaches that address broader issues like immigration, trade policies, supply chain resilience, land use, and skill development.

Keywords- Horticulture, Market, Aesthetic benefits, Sustainable future, Pharmaceutical importance, Urban life

Introduction

As incomes rise, cities expand, lifestyles evolve, and global markets interconnect, consumer preferences are shifting from cereals towards more valuable agricultural commodities (Mittal, 2007). This shift underscores the importance of crop diversification as a promising strategy. Thorough investigation into its potential to enhance productivity, sustainability, and profitability is essential, requiring concerted efforts in this direction (Singh, 2001).

Horticultural crops play a significant role in bolstering the Indian economy by increasing farm yields, generating employment opportunities, and supplying essential raw materials to various food processing industries (Qingxue et al., 2016).

Efficient irrigation systems, such as drip irrigation and precision watering, offer solutions to minimize water wastage while maximizing water utilization efficiency (Chaves et al., 2019). Despite operating on limited land, horticulture faces high demand for its produce. Meeting this demand with fewer resources presents a challenge, necessitating the adoption of sustainable practices to ensure both environmental and economic sustainability (Cappelli et al., 2022).

1. Sustainable development and Judicial use of resources

Achieving sustainable development hinges upon the prudent management and utilization of resources. Embracing technological innovations like precision agriculture, sensor-based irrigation, and digital monitoring platforms is crucial in promoting sustainable gardening practices. These advancements play a pivotal role in optimizing resource utilization, minimizing environmental footprint, and maximizing productivity (Kang et al., 2017).

Drip irrigation serves as a notable example of resource-efficient farming, often leading to a 10-50% increase in crop production per unit of water. This efficiency not only promotes water conservation but also reduces labor demands, as demonstrated by the enhanced cauliflower yields in Nepal (von Westarp, 2004).

Furthermore, the integration of automated pest and disease detection systems in plant cultivation significantly enhances the monitoring of scalable fruit and vegetable crops. Timely identification

of pests and diseases enables prompt intervention, thereby improving overall crop health and productivity (Silke et al., 2020).

Research examining the impact of different cropping systems on carbon stocks has revealed substantial variations. For instance, carbon stocks ranged from 98.2 t/ha in coconut monoculture to 140.06 t/ha in coconut combined with jamun cropping systems. This underscores the critical role of crop selection in sustainable land management practices (Bhagya et al., 2017). By leveraging these technological advancements and understanding their implications, agricultural practices can be tailored to promote both environmental sustainability and enhanced productivity.

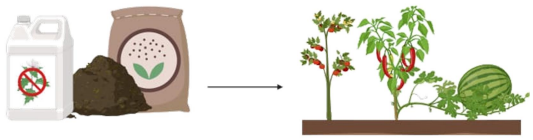

Figure 1: Optimum use of resources

2. Bio aesthetic value & environment friendly

Plants not only have the remarkable ability to break down hazardous pollutants in the air but also serve as effective absorbers of heat and sound. Beyond their functional benefits, the presence of indoor plants in workplace settings has been found to reduce stress, alleviate health issues, and enhance productivity. These utilitarian advantages aside, plants also contribute to the visual appeal of spaces, elevating their aesthetic aura (Huxley et al., 1979).

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Figure 2 : Environmental friendly

Figure 4: Aesthetic value

3. Nutritional & Health benefits

Fruits and vegetables rich in antioxidants play a crucial role in reducing the risk of chronic diseases by safeguarding against free-radical damage (Southon, 2000). The synergistic interplay of micronutrients and antioxidants found in these plant-based foods significantly contributes to improved health outcomes, as evidenced by higher birth weights observed in India (Rao et al., 2001).

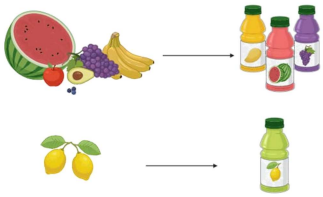

Figure 3: Value added products

4. Demand for horticulture produce in urban culture

A comparative study examining elasticities across countries and food commodities uncovered that in low-income countries, fruits and vegetables exhibit higher expenditure and own-price elasticities. This suggests that the demand for these products in developing countries will undergo significant changes with income increases or price reductions (Seale et al., 2003). The anticipated growth in demand, particularly in urban areas, can be attributed to their pivotal role as dynamic food markets within developing countries, driven by the burgeoning urban

populations and rising incomes (Weatherspoon and Reardon, 2003).

Additionally, research focusing on horticultural therapy among urban jail inmates has demonstrated sustained positive effects on psychosocial functioning. This includes decreased depression among individuals with emotionally detached mothers, reduced substance usage, and a lasting desire for assistance (Rice and Lremy, 1998).

Figure 5 : Reduce stress

Figure 6 : Produce more Biomass

5. Poverty alleviation

Enhancing agricultural productivity stands as a crucial step toward achieving the first Sustainable Development Goal of eradicating extreme poverty and hunger (von Braun et al., 2004).

Transitioning from cereal production to horticultural production holds significant promise in creating job opportunities. In India, for example, it is estimated that shifting production from coarse cereals to high-value vegetables such as cauliflower, eggplant, and tomato would result in the generation of an additional 70 person-days of employment per hectare, on average (Joshi et al., 2003).

The substantial increase in fruit and vegetable trade volume further underscores the economic potential of horticultural development. From 24 million metric tons in 1961 to 125 million metric tons in 2001, the trade volume quintupled during this period (FAOSTAT data, 2004).

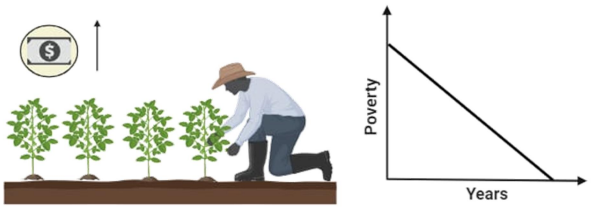

Figure 7 : Improves Farmer's Livelihood

6. Export potential

Cultivating horticultural crops emerges as the optimal alternative for Indian agriculture, offering multifaceted benefits. Not only does it enhance land productivity and create employment opportunities, but it also improves farmers' economic status by yielding higher returns from exports. Crucially, horticulture contributes significantly to ensuring nutritional security for the population (Dahatreyulu, 1997).

India's impressive production statistics underscore its potential in the horticultural sector. With an annual production of 15.73 billion coconuts from 1.89 million hectares, averaging 8,300 nuts per hectare annually, the country demonstrates a robust capacity for horticultural output (CDB, 2018).

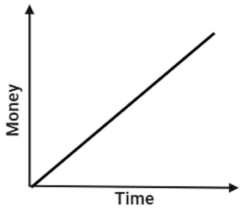

Figure 8 : Higher export potential

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