Post-Harvest issues in seed spices in India
The case of Coriander and Cumin

K J Joseph and *S Mohanakumar*

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Centre for Development Studies, Thiruvananthapuram

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Report of the study "Post-Harvest issues in seed spices in India: *The case of Coriander and Cumin"*. The study was conducted by Prof. K J Joseph and *S Mohanakumar* as part of the National Research Programme on Plantation Development.

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Abstract

Considering the significant export potential and export oriented employment generation on the one hand and the imperative of adhering to the quality standards for reaping the export potential on the other, present study explored the post harvest issues in case of cumin and coriander. It also explored the production conditions as it also has crucial bearing on the price realisation as well as quality of the product. Study is based on the primary survey in Rajasthan and interaction with different stakeholders along with the secondary data available from the Spices Board. The study highlights several issues in the processing and marketing of cumin and coriander, with implications for policy. To begin with, there is empirical evidence to suggest that the potential for expanding the production is significant. However, there are debilitating production conditions like credit market-product market linkages that need to be addressed as it leads to lower price realisation. The *farmers depend mainly on private agencies for technical advice and extension services Pesticides are bought at exorbitant prices from private vendors without any authentic laboratory test for its use on edible items, which along with non-adherence to international standards of hygienic and sanitary conditions prescribed under WTO for edible items is a major bottleneck in diversifying market for cumin and coriander in India. To a great extent, market uncertainty and price volatility have contributed largely to the area fall in coriander. Processing at different levels needs improvement as the existing practices tend to undermine quality. Awareness about the imperative of maintaining quality standards as well as the infrastructure for quality testing needs much improvement. A large majority of the growers in both crops are not aware of the Spices Board initiative to provide polythene sheets at subsidised rate. Though much of the output is sold through the auctions, the present method of auction through an open outcry system leaves much scope for improvement. Here much could be learned from the e-auction in cardamom after addressing some of its weaknesses. It is evident that both production conditions and the post-harvest issues of coriander and cumin in India are more or less the same. On the whole, there is an immense opportunity for improving the farmer-unfriendly conditions that prevails at present. This in turn could attract more farmers to the cultivation of these crops leading not only for enhanced foreign exchange earning but also to improved livelihoods inter alia through export oriented employment generation. Once remunerative prices are assured and farmers have sustained interest in these crops, organisational innovations in sync with rubber producers societies could be initiated which could serve as a catalyst for the much needed change.*

Background

India is the leading seed spice producer in the world. Among 52 spice crops produced in India, relative significance of crops in terms of area, production, yield, geographical concentration and export earnings do vary significantly across crops. A few of spice crops are perennials like pepper while a majority of them are seasonal and their production is adjustable to market conditions with a maximum gestation period of less than a year. Among the seasonal spice crops, Cumin and Coriander assume special significance as these crops are highly sensitive to agro-climatic conditions, weather changes and are not profitably extendable to marginal lands. Arid or semi-arid districts in Rajasthan, Gujarat and Madhya Pradesh are the leading producers of Cumin and Coriander in India.In the total area of 6.65 lakh hectares under Coriander, Madhya Pradesh accounted for 41.7% followed by Rajasthan (27.3%)[1] and Gujarat (18.2%) in 2017-18. Rajasthan has 64% in the total area of 7.81 lakh hectares under Cumin, followed by Gujarat in 2017-18. Being a labour intensive crop with 35 man-days per hectare,Cumin and Coriander together generate employment of 2.53 lakhman days in the crop production and it is in addition to employment in allied activitiesof trading and processing of the crop. India exported 35,185 tones of Coriander and 1.43 lakhtones of Cumin in 2017-18 and the export related employment from these two crops amounted to 44000 man days per annum, given the yield of 0.76 tone and 1.56 tone per hectarefor Coriander and Cumin.

The demand for spices has been on the increase. Spices, being natural,are increasingly substituted for artificial additives for flavouring of foods. The entry into the world market, however, is becoming a difficultproposition as there exists heightened competition in the world market with new players entering the market[2]. Even the competition in the domestic market has aggravated from traders in the international

[1]However it may be noted that in 2015-16, Rajasthan had the largest area among all the states among with a share of 34.1 per cent.

[2]They include Bulgaria (Coriander, fenugreek), Turkey, Iran, Egypt (Cumin, ajowan, nigella), China (celery), Romania, Germany, Hungary (dill), 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)

market with the reduction in tariff barriers as the WTO regime came into existence resulting intoprice volatility.More importantly, consumers have become more quality conscious and the sanitary standards laid down in the international markets have serious consequences on the acceptability of Indian produce particularly in developed countries. Hence the entry into the world market calls for adherence to both intrinsic and extrinsic quality measures[3]. Hence the quality management, in sync with various quality standards with respect to commercial requirements, cleanliness and health specifications (Selven, 2007) has become an emerging challenge. Addressing this issue has become a precondition not only for entering the world market and expanding the domestic market but also for strengthening competitiveness and improving market share. The export intensity of Coriander is relatively low (10%) and that of Cumin is 28.5%. Nonetheless, given the growing world demand especially for value added products and those that adhere to the quality standards, there is much scope for further increasing exports and thus earning more foreign exchange while generating substantial export driven employment. Given the background, the study looks into: (i) production structure and trend in the external trade of Cumin and Coriander; (ii) how does the production system influences the post-harvest issues including marketing of these crops? (iii) what are the remediable and irremediable issues of Cumin and Coriander on post-harvest? Given the questions to be addressed, the discussion in the paper is organised as follows. Section 1 presents the sample design,and productionstructure and conditions for Cumin and Coriander. Trends in price, export and import are discussed in Section 2; and Section 3 analyses the post-harvest issues of crops,followed by the concluding section.

Section 1

Production Structure and Conditions

1.1. Data source and Sample Design

The study is based on a primary survey 400 farmer households of Cumin and Corianderfrom important cropgrowing districts in Rajasthan supplemented with primary survey of traders at different layers in the market. Given the constraints in administering printed schedules for traders, direct personal observations method was used as primary

[3]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.

survey tool in specialised markets for Cumin in *UnjaMandi* in Gujarat and *RamganjMand*, (Kotta) *and BhavaniMandi* for Coriander in Rajasthan. Discussion with officials at Spices Park in *Ramganj* helped clarify several post-harvest interventions of the Spices Board. Based on secondary data on area and production by districts, sample villages and cultivator households were chosenemploying a non-probability sampling technique called snowball sampling where existing study subjects recruit future subjects from among their acquaintances. Snowball sampling method was adapted in the absence of a sample frame for the selection of sample size for the study. Secondary data from Spices Board and other sources were used for the background analysis. The geographic spread of Coriander and Cumin indicated that southern districts in Rajasthan (Kota, Baran and Bundi) for Coriander.Barmer and Jodhpur districts in the south-west of Rajasthan, were located as ideal for Cumin.Tables 1 and 2 show sample size by districts, blocks and villages selected for the study/

Table 1. Sample Area of Cumin in Rajasthan State 2016-17 to 2017-18

District & Block	Panchayat Name	Village Name	No. of Sample
Barmer	Bola	Bola	4
		Mithisar	9
	Booth Jetmal	Booth Jetmal	6
	Derasar	Derasar	3
		RamdiyonkiBasti	2
	JakhdonkiDhani	JakhdonkiDhani	5
		AndekaTala	12
		MandokaTala	8
		Sarnonka	7
	Sanawara	Sanawara	12
		MoodhonkaTala	5
Jodhpur (District) Bawari (Block)	Anwana	Anwana	10
	Bawari	Bawari	1
	Danwara	BasniDanwara	1
	KelawaKalan	KelawaKalan	35
		Bhakrokidhani	1
		Guru Jambeshwar Nagar	2
		KelawaKhurd	75
		MeghwalDhani	1
		VishnoiyokiDhani	1
Total			**200**

Table 2. Sample Area of Coriander from Baran District in Rajasthan

Block Name	Panchayat	Village Name	No. of Sample
Antah	Bohat	Bohat	10
	Hingoniya	Harsoli	31
		Hingoniya	20
		Shyampura	1
Atru	Antana	Antana	9
		Musen Mata	16
	Patna	Moondla	14
Baran	Badan	Badan	27
	Koyla	Koyla	32
	Miyada	KheriJageer	32
	Thamli	Raniheda	12
Total			204

The structure of landholdings in South East Rajasthan (Coriander cultivation) is different from South-West Rajasthan (Cumin). The average size of holdings of Coriander farmers is mostly small and semi-medium while medium and large farmers cultivate Cumin in Rajasthan. In desert districts, average size of holdings is larger than irrigated area where Coriander is cultivated. For Cumin, medium and large farmers (> 15 bigha of land) would have a higher weights while <15 *bigha* land holdings will be the dominant category for Coriander growers.

1.2. Production Structure: Evidence from Field Survey

As mentioned elsewhere, there has been a close correspondence between production structure, marketing , and farm gate price (Kumar, et al, 2011). Table 3 presents the descriptive statistics of sample households of Cuminand Coriander in Rajasthan.The household characteristics, viz., mean age of the farmers, education and main occupation, assume special significance to understand the economic status of a crop in relation to its dependent population. The mean age for the Coriander household heads are (47.7 years) higher than Cumin (45.1 years) farmers. Majority of farmer household heads (48.5%) belong to 41 to 60 years category and the share is more or less similar across crops. This is very much contrast to what we generally observe in plantation

crops like Cardamom, Rubber, Coffee wherein younger generation are found to be less inclined towards traditional agriculture. This might be an indication of backward conditions under which the crop is cultivated. However, the proportion of farmers who have age above 60 years in Cumin is 11% whereas the share in Coriander is 17.2%, which is above the total sample (14.1%).

Table 3: Household characteristics of the sample farmers in Cumin and Coriander

Variable	Cumin	Coriander	Total
Age in years			
Up to 40	80 (40)	71 (34.8)	151(37.4)
41 to 60	98(49)	98 (48)	196 (48.5)
Above 60	22 (11)	35 (17.2)	57 (14.1)
Mean age	45.1	47.7	46.3
Education			
Below Primary	101 (50.5)	47 (23.0)	148 (36.6)
Primary pass to Metric pass	81 (40.5)	123 (60.3)	204 (50.5)
Above secondary	18 (9.0)	34 (16.7)	52 (12.9)
Mean education	2.9	4.1	3.5
Mean Family size	5.7	5.7	5.7
Mean Earning member	2.8	2.6	2.7
Occupation			
Only Cultivation	68 (33.7)	91 (44.6)	158 (39.2)
Cultivation with other activities	132 (66.3)	113 (55.4)	245 (60.8)

Source: Sample Survey, 2018

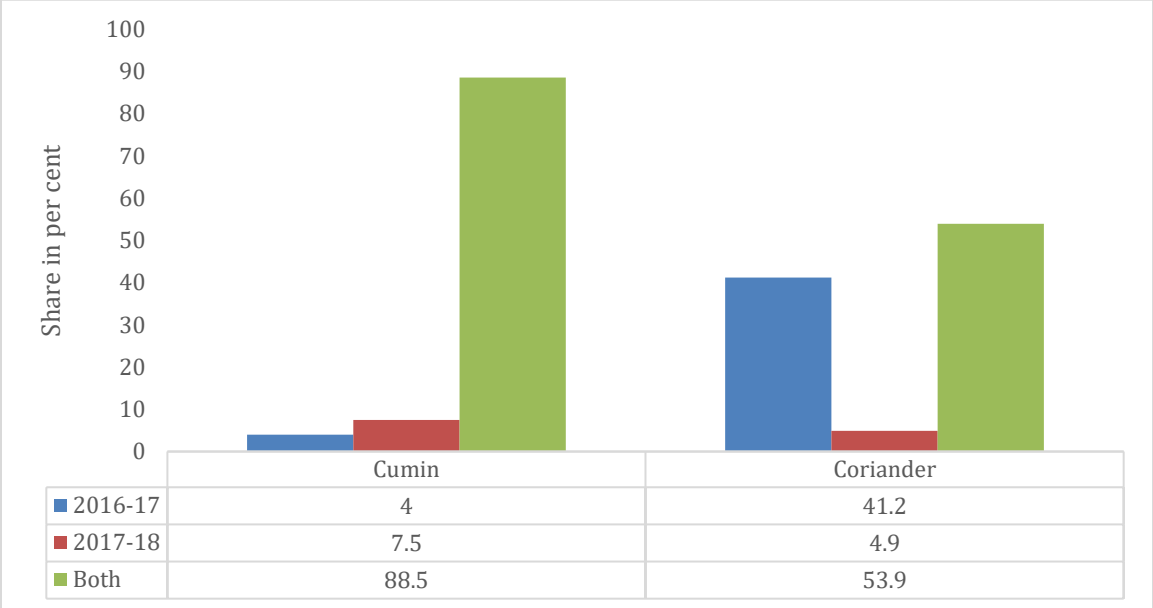
Mean years of schooling and educational level of farmers have profound implications in the economic analysis of any crop. However, a difference in average years schooling is influenced by a handful of social and economic factors and it is independent of the crops grown.

The mean years of schooling for household head is 3.5 years, but heads of Coriander households were more educated (4.1 years) than those of Cumin farmers (2.9 years). Majority of the Cumin farmers have education below primary (50.5%) whereas for Coriander farmers 60.3% have education upto metric pass. Further, the share of farmers who have education above secondary is also highest for Coriander (16.7%) than

Cumin farmers (9%). The average family size and income sources of the farmers were same for Cumin and Coriander (Table 3). The occupation status of the farmer household heads shows that majority of the Cumin (66.3%) and Coriander (55.4%) farmers were engaged in allied activities too along with cultivation of Cumin and Coriander. However, farmers who have engaged only in cultivation was 33.7% for Cumin and 44.6% for Coriander and on an average, 60.8% of sample households reported to have multiple occupations for livelihood and 39.2% depends only on one single source i.e., cultivation.

It can be seen from figure 1.1 that 88.5% of the Cumin farmers and 53.9% of the Coriander farmers are engaged in cultivation in 2016-17 and 2017-18. However, 41.2 % of the Coriander did not sow in 2017-18 and the observed area fall may be viewed against the backdrop.

Figure 1.1: Distribution of growers on the basis of year of cultivation

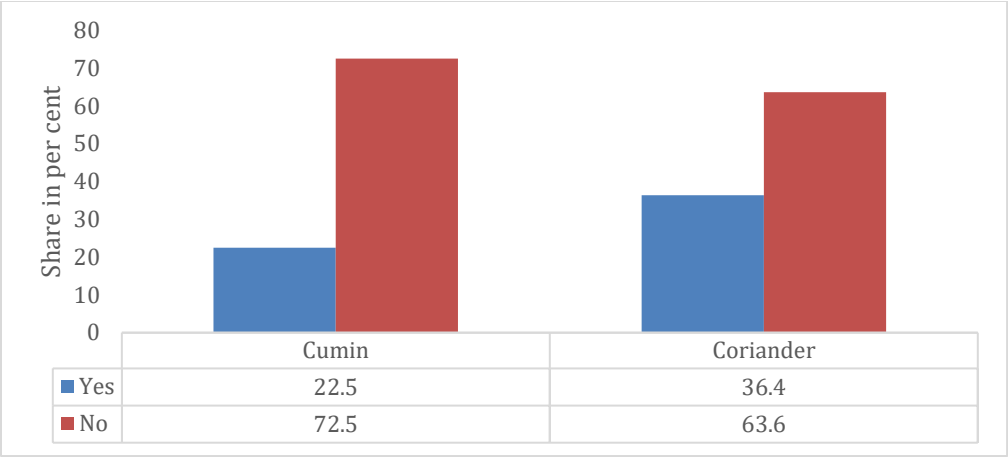


	Cumin	Coriander
2016-17	4	41.2
2017-18	7.5	4.9
Both	88.5	53.9

Source: Sample Survey, 2018

It is observed from figure 1.2.that the share of tenant cultivations (leased land farming) in Coriander (36.4%) is higher than Cumin farmers (22.5%). However, incidence of leased land farming in both Coriander and Cumin are not prominent.

Figure 1.2: Distribution of farmers by leased land farming in Cumin and Coriander



Source: Primary Survey

1.3. Land Holding status

Land holdings of Cumin and Coriander farmers can be categorized into marginal (Up to 1 ha), small (1.01 to 2 ha), medium (2.01 to 4 ha) and large (Above 4 ha). Table 4 shows that medium and large farmers together account for 71% of the total land holdings and there is no significant change in the density of different type of size of holdings.

Table 4: Distribution of farmers on the basis of total area under cultivation across different size of holdings

Land holding	Cumin		Coriander		Total	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
Marginal (up to 1 ha)	11 (5.5)	8 (4)	21 (10.3)	26 (12.7)	32 (7.9)	34 (8.4)
Small (1.01 to 2 ha)	28 (14.0)	28 (4)	48 (23.5)	52 (25.5)	76 (18.8)	80 (19.8)
Medium (2.01 to 4 ha)	97 (48.5)	95 (47.5)	61 (29.9)	67 (32.8)	158 (39.1)	162 (40.1)
Large (Above 4 ha)	57 (28.5)	68 (34)	73 (35.8)	57 (27.9)	130 (32.2)	125 (30.9)
Total	193	199	203	202	396	401

Source: Primary Survey

The crop wise analysis shows that proportion of medium and large farmers for Cumin in 2016-17 was 77% and it increased to 81.5% in 2017-18. The share of semi-medium and medium farmers declined from 65.7% in 2016-17 to 60.7% in 2017-18. The relative share

of marginal and small holdings, declined from 19.5 % in 2016-17 to 8 % in 2017-18 while the proportion of the same category increased from 33.8% in 2016-17 to 38.2% in 2017-18 for Coriander. Important observations emerging from the landholding structure are that small and marginal farmers are withering from Cumin cultivation on the risk element associated plant diseases, water shortage and weather changes are unaffordable to them while large farmers continue with the cultivation.

As mentioned before, marketing structure of a crop needs to be situated in the broader context of the produciton strucutre. Coriander is produced in the kharif seasons, between October to March. Sowing is performed in the last week of October or first week of November and the crop is harvested in March. The plant is drought loving and it does not require water from its flowering stage to harvesting.

1.4. Production conditions: Coriander

Important Coriander cultivating states are Madhya Pradesh, Rajasthan and Gujarat. Rajasthan accounted for 34% of the area and 50% of production of Coriander in India in 2016-17. It also accounted for 2.63% and 4.76% of the value and volume of spices exports respectively. Since 2012-13, there has been a continuous decline in the quantity and unit value of exports of Corianderwhile its imports have been on the increase. Price of Coriander in the domestic market have been sliding down for the last few years and subsequent to the fall in the price of the commodity, farmersare forced to slash down the standard cultural practices or in extreme cases leave land fallow. In certain cases, Coriander has been substituted with other next best alternative crops in the region. Unlike most other plantation crops, which are perennial in nature, Coriander is a seasonal crop (kharif)and its production is adjustable to the market price with a maximum gestation period of six months from November to March. Agricultural commodities involve lagged production-price response since the decision of farmers on area sown in the current year is based on the price received in the preceding years as well as the expected price in future. Trends in the external trade of export oriented crops are manifested in the conventional model for price determination. Tables 5, 6 and 7give

short-term trends in area, production and productivity of Coriander from 2013-14 to 2016-17. Important observations emerging from the production trend in Coriander are: (i) relative share in area and production of the crop in the major producing states, viz., Rajasthan and Madhya Pradesh are on the decline while Gujarat have made substantial uptrend in both area and production. However, productivity of the crop in Rajasthan and Madhya Pradesh has increased indicating that farmers have withdrawn the crop from marginal lands and the production is concentrated to the most fertile lands. It is often read in the literature as a pointer towards the rational response of farmers to non-profitability emerging either out of price volatility or continuous fall in price. There exist several parallels to such comparable situations in the crop history in several states (Mohanakumar and Sharma, 1991; Mohanakumar and Chandy 2006). Conversely, in spite of the increase in area and production of Coriander in Gujarat, there has been a substantial decline in productivity of the crop in the state and it shows that Coriander has substituted other less remunerative crops in arid districts in Gujarat. It is rather clear from the significant fall in coefficient of variation of area under Coriander cultivation in important states as compared to the same in production (Tables 5&6). The negative rate of growth in productivity of Coriander in Gujarat as compared to positive rate of growth in Rajasthan and Madhya Pradesh are indicative of the emerging production scenario and the geographical relocation of the crop.

Table 5: Relative Share of Area under Coriander by Major States - 2013-14 to 2016-17

Year	Rajasthan (%)	Gujarat (%)	Madhya Pradesh (%)	Others (%)	India (000 ha)	CV(%)
2013-14	40.87	4.60	35.78	18.75	447.13	72.502
2014-15	45.11	7.97	26.06	20.86	552.66	70.397
2015-16	36.58	15.23	28.40	19.79	581.6	40.275
2016-17	32.36	18.28	30.19	19.17	662.5	28.139
Compound growth rate	4.08	55.77	5.74	10.94	10.33	

Source: Spices Board

Table 6: Relative Share of Production under Coriander by Major States -2013-14 to 2016-17

Year	Rajasthan (%)	Gujarat (%)	Madhya Pradesh (%)	Others (%)	India (000 MT)	CV(%)
2013-14	37.33	10.30	23.91	28.46	313.65	56.67
2014-15	43.05	13.94	20.56	22.45	461.71	59.02
2015-16	38.84	23.73	18.55	18.89	584.98	39.00
2016-17	34.77	31.15	16.82	17.26	609.4	34.42
Compound growth rate	15.99	55.68	8.12	4.19	18.06	

Source: Spices Board

Table 7: Productivity under Coriander by Major States - 2013-14 to 2016-17 (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	1068.02	1566.59	656.80	1005.81
2016-17	988.34	1567.30	512.50	919.85
Compound growth rate	11.44	-0.05	2.26	7.01

Source: Spices Board

Table 8 shows the response of cultivators of Coriander crop to the change in area and production under the crop. Area under the crop has declined by 43% between 2016-17 and 2017-18. It is important to note that 88% of Coriander cultivating farmers in the total sample 200 has reported that they have reduced the area under cultivation in Rajasthan and the observation from the primary survey confirms the findings from the secondary data (Table 9). Almost half of the farmers reported that price fall is the single most reason for the reduction in area while 28% of farmers have left their land barren as the cultivation was remunerative and 12% have either leased out or sold their land as the reason for the change in area in 2017-18 as compared to 2016-17 (Table 10). It has also been observed from the secondary data on production of Coriander that there has been a substantial decline and the same was capture in the primary survey as well for the period 2017-18 as compared to 2016-17. Farmers have overwhelmingly reported that (95%) there has been a reduction in production and the area fall followed by droughts and crop diseases are important reasons for the fall in production (Tables 11& 12). Table 13 gives a broad view of the problems that farmer encounter in the production process of Coriander. Lack of institutional intervention for disease control and technical advise

were reported as an important bottleneck that farmers encounter as about 60% of farmers reported plant disease as important issue in production. There are numerous private pests companies which operate with their marketing agents and most of the pests are imported ones with exorbitant prices. There has been no scientific recommendation or approval from recognised and authorised agencies for such pests on its use in edible items. It may also be noted that 3% of farmers have reported that the quality of pests are inferior in quality and on the frequent excessive dose of pests on Coriander, newer varieties are introduced in the market by private agencies for sale. Scarcity of water and crop loss caused by stray animals, particularly in the light of vigorous cow protection campaign, has been a serious issue for farmers.

Table 8: Change in Area under Coriander andCumin -2016-17 & 2017-18.

Name of District	Name of Crop	2016-17		2017-18		Change in area in 2017-18 over 2016-17 (%)
		Number of farmers	Area under Cultivation (inBigha)	Number of farmers in the sample	Area under Cultivation (inBigha)	
Barmer	Cumin	67	957.5	67	988	3.18
Jodhpur	Cumin	133	1403	133	1677	19.52
Total	**Cumin**	**200**	**2360.5**	**200**	**2665**	**12.89**
Baran	Coriander	200	1611	200	907	(-)43.69

Source: Primary Survey

Table 9: Percentage of Farmers Reduced Area under Coriander&Cumin

Response	Coriander		Cumin	
	Frequency	Percentage	Frequency	Percentage
Reduced	176	88	131	65.5
Increased or not Changed	24	12	69	34.5
Total	200	100	200	100

Source: Primary Survey

Table 10: Reasons for Area Fall under Coriander and Cumin

Reasons	Coriander		Cumin	
	Frequency	Percent	Frequency	Percent
Leased in	0	0	17	12.92
Leased out / sold land	29	16.48	8	6. 82
Left Uncultivated	50	28.41	50	38.17
Price fall	86	48.86	37	28.24
Others	12	6.82	19	14.00
Total	176	100	129	100.00

Note: Others include Plant diseases, Weather change, Low production, water shortage

Source: Primary Survey

Table 11: Proportion of Farmers Reduced Production under Coriander&Cumin

Response	Coriander		Cumin	
	Frequency	Percent	Frequency	Percent
Area reduced	190	95	169	84.80
Not reduced but increased	10	5	31	15.20
Total	200	100.00	200	100.00

Source: Primary Source

Table 12: Reasons for Fall in Production ofCoriander&Cumin

Reasons	Coriander		Cumin	
	Frequency	Percent	Frequency	Percent
Fall in Area	60	31.09	52	30.77
Drought	31	16.44	29	16.92
Flood	3	1.55	19	11.24
Frost damage	29	15.03	16	9.47
Left Uncultivated	37	19.17	26	15.38
Others	13	6.74	30	17.75
Total	193	100.00	169	100.00

Note: Others include weather change and Plant diseases

Source : Primary Survey

Table 13: Issues related to Production of Coriander

Issues	**Percentage**
Plant Disease	59.80
Problem of Stray Animals	13.24
Scarcity of Water	20.59
Shortage of Electricity	2.45
Poor Quality of Pesticides	0.98
No Response	2.94
Total	100.00

Source: Primary Survey

1.5. Production conditions: Cumin

India, China and Mexico are three major producers of Cumin. India and China together account for more than 70% of the total world production. As compared to China and Mexico, India consumes about 63% of the world production indicating the huge domestic market for the crop with little regional variation in per capita consumption of Cumin. India and China together consumes about 90% of the total world production of Cumin. However, Cumin is more of an export oriented crop as compared to Coriander as 30% of the domestic produce of Cumin is exported from India. More than 60% of area under Cumin cultivation in India is concentrated in two states, viz., Rajasthan and Gujarat. In Rajasthan, Barmer and Jodhpur are two major (desert) districts accounting for more than 70% of totalarea and production of Cumin. The crop contributed 12% of the total volume of exports of spice from India and 10% of the export earnings in 2015-16. There has been a substantial increase in area of Cumin from 5.9 lakh hectare to 7.60 lakh hectare while the production of the crop increased from 3.9 lakh tonne to 4.85 lakh tonneduring the period between 2013-14 to 2016-17. However, there is a marginal decline in productivity of the crop from 655kg/hectare to 645 kg/hectare during the reference period. The increase in area and production of Cumincan be attributed to fall in the price of other next best competitive crops grown in the marginal land for Cumin in Rajasthan and Jodhpur.

Tables 14, 15& 16 show the relative share in area, production and productivity respectively of Cuminin major producing states in India during 2013-14 to 2016-17. Important observations from area, production and productivity are: (i) there has been a substantial shift in area under Cumin from high productivity zone (Rajasthan) to low productivity zone (Gujarat). Rajasthan accounted for 54% of the area under Cumin in 2013-14 and it declined to 36% in 2016-17 and the area under the crop in Gujarat increased from 45% to 63% during the reference period and the observed increase in the coefficient of variation (CV) in area from 12% to 37% may be viewed against the area shift. Nonetheless, there has not been any commensurate fall in production of Cumin in Rajasthan as productivity difference between these two adjacent states, particularly;Cumin growing districts in these two states did work to the advantages of Rajasthan. It is not an encouraging trend to note that productivity of Cumin in Rajasthan

is three times higher than that of Gujarat. Moreover, productivity measured in terms of kilogram per hectare of land registered a negative rate of growth to the tune of (-)9.17% as compared to 6.05% growth in productivity in Rajasthan during the period between 2013-14 to 2016-17. Withdrawal of cultivation from marginal lands in Rajasthan due to water shortage and plant diseases and extension of the cultivation in Gujarat could be one of the reasons for the observed change.

Table 14: Relative Share of Area under Cumin by Major States - 2013-14 to 2016-17

Year	Rajasthan (%)	Gujarat (%)	Others (%)	India (000 ha)	CV(%)
2013-14	54.49	45.50	0.01	513.85	12.71
2014-15	51.13	48.86	0.01	889.76	3.20
2015-16	36.56	63.25	0.19	808.02	37.82
2016-17	36.66	63.10	0.24	760.20	37.48
Compound growth rate	-0.12	19.68	178.32	10.29	

Source: Primary Survey

Table 15: Relative Share of Production under Cumin by Major States - 2013-14 to 2016-17

Year	Rajasthan (%)	Gujarat (%)	Others (%)	India (000 ha)	CV(%)
2013-14	43.08	56.91	0.01	858.9	19.563
2014-15	75.11	24.89	0.01	485.51	71.025
2015-16	59.79	39.92	0.29	503.27	28.183
2016-17	58.50	41.19	0.31	485.5	
Compound growth rate	-6.40	-20.02	96.80	-13.29	

Survey: Primary Survey

Table 16 Productivity under Cumin by Major States from 2013-14 to 2016-17 (Kg/ha)

Year	Rajasthan	Gujarat	Others	India	CV(%)
2013-14	1321.43	801.60	1018.62	1019.02	35
2014-15	2090.50	277.91	393.09	416.93	108
2015-16	3333.33	375.00	954.55	833.33	113
2016-17	1671.50	545.66	622.84	638.65	72
Compound growth rate	6.05	-9.17	-11.57	-11.02	

Source: Primary Survey

There has been a positive growth in area under Cumin to the tune of 12.89% in the field survey (Table 8). However, 65% of sample farmers reported that they had reduced their area under Cumin cultivation while 34.5 of farmers reported that they had increased or did not change the area under Cumin cultivation. It can reasonably presumed that increase in area by relatively smaller proportion of sample farmers could outweigh the reduction in area by a larger proportion of farmers. It may also be noted that about 13% of sample farmers cultivating Cumin have leased in land for its cultivation and it widely practiced in desert area as farmers without watering facility lease in land with tube well to cultivate the crop. It in turn points out to the relative profitability of the crop (Table 9). However, 85% of farmers revealed that their production had fallen while 15% reported a rise in production (Table 11). Important reasons for the reported fall in the production of Cumin (driven by productivity fall) is due to area fall, followed by drought and leaving land barren or uncultivated (Table 12).

Based on the primary survey, major problems encountered by Cumin farmers in the production of the crop are presented in Table 17. Plant diseases and lack of any technical advise or institutional support together accounted for more than 50% of the problems of farmers in Rajasthan. The leased cultivation for Cumin farmers pose a serious problem as they lease in land with live tube well at an exorbitant cost of 50% of the produce with the land lord and the farmer is left with a little margin and it is reported as a serious disincentive to cultivation.

Table 17: Issues related to Production of Cumin

Issues	Cumin Farmers' Response(%)
Lack of Technical Advice on seed, Fertilizer and Pests	19.00
Plant Disease	32.50
Shortage of Water	8.00
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

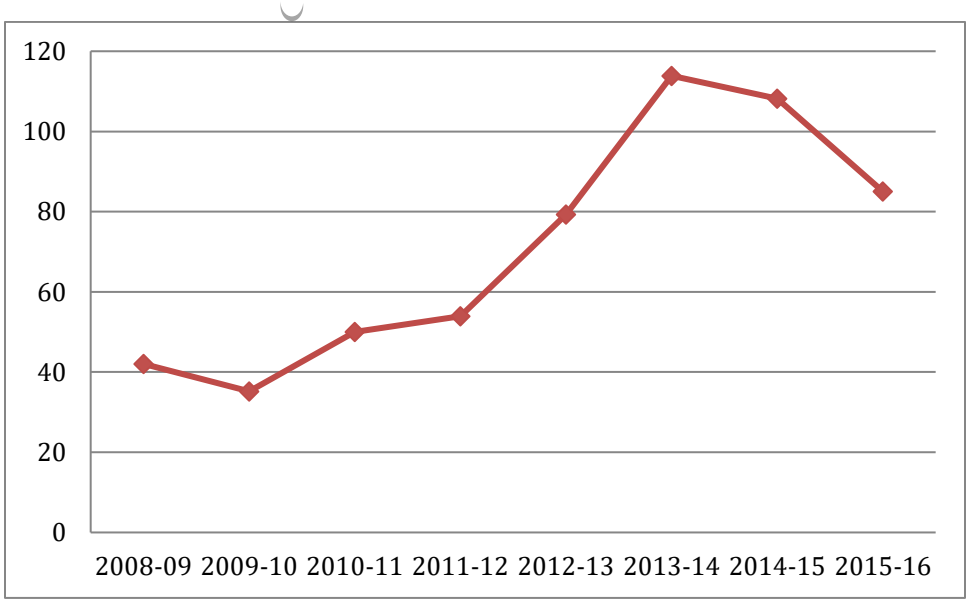
Section 2

Trends in Price and Foreign Trade

2.1. Price Trend:Coriander

Price volatility is an inherent characteristic feature of export oriented crops and the scale and magnitude of volatility has aggravated with trade liberalisation. The area under Coriander grew at an annual rate of 4.9% while its production registered a growth rate of 4.2% per annum during the period 2012-13 to 2016-17. It may appear to be contradictory that in spite of sharp fluctuations in price, the area and production of these crops increased and it is attributable to a variant of "hunger farming" as farmers are left with little other alternatives in areas where Coriander is grown during kharif crop season. The price of the crop may be viewed against the fall in the productivity of Coriander during the reference period. Figure 2.1 shows the trend in the price of Coriander during 2008-09 to 2015-16.

Figure 2.1: Trend in the price of Coriander -2008-09 to 2015-16.



Source: Spices Board

An important observation emerging from the trend in price (Fig.1) is that there have been fluctuations in the price of the crop during 2008-09 to 2015-16, particularly in the terminal years of the analysis. More importantly, monthly price of the crop shows

how the Coriander farmers are rather forced to sell major share of their produce at a much lower price than the annual average price. It may also be noted that the Coriander crop is harvested in the month of March and sold in the market between March and April as the storage of the produce causes weight loss. Price during these two months are important in the sense that the Commission Agents of traders in specialised markets approach farmers and fix the price for the crop mostly in the month of March and farmers contact the agents in the specialised markets whom they have been contacting for many years and believed to have established a faith that the agent would not cheat. However, the trust that the agents would help them realise a better price from traders is a myth as the commission agents are full-time employees or rather more loyal to the traders for a fairly long time in the specialised markets. Moreoften than not, farmers are unable to change their market agents as the later supply credit to the former for a fairly long period. Table 18 shows the monthly price movements of Coriander during 2008-098 to 2016-17.

Table 18. Monthly Price of Coriander (Rs/Kg)

Month	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
April	47.17	30.75	52.75	47.25	75.88	98.50	93.63	79.13	78.75
May	46.50	28.63	51.75	46.12	76.50	99.80	104.10	82.50	78.13
June	43.06	28.25	46.50	46.80	75.62	102.88	120.63	82.50	75.00
July	45.75	31.19	51.50	50.88	75.87	119.00	121.50	86.25	68.75
August	46.63	31.08	49.92	53.88	77.00	124.75	120.00	89.37	69.50
September	42.58	28.92	58.38	47.40	78.50	115.00	116.87	88.00	NA
October	41.58	31.84	49.50	52.63	72.88	115.30	120.90	90.00	NA
November	45.13	33.13	47.25	53.50	75.50	123.33	122.50	83.75	NA
December	44.08	35.25	48.10	56.10	80.63	133.75	121.87	86.00	NA
January	37.88	48.67	49.12	62.00	79.10	134.40	96.25	87.50	NA
February	32.38	47.83	50.12	63.13	86.13	108.38	82.50	86.25	NA
March	31.25	46.69	45.30	67.20	97.88	91.50	77.50	79.10	NA
Average	42.00	35.19	50.02	53.91	79.29	113.88	108.19	85.03	74.03
CV	0.34	0.58	0.26	0.27	0.13	0.13	0.16	0.05	0.19
Price ratio	93.36	110.03	98.01	106.15	109.57	83.42	79.09	93.04	NA
Average price	39.21	38.72	49.03	57.23	86.88	95.00	85.57	79.12	NA

Note: (i) Price ratio shows the ratio of price between annual average and peak production season (March - April)

(ii) Average price is the price of March and April

Source: Estimates based on Spices Board data

It could be observed from the monthly price movement that the average price of March and April every year from 2008-09 to 2015-16 is significantly lower than the annual average price of the crop. For example, average annual price of Coriander in 2008-09 was Rs 42/kg and the average price of March and April in the same year was Rs

39.21 or 93% of the annual average price. Similarly, the average annual price for the year 2015-16 was Rs 85/kg but the price for March and April was Rs 79/kg. However, a positive trend in the price outcome is that difference inminimum and maximum price between peak and off seasons have been on the decline for Coriander as indicated in the coefficient of variation.

Coriander produced in Rajasthan fetches a premium price in the export market owing to its superior quality. For the last few years, area under Coriander has been declining in Rajasthan and Madhya Pradesh while its area in Junagarh, Rajkot, Kutch and GirSomnath districts in Gujarat has increased by 39% in 2015-16. Nigella seeds or what is known in local dialect as *Kalonji* is grown as a substitute for Coriander. Water availability and extension of irrigation facilities in Baran area compounded by the fall in price, has tempted farmers to substitute Coriander with *Kalonji*.

2.2. Price Trend: Cumin

Figure 2.2 and Table 19 show the price trend of Cumin during 2008-09 to 2016-17. As observed in the case of Coriander, there has been seasonal decline in the price of Cumin as well. The average price for March and April is significantly less than the annual price of the crop. It may be noted that the traders of the crop do not face seasonality in the price as they spread the trade of the crop throughout the year and demand for Cumin takes little seasonalityand therefore fetches a higher in every sale. It was found that 80% of the produce is sold in the harvesting period, i.e., March and April during which price of the crop is at its lowest ebb.

Table 19: Monthly Price of Cumin (Rs/Kg)

Month	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
April	109.42	102.13	124.81	127.50	143.75	109.38	165.63	168.75	203.87
May	103.59	102.41	122.88	143.25	147.50	121.50	173.50	179.37	200.00
June	99.56	107.08	117.88	141.50	146.30	123.75	172.50	178.70	194.00
July	101.75	123.13	131.34	156.25	146.75	123.40	166.50	199.75	198.75
August	105.19	130.13	135.42	166.25	148.30	117.75	169.30	204.00	202.40
September	103.75	128.96	162.50	152.00	148.75	117.25	167.50	194.70	NA
October	105.42	119.81	133.12	155.63	142.00	116.30	170.50	187.87	NA
November	124.69	123.75	129.88	159.25	136.10	123.83	170.00	188.75	NA
December	122.08	139.75	149.50	159.10	137.50	134.25	170.63	198.00	NA
January	108.12	130.00	164.38	155.88	133.90	143.50	160.00	197.50	NA
February	100.78	133.17	156.25	148.75	127.00	154.00	157.50	198.25	NA
March	100.42	133.41	139.10	142.50	110.25	150.50	160.80	193.50	NA
Average	107.06	122.81	138.92	150.66	139.01	127.95	167.04	190.76	199.80

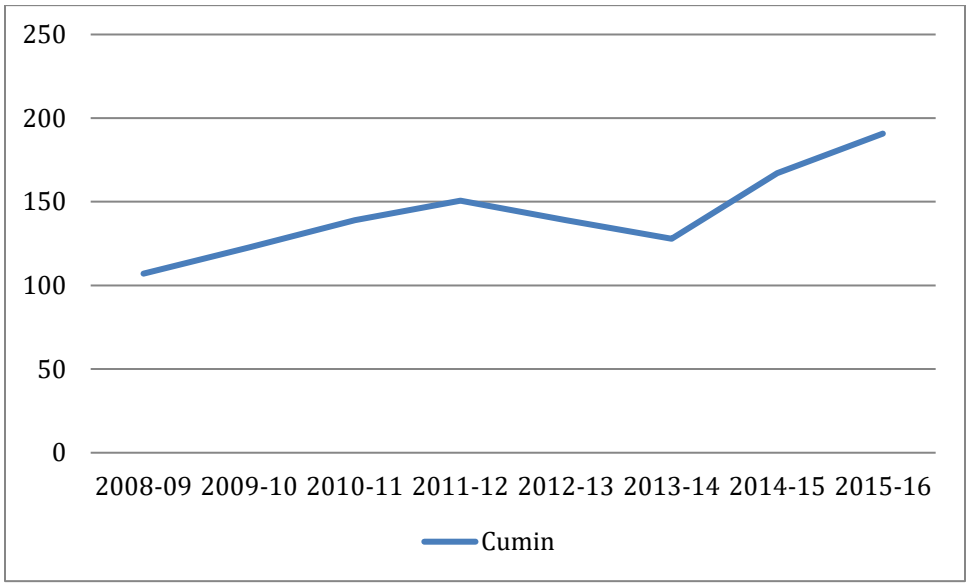
SD	8.20	12.62	15.67	10.52	11.31	14.35	5.15	10.47	3.81
CV	0.08	0.10	0.11	0.07	0.08	0.11	0.03	0.05	0.02
Average price	104.92	117.77	131.955	135	127	129.94	163.21	181.12	NA
Price ratio	98.00	95.90	94.99	89.61	91.36	101.56	97.71	94.95	NA

Note: (i) Price ratio shows the ratio of price between annual average and peak production season (March - April)

(ii) Average price is the price of March and April

Source: Estimates based on Spices Board data

Fig 2.2: Average Price of Cumin (2008-09 to 2015-16) unit (per kg)



Source: Primary Survey

2.3. Foreign Trade of Coriander and Cumin

Research and infrastructure development is skewed towards perennial spice crops in India, notwithstanding the fact that annual and seasonal spice crops too contribute substantially to the foreign exchange earnings from spice crops. It is observed that there has been a substantial year-to-year fluctuations in the volume of exports and export earnings from spice crops. For instance, decline in the volume of export of Coriander has contributed to the total decline in the quantity of exports of spices from India. The quantity of Coriander exported from India declined by 13% and export earnings from the crop by 14% in 2015-16. Following the same trend, export of Cumin has declined by 37% and its value by 15% during the same year. However, it is not attributable to any

general trend or pattern as there has been an overall increase in the earnings from spice export during the same period. Against the back drop, it is worth examining why the external market for spices in India, particularly Cumin and Coriander, which are inevitable ingredients in food items mostly in Asian countries, do fluctuate violently. It has also been observed that the domestic price of these crops do vary in tandem with the unit value realised from exports. Is there any association or co-movement in price in domestic and international markets? and if so, what are the factors driving the demand for Coriander and Cumin both in the international and domestic markets.

Often, volume of production and size of export earnings are two crucial factors influencing the level of price realisation for farmers. Neither Cumin nor Coriander merit attention on these grounds as these crops are concentrated mostly in one or two states and within those states, their relative economic significance is rather niggardly. Although the relative contribution of Cumin and Coriander in the total export earnings is less, these crops are vital elements in providing livelihoods to a large number of farmers and wage labours in arid and semi-arid zones in India. Further, in absolute terms, contribution of those crops are important and further Corianders and Cuminnever bump intosevere completion in the international market as the production of those crops are highly agro-climatic zone specific. There is ample market space to improve India's share in the international market for these crops as the purchasing power is getting increasingly shifted to South East and South West Asia. Table 20 shows important export market for Coriander from India and it is encouraging to note that farmers in India could diversify the geographical concentration of their produce. Trend in the quantity, value, unit value and quantity exported as percentage of production of Coriander are given in Table 21. Broadly, two important trends emerge from the trend: (i) there has been in crease in the export of the crop as percentage of its production from 3.73% to 12.88% during the first half of the 2000s and it started declining with significant volatility and for the last few years, 1ess than 10% of the crop get its value realised from the international markets. However, there has been significant jump in the unit price of Coriander from India during the period of its fall in quantity exported. For analytical brevity, the analysis of import of Coriander is restricted to the period during which there has been a hike in its exports. Table 22 shows the trend in the import of Coriander from India. It is clear from the trend

in imports of Coriander that there has been substantial hike in the quantity of imports of the crop with a compound rate of growth of 58.34% between 2012-13 to 2016-17.

Table 20. Important Export Markets for Coriander from India 2001-2012

Country	2001	2005	2010	2012	2016
UAE	6.92	12.44	8.47	12.65	14.33
Indonesia	11.61	0.28	1.93	0.85	Neg.
Malaysia	44.40	32.88	24.01	30.06	25.17
Singapore	13.75	6.99	3.39	2.61	2.43
Others	23.32	47.41	62.2	53.83	58.07

Note: (i) Neg. – Negligible
Source: Trade Map upto 2012 and 2016- Spices Board

Table 21. Quantity and Value of Exports of Coriander

Year	Quantity (Tonne)	Value (000 US $)	Unit Value US $ / tonne	Quantity exported as % of production
2001	11910	8205	689	3.73
2002	14585	8638	592	8.38
2003	14813	10868	734	3.80
2004	31935	17642	552	12.88
2005	27984	16440	587	12.53
2006	24890	18141	729	10.67
2007	29953	26505	885	9.67
2008	35872	46309	1291	14.82
2009	38382	37905	988	16.21
2010	28862	34646	1200	5.99
2011	32498	34011	1047	6.10
2012	43271	36227	837	8.26
2013	45750	69583	1521	11.45
2014	46000	88054	1914	9.90
2015	40100	68474	1708	8.13
2016	30300	46382	1531	NA

Source: (i) Trade Map upto 2013; (ii) 2013 onwards is from Spices Board.

Table 22. Quantity and Value of Imports of Coriander

Year	Quantity (Tonne)	Value (Rs lakh)	Unit Value (Rs/KG)
2012-13	4470	3526.04	78.88
2013-14	4640	5177.1	111.57
2014-15	9750	9631	987.79
2015-16	25305	17467.1	690.26
2016-17	44485	22048.6	495.64
Compound Growth rate	58.34	44.28	-8.87

Source: Spices Board

Cumin is primarily an export oriented crop, but its import has been increasing at a faster rate since 2014-15 (Table 23) while its quantity exported as percentage of production of Cumin has declined to 12% in 2016-17 from a peak export percentage of 30% in the early 2000s (Tables 23& 24)

Table 23. Quantity and Value of Export of Cumin

Year	Quantity (Tonne)	Value (Rs lakh)	Unit Value (Rs/KG)
2012-13	85602	115306.81	134.70
2013-14	121500	160006	131.69
2014-15	155500	183820	118.2
2015-16	97790	153113	156.57
2016-17	119000	196320	164.97
Compound Growth rate	6.81	11.23	4.14

Source: Spices Board

Table 24. Quantity and Value of Import of CuminSeed in India

Year	Value (US$ 000)	Quantity Imported (in KG)	Unit Value (US$ '000/KG)
2001	1607	1058518	1.52
2002	3179	2726560	1.17
2003	3842	2066925	1.86
2004	1445	1265256	1.14
2005	2180	1459987	1.49
2006	1045	615464	1.70
2007	8684	3874869	2.24
2008	1075	452463	2.38
2009	9165	4233692	2.16

2010	2591	1053664	2.46
2011	1914	669491	2.86
2012	309	120000	2.58
2013	1632	570000	2.86
2014	489	200000	2.45
2015	5464	2000000	2.73
2016	7486	2800000	2.67

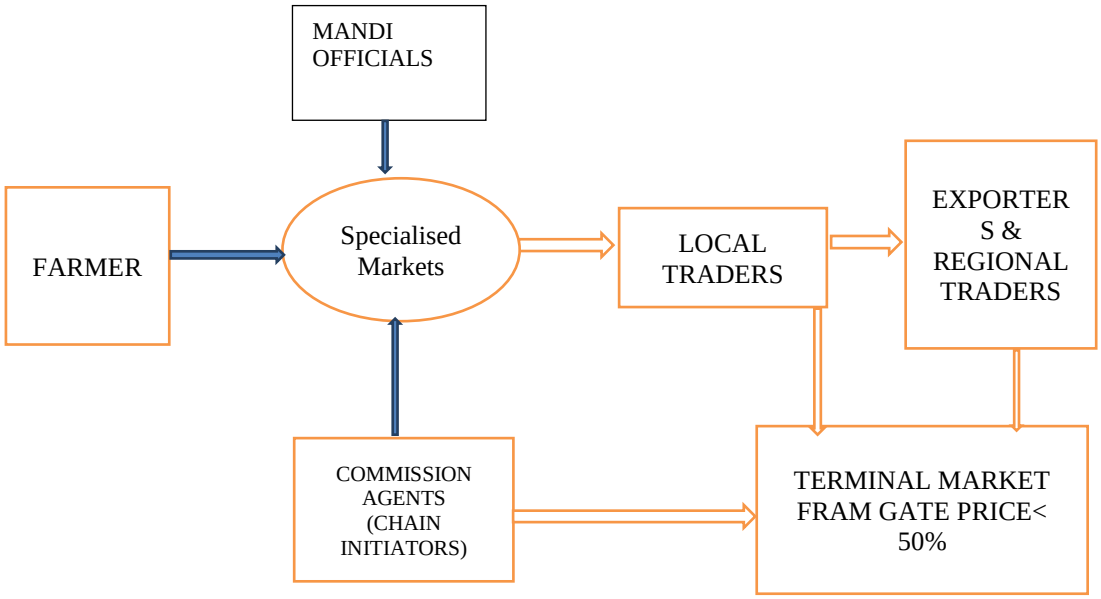
Section 3

Post harvest processs and marketing

3.1. Coriander

The post-harvesting issues takes different stages and important post-harvesting issues of the Coriander crop can be summarised as follows as reported revealed by the field survey in major markets and the crop growing area. Flow chart 1 explains the

Flow Chart 1. The Supply Chain of Coriander and Cumin



channels of commodity sale from farmers to the specialised markets. Agentes of traders meet the farmers, inform the price status in the market and arrange for their sale in auction place in the market. Alongside, the officals of the marekt, traders and agents join together and assemble in the auction site and perform the outcry for sale. It is the responsibility of the respective Agent to locate the place for heaping the produce and inform the office of the market for auction on behalf of the farmer.

Stage-1 Visit of Commission Agents to the Village: This stagecommences with the entry of the casual visit of Commission Agents in the village to meet farmers, give loans who needs money on ensuring that there is standing crop and the product is assured to the trader with whom the CA is attached, and where money is loaned to the farmer.

Stage-2 Market information and product grading: On the harvesting,Coriander is kept in the field to be transported to the market, if the farmer plans to sell immediately or stored in the home. Market is situated in the district head quarter. The farmer contacts the commission agent to collect information on the price trend and often grades are accorded by location of production and CA is aware of the type of the produce from a locality. The CA reports the market outcome on the basis of the grade or quality of the produce. There are five major grades of Coriander sold and grading absolutely visual.The CA declares the grade and as the auction (out cry) starts,trader cry out the price of the produce which seldom differ from the price offered by the CA under normal situation of demand for the produce in the market.

Table 25: Important Grades of Coriander

Grade	Name	Rate as on 3.06.2018 (Rs/kg)
1	Bethami	Rs 48/- 50/-
2	Eagle	Rs 50/- 52/-
3	Scooter	Rs 58/- 60/-
4	Parrot	Rs 80/- 85/-
5	Double Parrot	Rs 98/- 105/-

Source: Primary Survey in Ramganj Mandi in Rajasthan

The visual grading is performed jointly and through a tacit understanding between CA

and the trader. However, as the crop rests in the field after harvesting, its colour fades and the evaporation of water content from the crop alters its shape as well. The grading is based also on the colour and shape of the crop.

On enquiry with the CA, the farmer depending on his need for money transport the produce to the market. The CA might spot a place for the farmer to heap his produce in the market where the CA flags his name board to notify that the produce belong to a particular CA. The farmer has to pay at the rate of Rs 7/- per bag of Coriander to the CA for unloading and again bagging the produce and heaping it in the market place.

Stage 3 Auction and sale: The farmer is told to be free to sell the produce whoever he wants to sell in the mareket,but in practice , the farmer sells the produce to thew CA and to his trader and therefore the auction is reduced to a process to be hold or part of the market rule. The market officials arrives around 9 am and the auction commences with their arrival. There could be many other crops for auction on the day and in seasons, the market officials gives importance to the seasonal crops as its quantity is relatively large as compared to off-seasonal crops. The officals, traders and CAs assemble around the heap of the produce and announces the auction through an out cry method. By looking at the grade of the produce, traders quotes their prices by calling out and the price is often settled or auction process does not prolong for not more than two minutes and the team moves over to the next heap of the produce.

The practice is that the traders whose CA has brought the produce to the market would take the product on auction and the cash will be paid to the farmer the same day after deducting the loading and unloading charges, loan amount and the rate of interest. The CA receives 2% of the total sales procedes as accepted rate of commission for loading and unloading,Rs 7 per (bori) 40 kg/bag is changed from the farmer. It seldom happens that the farmer takes the produce back home once it is brought for sale. Although there is auction, in practice there is a tacit understanding among traders in the market that the contracted farmer of a CA in general will not be bought by another trader and therefore the auciton process does not improve the farm gate price of the farmer.

Stage 4: Pricing of the produce and post-harvest process: Although there are five grades in the market, more than 60% of the produce of Coriander is bought as Bethami grade, and remaining 20% is sold as Scooter. Rest of the grades like parrot and double parrort are seldom auctioned in the market as the field survey in Ramganj Mandi in Kotta, Krishi Upaj Mandi in Baran have revealed. However, traders bring in their stock after cleaning and grading in the Mandi and such produce are sold as parrot and double parrot. Parrot ,double parrot grades are bought and sold betyween trader and rarely between farmers and traders.

Ungraded produce and its sale: There exists another grade which is the inferior most and ungraded in the market. It is called ungraded Coriander. In the market, between 20% and 25% of the produces is bought by traders as ungraded and its price remain undecided until the auction takes place. Old stocks available with farmes, wet produce stocked for more than six months in jute bags, colour faded to dark or black, broken produce etc are auctioned with no graded price in the market.

Implicit understanding between traders and CAs: Commission Agents play multiple role in the market. They give assurance to the farmers that they farmers get a little higher than the market rate and a commssion for the margin is also fixed before the sale takes place. This is possible when the market for Coriander is relatively better. On the sale of the produce, the farmer shares a part of the hiked price to the CAs and in effect, it is a tacit understanding between the CAs and the trader.

Stage-5 Post harvest process and sale: It is an important and intermediate stage between sale in the terminal market and producer's market. The produce bought by the traders is taken to their process centres for further processing. The processing includes the following:

(a) Cleaning and Drying: For cleaning, machine is used by traders and a cleaning cum drying mechine costs Rs 20 lakh. However, large traders now use SORTEX mechine which cost Rs 20 million. Cleaning and Drying is done in the machine. The process of drying improves the colour of the produce and thereby Bethami produce is transformed into higher grades. It is worth noting that drying process is an elementary process with minimum cost. Cleaning of the produce is intended to

separate broken produce from the whole, other parts of the plant that get mixed up with the produce. These are called wastes and the waste is sold to spice powder manufacturers at a price higher than the lowest quality produce called Bethami in the market. However, a cleaning-cum-grading mechine costs about Rs 5 lakh and for a farmer, it is finanacially not feasible to purchase and maintain a grading machine. It is aviable only with large traders.

(b) Grading: Coriander is graded into different products as per the demand requirements of regional and export markets. The broken Coriander is sold to the manufacutrers of spice powder producers and the price of the produce is still higher than the lowest quality whole Coriander in the market (Bethami).

(c) Regional Markets and Sale: Regional Markets for Coriander is divided primarily into four: (i) Erode in Tamil Nadu and Veerad nagar in Andhra Pradesh (formerly); (ii) Delhi market catering to the Central India; (iii) Punjab and Agra; (iv) West Bengal and Odisha and North East.

Deduction for wastage: For every 40 kg (*bori in Hindi)*: For every 40 Kg of Coriander, the price of 2kg is deducted to account for the waste in the produce irrespective of the quality. The waste is supposed to include broken produce and other parts of the plant. However, these waste is sold by the trader to the spice powder manufactures for a price higher than the lowest quality produce in the market bought from farmers.

Table 26. Cleaning and Sorting of Lowest Quality Produce (Bethami) of 100 kg

Grade	Name	Rate as on 3.06.2018(Rs/kg)
1	Bethami	Rs 48/- 50/-
2	Eagle (70%)	Rs 52/kg
3	Scooter (20%)	Rs 60/kg
4	Parrot (5%)	Rs 85/ kg
5	Broken and waster	Rs 45/kg

Source: Primary in Ramganj Mandi, Rajasthan

Costs invovled in post harvesting process:

As noted elsewhere, once the produce is sold in the market by the farmer, Coriander undergoes different stages of processing from cleaning to grading and packing. In our primary survey, we could not meet a single farmer who undertakes any of such activities

in the post-harvest stages and all such process are performed by the trader. The stages and costs involved can be summarised as given in Table 27**.**

Table 27: Stages of Post-Harvesting Process and Cost

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

3.2.Cumin

As noted before, Cumin is cultivated in the desert districts in Rajasthan and arid zone in Gujarat. Unlike Coriander, market for Cumin is centered in the UnjahMandi in Gujarat and the price difference between UnjahMandi and local Mandis are substantial. Moreover, the distance between main market for Cumin and its production centres in Rajasthan are too far to take as the cost of transport per unit of production will be higher than the price difference between local buyers in the production centres and main market. A mild glut in the main market for Cumin is manifested significantly in the price difference.

Grading in Cumin Market: Colour and shape(length) of the crop are two important product characteristics that are used for visual grading in the market for Cumin. In the local market, Cumin is bought for the lowest grade price and the local buyers make the payment after the product is sold in the main market.

Cleaning and Drying: The machine for cleaning and drying of Cumin is available only with the traders and it also works to the disadvantages of farmers in the local market

To sum up the discussion so far it is evident that both production conditions and the post-harvest issues of Coriander and Cumin in India are more or less the same. Farmers are subjected to multiple forms of exploitation; along with the credit-product market linkage, imperfect auction system and different layers of middlecoupled with lower prices during the harvesting season are some of the manifestations of the backwards production

conditions andpost-harvestprocess that prevails at present. Hence, there is immense opportunity for improving the farmer-unfriendlyconditions, which in turn could attract more farmers to the cultivation of these crops.

3.3. Product -credit market linkage

There a vlumnoue literaue on Indian Agriculture beginning with Bhaduri (1974) characterising inter-linkages between different markets in Indian agrculture. Scholars in general articulated such interlinages as a cause and effect of the backwardness of India's agricultural sector. The sitution in case of Cumin and corander is not mrkedly diferent where in inter-likeage is between the product market and and the credit market which is found to be strong.

Since corriander farmers are mostly small or semi-medium, they need credit from sowing seasons to the harvesting seasons. Although credit is avialble from formal money market or Kisan Credit Card, farmers prefer to borrow from the product market. For Coriander, the main market is situated in Kota and in the boarder district of Madhya Pradesh called Bhavani Mandi. The Coriander market is multi layered and the farmers and traders is connected through the commission agents. Under a single trader/exporter, there could be a number of Commission Agents who identify potential farmers who could offer the produce to the trader. Each farmer is identified with a commission agent for a fairly long time and most of the cases the trust is established with the associcaiton of trade for generations. The Commisssion Agent takes money from the trader and lend to the farmer usually for a rate of interest of 24% or in local dialect, it is known as for Rs 2. It is the responsibility of the Commission Agent (CA) to ensure that the loan is returned immediately after the sale to the trader and therefore the lender does not need to know about the whereabouts of the farmer or it involves zero risk as the money is paid back on time or the creidt is cut from the sale procedure.

3.4. Processingof Coriander and Cumin

The choice of post harvesting types reveals that majority of Cumin (97%), Coriander (78.7%) have used own processing facility and the proportion higher than those farmers who have utilized common processing centre (Figure 3.1.).Despite, various advantages

associated with group processing, on account of economies of scale like reduced cost, data from the field survey tend to suggest that incidence of group processing rather negligible. Majority of the farmers are found having their own processing facilities. Tables 28 & 29 explain major issues involved in the process of Coriander and Cumin. An important point emerging is that lack of facilities and government support are major issues in the processing side both Coriander and Cumin.

Table 28: Issues Related to Processing of Coriander

Issues	Percentage
Lack of Facilities	49.51
Lack of Knowledge	5.39
High Cost of Grading Machine	0.98
No Specific Problem	44.12
Total	100.00

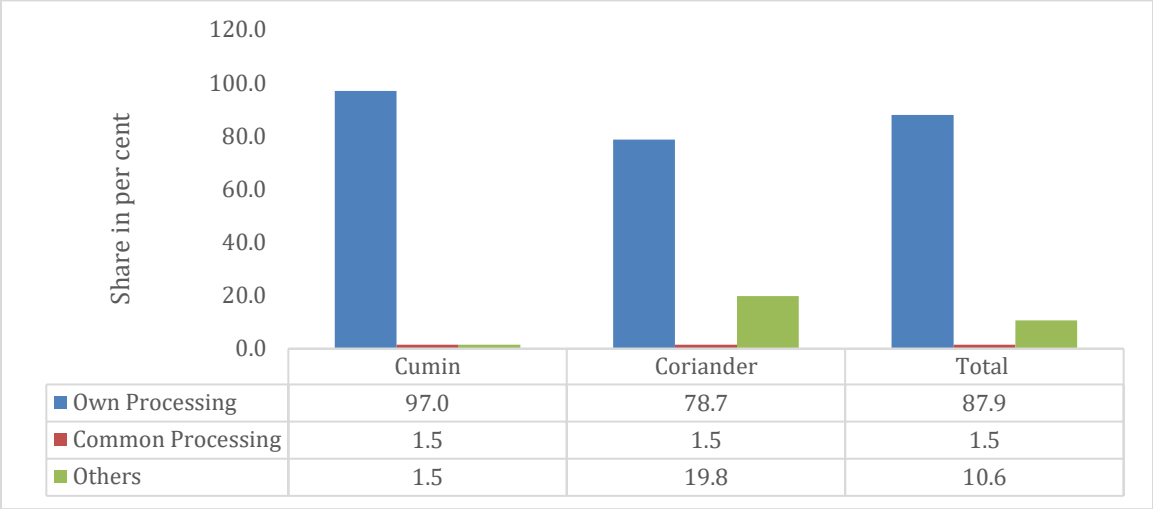
Source: Primary survey

Table 29: Issues Related to Processing of Cumin

Issues	Percentage
Lack of Government Support	36
Lack/Absence of Facilities for Processing and Grading	62.5
High Cost of Production	1.5
Total	100

Source: Primary survey

Figure 3.1.Distribution of growers on the basis of type of post harvesting

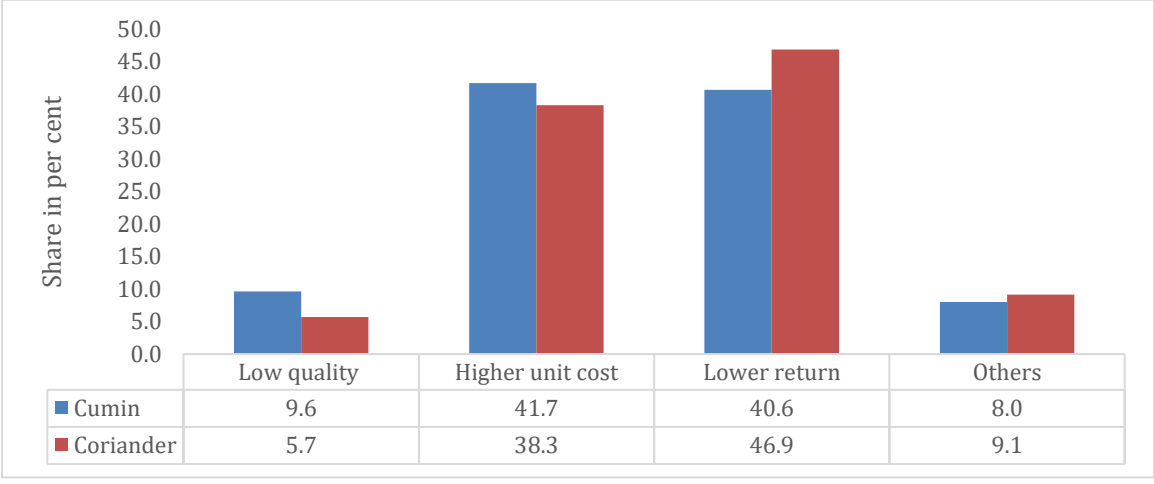


	Cumin	Coriander	Total
Own Processing	97.0	78.7	87.9
Common Processing	1.5	1.5	1.5
Others	1.5	19.8	10.6

Source: Sample Survey, 2018

As expected, regarding the issues faced by farmers with own processing centre, it is evident from figure3.2.that majority of the farmers in Cumin (82.3 %) and Coriander (85.2) have experienced higher unit cost and lower return. Further, 9.1% of farmers in Cumin and 5.7% of farmers in Coriander have reported the issue of low quality of the produce.

Figure 3.2. Distribution of farmers on the basis on issues in own processing centre

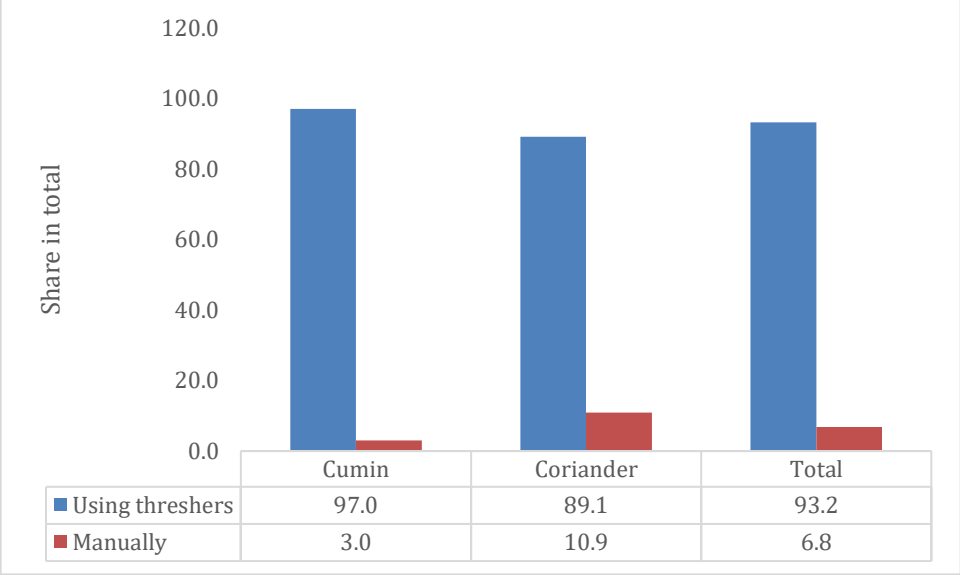


	Low quality	Higher unit cost	Lower return	Others
Cumin	9.6	41.7	40.6	8.0
Coriander	5.7	38.3	46.9	9.1

Source: Sample Survey, 2018

The quality of the product has a crucial bearing on the processing method adopted at the different stages. In case of threshing, mechanised threshing has often been advocated instead of manual threshing which could lead to reduced product quality because of animal waste, foreign particles and others. Here it is encouraging to note that majority of the farmers are found using mechanised threshing which could be helpful in enhancing the product quality. Further, it is also interesting to note that there is hardly difference in the adoption of mechanised threshing between Cumin and Coriander. To be more specific, 97% of Cumin and 89.1% of Coriander farmers have used threshers to do the process instead of manual threshing (see Figure 3.3.).

Figure 3.3.Distribution of farmers on the basis of the choice of threshing method

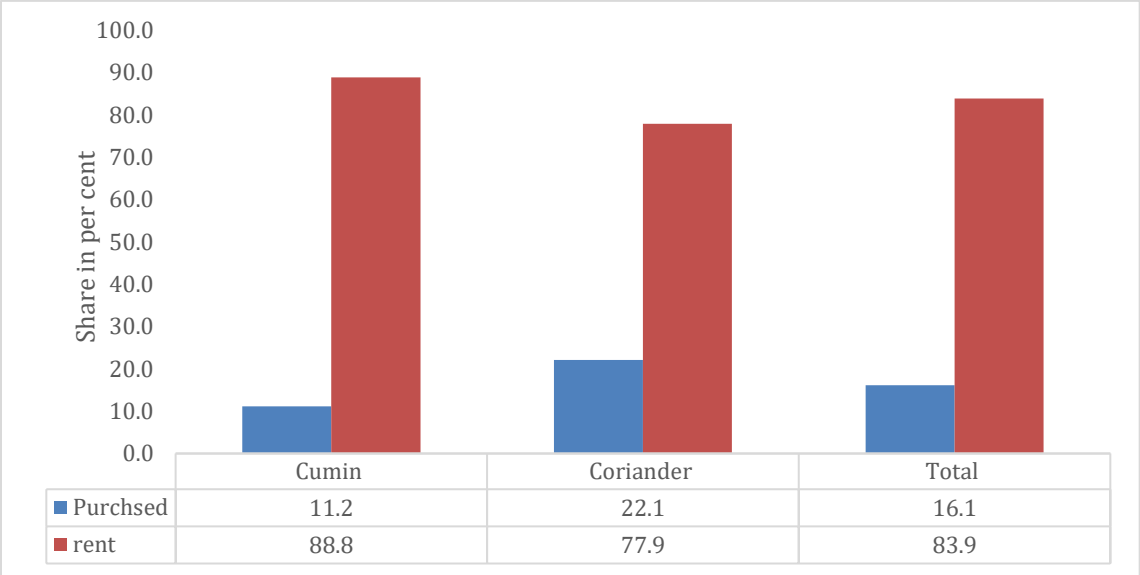


	Cumin	Coriander	Total
Using threshers	97.0	89.1	93.2
Manually	3.0	10.9	6.8

Source: Sample Survey, 2018

However, it may be noted that a Cumin thresher is high cost capital equipment with price ranging between Rs1.5 to Rs 2 lakh is not affordable to many of the Cumin and Coriander growers many of whom being small holders. Hence, the common practice observed in the field is availed the threshing machines on rent 88.8% of Cumin farmers and 77.9% of Coriander farmers (figure 12). Only 16.1% of the total farmers have purchased thresher for threshing.

Figure 3.4. Distribution of farmers on the basis of ownership of thresher

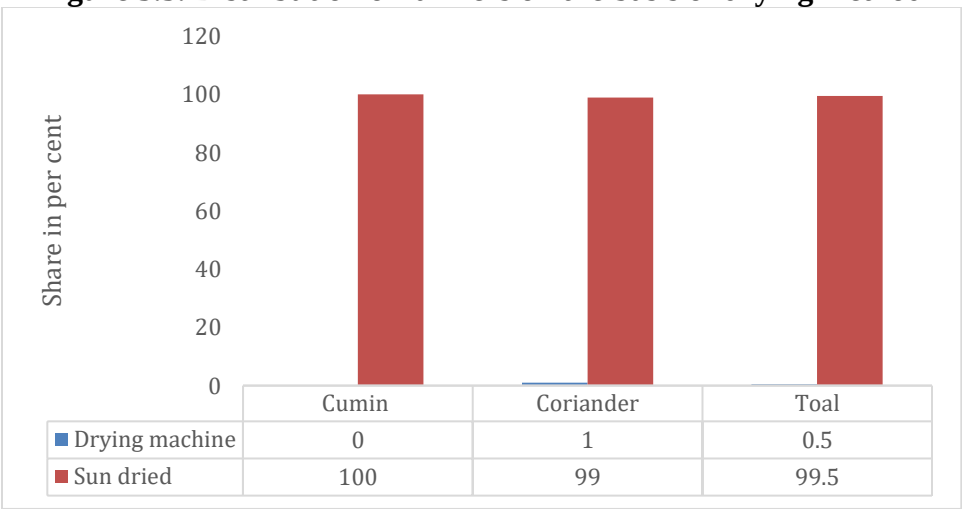


	Cumin	Coriander	Total
Purchsed	11.2	22.1	16.1
rent	88.8	77.9	83.9

Source: Sample Survey, 2018

While drying there is high risk of contamination by dust and dirt occurring if the raw materials are laid out in the sun. Solar and powered dryers protect against contamination and are thus often strongly recommended. Though machines are available for drying the harvested crop to bring down the humidity level of 9-10 percent, presumable on account of the high capital cost involved, most of the farmers are found adopting the sun drying method (Figure 3.5.).

Figure 3.5. Distribution of farmers on the basis of drying method



	Cumin	Coriander	Toal
Drying machine	0	1	0.5
Sun dried	100	99	99.5

Source: Sample Survey, 2018

With a view to ensure quality while sun drying, spices board has provided for a scheme wherein polythene sheets to have been provided at subsidised rate to the growers. However, data from the field survey revealed only a negligible proportion of farmers (less than five per cent)among both crops have not obtained polythene sheets from Spices Board (Table 30). On probing the reasons for not making use of the facility, it emerged that over 80 per cent of the farmers are not aware of the scheme (Table 30).

Table30: Distribution of farmers on the basis of availing polythene sheets of Cumin/Coriander

Category	Cumin	Coriander	Total
Polythene sheets for subsidy from Spices Board			
Yes	3.57	5.53	4.56
No	96.43	94.47	95.44
Reasons for not obtaining			
Not aware	77.4	83.1	80.2
Did not feel the need	19.5	7.7	13.7
High rate	0.5	2.2	1.3
Others	2.6	6.6	4.6

Source: Sample Survey, 2018

Regarding the method of cleaning, 84.4% of Cumin farmers and 41.1% of Coriander farmers have reported that they were following manual method to clean the crops. Among the farmers who were using machine to clean the crop, it is evident from Table 10that 78.5% of them have availed the service of cleaning machine by rent.

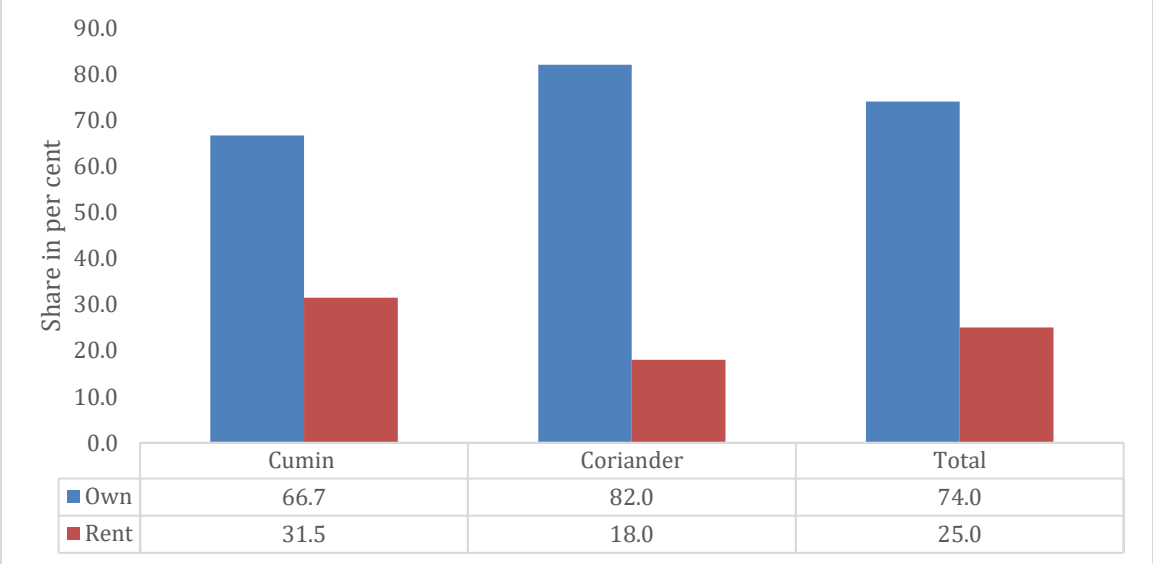
Table 31: Distribution of farmers on the basis of method of cleaning machine and its ownership

Category	Cumin	Coriander	Total
Cleaning machine	15.6	58.9	36.9
Manually	84.4	41.1	63.1
Ownership of cleaning machine			
Purchased	16.1	22.9	21.5
Rent	83.9	77.1	78.5

Source: Sample Survey, 2018

When we compare the grading facility among growers, it is evident that 74% of the total farmers were having own grading facility. The crop wise analysis show that Coriander farmers (82%) were having highest share of own grading facility than Cumin farmers (66.7%)(Figure 3.6.).

Figure 3.6.Distribution of farmers on the basis of availing grading facility



	Cumin	Coriander	Total
Own	66.7	82.0	74.0
Rent	31.5	18.0	25.0

Source: Sample Survey, 2018

The information on quality testing shows that 99% of the farmers irrespective of crops have not done quality testing of their produce during the period of study. The reasons for not performing quality test varies among crops. In case of Cumin, 88% have reported high fees charged by the concerned centres as the major reason for this trend, whereas 10.9 per cent have stated the issue of long distance as the reason for not doing quality testing centres. One of the major reasons that 71.1% of Coriander farmers have reported was the lack of awareness about quality testing. However, 24.9% were faced the issue of long distance to reach the quality centres (Table 32).

Table 32: Distribution of farmers on the basis of availing Quality testing

Category	Cumin	Coriander	Total
Quality testing			
Yes	0.0	1.0	1.0
No	100.0	99.0	99.0
Reasons for not doing quality testing			
Not aware	1.04	71.1	36.5
High fees	88.0	1.0	44.0
Located far	10.9	24.9	18.0
Others	0	3.05	1.54

Source: Sample Survey, 2018

At aggregate level, it is seen that not aware (36.5%), high fees (44%) and long distance (18%) as the major issues that the farmers experience related to quality testing.

3.5. Marketing Channel:

While the study has highlighted, the considerable potential for bringing more area under the cultivation of Cumin and Coriander, being seasonal crops being seasonal crops, farmers decision on land allocation will be governed a great extent by the price that they receive for these crops. While the demand and supply side factors both at the domestic and foreign market influence price, the ultimate price that farmers get is governed by a great extent on the prevailing marketing system and the marketing efficiency. In exploring these aspects, the scholars often analyse the channels of marketing and the marketing efficiency. Marketing efficiency is often analysed by estimating the producer's share in consumer's rupee while the marketing channel the focus is on the different actors involved in the movement of the product from the producer to the ultimate consumer. To the extent that the farmers have different options open in disposing their product, we shall begin with an analysis of the markets where the product is being disposed and the farm-gate price received. The marketing options open to the farmers include, on site sale often through contract, sale in the special market and through the local dealers and general market (Table 33). In all most all the agricultural commodities, the onsite sale through contract, very often takes place even before the crop is mature.

Table 33:Distribution of Farmers by Placeof Sale

Place of Sale	Cumin No. of farmers	Coriander	Total
Production Site	5	0	5
(%)	4.46	0	1.81
Special Market for Crop	87	164	251
(%)	77.68	100	90.94
General Market	19	0	19
(%)	16.96	0	6.88
Others	1	0	1
(%)	0.89	0	0.36
Total	112	164	276
Total (%)	100	100	100

Source: Primary Survey

Such sales often take place under desperate conditions leading to much lower price realisation. The special markets with larger numbers of buyers and sellers operating under the regulatory conditions of the state, involving greater competition often found to fetch better prices as compared to other marketing options. From Table 33, it is evident that while the entire Coriander output is sold in the special market, the share of special market in Cumin is 78 per cent. The share of onsite sale is only 5 per cent, the remaining output is found sold through the general market/local dealers.

Table 34gives the comprehensive index of the market infrastructure facilities available. It is a summary measure of twelve items elicited in the primary survey with weights assigned to different items as presented in Table 35. It is clear from the Table that a very high percentage of farmers do not avail any market infrastructure facility and it has strong bearing on the price realised as revealed in the Logit Model presented in the section. Table 36shows the accessibility to technical advise from different agencies. Percentage of farmers availing technical advise authorise government agencies are much on a lower side for both Coriander and Cumin. An important source of technical advise is the progressive farmers in the next door for both the crops.

Table 34: Comprehensive Index of Market Infrastructure forCumin and Coriander

Index	Farmers Response (%)	
	Cumin	Coriander
0	35.38	2.11
01 -0 5	18.47	16.02
05 - 10	7.69	19.72
10 – 15	17.95	25.34
15 – 20	17.43	25.36
20 – 25	3.08	11.27
Total	**100**	**100**

Source: Primary Survey

Table 35: Weights Assigned to Market Infrastructure

Items	Weights			
	Not Available	Bad	Average	Good
Go-Down 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: Primary Survey

Table 36: Access to Technical Advice for Cultivation of Cumin and Coriander

Source of Technical advice	No. of farmers accessed (Cumin)	No. of farmers accessed (Coriander)
Agriculture Supervisor(G.P)	39	83
Extension Agent/Officer	5	10
KrishiVigyan Kendra	27	31
Agricultural University/College	4	0
Private Commercial Agents	123	71
Progressive Farmer	187	193
Radio	4	18
TV	11	49
Newspaper	41	93
Internet/Computer	4	14
Smartphones	6	16
Mobiles	43	58

Farmers Organisations	7	6
NGO's	0	0
Others	3	6

Source: Primary Survey

Important issues related to Cumin and Coriander elicited from farmers are reported in Table 37 & 38 **.** Price fluctuations and non-availability of markets are important factors affecting Cumin farmers whereas price fluctuation is the major cause of worry for Coriander farmers.

Table 37: Issues Related to Marketing of Cumin

Issues	**Percentage**
Price Fluctuation	33.00
Non Availability of Good Mandi Nearby	29.50
Agents decides the Price	10.50
Long Distance of Mandi	14.00
No Support from Government/Lack of storage facilities	1.50
Low Selling Price at time of Harvesting	1.50
Less Production and Losses due to wastage after Filteration	0.50
No Response	9.50
Total	100.00

Source: Primary Survey

Table 38: Issues Related to Marketing of Coriander

Issues	**Percentage**
Price Fluctuation	80.39
Unfair Deal while Auctioning	7.84
Lack of government support at time of Natural Calamities	0.49
No Response	11.27
Total	100.00

Source: Primary Survey

An analysis of the average price received across different markets revealed that in sync with general pattern the price obtained through onsite sale is only 74 percent of the special market. Interestingly enough, price in the general market and local dealers is reportedly on par within fact marginally higher) the price received in the special market.

Exploring the reason for selling the produce in the special market, we observed broadly two kinds of growers. The set of growers have preferred the special markets because it offered them a higher price. In case of Coriander the share of such growers was 46 per cent and 42 per cent in case of Cumin. Exploring further, it emerged that large proportion of these growers are those with holding size above less than 2 hectares. Another set of farmers are reportedly selling in the special market because they have taken advance from the dealers. The share of such growers is high as 47 per cent in Coriander and 33 percent in Cumin (Table 39).

Table 39. Reasons for Selling Produce in Special Market

Reason	Cumin		Coriander	
	Freq.	Per cent	Freq.	Per cent
Advance/loan already taken	28	33.33	75	46.58
Influence of friends and fellow farmers	5	5.95	1	0.62
Assured sales	2	2.38		
higher/fair price	35	41.67	74	45.96
low marketing cost	5	5.95		
proximity	6	7.14	1	0.62
logistic support			4	2.48
access to input markets	1	1.19	1	0.62
better infrastructure	1	1.19	1	0.62
Others	1	1.19	4	2.48
Total	84	100	161	100

Source: Primary Survey

The incidence of such high proportion of farmers availing advance tends highlights the widespread prevalence of interlined credit product linkages, which has been articulated in the literature as a key feature of the backward agriculture. Studies have shown that credit product market linkage is often disadvantageous to the farmers as it leads to lower price realisation. Our further exploration of the data revealed that large proportion of the farmers belonged to relatively a smaller size class. What is more important while the former category of farmers in sync with their expectation received a higher price the realised by the latter category was only 60 per cent of the former.

Table 40: Quantity Sold to Whom			
Markets	Cumin	Coriander	Total
Trader/agents	135	161	296
Percentage	79.88	98.17	88.89
Landlords/ moneylenders	29	0	29
Percentage	17.16	0	8.71
Directly to wholesaler	4	3	7
Percentage	2.37	1.83	2.1
Others	1	0	1
Percentage	0.59	0	0.3
Total	169	164	333
Percentage	100	100	100

Source: Primary Survey

To the extent that special market is the major place of disposal of the output, it is important to explore the major players therein. In the special market, there are different players. The first ones are the commission agents and traders whose prime activity is trading. However, they also play the role of moneylenders through their commission agents and deal directly with the farmers. Second category is the moneylenders whose prime activity is money lending and engaged in trading with strong credit market linkage. Thirdly, there are wholesales who act on behalf of the dealers and traders. They go to the field provide advance if any needed and attract as much possible output the special market for a commission. Finally, there are wholesalers. From the field survey, it is evident that while 98 percent of Coriander farmers sold their product to the commission agents cum traders, the corresponding share for Cumin was only 80 percent. Of the remaining Cumin growers, 17 per cent sold their product to the moneylenders cum traders who have strong links at the village level. If we piece together information presented in Tables40&41, it could be inferred that bulk of the sales on the basis of advance taken is at the instance of commission agents cum traders.

Table 41: Mean Price received from different agents					
Cumin					
Variable	Obs	Mean	Std.	Min	Max
Trader/agents	139	13266.91	1631.501	4000	17000
Landlords/ moneylenders	28	13439.29	944.5121	11000	15000
Directly to wholesaler	4	14725	3760.652	10000	19200
Coriander					
Trader/agents	161	3688.98	809.59	1700	8000
Landlords/ moneylenders	0				
Directly to wholesaler	3	4066.67	115.47	4000	4200

Source: Primary Survey

The moot question at this juncture is the farm-gate price received by the growers from different actors discussed already. It is evident from Table 41 that both in Coriander and Cumin, the very small proportion of the growers who managed to sell their produce directly to the wholesalers received highest price. On the other-hand the price paid by the commission agents cum traders is found the lowest in both crops. The average price paid by them is found to be 10 percentlower in both cases.

3.6. Factors Influencing the Decision of Farmers on Choice of Markets

It is important to examine the factors influencing the decision of farmers. For Cumin and Coriander, there exist two type of markets. The specialised markets, which have come 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 the State Agricultural produce marketing. The objective of the Model Act (Development and Regulation Act 2003) was to regulate marketing of agricultural and horticultural produce by setting up marketyards and constituting Market Committeesin every prominent agricultural produce districts in India. Even though such committees had representatives from farmers and traders who were nominated by the governments, the ultimate control over the markets rests with the traders. The specialised markets are such markets and the price in the local markets is always a derivative of the specialised markets. The price in the Specialised Markets is always therefore higher than the local markets where the agents or sub-agents of traders of the specialised markets operate on

behalf of traders and Commission Agents.In this case, Cumin farmers are in a disadvantageous position as major sites of production in Rajasthan (Barmer) is 350 km away and Jodhpur is 500 km away from UnjaMandi, the specialised market. It is located near Ahmadabad in Gujarat. On the contrary, Coriander farmers have specialised markets in major Coriander producing districts in Rajasthan and Madhya Pradesh. Studies on the participation of farmers of different types by markets suggests that education and asset position of farmers are important variables influencing the decision of farmers (Sutradhar, 2008). In the case of food products, quality control driven by consumer preference assumes paramount importance as revealed in a study on post-harvesting issues (Kooiman et al, 2005). There has been a close association between resource strength of farmers and modernisation of marketing system. However, cultivation practices exert bearing on farmers and farmers with traditional practices tend to sell in the village market with less value addition (Anjani Kumar, 2011). Tables 42 &43 explain the status of market infra structure facilities available for Cumin and Coriander. For Cumin, shortage of Go-Down facility and anomalies in the auction agreement are important lacunas where as for Coriander, it is the absence of sorting and grading facilities for farmers as the major cause of concern for farmers. It is quite true as the visual grading of the product is used in the specialised market for under cutting the price and further, the cost of sorting cum grading machines is rather costly to afford even for traders. The cost charged by traders who possess the facilities is exorbitant and unjustifiable as reported by farmers.

Table 42: Market Infrastructure Facilities for Cumin (%)

Facilities	Not Available	Bad	Average	Good	Total
Go-Down 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

Table 43: market Infrastructure facilities for Coriander (%)

Facilities	Not Available	Bad	Average	Good	Total
Go-Down Facilities	8.33	3.92	74.02	13.73	100.00
Auction Agreement	29.90	2.45	50.49	17.16	100.00
Supervision of sale	31.86	1.47	50.49	16.18	100.00
Loading Facilities	7.35	3.43	50.49	38.73	100.00
Sorting/ Grading Facilities	55.39	0.49	27.45	16.67	100.00
Cleaning Facility	44.61	0.49	37.25	17.65	100.00
Weighting Facilities	6.37	0.98	51.47	41.18	100.00
Packing Facilities	37.25	21.57	40.69	0.49	100.00
Banking Facilities	39.71	0.98	25.49	33.82	100.00
Motorable Roads	4.90	5.39	48.53	41.18	100.00
Computer Facilities	60.29	1.47	13.73	24.51	100.00
Internet Facilities	62.75	0.49	12.25	24.51	100.00

Source: Primary Survey

3.7.Logit Regression

Data in the post-harvesting process, price realisation and its proximity to farm gate price depends on a number of factors and Logit model is fitted to estimate the influence of each variables on the decision of farmers to sell in the Specialised markets for Cumin and Coriander separately. The model is specified as;

Outcome Variable:

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

1= If farmers sell in the specialized market and ;

0= Otherwise (If farmer sale in the local market, Agents or any others than Specialised Markets for the crop)

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

S. No.	Symbols in Equation	Name of Variables
1	X_1	Educational 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:

$$\frac{\Delta Y_{Mkt}}{\Delta X_1} > 0 ; \frac{\Delta Y_{Mkt}}{\Delta X_2} > 0 ; \frac{\Delta Y_{Mkt}}{\Delta X_3} < 0 ; \frac{\Delta Y_{Mkt}}{\Delta X_4} > 0 ; \frac{\Delta Y_{Mkt}}{\Delta X_5} > 0 ; \frac{\Delta Y_{Mkt}}{\Delta X_6} > 0; \frac{\Delta Y_{Mkt}}{\Delta X_7} > 0$$

Table44: Logistic Regression for sale in the Special Market of Cumin (N=195)

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 (InQtl)	.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				

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

Table45: Logistic Regression for sale in the Special Market for Coriander (N-142)

Independents Variables	Coefficient	Odds Ratio	Z-Statistics	P-Value	dy/dx	P- Value of dy/dx
Education	-0.1840	.8319	-1.30	0.192	-0.0210	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 (InQtl)	-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				

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

Table 44 explains the results of the Logit model for Cumin and the marginal effect of the variables specified in the model on the dependent variable, selling in the specialised markets or not. It is important to note that there is an inverse relationship between distances of the specialised market and production site. It means if a specialised market is set up in Barmer or Jodhpur for Cumin, farmers would sell their produce for a better price. However, price factor did not appear significantin the specialised market for Cuminas compared to the price in the local market. It is because farmers mostly sell in the local market. The third significant variable for Cumin farmers is the lack of market infrastructure facilities which includes go downs, banking facility, auction agreements, internet facility etc which help the farmers to sell in the specialised market. The marginal effect of each variable on the decision of farmers to sell the produce in the specialised market is captured with Logit regression and presented in Table 1. It is found that marginal effect of market infrastructure and price effect on selling in the specialised markets are much higher. In the case of distance, if the distance between specialised markets and production site is reduced by one kilometre, it would increase the sale in the specialised markets by 0.08%.

Table 45presents the Logit regression results and the marginal effect of the variable for Coriander. In the case of Coriander, there is not much difference in distance

between specialised markets and production site and therefore the coefficient turned out to be positive for distance. However, market infrastructure is an important determinant influencing farmers' decision on sale in the specialised markets and the price difference between local and specialised markets have also come out significant for Coriander. The marginal price effect forCoriander shows that one unit change (Rs 1) in the price of Coriander in specialised market attracts 0.02% of more farmers to the market.

3.8. Concluding observations

Cumin and Coriander are two important seed spices produced and exported from India for a fairly long time. As the commercial cultivation of these crops is sensitive to agro-climatic conditions and their production are concentrated in a few geographical locations in India, add-on to the locational advantage of crops in the international market. The post harvesting process of agriculture produce is an extension of its mode of production and it involves different stages from harvesting to processing, packing for sale and its transportation to different destinations in the terminal markets. Cumin and Coriander are consumed directly on purchase and, therefore, sanitary and phytosanitaryconditions of WTO assume significance. Cumin is mostly grown under traditional method of farming as farmers use own farm collected seeds and follow unscientific cultural practicesleaving substantial bearing on cost of production, productivity and eventually on net returns from its cultivation. Coriander farmers, however, are relatively more exposed to modern method of cultivation. Yet the post harvesting process and marketing of both crops need improvement. Both Coriander and Cumin farmers do sun-drying of the crop in the farm yard exposingit to several unhygienic elements including animal wastes and in the international standards such unhygienic process lay serious barriers on market diversification. Despite being edible items, the hygiene conditions in the market yards need much improvement. Though much of the output is sold through the auctions, the present method of auction through an open outcry system leaves much scope for improvement. Here much could be learned from the e-auction in cardamom

As part of the outward-export led strategy for economic growth persuaded more vigorously under the new economic dispensation, regulated markets for agriculture produce have been established under the tutelage of the state sponsored marketing committees in major districts of agriculture prominence in India in the first half of 2000s. However, Cumin farmers have to cover a non-viable economic distance between 350-500 km to sell cumin in *Unja* Market in Ahmadabad (Gujarat) whereas the production of the crop take place mostly in arid districts of Rajasthan. It eventually leads the Cumin farmers with little alternative to sell in the local market to agents at a price of 20% to 30% less than in the specialised market. Conversely, Coriander farmers could sell their produce in the specialised markets without much transaction cost, but they suffer a different set of problems such as inadequate access to technical knowhow and advice from experts as well as severe shortage of market infrastructure facilities, high incidence of plant diseases and unscrupulous exploitation by private pesticide traders. As significant proportion of growers of both Cumin and Coriander reported that they were not even aware of Spices Board, leave alone its initiatives like the supply polythene sheets at a subside rate to the farmers. The econometric analysis revealed that market infrastructure, technical advice, distance from the specialised markets and price are important factors influencing the decision of farmers to sell 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 earning but also employment and income generation for the farmers. This however, calls for substantial improvement in the production conditions and post-harvest processes. In the light of the above, the study underline the importance of the Spices board joining hands with the state level agencies towards imparting training on various aspects of production and post harvest process and 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

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Appendix Tables

Appendix Table 1 Relative Share of Area under Cumin by Major Districts (%) - 2006-07 to 2015-16

Year	Barmer	Jaisalmer	Jalore	Jodhpur	Nagpur	Others	Rajasthan	CV
2006-07	31.08	4.93	24.93	15.42	8.29	15.34	149816	59.22
2007-08	31.59	2.99	28.50	14.65	6.35	15.91	215475	68.98
2008-09	34.41	4.47	26.96	18.22	6.32	9.61	169035	72.45
2009-10	33.54	5.07	29.41	18.01	7.87	6.11	203855	74.57
2010-11	31.70	4.88	26.88	17.59	10.07	8.88	330637	64.32
2011-12	28.32	5.06	23.87	18.82	11.89	12.04	467977	51.70
2012-13	27.76	6.01	24.78	21.43	9.35	10.67	494842	54.64
2013-14	27.52	6.40	19.91	27.28	9.96	8.94	488823	56.99
2014-15	24.04	7.21	16.21	31.13	11.91	9.50	434783	55.46
2015-16	25.83	7.63	18.73	28.92	9.71	9.17	511078	55.30
Compound growth	10.98	18.09	9.87		20.40		14.86	

Source: Spices Board

Appendix Table 2. Relative Share of Production under Cumin by Major Districts (%) -2006-07 to 2015-16

Year	Barmer	Jaisalmer	Jalore	Jodhpur	Nagpur	Others	Rajasthan	CV
2006-07	98.77	15.93	138.50	71.50	87.28	102.51	157.97	47.55
2007-08	82.95	51.96	118.20	128.74	104.11	82.19	307.97	29.57
2008-09	54.81	60.79	96.93	171.38	179.05	101.31	252.78	48.21
2009-10	55.84	86.18	135.32	131.80	113.27	73.02	395.04	32.81
2010-11	77.97	147.23	87.49	125.55	130.99	104.85	347.59	23.87
2011-12	67.57	98.37	98.77	122.17	138.00	107.24	379.89	22.75
2012-13	68.71	62.17	95.96	118.17	152.25	129.82	356.37	33.84
2013-14	77.72	73.63	87.53	129.38	130.91	91.12	478.33	25.83
2014-15	97.82	89.70	174.81	86.27	80.78	54.79	277.90	41.77
2015-16	61.37	116.30	90.97	124.13	159.44	74.64	392.99	34.45
Compound growth	15.92	57.81	15.40	39.36	33.63	13.96	23.84	

Source: Spices Board

Appendix Table 3. Productivity under Cumin by Major Districts from 2006-07 to 2015-16

Year	Barmer	Jaisalmer	Jalore	Jodhpur	Nagpur	Others	Rajasthan	CV
2006-07	156.03	25.16	218.78	112.94	137.88	161.92	157.97	47.55
2007-08	255.45	160.02	364.01	396.47	320.63	253.11	307.97	29.57
2008-09	138.55	153.65	245.01	433.21	452.60	256.09	252.78	48.21
2009-10	220.60	340.46	534.57	520.68	447.47	288.47	395.04	32.81
2010-11	271.02	511.75	304.10	436.39	455.30	364.44	347.59	23.87
2011-12	256.69	373.68	375.20	464.10	524.24	407.40	379.89	22.75
2012-13	244.86	221.55	341.98	421.13	542.57	462.65	356.37	33.84
2013-14	371.78	352.20	418.68	618.88	626.20	435.87	478.33	25.83
2014-15	271.85	249.28	485.81	239.76	224.49	152.25	277.90	41.77
2015-16	241.19	457.05	357.50	487.80	626.59	293.34	392.99	34.45
Compound growth	4.96	38.01	5.61	17.65	18.32	6.82	10.66	

Source: Spices Board

Appendix Table 4 Relative Share of Area under Coriander by Major Districts (%) -2006-07 to 2015-16

Year	Baran	Jhalawar	Kota	Other	Rajasthan	CV
2006-07	32.76	47	17	2.97	131137	76.74
2007-08	38.88	40	19	2.22	212961	72.50
2008-09	37.42	40	20	2.92	241968	68.73
2009-10	33.33	42	22	2.72	232270	68.15
2010-11	30.28	43	23	3.45	198052	66.62
2011-12	31.87	44	22	2.79	268028	69.49
2012-13	29.01	46	23	2.37	158152	71.45
2013-14	29.72	43	27	0.00	177367	72.08
2014-15	25.98	43	27	4.01	249465	63.77
2015-16	21.13	46	26	6.83	212725	65.19
Compound growth	0.45	4.73	9.42	14.06	4.96	

Source: Spices Board

Appendix Table 5: Relative Share of Production under Coriander by Major Districts (%) -2006-07 to 2015-16

Year	Baran	Jhalawar	Kota	Other	Rajasthan	CV
2006-07	35	44	18.11	3.10	155101	72.41
2007-08	49	23	25.47	2.45	166127	75.92
2008-09	40	34	23.04	2.85	273693	65.64
2009-10	36	38	24.00	2.12	281235	65.85
2010-11	39	32	26.16	2.70	219077	63.27
2011-12	35	37	25.29	2.40	329649	63.76
2012-13	35	36	26.95	1.92	186894	63.67
2013-14	27	45	28.58	0.00	113210	74.07
2014-15	31	46	21.13	2.03	198887	73.97
2015-16	28	39	25.63	6.90	227203	53.97
Compound growth	1.65	2.78	7.56	12.56	3.89	

Source: Spices Board

Appendix Table 6: Productivity under Coriander by Major Districts from 2006-07 to 2015-16 (KG/hectare)

Year	**Baran**	**Jhalawar**	**Kota**	**Other**	**Rajasthan**	**CV**
2006-07	1258	1100	1259	1232	1183	6
2007-08	980	450	1067	859	780	33
2008-09	1222	958	1309	1106	1131	13
2009-10	1295	1098	1334	944	1211	16
2010-11	1437	812	1261	866	1106	28
2011-12	1350	1048	1444	1058	1230	16
2012-13	1440	927	1385	955	1182	23
2013-14	574	665	667	0	638	67
2014-15	938	862	618	403	797	35
2015-16	1416	911	1061	1079	1068	19
Compound growth	1.19	-1.86	-1.70	-1.32	-1.01	

Source: Spices Board

Appendix Table 7. Frequency for Change in Area of Cumin and Coriander 2016-17 and 2017-18

District Name	Crop	No. of Farmer Changed Area		Total
		Yes	No	
Barmer	Cumin	44	26	70
Jodhpur	Cumin	87	39	87
Total	**Cumin**	**131**	**65**	**196**
Baran	Coriander	176	27	203

Source: Primary Survey