Advancing the Arena of Rice Farming: Organic production

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Introduction

For almost 10,000 years, agriculture has been practiced traditionally in India, where it has been shown to be more sustainable than other agricultural systems. The Green Revolution was started in order to feed the expanding population, and it was mostly based on modernizing old methods using chemical fertilizers, insecticides, and high-yielding crop varieties. However, this practice causes a significant loss of biodiversity and soil fertility, which impacts different ecosystems and speeds up the release of greenhouse gases like CO_2 and NO_2, which contributes to climate change and global warming. Organic farming has once again become a viable choice due to a number of issues with contemporary agricultural technologies. Organic farming is a system of agriculture that seeks to maintain and improve land through natural and biological processes. It is farming of permanency and aimed at promoting plant, animal and human health (Somani *et al.*, 1992).

Key factors of organic farming

A comprehensive approach to production management, organic rice cultivation and production avoids or excludes the use of genetically engineered seeds, synthetic fertilizers, pesticides, growth regulators, preservatives, and additives for animal feed. Crop rotation, the use of crop residues, animal manures, off-farm organic wastes, green manures, biofertilizers, and biopesticides are all part of the organic farming system. It also uses mechanical cultivation to supply plant nutrients and control insects, pests, and weeds, which helps to reduce pollution in the environment. In the end, this supports the ecology and sustainable rice production. Additionally, it is economical, which supports our small and marginal farmers in the nation's rural areas, preserving their economic, social, and cultural standing.

Extent of organic farming at Global level and Indian scenario

With 1.8 million growers, organic farming occupies over 37.2 million hectares of land on the Globe. Oceania (12.2 m. ha), Europe (9.3 m. ha), and Latin America (8.6 m. ha) have the biggest amounts of area used for organic farming. The United States, China, Argentina, and Australia have the largest extent of land used for organic farming.

The idea of organic farming is not new to India; in fact, it has long been practiced by farmers there, and some regions are automatically considered organic. India currently leads the globe in the number of organic producers (677,257) and ranks fifth in terms of the total area under organic cultivation (approximately 2.8 million hectares, including the wild herb harvest region of MP and UP) (APEDA, 2022). Madhya Pradesh is the state with the largest organic certified area, followed by chhattisgarh, Uttar Pradesh, Maharashtra, Gujarat, Rajasthan, Odisha, Karnataka, Uttarakhand, Sikkim, and Jharkhand. Sikkim accomplished the amazing feat of certifying all of its arable land—more than 75,000 hectares—as organic in 2016.

India has a great deal of potential to dominate the global organic rice export market. By setting up model farms in areas like Punjab, Haryana, and Uttar Pradesh, APEDA worked to produce and export aromatic rice, basmati rice, and other types of rice. In the globe, India is the biggest producer and exporter of cereal goods. In 2021–2022, India's cereal exports totaled Rs. 96,011.42 Crore, or 12,872.64 USD million. During the same year, 75% of India's total cereal exports (in value terms) were rice, including both Basmati and non-Basmati varieties.

Technologies for Organic rice cultivation

Varieties: Improved White Ponni, Bhavani, Mappillai Samba, Kichedi Samba, IR 20, CO 43, CO (R) 48, KDML 105, Red Kavuni and Seeraga Samba

Season: Kuruvai, Thaladi and Samba seasons

Seed rate: Adopt a seed rate of 7- 8 kg for single seedling per hill; Spacing: 25 cm x 25 cm (SRI)

Seed treatment: Seed treatment with Panchagavya @ 1 % (overnight soaking and shade dry) followed by treatment with Pseudomonas fluorescens @ 10 g/kg,

Azospirillum @ 30 g/kg and Phosphobacteria @ 30 g/kg.

Field preparation: Incorporating 10 t of FYM/ha, 5 tons of paddy straw, and 10 t of insitu grown dhaincha/sunhemp green manure/ha is part of the package of procedures to be followed for organic rice during land preparation and puddling. Vermi-compost at a rate of 2 t/ha may be put to the final puddle (optional). About 150 kg N, 40–50 kg P2O5, 100–120 kg K2O, and micronutrients can be provided by these organics.

Nutrient management in organic rice cultivation: The rice crop anticipates the difficulties in growing rice organically and shares the highest percentage of pesticides (17–18%) and fertilizers (40%). Green manures, fertilizers, and crop rotations based on legumes can all be used to grow rice. In addition to managing weeds, the green manure/legume plants can conserve up to 30–50% of the nitrogen needed for rice (Preston, 2003). Organic manures like FYM, compost, and vermi-compost can be used at a rate of 5 t/ha for preparing seed beds. Azospirillum, phosphorus-solubilizing bacteria (PSB), or phosphorus-solubilizing microorganisms (PSM) at a rate of 10 g per kilogram of seed. immersing the roots of seedlings in a suspension of Azospirillum and/or PSB/PSM made with 600 g of culture per hectare

Utilization of biofertilizers: Many biofertilizers, including Rhizobium, Azotobacter, Azospirillum, phosphate-solubilizing microorganisms (PSMs), and Azolla, can be used to produce organic rice. When compared to other biofertilizers, azolla breaks down more quickly, gives the rice plants more nitrogen, and can boost rice yield by as much as 1.4 to 1.5 tons per hectare (Waseem et al., 2012). 30 minutes prior to plucking, 25 kilogram of farmyard manure is combined with 2.5 kg of Azospirillum per hectare and applied in the nursery. After 30 minutes of submersion in the nursery, the seedlings are moved. Apply 2–3 kg of biofertilizers per hectare, such as Azospirillum or PSB/PSM, combined with 25 kg of FYM or vermi-compost, to the soil right before planting. The color blue. To promote the growth and development of the crop, three liters of Panchagavya are sprayed for every 100 liters of water during the pre-flowering stage and then twice at 15-day intervals. Ten-liter power sprayers might require 300 milliliters each tank. Sediments must be filtered when using a power sprayer, and a nozzle with a larger pore size must be used when using a hand-operated sprayer.

Water management: Depending on the soil type and weather, there should be 15–18 irrigations. The germination period (1–15 days), vegetative phase (16–44 days), and flowering phase (85–90 days) are the most important times for watering.

Plant protection: Acalypha indica, Cyanodon dactylon, Cyperus rotundus, Digera arvensis, Chloris barbata, Trianthema portulacastrum and Parthenium hysterophorus are the major weed species. The Critical stages for weed competition in rice are vegetative and flowering phases. Manual weeding and stubble mulching with organic materials found to be effective in controlling weeds. For effective insect pest and diseases, the following approaches can be adopted:

1. Selection of varieties with moderate resistance for major pests and diseases of rice
2. Cultural control: Land preparation, irrigation, balanced nutrition, field sanitation, trap crops, time of planting, green manuring, destruction of crop residues etc.
3. Mechanical control: Collection and destruction of various stages of pests
4. Biological control: Use of natural enemies like predators, Parasitoids and pathogens
5. Use of pheromone traps: These traps are now commercially available.
6. Use of Biopesticides: Use of NPV etc.
7. Botanicals: Neem products, different plant extracts etc.
8. Organic solutions: Panchagavya, amruthajalam etc.

Disease management organic rice cultivation

1. Clean cultivation and field sanitation
2. Use of Biocontrol agents: Trichoderma, Pseudomonas, Bacillus etc.
3. Crop rotation with solanaceous crops for reducing bacterial wilt
4. Soil application of Neem cake in nursery and spraying Neem Seed Kernal Extract and Neem oil for reducing sheath blight
5. Spraying of neem cake extract (5 %), Neem Seed Kernal Extract (2%), prosopis leaf extract 10 %, Acacia leaf extract 10 % and *Bacillis subtilis*

suspension reduces the incidence of bacterial blight

6. Presoaking of paddy seeds in milk and spraying of adathoda vasica controls rice thungro and stunt viral diseases
7. Soaking of seeds in 20 % of pudhina leaf extracts reduces rice leaf spot disease
8. Spraying of the extract taken from 1 kg of shredded turmeric rhizome soaked with 4 liters of cow urine and diluting it to 20 liters along with 4 ml of khadi soap in rice reduces the incidence of leaf spot and leaf blight.

Organic certification Agencies: The are six accreditation agencies for certification of organic products identified by the Government of India. They are: Agricultural & Processed Food Products Export Development Authority (APEDA), Coffee Board, Spices Board, Tea Board, Coconut Development Board, Directorate of cashew and Cocoa Development functioning under the Ministry of Commerce and Industries. Twenty inspection and certification bodies are accredited to certify organic products based on the National Programme for Organic Production (NPOP) guidelines.

Conclusions: Due to the recent trend of rising demand for organically cultivated products in both India and international markets, organic farming opens the door to increased rice farming profitability. As a result, appropriate attention can be paid for promoting organic rice cultivation techniques. The new technologies developed by different platforms in organic farming ought to be evaluated to demonstrate their effectiveness in raising the rice productivity.

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