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Aquaponics & Hydroponics in India: Farming of the Future

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INTRODUCTION

Why Soil-less Farming Matters in India

India has one of the largest agricultural workforces in the world, yet farming faces major challenges like land scarcity, water shortages, monsoon dependency, and climate stress. Conventional agriculture alone won't keep up with rising food demand, especially as cities expand and natural resources shrink. Soil-less farming systems like **hydroponics** and **aquaponics** are becoming practical, sustainable alternatives for India's food system.

What are these systems?

- **Hydroponics** grows plants without soil, using a water + nutrient solution delivered directly to roots.
- **Aquaponics** couples fish farming with hydroponics: fish waste becomes plant nutrients, and plants clean the water in a closed loop.

These systems radically reduce water and land use — hydroponics can cut water use by up to 90% versus traditional farming, while aquaponics recirculates water so only a tiny fraction is lost.

Why it matters for India:

- India's irrigation water demand and land limits make traditional farming increasingly unsustainable.
- Rapid urbanisation fuels demand for fresh, locally grown produce close to consumers.

Hydroponics in India: Facts, Growth & Examples What's hydroponics?

Plants are grown in nutrient-rich water solutions rather than soil, enabling precise nutrition and year-round production inside greenhouses or

controlled environments — essential for modern, water-efficient farming.

Market & growth:

The Indian hydroponics market is booming: valued at ~USD 592 million in 2025 and projected to reach ~USD 2.66 billion by 2034 (~16% CAGR) as controlled environment farming expands in urban centres. Another report forecasts the sector reaching ~USD 1.36 billion by 2033 from ~USD 200M in 2025 (~25% CAGR).

What crops thrive:

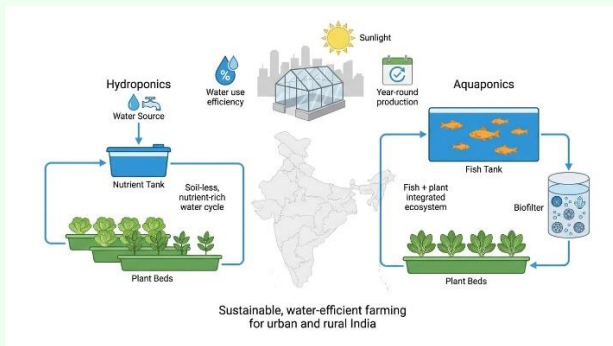
- Leafy greens like lettuce and spinach (major share).
- Herbs, tomatoes, strawberries, and high-value vegetables.

Indian real-world examples:

- In Indore, a hydroponics project at Holkar Science College grows vegetables like spinach and lettuce indoors, using only 10–20% of the water used by traditional methods. This initiative won awards and targets rural and municipal scaling.
- IIT Roorkee has developed indigenous, low-cost systems to treat hydroponic wastewater, addressing nutrient discharge issues.
- In Ladakh, a patented hydroponic system uses treated wastewater, offering a climate-smart solution for arid regions with limited water and soil.

Benefits:

- ✓ Cuts water use drastically vs soil farming.
- ✓ Year-round production in urban/indoor setups.
- ✓ Keeps produce pesticide-free and high-quality.



Aquaponics in the Indian Context

What's aquaponics?

Aquaponics marries aquaculture (fish farming) with hydroponics. Fish waste in the water provides nutrients to plants; plants filter the water, which cycles back to fish tanks. It's a closed-loop, resource efficient food system.

Growth potential:

Although global aquaponics isn't as big as hydroponics yet, the market is expected to grow steadily — from ~USD 1.14B in 2025 to over ~USD 4.18B by 2035 as sustainable food systems become mainstream.

In India, adoption is growing as farmers and entrepreneurs look for water-efficient, integrated fish + veggie production solutions, especially in water-stressed and urban areas.

Indian developments & examples:

- Academic research shows aquaponics is gaining traction as a sustainable aqua-agrifarming practice that can boost yields with minimal environmental impact.
- Historical examples like LandCraft Agro (an early large aquaponics farm in India) highlight how fish + vegetable systems can integrate into organic food supply chains.

Benefits specific to India:

- ✓ Helps farmers combine fish + vegetables, increasing income streams.
- ✓ Ideal for urban, peri-urban, and arid regions with

water limits.
✓ Reduces chemical fertiliser use, boosting food safety.

Table: Comparison of Hydroponics and Aquaponics Systems in India

Parameter	Hydroponics	Aquaponics
Definition	Soil-less cultivation using nutrient solution	Integrated fish-plant system; fish effluent supplies nutrients
Water Use	10–20% of conventional farming	5–15% (recycled)
Crops Produce	Leafy greens, herbs, tomatoes	Leafy greens, herbs + tilapia/catfish
Yield	+30–50% vs soil	+25–40% combined yield (plants + fish)
Space	Medium; vertical stacking possible	Medium; requires tanks + grow beds
Urban Suitability	High	High
Maintenance	Nutrient pH, light	Fish health, water quality, nutrient balance
Adoption (India)	Indore, Ladakh	LandCraft Agro, MP & Karnataka demo farms
Sustainability	Water-efficient, pesticide-free	Water-efficient, dual-income, chemical-free

Urban & Commercial Applications in India

Urban Farming & Food Security:

India's megacities (Delhi, Mumbai, Bengaluru, Chennai) are seeing a rise in hydroponic and aquaponic micro-farms on rooftops, terraces, and community centres, making fresh, pesticide-free produce available locally. Controlled environments make supply chains shorter and more resilient.

Commercial Farming & Market Trends:

- India's vertical farming sector (closely tied to hydroponics/aquaponics) was valued at ~USD 100M in 2025 and is projected to approach ~USD 699M by 2034 (~20%+ CAGR) as more startups and investors back controlled-environment agriculture.

- Urban farms can supply high-value greens to restaurants, hotels, supermarkets, and direct-to-consumer channels.

Challenges in India:

- High initial costs and need for technical know-how.
- Power supply reliability issues in non-urban areas.
- Limited awareness among many farmers about these systems.

Real impact stories:

- Hydroponic innovations at research institutes are increasing crop yields and nutritional content while slashing water use — especially relevant for states like MP and Rajasthan facing water stress.
- Wastewater-based hydroponic systems in Ladakh showcase water reuse in extremely dry ecosystems.

Getting Started + Future Outlook (India)

For Beginners & Farmers:

- Start with small hydroponic setups (e.g., NFT or DWC) for leafy greens.
- Explore aquaponic kits combining fish like tilapia with vegetables.
- Join local agri-tech groups for training and knowledge sharing.

Government & Policy:

Support under modern agriculture initiatives, protected cultivation schemes, and startup programmes helps reduce entry barriers and fosters innovation.

Future of Soil-less Farming in India:

Hydroponics and aquaponics are not just trends — they're practical responses to water scarcity, urban food demand, and climate uncertainty. These systems tie into India's broader goals for sustainable agriculture, clean food systems, and resilient urban supply chains.

Call to Action:

"Grow more with less — embrace soil-less farming and be part of India's sustainable agriculture revolution!"