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RESEARCH NOTE

Production and Marketing of Seed Spices: A Study of Cumin and Coriander in Rajasthan*

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ABSTRACT

Cumin and coriander are export-oriented crops in India. In terms of value and quantity, exports of coriander and cumin have declined while imports have been on the rise. The decline in the area and production of these two seed spices in Rajasthan is partly attributable to price volatility in the domestic market due to large-scale imports. Withdrawals of extension services and marketing assistance from the Spices Board after trade liberalisation have contributed to the market uncertainty of seed spices in India. Against this backdrop, the present study analysed the issues and challenges that the farmers encounter in the production and post-production phases of the crop. The study is based on both primary and secondary data sources. Analysis reveals that traders of cumin and coriander in APMCs are in collusion, which makes the outcome of the auction process less favourable to farmers. The study underlines that farmers require institutionalised post-harvest technology coupled with production assistance to result in a larger share of the international market, for which basic infrastructure facilities in APMCs in India have to be at par with international standards.

Keywords: Seed spices, cumin and coriander, market infrastructure, export volatility, agricultural marketing reforms

JEL codes: O13, Q13, Q17, Q18, L66

I

INTRODUCTION

India enjoys absolute control over the production of spices and seed spices in the world. India is the world's largest producer of spices with a 42 percent share in the global production of 15.8 million tons in 2020 (FAO, 2020), distantly followed by China (7%), Nigeria (5%) and Indonesia (4%). Globally, seed spices accounted for 14 percent of the total production of the spices. In the global production of seed spices of 2.27 million MT in 2020, India contributed 63 percent. India contributed 65 percent of global coriander production in 2020, distantly followed by Turki (14%), Mexico (6%) and Syria (3%). In the case of cumin production, India's share was as high as 70 percent, followed by Syria (12%), Iran (8%) and Turkey (6%) in 2020 (FAO, 2020).

India outpaced China in the value of spices traded in the global market with 17.2 percent of the world exports in 2022 (OEC, 2023). Globally, the total value of export of coriander was estimated at US$ 147.13 million in 2022 whereas India

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contributed 35 percent of it. Italy, Bulgaria, and Morocco together contributed 40 percent of the total value of coriander exports in 2022 (Tridge, 2023). India contributed 92 percent to the total value of cumin exports (US$ 500 million) in 2022, followed by Turkey (3.5%) and Egypt (0.9%) (Tridge, 2023). On the other hand, in the value of spices exported from India, the relative contribution of coriander and cumin were 1.6 percent and 11 percent respectively in 2022. The export intensity of cumin was 30 percent while the same for coriander was 6 percent in 2021-22.

Coriander and cumin accounted for 42 percent and 32 percent respectively in the production of seed spices in India in 2021-22. These two crops are cultivated in arid and semi-arid regions in districts bordering Rajasthan, Madhya Pradesh, and Gujarat. In Rajasthan, coriander is cultivated in south-eastern districts, while cumin is mostly grown in the desert districts of the state. In the total area of 6.31 lakh hectares under coriander, Madhya Pradesh accounted for 46 percent followed by Gujarat (19.8%) and Rajasthan (19.7%) in 2021-22. In the case of cumin, Rajasthan accounted for 59 per cent of the total area of 10.36 lakh hectares, closely followed by Gujarat (41%) in 2021-22 (Spices Board of India, 2022).

Bairwa *et al.* (2022) analysed the performance of cumin and coriander seed for the 1991-2019 period. The study found that the production and productivity of cumin seeds in India registered a higher growth during 2005 to 2019 as compared to 1991-2004. Conversely, coriander performed better in terms of production and productivity during 1991-2004. On the other hand, Meena *et al.*, (2020b) compared net profits realised by the cumin and coriander growers in Rajasthan and observed that coriander farmers in Rajasthan earned a net profit of ₹15,422/ha while cumin farmers could earn ₹41,973/ha in 2018. Meena *et al.*, (2018) observed that the export value of coriander grew faster during 1985 to 1995 as compared to the1995-2015 period and the export value of cumin grew faster during 2005 to 2015 period (Meena *et al.*, 2018). Product management and adherence to international phytosanitary standards are major constraints for exporting spices from India (Selven, 2007). Moreover, FSSAI (2019) observed that spices contain the maximum pesticide residues in seed spices as compared to other food commodities tested between 2013 and 2017 in India.

Like any other agricultural commodity produced by marginalised and small farmers, coriander and cumin seed cultivators are rather forced to sell a major share of their production immediately after harvesting. The price of these commodities was found at its lowest ebb during the harvesting season (March-May) (Meena *et al.*, 2020a; Verma *et al.*, 2013). The cumin and coriander farmers' incapacity to withstand market uncertainty and financial manoeuvrability to hold stocks until the market signals a remunerative price, is indicative of their fragility. The relationship among the land holding size, time of commodity Sale, and prices has been sufficiently explored for agricultural commodities in the Indian context (Mohanakumar & Sharma, 2000; Mohanakumar & Chandy, 2005; Kumar *et al.*, 2011). Inadequate

mechanisation of sowing and harvesting technologies, weak extension services, inadequate accessibility to credit, non-existence of Minimum Support Price (MSP), and shortage of storage facilities have been identified as major constraints for the cumin farmers in the Barmer district in Rajasthan (Pagaria & Sharma, 2019). As a result, small and marginal farmers are forced to sell their produce in the unregulated village market with little value addition (Singh & Pothula, 2013). Sutradhar (2014) contended that there was a close association among the resource strength of farmers, the marketing system, education and market choice.

Price is an important driver of growth for agricultural commodities. However, individual farmers are incapable of influencing the supply of a commodity in the market. The demand, on the other hand, is shaped by a handful of factors such as consumer preferences, regulations in domestic and international markets, technological interventions, and innovations besides prices. Given the supply and demand conditions of cumin and coriander seeds, farmers need to be aware of factors influencing the allocation of scarce means in crop production. It warrants a comprehensive understanding of the market structure, its composition, the nature of management, power relations of different stakeholders in the market structure. Factors governing the market conditions of farm produce are embedded in the wide umbrella of commodity market dynamics. However, issues and concerns of cumin and coriander farmers, as in the case of other seed spices, have not yet been sufficiently explored from farmers' perspective. Further, cumin and coriander are export-oriented seed spices and have the potential to carve out a bigger share in the international market, provided the supply-side bottlenecks are corrected. These two seed spices are sold as 'ready to consume' and adhere to WTO specifications of phytosanitary stipulations to compete in the international market. In this context, a detailed analysis of the pre and post-harvesting issues and challenges of cumin and coriander cultivators have been carried out from the farmers' viewpoint. Given the setting, the discussion is organised into three sections. Section 1 explains the production structure of coriander and cumin. Trends of external trade of these two crops are analysed in Section 2; and Section 3 discusses the post-harvesting issues of cumin and coriander farmers, followed by a conclusion.

The study has used both primary and secondary sources of data. The secondary data sources include the Spices Board of India and FAO statistics. For the primary survey, the major constraint was the non-availability of a sample frame. A complete enumeration of cumin and coriander cultivating villages in selected districts is beyond the means available for the study. Accordingly, a sample size of 400 households was fixed and equally distributed between cumin growing districts in the western part and coriander growing districts in the south-eastern districts of Rajasthan. Specific villages with the maximum area under cumin and coriander were spotted in selected districts and samples were selected using the snowball sampling approach. After a detailed discussion with a trader, Gram Panchayat Sarpanch, and

Ward Punch in the spotted village, a sketch of types of farmers defined in terms of area under cultivation was drawn. The list of farmers from selected villages was used as a proxy for the sample frame, from which samples were picked up. The cumin growers are concentrated in the Barmer and Jodhpur districts in western Rajasthan. Accordingly, 73 samples from selected villages in Barmer and 127 samples from selected villages in Jodhpur Districts were picked up based on the proportion of farmers with land size. Coriander is majorly cultivated in the Baran district of Rajasthan and, therefore, 200 sample farms were randomly picked up from selected villages in the Baran district. Besides the Comprehensive Index of Market Infrastructure (CIMI), Logit regression has been estimated to identify the determinants influencing farmers' decisions on the choice of market for the sale of cumin and coriander. Details of variables in the model have been described in the respective section.

II

TRENDS IN THE PRODUCTION OF CORIANDER AND CUMIN

Important states cultivating coriander and cumin are Madhya Pradesh, Rajasthan, and Gujarat. Rajasthan accounted for 41 percent and 37 percent of the area and production of coriander respectively in 2013-14. The relative share of the state declined to 19 percent for both area and production of coriander in 2021-22. On the contrary, the relative share in area and production of coriander in Gujarat (20% and 22%) and Madhya Pradesh (46% and 48%) have registered significant increases, during the period, between 2013-14 and 2021-22. For the promotion of agricultural exports, in the EXIM policy for 1997-2001, the Ministry of Commerce introduced the Agricultural Export Zone (AEZ) in 2001. Bairwa *et al.*, (2022) observed that the growth rate in the area, production, and productivity of coriander seed remained higher during pre-AEZ (1991-2004) than in post-AEZ (2005-2019), while cumin seed performed better during the post-AEZ period.

TABLE 1. RELATIVE SHARE OF AREA UNDER CORIANDER BY MAJOR STATES – 2013-14 TO 2021-22

Year	Rajasthan (%)	Gujarat (%)	Madhya Pradesh (%)	Others (%)	India (000 ha)
2013-14	40.87	4.60	35.78	18.75	447.13
2014-15	45.11	7.97	26.06	20.86	552.66
2015-16	34.05	14.18	32.64	19.13	624.78
2016-17	27.01	18.02	40.99	13.99	672.76
2017-18	17.97	13.78	51.42	16.83	544.24
2018-19	14.68	6.41	59.57	19.34	469.98
2019-20	11.35	16.29	55.26	17.10	528.97
2020-21	18.93	21.51	45.43	14.12	656.45
2021-22	19.67	19.79	45.92	14.62	631.69
CAGR (%)	-4.70	25.30	7.72	1.22	4.41

Source: Spices Board of India

Table 1 explains trends in the area in major coriander-producing states from 2013-14 to 2021-22. Important observations from the production trend in coriander are: (i) relative share in area and production of coriander in the major producing states, *viz*., Rajasthan has been on the decline, and (ii) the observed increase in productivity of coriander in Rajasthan and Madhya Pradesh indicates that farmers have withdrawn coriander from marginal lands and it is the response of any rational farmer in the wake of a continuous price fall (Mohanakumar & Chandy, 2005; Mohanakumar & Sharma, 2000). Despite an increase in the area under cultivation of coriander in Gujarat, productivity has been on the decline. It could be because coriander had replaced other less remunerative crops in arid districts in the state. The negative rate of growth in the productivity of coriander in Gujarat as compared to the positive rate of growth in Rajasthan and Madhya Pradesh is indicative of the emergence of a new production scenario and geographical relocation of coriander cultivation in India.

India is a major producer and consumer of cumin and contributes about 70 percent of the world's total cumin production (Anandh M., 2016). More than 99 percent of the area under cumin cultivation in India is concentrated in two states, *viz*., Rajasthan and Gujarat. Trends in the area under cumin are given in Table 2. Barmer and Jodhpur are two major cumin cultivating districts, accounting for more than 70 percent of the area and production of cumin in Rajasthan. There has been a substantial increase in the area under cumin from 5.1 lakh hectares to 10.4 lakh hectares and the production of the crop increased from 3.9 lakh tonnes to 7.25 lakh tonnes during the period 2013-14 to 2021-22. However, there has been a marginal decline in the productivity of the crop from 759 kg/hectare to 700 kg/hectare during the reference period. The observed increase in area and production and the fall in the productivity of cumin are attributable to the area extension under the crop to marginal lands by substituting the next best alternative crops in the cumin-growing districts in Rajasthan.

TABLE 2. RELATIVE SHARE OF AREA UNDER CUMIN BY MAJOR STATES 2013-14 TO 2021-22

Year	Rajasthan (%)	Gujarat (%)	Others (%)	India (000 ha)
2013-14	54.49	45.50	0.01	513.85
2014-15	51.13	48.86	0.01	889.76
2015-16	63.23	36.55	0.22	808.23
2016-17	64.04	35.70	0.26	780.92
2017-18	60.17	39.61	0.22	966.17
2018-19	65.79	34.01	0.21	1027.94
2019-20	61.10	38.72	0.18	1276.28
2020-21	56.09	43.72	0.19	1087.01
2021-22	58.81	40.99	0.19	1036.71
CAGR (%)	10.22	7.76	58.13	9.17

Source: Spices Board of India

There has been a geographical shift in the area under cumin from a high-productivity zone (Gujarat) to a low-productivity zone in the recent past (Rajasthan). Rajasthan accounted for 54 percent of the area under cumin in 2013-14 and it increased to 59 percent in 2021-22 while the area under cumin in Gujarat declined from 45 percent to 41 percent during the reference period (Table 2). On the other hand, the productivity of cumin in Rajasthan declined to nearly half of the productivity of the crop in Gujarat in 2021-22. Moreover, the productivity of cumin seed increased marginally by 0.5 percent in Gujarat as compared to (-) 2.31 percent growth in Rajasthan during 2013-14 and 2021-22 (Spices Board of India, 2023).

Table 3 explains the household characteristics of sample households. The average age of farmers is around 45 years and the average years of schooling is only three years for cumin farmers as compared to 47 years and four years, respectively for coriander farmer.

TABLE 3. DISTRIBUTION OF SAMPLE HOUSEHOLDS BY CHARACTERISTICS

Characteristics	Cumin Farmers	Coriander Farmers
Age		
≤ 40 (% of HHs)	40.2	35.1
41 to 60 (% of HHs)	49.2	48.5
> 60 (% of HHs)	10.6	16.4
Mean Age (Years)	45.1	47.7
Education		
< Primary (% of HHs)	50.8	23.3
Primary to Metric pass (% of HHs)	40.7	60.9
> Secondary (% of HHs)	8.5	15.8
Mean Education (Years)	2.9	4.1
Family Size		
Mean Family Size (Number)	5.7	5.7
Mean Earning Members in the Family (Number)	2.8	2.6
Occupation		
Cultivation as a Primary Occupation (% of HHs)	34.1	45.0
Cultivation as a Secondary Occupation (% of HHs)	65.8	55.0

Note: 1. HHs-Households.
Source: Primary Survey, 2018

It is justifiable because cumin is cultivated in desert districts of Rajasthan, which are economically and socially backward as compared to agriculturally advanced districts such as Baran and Kota. Average family size is one of the determinants of family labour and it appears that the cumin and coriander farmers do not have the advantage of family size. The dependence of coriander farmers in

farming as the mainstay of their livelihood is higher than cumin farmers. This is because coriander is grown by a relatively more affluent section of the farming community.

Cumin is cultivated in desert districts in Rajasthan and, therefore, the average size of landholdings of cumin farmers is higher as compared to coriander (Table 4). The acute water shortage and uncertain weather conditions compel farmers to lease out land to those who possess tube wells supplemented with an adequate supply of family labour. The tenant cultivators of cumin pay an exorbitant land rent of 50 percent of the produce. Upon the payment of land rent and other costs of production, tenant farmers are left with a thin margin and it is reported as a serious disincentive for cumin cultivators in Rajasthan. In the arid zone of the state, landless farmers are left with little alternative. The nature, content, and consequences of challenges that farmers in 21st-century India encounter do differ across crops and regions (Singh, 2019).

TABLE 4. DISTRIBUTION OF CULTIVATOR HOUSEHOLDS BY AREA IN RAJASTHAN

Size of Holdings (ha)	Cumin Farmer (% of HHS)		Coriander Farmer (% of HHS)	
	2016-17	2017-18	2016-17	2017-18
Marginal	5.7	4	10.3	12.9
Small	14.5	14.1	23.6	25.7
Medium	50.3	47.7	30	33.2
Large	29.5	34.2	36	28.2
Total sample size (Nos)	193	199	203	202

Note: Figures are in percentage of total HHs in the respective category
Source: Primary Survey, 2018

More than 85 percent of coriander cultivators reported that they had reduced the area under coriander in the survey year (2018) as compared to previous years in Rajasthan. An uncertain market coupled with non-remunerative prices and the wide spread of plant diseases are reasons for 48 percent of coriander farmers to reduce the area under the crop while 28 percent of them left land fallow. Another 16 percent have substituted coriander with alternative crops. The farmers pointed out that the fall in the area, intermittent droughts, and frost damage were major reasons for the fall in coriander production. Lack of institutional extension service support for disease control and near total absence of technical advice from government sources were problems that farmers encountered. In a sample study to determine the level of pesticide residues in food articles during 2012-13 to 2016-17, it was found that pesticide residue was the maximum in spices as compared to other crops (FSSAI, 2019). As the Spices Board stopped its extension services to spice crops by the early 1990s, numerous private pesticide manufacturing companies started marketing pesticides without any scientific backup and approval from authorised agencies for crops of edible items. When the farmer came to know that this particular pesticide was not effective, the companies introduced newer brands. Besides this, crop loss

caused by stray animals, particularly in the light of vigorous cow protection campaigns, has also been a serious threat to coriander farmers. In the case of cumin, 86 percent of farmers reported that cumin production had declined over the years and the important reasons for the fall in the production of cumin (driven by productivity fall) are droughts and near total absence of state-run extension services and irrigation facilities.

III

TRENDS IN EXTERNAL TRADE

India has carved out a significant share in the global trade for spices with 17 percent in the value of exports in 2022 (OEC, 2023). Cumin contributed about 14 percent in terms of quantity and 11 percent in terms of the value of export of spices from India in 2021-22 (Spices Board of India, 2022). Competition in the international market for spices from India has substantially increased with the onset of trade liberalisation in 1991, especially after the post-WTO regime. Product management along with various quality standards including cleanliness and health specifications have brought in negative outcomes for spice exports from India (Selven, 2007). However, the unit value and quantity of coriander exported from India have been fluctuating widely since 2012-13 while the quantity imported has been on the increase. The export of coriander seed has declined by 15 percent in volume during the period under reference. As a percentage of production, the export of coriander declined from 15 percent in 2013-14 to 6 percent in 2021-22. About 50 percent of the quantity and value of exports of coriander from India find its market in Asian countries, particularly, Malaysia, UAE, and Saudi Arabia. Fluctuations in demand emerging from major destinations of export have caused volatility in prices in the international and domestic markets for coriander in India. The cumin seed exported from India declined by 27 percent in 2021-22 over the previous year. Meanwhile, the volume of coriander imported to India registered an annual growth rate of 14.9 percent while the value of imports increased by 16.23 percent during 2013-14 to 2020-21. The unit value of exports of coriander from India is higher than its unit value of imports by 12 percent to 70 percent during 2012-13 to 2021-22. The recent spike in the quantity and value of imports of coriander to India is a major cause of concern and it amounts to dumping into the domestic market with cheap imports by major producing countries, especially, China, Indonesia, Tanzania, and Bulgaria.

The volume of cumin seed exported from India declined by 27 percent in 2021-22 over the previous year. Cumin is primarily an export-oriented crop, but its import has been increasing at a faster rate than exports. The volume of exports of cumin as a percentage of production declined from 37.5 percent to 29.9 percent between 2020-21 and 2021-22. The volume and value of cumin exported from India grew at an annual growth rate of 10.89 percent and 12.56 percent respectively while the unit value of export grew by 1.53 per cent during 2012-13 to 2021-22. The domestic market price of cumin, to a great extent, converges with the price in the

international market. There has been a significant increase in the volume and value of imports of cumin into India by 50.43 percent and 53.46 percent respectively during 2012-13 to 2021-22. The unit value of imports of cumin is marginally higher than the unit value of exports implying that a segment of the domestic market of cumin has increasingly been carved out by imports, particularly from China.

Although coriander and cumin produced in India command a premium price in the international market, yet export of these crops in both value and quantity have declined over the years. It is, therefore, pertinent to explore the reasons for the observed fall in the volume and value of exports and the increase in imports of cumin and coriander. Stipulations of the WTO demand adherence to phytosanitary conditions. In other words, the produce has to be clean, disease-free, and pesticide content in the produce must be within the statutory threshold. Traders-cum- exporters of these crops in major APMCs reported the following as important factors affecting the performance of these crops in the international markets: (i) 16 percent of farmers used threshing machines and the rest of them performed manual threshing. The manual threshing deteriorates the quality of edible items such as cumin and coriander because these products are directly consumed upon purchase. Moreover, manual threshing involves a high risk of contamination with foreign articles. The level of contamination increases with drying in the open under sunshine. Solar and electric-powered dryers save these crops from contamination while drying. Though machines are available for drying, it is unaffordable for small-scale producers, (ii) more than 40 percent of coriander and 84 percent of cumin farmers adopted manual cleaning of the produce; (iii) the quality testing of coriander and cumin is essential as stipulated under the WTO for edible items to be traded in the international market. It is rather strange to note that only one percent of sample households reported that they had performed quality testing of certification of the produce while 99 percent of farmers responded in the negative. Lack of awareness, exorbitant user fees, and long distances to access quality testing centre were important reasons for farmers not opting for it. Cumin and coriander seldom satisfy the phytosanitary conditions due to traditional and outdated methods of drying and sorting in India.

IV

POST-HARVEST ISSUES OF CUMIN AND CORIANDER FARMERS

The observed change in the area and productivity of cumin and coriander in Rajasthan may be juxtaposed against the long-term trends in the prices of these two crops. The coriander and cumin crops are harvested in March and sold during March and April. The price of coriander in the domestic market has been volatile for the last two decades (Figure 1). The area sown is influenced by the price expected and realised in the preceding years and agricultural production exhibits a lagged response to price. Although, price volatility is an inherent characteristic of export-oriented crops, the scale and magnitude of price volatility have intensified with trade liberalisation.

During the peak season of market arrival, prices of cumin and coriander are 20 percent to 40 percent less than the average price. The average annual price of coriander in 2014-15 was ₹114/kg, while the average price in the peak months of harvesting was (March-April) only ₹95/kg. Similarly, the average annual price of coriander seed for the year 2020-21 was ₹97/kg but the average price for March-April in 2021 was ₹83/kg. However, the gap between peak and lean season prices of coriander seed has narrowed down over the years except for 2020-21. Coriander produced in Rajasthan fetches a premium price in the export market owing to its superior quality. Similarly, the average price of the cumin seed during March and April is significantly lower than the average annual price. As trading of the crop is spread over the year with very little seasonality in demand conditions, traders gain by selling cumin at a higher price which was procured at a low price in the peak production season.

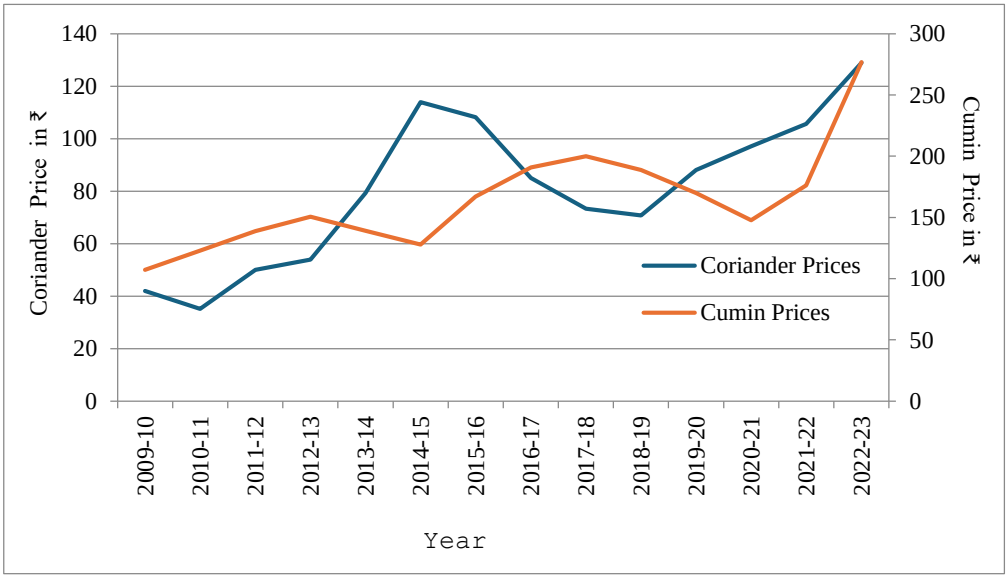

Figure 1. Average Domestic Price of Coriander and Cumin- 2009-10 to 2022-23
Source: Spices Board of India

There is a significant price difference between local and Specialised Markets (APMCs) for cumin. It was reported that 32 percent of medium farmers sell their produce to village traders, while large farmers sell their produce to wholesale traders in the nearest market, mostly in the specialised market for the crop. The market price of coriander seed touches its peak in November and its trough during the harvesting period, *i.e.*, February-March. Meena *et al.*, (2020a) reported that 53 percent of coriander seed production arrived in the market from March to May. The pattern of market arrival indicates that small and marginal farmers are incapable of holding the produce even for a few months following the harvest (Verma *et al.*, 2013). Marginal

and small farmers are subjected to multiple forms of market exploitation. The negative association between the quantity of market arrival and the price is indicative of the lack of staying power of marginal, small, and medium farmers. The association of production structure and market arrivals with prices has sufficiently been explored for agricultural commodities in the Indian context (Mohanakumar & Sharma, 2000; Mohanakumar & Chandy, 2005; Kumar *et al.*, 2011).

The Specialised Markets are expected to ensure the best competitive price by bidding, while the price in the local markets is always a derivative of the specialised markets. The local market is operated by agents or sub-agents of traders in specialised markets. Therefore, the Specialised Markets (APMCs) are the price setters, and the prices in the APMCs' are higher than the local markets. Price transmission assumes special significance for export-oriented crops like cumin and coriander. A higher order of market integration for agricultural commodities brings prosperity to farmers, especially when prices move up.

A study on markets for cumin in Rajasthan revealed that Nagaur and Pali; Nagaur and Jodhpur; and Nagaur and Jalore markets are closely integrated, implying that there exists little difference in the price of cumin across these districts. However, the price of cumin from the Nagaur to Jodhpur markets gets transmitted much faster as compared to other markets (Richard *et al.,* 2016). In the case of coriander, Rani and Meena (2021) found that the inter-state (Rajasthan and Madhya Pradesh) price transmission was relatively slow as compared to intra-state (within Rajasthan) for coriander. Slow transmission of coriander prices prevents farmers, particularly small and marginal from realising a better price. Farmers with traditional cultivation practices tend to sell in the village market with less value addition (Singh & Pothula, 2013). Studies on farmers' participation in different types of markets suggest that the education and asset position of farmers are important variables influencing the market choice of farmers (Sutradhar, 2014). In the case of food products, quality control driven by consumer preference assumes importance. There has been a close association between the resource strength of farmers and the modernisation of the marketing system.

In APMCs, traders use three different ways for product discrimination to undercut the price of coriander and cumin, viz., (i) visual grading with local brandings; (ii) auction process through outcry method; and (iii) advance payment for standing crops and disbursement of loan to ensure supply of product at a pre-determined price. These three methods are more prominent in coriander markets than cumin because coriander has more APMCs and, therefore, traders have to compete to ensure the supply during the peak production season. On the contrary, the Unjha Market in Gujarat is the only specialized market for cumin produced in Rajasthan. In the absence of a specialised market for cumin in Rajasthan, local traders purchase from small farmers in villages at a lower price compared to specialized markets. Farmers too prefer to sell to local markets because cumin cultivated in the Jodhpur

district of Rajasthan has to be transported to the Unjha Market in Gujarat for sale, which is 450-500 km away.

In the case of coriander, agents of traders from specialized markets identify potential suppliers (farmers) from villages to ensure the supply of coriander to traders in APMCs. In case the farmer is cash-starved, the trader gives a loan against the standing crop usually at 24 per cent annual interest. The trader, therefore ensures the sale of the product to him, and the sale proceeds are paid after deducting the loan amount with interest. The trader allows the farmer to pay part of the loan from the sales proceeds and the remaining loan amount is purposely collected from the farmer next year and the credit-product market linkage is sustained for years to the advantage of the trader. The advances made to farmers by traders involve zero risk because agents of traders would be constantly in touch with the farmers.

TABLE 5. LOCAL GRADES OF CORIANDER IN SPECIALISED MARKETS

Grade	Name	Rate as on 3.06.2018(₹/Kg)
1	Broken / ungraded	45
2	Bethami	48
3	Eagle	52
4	Scooter	60
5	Parrot	85
6	Double Parrot	110

Source: Primary Survey (2018), Ramganj Mandi, Rajasthan

The visual grading of coriander crops depends on the locale of production, colour, shape, and size of the produce. Five major grades, representing the quality and geographical locations of production in Rajasthan, do prevail for coriander seed, and the product is visually graded by traders. The Commission Agents (CAs') declare the grade in public and commence the auction (outcry) process. After a few minutes, the process is finished. The auction process in APMCs is reduced to a ceremonial act to complete the formality. However, the auction process and cry-out methods are supervised by officials of APMCs. The final prices of the product, arrived at through the outcry method in the specialised market seldom differ from the average price prevailing in the market for coriander. It seldom happens that the farmer takes back the product once it is brought to the APMCs for sale because it incurs a huge expenditure to the farmer for transport costs, loading and unloading, heaping in the APMC yard, and re-packing the produce.

Although coriander seeds are visually graded, more than 60 percent of coriander is sold as ungraded or *Bethami* grade and 20 percent are sold as *Scooter* grade (Table 5). If coriander seed is kept in the field for a longer period or stored for a better market price after the harvest, its colour fades and the evaporation of water content alters the shape and reduces the weight of the produce. The farmer pays a fee of ₹7/- per bag of coriander to the CA for unloading and packing the product. Large traders use the SORTEX machine for drying, cleaning, colouring, and shaping

coriander seeds. The coriander bought as an ungraded type at the lowest price, is processed in the SORTEX machine and sold as *parrot* or double parrot by the trader. The price difference between lower and higher grades is almost double. Coriander and cumin traded in Rajasthan are transported to major regional markets such as Erode in Tamil Nadu and Veerad Nagar in Andhra Pradesh (formerly), Delhi, and West Bengal markets. Farmers are incapable of undertaking any post-harvest operations due to the exorbitant costs involved in the post-harvest processing, especially for coriander.

V

FACTORS INFLUENCING FARMERS' DECISIONS

Given the supply and demand conditions, price is influenced by marketing efficiency and different channels of marketing. Marketing efficiency is assessed by estimating the producer's share in the consumer's rupee, while the marketing channel emphasizes players at various knots in the supply chain. A higher price in APMCs as compared to prices in the local market and further the loan received from the agents of traders in APMCs, together explain the market choice for 90 percent of cumin and coriander farmers. A tiny fraction of cumin farmers sell directly to APMCs and receive a higher price as compared to those who sell to local traders and agents of traders from APMCs. The average price realised from local traders was found 10 percent lower than the price in APMCs for cumin and coriander.

Table 6 shows the Comprehensive Index of Market Infrastructure (CIMI), computed from farmers' responses on the availability of infrastructure facilities in the market. The value of the CIMI ranged between zero to 25. When a farmer does not make use of any facility available in APMCs, the value of the Index is zero while if he/she makes use of all facilities, the index value is 25. Important observations from Table 6 are: (i) more than 35 percent of cumin farmers and 2 percent of coriander farmers reported that they had not availed of any facility from APMCs, (ii) 11 percent of coriander farmers responded that they had used all infrastructure facilities of the APMCs and the corresponding proportion of cumin farmers was only 3 percent.

TABLE 6. DISTRIBUTION OF FARMERS BY COMPREHENSIVE INDEX OF MARKET INFRASTRUCTURE

Index	Farmers' Response (Percentage)	
	Cumin	Coriander
0	35.38	2.11
0.01 to 5	18.47	16.02
5.01 to 10	7.69	19.72
10.01 to 15	17.95	25.34
15.01 to 20	17.43	25.36
20.01 to 25	3.08	11.27
Total	100	100

Note: The methodology of estimation of CIMI can be obtained from the working paper no.188 available at www.idsj.org (Mohanakumar *et al.*, 2023)
Source: Primary Survey, 2018

Reasons for not utilising the infrastructure facilities available in the APMCs call for a detailed analysis from farmers' perspectives. Farmers have expressed a series of concerns about the sale of the product in APMCs. About 30 percent of cumin farmers complained that they had not been able to receive a remunerative price because APMCs are situated far away from the site of production. However, APMCs are available at shorter distances from the site of production for coriander farmers. A major concern for more than 80 percent of coriander farmers is price volatility. Lack of adequate government support is one of the major concerns of both coriander and cumin farmers as reported in the primary survey. The withdrawal of the Spices Board from extension services has manifested and considerably added to farmers' hardships. Although Krishi Vigyan Kendra caters to the needs of cumin and coriander farmers, yet the services of Krishi Vigyan Kendra' are too limited to reach out to a large share of farmers in the area under cultivation.

Table 7 explains the response of farmers on the availability of technical services for the cultivation of cumin and coriander. It is strange to note that the service from the agricultural department (Extension Agent of Agricultural Officers) is availed by less than one percent of cumin and less than two percent of coriander farmers. About five percent of farmers avail technical assistance from Krishi Vigyan Kendra while the agricultural university provides services to none in the case of coriander and less than one percent for cumin farmers. A major source of technical input for coriander and cumin farmers is the progressive farmers and commercial agents working in the area.

TABLE 7. ACCESS TO TECHNICAL ADVICE FOR THE CULTIVATION OF CUMIN AND CORIANDER

Source of Technical advice	Cumin Farmers (%)	Coriander farmers (%)
Agriculture Supervisor in Gram Panchayat	7.74	12.81
Extension Agent/Officer	0.99	1.54
Krishi Vigyan Kendra	5.36	4.78
Agricultural University/College	0.79	0.00
Private Commercial Agents	24.40	10.96
Progressive Farmer	37.10	29.78
Radio	0.79	2.78
TV	2.18	7.56
Newspaper	8.13	14.35
Internet/Computer	0.79	2.16
Smart Phones	1.19	2.47
Mobiles without Internet	8.53	8.95
Farmers Organisations	1.39	0.93
NGO's	0.00	0.00
Others	0.60	0.93

Source: Primary Survey, 2018

It is important to identify the factors influencing farmers' decision to sell in APMCs or to local traders. Five explanatory variables, *viz*., education level of farmers, the primary source of income (agriculture or non-farm), distance from the locale of production to the APMCs measured in a kilometer, quantity produced as a proxy for the volume available for sale, the difference between the price at APMC and price realised from the last sale of the produce per quintal of cumin and coriander were specified in the model. In addition to these five standard variables, access to technical advice and services from different sources including the Spices Board and agricultural department of the state government, and a Comprehensive Index of Market Infrastructure (CIMI) were added to the model. The CIMI was constructed using data elicited from different stakeholders of APMCs for both cumin and coriander. Logit regression models were used to quantify the impact of each variable on the choice of sale of cumin and coriander. The Logit regression models with the categorical dependent variable as '1' represent sales to APMCs and '0' for the sale of cumin and coriander to markets other than APMCs (local vendors and traders). Tables 8 and 9 present the Logit regression models for cumin and coriander farmers in Rajasthan.

Outcome Variable

Participation of farmers in Special Markets (APMCs) for Coriander and Cumin (Y_{Mkt})

1= If farmers sell in the specialized market and;

0= Otherwise (If a farmer sells in the local market or Agents)

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \mu_i$$

DESCRIPTION OF VARIABLES

S. No.	Variable	Description
1	X_1	The education level of the farmer
2	X_2	Primary income source (1=Farming, 0= Non-farming)
3	X_3	Market distance from production centre to APMCs (in Km)
4	X_4	Production (in Quintal) -indicates availability of crops for sale
5	X_5	Price difference between local markets and APMCs (Rs./ Quintal)
6	X_6	Access to technical advice
7	X_7	Comprehensive Index of Market Infrastructure (CIMI)

Findings from Table 8 are: (i) The long distance between the production site and APMCs dissuades farmers from selling produce in APMCs. It means, if APMCs for cumin seeds are available in the Barmer or Jodhpur districts of Rajasthan, farmers would have chosen to sell in APMCs and realised a higher price; (ii) A higher price for cumin is not sufficient enough to attract farmers to APMCs because farmers compare the net revenue from the sale of the produce vis a vis the transport costs from production point to the APMCs, which is located 500 km away, and other incidental expenses; (iii) APMCs with adequate market infrastructure facilities (CIMI) for cleaning, drying, colouring and shaping, storage, internet facilities, and transparency in the auction process to attract farmers to the APMCs.

TABLE 8. LOGISTIC REGRESSION ON CHOICE OF SALE IN THE APMCs OF CUMIN

Independents Variables	Coefficient	Odds Ratio	Z-Statistics	P- Value	dy/dx	P-Value (dy/dx)
Education	.0398	1.0406	0.45	0.653	.0074	0.652
Primary Income Source	-0.9266	.3959	-1.25	0.211	-0.1733	0.206
Market Distance (in Km)	-0.0047	.9953	-3.89	0.000*	-0.0008	0.000*
Production (In Qtl)	.0092	1.0093	0.76	0.446	.0017	0.444
Price (per Qtl)	-7.57e-06	.9999	-0.04	0.968	-1.42e-	0.968
Access to Technical Advice	-0.1341	.8745	-0.94	0.348	-0.0251	0.345
Market Infrastructure Index	.1427	1.1534	5.35	0.000*	.0267	0.000*
Constant	1.0357	2.8169	0.40	0.692		
LR (χ^2)	Df	p-Value				
49.54	7	0.000				

Source: Estimated by author, Note: Level of significance * 1%, ** 5% and *** 10%

In the case of coriander (Table 9), (i) the price difference between APMCs and the local market is an important determinant of farmers' decision to sell in APMCs. A higher price in APMCs as compared to local markets attract coriander farmers to the specialised markets; (ii) the distance between the production site and the APMCs is not significant enough to influence the decision of coriander farmers to choose the market for sale. It could be because APMCs for coriander are available in all major production sites of the crop or at district headquarters. (iii) Comprehensive Index of Market Infrastructure (CIMI) indicating facilities available in specialised markets is the second important variable attracting farmers to sell coriander in APMCs. The model implies that APMCs play an important role in the marketing of export-oriented cumin and coriander in India. Moreover, APMCs are the price setters, and local vendors and local markets are price takers. In the absence of APMCs, farmers would be forced to sell cumin and coriander in the unprocessed form at a

lower price, which would work to the advantage of large traders, who possess costly machines for the primary processing of products.

TABLE 9. LOGISTIC REGRESSION ON CHOICE OF SALE IN THE APMCs FOR CORIANDER

Independents Variables	Coefficient	Odds Ratio	Z-Statistics	P- Value	dy/dx	P-Value of dy/dx
Education	-0.184	.8319	-1.30	0.192	-0.021	0.186
Primary Income Source	-0.5837	.5578	-0.44	0.661	-0.0667	0.661
Market Distance (in Km)	.1743	1.1904	3.78	0.000*	.0199	0.000*
Production (in Qtl)	-0.0246	.9757	-0.90	0.370	-0.0028	0.366
Price (per Qtl)	.0019	1.0020	2.43	0.015**	.0002	0.009*
Access to Technical Advice	.0708	1.0734	0.55	0.585	.0081	0.584
Market Infrastructure Index	.2416	1.2733	4.63	0.000*	.0276	0.000*
Constant	-9.7141	.00006	-2.98	0.003*		
LR (χ^2)	Df	P-Value				
50.62	7	0.000				

Note: Level of significance * 1%, ** 5% and *** 10%

VI

CONCLUSION

The commercial cultivation of cumin and coriander is constrained by agro-climatic conditions and, therefore, concentrated in a few geographical locations in India. Following the trade liberalisation in 1991, imports of both cumin and coriander have substantially increased while the volume of exports, particularly of coriander has significantly reduced. The price volatility of coriander has resulted in a sharp decline in the area and production of the crop in Rajasthan. Cumin and coriander are consumed directly on purchase and, therefore, sanitary and phytosanitary conditions of WTO assume significance in the international market. Following the trade liberalisation in the 1990s, the Spices Board, the agency responsible for propagation and promotion of spices, has withdrawn most of its services to farmers including marketing facilities. As a result, farmers are compelled to depend solely on private vendors for technical advice and supplies of unauthorised pesticides at exorbitant prices. Such pesticides are not scientifically tested for use on edible items. The Cumin farmers in Rajasthan sell their produce to local markets due to the non-

availability of APMCs in the western part of the state. Even though infrastructure facilities in APMCs are available, for more than 50 percent of farmers, it is not accessible due to exorbitant costs charged by traders in APMCs. The Doubling Farmers' Income (DFI) Committee's recommendations would not bear fruit unless APMCs are modernised with adequate infrastructure facilities for small and marginal farmers to ensure that export-oriented crops and edible items of agricultural products are processed at international standards. The study underlines that despite several constraints, APMCs do play an important role in the marketing of agricultural products, although APMCs are more supportive of traders. It is evident that Indian farmers are losing the market share in coriander and to a certain extent for cumin, globally and further, the domestic market has increasingly been carved out by imports. Augmentation of productivity is inevitable and be made possible only if the Spices Board is revived.

Endnotes:

i. Till 2015-16, Rajasthan had the largest area under coriander cultivation among all the states with a share of 34%.

ii. Monitoring of Pesticide Residues at the National Level (MPRNL) detected residues of non-approved pesticides in 377 samples out of 761 samples collected and tested by different labs in India from April 2017 to March 2018 (FSSAI, 2019).

iii. They include Bulgaria (coriander, fenugreek), Turkey, Iran, Egypt (cumin, ajwain, and nigella), China (celery), Romania, Germany, Hungary (til), Southern France, Cyprus, Pakistan, and Sri Lanka. Many other countries of South America, Europe, South African, and the Asian continent are also likely to enter in the production of seed spices (Vijay and Malhotra 2002)

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