Spirulina Farming

Volume 01, Issue-02

Cultivating the Superfood of the Future

August 2025
Digital AgriNews e-Magazine

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Abstract

Spirulina, a blue-green microalga belonging to the genus Arthrospira has gained global attention for its rich nutritional profile and sustainable cultivation practices. As a potent source of proteins, vitamins, minerals and antioxidants, Spirulina has found applications across health, food, feed and cosmetic industries. This article explores the scope, techniques, economic potential, government support, challenges and value-added product opportunities of Spirulina farming, with a particular focus on its relevance for Indian farmers and agri-entrepreneurs.

Introduction

With rising global awareness about health and immunity, Spirulina has emerged as a sustainable and nutrient-dense superfood. Arthrospira platensis is widely used in the pharmaceutical and health food industries due to its high content of essential amino acids, fatty acids, antioxidants, and other beneficial compounds (Yu et al., 2025). The World Health Organization (WHO) and Food Agriculture Organization (FAO) have recognized Spirulina as an effective means to combat malnutrition and improve food security (Joint WHO/FAO/UNU, 2007).

Spirulina thrives in warm, alkaline water (30-35°C, pH 9-11) and is primarily cultivated as A. platensis and A. maxima. Its dry biomass contains approximately 55-70% protein with all essential amino acids, alongside substantial levels of vitamins (B1, B2, B12, A and E), minerals (iron, calcium, magnesium, potassium), and pigments such as phycocyanin and chlorophyll, carotenoids (Sow and Ranjan, 2021; Belay et al., 1993).

1 *ADVANTAGES OF* SPIRULINA FARMING

Spirulina cultivation offers several ecological and economic benefits. It requires 10 times less water than traditional crops and can be grown in tanks on non-arable land, making it ideal for rooftop or backyard farming. and, making it ideal for rooftop or backyard farming. Spirulina contributes to climate change mitigation by sequestering CO_2 during photosynthesis. Its short growth cycle, harvestable every 10-15 days, enables continuous income. With increasing demand for plant-based nutrition and immunity boosters, Spirulina's market value has soared, especially after the COVID-19 pandemic (Anitha et al., 2020).

2 *CULTIVATION* METHODOLOGY

Site and Tank Setup

Cultivation typically involves shallow, rectangular tanks made from cement or lined with plastic. These are placed in sunlit areas, as Spirulina requires at least 6-8 hours of daily sunlight. Each tank holds 1000-2000 litres of water, maintained at pH 9-11 and temperatures between 30-35°C. Paddle wheels or air pumps are used for consistent aeration and mixing (Sow and Ranjan, 2021).

Nutrient Medium

The culture medium consists of:

- Sodium bicarbonate and sodium carbonate

Harvesting and Processing

Once the culture reaches a dense green color (typically within 10-15 days),), the biomass is filtered using the fine mesh cloth, washed to remove residual salts, and sun-dried or freeze-dried. The dried Spirulina is ground into powder or processed into paste, tablets, or capsules.

Economic analysis

A cost-benefit analysis reveals Spirulina farming as a viable income-generating venture:

Input	Estimated cost (INR)
Setup (100 m2 tank system)	₹60,000-₹80,000
Monthly operational cost	₹10,000-₹15,000
Dry Spirulina Yield/Month	8-10 kg
Market selling price per kg	₹800-₹1,500
Expected revenue/month	₹8,000-₹15,000
Break-even period	Within 6-9 months

(Source: TNAU Agritech Portal, 2022)

Training and Government Support

Various Indian institutions and programs are actively promoting Spirulina farming:

- **Indian Agricultural Research Institute (ICAR-IARI)** offers training on cultivation techniques and value-added product development.
- **Tamil Nadu Agricultural University (TNAU) and Central Institute of Fisheries Education (CIFE)** offers practical guidance and skills for producing and utilizing Spirulina biomass (CIFE, 2025).
- **Spiru Swastha**, a private initiative, provides live training and market linkage assistance (Spiru Swastha, 2025).
- **National Botanical Research Institute (NBRI) and Central Food Technology Research Institute (CFTRI)** contribute to research and technology development.

Challenges in Spirulina Farming

While Spirulina farming holds great potential, several challenges limit its broader adoption and sustainability:

- **Contamination risks:** Without strict hygiene and biosecurity measures, Spirulina cultures are prone to contamination by harmful microorganisms such as bacteria, fungi or even toxic algae, which compromise product quality and safety (Bumandalai et al., 2024).
- **Lack of Awareness and Technical Knowledge:** Many aspiring farmers, especially in rural areas, are unaware of Spirulina's benefits and lack the technical know-how to cultivate it effectively. This knowledge gap leads to poor practices and reduced yields (Villaró-Cos et al., 2024).
- **Unorganized Marketing Systems:** Spirulina marketing remains largely informal. Small-scale producers struggle with inconsistent demand, lack of branding, and limited access to stable markets, impacting profitability.
- **Standardization and Certification Issues:** The absence of consistent production standards and certification protocols affects consumer trust and hampers exports. Quality variations make it difficult for producers to meet regulatory expectations (Zrimec et al., 2024).

3 VALUE-ADDED PRODUCTS AND MARKET SCOPE

Spirulina holds significant potential for value addition due to its diverse applications. Common consumer products include Spirulina powder, capsules, and tablets, often used in smoothies, juices, and health supplements. These formats are widely available through e-commerce platforms like Amazon and Flipkart and are popular among wellness-focused consumers.

In the functional food sector, Spirulina is incorporated into energy bars, snacks, noodles, and biscuits, enriching them with protein and micronutrients. These products are especially well-accepted by children and young adults (Abdel-Rahman et al., 2016). In animal husbandry and aquaculture, Spirulina enhances growth performance, immune response, and product quality in livestock, poultry, and fish.

It is widely used in fish and shrimp feed for improved coloration, disease resistance, and faster growth (Khan et al., 2005; Habib et al., 2008).

The cosmetic industry also uses Spirulina for its antioxidant and vitamin-rich composition. It is increasingly featured in skincare and haircare products such as soaps, face masks, and shampoos, with Indian startups and women entrepreneurs driving innovation in this space (Gupta and Agarwal, 2021). Spirulina residues are utilized as organic biofertilizers and biostimulants, promoting nutrient uptake, plant growth, and stress resistance, aligning with sustainable agriculture practices (Ronga et al., 2019).

Market demand is growing both domestically and internationally. In India, Spirulina is sold through health stores, fairs, and online platforms. Globally, exports to the US, Japan, Germany, and France are increasing. As per APEDA (2023), India's export of Spirulina products has grown steadily, boosted by heightened health awareness post-COVID-19. Companies like Parry Nutraceuticals and Prolgae are scaling production to meet this demand.

CONCLUSION

Spirulina farming represents an inclusive, profitable, and sustainable agri-enterprise suited for India's rural economy. With low inputs, high returns and broad applicability across sectors, it is particularly beneficial for youth, and smallholder farmers. Supported by training, government schemes, and innovative market strategies, Spirulina has the potential to transform livelihoods while addressing nutritional security and environmental sustainability.

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