IDSJ Working Paper 188

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Please send suggestions and comments to
S. Mohanakumar, (mohanakumar.s@gmail.com)
Convenor, Publications

Institute of Development Studies
8-B, Jhalana Institutional Area
Jaipur-302 004 (India)
Phone : 91-141-2705726 / 2706457 / 2705348
Fax : : 91-141-2705348
E-Mail : idsj@dataone.in
visit us at : www.idsj.org

Printed at : Classified Printers, Jaipur

Production Structure and Market Dynamics of Seed Spices : A Study of Cumin and Coriander in Rajasthan

S Mohanakumar, K J Joseph and Prem Kumar[i]

Abstract

The study is based on a primary survey of 400 farmers and personal interviews with traders in major APMCs for cumin and coriander in Rajasthan. Analysis of the production structure and market dynamics of coriander and cumin crops in Rajasthan are the objectives of the study. The study also looks into post-harvest issues that coriander and cumin farmers encounter in Rajasthan and the scenario that emerged after the withdrawal of extension services for these crops by the Spices Board following trade liberalisation in 1991. Cumin cultivation has been shifting from Rajasthan to Gujarat due to absence of specialised market for cumin nearyby, shortage of water and lack of electricity connection in major cumin production districts such as Barmer and Jodhpur in Rajasthan. Pest-attack and an uncertain market compounded by price volatility are major concerns of coriander farmers in the south-eastern districts of the state. Specialised markets or APMCs do not cater to the demands of coriander and cumin farmers due to inadequate infrastructure facilities for the preliminary processing of edible products like cumin and coriander. Besides this, there exists several other practices in APMCs including local branding of products by traders, which puts the farmers at the receiving end. The present system of manual drying and sorting for coriander and cumin does not adhere to the international standards of sanitary and phytosanitary stipulations for trading of plant products, which are edible items in the international market. There has been a significant decline in the export orientation of coriander and, to a certain extent, of cumin. The decline in export orientation was coupled with a sharp rise in imports of coriander and cumin, which are attributable partly to the poor phytosanitary standards of the APMCs and in partly to the dumping of coriander in the domestic market. The study suggests strengthening of infrastructure facilities in APMCs and take measures that farmers receive the best competitive price. Dilution of APMCs would throw farmers on the mercy of traders, and it would prove to be counter-productive.

Keywords: *Cumin. Coriander, APMC, Rajasthan, Export and Import*

Introduction

India is the leading spice producer in the world with 52 spice crops. A majority of spice crops have a maximum gestation period of less than a year. Among seasonal seed spice crops, coriander and cumin assume special significance as these crops are highly sensitive to weather changes and their cultivations are not extendable to marginal lands. Production of cumin and coriander is concentrated in arid or semi-arid districts in Rajasthan, Gujarat, and Madhya Pradesh. In the total area of 6.31 lakh hectares under coriander, Madhya Pradesh accounted for 46% followed by Gujarat (19.8%) and Rajasthan (19.7%)[ii] in 2021-22. Rajasthan accounted for 59% of the total area of 10.36 lakh hectares under cumin, followed by Gujarat (41%) in 2021-22. The demand for spices in the international market has been increasing for the last many years while entry into the world market is a difficult proposition for countries like India. The competition is aggravated by the entry of new producers into the market[iii]. The competition in the domestic and international markets has tightened after trade liberalization since 1991. Like other exportable agricultural commodities from India, the post-WTO regime has adversely impacted the export orientation of seed spices as well. The policy of Doubling Farmers' Income of the NDA government has not yet yielded the desired outcome. In the international market, consumers have become more quality conscious and the sanitary standards call for adherence to both intrinsic and extrinsic quality measures of international standards[iv]. Quality management along with various quality standards including cleanliness and health specifications need to be adhered to by producers of spices and edible crops in India (Selven, 2007). The export intensity of coriander and cumin is six percent and 30 percent respectively in 2021-22. Nonetheless, given the world demand especially for value-added spice products and those that adhere to quality standards, there is much scope for further increase in exports. Against the backdrop that the study focuses on two aspects: (i) issues that farmers of cumin and coriander crops encounter in their post-harvest phase, especially

in specialised markets; (ii) analyze trends in production and the external trade of coriander and cumin. The discussion in the paper is organised into three sections. Section 1 explains the production structure of coriander and cumin. Trends in price, export, and import are discussed in Section 2; and Section 3 analyses the post-harvest issues of crops, followed by a conclusion.

Section 1

Production Structure

The study is based on a sample survey of 400 farmers divided equally among major coriander and cumin-growing districts in Rajasthan. The household survey tool was supplemented with personal interviews of traders from specialised markets. *Unjha Mandi* (Mehsana district) in Gujarat is a specialised market for cumin, while *Ramganj Mandi* (Kota district) and *Bhawani Mandi* (Jhalawar district) in Rajasthan are specialised market for coriander. Based on secondary data on area and production, sample villages and cultivator households were selected with a non-probability snowball sampling. The snowball sampling method was adopted in the absence of a sample frame with the list of farmers by villages in selected districts. The cultivation of coriander is concentrated in the Kota, Baran, and Bundi districts of Rajasthan, while cumin is cultivated prominently in the south-west districts of Rajasthan, viz., Barmer and Jodhpur[v].

There are studies, which suggest an association between production structure and, marketing. These two variables influence the farm gate price as well (Kumar et al., 2011). The household characteristics, *viz.*, mean age of the farmers, education, and main occupation of households reveal the socio-economic significance of farmers cultivating a specific crop. The majority of farmers (48.5%) belonged to the 41 to 60 years of age category. It is in sharp contrast with the observation noted in certain plantation crops such

as cardamom, rubber, coffee, etc., where the younger generation was found less inclined towards traditional agriculture. The mean years of schooling and education level of farmers have significant implications in the economic analysis of a crop. However, differences in the average years of schooling are influenced by a handful of social and economic factors and it is assumed to be independent of the crops grown. The mean years of schooling were 3.5 years, but coriander farmers spent more years in school (4.1 years) as compared to cumin farmers (2.9 years). The share of farmers, who had education above secondary level was higher (16.7%) for coriander farmers as compared to cumin farmers (9%). The average family size was more or less the same for the coriander and cumin growers. The occupation status of the farmers shows that the majority of the coriander (55.4%) and cumin (66.3%) farmers were engaged in other agricultural activities along with the cultivation of cumin and coriander. Due to shortage of water and uncertainty weather conditions, farmers tend to lease out the land and the landless farmers with sufficient size of family labour lease in for the cultivation of cumin and coriander. The share of tenant cultivator (leased land farming) in coriander was 36.4% and for cumin, it was 22.5%. Medium and large farmers together accounted for more than 70% of the total farmers across group for cumin and coriander cultivation. The share of medium and large farmers was relatively higher for cumin as compared to coriander (Table 1).

Coriander and cumin are cultivated in the rabi season (October to March). Sowing is performed between the last week of October and the first week of November, while the crop is harvested during March-April. The coriander and cumin plants could sustain drought condition and it does not require water during the flowering and harvesting stages. If it rains in January or February, the crop will get destroyed.

Table 1: Distribution of Farmers by Area under Cultivation by Crops

Size of Holdings (ha)	Cumin (%)		Coriander (%)	
	2016-17	2017-18	2016-17	2017-18
Marginal (up to 1 ha)	11 (5.7)	8 (4)	21 (10.3)	26 (12.9)
Small (1.01 to 2 ha)	28 (14.5)	28 (14.1)	48 (23.6)	52 (25.7)
Medium (2.01 to 4 ha)	97 (50.3)	95 (47.7)	61 (30)	67 (33.2)
Large (Above 4 ha)	57 (29.5)	68 (34.2)	73 (36)	57 (28.2)
Total	193	199	203	202

Source: Primary Survey, 2018

Production Conditions: Coriander

Important states cultivating coriander are Madhya Pradesh, Rajasthan, and Gujarat. The share of coriander cultivation under these states went through a shift between 2013-14 and 2021-22. Rajasthan accounted for 41 percent of the area and 37 percent of the production of coriander in India in 2013-14, which declined to 19 percent of the area and production in 2021-22. The share in area and production of coriander for Rajasthan is less than the other two major states, *viz*., Gujarat (20% area and 22% production) and Madhya Pradesh (46% area and 48% production) in 2021-22. The relative share of the quantity and value of coriander exported from India in the total export of spices accounted for 3.2 percent and 1.6 percent respectively in 2021-22 (Spices Board India, 2022). There has been a continuous decline in the unit value and quantity of coriander exported from India since 2012-13. Conversely, the quantity of imports has been increasing. The price of coriander in the domestic market has been sliding down for a few years, which has resulted in a decline in the area under the crop. Agricultural commodities exhibit a lagged price response to production since the decision of farmers on the area sown is influenced by the price expected and realized in the preceding years. Important observations emerged from the production trend in coriander are: (i) relative share in the area under cultivation and production of coriander in major producing states, viz., Rajasthan and Madhya Pradesh

are on the decline while Gujarat has made up for both area and production; (ii) the increase in the productivity of coriander in Rajasthan and Madhya Pradesh showed that farmers had withdrawn the coriander cultivation from marginal lands. The concentration of farming to the most fertile lands in the wake of a continuous price fall is a rational response of farmers. There exist several parallels to such comparable situations in the literature on crop farming (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 suggests that coriander had replaced other less remunerative crops in the arid districts in Gujarat (See Tables 2, 3, and 4). 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 the geographical relocation of coriander cultivation in India.

Table 2: 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 India

The cultivated area under coriander has been declining in Rajasthan at an annual rate of 4.7%, while its area in Gujarat and Madhya Pradesh has increased by 25.3% and 7.72%

respectively, during 2013-14 to 2021-22. The cultivated area under coriander has been increasing in major coriander-producing districts in Gujarat, viz., Junagarh, Rajkot, Kutch, and Gir Somnath. Nigella seeds, which is known as Kalonji in the local dialect. Water availability and extension of irrigation facilities in Baran districts compounded by the fall in the price of coriander seed have forced farmers to substitute it with Kalonji.

Table 3: Relative Share of Production under Coriander by Major States- 2013-14 to 2021-22

Year	Rajasthan (%)	Gujarat (%)	Madhya Pradesh (%)	Others (%)	India (000 MT)
2013-14	37.33	10.30	23.91	28.46	313.65
2014-15	43.05	13.94	20.56	22.45	461.71
2015-16	39.65	24.22	18.93	17.19	572.99
2016-17	23.97	21.95	44.87	9.22	863.52
2017-18	18.05	16.19	54.14	11.62	721.39
2018-19	14.94	7.58	63.09	14.39	599.48
2019-20	12.75	18.43	56.33	12.49	700.81
2020-21	20.50	24.47	45.03	10.01	891.31
2021-22	18.57	21.85	48.77	10.80	800.74
CAGR (%)	3.03	23.52	22.91	-0.39	12.43

Source: Spices Board India

Table 4: Productivity under Coriander by Major States - 2013-14 to 2021-22 (Kg/ha)

Year	Rajasthan	Gujarat	Madhya Pradesh	India
2013-14	640.73	1570.73	468.75	701.47
2014-15	797.24	1461.19	659.01	835.43
2015-16	1068.0	1566.6	531.9	917.1
2016-17	1139.0	1563.7	1405.0	1283.6
2017-18	1331.3	1557.5	1395.6	1325.5
2018-19	1298.2	1507.1	1350.9	1275.5
2019-20	1488.0	1498.7	1350.6	1324.9
2020-21	1470.0	1544.3	1345.6	1357.8
2021-22	1196.5	1400.0	1346.4	1267.6
CAGR (%)	8.12	-1.43	14.10	7.68

Source: Spices Board India

Table 5 shows the reasons for the change in the area under coriander cultivation in Rajasthan as revealed by farmers in the sample survey. The 44% of reduction in area under coriander cultivation was observed in 2017-18 compared to 2016-17. It is important to note that 88.5% of farmers in the total sample of 200 farmers reported that they have reduced the area under coriander cultivation in Rajasthan. The fall in price was a reason for 48% of farmers to cut down the area under the crop while 28 percent left land fallow. Another 16 percent substituted the crop with another crop. A substantially large proportion of farmers (86.5%) reported that they reduced the production of coriander during the last two production seasons. The farmers pointed out that the fall in the area, droughts, and frost damage were the major reasons for the fall in coriander production. Lack of institutional intervention for disease control and near total absence of technical advice from authentic sources were the problems that farmers encountered.

Table 5: Reasons for Fall in Cultivated Area under Coriander (2016-17 to 2017-18)

Reasons	Coriander	
	Percent	Percent
Leased in	Nil	12.11
Leased out / sold land	16.38	6. 82
Left Uncultivated	28.24	38.17
Price fall	48.59	28.24
Others	6.78	14.50
Total	100	100.00

Note: Others include Plant diseases, Weather changes, Low production, and water shortage
Source: Primary Survey, 2018

About 60 percent of farmers reported plant disease as an important issue in production (Table 6). There are numerous private pesticide manufacturing companies, which operate with their marketing agents in the area. Most of the pesticide products available in the market are imported and charge exorbitant prices. The marketing agents of these companies are selling these pesticide products in the market without any scientific

recommendation and approval from the recognized and authorized agencies for their use on crops of edible items. It may also be noted that 3 percent of farmers reported that the quality of pesticides was inferior, thus coriander crops require these pesticides on a higher frequency and in excessive doses. When the farmer came to know that this particular pesticide was of inferior quality, these companies introduced newer brands and sold them. Scarcity of water and crop loss caused by stray animals, particularly in the light of vigorous cow protection campaigns, has also been a serious threat.

Table 6: Problems of Coriander Farmers

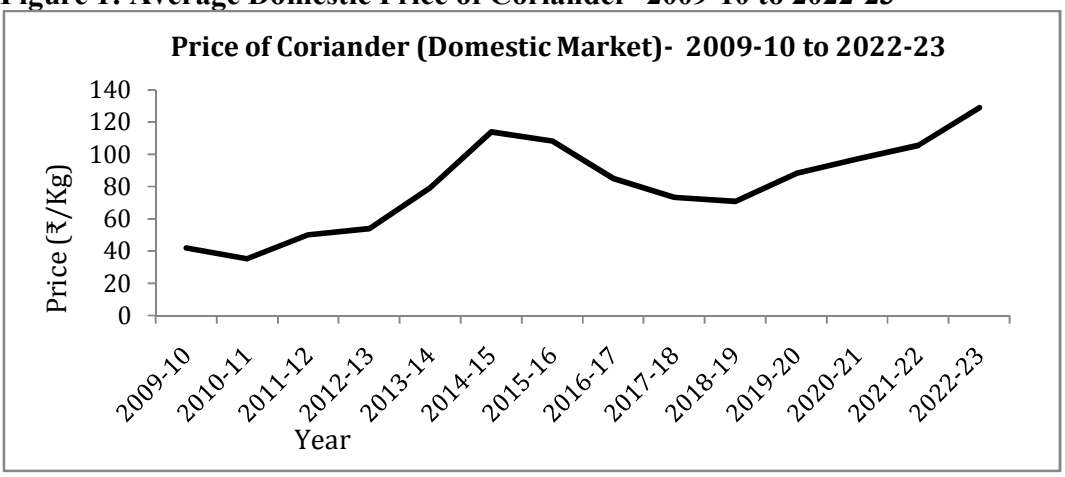
Problem	Percentage
Plant Disease	59.80
Stray Animals	13.24
Scarcity of Water	20.59
Shortage of Electricity	3.45
Poor Quality of Pesticides	5.11
Total	100.00

Source: Primary Survey, 2018

Trends in the Price of Coriander

Price volatility is an inherent characteristic of export-oriented crops. The scale and magnitude of price volatility have intensified with trade liberalization. The cultivated area under coriander grew at an annual rate of 4.4% while its production registered a growth rate of 12.4% per annum during the period 2013-14 to 2021-22. It may appear to be contradictory that despite sharp fluctuations in price, the cultivated area and production under the coriander crop increased. It is attributable to a variant of “hunger farming” in which farmers are left with little alternatives in substituting coriander with other crops. The price of coriander seed may be viewed against the fall in the productivity of coriander during the reference period. Figure 1 shows the trend in the price of coriander during 2009-10 to 2022-23.

Figure 1: Average Domestic Price of Coriander- 2009-10 to 2022-23



Source: Spices Board India

The average annual price of coriander in 2014-15 was ₹114/kg, while the average annual price of the same for March and April in the corresponding year was ₹95 or 83% of the annual average price. Similarly, the average annual price of coriander seed for the year 2020-21 was ₹97/kg but the average price of the same for March and April was ₹83/kg. A positive trend in the price trend is that the difference in the minimum and maximum price between peak and lean seasons has declined for coriander seeds. Coriander produced in Rajasthan fetches a premium price in the export market owing to its superior quality. The monthly price of the coriander seeds shows how farmers are forced to sell a major share of their produce at a much lower price as compared to its annual average price. The coriander crop is harvested in March and sold in the market during March and April as the storage of the product causes weight loss. The Commission Agents (CA) of traders in specialized markets approach farmers and fix the price for the crop from February-March or else, farmers contact the CA in the specialized markets to whom they have been selling their products for many years and have established a mutual trust. However, farmers believe the CA would help them fetch a fair deal from the trader. The CAs are full-time

employees and are more loyal to the trader. Farmers are, to an extent, bound to sell the product to the CA as the farmer has already taken the price for the standing crop in advance or has availed loan from the trader through the CA. The farmer has housed far away from the market and the market information is collected through the CA. It is the CA that connects the farmer with a particular trader and arranges the yard for cleaning, grading, and sale of the product in the specialized market for coriander. The relationship between the farmer and the trader in the market is much deeper for both, although it works to the advantage of the trader than the farmer.

Production conditions: Cumin

India is a major producer of cumin and contributes around 70 percent of the world's total cumin production, which was followed by the Syria, Turkey and Iran with long gap (Anandh M., 2016). India consumes around 70 percent of her total production of cumin, while Syria and Turkey consumes only 10 percent of their cumin production. Still, India contributes in the export market with a two-third of the total global cumin export (Anandh M., 2016). In other words, India has a substantially large International as well as domestic market for cumin. However, cumin is more of an export-oriented crop as compared to coriander as 30% of the domestic production of Cumin is exported from India. More than 99% of the area under cumin cultivation in India is concentrated in two states, *viz*., Rajasthan and Gujarat. In Rajasthan, Barmer and Jodhpur are two major cumin cultivating districts, which together accounted for more than 70% of the total area and production of cumin in the country. Cumin contributed 14 percent of the total quantity of exports of spices from India and 11 percent of the total export value in 2021-22 (Spices Board India, 2022). There has been a substantial increase in the area of cumin from 5.1 lakh hectares to 10.4 lakh hectares, while the production of the crop increased from 3.9 lakh tonne to 7.25 lakh tonne during the period between 2013-14 and 2021-22. However, there is a marginal

decline in the productivity of the crop from 759 kg/hectare to 700 kg/hectare during the reference period. The increase in the area and production of cumin is attributable to a fall in the price of the next best alternative crops in the marginal land for cumin in the Jodhpur district in Rajasthan.

Table 7: 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 India

There has been a substantial shift in the area under cumin from a high-productivity zone (Gujarat) to low productivity zone in the recent past (Rajasthan). Rajasthan accounted for 54% of the area under cumin in 2013-14 and it increased to 59% in 2021-22 and area under the cumin in Gujarat declined from 45% to 41% during the reference period (Table 7). Nonetheless, there has not been any commensurate fall in the production of cumin in Rajasthan as the upward trend in the area works in favour of Rajasthan (Table 8). On the other hand, the productivity of cumin in Rajasthan was nearly two-thirds of Gujarat in 2013-14, which further declined to nearly half of Gujarat in 2021-22. Moreover, productivity measured in terms of kilogram per hectare of land registered an annual rate of growth to the tune of positive 0.5 percent in Gujarat as compared to the annual growth rate of negative 2.31 percent in Rajasthan during the period between 2013-14 and 2021-22 (Table 9).

Table 8: Relative Share of Production under Cumin by Major States - 2013-14 to 2021-22

Year	Rajasthan (%)	Gujarat (%)	Others (%)	India (000 MT)
2013-14	43.08	56.91	0.01	390.00
2014-15	75.11	24.89	0.01	485.51
2015-16	39.91	59.80	0.29	503.26
2016-17	41.36	58.26	0.39	500.36
2017-18	43.94	55.77	0.29	689.42
2018-19	54.04	45.65	0.30	700.65
2019-20	46.94	52.80	0.26	912.04
2020-21	40.07	59.67	0.26	795.31
2021-22	41.83	57.88	0.30	725.65
CAGR (%)	7.67	8.30	61.67	8.07

Source: Spices Board India

Table 9: Productivity under Cumin by Major States- 2013-14 to 2021-22 (Kg/ha)

Year	Rajasthan	Gujarat	India
2013-14	600.0	949.3	759.0
2014-15	801.6	278.0	545.7
2015-16	393.0	1018.8	622.7
2016-17	413.8	1045.7	640.7
2017-18	521.1	1004.6	713.6
2018-19	559.9	915.1	681.6
2019-20	549.1	974.3	714.6
2020-21	522.7	998.6	731.6
2021-22	497.8	988.2	700.0
CAGR (%)	-2.31	0.50	-1.01

Source: Spices Board India

In the field survey, 65.5 percent of households reported that they had reduced the area under cumin cultivation while 34.5 percent of farmers had reported an increased or did not cut down the area under cumin cultivation during the period of the survey (2017-18). It can be presumed that an increase in area by a relatively smaller proportion of medium and large farmers could outweigh the reduction in the area by a large proportion of small and marginal farmers. It may also be noted that about 13 percent of sample farmers have

leased land for cumin cultivation and it is widely practiced in the desert area as farmers without irrigation facilities used to lease irrigated land to cultivate the crop. It indicates the relative profitability in the cultivation of cumin as compared to coriander. However, 86 percent of farmers reported that their cumin production had declined over the previous years, while 14 percent of farmers reported a rise in production over the previous year. Important reasons for the reported fall in the production of cumin (driven by productivity fall) are droughts and the absence of adequate irrigation facilities.

Table 10: Problems of Cumin Farmers' in Rajasthan

Issues	Cumin Farmers' Response (%)
Lack of Technical Advice on seeds, fertilizer, and pests	19.00
Plant Disease	32.50
Shortage of Water	8.00
The problem of Stray Animals	12.00
Weather Change	14.00
No Access to Government Loan	0.50
Leased land Cultivation	2.00
High Cost of Production	7.50
Shortage of Electricity	1.50
No Response	3.00
Total	100.00

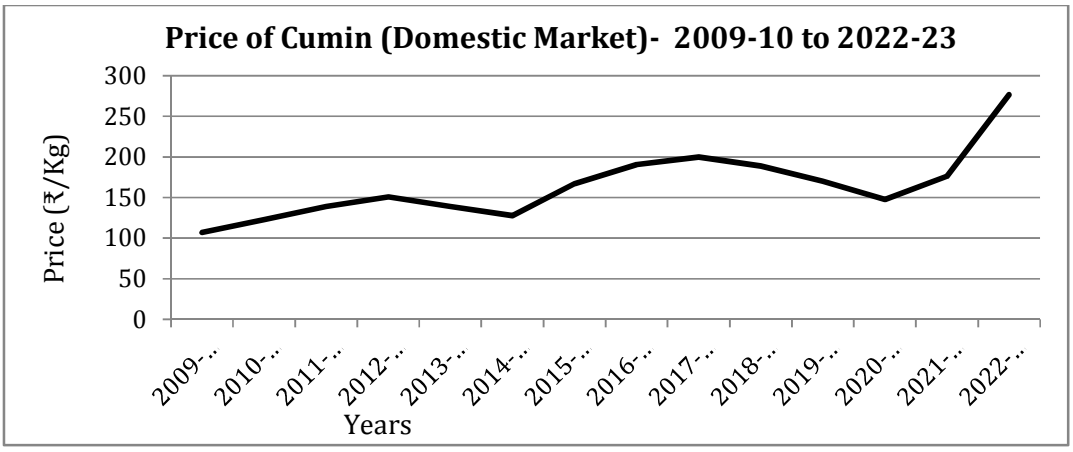
Source: Primary Survey, 2018

Major problems that the cumin growers encounter were: pest- attacks and lack of technical advice from the Spices Board. The tenant cultivators of cumin pay an exorbitant cost of 50 percent of the produce as rent. It includes the facilities for irrigation in the pre-blossom phase of the crop. On paying rent and other cost of production, farmers are left with a very narrow margin. It is reported as a serious disincentive for cumin cultivators in Rajasthan (Table 10).

Figure 2 shows the price trend of cumin during 2009-10 to 2022-23. As observed, there has been seasonal price volatility. The average price of the cumin seed during March and

April is significantly lower than the average annual price of the crop. 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 they procured from farmers at a lower price in the peak production season. More than 80 percent of the cumin production was sold in the harvesting period, i.e., March and April during which the price of the crop is at its trough point of the year.

Figure 2: Average Domestic Price for Cumin- 2009-10 to 2022-23



Source: Spices Board India

Section 2

Trends in Foreign Trade

India is the largest producer of spices in the world accounting for 42 percent of the world production and 47 percent of the area under spices. During the last decade (2010-2020), world production of spices registered a decadal growth rate of 5 percent. The production of spices in the world touched 15.82 million MT in 2020 (Spices Board India, 2023). China is the distant second largest producer of spices with 7 percent share in world production, closely followed by Nigeria (5%) and Indonesia and Ethiopia (4 % each) in 2020. In terms of productivity, China tops the rank with a production share of 7 percent

from an area of 3 percent under spice cultivation in the world. Seed spices including cumin and coriander accounted for 14 percent of the world's production of spices in 2020. India has carved out a significant share in the world trade of spices with 20 percent in the value of export (Spices Board India, 2023).

Research, schemes, and programmes are mostly meant for perennial spice crops in India, notwithstanding the fact that annual and seasonal spice crops too contribute substantially to foreign exchange earnings. There have been fluctuations in the quantity and value of exports of spice crops from India, especially after the trade liberalisation. The quantity of coriander seed exported from India declined by 15 percent and export earnings (at current prices) declined by 3 percent in 2021-22 as compared to the previous year. Similarly, the volume and value of cumin exported from India declined by 27 percent and 21 percent respectively during the same period. It is worth examining why the external market for cumin and coriander, which are inevitable ingredients in food items mostly in Asian countries, do fluctuate violently.

The production and quantity exported are two factors influencing the price. Although the relative contribution of coriander and cumin seed in the total export earnings is relatively insignificant, these crops have provided livelihoods to a large section of farmers and wage labours in arid and semi-arid zones in India. Broadly, two important trends have emerged in the export of coriander and cumin during the last one decade: (i) there has been a decline in the export of the coriander seed as a percentage of production from 15 percent in 2013-14 to 6 percent in 2021-22 (Table 11). However, the unit price of the crop has increased over the years. Moreover, the quantity and value of exports of coriander from India have been volatile leaving a profound impact on the price of the product in the domestic market. 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. Variations in the demand emerging from the major destinations cause fluctuations in the domestic price of the product (Table 12).

Table 11: Quantity and Value of Exports of Coriander from India

Year	Quantity (MT)	Value (₹ lakh)	Unit Value ₹/Kg	Quantity Exported as % of Total Production	Growth Rate in Quantity (YoY)	Growth Rate in Value (YoY
2012-13	43271	19711	46	-	-	-
2013-14	45750	42098	92	14.59	5.73	113.57
2014-15	46000	53836	117	9.96	0.55	27.88
2015-16	40100	44830	112	7.00	-12.83	-16.73
2016-17	30300	31108	103	3.51	-24.44	-30.61
2017-18	35185	27275	78	4.88	16.12	-12.32
2018-19	48900	35208	72	8.16	38.98	29.09
2019-20	47135	39831	85	6.73	-3.61	13.13
2020-21	57359	49628	87	6.44	21.69	24.60
2021-22	48658	48251	99	6.08	-15.17	-2.77
CAGR	1.31	10.46	9.03	-	-	-

Source: Spices Board India

Table 12: Relative Share in Value of Export of Coriander from India by Destinations

Country	2017-18	2018-19	2019-20	2020-21	2021-22
Malaysia	27.89	22.68	25.06	20.21	23.81
UAE	11.05	7.95	9.76	9.35	8.55
Saudi Arabia	6.93	6.61	6.85	5.09	5.83
Nepal	5.73	6.19	6.63	9.86	9.27
Singapore	2.09	2.16	1.93	1.67	1.58
Indonesia	0.55	1.90	1.12	2.80	0.48
USA	8.04	7.08	6.04	8.22	8.39
UK	8.89	7.47	7.60	7.86	6.94
South Africa	6.17	6.52	6.73	6.42	5.55
Others	22.66	31.43	28.28	28.53	29.60
Total Exports (₹ lakh)	27274	35208	39831	49627	48251

Source: Spices Board India

Alongside, there has been a substantial hike in the quantity of coriander imported into India. It increased at a compound annual growth rate of 14.9 percent while the value of imports increased by an annual compound growth rate of 16.23 percent during 2013-14 to

2020-21 (Table 13). A higher rate of growth in the value of exports as compared to the rate in the number of exports of coriander is attributable to a higher unit value of exports during the reference period. The unit value of exports of coriander from India is higher than its unit value of imports by a range between 12 and 70 percent during 2012-13 to 2021-22. The recent spike in the quantity and value of imports of coriander to India may be considered an act of dumping into the domestic market with cheap imports of coriander by major producing countries.

Table 13: Quantity and Value of Imports of Coriander in India

Year	Quantity (MT)	Value (₹ lakh)	Unit Value (₹/Kg)	Growth Rate in Quantity (YoY)	Growth Rate in Value (YoY
2012-13	4470	3526	79	-	-
2013-14	4640	5177	112	3.80	46.82
2014-15	9750	9631	99	110.13	86.03
2015-16	25305	17467	69	159.54	81.36
2016-17	44485	22049	50	75.80	26.23
2017-18	28040	13200	47	-36.97	-40.13
2018-19	13230	5609	42	-52.82	-57.51
2019-20	12000	8027	67	-9.30	43.12
2020-21	8777	5881	67	-26.86	-26.74
2021-22	15603	13647	87	77.77	132.06
CAGR	14.90	16.23	1.15	-	-

Source: Spices Board India

Cumin is primarily an export-oriented crop, but its import has been increasing at a faster rate than exports. The quantity of exports of cumin as a percentage of the total production has increased to 37.5% in 2020-21 (COVID-19 year), which declined to 29.9% in 2021-22. The export orientation of the crop defined as quantity exported as a percentage of domestic production has been ranging between 20 and 30 percent for the last decade (Table 14).

Table 14: Quantity and Value of Export of Cumin from India

Year	Quantity (MT)	Value (₹ lakh)	Unit Value ₹/Kg	Quantity Exported as % of Total Production	Growth Rate in Quantity (YoY)	Growth Rate in Value (YoY
2012-13	85602	115306	135	-	-	-
2013-14	121500	160006	132	31.15	41.94	38.77
2014-15	155500	183820	118	32.03	27.98	14.88
2015-16	97790	153113	157	19.43	-37.11	-16.70
2016-17	119000	196320	165	23.78	21.69	28.22
2017-18	143670	241799	168	20.84	20.73	23.17
2018-19	180300	288480	160	25.73	25.50	19.31
2019-20	214190	332806	155	23.48	18.80	15.37
2020-21	298423	425155	142	37.52	39.33	27.75
2021-22	216996	334434	154	29.90	-27.29	-21.34
CAGR	10.89	12.56	1.51	-	-	-

Source: Spices Board India

Table 15: Quantity and Value of Import of Cumin in India

Year	Quantity (MT)	Value (₹ lakh)	Unit Value (₹/Kg)	Growth Rate in Quantity (YoY)	Growth Rate in Value (YoY
2012-13	120	168	140	-	-
2013-14	570	987	173	375.00	487.27
2014-15	200	299	149	-64.91	-69.72
2015-16	2000	3577	179	900.00	1096.52
2016-17	2800	5021	179	40.00	40.35
2017-18	3420	6066	177	22.14	20.82
2018-19	949	1832	193	-72.25	-69.80
2019-20	2615	4419	169	175.55	141.25
2020-21	7139	11121	156	173.00	151.64
2021-22	4733	7935	168	-33.70	-28.65
CAGR	50.43	53.46	2.01	-	-

Source: Spices Board India

The quantity and value of cumin exported from India grew at an annual compound growth rate of 10.89 percent and 12.56 percent respectively during 2012-13 to 2021-22. During the reference period, the unit value of export grew annually by 1.53 percent. The annual percentage change in the export value of cumin is more or less steady during the last decade. The domestic market price of cumin, to a great extent, converges with the price of the product in the international market. The issue of concern is the phenomenal increase in the quantity and value of imports of cumin into India by 50.43 percent and 53.46 percent respectively during 2012-13 to 2021-22. More interestingly, the unit value of imports of cumin is marginally higher than the unit value of exports (Table 15). It implies that a segment of the domestic market of cumin has increasingly been carved out by the quality of the product grown and processed outside India, primarily in China.

Section 3

Post Harvest Processing and Marketing

Research on various aspects of marketing and issues of post-harvesting encountered by farmers in specialized markets for cumin and coriander seldom attracts adequate scholarly attention. The Unjha Market in Gujarat state is the specialized market for cumin grown in Rajasthan and Gujarat while coriander farmers have more specialised markets in major production centres of the crop. Post-harvesting and marketing of the product in the speicalised markets for cumin and coriander involved multiple stages, which are more or less the same for both crops. The post-harvesting process and marketing commence with the visit of Commission Agents of Traders of Specialised Markets to Villages for spotting potential farmers to ensure the supply of coriander and cumin to a particular trader in the market. In case, the farmer required a loan from the traders for the standing crop, it would be granted by the CA. However, the extent of convincing farmers depends on the expected price and the likely market impulse. After the harvest, coriander and cumin are heaped in the field or would be stored for sale in a later period, when the glut is cleared.

The farmer contacts the CA regularly to collect market information. For coriander, the geographical location of the field does matter for the grading and pricing of the product. Five major grades, with local descriptions to represent the quality and geographical location of the farm from where the product originated, do prevail for coriander seed, and the grading is performed visually by CAs and traders. The produce is generally graded based on the size, shape, colour, and weight of the product. The CA declares the grade and starts the auction (outcry) process in which traders in the market cry out the prices of the produce and the farmer agree to sell their produce to the highest bidding trader if satisfied with the price offered. The final prices of the product arrived at through the outcry method in the speicalised market seldom differ from the price offered by the CA. The visual grading is performed jointly and through a tacit understanding between CA and traders in the market. However, if the product is kept in the field for a longer period after the harvest, its color could fade and the evaporation of water content alters the shape and reduce the weight of coriander and cumin. Coriander and cumin are graded based on their colour and shape. Traders claim that farmers have great faith in them, which is time-tested and generational. Often, the CA hosts a flag with the trader's/CAs name on the tip of the heap to notify other traders that the particular product belongs to him. The farmer pays a fee of ₹7/- per bag of coriander to the CA for unloading and packing the product.

Officials of APMCs reach the specialised market by 9 a.m. on working days and the auction commences. There could be many other crop on the same yard, but seasonal crops get priority for auction. The officials, traders', and CA's assemble around the heap of the product and start crying out the price bid. Traders assess the grade of the product by viewing the shape, size, and colour of the product and bid for it by calling out. The auction process for a heap does prolong for a maximum of five minutes. The farmer receives the spot payment after deducting the loan amount with a 24 percent rate of interest, if any. The CA receives 2% of the total sales proceeds. It seldom happens that the

farmer takes back the product once it is brought to the market for sale. It will cause a huge loss to the farmer in terms of transport costs, unloading, heaping in the yard, and packing it. The long-established associations with a trader and CA help the farmer to gather market information and sell the product.

Table 16: Local Grades of Coriander in Specialised Markets

Grade	Name	Quantity of Coriander out of 100 kg of Bethami (in Kg)	Rate as on 3.06.2018(₹/Kg)
1	Bethami	0	48
2	Eagle	70	52
3	Scooter	20	60
4	Parrot	5	85
5	Broken and waster	5	45

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

Although coriander seeds are visualy graded under five local names in the specialised market, more than 60 percent of the product of coriander is bought as *Bethami* grade, and 20 percent are sold as *Scooter* grade. The field survey in Ramganj Mandi in Kota and Krishi Upaj Mandi in Baran revealed that other grades like the *Parrot* are seldom auctioned in the market. After the primary processing (sieving and cleaning) of the product, it is being sold to the processors and exporters as premium quality Parrot and Double Parrot coriander (Table 16). The lower-grade of coriander is sold as Ungraded in the market. Around 20 to 25 percent of the total product is traded in the market as ungraded. Colour faded and shapeless stocks available with farmers with moisture content due to stocking in jute bags for months are auctioned as ungraded coriander at a lower price. Traders have a cleaning cum drying machine, which costs around ₹20 lahks, is used to clean and dry the coriander seeds bought from farmers at a lower grade. Large traders use a SORTEX machine, which cost around ₹20 million. Alongwith drying and cleaning, the SORTEX machine can be used for enhancing color and shape of coriander and cumin seed. Further it can also separate the broken and shaded seeds from graded ones, which

are essential product characteristics for the export market. However, such machines are not affordable to individual farmers and small traders. Regional Markets for Coriander are: (i) Erode in Tamil Nadu and Veerad Nagar in Andhra Pradesh (formerly); (ii) Delhi market for Central India; (iii) Punjab and Agra; (iv) West Bengal market for Odisha and North East. Farmers are individually unable to undertake any post-harvesting operations. Costs involved in the post-harvest processing of coriander are given in Table 17**.**

Table 17: Stages of Post-Harvesting Process and Cost

Stage	Process	Costs per unit
1	Commission Agent cost	2% of the value
2	Mandi Tax	1.6% of the value
3	Processing cost	₹20 for 40 kg
4	Labor cost for cleaning and packing	₹8 for 40 kg.
5	GST	15% -20%

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

Cumin-cultivating farmers in Rajasthan encounter a different set of problems. The distance between the main market for cumin and its production centres in Rajasthan is substantially higher. Thus, the transportation cost of carrying cumin to the main market would be higher than the price difference between the local and main markets. A mild glut in the main market for cumin is manifested significantly in the price difference. The colour, size, and shape are used for the visual grading of cumin. In the local market, cumin is bought at the lowest grade price and the local buyers make the payment to the farmer after the product is sold to the CA at the specialised market in Unjha Mandi in Ahmedabad. Farmers are subjected to multiple forms of exploitation; along with the credit-product market linkage, imperfect auction system, and different layers of middlemen. Since cumin farmers are mostly small or semi-medium farmers. Therefore, their dependency on credit during sowing to the harvesting seasons is higher compared to

the large farmers. Although, credit is available from the formal money market or Kisan Credit Card (KCC), still farmers prefer to borrow from the product market.

Section 4

Infrastructure in Specialised Markets

The specialised markets came into existence as an outcome of the Expert Committee appointed by the Government of India (Ministry of Agriculture) in December 2000 to draft a Model Act for State Agricultural Produce Marketing. This task culminated into a new model act, viz., Development and Regulation Act 2003. The objective of this Model Act was to regulate the marketing of agricultural and horticultural produce by setting up market yards and market committees in every prominent agricultural produce district in India. Even though, Market Committees had representatives from farmers and traders, who were nominated by the governments, the ultimate control over the market rests with the traders. When a particular commodity is traded dominantly in a market governed by such a committee, the market could be termed as the specialized market for the commodity under consideration. The Specialised Markets discover the prices of the commodity by competitive bidding, while the prices in the local markets are always a derivative of the specialised markets. Generally, the local market is operated by the agents or sub-agents of the traders in the specialised market. Therefore, the price in the Specialised Markets tends to be higher than in the local markets. It needs to be pointed out that cumin farmers in Rajasthan are in a disadvantageous position as the specialised market for cumin, Unjha Mandi (Mehsana, Gujarat), is situated at far away location from the major sites of production in Rajasthan, viz., Barmer (350 km away) and Jodhpur (500 km away). On the contrary, specialised markets for coriander are situated in the major coriander-producing districts in Rajasthan (Ramganj Mandi, Kota) and Madhya Pradesh (Bhawani Mandi). Although, these Mandi's are situated in the purview of different states

but they share the border, one from Rajasthan side and the other from Madhya Pradesh side. Studies on farmers' participation in different types of markets suggest that the education and asset position of farmers are important variables in influencing the decision of farmers on market choice (Sutradhar, 2014). In the case of food products, quality control driven by consumer preference assumes paramount importance as revealed in a study on post-harvesting issues. There has been a close association between resource strength of farmers and modernisation of the marketing system. However, cultivation practices exert a significant bearing on farmers, which suggests that the farmers with traditional cultivation practices tend to sell in the village market with less value addition (Singh & Pothula, 2013).

Table 18: Market Infrastructure Facilities Perception- Cumin Farmer (%)

Facilities	Not Available	Bad	Average	Good	Total
Godown Facilities	59	3.5	33	4.5	100
Auction Agreement	60.5	4.5	31	4	100
Supervision of Sale	62	1.5	31	5.5	100
Loading Facilities	37.5	1	46	15.5	100
Sorting/ Grading Facilities	71.5	3.5	17.5	7.5	100
Cleaning Facility	66.5	5.5	20.5	7.5	100
Weighting Facilities	38	2	29	31	100
Packing Facilities	62.5	0	14.5	23	100
Banking Facilities	62	2	14.5	21.5	100
Motorable Roads	38.5	8.5	29	24	100
Computer Facilities	62	2	15.5	20.5	100
Internet Facilities	66	2	14	18	100

Source: Primary Survey, 2018

Tables 18 and 19 explain the status of market infrastructure facilities available for cumin and coriander respectively as perceived by farmers of respective crops. Shortage of godown facilities, and the exorbitant cost charged for cleaning and sorting of coriander

and cumin, compounded further by anomalies in the auction process were major concerns of cumin and coriander farmers, particularly of marginal and small. It is quite true that the visual grading of the product in the specialised market is used to cut the cost of marketing because the sorting cum grading machines are rather costly to afford even for traders. The sorting and grading rate charged by traders, who possess the machine, is exorbitant and unjustifiable as reported by farmers.

Table 19: Market Infrastructure Facilities Perception- Coriander Farmer (%)

Facilities	Not Available	Bad	Average	Good	Total
Godown Facilities	8.33	3.92	74.02	13.73	100
Auction Agreement	29.90	2.45	50.49	17.16	100
Supervision of sale	31.86	1.47	50.49	16.18	100
Loading Facilities	7.35	3.43	50.49	38.73	100
Sorting/ Grading Facilities	55.39	0.49	27.45	16.67	100
Cleaning Facility	44.61	0.49	37.25	17.65	100
Weighting Facilities	6.37	0.98	51.47	41.18	100
Packing Facilities	37.25	21.57	40.69	0.49	100
Banking Facilities	39.71	0.98	25.49	33.82	100
Motorable Roads	4.90	5.39	48.53	41.18	100
Computer Facilities	60.29	1.47	13.73	24.51	100
Internet Facilities	62.75	0.49	12.25	24.51	100

Source: Primary Survey, 2018

This section addresses the importance of specialised markets (APMCs) for agricultural products in Rajasthan. Spices Board of the Government of India has been the nodal agency for the extension services to spices producers in India. As part of liberalisation, over the years, the Government of India has significantly downsized the technical manpower and other extension activities to farmers in India. It has left a significant impact on the production and productivity of spice crops in India. Small and marginal farmers with severe capital constraints find it rather difficult to meet hygienic, phytosanitary

stipulations, and product specifications for the international market. The majority of coriander and cumin farmers bring the product into the market after preliminary processing. Despite the advantages of group processing of coriander and cumin like reduced cost of processing, the prevalence of group processing was found negligible. Farmers reported that the lack of infrastructure facilities in APMCs prevent them from fetching a better price for coriander and cumin in the domestic and export market. Table 20 shows important issues encountered by farmers of coriander and cumin.

Table 20: Problems in APMCs encountered by Coriander and Cumin (%)

Issues	Coriander (%)	Cumin (%)
Lack of Facilities	49.50	62.50
Lack of Knowledge	5.40	0.00
High Cost of Grading Machine	1.00	1.5.00
Lack of Government Support	44.10	36.00
Total	100.00	100.00

Source: Primary survey, 2018

Manual threshing deteriorates the quality of edible products such as cumin and coriander which are directly consumed upon purchase. Animal waste, foreign particles and other impurities might get into the product in the manual threshing process. The majority of the farmers reported having used mechanized threshing. To be more specific, 89.1 percent of coriander and 97 percent of cumin farmers have used threshing machines. Thresher machines used for coriander and cumin processing are costly equipment with a price range between ₹1.5 and ₹2 lakh. Farmers avail the threshing machines on rent as a common practice. Only 16.1 percent of farmers in the sample reported to have possessed threshing machines. There is a high risk of contamination of coriander and cumin while it is laid out under sunshine for drying. Solar and electric-powered dryers could protect from contamination while drying. Though, machines are available for drying, which would bring down the moisture content in cumin and coriander by 10 percent, farmers' are

unable to purchase the machine and the APMCs does not provide it. To international standards, cumin and coriander are unlikely to meet the phytosanitary conditions due to traditional and outdated methods of drying and sorting. The data from the field survey revealed that a negligible proportion of coriander and cumin farmers (<5%) have availed the subsidised polythene sheets from the Spices Board for covering the product from attracting dust and dirt while drying in the open space. It was reported that over 80 percent of farmers were not aware of the scheme and programmes of the Spices Board. More than 40 percent of coriander farmers and 84 percent of cumin farmers adopted manual cleaning of their products. The information on quality testing of coriander and cumin, an essential certification procedure for trading in the international market for edible products has not been performed by 99 percent of farmers. In the case of cumin, 88 percent of farmers reported that they could not afford the user fee for quality testing while 11 percent of farmers did not access it due to its non-availability and accessibility of the facility. Lack of awareness about the quality testing facilities (36.5 percent), high user fees and long distance to access the quality testing centre were important reasons for farmers not opting for it. The observed trend in the decline of quantity and value of imports of cumin and coriander may be viewed from this backdrop.

Section 5

Agricultural Produce Market Committee (APMC) and Farmers

Given the supply and demand conditions, the market 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 analysis of the marketing channel emphasizes on players at various knots of the supply chain. There are different marketing options available to farmers, viz., (i) Special Market through local dealers; (ii) General Market; and (iii) Spot sale through contract. More than 75 percent of cumin growers and 100 percent of coriander farmers sell their produce in APMCs.

Farmers are attached to APMCs for a long time. Several factors attach them to APMCs. A higher price for the product than local markets and advances taken from traders, together explain the preferences of the APMCs market for 90 percent of cumin and coriander farmers. As the APMCs for cumin are about 400-500 km away from the production centres in Rajasthan, local traders take the advantage of the higher transportation cost incurred to small and marginal farmers to take the product to APMCs in Gujarat, and therefore cumin farmers are rather compelled to sell the product either in the general market or to local agents of APMCs. A tiny fraction of farmers sell their crops directly to the wholesalers and received a higher price as compared to those who sell through CAs. The average price realised from the commission agent cum traders was found about 10 percent lower than the price realised from the wholesaler for both crops.

Table 21: Distribution of Farmers by Sales in the Special Market

Types of Buyer	Distribution of Farmers	
	Cumin	Coriander
Trader/agents	79.88	98.17
Landlords/ Moneylenders	17.16	0.00
Wholesaler	2.37	1.83
Others	0.59	0.00
Total	100	100

Source: Primary Survey, 2018

It underlines the importance of APMCs as the most preferred marketing channel of farmers. The APMCs offer a higher price as large numbers of buyers and sellers work under the regulatory conditions of the state and provide a competitive price. The credit-product market linkages have been well articulated in the literature on the backwardness of agriculture in Asia. Studies have shown that credit-product market linkages are more often than not proven to the disadvantageous of farmers as it culminates into a lower price realisation. It could also be observed that about 98 percent of coriander and 80 percent of

cumin farmers sell their crops directly to CAs in APMCs. In other words, APMCs work with a set of layers of agents and sub-agents that connect them with the trader in the APMCs (Table 21).

The adoption of advanced technology for marketing of the product depends on several factors including price differences between the sale of the product as a raw material, intermediate product (after preliminary processing), and final product, which is ready to be sold in the domestic and international markets. There exists a minimum of 12 infrastructure facilities including services for auction and supervision of sale by officials in the APMCs. It is quite likely that small and marginal farmers with relatively smaller quantities of sale prefer to sell the product with minimum cost and directly from the field without any processing. However, a significant price difference would compel even the small and marginal farmer to undertake preliminary processing before the sale, provided such processing is readily available with minimum cost and effort. Farmers' responses to the use and effectiveness of infrastructure facilities were elicited in the primary survey tool. The outcome of the responses has been translated to an Index by assigning weights to every item of infrastructure for comprehensiveness.

Table 22: 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

Source: Primary Survey, 2018

Appendix Table I, lists out the weightage assigned to calculate the CIMI for facilities available in APMCs and the response of cumin and coriander farmers to the quality of services. The distribution of farmers by the Comprehensive Index of Market Infrastructure (CIMI) is presented in Table 22. The value of the CIMI ranged between zero to 25. When a farmer responds that she does not make use of any facility available in APMCs, the value of the Index will be zero while if she makes use all facilities, the index will be 25.

Important observations from Table 22 can be summarised as follows: (i) Cumin which is cultivated in agriculturally backward districts of the western desert, more than 35 percent of farmers reported that they did not avail any facility from APMCs as such markets are far-away from their farms. In the case of coriander farmers, 11 percent of farmers responded that they had used all infrastructure facilities available in APMCs, while only 3 percent of cumin farmers use every market facility in APMCs. Reasons for not utilising the infrastructure facilities available in the APMCs need detailed exploration from farmers' perspective. Farmers reported a series of concerns related to the sale of the product in APMCs and other sales outlets. About 30 percent of cumin farmers complained that they were unable to receive a remunerative price due to the non-availability of APMCs. For coriander farmers, APMCs are available at shorter distances from the main centres of production. However, the major concern for more than 80 percent of farmers is the price volatility of coriander while the price for cumin is reported to be more or less stable by cumin growers (67%).

Important issues faced by the farmers in the marketing of coriander and cumin were elicited from the farmers' responses and are reported in Table 23. It underlined that the price fluctuations and non-availability of nearby markets were important factors and had strong bearings on the cumin farmers, while the fluctuation in the prices remains the single most cause of worry for coriander farmers. Lack of adequate government support is

one of the major concerns of both coriander and cumin farmers. It is a fact that the Spices Board has withdrawn its extension activities since the introduction of liberalisation in the early 1990s.

Table 23: Important Problem in Marketing of Coriander and Cumin

Issues	Coriander (%)	Cumin (%)
Price Fluctuation	80.40	33.00
Non Availability of APMCS nearby	Nil	43.50
Unfair Deal while Auctioning	7.80	10.50
Lack of Government Support for Storage Facilities and Natural Calamity	11.80	22.00
Total	100.00	100.00

Source: Primary Survey, 2018

Table 24: Access to Technical Advice for Cultivation of Cumin and Coriander

Source of Technical advice	Cumin Farmers (%)	Coriander farmers (%)
Agriculture Supervisor(G.P)	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	8.53	8.95
Farmers Organisations	1.39	0.93
NGO's	0.00	0.00
Others	0.60	0.93

Note: Total number of farmer accessed technical advice is higher than total because of multiple source of technical advice for a single farmer
Source: Primary Survey, 2018

The withdrawal of the Spices Board from extension services has manifested in the response of farmers and has considerably added to their hardships (Table 24). In the absence of qualified technical personnel from the Spices Board and Agricultural departments, farmers depend on services from the private sector, which are more often than unauthorised to deal in pesticides for edible products. However, Krishi Vigyan Kendra caters to the needs of cumin and coriander farmers, to an extent. However, the Krishi Vigyan Kendra' are few and far as there is, at the most, only one Krishi Vigyan Kendra in a district. The vacuum left by the technical personnel from the Spices Board is increasingly being filled up by agents of companies in the private sector that sell pesticides to farmers, which are highly toxic and exorbitantly priced.

Logit Regression

The association among the post-harvesting process, price realisation, and farm-gate price are dependent on a number of factors. The Logit model is fitted to estimate the influence of each variable on the decision of farmers to sell or not to sell in the specialised markets for coriander and cumin. The results of the Logit model for cumin and coriander farmers are presented in the Table 25 and Table 26 respectively. The models are specified as:

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 farmer sells in the local market, Agents or any others than APMCS

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

S. No.	Variable	Description
1	X_1	The education level of Farmer (in Category 12)
2	X_2	Primary Income Source (1=Farming, 0= Non-farming)
3	X_3	Market Distance (in Km)
4	X_4	Production (In Quintal)
5	X_5	Price (Rs./per Quintal)
6	X_6	Technical access Comprehensive Index
7	X_7	Market Infrastructure Comprehensive Index

Hypothesis:

$$\frac{\Delta Y_{Mkt}}{\Delta \chi_1} > 0 \; ; \frac{\Delta Y_{Mkt}}{\Delta \chi_2} > 0 \; ; \frac{\Delta Y_{Mkt}}{\Delta \chi_3} < 0 \; ; \frac{\Delta Y_{Mkt}}{\Delta \chi_4} > 0 \; ; \frac{\Delta Y_{Mkt}}{\Delta \chi_5} > 0 \; ; \frac{\Delta Y_{Mkt}}{\Delta \chi_6} > 0; \frac{\Delta Y_{Mkt}}{\Delta \chi_7} > 0$$

Table 25: 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*	-0.00088	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-06	0.968
Technical Index	-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%

Table 26: 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	-0.1840	.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*
Technical Index	.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				

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

The odd ratio of each variable on the decision of farmers to sell in the APMCS has been estimated with Logit regression. Findings of the models are: (i) there is an inverse relationship between distance (the APMCs to the production site) and choice of the sale in the APMCs. It means if APMCs for cumin seed are available in the Barmer or Jodhpur districts of Rajasthan, farmers would have sold the product for a better price for cumin; (ii) the price factor did not find any significant influence on the choice of the market as the cost of transportation exceeds the price margin in the APMCs over the sale to the market or agents for cumin farmers receive a large chunk of farmers' sell proceeds in the local market; (iii) lack of market infrastructure facilities. It includes godown, banking, auction agreements, internet facility etc., which would make it easy for the farmers to sell their produce in the APMCs. Market infrastructures have positive influences over the choice of farmers for selling cumin seed in the specialised markets.

In case of coriander, the distance between production site and the APMCs are not a significant variable influencing the decision of farmers to choose the market for sale. It could be because, APMCs for coriander is available in all major production site of the crop. Market infrastructure and price effect (difference between local and specialised market) were found important determinants of farmers' decision on the sale of coriander in the APMCs. The odd ratio for coriander shows that the market price of coriander and availability of market infrastructure is more likely to attract farmers to APMCS.

Conclusion

Cumin and Coriander are two important seed spices, which together account for more than 30 percent of the total value of exports from spices in India. These drought-loving plants are cultivated in arid and semi-arid zones in the country. The commercial cultivation of these crops is sensitive to agro-climatic conditions and therefore, cultivation of these two crops is concentrated in a few geographical locations in Rajasthan, Gujarat, and Madhya Pradesh. The post-harvesting process of agriculture produce is an extension of its mode of production and it involves different stages from harvesting to primary processing such as sieving, cleaning, drying, and packing for sale. Cumin and coriander are consumed directly on purchase and, therefore, sanitary and phytosanitary conditions of WTO assume significance in the international market. Cumin is mostly grown under the traditional method of farming as farmers use their farm-collected seeds and follow traditional cultivation practices leaving substantial bearing on the cost of production, productivity, and eventually on net returns from its cultivation. Coriander farmers, however, are relatively more exposed to modern methods of cultivation. Yet the post-harvesting process and marketing of both crops need improvement.

On the introduction of trade liberalisation in India in the 1990s, the Spices Board has withdrawn the extension service and other marketing facilities provided to spice crop

cultivators. As a result, farmers are rather compelled to depend solely on the private vendor for technical advice and services including the use of pesticides for the crops. Farmers receive a higher price in the APMCs meant for these crops. For coriander, APMCs are available in different district quarters of the state of Rajasthan, while cumin farmers in Rajasthan have to transport the crop to Unjha APMC in Gujarat, which is 400-500 km away from the production site. Even though, there exist infrastructure facilities in APMCS, almost 50 percent of farmers are unable to make use of it. In the case of cumin, the absence of APMCs in the vicinity of production compels farmers to sell the crop to local traders while coriander is graded locally by traders, and the price is fixed. The study found that APMCs are inevitable for the furtherance of the interest of farmers and if the farm-product market is thrown open to the vagaries of private vendors, farmers will be left high and dry.

As significant proportion of farmers for both cumin and coriander reported that they were not even aware of Spices Board, leave alone its initiatives like the supply of polythene sheets at a subsidised rate to the farmers. The econometric analysis revealed that market infrastructure, distance from the specialised markets, and prices are important factors in influencing the decision of farmers to sell their produce in the specialised markets for cumin and coriander. To sum up, it is evident that there is enormous scope for area expansion, production and productivity, which would help, not only add to export earnings but also employment and income generation for the farmers. However, calls for substantial improvement in the production conditions and post-harvest processes. In light of the above, the study underlines the importance of the collaboration between the Spices Board and state-level agencies for imparting training on various aspects of production such as the post-harvesting process and the building up of market infrastructure facilities. It appears that any effort towards organising the farmers into Spice Producers' Societies at the instance of the Spices Board might be highly rewarding.

Endnotes:

[i] S Mohanakumar is Professor and Director and Prem Kumar is research scholar in IDSJ. K J Joseph is the Director of Gulati Institute of Finance and Taxation, Thiruvananthapuram, Kerala.
The paper is an outcome of a collaborative research project of the Centre for Development Studies, Thiruvananthapuram, Kerala and the Institute of Development Studies, Jaipur, Rajasthan

[ii] However it may be noted that till 2015-16, Rajasthan had the largest area under coriander cultivation among all the states with a share of 34 percent.

[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 Asian continent are also likely to enter in the production of seed spices (Vijay and Malhotra 2002)

[iv] The extrinsic qualities are mainly seed size, shape and luster, cleanliness from dead insects, animal excreta, hair and other foreign material. The intrinsic qualities are high essential oil content, free from pesticide residue, low aflatoxin level and microbial load.

[v] The structure of landholdings size in south-east part of Rajasthan (coriander cultivation) is different from south-west part of Rajasthan (cumin). The coriander farming is mostly dominated by small and semi-medium farmers while the cumin farming is dominated by the medium and large farmers. Average landholdings size for coriander cultivation was found smaller (<15 *bigha*) but irrigated, while the average landholding size for cumin was found larger (>15 *bigha*) but unirrigated.

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APPENDIX

Table I: Weights Assigned to Market Infrastructure

Items	Weights			
	Not Available	Bad	Average	Good
Godown facilities	0	0.5	1	2
Auction agreements	0	0.5	1	2
Supervision of sale	0	0.5	1	2
Loading facilities	0	0.5	1	2
Sorting/Grading facilities	0	0.5	1	2
Cleaning facilities	0	0.5	1	2
Weighing facilities	0	0.5	1	2
Packing facilities	0	0.5	1	2
Banking facilities	0	0.5	1	2
Motorable Roads	0	0.5	1	2
Computer facilities	0	0.5	1	2
Internet facilities	0	0.5	1	2

Source: Estimated by Authors

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