

## **Organic spices in India: Potential, progress and pathway forward**

**India holds immense potential in organic spice cultivation, driven by rising global demand for safe, eco-friendly produce. Organic farming excludes synthetic inputs, relying on sustainable practices to enhance soil health, biodiversity, and crop resilience. India leads with 1.4 million certified organic producers and 95,087 tonnes of organic spices produced in 2022–23, showcasing a 215% growth since 2014–15. Key spice-producing states include Madhya Pradesh, Kerala, and Sikkim. Research advancements at ICAR-IISR have led to the development of integrated organic management practices, disease-resistant varieties, and eco-friendly pest control measures. However, the sector faces challenges such as limited domestic market penetration, certification complexities, dependency on export markets, and inadequate traceability. This paper examines the current progress, production technologies, trade patterns, and challenges in India's organic spice sector, proposing strategic pathways to enhance productivity, market access, and policy support to ensure sustainable development and global competitiveness in organic spice value chains.**

**O**RGANIC agriculture involves a broad spectrum of methodologies which are generally supportive of the environment. Organic farming is a production system, which largely excludes the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives and relies on crop rotations, crop-residues, animal manures, legumes, green manures, off-farm organic wastes and biological pest control to maintain soil productivity, to supply plant nutrients, and to control pests and diseases. The system's aims are, preserving the reproductive and regenerative capacity of the soil to support good plant health management, and production of food with less or no contaminants. Organic agriculture has been gaining considerable importance and many farmers are opting for the same to produce safe foods and preserve the environment. Many countries have been able to convert 2-10% of their cultivated areas into organic farming. The demand for organic products is growing fast at the rate of 20% per annum in developed countries. Realizing the importance of organic agriculture at the global level, more nations are supporting organic agriculture, and presently about 108 countries have adopted organic regulations of one form or the other. At the global level, organic agricultural land increased from a mere 11 million ha in 1999 to 96.2 million ha in 2022 with the corresponding increase of producers from 0.2 million to 4.5 million during the same period.

### **The Indian scenario**

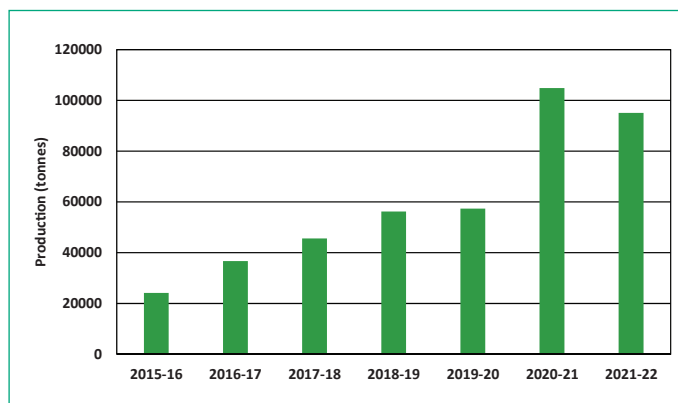
In India, the Ministry of Industries and Commerce,

Government of India implemented the National Programme for Organic Production (NPOP) to assist the growers to tap the growing demand for organic products and to accredit certification programmes in the country. Presently, the country has 5.41 million ha of land under organic production under various streams of certification and 4.78 m ha area under wild harvest collection (forest). The Agricultural and Processed Food Products Export Development Authority (APEDA) is the implementation agency for the NPOP.

More than seven lakh of land under organic cultivation is covered under Participatory Guarantee System (PGS), which is farmer group centric quality assurance system working outside the framework of third-party certification. While NPOP certified products can be traded in export and in domestic market, PGS certification enables trading of organic products within the domestic market.

India has the largest number of certified organic producers in the world with 1.4 million farmer producers certified under NPOP standards. Out of the total organic certified production of 2.9 million tonnes in India (2022-23), spices and condiments accounted for 95,087 tonnes. The output of organic spices witnessed robust growth during the recent years with an output growth of 215% between 2014-15 and 2021-22. Though organic spice production is carried out in several states, a few states dominate the organic spice production scenario. The states of Madhya Pradesh, Maharashtra, Kerala, Karnataka and Rajasthan together contribute 73.2% of the total organic spice production in the country. Sikkim is a declared

organic state which produces 81,000 tonnes of organic ginger and 5,280 tonnes of large cardamom, annually.



Trends in production of organic spices

## Organic farming Technologies in spices

### Cropping systems

Spice crops are highly amenable for mixed and intercropping, where black pepper, cardamom and nutmeg can ideally cultivated along with other plantation and horticultural crops like coconut, arecanut, cocoa, coffee, tea, citrus, etc. There is also great scope of covering all the shade trees with black pepper vines in tea and coffee estates in South and North East India. Rhizomatous crops such as ginger and turmeric are highly remunerative as intercrops in coconut and other horticultural tree crops under partial shade. Ginger and turmeric can also be intercropped with a wide variety of other crops including vegetables, pulses, cereals, oil seeds, fodder and medicinal plants. Green manure crops like daincha (*Sesbania aculeata*) or legumes like cowpea can be raised successfully in inter-spaces of ginger and turmeric beds in a row, which adds to 50% of the green leaves required for mulching and suppresses weed growth, reducing the cost of cultivation. Application of dried coconut leaves as a mulch at the time of planting for suppressing weeds in ginger is a viable technology that can be practiced in places where coconut is being grown and it recorded maximum benefit cost (B:C) ratio (2.04).

Plantation crops being perennial in nature contribute large quantities of waste by-products, which by composting and recycling will meet the nitrogen requirement of the crop and partly other nutrients. Composts made out of leaf and sheath wastes and husks of these plantation crops are also valuable sources of plant nutrients. Leaf and bunch wastes of coconut, arecanut and oil palm, coffee husk and spent tea leaf have been found to give very high bioconversion efficiency.

### Crop management

Definite principles, basic standards of production, documentation, inspection and certification guidelines have been developed by Spices Board in line with the National Programme of Organic Production standards (NPOP) of India. Even though there are no varieties released specifically for organic cultivation, number of varieties that are resistant/tolerant to pest and diseases were released in spice crops. The Institute, has developed

package of practices for organic production of major spices like black pepper, ginger and turmeric. For organic production of black pepper, traditional varieties adapted to the local soil and climatic conditions that are resistant to pests and diseases, are preferable. Turmeric varieties *Suguna*, IISR–*Pragati* and *Sudharsana* are found to be suited for organic farming with stable rhizome yield and higher curcumin content. All crop residues and farm wastes like green loppings, crop residues, grasses, cow dung slurry, poultry droppings, etc., available on the farm can be recycled through composting, including vermicomposting, so that soil fertility is maintained at high level.

Leaf compost and vermicompost treatments supported significantly higher population of free-living N-fixing bacteria, phosphate solubilizing bacteria populations. Application of 20 t FYM + 2 t neem cake + 1 t ash + 4 t vermicompost/ha, *Azospirillum* sp. and P-solubilising bacteria (50 g/bed) for nutrient supplement, *Bacillus amyloliquefaciens* as seed treatment and soil drenching are helpful in sustaining the yield and keeping the rhizome rot disease incidence under check in ginger and turmeric. Talc and biocapsule based formulation (IISR Biomix) consisting of a consortium of PGPRs (*Bacillus amyloliquefaciens*, *B. megaterium* and *Acinetobacter* sp.) have been developed for application in the nursery and main field for enhanced growth and yield in black pepper. Very promising Zn solubilizing bacteria (ZSB) were isolated from the rhizosphere of turmeric and ginger and assessed for the type and quantity of organic acids secreted. The quality parameters of ginger (high oleoresin and low fibre) and turmeric (curcumin and starch) were found to be high under organic farming. Arbuscular mycorrhizal inoculation (*Rhizophagus* sp.) 10 g dose in seed beds improved seedling growth, nutrient uptake, and disease resistance in cardamom, black pepper and ginger. AMF inoculation also enhanced the phosphatase activity and mycorrhizal dependency in the rhizosphere.

Studies at ICAR-IISR indicated that organic management is viable in black pepper, ginger and turmeric on par with integrated management with sustained yield over years. Availability of soil nutrients were maximum in organic management with higher availability and uptake of nutrients. Regarding quality, organic management recorded higher quality parameters in ginger and turmeric. Organic management recorded maximum B:C ratio in ginger and turmeric with premium price on par with that of integrated management. Initial observations in cardamom also indicated higher yield potential under integrated management followed by organic. The sustainability index of the soil measured with nutrient index, microbial index and crop index compared under different management systems for cardamom and turmeric showed a highest soil microbial (MI) and crop indices (CI) under fully organic (1.23) and integrated systems (1.19).

### Pest and disease management

Spice crops are prone to attack by many pests and diseases for which several eco-friendly green technologies have been developed utilizing cultural methods, use of resistant varieties, natural products and bio-control agents.

## Resistant varieties developed against pests and diseases

| Crop                | Varieties            | Resistant/Tolerant against   |
|---------------------|----------------------|------------------------------|
| Black pepper        | IISR <i>Shakthi</i>  | <i>Phytophthora capsici</i>  |
|                     | IISR <i>Pournami</i> | <i>Meloidogyne</i> spp.      |
|                     | IISR <i>Thevam</i>   | <i>Phytophthora foot rot</i> |
| Cardamom            | IISR <i>Vijetha</i>  | Katte and CMV virus          |
|                     | IISR <i>Avinash</i>  | Rhizome rot and leaf spot    |
|                     | <i>Appangala-2</i>   | Katte and CMV virus          |
|                     | IISR <i>Manusree</i> | Drought                      |
|                     | IISR <i>Kaveri</i>   | Drought                      |
| Ginger and Turmeric | IISR <i>Mahima</i>   | Root knot nematode           |
|                     | IISR <i>Kedaram</i>  | Leaf blotch                  |
|                     | IISR <i>Pragati</i>  | Root knot nematode           |

Eco-friendly management schedules have been developed by ICAR-IISR using biological control of pest and pathogens of spices that have greater significance in the package of organic farming. PGPR consortiums have also been developed to promote rooting and growth of plants and controlling diseases in the nursery. Effective control of foot rot disease under field condition can be achieved by adopting cultural practices like shade regulation, phytosanitation, minimum tillage, adequate drainage and application of *Trichoderma asperillum*. In ginger, *Bacillus amyloliquefaciens* (PGPR) as seed treatment and drenching are helpful in managing rhizome rot disease incidence in the field. ICAR-IISR has made a significant breakthrough in encapsulation and delivery of PGPMs for growth promotion and disease control in spices. The institute has also developed a granular lime/gypsum-based *Trichoderma*/PGPR formulations for simultaneous delivery of microbes during soil amelioration. This ensures soil acidity/alkalinity neutralization and addition of beneficial microbes to the soil simultaneously to improve the soil bio activity. This formulation was found to be effective in neutralizing the sub soil acidity as well as the soil population of the delivered beneficial microbes in the lower soil depths in crops like black pepper, nutmeg, coconut and turmeric.

Soil solarization and fortifying the nursery mixture with *Trichoderma* spp. and VAM to raise the nursery rooted cuttings of black pepper and cardamom gives protection from foot rot pathogen *P. capsici* and nematodes *R. similis* and *M. incognita*. *Pochonia chlamydosporia*, a known nematode biocontrol agent, attacks on all stages of nematodes and being used as an effective bio agent against *R. similis* and *M. incognita* infecting spice crops. IDM protocols involving  $\text{CaCl}_2$  and *Bacillus lichiniformis* based formulation (Bacillich) for the control of bacterial wilt of ginger was standardized and demonstrated across India. Spinosad (derivative from actinomycetes, *Saccharopolyspora spinosa*) can substitute synthetic insecticides for thrips control in cardamom, when sprayed at 0.0135% for three times (March, May and August) and have less adverse effects on the environment. ICAR-IISR has also identified potential bio control agent *Lecanicillium psalliotae*, for

basal application (3-4 applications during May-September) for effective control of thrips on par with chemical insecticides, for organic cultivation.

Seed coating using PGPM is a novel approach of coating efficient strains of *Trichoderma* or PGPR on seeds/ seed rhizomes. The coated seeds/ rhizomes can be stored at the room temperature and it effectively addresses the constraints like low germination, slow initial growth and high susceptibility to seed borne diseases in spices like ginger, turmeric, tuber crops and seed spices.

## Promising biocontrol agents identified against pests and pathogens

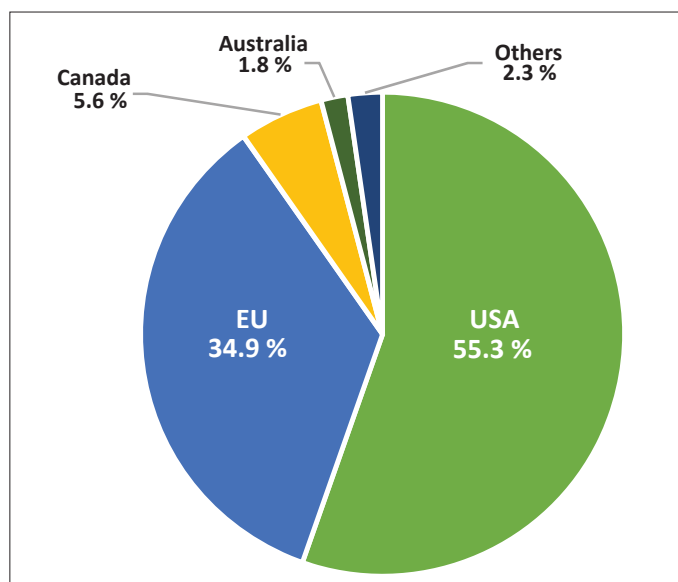
| Crop                | Biocontrol agent                  | Pathogen/Pest                                                                        |
|---------------------|-----------------------------------|--------------------------------------------------------------------------------------|
| Black pepper        | <i>Trichoderma</i> spp.           | <i>Phytophthora capsici</i>                                                          |
|                     | <i>Pochonia chlamydosporia</i>    | <i>Radopholus similis</i> ,<br><i>Meloidogyne incognita</i>                          |
|                     | <i>Chilocorus</i> spp.            | <i>Lepidosaphes piperis</i> ,<br><i>Aspidiotus destructor</i>                        |
| Cardamom            | <i>Trichoderma</i> spp.           | <i>Phytophthora meadii</i> ,<br><i>Pythium vexans</i> ,<br><i>Rhizoctonia solani</i> |
|                     | <i>Lecanicillium psalliotae</i>   | <i>Sciothrips cardamomi</i>                                                          |
|                     | <i>Metarhizium anisopliae</i>     | <i>Basilepta fulvicorne</i>                                                          |
|                     | <i>Beauveria bassiana</i>         | <i>Basilepta fulvicorne</i>                                                          |
| Ginger and Turmeric | <i>Bacillus amyloliquefaciens</i> | <i>Pythium</i> spp.                                                                  |
|                     | <i>Trichoderma</i> spp.           | <i>Pythium</i> spp.                                                                  |
|                     | <i>Bacillus lichiniformis</i>     | <i>Ralstonia</i> spp.                                                                |
|                     | <i>Steinernema</i> sp.            | <i>Conogethes punctiferalis</i>                                                      |
|                     | <i>Oschieus gingeri</i>           | <i>Conogethes punctiferalis</i>                                                      |
|                     | <i>Metarhizium pingshaense</i>    | <i>Conogethes punctiferalis</i>                                                      |

## Trade in organic spices

One of the major drivers of growth of organic spice production in India is the sustained export demand for organic spices. In the prevailing scenario organic management would become more profitable only by providing a premium price to the spice produces. India is a major source of organic spices at the global level which exports about 14% of its total organic spice output. Organic spice exports from India touched a new high of ₹ 36,790 lakhs for exporting 6,991 tonnes during 2024-25. The bulk of these exports are directed to European Union nations and USA, which together account for more than 90% of the organic spice exports from India. Canada and Australia are two other significant export destination for organic spices.

## Concerns and challenges

Production and marketing of organic spices face several concerns along its value chain. Addressing these concerns through deliberations among key stake holders and strategic interventions to shepherd the sector in desirable direction can strengthen the organic spice



Export destinations of Organic Spices from India

production economy. Some of the key issues of note in the sector are discussed below.

- Organic spices constitute barely 2% of the total organic output in the country. Considering the rising demand for organic spices and herbs special drives promoting certification of spice producers needs to be implemented.
- The organic spice economy is critically dependent on export markets for realizing its higher value which is highly skewed in favour of a few countries. Efforts for diversification of export destinations need to be undertaken through better value-added products and efficient marketing strategies at the global level to enhance the business scope.
- The development and deepening of domestic market for organic spices is also important for sustainable development of this niche sector. The level of awareness among the farmers about the various certification options like PGS system need to be enhanced for better adoption of certified organic spice production.

- The comparative cost of cultivation in conventional and organic production system need to be documented for various agro-ecological regions under different farming system models. Along with the environmental gains and ecological cost and returns of these systems also need to be documented for holistic comparison.
- To strengthen the concern for food safety in promoting organic spices, value chain traceability of spice products needs to be strengthened while exploring the market potentials.
- Identifying the research gaps in the sector and providing real-time technical guidance for addressing the challenges faced by the organic producers is the need of the hour. Moreover, the organic spice production hubs should be linked with assured buy back and guaranteed access to marketing opportunities to enable confidence among the primary producers.

## CONCLUSION

Organic agriculture is fast gaining consumer preference across the globe. In tune with this shift the demand for organic spices have also witness robust growth in the recent past. The latent potential in the organic spice sector is a boon for India with its diverse production systems and agroclimatic diversity. As a major player in global spice trade, India can play a vital role in organic spice value chains also. This would require enhancing the organic spice output in the country and aligning the production process with internationally accepted standards and established norms. Concerted efforts from institutional stakeholders, better coordination between public and private sector organizations and tailor made policies are required in the sector to address key challenges across production technology, processing, packaging, value chain and trade development. This can definitely help the organic producers to cater to the needs of this niche market while reaping higher returns from the farming of organic spices.

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## Labelling of Organic logos on organic products



### Safe Food

(Produce obtained from under conversions fields)



### Organic

(Produce obtained from fully organic fields)

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