



POLICY BRIEF #73

Streamlining the Indian Spices Market: Issues and Way Forward

JULY 2026

Authors:

**ARPITA MUKHERJEE
ESHANA MUKHERJEE
SAMRIDDHI DUBE**

Table of Contents

Abstract	i
Acknowledgement	ii
About the Authors.....	iii
List of Abbreviations.....	v
1. India: The Global Leader in Spices Production and Consumption	1
1.1 <i>Spices in the Domestic Food Market.....</i>	2
1.2 <i>Objective of the Policy Brief.....</i>	4
1.3 <i>Coverage and Methodology.....</i>	4
1.4 <i>Layout of the Policy Brief.....</i>	4
2. An Overview of the Indian Spices Sector and the Spices Supply Chain.....	5
2.1 <i>Spices Production in India</i>	5
2.2 <i>Fragmented Spices Supply Chain</i>	10
2.3 <i>Medium-term Projection of the Indian Spice Market under Different Scenarios ...</i>	12
3. Different Government Agencies Regulating Food Safety and Quality Standards	14
3.1 <i>Standards and Testing for Spices by Codex Alimentarius and Indian Government Bodies (FSSAI and BIS).....</i>	17
4. Food Safety and Standards: Issues and their Impact	20
4.1 <i>Regulatory Gaps.....</i>	20
4.2 <i>Issues with Laboratory Testing</i>	22
4.3 <i>Gaps in Data on Spice Production and Consumption</i>	22
4.4 <i>Poor Quality of Input, Excessive Use of Fertilisers and Pesticides, and Lack of Proper Storage and Post-Harvest Care Lead to Product Contamination</i>	23
4.5 <i>Gaps in Technology Adoption</i>	26
4.6 <i>Issues with FPOs.....</i>	26
4.7 <i>Storage Infrastructure related Gaps</i>	26
4.8 <i>Capacity and Other Human Resources Related Issues</i>	27
5. Recommendations to Streamline the Spices Market.....	27
5.1 <i>Strengthen Food Safety and Quality Standards for Spices</i>	28
5.2 <i>Streamlining Spice Laboratory Testing</i>	29
5.3 <i>Mitigate Data Gaps: Collect and Collate Data on Different Spice Varieties.....</i>	29
5.4 <i>Reduce Chemical Pesticide/Insecticide Usage and Improve Farm-Level Practices.</i>	30

5.5	<i>Technology Should be Adopted and Implemented across the Supply Chain</i>	30
5.6	<i>Establish Adequate Storage Infrastructure and Laboratories</i>	31
5.7	<i>Scaling up FPOs and Addressing their Information Gap</i>	31
5.8	<i>Address Skilled Manpower Shortages</i>	31
References		33
Appendix		40

List of Tables

Table 2.1:	Area and Production of Top Spices in 2025-26	6
Table 2.2:	Top 5 States for Red Chilli, Turmeric and Coriander in 2025-26	7
Table 2.3:	Spice Varieties, GI Tags and ODOP: Examples of Red Chilli, Turmeric and Coriander	9
Table 2.4:	Indian Spices Market: Select Studies on Current and Projected Market Size	12
Table 3.1:	Different Agencies at the Centre, and Their Roles and Responsibilities	16
Table 4.1:	Examples of Export Border Rejections of Indian Herbs and Spices (October 2025 – April 2026)	25
Table A1:	Objectives and Functions of Spices Board India and National Turmeric Board ..	40
Table B1:	Chilli Whole Standards: Codex Alimentarius vs FSSAI vs BIS	43
Table B2:	Chilli Ground/Powder Standards: Codex Alimentarius vs FSSAI vs BIS	45
Table B3:	Turmeric Whole Standards: Codex Alimentarius vs FSSAI vs BIS	47
Table B4:	Turmeric Ground/Powder Standards: Codex Alimentarius vs FSSAI vs BIS	49
Table B5:	Coriander Whole Standards: FSSAI vs BIS	51
Table B6:	Coriander Powder Standards: FSSAI vs BIS	52

List of Figures

Figure 2.1:	Spices Production and Area under Production (2023-24 to 2025-26)	5
Figure 2.2:	Share of Top Five States in Spices	6
Figure 2.3:	Indian Spices Market Estimate (2025 to 2034): Optimistic and Realistic Scenarios	13
Figure 3.1:	Spice Standards by Codex, FSSAI and BIS	18
Figure 3.2:	Spread of FSSAI-notified Primary Food Laboratories across Seven States	19

Abstract

India is known as the “Land of Spices”. In 2024-25, India produced 12.99 million tonnes of spices, accounting for a 45 per cent share in global production. Approximately 70 to 80 per cent of this is consumed in the domestic market, with food accounting for the largest end-use. In 2025, the Indian spice market for food was valued at around USD 5.15 billion. While spices are available in various forms for foods, whole and ground single spices have a market share of 63 per cent. Around 60-80 per cent of the entire spices market is in the informal sector. While there are concerns related to food safety and standards, and micro, medium and small enterprises (MSMEs) are not able to scale up into the formal branded segment, various measures have been taken by the government to help formalise the sector and ensure food safety and standards.

In this context, the objective of the policy brief is to understand the challenges in food safety and standards across the spices value chain and suggest measures to enhance food safety, formalisation of the Indian spice sector, and help MSMEs scale up into the formal segment.

Based on secondary data analysis, key informant interviews (KIIs) and stakeholder consultation, this policy brief found that the growth of the Indian spices market is below potential and even below the country’s real gross domestic product (GDP) growth. This is due to certain regulatory and standards gaps, implementation, and testing and monitoring issues, primarily in the conventional spices supply chain. Product contamination and food safety issues can happen in different parts of the supply chain, from farm to retail, because there is no traceability and little accountability, which leads to adverse public health effects.

This brief makes recommendations on strengthening supply chain traceability, product standards and testing, and data-driven policymaking to help the market formalise, integrate supply chains, ensure that food is safe for consumption and help MSMEs grow in the formal sector. If these measures are implemented, the growth rate will be doubled, and the Indian spices market will reach over USD 13 billion by 2034.

JEL Classification: I18, L66, Q13 Q18

Keywords: Spices, Supply Chain, India, Fragmentation, Food Safety and Standards, Farm to Fork

Author’s email: Arpita@icrier.res.in; mukherjeeshana@gmail.com; dube.samriddhi@gmail.com

Disclaimer: *Opinions and recommendations in the policy brief are exclusively of the author(s) and not of any other individual or institution, including ICRIER. This policy brief has been prepared in good faith on the basis of information available on the date of publication. All interactions and transactions with industry sponsors and their representatives have been transparent and conducted in an open, honest and independent manner as enshrined in ICRIER’s Memorandum of Association. ICRIER does not accept any corporate funding that comes with a mandated research area which is not in line with ICRIER’s research agenda. The corporate funding of an ICRIER activity does not, in any way, imply ICRIER’s endorsement of the views of the sponsoring organisation or its products or policies. ICRIER does not conduct research that is focused on any specific product or service provided by the corporate sponsor.*

Acknowledgement

We thank Dr. Shekhar Aiyar, Director and Chief Executive, Indian Council for Research on International Economic Relations (ICRIER), for his encouragement and support.

We express our sincere gratitude to Dr. Ramesh Chand, Distinguished Professor, ICRIER and Former Member, National Institution for Transforming India (NITI) Aayog, Government of India and to Mr. Siraj Hussain, Former Union Secretary, Ministry of Agriculture and Ministry of Food Processing, Government of India, and Advisor, Food Processing, FICCI, for reviewing this policy brief and sharing valuable inputs. We would also like to thank Mr. Tejus Gandhi, Chairman, FISS, and Mr. Udayakumar Karthik, Director, Asian Spices & Co-Chairman, FISS, for reviewing the policy brief and their valuable insights.

We are grateful to a number of experts from the industry and other stakeholders, whom we interviewed. An earlier version of this policy brief was presented at the Annual Trade Meet 2026 organised by the Federation of Indian Spice Stakeholders (FISS), on March 1, 2026. We are grateful to the participants for their suggestions and inputs.

We would also like to thank Ms. Geetika Gupta (Research Assistant, ICRIER) for reviewing this policy brief. We also thank Mr. Anu Mohandas (Programme Manager, ICRIER) for the support in facilitating the meetings and consultations, and Ms. Tara Nair for copy-editing this policy brief. We are also thankful to Mr. Rajesh Chaudhary (Associate Events, ICRIER) for formatting the policy brief.

About the Authors

DR ARPITA MUKHERJEE is a Professor at the Indian Council for Research on International Economic Relations (ICRIER). She has over 30 years of experience in policy-oriented research, working closely with the Government of India and policymakers in the European Commission and its member states, the United States of America (USA), the Association of Southeast Asian Nations (ASEAN) and in East Asian countries. She has conducted over 60 sector-specific studies for various governments, international organisations like the WHO, industry associations, non-government organisations and companies.



Her areas of expertise include services sector studies, trade and trade agreements, and health and nutrition. She specialises in sector and product-specific market trends, go-to-market strategy and government policies.

Dr Mukherjee has a PhD in Economics from the University of Portsmouth, UK. Before joining ICRIER, she worked with the UK-based think-tank Policy Studies Institute and taught at the University of Portsmouth. She has over 80 publications, including in national and international refereed journals, books, book chapters and government reports. Dr Mukherjee is a member of various government committees and policy panels and is on the editorial board of 10 journals. She has presented her work in various conferences and seminars and is on the advisory board of industry associations and non-government organisations. She is a regular contributor to newspapers and magazines.

MS. ESHANA MUKHERJEE is an External Consultant and, prior to that, was a Research Associate at ICRIER. She has worked on projects for the Indian government, foreign governments, multilateral organisations and industry associations on India's trade, investment and trade barriers. She has conducted extensive research on sectors like food processing, health and nutrition, and on issues like trade and cross-border investment flows, for Indian and multinational clients.



She completed her M.Sc. in International Economics from Erasmus School of Economics, the Netherlands, and graduated from the Gokhale Institute of Politics and Economics, Pune, with an M.Sc. in Business Economics and Finance.



MS. SAMRIDDHI DUBE is a former Junior Consultant at ICRIER. She has worked on projects focusing on health, nutrition and digital data analysis for policy framework development. In the healthcare sector, she used statistical packages to execute mixed effects and linear regression models to investigate the impact of social exposomes and policy frameworks on disease progression. Her research, which involves advanced statistical modelling and survey methodologies, serves as a key input for national policy frameworks and industry roadmaps.

She earned her Bachelor of Science in Mathematics and Economics, with a minor in Computer Science, from the University of Illinois at Urbana-Champaign.

List of Abbreviations

AGMARK	Agricultural Mark
AISEF	All India Spices Exporters Forum
APEDA	Agricultural and Processed Food Products Exports Development Authority
APMC	Agricultural Produce Marketing Committee
ASTA	American Spice Trade Association
BIS	Bureau of Indian Standards
CAC	Codex Alimentarius Commission
CAGR	Compound Annual Growth Rate
CCSCH	Codex Committee on Spices and Culinary Herbs
DASD	Directorate of Arecanut and Spices Development
e-NAM	Electronic National Agriculture Marketplace
EU	European Union
FAO	Food and Agriculture Organization
FISS	Federation of Indian Spices Stakeholders
FPO	Farmer Producer Organisations
FSSAI	Food Safety and Standards Authority of India
FY	Financial Year
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GI	Geographical Indication
Ha	Hectare
ICAR	Indian Council of Agricultural Research
IISR	Indian Institute of Spices Research
ISO	International Organisation for Standardisation
KII	Key Informant Interview
Mha	Million Hectares
MIDH	Mission for Integrated Development of Horticulture
MoAFW	Ministry of Agriculture and Farmers' Welfare
MoCI	Ministry of Commerce and Industry
MoFPI	Ministry of Food Processing Industries
MoHFW	Ministry of Health and Family Welfare
MoSPI	Ministry of Statistics and Programme Implementation
MPCE	Monthly Per Capita Consumption Expenditure

MRL	Maximum Residue Limits
MSME	Micro, Small and Medium Enterprises
MT	Metric Ton
NABARD	National Bank for Agriculture and Rural Development
NABL	National Accreditation Board for Testing and Calibration Laboratories
NCDEX	National Commodity and Derivatives Exchange
NCONF	National Centre of Organic and Natural Farming
NHB	National Horticulture Board
NHM	National Horticulture Mission
NIPHM	National Institute of Plant Health Management
NPOP	National Programme for Organic Production
NRL	National Reference Laboratories
NSO	National Statistics Office
ODOP	One District One Product
PET	Polyethylene Terephthalate
PFL	Primary Food Laboratories
PGS	Participatory Guarantee System
PIB	Press Information Bureau
PMFME	Pradhan Mantri Formalisation of Micro Food Processing Enterprises
PMKSY	Pradhan Mantri Kisan SAMPADA Yojana
R&D	Research and Development
RFL	Referral Food Laboratories
SAMPADA	Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters
SAU	State Agriculture Universities
SHC	Soil Health Card
SHG	Self-Help Groups
SHU	Scoville Heat Unit
SOC	Soil Organic Carbon
SRC	Sulphite Reducing Clostridia
UT	Union Territory
WHO	World Health Organization

Streamlining the Indian Spices Market: Issues and Way Forward

Arpita Mukherjee, Eshana Mukherjee and Samriddhi Dube

1. India: The Global Leader in Spices Production and Consumption



Known as the 'Land of Spices' or the 'Spice Bowl of the World', India dominates the global spices market through its centuries-old spices trade.
-Press Information Bureau (2025)

The global spice market is expanding, driven by increasing demand from the food and beverage, nutraceutical, cosmetic and pharmaceutical sectors. Growing health consciousness, the preference for natural ingredients, the popularity of ethnic cuisines and growth in e-commerce and packaged spice brands have boosted the global spice market (Ainapur et al., 2025; Research and Markets, 2025; Ken Research, 2025a; Renub Research, n.d.). In 2024, the global spice market was estimated at between USD 27 and

30.5 billion (Ken Research, 2025a; Research and Markets, 2025). With a compound annual growth rate (CAGR) of 6.71 per cent between 2025 and 2033, the global market is expected to reach USD 54.75 billion in 2033 (Research and Markets, 2025).

India leads global spices production with a share of 45 per cent (Ken Research 2025b). China, Vietnam, Indonesia, Nigeria and Ethiopia are some of the other key spice-producing countries.¹ As of 2025, India produced 75 of a total of 109 varieties of spices recognised by the International Organisation for Standardisation (ISO).² Among these, India is the world's leading producer of spices like red chillies, turmeric and coriander. It accounts for over 30 per cent,³ 80 per cent,⁴ and 70 per cent⁵ of global production respectively. India's annual production was estimated at approximately 12.99 million tonnes in the financial year (FY) 2024-25.⁶ India's spice exports were USD 4722.65 million in FY 2024-25 as compared to USD 4464.17 million in FY 2023-24.⁷ The spices sector accounts for approximately 9 per cent of India's total agricultural exports and over 40 per cent of horticultural exports [Press Information Bureau (PIB), 2025].

¹ <https://ufoodin.com/top-10-spices-producing-countries-the-worlds-flavor-masters/>; <https://tracextech.com/top-10-global-spice-exporters/> (Last accessed March 20, 2026).

² <https://www.ibef.org/exports/spice-industry-india> (Last accessed March 20, 2026).

³ <https://www.kenresearch.com/interviews/future-of-india-chilli-market-2030> (Last accessed March 23, 2026)

⁴ <https://turmericworld.com/exporting-country/> (Last accessed March 23, 2026)

⁵ <https://limeinstitute.org/blog/a-detailed-report-on-coriander-export-from-india/> (Last accessed March 23, 2026)

⁶ Spices Board India (2026). Spice Wise Area & Production in India. Available at <https://www.indianspices.com/sites/default/files/Major%20spice%20wise%20area%20production%202024-25%20web.pdf> (Last accessed March 23, 2026).

⁷ <https://www.indianspices.com/box2info.html> (Last accessed March 20, 2026).

India is the world's largest consumer of spices. According to market estimates, the spice market for food was around USD 5.15 billion in 2025 (see Section 2 for details). India's domestic spice consumption accounts for 75 to 80 per cent of total spice production (Ainapur et al., 2025; Ken Research, 2025b). The market is driven by deeply rooted culinary traditions, rising consumer preference for authentic flavours, increasing demand from the food processing industry and growing awareness of the health benefits of traditional spices. Rising disposable incomes and urbanisation are also key factors that boosted the demand for convenient, packaged spice products across various consumer segments (Ainapur et al., 2025). The standards for spices in India vary by their end-use. For example, turmeric with 5 per cent curcumin content is needed in nutraceuticals, while turmeric with 2 per cent curcumin content is allowed by the Food Safety and Standards Authority of India (FSSAI) for food (Mukherjee et al., 2025).

1.1 Spices in the Domestic Food Market

Food accounts for the largest end use of spices in India. The use of spices in foods can improve nutritional content and allow functional food innovation (Al-Habsi et al., 2025). Value addition improves the shelf life, helps retain the properties and reduces the wastage of spices. Processing helps to sustain demand generated throughout the year.

Whole spices, ground single spices, mixed spices and blended spices are mostly used in the preparation of food and beverages due to their ease in cooking [All India Spices Exporters Forum (AISEF) and YES Bank, 2023]. In India, whole and ground single spices had a share of 63 per cent in the spices market, driven by demand for food generated from households and institutions (covering the food processing industry, the hotel industry, etc.) (IMARC Group, 2026). Indian households use spices like turmeric, chilli powder, cumin and coriander in their daily cooking (IMARC Group, 2026). According to the 75th National Sample Survey for 2023-24, spices accounted for 3.27 per cent of the total monthly per capita consumption expenditure (MPCE), increasing from a 2.98 per cent share in 2022-23 [National Statistics Office (NSO), Ministry of Statistics and Programme Implementation (MoSPI), 2025]. Another study found that an average Indian consumes almost 271g of spices in one month (Srivastava et al., 2024). Single spices, especially whole and powdered, have seen a rise in demand from institutional buyers, such as restaurants and hotels.

Spices can be sold loose or packaged. The packaging can be in the form of single-serve sachets, pillow bags, resealable stand-up pouches, glass and polyethylene terephthalate (PET) jars, metal tins and cans, etc.⁸ The demand for good quality, clean and packaged spices is rising because of increased consumer awareness of the effects of pesticide residues and chemical contamination, and the long shelf-life and reduction in wastage due to packaging (IMARC Group, 2026; Mintel, 2025). In 2025, the sale of packaged spices (for food or other purposes) accounted for 67 per cent of the organised spice market due to their hygiene assurance, portion control and longer shelf-life (IMARC Group, 2026).

⁸ <https://qualipakmachines.com/what-are-the-different-packaging-for-spices/> Last accessed March 27, 2026).

Over the last three decades, several pan-Indian large corporates have emerged in spices manufacturing and retailing along with regional players, and micro, small and medium enterprises (MSMEs). Corporate manufacturers, retailers and e-commerce companies have developed their own spice brands.

The government has taken various measures to strengthen the spices supply chain. These include the setting up of the Spices Board India in 1987 and the National Turmeric Board in 2025, supporting the development of spice parks and promoting spices through support for the geographical indication (GI)⁹ and 'one district one product' (ODOP)¹⁰ initiatives. As of May 2025, there are eight spice parks with common processing and value addition facilities (PIB, 2025). India has around 42 GI tags in spices as of December 31, 2025.¹¹ Government schemes like the Pradhan Mantri Kisan SAMPADA Yojana (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) or PMKSY, and the Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) scheme have helped the sector formalise and expand.¹²

The FSSAI has set standards for 45 spices, such as chillies, turmeric, cumin and spice mixes.¹³ It covers whole spices, powdered spices, and oleoresins. FSSAI standards for spices regulate all stages – from post-harvesting to manufacture, storage, distribution and retail sales.¹⁴ The Bureau of Indian Standards (BIS) has set standards for 16 core spices and covers whole spices, ground spices, powders, concentrates and oleoresins, which also cover non-food safety issues like colour.¹⁵ The Spices Board India, which is primarily responsible for promoting exports, covers 52 spices,¹⁶ among which there are some whose standards are yet to be set by the FSSAI.

While the government has institutional mechanisms and policies, there are gaps in standards and implementation, often leading to food safety issues. Instances of product contamination, spices not meeting FSSAI standards and their impact on consumer health have been noted by several surveys and studies (for example, see Harke et al., 2023; Alawadhi et al., 2024; Sebastian and Praveen, 2019; Ababneh et al., 2023; Choudhary et al., 2024). Poor implementation of standards, the inability of a single agency to monitor the entire supply chain and a fragmented supply chain have also resulted in the rise of the informal sector. Around 60 to 80 per cent of the market is informal and consists of players who do not pay taxes, may sell loose, unbranded products, and may not follow food safety and standards

⁹ A GI is a sign used on products that have a specific geographical origin and possess qualities or a reputation due to that origin. For more details, see <https://www.wipo.int/en/web/geographical-indications> (Last accessed April 07, 2026).

¹⁰ The ODOP Initiative aims to convert every district in India into an export hub through the promotion of the product in which the district specialises. This will help districts foster economic and socio-cultural growth and create employment opportunities. For more details, see https://static.investindia.gov.in/s3fs-public/2023-09/II-005_ODOP%20Brochure_R4.pdf (Last accessed April 07, 2026).

¹¹ https://ipindia.gov.in/writereaddata/Portal/Images/pdf/State_wise_Registered_GI_of_India.pdf (Last accessed March 25, 2026).

¹² <https://www.indianspices.com/global-processing-hub-of-spices.html>; <https://www.ibef.org/exports/spice-industry-india> (Last accessed March 22, 2026).

¹³ https://fssai.gov.in/upload/uploadfiles/files/Chapter%202_9_Salt_Spices_Condiments%20and%20related%20products.pdf (Last accessed April 07, 2026).

¹⁴ https://fssai.gov.in/upload/uploadfiles/files/Chapter%202_9_Salt_Spices_Condiments%20and%20related%20products.pdf (Last accessed April 07, 2026).

¹⁵ <https://www.indianspices.com/quality.html> (Last accessed April 07, 2026).

¹⁶ <https://www.indiacode.nic.in/bitstream/123456789/1872/4/a1986-10.pdf> (Last accessed April 07, 2026).

requirements.¹⁷ This increases the regulatory compliance burden on the formal sector, who have to adhere to the mandatory FSSAI standards.

Thus, there is a need for India to develop a comprehensive approach to address the fragmented supply chain, help formalise the sector and ensure that safe and quality products reach the Indian consumers.

1.2 Objective of the Policy Brief

The objective of this policy brief is to understand the challenges in food safety and standards across the spices value chain and suggest measures to enhance food safety, formalise the Indian spice market, help the packaged and branded product market to expand and support MSMEs to scale up to develop their brands and packaged products.

1.3 Coverage and Methodology

Both organic and conventional spices are used in food. While there is traceability in the organic supply chain, implemented through the National Programme for Organic Production (NPOP) of the Agricultural and Processed Food Products Exports Development Authority (APEDA), and through the participatory guarantee system (PGS)-India of the National Centre of Organic and Natural Farming (NCONF), the core issues of food safety standards lie in the fragmented supply chain of conventional spices. Therefore, this policy brief covers only the conventional spices supply chain.

To examine in depth the reasons for fragmentation and the issues arising as a result, this policy brief examines in depth three of the most common whole and ground spices used in the Indian household and food industry – red chilli (referred to as chilli by FSSAI and BIS), turmeric and coriander. As of 2025, India is the leading producer of these three spices, accounting for almost 34 per cent, 80 per cent, and 70 per cent of the global production of red chillies, turmeric and coriander respectively.¹⁸ These are also commonly used spices in every household and institution.

The study is based on a literature review, secondary data analysis, 10 key informant interviews (KIIs) and one stakeholder consultation.

1.4 Layout of the Policy Brief

The policy brief is divided into five sections. Section 2 presents a brief overview of the Indian spices sector and discusses the spices supply chain. This section also presents the current market size and future growth projections under different scenarios. Section 3 presents an overview of the institutional structure for regulating food safety and quality standards.

¹⁷ <https://www.makreo.com/report/india-spices-market-size-and-forecast-2019-2029>;
<https://www.coherentmarketinsights.com/market-insight/india-spices-market-5374> (Last accessed March 23, 2026).

¹⁸ <https://www.fao.org/faostat/en/#data/QCL>, <https://www.kenresearch.com/interviews/future-of-india-chilli-market-2030>,
<https://turmericworld.com/exporting-country/>, <https://limeinstitute.org/blog/a-detailed-report-on-coriander-export-from-india/>
(Last accessed March 23, 2026)

Section 4 discusses some of the issues faced by the spices sector and their impact. Section 5 presents recommendations and measures to streamline the spices supply chain, ensure the implementation of food safety and standards, formalise the Indian spice market to double the sectoral growth rate and help the market expand to over USD 13 billion by 2034.

2. An Overview of the Indian Spices Sector and the Spices Supply Chain

Section 2.1 presents the trends in spices production in India, with a focus on red chilli, turmeric and coriander, followed by different varieties of spices. The spices supply chain is mapped in Section 2.2. Section 2.3 presents the market size and future growth projections under different scenarios.

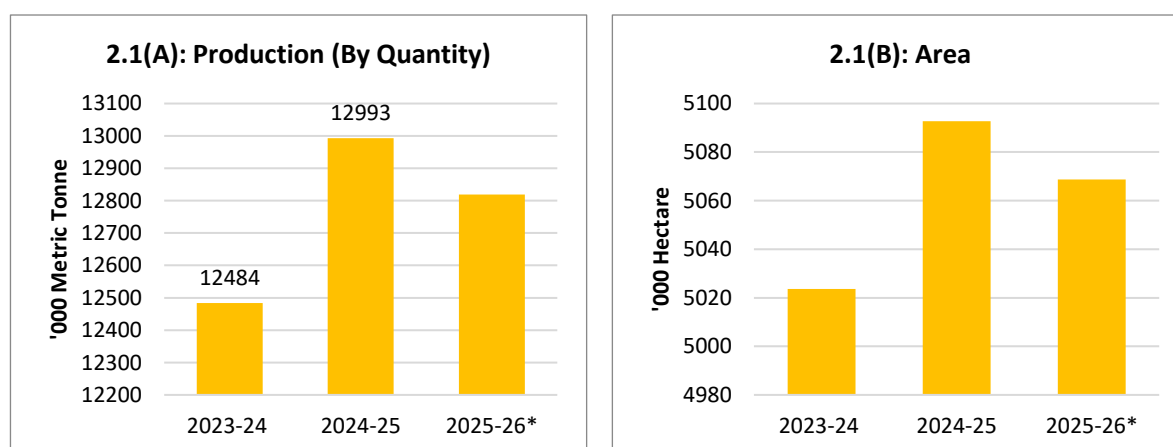
2.1 Spices Production in India

According to the Directorate of Arecanut and Spices Development (DASD), Ministry of Agriculture and Farmers' Welfare, India produces 75 spices recognised by ISO,¹⁹ out of which 25²⁰ are commercially important.²¹

Top spices by quantity of production differ from the list of top spices by the area of production, highlighting the difference in production and yield across the spices.

India produced close to 13 million tonne of spices (23 spices) from an area of 5 million hectares in 2024-25. Between 2023-24 and 2024-25, total spices production increased by 4.1 per cent, while area increased by 1.4 per cent (see Figure 2.1(A) and 2.1(B)).

Figure 2.1: Spices Production and Area under Production (2023-24 to 2025-26)



Source: Compiled from 2025-26 (First Advance Estimates): Area and Production of Horticulture Crops. Available at <https://agriwelfare.gov.in/en/StatHortEst> (Last accessed April 08, 2026).

Note: Values for 2023-24 and 2024-25 are final, while values for 2025-26 are first advance estimates.

¹⁹ <https://www.ibef.org/exports/spice-industry-india> (Last accessed May 04, 2026).

²⁰ Some of these are black pepper, chillies, ginger, turmeric, garlic, cardamom (both small and large), coriander, cumin, fennel, fenugreek, *ajwain*, celery, dill seed, nutmeg, clove, cinnamon, tamarind, saffron, vanilla, curry leaf, mint, and kokum.

²¹ <https://dasd.kerala.gov.in/spices-2/> (Last accessed March 26, 2026).

Seven spices account for over 94 per cent of the total spice production (see Table 2.1). Of these, three spices, namely garlic, ginger and red chillies (dried), account for 68 per cent (estimate) of the spices production in 2025-26.

In terms of the area under spice production, seven spices account for over 85 per cent of the area. Cumin, red chillies (dried) and coriander accounted for over half the production area (58 per cent) in 2025-26.

Table 2.1: Area and Production of Top Spices in 2025-26

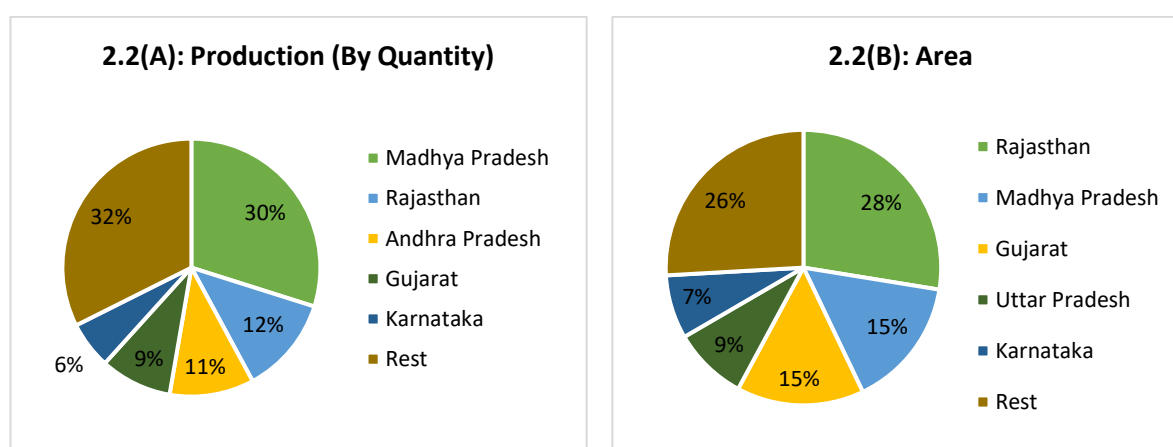
Production in '000 MT, Area in '000 Ha, Share in Per cent

Production				Area			
Rank	Spice	'000 MT	Share	Rank	Spice	'000 Ha	Share
1	Garlic	3641.5	28.4	1	Cumin	1542.6	30.4
2	Ginger	2604.5	20.3	2	Red Chillies (Dried)	785.7	15.5
3	Red Chillies (Dried)	2464.2	19.2	3	Coriander	607.8	12.0
4	Cumin	1143.4	8.9	4	Garlic	430.7	8.5
5	Turmeric	1137.6	8.9	5	Mint (Mentha)*	366.2	7.2
6	Coriander	861.6	6.7	6	Turmeric	312.1	6.2
7	Fenugreek	259.7	2.0	7	Black Pepper	288.6	5.7
Other Spices		706.0	5.5	Other Spices		735.0	14.5
Top 5		10991.2	85.7	Top 5		3733.0	73.6
Top 7		12112.5	94.5	Top 7		4333.7	85.5
Total		12818.5	100.0	Total		5068.7	100.0

Source: Compiled from 2025-26 (First Advance Estimates): Area and Production of Horticulture Crops. Available at <https://agriwelfare.gov.in/en/StatHortEst> (Last accessed April 08, 2026).

As seen in Figure 2.2(A), over 50 per cent of the total spice production is concentrated across three states, namely Madhya Pradesh, Rajasthan and Andhra Pradesh. However, as seen in Figure 2.2(B), the top states vary in terms of area under spices production, with Rajasthan, Madhya Pradesh and Gujarat accounting for almost 58 per cent of the total area under spices.

Figure 2.2: Share of Top Five States in Spices



Source: Compiled from 2025-26 (First Advance Estimates): Area and Production of Horticulture Crops. Available at <https://agriwelfare.gov.in/en/StatHortEst> (Last accessed April 08, 2026).

Taking the examples of red chilli (dried), turmeric and coriander, only a few states account for the major share of production, as well as the area under production (see Table 2.2). For example, Madhya Pradesh is estimated to produce more than half of the coriander produced in India in 2025-26, while Andhra Pradesh is estimated to produce 47 per cent of total red chillies (dried) produced. There is a need to diversify the production of spices like coriander and chillies across states to de-risk production and supply, and reduce overdependence on one state. If one state faces an issue like poor soil quality or a drought, it can affect the entire country's production.

Table 2.2: Top Five States for Red Chilli, Turmeric and Coriander in 2025-26

Area in '000 Ha, Production in '000 Metric Ton, Share in Per cent

States/UTs	Area	Share	States/UTs	Production	Share
Red Chilli (Dried)					
Andhra Pradesh	196.15	25.0	Andhra Pradesh	1167.11	47.4
Karnataka	125.78	16.0	Telangana	356.82	14.5
Madhya Pradesh	110.41	14.1	Madhya Pradesh	298.67	12.1
Telangana	85.15	10.8	Karnataka	221.44	9.0
Odisha	74.35	9.5	Odisha	89.00	3.6
Total (Top 5 states)	591.84	75.3	Total (Top 5 States)	2133.04	86.6
Total (All States)	785.68	100.0	Total (All States)	2464.18	100.0
Turmeric					
Maharashtra	87.58	28.1	Maharashtra	307.20	27.0
Odisha	34.90	11.2	Tamil Nadu	172.09	15.1
Tamil Nadu	27.16	8.7	Karnataka	106.66	9.4
Madhya Pradesh	26.55	8.5	Telangana	98.00	8.6
Andhra Pradesh	22.59	7.2	Madhya Pradesh	96.31	8.5
Total (Top 5 States)	198.79	63.7	Total (Top 5 States)	780.26	68.6
Total (All States)	312.09	100.0	Total (All States)	1137.61	100.0
Coriander					
Madhya Pradesh	327.24	53.8	Madhya Pradesh	488.17	56.66
Gujarat	125.00	20.6	Gujarat	170.00	19.73
Rajasthan	61.00	10.0	Rajasthan	90.28	10.48
Assam	31.47	5.2	Assam	34.80	4.0
Odisha	20.40	3.4	Andhra Pradesh	19.82	2.3
Total (Top 5 States)	565.10	93.0	Total (Top 5 States)	803.06	93.2
Total (All States)	607.81	100.0	Total (All States)	861.59	100.0

Source: Compiled from 2025-26 (First Advance Estimates): Area and Production of Horticulture Crops. Available at <https://agriwelfare.gov.in/en/StatHortEst> (Last accessed April 08, 2026).

The yield of spices shows very large variations across states. Karnataka, with the second largest area under red chilli, harvests only 1.76 metric tonnes per hectare (MT/Ha), whereas the yield in Andhra Pradesh is 5.9 MT/Ha, followed by Telangana (4.2 MT/Ha).

Detailed variety-wise production estimates are not available in the public domain, while consumers are getting more conscious of the different varieties and want specific varieties. Consumers are also increasingly looking at qualitative parameters like curcumin content in turmeric or pungency/heat intensity in chilli, for use in food.

Karnataka's low yields can be attributed to the state's rainfed conditions and low/high moisture stress, which have resulted in inconsistent red chilli yields and quality. This has led to reduced farmers' earnings, prompting farmers to shift to other crops with more stable/guaranteed income (Ashoka et al., 2022).

Although Maharashtra is the leading producer of turmeric, its per-hectare yield is low (3.7

There is a need to examine the reasons for the low yield of certain varieties of spices in certain states and focus on improving the yield.

MT/Ha) compared with other leading producers such as Tamil Nadu (6.34 MT/Ha). Variation in turmeric production across states can be attributed to reasons such as price fluctuations and differences in farming methods employed by

farmers (Mukherjee et al., 2025). The production yield also depends on the variety of the turmeric produced and its demand. For example, Waigon turmeric, grown in Maharashtra, has a low yield but has high demand due to its high curcumin content. A survey of turmeric farmers by the authors also noted that farmers were hesitant to expand cultivation due to an absence of a minimum support price and significant price volatility. This resulted in reduced yields and farmers switching to other crops due to financial losses (Mukherjee et al., 2025).

For coriander, productivity ranges from 1.1 MT/Ha in Assam to 1.49 MT/Ha in Madhya Pradesh (calculated from Table 2.2). Being a tropical crop, it requires frost-free climate, and thus can be grown under limited irrigated conditions of states like Madhya Pradesh and Gujarat (Msaada et al., 2007; Jadeja et al. 2026). A dry and moderately cool weather during seed formation stage increases the yield and the quality of the produce.²² High yield in Madhya Pradesh can be attributed to the presence of clay soil which is ideal in rainfed areas due to its high moisture retention.²³

Several varieties of different spices are produced in India (see Table 2.3). Depending on regional and state-specificities, the taste, smell, colour, other specific indicators and the quality of spices vary. For example, chilli varieties may vary in colour, pungency levels, wrinkles on the pod, flavour, length and oleoresin and capsaicin content. The Guntur Sannam Chilli and Warangal Chappatta, native to Andhra Pradesh, are known for their lower pungency and capsaicin content. They are widely used for colour extraction. While Byadagi Chilli, native to Karnataka, is known for its deep red colour, low pungency, wrinkles on the pod and sweet flavour, Ramnathapuram Mundu Chilli is well known for its high pungency, bright red colour and no wrinkles (Spices Board India, 2023). For turmeric, varieties depend on the percentage of curcumin content, rhizome size, aroma, flavour and oil content. For example, Erode Turmeric has a low 2.5 to 4.5 per cent curcumin content, but a unique aroma and flavour, making it popular for cooking. Its colour is golden yellow, while other varieties like Waigon turmeric, dark yellow in colour, have more than 6 per cent curcumin content and a pleasant

²² https://www.indianspices.com/sites/default/files/cultivation_practices-Coriander-1.pdf (Last accessed June 18, 2026)

²³ https://ispseeds.com/content/vegetable/ISP_Coriander.pdf (Last accessed June 18, 2026)

aroma (Spices Board India, 2023). Coriander varieties may vary in their colour, aroma, moisture content and volatile oil content.

Based on these indicators and characteristics, India had around 42 GI tags in spices as of December 31, 2025.²⁴ The GI tags and ODOP spices [under the Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme (PMFME) of the Ministry of Food Processing Industry (MoFPI)] are presented in Table 2.3.

Table 2.3: Spice Varieties, GI Tags and ODOP: Examples of Red Chilli, Turmeric and Coriander

Spices	District, State	GI Tag As on 31.12.2025	ODOP As on 19.08.2025
Red Chilli Variety			
Byadagi	Dharwar, Karnataka	✓	--
Red Chilli Chapata	Warangal District, Andhra Pradesh	✓	--
Red Chilli S4 Guntur Sannam	Guntur, Andhra Pradesh	✓	✓
Red Chilli Mundu	Ramanathapuram District, Tamil Nadu	✓	--
Turmeric Variety			
Erode Turmeric	Erode District, Tamil Nadu	✓	✓
Kandhamal Haldi	Kandhamal District, Odisha	✓	✓
Lakadong Turmeric	Jaintia Hills District, Meghalaya	✓	✓
Nizamabad Bulb	Nizamabad, Tamil Nadu	--	✓
Sangli Turmeric	Sangli District, Maharashtra	✓	✓
Vasmat Haldi	Hingoli, Maharashtra	✓	--
Waigaon Turmeric	Wardha District, Maharashtra	✓	✓
Coriander Variety			
Kasti Coriander	Latur District Maharashtra	✓	--
Kumbhraj Coriander	Guna, Madhya Pradesh	--	✓

Source: Compiled from various sources. Available at <https://globalhubexports.com/portfolio/byadgi-red-chilli/>, <https://www.protectourlivelihood.in/crops/chilli/>, <https://www.spicesindia.net/types-of-dry-red-chillies-in-india>, <https://meerajasvainternational.com/teja-s17-dried-red-chilli/>, <https://spicesontheweb.co.uk/byadgi-kdl-kaddi-kashmiri-chilli/#:~:text=This%20is%20called%20Byadgi%20Chilli,Dabbi%20with%20bags%20of%20flavour>, https://freshground.in/products/byadgi-chilli-whole-stemless-best-grade-kdl-pesticide-free-ipm-certified-single-origin?srsltid=AfmBOoqrGi5KfRmq1pVFq4ndB054utWRQrWQhcrIk-H_Ykt-zLoZRAf, https://ipindia.gov.in/writereaddata/Portal/Images/pdf/State_wise_Registered_GI_of_India.pdf, https://clusterobservatory.in/clustermap/cluster_read.php?map_id=1140&div=44, https://ipindia.gov.in/writereaddata/Portal/Images/pdf/State_wise_Registered_GI_of_India.pdf, https://ipindia.gov.in/writereaddata/Portal/Images/pdf/State_wise_Registered_GI_of_India.pdf, <https://www.india.gov.in/explore-india/odop/details/coriander> (Last accessed March 30, 2026)

The next section presents the different stages of the spices supply chain and the different stakeholders and their roles. It shows that the spices supply chain is highly fragmented, with a large number of small farmers. Traders and aggregators dominate the market.

²⁴ https://ipindia.gov.in/writereaddata/Portal/Images/pdf/State_wise_Registered_GI_of_India.pdf (Last accessed March 25, 2026).

2.2 Fragmented Spices Supply Chain

Farmers are a core component of the spices supply chain. Almost 86 per cent of farmers in India were small and marginal, with an average landholding of 1.1 ha, in 2021.²⁵ It was found during a survey that farmers put a small fraction of their agricultural land under spices (Mukherjee et al., 2025). In other words, most farmers cultivate spices along with other crops, and only a few depend on spices alone for their income and livelihood. This is to protect themselves from the price volatility of spices (Mohanakumar et al., 2023; Lal et al., 2024). One core issue in the supply chain is that multiple small farmers produce a small quantity of spices of varied quality, which makes it difficult to aggregate for quality uniformity (Rawat and Pandey, 2024). To address this issue, contract farming²⁶ is rising, and the government is promoting farmer producer organisations (FPOs) and co-operatives. Yet, even today, most companies source through aggregators/middlemen/local traders/commission agents (Lal et al., 2024; Shilpa, 2022) and through *mandis*.

Farm level practices like soil and water quality checks, quality of seeds and inputs like fertilisers and pesticides, and their usage, have implications for the quality of output and food safety. Several studies (see Section 4.4) noted that there is limited quality control over this part of the supply chain, and only a few farmers have adopted good agricultural practices (GAP). Further, FSSAI regulations do not apply to farmers. A survey of 262 turmeric farmers by the authors revealed that, although most farmers claim awareness of GAP, only 6 per cent were aware of soil testing needs and only 2 per cent were aware of correct pest and disease management (Mukherjee et al., 2025). In 2023-24, a study of 135 chilli farmers in Andhra Pradesh found that only 11.11 per cent of the non-contract farmers and 24.22 per cent of contract farmers had a high adoption level of GAP technologies (A. Aruna Kumari and K. Kalpana, 2025).

In the post-harvest stage, primary processing of spices (like cleaning, grading, curing, drying and polishing) can be done at farms or at facilities provided by FPOs, sorting units, grading units, or primary processors. Spices are often dried at farms and then transported to different processing units for post-harvest activities based on the type of spices (Momin and Jamir, 2021). Post-harvest activities may vary according to the variety of the spice and the region/state of production. For example, fresh turmeric is boiled as the first post-harvest operation at the farm or at the premises of FPOs across Telangana, Tamil Nadu, Maharashtra, Odisha and Madhya Pradesh. However, due to adverse weather conditions, turmeric farmers in Meghalaya wash the fresh turmeric, then dry and slice it instead of boiling it (Mukherjee et al., 2025).

²⁵ <https://www.pib.gov.in/FactsheetDetails.aspx?Id=148588®=3&lang=2> (Last accessed April 02, 2026).

²⁶ Contract farming (CF) is an agreement between farmers and buyers where both parties establish terms in advance for the production and marketing of agricultural products. This includes agreeing on the price, quantity, quality and delivery date. The contract may also specify details of the production methods or include the provision of inputs like seeds, fertilisers and technical assistance by the buyer (Mukherjee et al., 2025).

Despite government support for FPOs, co-operatives and self-help groups (SHGs), farmers sell only a small quantity of the produce to them; the bulk of the production goes to aggregators/middlemen/local traders/commission agents (KIs; Lal et al., 2024; Shilpa, 2022; Mukherjee et al., 2025; Mohanakumar et al., 2023). Mukherjee et al., (2025) found that only 20 per cent of the surveyed turmeric farmers sold through regulated markets, such as the electronic-National Agriculture Marketplace (e-NAM) portal and the Agricultural Produce Marketing Committee (APMC). Factors such as market infrastructure, distance from specialised markets and prices influence the decision of farmers to sell their produce in the specialised markets for spices such as cumin and coriander (Mohanakumar et al., 2023). Farmers get payments immediately if they sell to aggregators/middlemen/local traders/commission agents, who may also help finance the next cycle of the crop. Over 65 per cent of 262 turmeric farmers surveyed across six states²⁷ by the authors said that they sold their products to aggregators/middlemen/local traders/commission agents due to the immediate cash that they receive (Mukherjee et al., 2025).

In spice *mandis*, such as Ramganj in Rajasthan, Guna in Madhya Pradesh and Unjha in Gujarat, spices are sold to spice processing companies, retailers and bulk spice users such as hoteliers and/or restaurants. This is often based on the relationship between the aggregators/middlemen/local traders/commission agents and the company, and is based on the visual diagnostics and the physical characteristics of the spices (KIs, Rajkumar, 2012; Rawat and Pandey, 2024). Select *mandis* have developed for select spices.

Around 60 to 80 per cent of the processing is in the informal sector. There are some large pan-India companies, mid-sized companies and several MSMEs in this sector.

Spice processing companies in the formal sector do the testing in FSSAI-approved laboratories to ensure mandatory compliance with the FSSAI standards or voluntary BIS standards. Testing is also done by FPOs, SHGs and co-operatives, which can sell directly in the market. Companies can have their own processing units or can be engaged in contract manufacturing. Most of these companies source from aggregators/traders, then value-add, package and brand the product. Efficient logistics and infrastructure, including cold-storage chains and well-equipped warehouses and transportation facilities, are essential for preserving the quality of spices and reducing wastage at every stage from the farm to the consumer. Some large retailers have created their own brands. Yet, almost 37 per cent of the spices are sold directly to consumers in a loose/unpackaged format (IMARC Group, 2026).

A consumer or an end user, like hotels, has several purchase options. They can buy whole spices and grind them; they can buy packaged and branded products, and/or they can buy loose products. Many FPOs and co-operatives have started supplying directly to institutions at a price lower than the price of branded products. Indian consumers are price sensitive, and product pricing is a key determinant of purchase decisions (Sinha, 2021; Shinoj and Mathur,

²⁷ Telangana, Tamil Nadu, Maharashtra, Meghalaya, Orissa and Madhya Pradesh

2006). However, it is difficult to know if the loose spices go through a proper quality control process, focusing on food safety (Rajkumar, 2012; Fasiya et al., 2025).

One core issue in the spices supply chain is data and information. Agencies like the Federation of Indian Spices Stakeholders (FISS) and the National Commodity and Derivatives Exchange (NCDEX) Limited are attempting to strengthen the spice supply chain by gathering spice production data and providing market insights for farmers and the industry.

2.3 Medium-term Projection of the Indian Spice Market under Different Scenarios

Official data on the demand side of spices is not available, but several market research reports (for example, Renub Research, n.d.; Research and Markets, 2025; Zion Market Research, 2025; Coherent Market Insights, 2026) provide estimates of the current and projected market size of spices based on data collated from the industry, retail outlets, etc. The estimates differ due to differences in the coverage of spices, end uses, selection of base years and forecast years for estimation, key companies, end uses/segments, regions covered, etc. Further, the data on demand for specific spices (in terms of quantity or value), like coriander, for food is not available.

Given these data gaps and using the estimates from two studies with similar timelines and a similar classification of spices (see Table 2.4), the Indian spices market was estimated to be around USD 5.15 billion in 2025. The average CAGR for 2025-2034 of the spices markets is reported to be 4.9 per cent, which is lower than the growth rate in India's real gross domestic product (GDP), estimated at 6.5 per cent in 2025-26.²⁸

Table 2.4: Indian Spices Market: Select Studies on Current and Projected Market Size

Market Size in USD Billion, CAGR in Per Cent

Study	Market Size (Year)	Products and Segments Covered	CAGR (Year)	Projected Market Size (Year)
The Report Cube	4.98 (2025)	- By Product Type (Pure Spices, Blended Spices) - By Form (Whole, Powder, Paste, Other Forms)	3.78 (2026-2034)	6.95 (2034)
Renub Research	5.32 (2025)	- By Product Type: Pure Spices (Chilies, Ginger, Cumin, Pepper, Turmeric, Coriander, Others (Cardamom, etc.)) - By Product Type: Blended Spices - By Application (Meat and Poultry Products, Bakery and Confectionery, Frozen Foods, Snacks and Convenience Foods) - Others Forms (Powder, Whole, Crushed, Chopped)	6.11 (2026-2034)	9.07 (2034)

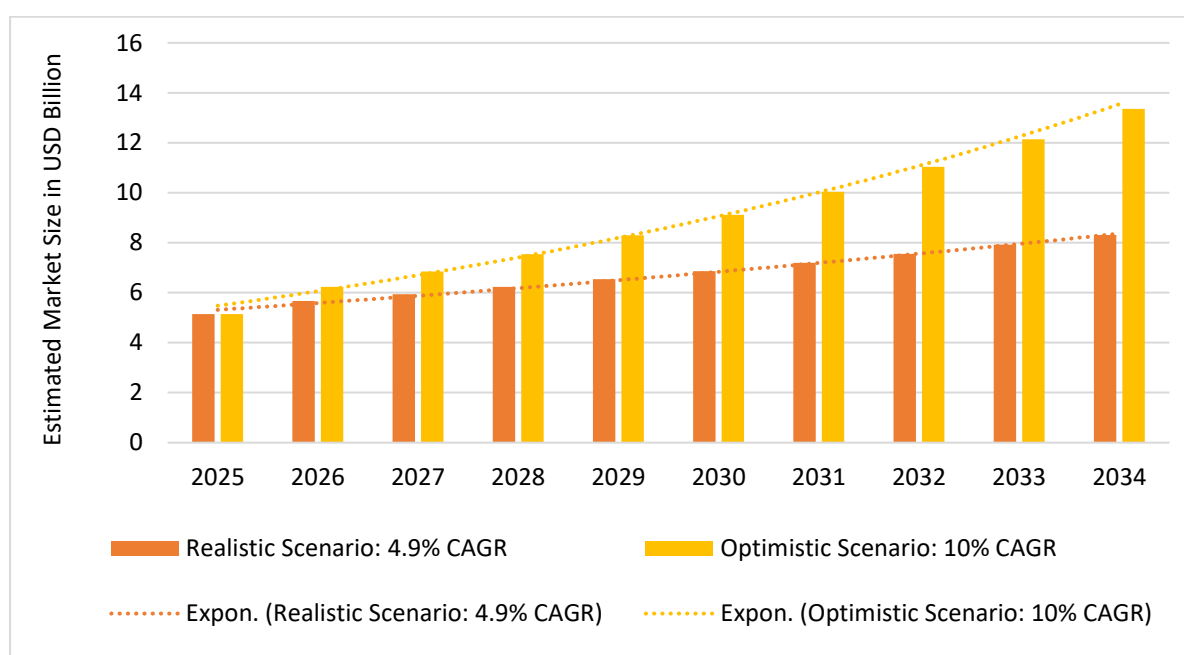
Source: Compiled from <https://www.renub.com/india-spice-market-p.php>; <https://www.thereportcubes.com/report-store/india-spices-market> (Last accessed March 27, 2026).

²⁸ https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD/IND (Last accessed May 15, 2026).

Using Table 2.4 and based on information collected through KIIs from agriculture universities, members of spices organisations like the FISS, and a survey of spices like turmeric (Mukherjee et al., 2025), the future growth of the spices market can be estimated under two different scenarios, considering the market size to be USD 5.15 billion in 2025. This is presented in Figure 2.3:

- **Realistic Scenario or Business-as-Usual Scenario:** If current industry and government efforts continue, the Indian spices market can grow at an average CAGR of 4.9 per cent between 2025 and 2034, reaching a market size of USD 8.31 billion by 2034.
- **Optimistic Scenario:** If the government and the industry take measures to streamline the spices supply chain with focus on food safety and quality, the Indian spices market can grow at a CAGR of approximately 10 per cent between 2025 and 2034 (which is twice the realistic growth rate), and reach an estimated market size of USD 13.4 billion by 2034.

**Figure 2.3: Indian Spices Market Estimate (2025 to 2034):
Optimistic and Realistic Scenarios**



Source: Estimated by the Authors

India is the global leader in spice production and consumption. Yet factors such as a large informal/unorganised market, food safety concerns and a fragmented supply chain limit the sector's potential growth. To double the growth rate and reach a market size of over USD 13 billion by 2034, the following should be done:

- There should be a government-driven robust mechanism for traceability to the farm and collection of production data for all spices by area, state, varieties, etc.

- The government/concerned departments/agencies should set a target and develop a plan for the growth of this sector.
- The government may strictly implement food safety standards across the entire supply chain with supply chain traceability. Farmers may be encouraged to adopt good agricultural practices (GAP).
- Policy should aim to formalise the sector and promote packaged and branded products.
- MSMEs should be encouraged to expand in the branded and value-added product segments.
- Gaps in governance and monitoring of the supply chain should be identified and addressed by the concerned authorities.

In the above context, the next section presents the governance structure, with focus on the (a) institutional mechanism at the centre and the states, (b) food safety and other standards for spices as designed by international bodies and Indian government agencies and (c) laboratory testing processes. It also presents initiatives of the government to streamline the spices supply chain and reduce wastage.

3. Different Government Agencies Regulating Food Safety and Quality Standards

India's governance structure is quasi-federal, with key subjects like agriculture and retail under the jurisdiction of the state. The centre can come up with broad policies, but implementation is often with the states.

The different agencies at the Centre, with their roles and responsibilities, are given in Table 3.1. Among them, FSSAI, under the Ministry of Health and Family Welfare (MoHFW), is the nodal agency for food safety standards. It has set the standards for 45 spices under the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011. It is yet to develop standards for some spices such as vanilla, tamarind, curry leaf and kokum.²⁹ FSSAI ensures the pan-India implementation of food safety standards through its four regional offices.³⁰ FSSAI standards are mandatory and have to be followed by all business operators in the spices supply chain, from the post-harvest stage to retail. FSSAI does not have regulatory authority over farmers and exports.

²⁹ Compiled from <https://www.indianspices.com/sites/default/files/spices%20list%20under%20purview%20of%20spices%20board.pdf> and https://fssai.gov.in/upload/uploadfiles/files/Chapter%202_9_Salt_Spices_Condiments%20and%20related%20products.pdf (Last accessed May 11, 2026).

³⁰ Northern Region (Delhi): Delhi, Haryana, Uttarakhand, Rajasthan, Himachal Pradesh, Punjab, Chandigarh, Uttar Pradesh, UTs of Ladakh and Jammu & Kashmir.
Southern Region (Chennai): Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Telangana and UTs of Puducherry, Lakshadweep
Eastern Region (Kolkata): West Bengal, Orissa, Bihar, Jharkhand, Chhattisgarh, Sikkim, A & N Islands, Assam, Arunachal Pradesh, Tripura, Manipur, Mizoram, Meghalaya, Nagaland.
Western Region (Mumbai): Maharashtra, Madhya Pradesh, Gujarat, Goa, Dadar and Nagar Haveli, Daman and Diu. Compiled from <https://fssai.gov.in/cms/regionaldirectors.php> (Last accessed May 11, 2026).

The Bureau of Indian Standards (BIS), under the Ministry of Consumer Affairs, Food & Public Distribution, has set voluntary standards for 16 spices (see Section 3.1), covering food safety and physical characteristics like colour, odour and flavour. BIS also does not have authority over spice quality at farm level.

Export standards are dependent on the export market, and Spices Board India, under the Ministry of Commerce and Industry (MoCI), is the nodal agency for the export of dried/whole/ground conventional spices (as listed in the Spices Board Act, 1986). Conventional fresh spice exports are under the Agricultural and Processed Food Products Export Development Authority (APEDA), MoCI. Thus, the standards for exports and the domestic market vary. India is among the few countries (the other being Australia³¹) which has different agencies monitoring standards for the domestic market and exports.

In the domestic spices supply chain, the Ministry of Agriculture and Farmers' Welfare (MoAFW) is the nodal authority at the centre, responsible for production and farmers' welfare. It has policies and schemes to support spice production. Under MoAFW, the Directorate of Arecanut and Spices Development (DASD), and the National Horticulture Board (NHB) support spice quality and standards primarily through nursery recognition and promotion of high-quality planting materials.

Spice processing is under the Ministry of Food Processing Industries (MoFPI), which has schemes to support processing through infrastructure development, capacity building, financial support for MSME producers, etc.

³¹ Standards Australia looks at export-related standards. Food Standards Australia New Zealand (FSANZ) develops standards for the domestic market. For more details, see <https://www.trade.gov/country-commercial-guides/australia-standards-trade> (Last accessed May 11, 2026).

Table 3.1: Different Agencies at the Centre, and Their Roles and Responsibilities

Ministry/Department/Agency		Role and Responsibilities
Ministry of Health and Family Welfare (MoHFW)	Food Safety and Standards Authority of India (FSSAI)	• Nodal authority for regulating food safety and health standards for the domestic market and imports • Has set mandatory quality standards for 45 spices • Has regulatory authority from post-harvest activities to retail • Does not have regulatory authority over farmers • Has notified 169 primary food laboratories for testing of spices
Ministry of Consumer Affairs, Food & Public Distribution	Bureau of Indian Standards (BIS)	• Has set voluntary standards for 16 spices, covering food safety standards and other physical characteristics like colour, odour and flavour • Has designated laboratories for testing of spices, not all of which are approved by FSSAI
Ministry of Agriculture and Farmers' Welfare (MoAFW)	Directorate of Arecanut and Spices Development (DASD)	• Co-ordinates and monitors the development of spices through ○ Government schemes like the Mission for Integrated Development of Horticulture (MIDH) ○ Programmes such as the Production and Distribution of Planting Materials of Spices and accreditation of spices nurseries • Collects and collates data on spices production (area and quantity)
	National Horticulture Board (NHB)	• Supports spice quality and standards through nursery recognition and promotion of high-quality planting materials
Ministry of Food Processing Industries (MoFPI)	--	• Supports spices processors/manufacturers through infrastructure development, capacity building and financial assistance through various schemes. For example: ○ Pradhan Mantri Kisan SAMPADA Yojana (PMKSY), the Food Safety and Quality Assurance Infrastructure sub-scheme provides financial assistance for setting up with National Accreditation Board for Testing and Calibration Laboratories (NABL) accreditation ○ Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme provides credit-linked subsidy to individual micro food processing enterprises, FPOs, SHGs and co-operatives to help them develop infrastructure for food processing facilities, and with marketing and branding

Source: Compiled by Authors from Various Sources. Available at

https://fssai.gov.in/upload/uploadfiles/files/Chapter%202_9_Salt_Spices_Condiments%20and%20related%20products.pdf, <https://www.indianspices.com/quality.html>; <https://dasd.kerala.gov.in/at-a-glance/>, NHB (2025), https://www.nhb.gov.in/guideline/Guidelines_for_Recognition_of_Spices_Nursery.pdf; MoFPI (2025), <https://pmfme.mofpi.gov.in/pmfme/#/Home-Page> (Last accessed April 01, 2026).

Overall, multiple government bodies at the centre regulate different parts of the spices value chain; there is no single nodal agency overseeing the entire spices value chain, from farm to retail. More recently, the National Turmeric Board was set up in 2025 to promote the cultivation, production, processing and marketing of turmeric. However, it is now under the Spices Board India (see Table A1 in Appendix A), which only has the mandate to promote exports. Thus, the domestic market gets neglected as the National Turmeric Board does not

have an independent budget and has to work under the Spices Board India, whose primary focus is exports. Other issues related to overlapping regulations and the lack of a single agency monitoring the entire supply chain for food safety are presented in Section 4.

Multiple agencies have also led to multiple testing requirements, with each agency having its own listed laboratories (see Section 3.1 for details of the laboratories by agencies and Section 4.2 for details of the issues related to laboratories).

At the state level, state governments may have their own priorities for promoting the production of certain spices. They have dedicated departments, like the State Horticulture Department or State Horticulture Mission, to implement centrally sponsored schemes like the National Horticulture Mission (NHM). States also have their own agricultural universities [State Agricultural Universities (SAUs)] for conducting spice-related R&D. While the centre can give broad guidelines and is responsible for food safety standards, states play a key role in the implementation of the food safety standards at the farm level, in the Agricultural Produce Marketing Committees (APMCs), etc.

3.1 Standards and Testing for Spices by Codex Alimentarius and Indian Government Bodies (FSSAI and BIS).

Apart from several agencies that set standards for spices to maintain food safety and quality in India, the Codex Alimentarius Commission (CAC) sets the international standards for spices to bring uniformity in food safety standards, although countries have the right to design their own standards as long as they are scientifically justified.³²

In India, FSSAI works closely with the CAC to ensure alignment in the FSSAI and CAC standards. The Codex Committee on Spices and Culinary Herbs (CCSCH), a subsidiary body under the CAC, is responsible for setting standards on spices and culinary herbs. It had formulated international quality and safety standards for 14 spices as of March 2026, including chilli pepper, paprika and turmeric.³³ Standards for coriander were finalised in October 2025 in the 8th session of the Codex Committee on Spices and Culinary Herbs (CCSCH8), but are yet to be adopted by the CAC (as of March 2026).³⁴

The BIS has set voluntary standards for 16 spices, including chilli, turmeric and coriander. The standards are prescribed for food safety, such as for lead content and for physical characteristics like odour, flavour and fineness (for powdered spices). For some spices like whole coriander seeds, the BIS standards are divided into two grades, Grade 1 (Special) and Grade 2 (Standard). Grade 1 has more stringent requirements with lower limits for characteristics like extraneous matter and damaged matter (see Tables B5 and B6 in Appendix B).

³² For details see the WTO Sanitary and Phytosanitary (SPS) Agreement to which India is a signatory.

³³ <https://www.fao.org/fao-who-codexalimentarius/codex-texts/list-standards/en/> (Last accessed February 28, 2026).

³⁴ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2180448®=3&lang=2> (Last accessed March 30, 2026).

The Agricultural Mark (AGMARK) certification under the Department of Agriculture, Co-operation and Farmers’ Welfare, used to be a voluntary standard; it is now obsolete as it is lower than FSSAI standards, which are a mandatory standard for food safety.

To understand how the standards may differ between Codex Alimentarius, FSSAI and BIS, we have mapped the standards for whole and ground chillies and whole and ground turmeric across the three agencies (Tables B1 and B2 in Appendix B, for chillies and Tables B3 and B4 for turmeric, respectively). Since there are no standards for coriander in Codex Alimentarius, for coriander whole and powder, FSSAI and BIS standards are compared (see Tables B5 and B6, respectively). There is partial alignment between the standards set by FSSAI and BIS, as well as between these and Codex. This variation in standards often leads to confusion among stakeholders.

Figure 3.1: Spice Standards by Codex, FSSAI and BIS

Codex Alimentarius - Codex Committee on Spices and Culinary Herbs (CCSCH)	Food Safety and Standards Authority of India (FSSAI)	Bureau of Indian Standards (BIS)
•International Voluntary Standards developed by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). •As of March 2026, the Codex Alimentarius has standards for 14 spices, including turmeric and chillies, in whole and powdered form.	•Mandatory Standards •Under the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, FSSAI has set standards for 45 spices, including chillies, coriander and turmeric. • It includes standards for spices in whole, powdered and oleoresin form.	•Voluntary Standards •The BIS sets standards for 16 spices which includes standards for odour, flavour and fineness. •It prescribes the methods for testing for each requirement. •It covers whole spices, ground spices, powders, concentrates and oleoresins. •There are two grades under the standards for whole coriander: Grade 1 (Special) and Grade 2 (Standard).

Note: (1) The Directorate of Marketing and Inspection under the Ministry of Agriculture and Farmers’ Welfare has developed the “AGMARK” standards for 28 spices. These standards are voluntary and aim to provide consumers with a higher assurance of quality; however, AGMARK standards are lower than those of FSSAI and BIS and have not been included in our comparisons.

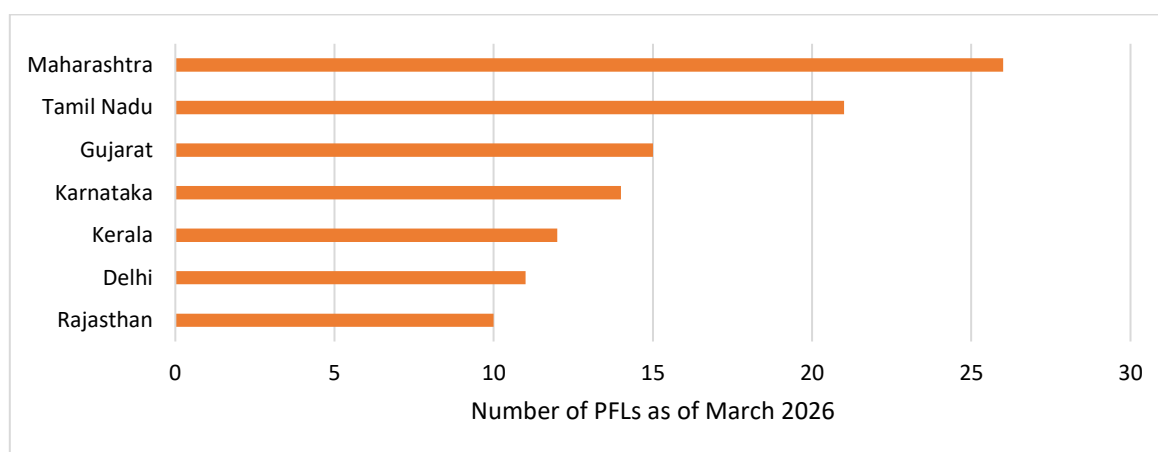
(2) The Spices Board sets standards for 52 spices for exports, which are not within the scope of our study.

Source: Compiled by the authors from FAO and WHO (2025); <https://fssai.gov.in/cms/about-fssai.php>; <https://www.indianspices.com/quality.html>; <https://www.fao.org/fao-who-codexalimentarius/codex-texts/list-standards/en/>; https://fssai.gov.in/upload/uploadfiles/files/Chapter%202_9_Salt_Spices_Condiments%20and%20related%20products.pdf; <https://standardsbis.bsbedge.com/> (Last accessed March 11, 2026).

With multiple agencies setting different standards, the testing procedures also differ by agency. Both FSSAI and BIS have their own list of approved laboratories.

The FSSAI recognises 232 primary food laboratories³⁵ (PFLs; details of the laboratories are presented in Appendix A2). Out of these, approximately 72 per cent (169 laboratories) can test herbs, spices and condiments, based on the scope of their accreditation.³⁶ These laboratories are not equally spread across India. Of the 169 spice-testing laboratories, almost 65 per cent (109 laboratories) are in just 7 states/regions (as shown in Figure 3.2). Among the north-eastern states, there are only four FSSAI-notified spice PFLs, with none in Arunachal Pradesh and Sikkim. Spice companies in these states have to travel to neighbouring states like West Bengal for spice testing. This delays the entire process and raises compliance costs.

Figure 3.2: Spread of FSSAI-notified Primary Food Laboratories across Seven States



Source: Compiled by Authors from

<https://fssai.gov.in/upload/uploadfiles/files/Validity%20order%20february.pdf> and

<https://nablwp.qci.org.in/laboratorysearchone> (Last accessed March 27, 2026).

There are 418 BIS-recognised laboratories as of March, 2026.³⁷ Yet, there is no information on the BIS webpage regarding how many BIS laboratories are equipped to test spices for use in food. While both FSSAI and BIS have their approved laboratories, the industry faces problems as all FSSAI-approved laboratories for spices testing are not recognised by BIS. Given that FSSAI requirements are mandatory, BIS should clearly identify the laboratories that can test spices for food.

The next section discusses eight key issues that limit the growth of the spices sector.

³⁵ <https://fssai.gov.in/upload/uploadfiles/files/Validity%20order%20february.pdf> (Last accessed March 27, 2026).

³⁶ <https://nablwp.qci.org.in/laboratorysearchone> (Last accessed March 27, 2026).

³⁷ <https://lims.bis.gov.in/home/labs/> (Last accessed March 11, 2026).

4. Food Safety and Standards: Issues and their Impact

The consultation with stakeholders and industry experts found that the growth of the formal spices sector is below potential. MSMEs are unable to move into the formal sector and develop brands due to eight issues, which are discussed below. These issues adversely affect quality, business development, consumer health and the country's reputation as a global spices hub.

4.1 Regulatory Gaps

There is no single nodal agency monitoring the food safety standards across the entire spices supply chain – from farm to retail – leading to the fragmented implementation of food safety regulations; if food safety is compromised and there is any contamination, it is difficult to identify the source of contamination. Specific regulatory issues are listed below.

- **FSSAI does not have Regulatory Authority over Farmers:** The food safety standards set by the FSSAI apply from the post-production stage. There are many issues related to health and safety at the farm level, including high use of pesticides and insecticides (see Section 4.4 for the impact of using high levels of pesticides and insecticides), which FSSAI cannot regulate and monitor. Stakeholders pointed out that it is difficult for the industry to establish traceability to the farm although it gets blamed for the contamination, which may actually happen at the farm level.
- **Gaps in Co-ordination between the Centre and the States:** While the centre gives broad guidelines and is responsible for food safety standards, states are responsible for agriculture production and implementation of farm-level practices. Lack of co-ordination between the centre and the states adversely impacts policy implementation.
- **Food Safety and Quality Standards Related Issues:** There are three key issues related to food safety and quality standards for spices:
 - **Limited Coverage of Spices by Standard-Setting Bodies:** At the international level, the Codex Alimentarius has standards for only 14 spices, and has not yet adopted standards for commonly used spices such as coriander. Under the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, the FSSAI has prescribed standards for 45 spices (in whole or powdered form, including spice mixes and oleoresins). Discussions with the industry highlighted that FSSAI does not have standards for commercially important spices such as tamarind, kokum and vanilla. Lack of standards leads to variation in the quality of these spices.
 - **Domestic Standards are Not Fully Aligned with Codex Alimentarius Standards:** As discussed in Section 3.1, unlike the FSSAI and BIS, the Codex Alimentarius has set specific and stringent standards for select spices. For example, for insect and mould characteristics, the Codex Alimentarius Standards have set specific quantitative limits for live and mould damage, while the FSSAI and BIS have not. The Codex Alimentarius also has more stringent limits than FSSAI and BIS for some metals and toxins. It is

worth mentioning that standards for many markets, like the United States of America or the European Union (EU), are higher than the Codex Alimentarius Standards. If Indian standards are not aligned with Codex Alimentarius, the gaps with export markets in food safety standards are greater. This increases the chances of export rejection due to contamination, as shown in Table 4.1.

- **Multiple Standard-Setting Bodies have Overlapping Regulations and Varying Standards:** There is no mapping of the objectives of various regulatory bodies, leading to overlapping goals and responsibilities. Agencies like FSSAI and BIS have different standards for spices and different training modules, causing confusion among stakeholders and consumers (Department-Related Parliamentary Standing Committee on Health and Family Welfare, 2018). For some spices, there are differences in limits set by the FSSAI and BIS. For example, while FSSAI lacks standards for curcumin content in turmeric, BIS has set limits (see Table B3). BIS also sets limits for aflatoxin B1 at 15 µg/kg, while FSSAI has not set specific limits for specific aflatoxins for turmeric and chillies (see Tables B1 to B4). Stakeholders pointed out that it is nearly impossible to meet these overlapping and multiple requirements.

Ideally, BIS should not set food safety standards, which is the domain of FSSAI, yet it does, while FSSAI lacks standards for many key spices. The multiple standards from different bodies increase compliance costs and hinder business, fostering a large informal sector that does not follow safety regulations. A study of 10,000 informal enterprises found 99 per cent prefer to remain informal, mainly due to high compliance costs (Lalchandani et al., 2024). Our consultations with stakeholders also noted that MSMEs struggle to understand how they can match the different requirements of other regulatory bodies, apart from the FSSAI. Specifically, they are unclear about the role of the BIS and its voluntary standards.

- **Food Safety Standards for Spices Do Not Account for Different Varieties of a Spice:** Different varieties of a spice have different characteristics, such as the moisture content, colour, pungency in chillies, and curcumin content in turmeric, yet the current standards do not account for these differences. For example, red chilli may have different levels of moisture content, higher than the FSSAI maximum limit of 9 per cent (see Table B1B2). Guntur chilli (G4) has a moisture level of 8.10 per cent, whereas Byadgi chilli naturally retains more water and can have moisture content up to 12.81 per cent (Bidari et al., 2009). Discussions with the industry also highlighted that, in some cases, there is a lack of specific standards, as in the case of chilli, where there is hardly any standard focusing on characteristics like colour and pungency, leading to adulteration of spices, by mixing artificial colour to enhance colour and vibrancy, mixing/blending of low-colour material with high pungency chilli, etc.
- **Poor Monitoring and Implementation of FSSAI Standards:** FSSAI standards are not implemented at the farm level, as is evident from the high use of pesticides and insecticides (see Section 4.4). There is limited implementation of standards and gaps in monitoring by FSSAI of the practices of traders/aggregators, and for loose spices, which

can be sold at a lower cost. A 2024 study in Barabanki, Uttar Pradesh, found that 1 out of 5 unpackaged turmeric powder samples was contaminated; the contamination in the case of other spices was 1 out of 5 samples for unpackaged red chilli powder and 4 out of 5 samples for unpackaged coriander powder, while none of the packaged spices was contaminated (Srivastava and Joshi, 2025). The lack of uniformity in the implementation of standards between the formal and informal sectors, as seen in studies (Srivastava and Joshi, 2025; Harke et al., 2023; Pantola and Agarwal, 2021), increases the compliance burden for the formal sector, which wants to source quality products and package and brand them.

4.2 Issues with Laboratory Testing

Different agencies, such as the FSSAI and BIS, have authorised different laboratories to test spices. Due to the variation in standards that they specify, the test results vary. During the consultations, stakeholders pointed out that due to the non-uniformity in laboratory testing, a sample passed by one laboratory can fail in another, increasing the compliance cost by INR 25,000-30,000. Additional time is then spent on appeal and getting the test result reversed. There can also be differences in laboratory results if samples that were packed and stored 6-8 months before were picked for testing.

A lack of uniformity across spice testing laboratories is increasing the compliance costs by INR 25,000 to 30,000.

The test results are also often delayed, with each test taking approximately 4 to 10 days, depending on the tests to be conducted. Some companies that have in-house laboratories are trying to reduce contamination by testing them in their own laboratories, and face fewer issues. However, the issues remain prominent for MSMEs.

According to stakeholder consultations, not all laboratories have equipment for testing all the requirements of a spice. The Department-Related Parliamentary Standing Committee on Health and Family Welfare (2018) noted that most food laboratories, including laboratories accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL), do not have facilities to test on all parameters, either because of lack of equipment or skilled manpower or both. Due to this, companies need to go to multiple laboratories to get all the required approvals for their spices.

There is also an uneven spread of spice testing laboratories across states (see Section 4.7 for infrastructure-related issues), which leads to delays in getting the results.

4.3 Gaps in Data on Spice Production and Consumption

The Department of Agriculture and Farmers' Welfare presents production data for only 23 spices (quantity and area of production) across 28 states/UTs. Production data for some commercially important spices, such as kokum, are not available. There is no spice-specific

consumption data. The spice market is highly price-volatile (Mohankumar et al., 2023; Lama et al., 2020), and with limited data, it makes it difficult for the industry to estimate the demand for spices and make a business plan, according to industry stakeholders.

There is hardly any data on spice farmers, FPOs and co-operatives. For example, although more than 8000 FPOs are registered on the MoAFW website, there is no information on which products or spices they cover. Hence, manufacturers, sourcing agents and buyers do not know whom to approach for their requirements (Mukherjee et al., 2025). While some organisations like FISS are trying to create a database of FPOs to address this issue, the industry finds it difficult to connect to the right FPOs.

There is also no consolidated list of laboratories which can test for spices under FSSAI or BIS. This makes it difficult for the industry to identify laboratories to work with.

Due to the lack of traceability and geo-tagging of farms, and a fragmented supply chain, data cannot be collected and consolidated using technology. There are gaps in data collection at the *mandis*, where aggregators/middlemen/local traders/commission agents who buy from farmers do not keep a record of each purchase. This makes it difficult to trace contaminated products back to the farms.

4.4 Poor Quality of Input, Excessive Use of Fertilisers and Pesticides, and Lack of Proper Storage and Post-Harvest Care Lead to Product Contamination

The quality of inputs at the farm level, such as seed, soil, water, fertilisers and insecticides/pesticides, impacts the quality and food safety of the spices. For example, a study in Rajasthan assessed the levels of trace elements in 80 soil samples of different spices, including coriander, to evaluate their health risks. A coriander variety from Baran district was found to have a target hazard quotient of more than one, indicating the non-carcinogenic health risks associated with the consumption of the spice (Jangir et al., 2026). In Firozabad, Uttar Pradesh, 40 spice samples were analysed to determine the prevalence of heavy metal contamination in spices available in a local market. It was found that the key sources of contamination were contaminated irrigation water and emissions from the glass industry/factories in the air and soil (Porwal, 2025).

Subsidies on chemical fertilisers incentivise their overuse, leading to an imbalance in the

Over 12 per cent of spices samples tested had pesticide residues beyond FSSAI's MRL limits (MoAFW, 2019).

application of major plant nutrients (nitrogen, phosphorus, potassium – NPK). This reduces fertiliser efficiency, negatively impacts crop yields and degrades soil quality (Mukherjee et al., 2025). Excessive use of fertilisers also leaves behind residues that survive the

drying process and concentrate these chemicals, causing the final spices to exceed legal maximum residue limits (MRLs, Patil et al., 2018). For example, in 2017-2018, out of 1,242

spice samples analysed for pesticide residue, around 150 samples had residue beyond FSSAI MRL (Ministry of Agriculture & Farmers' Welfare, 2019).

The excessive use of pesticides and fertilisers also affects soil quality. In 2025-26, under the SHC scheme, almost 92.87 lakh soil samples were tested.³⁸ Nearly 82 per cent of the samples recorded soil organic carbon (SOC) levels below the desired range of 1–1.5 per cent.³⁹ Low SOC levels weaken the nutrient-

97.05 per cent farms in Rajasthan, 96.88 per cent farms in Tamil Nadu, and 85.1 per cent of farms in Andhra Pradesh had SOC levels below the desirable range of 1-1.5 per cent.

- Soil Health Card, Cycle 2025-26

holding capacity of the soil and accelerate soil nutrient loss (Juneja et al., 2026). Major spice-producing states, such as Rajasthan, Tamil Nadu and Andhra Pradesh, have some of the lowest SOC levels.⁴⁰ Madhya Pradesh, which produces over 50 per cent of the total coriander, has one of the poorest soil qualities. Over 70 per cent of farms in Madhya Pradesh had low nitrogen.⁴¹ Poor soil health weakens crop resilience and reduces nutrient-use efficiency, often leading farmers to apply higher quantities of fertilisers to maintain productivity. Spices grown in these farms are more vulnerable to pests and diseases, with higher chances of contamination due to the higher dependence on pesticides and insecticides.

Discussions with stakeholders noted that spice contamination may happen in two ways. First, during processing, wilful offenders intentionally adulterate spices for profit by adding artificial colouring to make the spice appear vibrant or add husk to increase the quantity (Sudhabindu and Chandra, 2020; Harke et al., 2023; Pantola and Agarwal, 2021); for example, adding artificial colouring to turmeric and red chilli to enhance colour and vibrancy, mixing/blending of low-colour material with high pungency chilli. Second, contamination may be due to a knowledge gap or human error at the farm-level (such as lead contamination from the soil), or post-production processing (aflatoxin contamination due to poor storage, for instance). Farmers may not have proper post-harvest storage facilities, which increases the chances of contamination. For example, as per stakeholders' consultations, coriander seeds, stored at farms or farmers' houses, often get contaminated with mice droppings.

Industry experts also pointed out that when production is low, there is an increase in both adulteration and prices. Spice associations like FISS noted that the lower prices of contaminated products make it difficult for the industry to sell packaged and branded products.

According to FISS estimates, adulterated products adversely affect 20-25 per cent of the market share of the branded products.

Adulterants beyond the threshold limit pose health risks. For example, Sudan red dye, a common red chilli powder contaminant, is a carcinogen; other adulterants like lead and

³⁸ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2259279®=3&lang=1> (Last accessed May 13, 2026).

³⁹ <https://soilhealth.dac.gov.in/nutrient-dashboard> (Last accessed May 12, 2026).

⁴⁰ <https://soilhealth.dac.gov.in/nutrient-dashboard> (Last accessed May 13, 2026).

⁴¹ <https://soilhealth.dac.gov.in/nutrient-dashboard> (Last accessed May 13, 2026).

sawdust in turmeric, chilli and coriander powder may lead to digestive and gastrointestinal issues (Choudhary et al., 2024; Du and Zhang, 2024; Mohiuddin, 2019; Sudhabindu and Chandra, 2020; Xu et al., 2025).

Contamination can lead to loss of reputation for companies and has caused rejections of spices in the global market, affecting India's reputation as the global spice leader (Thomas et al., 2025). For example, between October 2025 and April 2026, 31 herb and spice consignments from India were rejected by the European Union due to contamination issues (as shown in Table 4.1). This adversely impacts the reputation of the country as a global spice hub. Unless basic food safety and standards are uniformly applied in the domestic market, exports are likely to continue to face rejection.

The EU rejected 31 herb and spice consignments from India between October 2025 and April 2026. This adversely affects the reputation of the country and companies.

Table 4.1: Examples of Export Border Rejections of Indian Herbs and Spices (October 2025 – April 2026)

S. No.	Reference	Type	Subject	Date	Notifying Country	Hazards
1	2026.2379	Food	Aflatoxin B1 in chilli flakes from India	20-03-2026 10:43:05	Germany	Aflatoxin B1 - {mycotoxins} aflatoxin total - {mycotoxins}
2	2026.1791	Food	Novel food – an extract from the rhizome of <i>Curcuma longa</i> L from India	04-03-2026 12:58:48	Slovenia	-
3	2026.0016	Food	Ethyleneoxide (sum) in Indian biryani masala	05-01-2026 10:43:18	Netherlands	ethylene oxide {pesticide residue}
4	2025.9864	Food	Chlorpyrifos in masala spice from India.	10-12-2025 12:06:08	Czechia	chlorpyrifos unauthorised substance {pesticide residues}
5	2025.9749	Food	Chlorpyrifos in whole coriander seeds from India	05-12-2025 11:59:20	Denmark	chlorpyrifos unauthorised substance {pesticide residues}, hexaconazole unauthorised substance {pesticide residues}
6	2025.8148	Food	Salmonella in turmeric powder	22-10-2025 15:02:46	Italy	Salmonella spp {pathogenic micro-organisms}
7	2025.7630	Food	Presenza di <i>Bacillus Cereus</i> in curcuma in polvere from India via Netherlands // Presencia de <i>Bacillus cereus</i> en cúrcuma en polvo procedente de La India a través de Países Bajos	07-10-2025 10:07:53	Italy	<i>Bacillus cereus</i> presumptive {pathogenic micro-organisms}

Source: Extracted and compiled from the RASFF notifications on consignment rejections. Available at <https://webgate.ec.europa.eu/rasff-window/screen/search> (Last accessed April 09, 2026).

Note: *as of April 09, 2026

4.5 Gaps in Technology Adoption

Low adoption of technology at the farm level results in poor record keeping of the amount and frequency of use of insecticides and pesticides. Limited traceability to the farm in the case of conventional spices makes it difficult to identify the source of contamination and address it (see Kumar et al., 2025; Mukherjee et al., 2025). There are gaps in the adoption of low-carbon processing technologies and alternatives to sun drying, such as solar drying for spices, due to the high cost (Das and Sharangi, 2018). When farmers rely only on sun drying, they are dependent on the weather, with the drying process taking a longer time and producing inconsistent quality (Elmatsani et al., 2024). Open sun drying also has a higher risk of contamination (Elmatsani et al., 2024). Improper drying, coupled with poor storage, often leads to contamination and increased wastage of spices.

4.6 Issues with FPOs

Companies are hesitant to work with FPOs due to concerns over the lack of supply consistency (Rawat and Pandey, 2024). Stakeholder consultations found that the prices charged by FPOs are 10-15 per cent higher than those of aggregators. Buyers have no way to verify an FPO's quality claims or farming practices without conducting expensive third-party audits (Fasiya et al., 2025). As a result, companies continue to source from the traders and middlemen while FPOs are unable to become a part of company supply chains (Rawat and Pandey, 2024). A survey by the authors found that over 57.6 per cent of the turmeric-FPOs rely on middlemen and agents, and 36.4 per cent use regulated markets, APMC, or e-NAM platforms (Mukherjee et al., 2025).

4.7 Storage Infrastructure related Gaps

Industry bodies like FISS estimate that cold storage capacity is only 50 per cent of what is needed in the country. There is no record of the location or capacity of these facilities, making it difficult to map existing infrastructure with availability and identify where infrastructure needs to be developed. According to the MoFPI and National Bank for Agriculture and Rural Development (NABARD) Consultancy Services (2022), a considerable amount of spices is wasted due to inadequate post-harvest management infrastructure. Poor storage conditions directly lead to aflatoxin contamination, a significant health hazard (Nejad et al., 2013; Moorthy, 2011).

There are no spice testing laboratories in some states. For example, the north-eastern states have only four FSSAI-notified primary spice testing laboratories, with none in Arunachal Pradesh, Meghalaya, Mizoram and Sikkim.⁴² There is a severe shortage of pack houses in certain districts, which can lead to product spoilage and fungus (Mukherjee et al., 2025).

⁴² Mukherjee et al. (2025) and <https://fssai.gov.in/upload/uploadfiles/files/Validity%20order%20february.pdf>; <https://nablwp.qci.org.in/laboratorysearchone> (Last accessed March 27, 2026).

4.8 Capacity and Other Human Resources Related Issues

One of the core issues is the capacity and knowledge gap at the farm level. Farmers may not be fully aware of the need for testing soil and water quality and how they should implement

A survey of 262 turmeric farmers revealed that 6 per cent were aware of soil testing needs, and 2 per cent were aware of correct pest and disease management (Mukherjee et al., 2025).

GAP at every stage of farming (Mukherjee et al., 2025). Due to the knowledge gap, farmers may not use the right fertilisers/insecticides/pesticides in the required quantity or may opt for lower-quality fertilisers or non-approved, cheap insecticides/pesticides, which may lead to lower

quality or contaminated spices. Initiatives like the SHC are trying to reduce this gap, but several farmers remain unaware of the scheme or are unable to interpret the SHC. For example, Veeraiah et al (2022) found that almost 40 per cent of farmers surveyed in Andhra Pradesh have not yet adopted the SHC recommendations, and almost 22 per cent of the surveyed farmers disagreed with the benefits and recommendations of the SHC. There is also low awareness among farmers on which pesticides are appropriate to use for which crops. For example, there is no approved pesticide for use in turmeric, despite it having one of the largest areas under production [Indian Council of Agricultural Research (ICAR) - Indian Institute of Spices Research (IISR), 2022]. This results in farmers using unapproved pesticides. Discussions with industry bodies like FISS also confirmed that farmers lack knowledge about post-harvest storage and proper drying techniques.

Almost 53 per cent of tested spice samples had residues of non-approved pesticides in 2017-18 (Ministry of Agriculture & Farmers Welfare, 2019).

The laboratories may also not have trained staff to test across all parameters (Department-Related Parliamentary Standing Committee on Health and Family Welfare, 2018). SME producers and logistics service providers may not know how to process and store the spices (Das and Sharangi, 2018). While training is being offered by various organisations, the quality of training varies and post-training monitoring is limited. Stakeholders may take the training but find it hard to implement due to various reasons, including lack of funds (A. Aruna Kumari and K. Kalpana, 2025).

The next section looks at how these issues can be addressed.

5. Recommendations to Streamline the Spices Market

This section presents eight key recommendations to double the growth of the spices market, help the formal, packaged and branded product market to grow and support MSMEs to scale up to develop their brands and packaged products.

5.1 Strengthen Food Safety and Quality Standards for Spices

The following recommendations are to strengthen food safety and quality standards for spices.

- **Single Nodal Agency to Monitor the Entire Spice Supply Chain:** Ideally, there should be a single agency monitoring the entire spice supply chain. Since many food safety issues are at the farm level, it is becoming increasingly important for FSSAI to have regulatory authority at the farm level. Given the serious health hazards caused by high MRLs and wrong farm-level practices, the Ministry of Health and Family Welfare may consider how FSSAI can help address health concerns at the farm level. One way can be for FSSAI to work closely with the state government machinery to establish farm-level food safety standards. Instead of new agencies or multiple bodies like the National Turmeric Board, there is a need for a single agency that can monitor the food safety and quality standards from farm to retail.
- **Improve Co-ordination between the Centre and the States:** The centre and the states need to co-ordinate their efforts to ensure uniform implementation of food safety standards, and ensure that appropriate measures are taken by agriculture extension workers in the states. The centre may work with the state governments to ensure that poor quality and unsafe inputs do not reach farmers. State governments also need to educate farmers on central government schemes like the soil health card, so that farmers can reap the benefits, engage in good agricultural practices (GAP) and help reduce contamination at the farm level.
- **Position India as a Global Leader for Spice Standards:** At the international level, as the host country for the Codex Committee on Spices and Culinary Herbs, India is actively working on the development and adoption of Codex Alimentarius standards for more spices. India, through the FSSAI, should take leadership and set Codex standards for the spices produced in India.
- **Reduce Overlap between Regulatory Bodies and Set Standards for All Spices:** FSSAI and BIS need to be aligned on their coverage of spices and standards to avoid overlaps. BIS should adopt and accept the standards set by the FSSAI, and FSSAI needs to set standards for all spices, especially commercially important spices like tamarind, vanilla and kokum, to reduce variation in quality. FSSAI may work with the industry and industry associations like FISS to identify a few spices where there is a need for specific standards for different varieties of a spice. For example, different moisture content may be described for different varieties of chillies. Although parameters such as pungency and colour do not directly fall under food safety, they are critical for quality control and prevention of adulteration. FSSAI has already incorporated marker-based quality parameters for some spices, like curcumin in turmeric and piperine in black pepper. This can be extended to

other spices. For example, in the case of red chilli, the Scoville Heat Unit (SHU) scale⁴³ and the American Spice Trade Association (ASTA) values⁴⁴ can be used to establish standards for different varieties.

- **Strengthen Monitoring and Implementation of FSSAI Standards:** FSSAI regulators and officers must be vigilant when inspecting certain supply chain stakeholders like aggregators/middlemen/local traders/commission agents. It should be ensured that all wilful offenders are held accountable. An offender tracking system or portal for the domestic market is needed. Apart from cancelling their FSSAI licence, there should be a system that flags or maintains a record of regular offenders in the public domain. Spices are of different qualities and rates. Since India is a huge market and not everyone can afford premium quality, lower qualities can also be traded and sold, but they should not be adulterated.
- **Extend Scope of Food Safety Measures to Farm Level:** Relevant authorities at the centre and states should collaborate to extend the scope of food safety measures to farms. This will require multi-stakeholder partnerships starting from mapping of farms to technology-based traceability to capacity-building of farms on good agriculture practices.

5.2 Streamlining Spice Laboratory Testing

There should be uniformity in testing parameters across all spice testing laboratories. This will help reduce variation in test results across laboratories and reduce compliance costs. All FSSAI-notified laboratories should also have BIS approval for spices testing. FSSAI and NABL need to work together to ensure that all accredited and notified laboratories have the requisite infrastructure and technology to conduct all types of testing in spices to facilitate ease of doing business. There is also a need for a clear package of practice for testing that has to be developed in consensus with the industry and industry associations like FISS. There must be a time commitment made by all FSSAI-notified laboratories.

5.3 Mitigate Data Gaps: Collect and Collate Data on Different Spice Varieties

A detailed database covering all spices, their varieties and the region/state-wise area under these needs to be developed and regularly updated to avoid underreporting and identify fraudulent practices. Industry and industry associations like FISS may work together to collect spice-wise consumption data. This will help accurate demand forecasting, production planning and reducing post-harvest losses.

⁴³ The Scoville Scale measures the level of pungency or heat of chilli/pepper based on the capsaicin content. It is measured in Scoville Heat Units (SHU), which represents the concentration of capsaicin. A pepper with more capsaicin is spicier than one with less. Hence, it is assigned a higher SHU. The scale ranges from 0 to more than 2.5 million SHU for the hottest chilli varieties. For more details, see <https://www.nist.gov/how-do-you-measure-it/how-do-you-measure-heat-pepper>, and <https://www.britannica.com/science/Scoville-scale> (Last accessed on April 10, 2026).

⁴⁴ The chilli ASTA value is set by the American Spice Trade Association to measure the colour intensity of chillies. It indicates the extractable colour content of a chilli variety, which is determined by its pigment concentration. It is expressed in ASTA units, with higher values representing richer and more intense colour. For more details, see <https://celliexports.com/chilli-asta-value/> and <https://astaspice.org/safe-view/27104> (Last accessed on April 10, 2026).

An online detailed database can help companies connect to their supply chain partners, especially farmers. Spice associations like FISS are working on developing a database of all suppliers, FPOs and buyers for its members. The government may partner with them to create this database.

5.4 Reduce Chemical Pesticide/Insecticide Usage and Improve Farm-Level Practices

There is an urgent need to reduce the use of chemical pesticides/insecticides and implement GAP at the farm level. Despite various organisations offering training, farm-level food safety issues persist. Training and capacity building on storage and post-harvest processing, targeting reduction in contamination, adoption of GAP, soil and water testing, and other environmental and sustainable practices will help target contamination at the farm level.

It is important to identify the kind of insecticides and pesticides needed under different climatic conditions for different types of spices, and their required quantity. Based on this, training is required on input quality, appropriate use of insecticides and pesticides and proper post-harvest storage practices. Farmers also need training on understanding and applying the recommendations of the soil health cards to help improve soil quality and crop yield. Workshops and training sessions for farmers can be conducted to educate them on keeping records of their farm practices. The government should also ensure that poor-quality inputs do not reach the farmers.

The Prime Minister has appealed to farmers to reduce the use of chemical fertilisers by 50 per cent, to protect soil health, reduce import dependence and promote sustainable natural farming.

Source:
<https://argusenglish.in/national/why-pm-modi-appealed-to-cut-chemical-fertilisers-use-by-50> (Last accessed May 13, 2026).

5.5 Technology Should be Adopted and Implemented across the Supply Chain

Food safety and standards need to be monitored, and traceability to the farm needs to be established. This is becoming an essential requirement for exports and needs to be implemented in the domestic market as well. The Agricultural and Processed Food Products Export Development Authority (APEDA) has already implemented it for organic spices, through TraceNet,⁴⁵ and other boards, like the Coffee Board of India, are using mobile applications for geotagging.⁴⁶ Industry associations like FISS may work with the state governments and undertake the activity for establishing traceability to the farms.

⁴⁵ TraceNet collects, stores and reports forward and backward traces and quality assurance data entered by the operators/producer groups and certification bodies within the organic supply chain in India. Available at: <https://traceability.apeda.gov.in/organic/tracenet/ACCESSTRACENET/Login.aspx?RequestID=87050291> (Last accessed April 2, 2026).

⁴⁶ The Coffee Board has developed a one-stop mobile app 'India Coffee App' for all actors in the coffee value chain, and an integrated mechanism to generate the polygon/geolocation of the farms. For more information, visit: https://coffeeboard.gov.in/RTI/Annual%20Report2024_2025_Hindi_Eng.pdf (Last accessed April 2, 2026).

All aggregators/middlemen/local traders/commission agents also need to maintain a record of farmers and farms from which they source their spice. This would help identify the source of the contaminated product and address the issue. For example, if spice standards are not met due to poor soil health, addressing the issue at the processing stage will not resolve the problem. Measures have to be taken to improve the soil quality. Here, technology can help establish traceability to the farm and improve record-keeping and monitoring.

5.6 Establish Adequate Storage Infrastructure and Laboratories

The centre may work with state governments to develop a system to map available infrastructure for spice storage and testing facilities, and the quality of their services. This will help identify the gap; targeted incentives can be given for the development of infrastructure, or efforts can be made to improve existing infrastructure. Adequate cold storage facilities need to be established to prevent product spoilage and reduce the incidence of aflatoxin contamination.

Sufficient laboratories, with appropriate equipment, need to be established in states where there is a shortage. Establishing well-equipped spice testing labs in all spice-producing states, and notifying of spice testing laboratories in states such as Sikkim and Arunachal Pradesh, which have no FSSAI-notified laboratories, should be prioritised.

The distribution of these facilities can be optimally aligned with the geographical concentration of spice cultivation.

5.7 Scaling up FPOs and Addressing their Information Gap

Scaling up and addressing the information/knowledge gap is crucial for spice FPOs to become a part of company supply chains. Strict monitoring of food safety standards at FPOs can also help mitigate company concerns regarding lack of consistency in supply and reduce the burden of expensive third-party audits on companies. A comprehensive database of FPOs, providing detailed product-specific information, will help companies identify and engage with the relevant FPOs. There is a need for increased support to onboard FPOs on e-commerce platforms and to educate farmers on using government platforms like e-NAM to help them expand market reach.

5.8 Address Skilled Manpower Shortages

Farm-level training on regularly testing soil and water quality and on using quality inputs such as appropriate fertilisers, insecticides or pesticides based on the crop is required. Food processing personnel should be trained on food safety methods and potential contamination that may occur. Laboratory technicians should be trained so that they can conduct all the tests required for spice testing. There is a need for capacity development and to increase the awareness of producers about quality and safety issues. Overall, a multi-stakeholder partnership for capacity building and targeted training is needed.

To conclude, MoAFW, MoFPI, FSSAI and state governments need to collaborate to double the growth of the Indian spices market. Regular data collection would support data-driven policy-making. Food safety and quality standards must be strengthened across the entire spices supply chain. Safer farm-level practices and traceability would help reduce the risk of contamination and benefit public health. Finally, the development of storage infrastructure and addressing the shortage of skilled manpower will help strengthen the monitoring of spices and overall food safety.

References

- A, Aruna Kumari & K, Kalpana (2025). Good Agricultural Practices in FPOs and Contract Farming: A Comparative study. *Archives of Current Research International*, 25(8), 673–681. <https://doi.org/10.9734/acri/2025/v25i81449> (Last accessed April 9, 2026).
- Ababneh, Q., Al-Rousan, E., Jaradat, Z., and Abulaila, S. (2023). First report of contamination of dried spices and herbs with desiccation-tolerant, biofilm-forming *A. baumannii*. *LWT – Food Science and Technology* 187, 115278. <https://doi.org/10.1016/j.lwt.2023.115278> (Last accessed March 20, 2026).
- Ainapur, S.D., BN, M.P., Prabhakar, I. and HR, M. (2025). Flavors of legacy: The evolution and prominence of India's spice industry. *International Journal of Research in Agronomy*, 8(7): 1866-1872. <https://www.doi.org/10.33545/2618060X.2025.v8.i7w.3902> (Last accessed March 20, 2026).
- Al-Habsi, N., Al-Khalili, M., Haque, S. A., Akhzami, N. A., Gonzalez-Gonzalez, C. R., Harthi, S. A., & Jufaili, S. M. A. (2025). Herbs and spices as functional food ingredients: A comprehensive review of their therapeutic properties, antioxidant and antimicrobial activities, and applications in food preservation. *Journal of Functional Foods*, 129, 106882. <https://doi.org/10.1016/j.iff.2025.106882> (Last accessed March 20, 2026).
- Alawadhi, N., Abass, K., Khaled, R., Osaili, T. M., and Semerjian, L. (2024). Heavy metals in spices and herbs from worldwide markets: A systematic review and health risk assessment. *Environmental Pollution*, 362, 124999. <https://doi.org/10.1016/j.envpol.2024.124999> (Last accessed March 20, 2026).
- All India Spices Exporters Forum (AISEF) and YES Bank (2023). Spices of India: Strides towards Markets Driven Imperatives. January 2023.
- Ashoka, N., Abdul Kareem, M, Shashidhara, N., Raju, R., Harshavardhan, M., Hongal, S., and Chandan, K. (2022). Dynamics of Chilli (*Capsicum annum* L.) production in Karnataka: An economic analysis. *Indian Journal of Economics and Development*. 18(2). https://www.researchgate.net/publication/362231800_Dynamics_of_Chilli_L_Production_in_Karnataka_An_Capsicum_annuum_Economic_Analysis (Last accessed June 03, 2026).
- Bidari, B. I., Math, K. K., and Ningnanur, B. T. (2009). Physical and chemical properties of dry chillies (*Capsicum annum* L.) grown in north Karnataka under rainfed conditions. *The Asian Journal of Horticulture*, (June to November, 2009). 4(1).173-175. <https://www.cabidigitallibrary.org/doi/pdf/10.5555/20103022176> (Last accessed May 25, 2026).

- Choudhary, B.P., Lal, R. and Kumar, P. (2024). Understanding the health implications of spice adulterations. *Journal of Postharvest Technology*, 12(3): 95-103. <https://jpht.in/MenuscryptFile/894bdfc5-9b96-4f39-bf81-6aa11cd37d52.pdf> (Last accessed June 18, 2026).
- Coherent Market Insights (2026). India Spices Market Analysis & Forecast: 2026-2033. March 2026. <https://www.coherentmarketinsights.com/market-insight/india-spices-market-5374> (Last accessed April 8, 2026).
- Das, S., & Sharangi, A. B. (2018). Impact of climate change on spice crops. In A. B. Sharangi (Ed.), *Indian spices: The legacy, production and processing of India's treasured export* (379–403). Springer. https://doi.org/10.1007/978-3-319-75016-3_14 (Last accessed April 9, 2026).
- Department-Related Parliamentary Standing Committee on Health and Family Welfare (2018), One Hundred Tenth Report on Functioning of Food Safety And Standards Authority Of India, Rajya Sabha, New Delhi, available at <https://cphfs.in/Proreport/CPHFS%20REPRESENTATION-RAJYA%20SABHA.pdf> (Last accessed March 18, 2026).
- Du, X. and Zhang, S. (2024), Adulterated Spice: Lead Poisoning, Conflicts, and Fertility. December 2024. Available at Social Science Research Network (SSRN) <https://ssrn.com/abstract=5055892> (Last accessed June 18, 2026)
- Elmatsani, H. M., Munarso, S. J., Benyamin, B., Budiyo, A., Yohanes, H., Djafar, M. J., Sjafrina, N., Koeslulat, E. E., Lukas, A., Lanjar, L., & Arianto, A. (2024). Global perspective on red chili drying: insights from two decades of research (2004–2023). *Frontiers in Sustainable Food Systems*, 8. <https://doi.org/10.3389/fsufs.2024.1456938> (Last accessed May 13, 2026).
- Fasiya, H S; P K, S.; M, H. & Thomas, A. (2025). The future of vertical coordination in high value agricultural markets: Insights from structured panel discussion. *Journal of Sustainable Technology in Agriculture*, 1(2). <https://doi.org/10.65287/josta.202512.A575> (Last accessed March 31, 2026).
- Food and Agriculture Organization (FAO) & World Health Organization (WHO) (2025). Codex: Together. <https://doi.org/10.4060/cd7427en> (Last accessed May 15, 2026).
- Harke, S., Pawar, A., and Patil, Y. Y. (2023). Quality and adulteration in ethnic spices and food ingredients in local market. *International Journal on Food Agriculture and Natural Resources*, 4(3), 21–26. <https://doi.org/10.46676/ij-fanres.v4i3.155> (Last accessed March 20, 2026).

- IMARC Group (2026). India Spices Market Size, Share, Trends and Forecast by Product Type, Application, Form, and Region, 2026-2034. <https://www.imarcgroup.com/india-spices-market> (Last accessed March 22, 2026).
- Indian Council of Agricultural Research (ICAR)-Indian Institute of Spices Research (IISR) (2022). The pesticide dilemma in spice sector: Espousing an enabling policy environment. ICAR-IISR Policy Brief No. 2. <https://spices.res.in/storage/app/public/publications/english/pdf/DXohqgTxmrSIXJCSU2kjlJoWpaeHeJs3sTLvF4T.pdf> (Last accessed May 14, 2026)
- Jadeja, S. R., Paghadar, S. F., Baraiya, V. K. and Zalavadiya, A. N. Comparative performance of Gujarat coriander – 4 (Sorath Sugandha) for yield, quality and disease resistance in Gujarat. *International Journal of Advanced Biochemistry Research* 2026; SP-10(3): 365-369. <https://www.doi.org/10.33545/26174693.2026.v10.i3Se.7882> (Last accessed June 18, 2026)
- Jangir, C. K., Aishwath, O. P., Sangwan, P. S., Panghaal, D., Yadav, H. K., Kumar, S., Saxena, S. N., Sharma, V., Kumar, S., & Meena, R. S. (2026). Assessing soil contamination and modeling trace element uptake in seed spices of Rajasthan. *International Journal of Environmental Research*, 20(86). <https://doi.org/10.1007/s41742-025-01028-7> (Last accessed March 31, 2026).
- Juneja, R., Sahu, B. Gulati, A. and Nand, S. (2026). Improving Soil Health for Better Crop Health and Human Nutrition. ICRIER. Policy Brief #62. https://icrier.org/pdf/pb63_Improving-Soil-Health-Better-Crop-Health-and-Human-Nutrition.pdf (Last accessed May 13, 2026)
- Ken Research (2025a). Global Spices Market Outlook to 2030. June 2025. <https://www.kenresearch.com/industry-reports/global-spices-market> (Last accessed March 20, 2026).
- Ken Research (2025b). Can India Defend Its 45% Global Spice Market Share Amid Rising Competition from Vietnam, China & Indonesia? October 2025. <https://www.kenresearch.com/articles/india-spice-export-analysis-and-market-outlook> (Last accessed March 20, 2026).
- Kumar, R., Chandan, K. S. H., Basetia, J., & Singh, H. (2025). Integrated Quality Assurance Framework for Indian Turmeric. *International Journal of Creative Research Thoughts (IJCRT)*, 13(5). <https://www.ijcrt.org/papers/IJCRT25A5544.pdf> (Last accessed March 31, 2026).
- Lal, C., Jakhar, B., Kait, R., Pruthi, S., & Kumar, V. (2024). Economics and marketing of selected spices and traditional crops: Insights into farmers from Haryana, India. *Problems of Agricultural Economics*, 379(2), 73–100. <https://doi.org/10.30858/zer/187581> (Last accessed April 9, 2026).

- Lalchandani, A., Dutta Barua, R. & Srinivasan, R. (2024), State of India's informal sector: A deep dive into enterprises, statistics, and segments. [https://www.microsave.net/wp-content/uploads/2024/12/State-of-Indias-Informal-Sector A-Deep-Dive-into-Enterprises-Statistics-and-Segments.pdf](https://www.microsave.net/wp-content/uploads/2024/12/State-of-Indias-Informal-Sector-A-Deep-Dive-into-Enterprises-Statistics-and-Segments.pdf) (Last accessed March 18, 2026).
- Lama, A., Singh, K. N., Shekhaway, R. S., & Gurung, B. (2020). Price dynamics of major high valued seed spices in India: an econometric insight. *Journal of Crop and Weed*, 16(1), 110–119. <https://doi.org/10.22271/09746315.2020.v16.i1.1280> (Last accessed May 15, 2026).
- Msaada, K., Hosni, K., Taarit, M. B., Chahed, T., Kchouk, M. E., Marzouk, B. (2007). Changes in essential oil composition of coriander (*Coriandrum sativum* L.) fruits during three stages of maturity. *Food Chemistry*. 2007;102(4):1131-1134.
- Ministry of Agriculture & Farmers Welfare (2019). Monitoring of Pesticide Residues in food products-Reg (File No. 7(5) 2019/Pesticides residues/RCD/FSSAI). Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi. <https://fssai.gov.in/upload/advisories/2019/10/5da705b31ca78Letter Report Pesticides MRL 16 10 2019.pdf> (Last accessed May 25, 2026).
- Ministry of Food Processing Industries (2025). Pradhan Mantri Kisan Sampada Yojana (PMKSY). Food Safety and Quality Assurance Infrastructure. MoFPI Assisted Food Testing Laboratories. Ministry of Food Processing Industries. Government of India. https://www.mofpi.gov.in/sites/default/files/guideline_12.11.2025_2_0.pdf (Last accessed March 20, 2026).
- Ministry of Food Processing Industries (MoFPI) & NABARD Consultancy Services (NABCONS) (2022), Study to Determine Post-Harvest Losses of Agri Produces in India, Government of India. https://www.mofpi.gov.in/sites/default/files/study_report_of_post_harvest_losses.pdf (Last accessed May 25, 2026).
- Mintel. (2025). India spices and seasoning market report 2025. <https://store.mintel.com/report/india-spices-seasonings-market-report> (Last accessed June 02, 2026).
- Mohanakumar, S., Joseph, K. J., and Kumar, P. (2023). Production structure and market dynamics of seed spices: A study of cumin and coriander in Rajasthan. Institute of Development Studies, Jaipur, Rajasthan, India. IDSJ Working Paper 188. <https://idsj.org/public/images/publication/1728549880.pdf> (Last accessed April 06, 2026).

- Mohiuddin, A. K. (2020). Health Hazards with Adulterated spices: Save the “Onion Tears.” *Asian Journal of Research in Pharmaceutical Sciences*. 10(1). 21-25. <https://doi.org/10.5958/2231-5659.2020.00005.3> (Last accessed May 11, 2026).
- Momin, M. C., & Jamir, A. R. (2021). Harvesting, handling and processing of spices. In S. Mitra (Ed.), *Postharvest management of horticultural crops* (458–484). Jaya Publishing House. New Delhi India. https://www.researchgate.net/publication/354916775_Postharvest_Management_of_Horticultural_Crops (Last accessed April 10, 2026).
- Moorthy, K. (2011). Determination of Aflatoxin Contamination in Various Spices. *Biosciences Biotechnology Research Asia*, 8(2): 893-900. <https://www.biotech-asia.org/vol8no2/determination-of-aflatoxin-contamination-in-various-spices/> (Last accessed March 31, 2026).
- Mukherjee, A., Dutta, S., Mukherjee, E., Gaikwad, K., Khanna, T., & Sen, N. (2025), Making India the Global Hub for Turmeric. January 2025. Academic Foundation. New Delhi.
- National Statistics Office (NSO). Ministry of Statistics and Programme Implementation (MoSPI). (2025). Household Consumption Expenditure Survey: 2023-24. August 2023 – July 2024. https://www.mospi.gov.in/sites/default/files/publication_reports/HCES%20FactSheet%202023-24.pdf (Last accessed March 22, 2026).
- Nejad, M., A. S., Bayat, M., & Ahmadi, A. A. (2013). Investigation of Aflatoxin B1 in Spices Marketed in Hyderabad, India by ELISA Method. *Journal of Pure and Applied Microbiology*, 7(4): 3219-3223. https://www.researchgate.net/publication/259949280_Investigation_of_Aflatoxin_B_1_in_Spices_Marketed_in_Hyderabad_India_by_ELISA_Method (Last accessed April 06, 2026).
- Pantola, P., & Agarwal, P. (2021). Detection of adulteration in spices. *International Journal of Advance Research and Innovation*, 9(2), 165–167. https://www.researchgate.net/publication/377490366_Detection_of_Adulteration_in_Spices (Last accessed March 31, 2026).
- Patil, V. M., Singh, S., Patel, K. G., & Patel, Z. P. (2018). Effect of sun drying and grinding on the residues of six insecticides in chilli fruits. *Pesticide Research Journal*, 30(2): 140-146. <https://doi.org/10.5958/2249-524X.2018.00023.7> (Last accessed March 31, 2026).
- Porwal, S. (2025). Study of presence of heavy metals in commercially available spices in Firozabad district. *International Journal in Physical and Applied Sciences*. 12(07). 40-57. <https://ijmr.net.in/current/2025/Jul/yrHJPO42INcXN03.pdf> (Last accessed May 25, 2026).

- Press Information Bureau (2025). Trading Aromas: The Rise of the Spice Economy. May 2025. <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/may/doc202551549001.pdf> (Last accessed March 23, 2026).
- Rajkumar, P. (2012), Spice route: Logistic journey of spices in retail supply chain perspective. *UTMS Journal of Economics* 3 (1). 9–20. <https://www.utmsjoe.mk/files/Vol.%203%20No.%201/1-A2- Rajkumar.pdf> (Last accessed March 18, 2026).
- Rawat, Pranjal & Pandey, Divyanshu (2024), Social Procurement Initiatives in the Farm Sector: A Study of the Corporate-FPO Engagement Ecosystem, available at <https://accessdev.org/wp-content/uploads/2025/11/SAP-Report-print-version-final.pdf> (Last accessed March 18, 2026).
- Renub Research (n.d.). India Spice Market Report by Products, Application, Form, States and Company Analysis 2026-2034. <https://www.renub.com/india-spice-market-p.php> (Last accessed March 20, 2026).
- Research and Markets (2025). Spice Market – Consumption Trends & Forecast 2025-2033. June 2025. <https://www.researchandmarkets.com/reports/6101939/spice-market-consumption-trends-and-forecast#product--toc> (Last accessed March 20, 2026).
- Sebastian, J. and Praveen, K.V. (2019). Performance and prospects of spice trade in India: An economic analysis. *Journal of Crop and Weed*, 15(2): 01-08 (2019). https://www.researchgate.net/publication/337275713_Performance_and_prospects_of_spice_trade_in_India_An_economic_analysis (Last accessed April 05, 2026).
- Shilpa, S. K. (2022). Participation of smallholder farmers in export of high-value spices: Role of producer organizations in India. *Artha-Vikas: Journal of Economic Development*, 58(1), 29–42. <https://www.spuvvn.edu/publication/arthvikas/Arth-Vikas-VOL%2058-1-%20Jan-June-2022.pdf#page=34> (Last accessed April 9, 2026).
- Shinoj, P., & Mathur, V. C. (2006). Analysis of demand for major spices in India. *Agricultural Economics Research Review*, 19(2). 367–376. <https://ageconsearch.umn.edu/record/57770/?v=pdf> (Last accessed April 9, 2026).
- Sinha, R. (2021). Effect of price sensitivity on consumer behaviour in the Indian retail sector. *International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management*, 8(6), 1–6.
- Spices Board India (2023). GI Spices of India. <https://online.pubhtml5.com/rjjvw/haap/> (Last accessed April 05, 2026).

- Srivastava, S.K., Sam, A.S., Mahida, D. (2024). Consumption and future demand of spices among Indian households. In: P.N. Ravindran, K. Sivaraman, S. Devasahayam, & K. N. Babu (Eds.), *Handbook of spices in India: 75 years of research and development*. (pp. 859–871). Springer, Singapore. https://doi.org/10.1007/978-981-19-3728-6_14 (Last accessed March 22, 2026).
- Srivastava, A. and Joshi, P. (2025). A quality evaluation of common spices marketed in packaged and unpackaged forms. *The Bioscan*, 20(Supplement 2), 853–858. <https://doi.org/10.63001/tbs.2025.v20.i02.S2.pp853-858> (Last accessed March 31, 2026).
- Sudhabindu, K., & Samal, K. C. (2020). Common adulteration in spices and do-at-home tests to ensure the purity of spices. *Food and Scientific Reports*, 1(9), 66–68. https://www.researchgate.net/publication/344452158_Common_adulteration_in_spices_and_Do-at-home_tests_to_ensure_the_purity_of_spices (Last accessed March 18, 2026).
- Thomas, L., Sajesh, V. K., & Sanil, P. C. (2025). Case study on recent trends in export rejections of spices from India: reasons, responses and regulatory challenges. *Plant Science Today*, 11(sp3). <https://doi.org/10.14719/pst.4201> (Original work published December 25, 2024) (Last accessed April 5, 2026).
- Xu W, Jin H, Wang Y, Wei F and Liu J (2025) Sulfur fumigation of botanical drugs: impact on chemical composition and pharmacological properties, and advances in detection technologies. *Front. Pharmacol.* 16. Article 1635850. <https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2025.1635850/full> (Last accessed May 11, 2026).
- Zion Market Research (2025). Indian Spice Market Size, Share, Growth Analysis Report Forecast 2034. June 2025. <https://www.zionmarketresearch.com/report/indian-spice-market> (Last accessed April 8, 2026).
- Veeraiah, A., Prathyusha, C., Shilpakala, V., Ramalakshmi Devi, S. and Padmodaya, B. (2022). A survey on awareness and adoption of soil health card (SHC) Recommendations by the farmers in YSR district of Andhra Pradesh. *Biological Forum – An International Journal* 14(2). 1152-1156(2022).

Appendix

Appendix A

A1. Comparison of the Objective and Function of the Spices Board India and the National Turmeric Board

Table A1: Objective and Function of Spices Board India and National Turmeric Board

Spices Board India		National Turmeric Board
Spices Board Act, 1986	Spices Board India Website	Ministry of Commerce and Industry, Notification dated October 4, 2023.
The Board may: - (i) develop, promote and regulate export of spices; (ii) grant certificate for export of spices and register brokers therefore; (iii) undertake programmes and projects for promotion of export of spices; (iv) assist and encourage studies and research for improvement of processing, quality, techniques of grading and packaging of spices; (v) strive towards stabilisation of prices of spices for export; (vi) evolve suitable quality standards and introduce certification of quality through "Quality Marking" for spices for export; (vii) control quality of spices for export; (viii) give licences, subject to such terms and conditions as may be prescribed, to the manufacturers of spices for export; (ix) market any spice, if it considers necessary, in the interest of promotion of export; (x) provide warehousing facilities abroad for spices; (xi) collect statistics with regard to spices for compilation and publication; (xii) import, with the previous approval of the Central Government, any spice for sale, and (xiii) advise the Central Government on matters relating to import and export of spices. The Board may also: (i) promote co-operative efforts among growers of cardamom;	Main Functions • Research, development and regulation of domestic marketing of small & large cardamom • Post-harvest improvement of all spices • Promotion of organic production, processing and certification of spices • Development of spices in the North East • Provision of quality evaluation services • Export promotion of all spices through support for: • Technology upgradation • Quality upgradation • Brand promotion • Research & product development Other responsibilities related to export promotion of spices: • Quality certification and control • Registration of exporters • Collection & documentation of trade information • Provision of inputs to the Central Government on policy matters relating to import & export of spices Multi-faceted activities • Promotion of exports of spices and spice products • Maintenance and monitoring of quality of exports • Development and implementation of better	The National Turmeric Board shall have the following objectives, namely, - (i) Promote new product development and value addition in turmeric; (ii) Promote awareness and consumption of turmeric and turmeric products in international markets; (iii) Facilitate market research in potential international markets for development of value-added turmeric products; (iv) Facilitate creation and improvement of infrastructure and logistics for exports of turmeric and turmeric products; (v) Encourage building of resilient and sustainable supply chains for turmeric and turmeric products by strengthening forward and backward linkages; (vi) Promote compliance with quality and safety standards across the supply chain of turmeric; (vii) Promote capacity building and skill development of turmeric growers for value addition activities; (viii) Strengthen documentation of traditional knowledge related to use of turmeric and its applications; (ix) Encourage studies, clinical trials and research on medicinal, health and

Spices Board India		National Turmeric Board
Spices Board Act, 1986	Spices Board India Website	Ministry of Commerce and Industry, Notification dated October 4, 2023.
(ii) ensure remunerative returns to growers of cardamom; (iii) provide financial or other assistance for improved methods of cultivation and processing of cardamom, for replanting cardamom and for extension of cardamom growing areas; (iv) regulate the sale of cardamom and stabilisation of prices of cardamom; (v) provide training in cardamom testing and fixing grade standards of cardamom; (vi) increase the consumption of cardamom and carry on propaganda for that purpose; (vii) register and licence brokers (including auctioneers) of cardamom and persons engaged in the business of cardamom; (viii) Improve the marketing of cardamom; (ix) collect statistics from growers, dealers and such other persons as may be prescribed on any matter relating to the cardamom industry; publish statistics so collected or portions thereof or extracts therefrom; (x) secure better working conditions and the provision and improvement of amenities and incentives for workers; and (xi) undertake, assist or encourage scientific, technological and economic research.	production methods, through scientific, technological and economic research. • Guidance to farmers on getting higher and better quality yields through scientific agricultural practices. • Provision of financial and material support to growers. • Encouraging organic production and export of spices. • Facilitating infrastructure for processing and value addition • Registration and licensing of all spice exporters. • Assistance for studies and research on better processing practices, foolproof quality management systems, improved grading methods and effective packaging techniques. • Production of promotional and educative materials in a variety of media for the benefit of exporters and importers.	wellness enhancing properties of turmeric; and (x) Any other objective as may be determined by the Central Government for promotion and development of the turmeric sector.

Source: Extracted from

<https://www.indianspices.com/sites/default/files/SpicesBoardAct1986andSpicesBoardRules1987.pdf> ; <https://www.indianspices.com/about-us/constitution.html>; <https://www.pureearth.org/wp-content/uploads/2023/11/National-Turmeric-Board-Gol-notification.pdf> (Last accessed May 11, 2026).

A2. Laboratory Testing for Spices

The FSSAI has notified food testing laboratories in the following categories:

- Primary Food Laboratories (PFLs): For analysing samples to ensure they meet the standards set by the FSSAI.⁴⁷ There were 232 PFLs across India as of March 2026.⁴⁸
- Referral Food Laboratories (RFLs): For analysing appeal samples and act as the final authority for testing food samples that fail primary analysis or are disputed.⁴⁹ There are 24 RFLs as of December 2025.⁵⁰ The RFLs can be general food laboratories, such as the National Food Laboratory in Maharashtra, or product-specific, for spices. Select RFLs test for water, soil or pesticide in food products, such as the Pesticide Formulation and Residue Analytical Centre, National Institute of Plant Health Management (NIPHM) in Telangana.
- National Reference Laboratories (NRLs): To set up country-wide standards for routine procedures, validation of standard testing methods, development of new methods and ensuring proficiency in testing across food laboratories with special reference to risks or food categories.⁵¹ As of August 2023, there were 11 NRLs; there is no dedicated NRL for spices.⁵²

⁴⁷ <https://fssai.gov.in/cms/food-laboratories.php> (Last accessed March 27, 2026).

⁴⁸ <https://fssai.gov.in/upload/uploadfiles/files/Validity%20order%20february.pdf> (Last accessed March 27, 2026).

⁴⁹ https://fssai.gov.in/upload/uploadfiles/files/Lab_Sample_Regulations.pdf (Last accessed March 27, 2026).

⁵⁰ <https://fssai.gov.in/upload/uploadfiles/files/Referral%20Laboratories%20notified%20under%20section%2043.pdf> (Last accessed March 30, 2026).

⁵¹ <https://fssai.gov.in/cms/food-laboratories.php> (Last accessed March 27, 2026).

⁵² <https://fssai.gov.in/upload/uploadfiles/files/Office%20Order%20of%20list%20of%20laboratories%20approved%20as%20NRLs.pdf> (Last accessed March 27, 2026)

Appendix B: Comparison of Spices Standards Across Multiple Regulators: Codex Alimentarius vs FSSAI vs BIS

Table B1: Chilli Whole Standards: Codex Alimentarius vs FSSAI vs BIS

Characteristic	Codex Alimentarius	FSSAI	BIS
Mandatory or Voluntary	Voluntary	Mandatory	Voluntary
Common Name	Chilli Pepper	Chillies and Capsicum (Lal Mirchi)	Chillies and Capsicum (Lal Mirch)
Scientific Name	<i>Capsicum annum L., Capsicum frutescens L., Capsicum baccatum var. pendulum (Willd.) Eshbaugh, (synonym of Capsicum frutescens L.) Capsicum chinense Jacq., Capsicum pubescens Ruiz & Pav</i>	<i>Capsicum annum L., Capsicum frutescens L.</i>	<i>Capsicum frutescens Linnaeus and Capsicum annum Linnaeus</i>
Extraneous matter	≤ 1 per cent (w/w)	≤ 1 per cent by weight	≤ 1 per cent (m/m)
Unripe and marked fruits	-	≤ 2 per cent by weight	≤ 2 per cent by weight
Broken fruits, seeds and fragments	≤ 10 per cent (w/w)	≤ 5 per cent by weight	≤ 5 per cent by weight
Moisture	≤ 11 per cent by mass	≤ 11 per cent by weight	≤ 11 per cent by mass
Total ash on dry basis	≤ 10 per cent by mass	≤ 8 per cent by weight	≤ 8 percent by mass
Ash insoluble in dilute HCl on dry basis	≤ 1.6 per cent by mass	≤ 1.3 per cent by weight	≤ 1.3 per cent by mass (Acid insoluble ash on dry basis)
Insect damaged matter	≤ 3 per cent (w/w) [Combined with Mould damage]	≤ 1 per cent by weight	≤ 1 per cent (m/m)
Total Aflatoxin	≤ 20 µg/kg**	≤ 30 µg/kg*	≤ 30 µg/kg
Aflatoxin B1	-	-	≤ 15 µg/kg
Pungency Scoville Heat Units	≥ 900	-	≥ 24,000****
Off size	≤ 5 per cent (w/w)	-	-
Other similar varieties	≤ 10 per cent (w/w)	-	-
Salmonella	“The products should comply with any microbiological criteria established in accordance with the principles and guidelines for the establishment and application of microbiological criteria related to foods (CXG 21-1997)”	Absent in 25g***	Absent in 25g
Bacillus cereus		10 ³ to 10 ⁴ ***	10 ³ to 10 ⁴
Sulphite Reducing Clostridia (SRC)		10 ² to 10 ³ ***	10 ² to 10 ³
Aerobic Colony Count		10 ⁶ to 10 ⁷ ***	-
Yeast and Mould Count		10 ⁴ to 10 ⁵ ***	-
Enterobacteriaceae		10 ² to 10 ³ ***	-
Staphylococcus aureus		10 ² to 10 ³ ***	-
Mammalian excreta & other excreta	≤ 1 mg/kg	“The pods shall be free from mould, living and dead insects, insect	“Shall be free from living insects and shall be practically free from mould growth,
Foreign matter	≤ 0.5 per cent w/w		

Characteristic	Codex Alimentarius	FSSAI	BIS
Live insects	0 count/100g	fragments, rodent contamination."	dead insects, insect fragments and rodent contamination, visible to the naked eye or using the required magnifying instrument."
Odour, Colour and Added Colour	"The product shall have a characteristic odour, flavour and colour which can vary depending on geoclimatic factors/conditions and shall be free from any foreign odour, flavour or colour, especially from rancidity and mustiness. The product shall be free from any adulteration."	"The product shall be free from extraneous colouring matter, coating of mineral oil and other harmful substances."	"The ground chillies and capsicum shall be free from extraneous colouring matter and flavouring matter."
Food Additives	"Anticaking agents listed in Table 3 of the General standard for food additives (CXS 192-1995) are acceptable for use in ground/powdered form of product conforming to this standard."	-	-

* As per the Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011, available at https://fssai.gov.in/upload/uploadfiles/files/Contaminants_Regulations.pdf (Last accessed February 19, 2026).

** As per the CXS 193-1995, General standard for contaminants and toxins in food and feed, available at https://www.fao.org/fao-who-codexalimentarius/sh-proxy/fr/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+193-1995%252FCXS_193e.pdf (Last accessed February 19, 2026).

*** As per Table 3, Appendix B of the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, available at [https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B(1).pdf) (Last accessed February 22, 2026).

**** The chilli with a lower Scoville index than those specified may be supplied, as agreed between the purchaser and the supplier.

Source: Compiled from https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+353-2022%252FCXS_353e.pdf; https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf; Bureau of International Standards, 2023, IS 3222:2023 Spices and Condiments - Chillies and Capsicum (Lal Mirch), Whole and Ground (Powdered) (Last accessed February 20, 2026).

Table B2: Chill Ground/Powder Standards: Codex Alimentarius vs FSSAI vs BIS

Characteristic	Codex Alimentarius	FSSAI	BIS
Mandatory or Voluntary	Voluntary	Mandatory	Voluntary
Common Name	Chilli Peppers	Chillies and Capsicum (Lal Mirchi)	Chillies and Capsicum (Lal Mirch)
Scientific Name	<i>Capsicum annuum</i> L., <i>Capsicum frutescens</i> L., <i>Capsicum baccatum</i> var. <i>pendulum</i> (Willd.) Eshbaugh, (synonym of <i>Capsicum frutescens</i> L.) <i>Capsicum chinense</i> Jacq., <i>Capsicum pubescens</i> Ruiz & Pav	<i>Capsicum annuum</i> L., <i>Capsicum frutescens</i> L.	<i>Capsicum frutescens</i> Linnaeus and <i>Capsicum annuum</i> Linnaeus
Moisture	≤ 11 per cent by mass	≤ 11 per cent by weight	≤ 11 per cent by mass
Total ash on dry basis	≤ 10 per cent by mass	≤ 8 per cent by weight	≤ 8 per cent by mass
Ash insoluble in dilute HCl on dry basis/Acid insoluble ash on dry basis	≤ 1.6 per cent by mass	≤ 1.3 per cent by weight	≤ 1.3 per cent by mass
Crude Fibre	-	≤ 30 per cent by weight	≤ 30 per cent by mass
Non-volatile ether extract on dry basis	-	≥ 12 per cent by weight	≥ 12 per cent by weight
Total Aflatoxin	≤ 20 µg/kg***	≤ 30 µg/kg**	≤ 30 µg/kg
Aflatoxin B1	-	-	≤ 15 µg/kg
Pungency Scoville Heat Units	≥ 900	-	≥ 24,000****
Salmonella	“The products should comply with any microbiological criteria established in accordance with the principles and guidelines for the establishment and application of microbiological criteria related to foods (CXG 21-1997)”	Absent in 25g***	Absent in 25g
Bacillus cereus		10 ³ to 10 ⁴ ***	10 ³ to 10 ⁴
Sulphite Reducing Clostridia (SRC)		10 ² to 10 ³ ***	10 ² to 10 ³
Aerobic Colony Count		10 ⁶ to 10 ⁷ ***	-
Yeast and Mold Count		10 ⁴ to 10 ⁵ ***	-
Enterobacteriaceae		10 ² to 10 ³ ***	-
Staphylococcus aureus		10 ² to 10 ³ ***	-
Odour and Flavour	“The product shall have a characteristic odour, flavour and colour which can vary depending on geoclimatic factors/conditions and shall be free from any foreign odour, flavour or colour, especially from rancidity and mustiness. The product shall		“Chillies and capsicum, shall have a characteristic pungent taste. It shall be free from foreign taste and flavour including rancidity and mustiness.”
Colour		“The powder shall be dry, free from dirt, extraneous colouring matter, flavouring matter, mineral oil and	“The ground chillies and capsicum may vary in colour from dark blackish red to orange yellow according to the variety.”

Characteristic	Codex Alimentarius	FSSAI	BIS
	be free from any adulteration."	other harmful substances."	"The ground chillies and capsicum shall be free from extraneous colouring matter and flavouring matter."
Fineness	-	-	"The chillies and capsicum, ground shall be ground to such fineness that all of it passes through 500 µm IS Sieve and nothing remains on the sieve."
Rodent Hair	≤ 6 count/25g	"It shall be free from mould, living and dead insects, insect fragments, rodent contamination."	"Shall be free from living insects and shall be practically free from mould growth, dead insects, insect fragments and rodent contamination, visible to the naked eye or using the required magnifying instrument."
Insect fragments	≤ 50 count/25g		
Mould damage	≤ 20 percent w/w		
Live insects	0 count/100g		
Food Additives	"Anticaking agents listed in Table 3 of the General standard for food additives (CXS 192-1995) are acceptable for use in ground/powdered form of product conforming to this standard."	"The chilli powder may contain any edible vegetable oil to a maximum limit of 2.0 percent by weight under a label declaration for the amount and nature of oil used."	"It may contain any edible oil up to a maximum of 2 percent by mass. The amount and name of the oil used shall be declared on the label."

* As per the Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011, available at https://fssai.gov.in/upload/uploadfiles/files/Contaminants_Regulations.pdf (Last accessed February 19, 2026).

** As per the CXS 193-1995, General standard for contaminants and toxins in food and feed, available at https://www.fao.org/fao-who-codexalimentarius/sh-proxy/fr/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+193-1995%252FCXS_193e.pdf (Last accessed February 19, 2026).

*** As per Table 3, Appendix B of the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, available at [https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B(1).pdf) (Last accessed February 22, 2026).

**** The chilli with a lower Scoville index than those specified may be supplied, as agreed between the purchaser and the supplier.

Source: Compiled from https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+353-2022%252FCXS_353e.pdf; https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf; Bureau of International Standards, 2023, IS 2322:2023 Spices and Condiments - Chillies and Capsicum (Lal Mirch), Whole and Ground (Powdered) (Last accessed February 20, 2026).

Table B3: Turmeric Whole Standards: Codex Alimentarius vs FSSAI vs BIS

Characteristic	Codex Alimentarius	FSSAI	BIS
Mandatory or Voluntary	Voluntary	Mandatory	Voluntary
Common Name	Turmeric	Turmeric (Haldi)	Turmeric (Haldi)
Scientific Name	<i>Curcuma longa</i> L. (<i>Curcuma domestica</i> Valetton)	<i>Curcuma longa</i> L.	<i>Curcuma longa</i> Linn. Or <i>Curcuma domestica</i> Valetton
Extraneous matter	≤ 0.5 per cent (w/w)	≤ 1.0 per cent by weight	≤ 1 per cent (m/m)
Foreign matter	≤ 0.5 per cent (w/w)	-	-
Defective Rhizomes	≤ 5 per cent (w/w)	≤ 5.0 per cent by weight	≤ 5 per cent (m/m)
Moisture	≤ 12 per cent (w/w)	≤ 12.0 per cent by weight	≤ 12 per cent by mass
Total ash on dry basis	≤ 8 per cent (w/w)	-	-
Acid insoluble ash on dry basis	≤ 1.5 per cent (w/w)	-	-
Insect damaged/defiled matter	≤ 1 per cent (w/w)	≤ 1.0 per cent by weight	≤ 1 per cent (m/m)
Curcuminoids/Curcumin content (colouring powder) on dry basis	≥ 2 per cent (w/w)	-	≥ 2 per cent by mass
Live insects	0 count/100g	"It shall be free from mould, living and dead insects, insect fragments, rodent contamination."	"Whole turmeric shall be free from living insects and moulds, and shall be practically free from dead insects, insect fragments and contamination by rodents, visible to the naked eye (corrected, if any, for abnormal vision)."
Mould/Contamination	≤ 3 per cent (w/w) visible mould		
Whole insects, dead	≤ 3 count/100g		
Mammalian excreta	≤ 6.6 mg/kg		
Other excreta	≤ 6.6 mg/kg		
Test for Lead Chromate	-	Negative	Negative
Food Additives	"Anticaking agents listed in Table 3 of the General standard for food additives (CXS 192-1995) are acceptable for use in ground/powdered form of product conforming to this standard."****	"The product shall be free from lead chromate, added starch and any other extraneous colouring matter"	-
Odour, Taste and Flavour	"The product shall have a characteristic odour, flavour, and colour, which can vary depending on geoclimatic factors/conditions, and shall be free from any foreign odour, flavour, and colour especially from rancidity and mustiness."	"The product shall have characteristic odour and flavour and shall be free from mustiness or other foreign flavours."	"Turmeric, whole, shall have the characteristic odour and flavour of the spice. It shall be free from mustiness or other foreign flavours."
Rhizome Guidelines	-	"The rhizomes shall be cured by soaking	-

Characteristic	Codex Alimentarius	FSSAI	BIS
		them in boiling water and then drying them to avoid regeneration. The rhizome should be in natural state or machine polished.”	
Lead	≤ 2mg/kg**	≤ 10 ppm*	≤ 10 ppm
Copper	-	≤ 5 ppm*	≤ 5 ppm
Arsenic	-	≤ 0.1 ppm*	≤ 0.1 ppm
Zinc	-	≤ 25 ppm*	≤ 25 ppm
Cadmium	-	≤ 0.1 ppm*	≤ 0.1 ppm
Tin	-	≤ 0.01 ppm*	≤ 0.01 ppm
Total Aflatoxin	≤ 20 µg/kg**	≤ 30 µg/kg*	≤ 30 µg/kg
Aflatoxin B1	-	-	≤ 15 µg/kg
Salmonella	“The products should comply with any microbiological criteria established in accordance with the principles and guidelines for the establishment and application of microbiological criteria related to foods (CXG 21-1997)”	Absent in 25g***	Absent in 25g
Bacillus cereus		10 ³ to 10 ⁴ ***	10 ³ to 10 ⁴
Sulphite Reducing Clostridia (SRC)		10 ² to 10 ³ ***	10 ² to 10 ³
Aerobic Colony Count		10 ⁶ to 10 ⁷ ***	-
Yeast and Mold Count		10 ⁴ to 10 ⁵ ***	-
Enterobacteriaceae		10 ² to 10 ³ ***	-
Staphylococcus aureus		10 ² to 10 ³ ***	-

* As per the Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011, available at

https://fssai.gov.in/upload/notifications/2020/08/5f3d09f97b78aGazette_Notification_Limit_Metal_19_08_2020.pdf (Last accessed May 15, 2026).

** As per the CXS 193-1995, General standard for contaminants and toxins in food and feed, available at https://www.fao.org/fao-who-codexalimentarius/sh-proxy/fr/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+193-1995%252FCXS_193e.pdf (Last accessed February 19, 2026).

*** As per Table 3, Appendix B of the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, available at [https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B(1).pdf) (Last accessed February 22, 2026).

**** Available at https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+192-1995%252FCXS_192e.pdf (Last accessed March 9, 2026).

Source: Compiled from https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCXS+359-2024%252FCXS_359e.pdf; https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf; Bureau of International Standards, 2022, IS 3576:2022 Spices and Condiments — Turmeric, Whole and Ground — Specification (Last accessed February 20, 2026).

Table B4: Turmeric Ground/Powder Standards: Codex Alimentarius vs FSSAI vs BIS

Characteristic	Codex Alimentarius	FSSAI	BIS
Mandatory or Voluntary	Voluntary	Mandatory	Voluntary
Common Name	Turmeric	Turmeric (Haldi) powder	Turmeric (Haldi) powder
Scientific Name	<i>Curcuma longa</i> L. (<i>Curcuma domestica</i> Valetton)	<i>Curcuma longa</i> L.	<i>Curcuma longa</i> Linn. Or <i>Curcuma domestica</i> Valetton
Moisture	≤ 10 per cent (w/w)	≤ 10.0 per cent by weight	≤ 10 per cent by mass
Total ash on dry basis	≤ 9 per cent (w/w)	≤ 9.0 per cent by weight	≤ 9.0 per cent by mass
Acid insoluble ash on dry basis	≤ 1.5 per cent (w/w)	≤ 1.5 per cent by weight (in dil. HCl)	≤ 1.5 per cent by mass (in dilute HCl)
Curcuminoids/Curcumin content	≥ 2 per cent (w/w)	≥ 2.0 per cent by weight	≥ 2 per cent by mass
Total Starch on dry basis	-	≤ 60.0 per cent by weight	≤ 60.0 per cent by mass
Test for Lead Chromate	-	Negative	Negative
Lead	≤ 2mg/kg**	≤ 10 ppm*	≤ 10 ppm
Copper	-	≤ 5 ppm*	≤ 5 ppm
Arsenic	-	≤ 0.1 ppm*	≤ 0.1 ppm
Zinc	-	≤ 25 ppm*	≤ 25 ppm
Cadmium	-	≤ 0.1 ppm*	≤ 0.1 ppm
Tin	-	≤ 0.01 ppm*	≤ 0.01 ppm
Total Aflatoxin	≤ 20 µg/kg**	≤ 30 µg/kg*	≤ 30 µg/kg
Aflatoxin B1	-	-	≤ 15 µg/kg
Salmonella	"The products should comply with any microbiological criteria established in accordance with the principles and guidelines for the establishment and application of microbiological criteria related to foods (CXG 21-1997)"	Absent in 25g***	Absent in 25g
Bacillus cereus		10 ³ to 10 ⁴ ***	10 ³ to 10 ⁴
Sulphite Reducing Clostridia (SRC)		10 ² to 10 ³ ****	10 ² to 10 ³
Aerobic Colony Count		10 ⁶ to 10 ⁷ ****	-
Yeast and Mold Count		10 ⁴ to 10 ⁵ ****	-
Enterobacteriaceae		10 ² to 10 ³ ****	-
Staphylococcus aureus		10 ² to 10 ³ ****	-
Food Additives	"Anticaking agents listed in Table 3 of the General standard for food additives (CXS 192-1995) are acceptable for use in ground/powdered form of product conforming to this standard."	"The powder shall be free from any added colouring matter including lead chromate and morphologically extraneous matter including foreign starch."	-
Live Insects	0 count/100g	"Free from mould, living and dead insects, insect fragments, rodent contamination."	"Free from dirt, mould growth, and insect infestation."
Fineness	-	-	"The turmeric powder shall be ground to

Characteristic	Codex Alimentarius	FSSAI	BIS
			such a fineness that all the material shall pass through 300 µm IS Sieve."
Odour, Taste and Flavour	"The product shall have a characteristic odour, flavour, and colour, which can vary depending on geoclimatic factors/conditions, and shall be free from any foreign odour, flavour, and colour especially from rancidity and mustiness."	"The powder shall have characteristic odour and flavour and shall be free from mustiness or other foreign odour"	"Turmeric, whole, shall have the characteristic odour and flavour of the spice. It shall be free from mustiness or other foreign flavours."

* As per the Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011, available at https://fssai.gov.in/upload/notifications/2020/08/5f3d09f97b78aGazette_Notification_Limit_Metal_19_08_2020.pdf (Last accessed May 15, 2026).

** As per the CXS 193-1995, General standard for contaminants and toxins in food and feed, available at https://www.fao.org/fao-who-codexalimentarius/sh-proxy/fr/?Ink=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS+193-1995%252FCXS_193e.pdf (Last accessed February 19, 2026).

*** As per Table 3, Appendix B of the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, available at [https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B(1).pdf) (Last accessed February 22, 2026).

Source: Compiled from https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?Ink=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS+359-2024%252FCXS_359e.pdf; https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf; Bureau of International Standards, 2022, IS 3576:2022 Spices and Condiments — Turmeric, Whole and Ground — Specification (Last accessed February 20, 2026).

Table B5: Coriander Whole Standards: FSSAI vs BIS

Characteristic	FSSAI	BIS	
		Grade 1 Special	Grade 2 Standard
Mandatory or Voluntary	Mandatory	Voluntary	
Common Name	Coriander (Dhania) whole	Coriander Whole	
Scientific Name	<i>Coriandrum sativum</i> L.	<i>Coriandrum sativum</i> L.	
Extraneous matter	≤ 1.0 per cent by weight	≤ 2 per cent by mass	≤ 4 per cent by mass
Split fruits	≤ 10.0 per cent by weight	≤ 4 per cent by mass	≤ 10 per cent by mass
Damaged/Discoloured fruits	≤ 2.0 per cent by weight	≤ 1 per cent by mass	≤ 2 per cent by mass
Insect damaged matter	≤ 1.0 percent by weight		
Shrivelled and immature fruits	-	≤ 1 per cent by mass	≤ 2 per cent by mass
Fruits of other varieties	-	≤ 2 per cent by mass	≤ 4 per cent by mass
Moisture	≤ 9.0 per cent by weight	≤ 9 per cent by mass	
Volatile oil content on dry basis	≥ 0.1 per cent (v/w)	≥ 0.1 per cent by mass	
Total ash on dry basis	≤ 7.0 per cent by weight	≤ 7.0 per cent by mass	
Acid insoluble ash on dry basis	≤ 1.5 per cent by weight	≤ 1.5 per cent by mass	
Freedom from Moulds, Insects, etc	"It shall be free from mould, living and dead insects, insect fragments, rodent contamination."	"The coriander, whole, shall be free from visible moulds and insects."	
Odour, Taste and Flavour	"It shall have typical aroma and shall be free from mustiness."	"The taste and flavour of coriander, whole shall have the characteristic pleasant taste and aroma. The material shall be free from musty odour."	
Added Colour	"The product shall be free from added colouring matter."	"The product shall be free from added colours."	
Salmonella	Absent in 25g*	Absent in 25 g	
Aerobic Colony Count	10 ⁶ to 10 ⁷ *	-	
Yeast and Mold Count	10 ⁴ to 10 ⁵ *	-	
Enterobacteriaceae	10 ² to 10 ³ *	-	
Staphylococcus aureus	10 ² to 10 ³ *	-	

* As per Table 3, Appendix B of the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, available at [https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B(1).pdf) (Last accessed February 22, 2026).

Source: Compiled from https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf; Bureau of International Standards, 2008, IS 2443:2008 Spices and Condiments - Coriander, Whole and Ground - Specification (Last accessed February 20, 2026).

Table B6: Coriander Powder Standards: FSSAI vs BIS

Characteristic	FSSAI	BIS
Mandatory or Voluntary	Mandatory	Voluntary
Common Name	Coriander (Dhania) Powder	Coriander Powder
Scientific Name	<i>Coriandrum sativum</i> L.	<i>Coriandrum sativum</i> L.
Moisture	≤ 9.0 per cent by weight	≤ 9.0 per cent by mass
Total ash on dry basis	≤ 7.0 per cent by weight	≤ 7.0 per cent by mass
Acid insoluble ash on dry basis	≤ 1.5 per cent by weight (in dilute HCl)	≤ 1.5 per cent by mass
Volatile oil content on dry basis	≥ 0.09 per cent (v/w)	≥ 0.1 per cent (v/m)
Added Colour	"The powder shall be free from added colour, starch, bleach or preservative."	"It shall be free from extraneous matter and added colours."
Freedom from Moulds, Insects, etc	"It shall be free from mould, living and dead insects, insect fragments, rodent contamination."	"The coriander powder shall be free from dirt, mould growth, insect infestation and rodent contamination visible to the naked eye (corrected if necessary) with such magnification as necessary. "
Fineness	"It shall be in the form of rough or fine powder."	"The coriander powder shall be ground to such a fineness that all of it passes through a 500-micron IS Sieve and nothing remains on the sieve."
Odour, Taste and Flavour	"It shall have typical aroma and shall be free from mustiness."	"The coriander powder shall have its characteristic pleasant taste and flavour. It shall be free from musty odour."
Salmonella	Absent in 25g*	Absent in 25g
Aerobic Colony Count	10 ⁶ to 10 ⁷ *	-
Yeast and Mold Count	10 ⁴ to 10 ⁵ *	-
Enterobacteriaceae	10 ² to 10 ³ *	-
Staphylococcus aureus	10 ² to 10 ³ *	-

* As per Table 3, Appendix B of the Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011, available at [https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B(1).pdf) (Last accessed February 22, 2026).

Source: Compiled from [https://fssai.gov.in/upload/uploadfiles/files/Food Additives Regulations.pdf](https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf); Bureau of International Standards, 2008, IS 2443:2008 Spices and Condiments - Coriander, Whole and Ground - Specification (Last accessed February 20, 2026).



Indian Council for Research on International Economic Relations (ICRIER)

Our Offices:

4th Floor, Core 6A, India Habitat Centre, Lodhi Road, New Delhi-110003
The Isher Building, Plot No. 16-17, Pushp Vihar, Institutional Area, Sector 6, New Delhi-110017
O: +91 11 43112400, **F:** +91 11 24620180 | **W:** www.icrier.org | **E:** info@icrier.res.in