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Case study on recent trends in export rejections of spices from India: reasons, responses and regulatory challenges

Lijo Thomas[1*], Sajesh VK[1] & Sanil PC[2]

[1]Social Science Section, ICAR-Indian Institute of Spices Research, Kozhikode 673 012, Kerala, India

[2]Community Agrobiodiversity Centre, M S Swaminathan Research Foundation, Wayanad 673 577, Kerala, India

*Email: Lijo.Thomas@icar.gov.in

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Abstract

Spices, integral to culinary traditions worldwide, significantly contribute to global trade and India's agricultural economy. India, the leading producer and exporter of spices, accounts for 7.7% of country's agricultural export earnings and exports to over 185 countries. Despite impressive growth in production and exports, export rejections remain a critical challenge, with over 200 consignments rejected annually due to factors such as pesticide residues, microbial contamination and poor labelling. These rejections, which vary by export destinations, compromise India's reputation and economic interests, particularly affecting smallholder farmers who dominate spice production. As a global supplier of spices, India's food safety and spice quality have global ramifications.

This study uses data from the United Nations Industrial Development Organization (UNIDO) Knowledge Hub (2010-2022) to analyses export rejections of Indian spices under HS code 09. It focuses on trends, underlying causes and mitigation strategies. Although aggregate rejection rates have declined by 53 % over the past decade, the number of export rejections is still significant. Mitigation strategies, including adoption of Good Agricultural Practices (GAP), Hazard Analysis and Critical Control Points (HACCP) protocols, traceability systems and capacity building, are crucial. Addressing export rejections requires an integrated approach involving all stakeholders in the spice value chain. Strategic investments in technology, training and research, along with proactive engagement with trade partners, are essential for sustaining India's dominance in the global spice trade. Further research is necessary to evaluate compliance costs and their implications for both producers and consumers, paving the way for more sustainable trade practices.

Keywords

export policy; indian spices; pesticide residues; rejection rate; spice exports.

Introduction

Spices are used worldwide, both in their raw form and as food additives, adding distinct flavours and aromas to culinary preparations. Apart from their culinary uses, their medicinal properties and ability to promote health and immunity have been widely recognized (1). Many spices contain substantial amounts of bioactive substances with beneficial effects for the human body. Commercially available spices are derived from various dried plant parts, including leaves, seeds, fruits, roots, bark and flowers. The Food and Agricultural Organization defines spices as "dried plants or parts of plants that are used to enhance the flavour, colour and aroma of food (2)". Spices are also among the most traded commodities in the world. The global spices and seasonings market is expected to grow at a

compound annual growth rate of 4.9% over the next 8 years, reaching a market value of USD 29.57 billion by 2032 (3).

The global spice trade, however, faces several critical challenges. Ensuring sustainability of the spice production systems and mitigating climate-change impacts on production and productivity of the crops are critical for ensuring undisrupted supply of spices across the global spice value chains. Quality and safety concerns arising from adulteration, pesticide residues, microbial contamination, lack of traceability and harmonized standards are also key challenges in the global spice trade. With increasing global awareness about food safety (4) and the expansion of spice trade, the importance of food export and import inspection is growing. Inspection systems and public perception of their effectiveness play a key role in enhancing consumer confidence in food quality and safety (5). There is also a growing realization that in an increasingly globalized world, contamination at one point in the food value chain could affect populations at distant regions (6). For example, the European Union, one of the largest markets for spices and herbs, sources most of its requirement from regions outside the union. Though consumed in small quantities, spices are used in a wide range of food products in their dried, low-water-activity formats and their sourcing and distribution involve highly complex networks (7). Therefore, food safety concerns about spices tend to be highly specific.

As a leading producer, exporter and consumer of spices, India plays an important role in the global spice industry and trade and the country has earned the sobriquet of “Land of Spices” by virtue of its historical importance as a source of several spices since ancient times (8). The country continues to be a global hub of production, processing and export of spices and other spice-based value-added products, such as spice oils and oleoresins. The availability of diverse agroclimatic conditions within the Indian subcontinent enables the country to cultivate a wide variety of spices, with commercial cultivation reported in more than 60 spice crops (9). The significance of spices in India's agricultural exports is undeniable, contributing an impressive 7.7% by value during 2021-22 (10). Export markets play a crucial role in ensuring adequate demand for spice commodities, with India's spice exports reaching a remarkable $4.068 billion in 2021-22. The reach of Indian spices extends to over 185 countries, encompassing a diverse export basket of more than 225 spice products (11). It is estimated that the quality concerns, including food safety concerns, regarding India’s spice exports could affect exports worth USD 2.17 billion (12). However, India's spice exports have faced export rejections from importing countries. Export rejections hurt the reputation of the source country and reduces the marketability of the spices, impacting the economic interests of producers, traders and other stakeholders in the value chain (13). Against this backdrop, the onus lies on the Indian spice sector to deliver high-quality, food-safe spice commodities and value-added products.

This article analyses the recent trends in the scale of spice export rejections from India, exploring the implications for various stakeholders within the spice value chain. It further discusses potential responses from the sector to proposes strategies to mitigate and reduce spice export rejections from India.

Data and Methodology

In the standard global trade classification, spice commodities are classified under the Harmonized System (HS) code 09, which encompasses not only spices but also coffee, tea and mate. Notably, spices make up over 70% of the exports within this group. Consequently, data for this HS code serves as a proxy for analysing export rejections in spices. In this case study, we use the export rejections reported for India under HS code 09, as documented by the United Nations Industrial Development Organization (UNIDO) Knowledge Hub. The export rejections by the United States, European Union, Australia and Japan for this category are available in the database. This provides a comparable dataset for tracking rejections over the period 2010-2022, for which continuous data is available. These countries/ regions represent the major export destinations among the developed countries.

Using this dataset, we examined trends in the annual number of rejections and the aggregate rejection rate to measure export rejections for spices during the period of study period. Given the fluctuations in the value of spice exports, it is more insightful to examine the trends in the unit rejection rate. The unit rejection rate is measured as the number of rejections per one million USD. A higher unit rejection rate suggests a higher level of noncompliance with food safety and quality standards by the exporting country (14). To evaluate India's performance relative to other exporting countries, we compare India's relative rejection rate (the natural logarithm of the ratio of total rejection shares to total import share) with the median value of the relative rejection rate for each destination.

Results and Discussion

Spice exports from India and aggregate rejections

Spices are prominent in global trade, being incorporated into numerous product lines as ingredients and extracted forms. Spice commodities are a key component of the agricultural export basket of India. During 2021-22, spice commodities contributed 7.7% of India’s gross agricultural export earnings. The area under spice crops and the domestic output of spices have grown substantially in India since the beginning of this century (Table 1). While the area under spices doubled, the output more than tripled, indicating significant yield enhancements in these crops. From 236 thousand tonnes at the turn of the century, India’s spices exports have increased over 6-folds by 2023-24. Export markets play a crucial role for primary producers as they often command premium prices for spices. The rise in export quantity and the increasing concerns about food safety worldwide make it crucial for the Indian spice sector to enhance its capability to supply food-safe spices.

The trends in aggregate rejection rate for commodities under HS code 09 exported from India to selected destinations since 2010 is presented in Table 2. Though there is an increase in the number of rejections in European Union during the last 2 years, the total number of rejections across these destinations show a gradual rejection. Between the triennium ending 2012 and 2022, there is a reduction in number of rejections by 53%.

The rise in number of export consignments and export

Table 1. Trends in India' spice area, production and exports.

Year	Area ('000 ha)	Production ('000 tonnes)	Export quantity ('000 tonnes)	Export value (Million USD)
2000-01	2342	3002	236	354
2005-06	2331	3808	350	478
2010-11	3044	5933	526	1734
2015-16	3457	6902	843	2542
2020-21	4483	11043	1760	3984
2023-24	4761	11802	1540	4249

Ministry of Commerce and Industry, Government of India

Table 2. Aggregate rejection rate of exports from India for HS code 09 (2010-2022).

Year	Australia	EU-28	Japan	United States	Total
2010	29	109	18	531	687
2011	33	47	18	360	458
2012	31	37	13	288	369
2013	20	26	7	256	309
2014	17	26	8	154	205
2015	18	33	4	216	271
2016	17	62	11	194	284
2017	24	53	3	140	220
2018	36	24	3	137	200
2019	12	9	12	223	274
2020	30	5	1	127	184
2021	47	69	6	182	304
2022	25	69	4	126	224
Total	339	608	108	2934	3989

United Nations Industrial Development Organization (UNIDO), Knowledge Hub

volume can lead to an increase in rejections. The unit rejection rate provides the rejection rate adjusted for the rise in export volume. There is a marked decline in the unit rejection rate between the triennium ending in 2012 and 2020 for all the export destinations included in this study (Table 3). The reduction ranges from 10.5% for Australia to 80.4% for the European Union. This downward trend in the unit rejection rate indicate progress for Indian spice exports, signalling improved compliance with export market requirements. The analysis also reveals that India's relative rejection rate is lower than the median values, indicating that India performs better as a supplier. Despite the decline in the aggregate rejection rate (53% between the triennium ending 2012 and 2022) and the unit rejection rates across destinations, the number of rejections remain high. More than 200 rejections of spice export consignments have been recorded in each of the last 5 years, highlighting the persistence of these issues and the need for proactive solutions. The first step in addressing this issue would be to identify the underlying reasons for rejection. This will aid the deployment of targeted mitigation strategies to reduce the number of spice export rejections.

Reasons for export rejections and mitigation strategies

Understanding the underlying reasons for export rejections can guide the prioritization of mitigation strategies to address them. Table 4 presents the percentage share of significant reasons for export rejection in major destinations. The prominence of reasons of export rejection varies across destinations. For instance, in Australia, bacterial contamination and labelling issues together account for over 80% of export rejections from India in this category. In the European Union, the detection of mycotoxins is the primary reason for rejection. This suggests the need for tailored export strategies based on each destination's specific requirements while improving overall product quality and food safety. Bacterial contamination, for example, is the leading cause of export rejections from the USA. This issue can be addressed through targeted post-harvest management strategies to reduce bacterial load in the final product. In Japan, over a third of export rejections are attributed to pesticide residues, a significant cause for rejection in Australia and the USA. Implementing strategies to minimize pesticide residues in primary spice production can significantly reduce export

Table 3. Declining trend in unit rejection rate of exports from India for HS code 09.

Country/Region	Rejections per million USD exports			Relative rejection rate (2020)	
	TE 2012	TE 2020	% change	India	Median value
Australia	0.496	0.444	-10.5	1.254	1.724
EU-28	0.107	0.021	-80.4	0.539	2.942
Japan	0.292	0.109	-62.7	0.469	1.845
United States	1.744	0.538	-69.2	2.029	2.493

Compiled from UNIDO

Table 4. Reasons for export rejection for HS code 09 commodities from India (2010-2020).

Reason for rejection	Australia	EU-28	Japan	United States
Pesticide residues	15	6	35	14
Adulteration/missing document	1	10	6	2
Bacterial contamination	34	9	-	50
Labelling	49	-	-	16
Additive	-	2	2	6
Hygienic conditions/control	-	1	12	12
Mycotoxins	-	68	45	-
Others	1	4	-	-
Total	100	100	100	100

Values in %

rejections.

An important reason for the persistence of these factors is the low awareness among the primary producers about the quality requirements of the destination markets. Fewer than 15% of the domestic production is destined for export markets, with the remaining produce being sold in the domestic markets. In a price-sensitive market like India, the quality requirements in the domestic spice market tend to be lower. The predominance of smallholder production systems in spices, employing traditional, labour-oriented production practices and commonly following a mixed farming approach with multiple crops, increases the risk of cross-contamination of the spice commodities produced. The smallholding also means that substantial aggregation occurs in the spice value chain, where produce from several farms gets mixed, increasing the chances of compromised quality parameters. In the face of such challenges, risk-based preventive controls, starting right from the farm, have been recommended to ensure safety of the final products (15).

Addressing the underlying reasons for export rejection requires an integrated approach with interventions starting right from the primary production stage in farmers' fields. More than 80% of the operational holdings cultivating spice crops in India have a size of less than 2 ha and are classified as small and marginal holdings (16, 17). Therefore, aggregation of spice commodities from several holdings occurs at various points in the spice value chain. This creates special challenges for the firms involved in spice exports. Since multiple stakeholders are involved in the spice value chain, the implementation of these mitigation strategies requires coordinated action. These include firms and institutions from the public and private sector apart from primary producers and farmer collectives.

Implementation of internationally accepted standards like Hazard Analysis and Critical Control Points (HACCP) protocol in spice production and processing facilities and deploying traceability systems in spice value chains, can improve overall produce quality and address multiple issues causing export rejections. Training and capacity building of the primary spice producers for to adopt good agricultural practices in primary production and processing can also help in mitigate issues like microbial contamination, pesticide residues and so on. Common reasons for the export rejection of spices from India and specific mitigation measures are provided in Table 5. Apart from these responses addressing basic issues, it will be beneficial for the spice industry in India to engage with international buyers and trade partner countries to understand the specific requirements and quality standards to ensure compliance in spice exports.

Table 5. Mitigation strategies for major reasons of export rejection of spices from India.

Reason for rejection	Mitigation strategies
Adulteration/missing document/issues related to labelling	Implement rigorous quality checks at multiple points in the value chain to detect adulteration
	Deploy advanced and efficient testing methods at primary aggregation points and major spice production hubs
	Training and capacity building for spice exporting firms on documentation, labelling requirements and international compliance
	Digitalization of documentation process to reduce errors
	Establishment of centralized document repositories and databases under public sector for efficient tracking of certifications and consignments
Bacterial Contamination/Mycotoxins/ other contaminants	Implement strict hygiene during harvesting and post-harvest processing
	Train farmers to adopt good agricultural practices to reduce product contamination at the farm level
	Ensure quality of the water used in production process
	Ensure optimum drying of spices on clean surface
	Approved decontamination techniques like steam sterilization can be advocated.
	Conduct test for measuring microbial load at multipole points along the value chain
	Improve packaging standards (air tight and food grade) to prevent contamination during transport and storage
	Implementation of Good Manufacturing Practices (GMP) and food safety management system (FSMS)
	Promote research on identifying sources of contamination at the farm level on their mitigation at the primary processing level
Heavy metal contamination	Conduct scientific studies to determine the source of heavy metal contamination by testing the product at various stages of the value chain
	Conduct regular testing of soil and irrigation water for heavy metal content
	Establish traceability mechanisms to track the source of contamination and ensure accountability in the spice supply chain
	Ensure that the machinery used in processing do not contribute to heavy metal contamination
	Establish a monitoring mechanism for heavy metals in agricultural inputs like compost, fertilizers and other chemical inputs used in spice production.
Pesticide residues	Promote the use of integrated pest management strategies for reducing over dependence on chemical pesticides.
	Training and capacity building of farmers on IPM techniques
	Strengthen the network of accredited pesticide residue testing facilities across the country
	Align the domestic Maximum Residue Limit (MRL) levels with those prevailing in export destinations
	Increase the choice set of pesticides available to the spice farmers by increasing the number of registered and approved pesticides for spice crops
	Strengthen the pesticide regulation through stringent enforcement and penalties for non-compliance
	Provide incentives for farmers and farmer collectives to adopt globally recognized standards and certification

Responses and policy challenges

India's spice production and export have experienced remarkable growth in recent times. The country's spice output has increased from 6.7 million tonnes in 2014-15 to 11.8 million tonnes in 2022-23, reflecting an annual growth rate of 7.3% (18). During the 5 years from 2017 - 18, spice exports from India rose by an impressive 42%. Enhancing the capacity of the spice production sector to supply high-quality, food-safe spices is crucial for sustaining the growth of export demand for Indian spices. The Spices Board of India has implemented mandatory testing of several spice commodities designated for export. Under this program, 77222 samples were tested during 2021-22, with 1709 samples rejected due to non-compliance with the specifications of export destinations (19). Mandatory testing ensures that spices exported from India comply with standards set by relevant national and international organizations and the food regulations of importing countries.

Intensive investment in systems, technologies and human resources, along with efforts to promote good agricultural practices and improve the post-harvest practices among spice farmers, have long been recognized as critical interventions for improving the quality and hygiene of spices in India (20). To advance these objectives, India has taken several measures to improve its performance in these identified aspects. For example, India the strategic investments in institutional infrastructure have strengthened the food safety and quality control measures at all stages of the spice value chain. These measures include increasing the number of food safety laboratories and developing scientific storage and transportation facilities within the country. However, the existing facilities for testing spices for various quality parameters are inadequate for a vast country like India. For instance, apart from the quality evaluation facilities under the Spices Board, there are only 33 National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited laboratories in the country for testing pesticide residues (21). The increasing complexity and lack of uniformity in food safety regulations across importing countries also pose a significant challenge for Indian spice exporters in complying with the requirements of all destinations. The installed food safety associated infrastructure forms only the necessary condition for facilitating trade, whereas the sufficient condition would be an enabling policy environment aimed at reducing the overall transaction costs of trade (22).

The National Agricultural Research System in India, including organizations under the Indian Council of Agricultural Research and State Agricultural Universities, has developed a range of technologies and integrated pest and disease management strategies for spice crops. They also serve as a network for training spice farmers in improved production practices to meet export quality requirements. The availability of robust technology support is a significant strength of India's spices sector. Training and capacity-building programs focusing on GAP practices and quality-compliant spice production can increase the availability of good-quality spices for both export markets and domestic consumption Training and capacity building programmes focusing on GAP practices and quality compliant spice production can increase the availability of good-quality spices for both for export markets and for domestic consumption (23).

Regulatory and policy frameworks focusing on enhancing the quality of spice commodities are critical for strengthening India's spice economy. Some of the measures that can be undertaken include:

- *Mission-mode approach for capacity building:* Implement a comprehensive capacity-building program for primary spice producers on food safety practices and adoption of GAP. This will enhance the quality of spice commodities by promoting rational, safe and need-based use of pesticides, along with scientific post-harvest management of the produce.
- *Prioritize research investment:* Increase investment in research and development of new technologies to detect and remove contaminants from spices.
- *Improve labelling and documentation:* Address the issue of export rejections due to poor labelling and documentation by developing clear guidelines for exporters and working with importing countries to harmonize requirements.
- *Provide financial and technical assistance:* Offer financial and technical assistance to exporters to help them comply with the complex food safety regulations and export requirements of importing countries.
- *Efforts for harmonized standards:* India should assume a proactive role in developing a consensus on harmonized food safety standards across different countries through platforms like the Codex Alimentarius Commission and the Food and Agriculture Organization (FAO).
- *Expand approved pesticide options:* Address the lack of adequate approved pesticides for spice cultivation. The non-availability of approved pesticides leads to using unauthorized pesticides and the subsequent rejection of spice export consignments.

Conclusion

The global spice trade offers immense opportunities for India, especially considering its current position as the leading producer and exporter of spices globally. However, the quality and safety of Indian spices remain critical to its continued success in international markets. The impressive achievement in increasing spice production and export volumes aside, the persistent issue of export rejections remains a pressing concern for the sector. There is an urgent need for a strategic focus on improving compliance with global food safety and quality standards. Export rejections, caused by factors such as heavy metal contamination, pesticide residues, microbial contamination and poor documentation, not only harm the country's reputation but also affect the livelihoods of millions of small and marginal spice farmers. The major reasons for rejections vary across the major export markets studied, pointing to the need for destination-specific strategies. The analysis reveals a significant reduction in both aggregate rejection rates and unit rejection rates over the past decade, which indicates improved compliance efforts. However, the consistently high number of annual rejections highlights the need for sustained and targeted interventions.

Reducing the export rejections arising from multiple factors require an integrated approach involving technology, capacity building and policy support. The collaboration between stakeholders-farmers, aggregators, processors, exporters and government agencies-is also critical to sustained maintenance of quality standards in spices. Training and capacity building of farmers and other value chain actors, strengthening the regulatory framework, adopting internationally accepted quality standards like HACCP, implementing traceability systems and promoting good agricultural practices can significantly enhance the safety and quality of spices. Building robust testing infrastructure and capacity, expanding research into mitigation technologies and fostering collaborations with trade partners will further solidify India's position in the global spice trade. Further research is required to fully understand and quantify the impact of these export rejections on the primary producers of spices. The cost of compliance and higher cost of production involved in producing spices meeting the export standards and its impact on retails prices in the consuming markets is another area which warrants more detailed examination.

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Authors' contributions

LT, SVK and SPC conceptualized the study and participated in its design. LT and SPC compiled and performed the statistical analysis of the data. LT and SVK were involved in drafting the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

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