

# RAJASTHAN AGRICULTURAL COMPETITIVENESS PROJECT



## Value Chain Analysis

### Coriander



Prepared by:



**AGRI BUSINESS PROMOTION FACILITY**

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## Executive Summary: Coriander

Coriander is an important spice crop with a critical role in flavouring food. It is a tropical crop and is typically cultivated as a Rabi season crop in severe frost free areas during the flowering stage. Notably, all parts of the plant are edible, but the fresh leaves and the dried seeds are the parts traditionally used in cooking. Some of the different types of coriander are coriander foliage, coriander flower and coriander fruits. Coriander leaves are particularly rich in vitamin A, vitamin C and vitamin K, with moderate content of dietary minerals. Although seeds generally have lower content of vitamins, they do provide significant amounts of dietary fibre, calcium, selenium, iron, magnesium and manganese.

Basically coriander plant productivity is about one and three-fourth tonnes per acre of seed. The root is powdered and used as a condiment. An essential oil from the seed is used as a food flavouring agent. As a matter of fact, this blend is used in daily cooking in Indian kitchens. The fruit of the coriander plant contains two seeds which, when dried, are the portions used as the dried spice. Coriander seeds are available as whole or in ground/powder form.

The major global leaders in production producers of coriander are India, Morocco, Canada, Romania, Russia and Ukraine. Coriander has been cultivated for seed purpose in India and many other countries. India, Turkey, Egypt, Romania, Morocco, Iran and China are the major exporters of coriander and Middle East, South-east Asia, USA, UK and Germany are the leading importers.

India, being the largest producer, is the largest consumer and exporter of coriander in the world. The country accounts for approximately 80 percent of the total world Coriander production. Malaysia and Pakistan are major importers of coriander from India Coriander is cultivated across India though production is concentrated in Rajasthan, Madhya Pradesh, Assam, Gujarat and Andhra Pradesh. Notably coriander production is mostly concentrated in north-central India and Assam. The Largest producer of coriander seed in the country is Rajasthan accounting for about 58% followed by MP with about 15%, Assam and Gujarat with 8% each of total domestic coriander seed production. India is the largest producer and consumer of coriander seed.

Unfortunately, both area and production has declined during recent years due to weather concerns in Rajasthan. The major buyers of coriander seeds from Rajasthan are spice powder-making industries located in the Southern states like Tamil Nadu, Andhra Pradesh and around Delhi. The highest area for coriander production was reported in district Jhalawar (42%) followed by Baran (35%) and Kota (20%). The improved varieties of coriander being used for cultivation in Rajasthan are CO1, CO2 and Gujarat.

The farmers in the Hadauti region store around 60% of their produce harvested for the period of 3 months to 2 years in order to sell when prices are up-beat offered. Timely harvesting is necessary to avoid losses by shredding of seeds when the over dried crop gets ready for harvest in 110 to 125 days after sowing. It is harvested when 50% of seeds of coriander turn yellow. Coriander should be stored at less than 10 percent moisture with green material removed as soon as possible. The seed "cures" in early storage, and aeration assists this process. Therefore, aeration is strongly recommended even if the seed is harvested dry. Coriander seed must cure during storage. Natural air drying or aeration is beneficial for curing.

The gross yield of coriander seeds is about 1.25 MT per ha. The market rate of the seeds is about Rs. 50,000 per MT or Rs. 50 per kg or Rs. 43,750 per ha. The cost of cultivation is about Rs. 43,750 per ha. Net realization (from sales of grains) per ha is about Rs. 27,550 per ha. Farmers in the district also grade seeds at home and the lower grade is sold at about Rs. 2,500 per quintal. The wastage during the threshing process (which is around 5% of the total yield) is used as cattle feed. If the yield loss of about 5% is considered then the net realization per acre comes to about Rs 24,375 per ha.

Peak crop arrivals are seen during March-May with monthly arrivals exceeding 150,000 quintals at the mandi. The lowest arrivals are seen in August and September, with monthly arrivals below 6,000 quintals.

Notably, the crop in year 2014-15 was highly profitable year for Coriander traders as prices spiralled upwards from Rs. 6,000 per quintal in March 2015 and hit a high of Rs. 12,700 in May 2015. In a span of three months, people have seen Coriander prices double.

Coriander prices also witnessed a correction with the onset of sowing season in October 2015. Prices fell from Rs. 12,000 per quintal in October 2015 and hit a low of Rs. 6,400 per quintal in January 2016. Higher acreage and favourable weather conditions in the key growing regions of Rajasthan and Madhya Pradesh kept prices under pressure throughout the sowing season.

A range of support institutions exist in the region. These include a range of farmer's level advisory service and service providers which supports the farmers by way of the information dissemination of market intelligence and agricultural extension services. Some important support institutions for coriander in Rajasthan are the Department of Agriculture, Govt. of Rajasthan who provides extensive support through their team of State/District/Tehsil and Panchayat level officials on; recommended package of practices for the crop, mini kits for crop demonstration and subsidy support on certified seed distribution to farmers. Other support structures of the Department of Agriculture are the Rajasthan State Seed and Organic Production Certification Agency, The Rajasthan State Seeds Corporation Ltd, the State Institute of Agriculture Management, Rajasthan State Warehousing Corporation, and Rajasthan State Agriculture Marketing Board who contribute to the productivity, storage and market linkage of the crop. Apart from this, there are various Krishi Vigyan Kendras around Kota attached through State Agriculture Universities/ ICAR also contribute in terms of seed production, technology demonstration and post-harvest management of the crop. RARI, Durgapura has also played a significant role in production of improved varieties of Coriander contributing to both production and productivity in the State. Also, Indian Spice Board has established Spice Parks at Jodhpur and Kota for supporting the storage and

processing of coriander seeds. There is also support of the National Agriculture Research System and NRC spices located at Ajmer for advances in Coriander production technology.

The price spread along with the share of stakeholders in consumer's rupee spent at every stage of the value chain starting from the farm till the retailer is detailed out in the report. The price spread and values accrued to stakeholders across the chain reflects the profit margins accrued to different stakeholders. Farmer shares 62% of the consumer's rupee while the shares of traders, processors, wholesalers and retailers are 2%, 10%, 6% and 20% respectively. 36% of the value accruals are accrued to processors and retailers. Producers' incomes are apparently dependent on yield as well as their dependency on the type of end product. (eg. spices, puree, paste, oil etc.). Here in the existing value chain of coriander, the price build up has been calculated for the important first channel where the target consumers are urban households and institutional buyers like hotels, canteens. The product considered is coriander powder.

Typically farmers sell the raw coriander at about Rs. 5,000 per quintal to traders with respect to past season of coriander. In the local mandis, it was sold by traders to the processors at Rs. 5,150 per quintal (gross margin 3%). The processors, upon primary and secondary value addition, sell it to wholesalers at Rs. 5,923 (gross margin 15%). Thereafter the wholesale and retail prices are set up at Rs. 6,456 per quintal and Rs. 8,069 per quintal with a gross margin of 9% and 25% respectively. Due to limited infrastructure facilities at the dispersal of various stakeholders, marketing efficiency is adversely affected.

The existence of a long chain of middle men including the APMC and related commission agents, producers share in consumers' rupee is adversely affected. This mirrors the need for promotion of contract farming options as an alternate channel to APMC. However, the limitations in the contract farming policy & statutes merit correction. Rajasthan's population in rural and semi urban areas prefer freshly grinded coriander powder. In urban areas branded coriander powder is more preferred. Major brands in the market are namely MDH, Catch, and Everest etc. Best quality coriander whole seeds (double parrot, single parrot, scooter variety, eagle variety) have great demand for export to the US, Europe and Gulf countries.

A SWOT analysis of the coriander value chain highlights that the largest producer of coriander seed in the country is Rajasthan with Kota and Ramganj being the biggest mandis. Coriander has several other therapeutic uses. It is also used to treat measles, haemorrhoids, toothaches, worms, and joint pain, as well as infections caused by bacteria and fungus. Coriander powder is a major ingredient in several blends like Hot masala, curry powders, etc. Dehydrated coriander leaves and its powder has become a mainstay ingredient for several ready to cook curries, instant noodles, etc. But when it comes to its disposition in the target clusters of RACP, one finds that there is lack of knowledge of coriander production technologies among the local farmers. They also face the non-availability of improved & good quality seed. There is lack of grading and storage facilities. There is inadequate infrastructure/ facilities with producers, traders, millers and at market level resulting in marketing inefficiencies. The large number of intermediaries in the chain leads to low income to producer which eats into the margins of farmers. Obsolete techniques are being used in processing, which reduces output. Under-ripe coriander seeds have an unpleasant flavor and over-ripe seeds tend to shatter which reduces the yield. Fluctuations in

supply (based on production), coupled with export-import dynamics, make prices of coriander unstable which obviously affects producers and consumers both.

These weakness can be removed with the intervention opportunities such as setting up a FPC in the cluster which would then have a scope for tie up of FPCs through FCSC with firms like Patanjali, MDH, Catch, coriander processing units/ MSME firms, housing societies in urban areas and retail outlets. There is also scope for facilitation of start-ups from amongst FPOs or individual entrepreneurs, in secondary processing of value added products of Coriander like powder, blends, roasted coriander, etc. There is also scope for establishment of quality sorting and grading facilities as part of FCSC, along with facilities for packaging and vehicle to facilitate transportation. The FPC can then promote good agricultural practices with regard to planting, harvesting, use of inputs, disease management, pest control, etc. through FCSC. FPCs can also undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of CFC or FCSC as well as facilitate custom hiring services and hence lead farm mechanization through CFC.

### **Pre and Proposed Post-Intervention Value Chain of Coriander**

The pre and post intervention value chain for the commodity may be viewed as follows:

- **Existing Pre Intervention Value Chain: Coriander**

The present pre-intervention or value chain for Coriander may be viewed as one with two critical production-distribution or activity-marketing channels. The product is largely marketed by farmers through the APMC, local vendors and private food processors. Channel 1 may be viewed in terms of one for table variety and the other for processed products of coriander like powder, paste, oil and puree which are consumed by urban households and institutional buyers like hotels and canteens, etc. Channel 2 is actually derived from the mandi itself where the raw coriander seeds are bought by the food processors which not only cater the local national market but also target the export to the countries like US, UAE, etc.

Yield loss occurs at every stage of the existing value chain of coriander starting from post-harvest to mandi sales and processing. Such yield loss total up to a significant amount of 12-18% of the actual harvested output. The major reasons for such yield loss could be attributed to the poor storage, inefficient transportation and improper handling of the produce till mandi. At processor level, higher percentage of the yield loss occurs due to the use of obsolete technologies which end up giving lower yield.

- **Proposed Post Intervention Value Chain: Coriander**

In the envisaged post-intervention value chain of Coriander, FPCs/farmer associations could bypass the APMC and commission agents and undertake the value chain activities like aggregation and operate common facilities (FCSCs) undertaking drying, storage, packaging and transportation. Upon these primary processing and storage activities, the commodity may be supplied to SME as well as large processors like MDH, Patanjali and Everest.

The post intervention value chain map for Coriander may be visualised as one with three production-distribution or activity-marketing channels: raw coriander leaves, coriander seeds and value added products like Coriander powder, paste, oil and puree. It is also envisaged that PCs of producers with FCSCs is evolved. Such FCSCs undertakes storage, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring, facilitating B2B connectivity etc. These could help

in increasing net value accruals to farmers by 15-30%. Farmers' income from Coriander cultivation may be enhanced. Presently, the gross average yield per acre is 5-6 quintals per acre. The average market rate of sale is about Rs.3500 per quintal or Rs. 17,500 per acre (Along with sales of coriander leaves, the gross realization is about Rs. 41,500 per acre). The average cost of cultivation is about Rs. 14,000 per acre. Other than good harvest practices, input facilitation (high seed prices during cropping season) needs to be provided/disseminated amongst farmers.

In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of producer motivation. There is also need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors. There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field-level. In this regard, it may be appropriate for ABPF to enable formation of FPCs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC like schemes may be explored. The RACP and line departments need also work in coordination with NGO/service providers and the KVK etc. on high moisture content in harvested coriander, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage and drying at farm level. The storage facility may be also therefore established as part of FCSC with assistance under the project. There is also need for awareness seminars and B2B meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri- marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

By way of conclusion, this report on the value chain of coriander clearly brings out that unlike any other enterprise, agriculture is highly dependent on external factors like nature and particularly climate for its success. This perpetual environment of high risk and vulnerability has significantly lowered farmers' confidence and suppressed their entrepreneurial instincts as was reflected in the discussions held at the cluster level meetings. In the Coriander value chain, despite increasing input costs, all active players such as suppliers, transporters, processors, traders and corporates but for producer farmers have benefitted. Thus RACP along with the market driven interventions of ABPF, aims to aggregate farmers and help join hands for a collective cause, help and even push them move up the agriculture value chains as to actively participate in market functions. This would spur vertical business integration and diversify their market channel mix to reduce their vulnerabilities.

In this regard, an important role of ABPF- GT would be to carry out capacity building initiatives of the potential leaders (BoDs) of the FPC, NGO staff and PMU staff line, conduct value chain studies of crops (market led), plan interventions required to improve returns to farmers in the 17 project clusters, help develop the business plans for the registered producer companies of clusters, support and assist agri start-ups in the region and thus, develop alternate and direct market linkages. The formation of FPC, supported by RACP ABPF, local NGOs and facilitation centres like KVKs, provides the much needed opportunity to farmers to positively re-orient their destiny.

# Chapter 1- Introduction

Coriander, Coriandrum sativum, is an erect annual herb in the family Apiaceae. The leaves of the plant are variable in shape, broadly lobed at the base of the plant, and slender and feathery higher on the flowering stems. It is a soft, hairless plant. The plant produces an oval shaped fruit which is yellow-brown in colour and contains two seeds. Coriander is an annual plant, surviving only one growing season and reaches up to 50 cm (19.7 in). Coriander may also be referred to as cilantro, Chinese parsley or dhanian and originates from the Near East. All parts of the plant are edible, but the fresh leaves and the dried seeds are the parts most traditionally used in cooking. Some of the different types of coriander are coriander foliage, coriander flower and coriander fruits.

## **Origin of Coriander**

Fifteen desiccated mericarps were found in the Pre-Pottery Neolithic B level of the Nahal Hemar Cave in Israel, which may be the oldest archaeological find of coriander. Coriander seems to have been cultivated in Greece in the second millennium BC. Late Bronze Age invaders introduced coriander into Britain. The invaders used coriander to flavour their coriander gruel. Coriander was brought to the British colonies in North America in 1670, and was one of the first spices cultivated by early settlers.

## **Nutritional Value**

The nutritional profile of coriander seeds is different from the fresh stems or leaves. Coriander leaves are particularly rich in vitamin A, vitamin C and vitamin K, with moderate content of dietary minerals. Although seeds generally have lower content of vitamins, they do provide significant amounts of dietary fibre, calcium, selenium, iron, magnesium and manganese. Its uses in global food preparation are only the tip of the iceberg. It has eleven components of essential oils, six types of acids (including ascorbic acid, better known as vitamin C), minerals and vitamins, each having a number of beneficial properties.

## **Economic Aspect**

The root of coriander is powdered and used as a condiment. An essential oil from the seed is used as a food flavouring agent. As a matter of fact, is used in daily cooking in Indian kitchens. The fruit of the coriander plant contains two seeds which, when dried, are the portions used as the dried spice. When ripe, the seeds are yellowish-brown in colour with longitudinal ridges. Coriander seeds are available as whole or in ground/ powder form.

### **1.1. Global Scenario**

#### **Coriander Producing Countries**

The major global producers of coriander are India, Morocco, Canada, Romania, Russia and Ukraine. The other producers are Iran, Turkey, Israel, Egypt, China, US, Argentina and Mexico. Coriander is known to have been cultivated for seed purpose in India, Morocco,

Canada, Romania, Russia, Ukraine, Turkey, Egypt, China, US, Argentina and Mexico.<sup>1</sup> India, Turkey, Egypt, Romania, Morocco, Iran and China are the major exporters of coriander and Middle East, South-east Asia, USA, UK and Germany are the major importers.<sup>2</sup>

Coriander is an indispensable spice in Indian and other Cuisines. It is believed to be a native of Southern Europe. Although it is now widely cultivated all over the world for its green leaves, seed production is largely concentrated in India. Coriander is commonly known as “Dhaniya” in India. In India Rajasthan is a major producer of coriander. Coriander is known by different names in the international level. Details of some names in different languages are given in the table below:

**Table 1: Different Names of Coriander in other languages**

Country/Language	Local Name
Spanish	Cilantro
French	Corriander
German	Koriander
Swedish	Koriander
Arabic	Kuzhbare
Dutch	Koriander
Portuguese	Coentro
Russian	Koriandr
Japanese	Koendoro
Chinese	Hu-sui

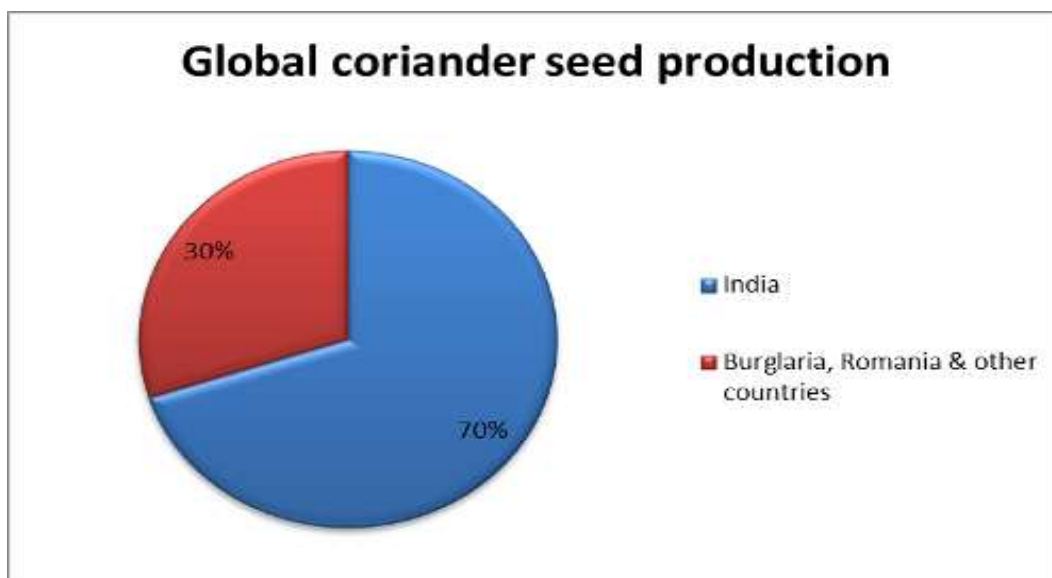
In terms of global coriander seed production, it is observed that India leads the global scenario by producing almost one-third of the total world production. The other major countries include Bulgaria, Romania, Egypt, Morocco and many others.

<sup>1</sup> <http://www.commoditiescontrol.com/eagrtrader/staticpages/index.php?id=132>(retrieved 5th April 2017)

<sup>2</sup> [http://www.incubatorscommodities.com/project\\_asset/product\\_pdf/corianderprdnote.pdf](http://www.incubatorscommodities.com/project_asset/product_pdf/corianderprdnote.pdf)(retrieved 5th April 2017)

The following figure illustrates the world coriander seed production:

**Figure 1: Global Coriander Seed Production in 2015-16**



(Source: <http://www.srkspices.com/our-products/coriander-seed/> (retrieved 5th april 2017))

### Export Scenario of Coriander

India is the major exporter, producer and consumer of Coriander in the world. The export data also backs the fact that India, being the world largest producer of coriander, dominates the world market; with major exports to Malaysia, Pakistan, UAE, Saudi Arabia, US, Yemen and other Asian countries.<sup>3</sup>

India is a significant producer of coriander, but early in the sixties almost all production was meant only for domestic consumption. Later, India started export of coriander seeds and exported about 21000 metric tons of coriander seeds all over the world. Pakistan too produces coriander seeds to meet its domestic demand and also sometimes imports from India to meet its deficit. Production in Eastern Europe is also known to be substantial, but very little information is available. The maturity cycle of seed is approximately 100 days. The smaller-seeded coriander requires a longer growing period of approximately 120 days. Producers pursuing coriander cultivation should ideally investigate prevailing pricing of the crop as prices can vary. Due to global competition, the Canadian advantage seems to be in producing a product with high quality and consistent seed size to compete in export markets.<sup>4</sup>

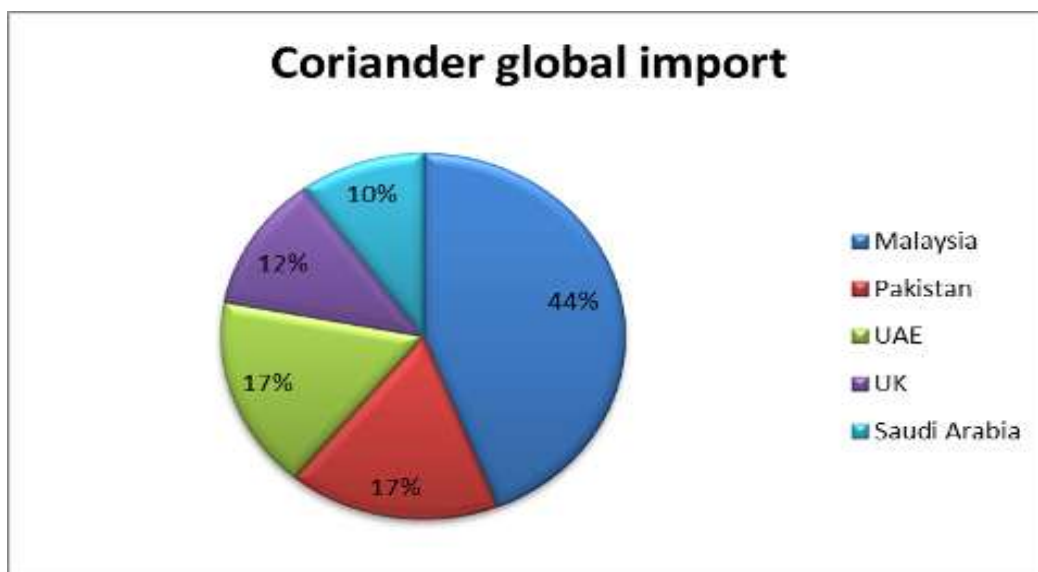
### Import Scenario of Coriander

In 2014-15, Malaysia was the top importer of Coriander from India followed by Pakistan and Saudi Arab. Malaysia's imports in 2014-15 were recorded at 10,378 tons which was lower as compared to 11,152 tons recorded in 2013-14. Coriander exports to Pakistan have witnessed a significant rise from 2,573 tons in 2013-14 to 4069 tons in 2014-15. Exports to UAE and Saudi Arabia were recorded at 3,940 tons and 2,264 tons respectively. However, in 2015-16 exports from India lost momentum due to crop failure. In 2015-16, 22,650 tons of coriander was exported between April-September.

<sup>3</sup> <http://www.srkspices.com/our-products/coriander-seed/> (retrieved 5th april 2017)

<sup>4</sup> <https://www.scribd.com/document/171112902/Present-and-Future-Prospectus-for-Coriander-Seed-Production-in-South-east-Rajasthan-pdf> (retrieved 5th april 2017)

Figure 2: Global Import Scenario of Coriander in 2015-16



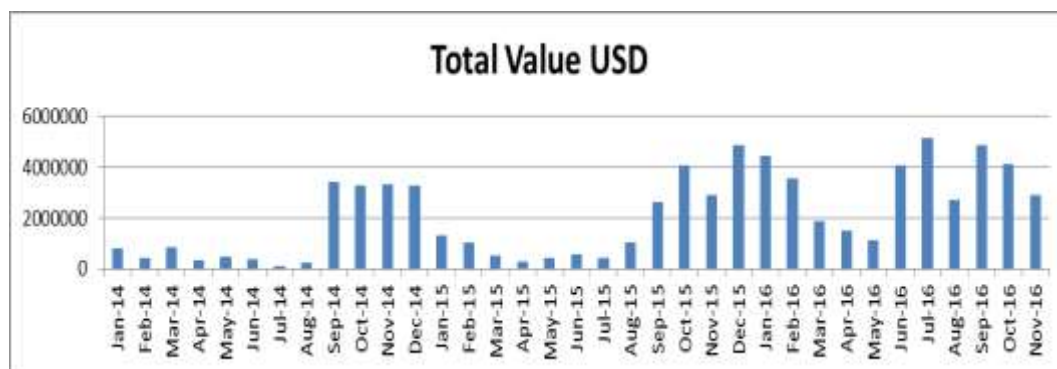
Source:

[http://www.nirmalbang.com/Upload/Coriander\\_Crop\\_Survey\\_and\\_Analysis\\_2016.pdf](http://www.nirmalbang.com/Upload/Coriander_Crop_Survey_and_Analysis_2016.pdf) (retrieved on 5<sup>th</sup> Apr, 2017)

The United States is the primary export market for Canadian coriander seed where the Canadian market share has gone from 0.001 per cent in 1986 to approximately 65 per cent of all coriander imports in recent years. Secondary export markets include Sri Lanka, Trinidad and Tobago, the United Kingdom, Mexico and Guatemala.

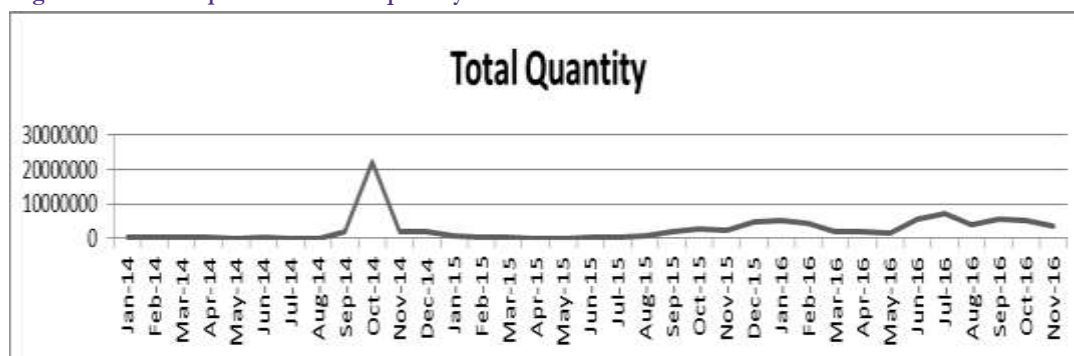
As per statistics from January 2014 to November 2016, the total value of global coriander imports has been calculated to be USD 7, 34, 93, 849. The market has seen huge changes with respect to the value of coriander imported globally. During the year 2016, the prices have more or less remained at high levels as compared to the previous years except for a certain period during mid-2016. The following figure shows the total values (in USD) of global coriander imports month wise for the period January 2014 to November 2016:

Figure 3: Global Imports in terms of value of coriander from India



The total quantity of global coriander imports for the period January 2014 to November 2016 amounts to 89992366 MT. The years have more or less seen stable imports of quantity with a range of 0-3000000 MT. However, during October 2014, there was a sharp increase as the quantity jumped to 22021934 MT. Compared to the previous years, the year 2016 has seen the increase in quantity of global coriander imports. The details of global imports of coriander in terms of quantity for the period January 2014 to November 2016 have been given in the figure below:

Figure 4: Global imports in terms of quantity of coriander from India



(Source: <https://www.zauba.com/importanalysis-coriander-report.html> (retrieved on 14th April 2017))

The average price per unit of global coriander imports during the period January 2014 to November 2016 was USD 1.66. Initially, in the years 2014-15, global coriander import average prices were high with highest being in May 2015 of USD 5.2. But since 2016, coriander prices fell down and have been in the range of USD 0.8-1. The monthly average prices of global coriander imports have been given in the figure below:

Figure 5: Global Import average prices of coriander from India



(Source: <https://www.zauba.com/importanalysis-coriander-report.html> (retrieved on 14th April 2017))

### Worldwide consumption of coriander, its varieties and their analysis

Buyers look for minimal stem and chaff content, uniform light brown colour and a mildly sweet and spicy flavour and aroma. Canadian coriander appears to have a distinct flavour profile that buyers like. In Canada, approximately 23,000 ac (9,300 ha) was deployed towards coriander production, with close to 9,000 tonnes produced.

### Coriander Seed

The total quantity of global coriander seeds imports for the period January 2014 to November 2016 amounts to 84932651 MT. The years have more or less seen stable imports of quantity with a range of 0-3000000 MT. However, during October 2014, there was a sharp increase as the quantity jumped to 21853979 MT. Compared to the previous years, the year 2016 has seen the increase in quantity of global coriander seed imports. The details of global imports of coriander seeds in terms of quantity for the period January 2014 to November 2016 have been given in the figure below:

The average price per unit of global goat imports during the period January 2014 to November 2016 was USD 1.5. Initially, in the years 2014-15, global coriander import average prices were high with highest being in May 2015 of USD 5.67. But since 2016, coriander prices fell down and have been in the range of USD 0.8-1. The monthly average prices of global goat imports have been given in the figure below:

Figure 6: Global Imports of Coriander Seeds in terms of Value of Imports from India



(Source: <https://www.zauba.com/importanalysis-coriander+seed-report.html> (retrieved on 14<sup>th</sup> April 2017))

### Coriander Powder

As per statistics from August 2014 to October 2016, the total value of global coriander powder imports has been calculated to be 117604 MT. The coriander powder market has seen huge changes with respect to the value of coriander powder imported globally. The value has frequently fluctuated up and down during several months as can be seen in the figure. The highest value was recorded in January 2015 a value of 33438 MT. The following figure shows the total values (in USD) of global coriander powder imports month wise for the period August 2014 to October 2016:

Figure 7: Global coriander powder imports in terms of value of imports



Source: <https://www.zauba.com/importanalysis-coriander+powder-report.html> (retrieved on 14<sup>th</sup> April 2017)

The total quantity of global coriander powder imports for the period August 2014 to October 2016 amounts to 99275 MT. The quantity of global imports has seen several shifts as can be observed in the figure below. The highest quantity of import was in November 2014 a value of 24105 MT. The details of global imports of coriander powder in terms of quantity for the period October 2014 to August 2016 have been given in the figure below:

The average price per unit of global coriander powder imports during the period August 2014 to October 2016 was USD 12.9. The average prices have more or less remained in the lower range of USD 1-3. But in April 2016, the average prices went rocketing to USD 124.8. The monthly average prices of global coriander imports have been given in the figure below:

Figure 8: Global imports of coriander powder in terms of quantity



Figure 9: Global Import Average Prices for coriander powder



(Source: <https://www.zauba.com/importanalysis-coriander+powder-report.html>(retrieved on 14<sup>th</sup> April 2017))

### Coriander Seed

As per statistics from January 2014 to November 2016, the total value of global coriander seed exports has been calculated to be USD 64742197. It has been observed that global prices trend goat export has not improved much as there are no significant increases in value of global goat exports over the past few months. Instead, the year 2014-15 proved to be good in terms of value of global coriander seed exports. During the year 2016, the prices have more or less remained at low levels as compared to the previous years. The following figure shows the total values (in USD) of global coriander seed exports month wise for the period January 2014 to November 2016:

Figure 10: Global exports of coriander seeds in terms of value



(Source: <https://www.zauba.com/exportanalysis-coriander+seed-report.html> (retrieved on 14<sup>th</sup> April 2017))

The total quantity of global coriander seed exports for the period January 2014 to November 2016 amounts to 46209163 MT. The quantity has more or less remained stable with a few ups and down in between. The year 2016 has instead seen a decline. The details of global exports of coriander seed in terms of quantity for the period January 2014 to November 2016 have been given in the figure below:

**Figure 11: Global exports of coriander seed from India in terms of Quantity**



The average price per unit of global coriander seed exports during the period January 2014 to November 2016 was USD 1.58. Average prices have more or less remained in the range of USD 1-2 throughout the years. December 2014 recorded the highest price of USD 2.02. The monthly average prices of global coriander seed exports have been given in the figure below:

**Figure 12: Global Average prices of export of Coriander seed**



(Source: <https://www.zauba.com/exportanalysis-coriander+seed-report.html> (retrieved on 14<sup>th</sup> April 2017))

### Coriander Powder

As per statistics from January 2014 to November 2016, the total value of global coriander powder exports has been calculated to be USD 35437175. It has been observed that global prices trend of coriander powder export has not improved much as there are no significant increases in value of global coriander powder exports over the past few months. Instead, the year 2014-15 proved to be good in terms of value of global coriander powder exports. During the year 2016, the prices have more or less remained at low levels as compared to the previous years. The following figure shows the total values (in USD) of global coriander powder exports month wise for the period January 2014 to November 2016:

Figure 13: Global exports of coriander powder in terms of value



(Source: <https://www.zauba.com/exportanalysis-coriander+powder-report.html> (retrieved on 14<sup>th</sup> April 2017))

The total quantity of global coriander powder exports for the period January 2014 to November 2016 amounts to 16856788 MT. The quantity has more or less remained stable with a few ups and down in between. The year 2016 has instead seen a decline. The details of global exports of coriander powder in terms of quantity for the period January 2014 to November 2016 have been given in the figure below:

Figure 22: Global exports quantity of coriander powder



(Source: <https://www.zauba.com/exportanalysis-coriander+powder-report.html> (retrieved on 14<sup>th</sup> April 2017))

The average price per unit of global coriander powder exports during the period January 2014 to November 2016 was USD 2.24. Average prices have more or less remained in the range of USD 1-2 throughout the years. January 2015 recorded the highest price of USD 3.21. The monthly average prices of global coriander powder exports have been given in the figure below:

Figure 14: Global average prices of coriander powder exports



(Source: <https://www.zauba.com/exportanalysis-coriander+powder-report.html> (retrieved on 14<sup>th</sup> April 2014))

## 1.2. Indian Scenario

### Production

Coriander is cultivated across the country though production is majorly concentrated in Rajasthan, Madhya Pradesh, Assam, Gujarat and Andhra Pradesh.

Coriander productivity has been severely affected by weather adversities during the last couple of years. People have witnessed a drastic fall in Coriander production in 2013-14 as excessive rainfall and cold weather during the growth stage drastically reduced Coriander productivity. In 2014-15, there was a similar trend as unseasonal rains during the harvesting stage across Rajasthan and Madhya Pradesh had damaged the crop severely.

Coriander production in 2014-15 was recorded at 4.62 lakh tons, while in 2012-13 production was 5.24 lakh tons from a similar acreage. The main reason for a drop in production was the unseasonal rains before and during the harvesting season that damaged the crop to a great extent.

Unseasonal rains had damaged the crop by approximately 30 percent, while 10 percent of the crop was damaged due to disease and pest. The crop in the year 2014-15 was met with an overall damage of 40 percent during the season.

Carry forward stocks were expected to be in the range of 56,000 tons to 58,000 tons in 2015-16 as compared to 88,000 tons in 2014-15. As of January 2016 Coriander stocks were reported at 16,000 tons in Kota as compared to 56,000 tons in 2015.<sup>5</sup>

The following figure shows the area and production data of coriander in India over the years. It is observed that the year 2013-14 showed a decline in both area and production whereas for the other years, production has been maintaining a stable trend.

**Table 2: Coriander Production in India from 2008-09 till 2015-16<sup>6</sup>**

Major States	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Rajasthan	280306	281076	218899	261248	290638	244184	281672
Madhya Pradesh	59075	70872	70872	66869	94099	62845	91196
Assam	39480	46865	21568	28567	28636	33771	27753
Gujarat	38420	42649	32634	32310	43329	35583	41992
Andhra Pradesh	15615	20605	13749	7427	18255	15637	17692
Orissa	9140	9440	11200	11100	14871	9319	14412
Uttar Pradesh	3417	3805	3444	4328	4573	3338	4432
Others	26062	26173	22294	16838	29600	23323	28687
<b>Total</b>	<b>471515</b>	<b>501485</b>	<b>394659</b>	<b>428687</b>	<b>524000</b>	<b>428000</b>	<b>507835</b>

Area '000 ha

Production '000 tonnes

The following table shows that Rajasthan is the Indian leader in the production of Coriander, followed by Madhya Pradesh and Gujarat. As per 2014-15 data, Rajasthan produced 198000 tons of coriander and placed itself at the top position in India with a share

<sup>5</sup> [http://www.nirmalbang.com/Upload/Coriander\\_Crop\\_Survey\\_and\\_Analysis\\_2016.pdf](http://www.nirmalbang.com/Upload/Coriander_Crop_Survey_and_Analysis_2016.pdf)

<sup>6</sup> <http://www.nbhcindia.com/docs/research-reports/Seasonal%20Commodity%20Insight%20-%20Dhaniya.pdf> Seasonal Commodity Insight of National Bulk Handling Corporation Pvt. Ltd. (retrieved on 20<sup>th</sup> Jun, 2017)

of 43%. The details of other coriander producing states with their respective production data has been given below:

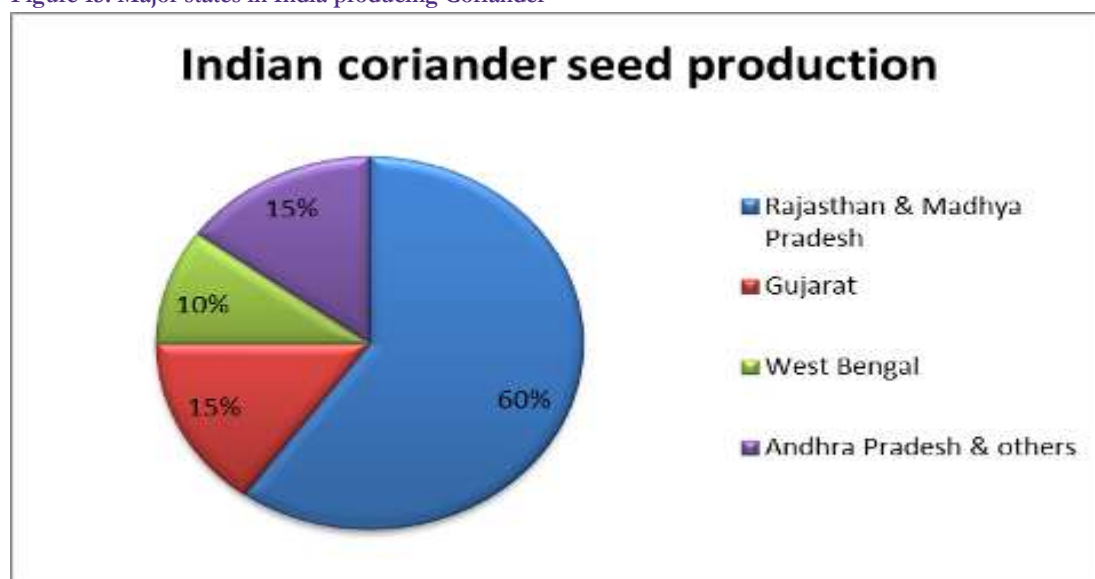
**Table 3: Indian Coriander production State wise Scenario**

Sr No.	State	Production (000 tons)	Share(%)
1	Rajasthan	198.76	43.05
2	Madhya Pradesh	94.91	20.56
3	Gujarat	64.38	13.94
4	Assam	53.96	11.69
5	Andhra Pradesh	20.78	4.5
6	Orissa	11	2.38
7	Haryana	4.41	0.96
8	Uttarakhand	3.8	0.82
9	Uttar Pradesh	3.33	0.72
10	Tamil Nadu	2.61	0.57
11	Bihar	1.7	0.37
12	Karnataka	0.82	0.18
13	Chhattisgarh	0.75	0.16
14	Telangana	0.38	0.08
15	Himachal Pradesh	0.05	0.01
16	Meghalaya	0.05	0.01
17	Mizoram	0.02	negligible
	<b>Total</b>	<b>461.71</b>	

Source: [http://agriexchange.apeda.gov.in/India%20Production/India\\_Productions.aspx?hscode=1102](http://agriexchange.apeda.gov.in/India%20Production/India_Productions.aspx?hscode=1102)

Coriander production is mostly concentrated in north-central India and Assam. Largest producer of coriander seed in the country is Rajasthan accounting for about 58% followed by MP with about 15%, Assam and Gujarat with 8% each of total coriander seed production in the country.<sup>7</sup> The following figure depicts the state wise scenario of production of coriander seed in India:

**Figure 15: Major states in India producing Coriander**



<sup>7</sup> <http://www.commoditiescontrol.com/eagritrader/staticpages/index.php?id=132> (retrieved on 5<sup>th</sup> April 2017)

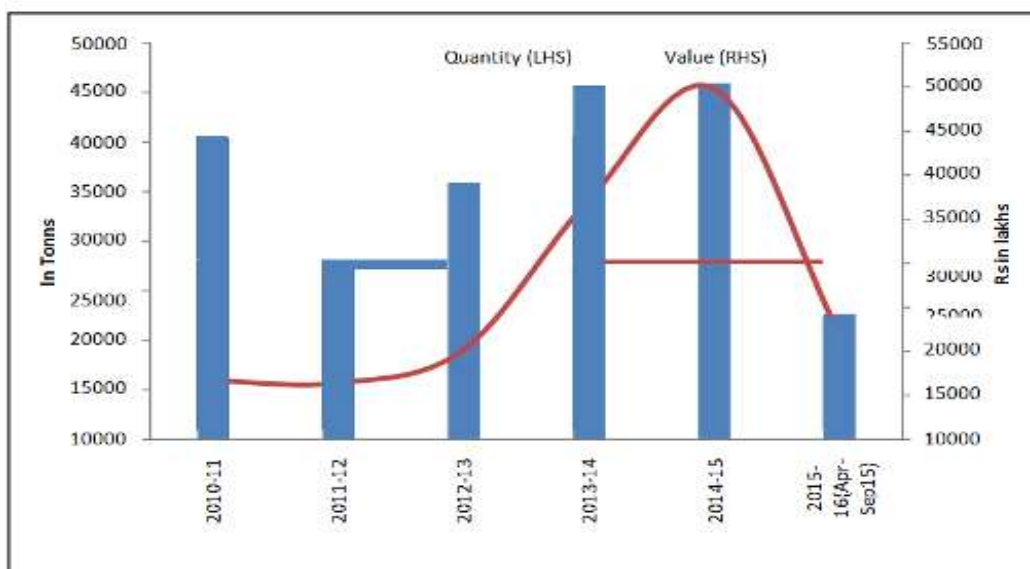
(Source: <http://www.zernoexport.com/en/catalog/specui/coriander> (retrieved on 5th April 2017))

Coriander production has increased significantly in the past decade and is currently hovering around 5 lakh ton. The rise in output was primarily on account of rise in yields.<sup>8</sup> The following table illustration shows the Indian coriander sowing and production scenario for 5 years and it can be observed that the production has not seen a high rise during the given years. Instead, it has remained stable and fluctuated near the same figure.

### Export from India

India is the largest producer, consumer and exporter of coriander in the world averaging 3 lakh tons per annum. It accounts for approximately 80 percent of the total world Coriander production. Coriander exports from India have been rising over last two years as supply from the top two competitors i.e. Bulgaria and Romania have dropped as unfavourable weather damaged most of the produce in these countries. India has taken advantage of the situation and ramped up its exports over the last couple of years.<sup>9</sup>

Figure 16: Coriander Export scenario of India from 2010-11 till 2015-16



(Source: Spice Board of India)

The production fluctuates widely between years in India and has varied from below 2 lakh tons to above 4 lakh ton in this decade. India annually exports around 25,000 - 30,000 ton of coriander a year. India exported 30,200 ton of coriander in 2008 valued at Rs. 204 crore in 2008. The major buyers were Malaysia (7050 ton), UAE (5450 tons), Pakistan (3215 tons) and Saudi Arabia (2475 tons). The major domestic buyers of coriander seed in India are spice processing agencies, which consume around 50% of the production and are mostly located in the southern states of India and near Delhi region.<sup>10</sup>

In the month of November 2016, India exported Coriander-Powder worth USD 1,103,877.95. Saudi Arabia is the largest importer of Coriander-Powder accounting for exports worth USD 285,887.85 followed by United Arab Emirates and United Kingdom

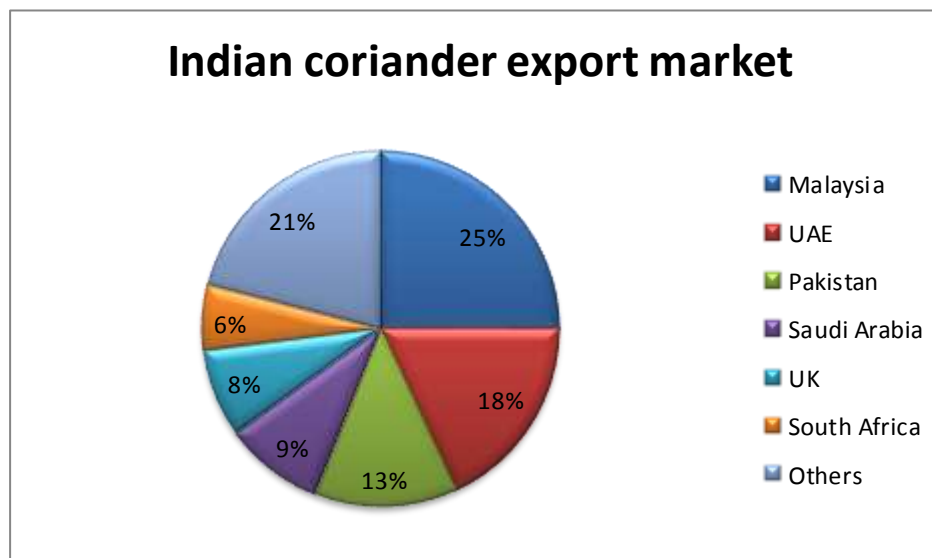
<sup>8</sup> <http://www.commoditiescontrol.com/eagrtrader/staticpages/index.php?id=132> (retrieved on 5th April 2017)

<sup>9</sup> [http://www.nirmalbang.com/Upload/Coriander\\_Crop\\_Survey\\_and\\_Analysis\\_2016.pdf](http://www.nirmalbang.com/Upload/Coriander_Crop_Survey_and_Analysis_2016.pdf) (retrieved on 5th April 2017)

<sup>10</sup> [http://www.incubatorscommodities.com/project\\_asset/product\\_pdf/corianderprnote.pdf](http://www.incubatorscommodities.com/project_asset/product_pdf/corianderprnote.pdf) (retrieved on 5th April 2017)

which imported Coriander-Powder worth USD 253,151.01 and USD 88,486.94 respectively in the year 2016.<sup>11</sup>

Figure 17: Indian Export Market for coriander



Source: <http://www.zernoexport.com/en/catalog/specui/coriander> (retrieved on 5th April 2017)

Malaysia and Pakistan are major importers of coriander from India. The following table depicts the values of the major importers of coriander from India. Over the years, the numbers are increasing and the quantity and values are seen to be increasing simultaneously.

Table 4: Export Scenario of coriander from India

Country	2011-12		2012-13		2013-14 (P)		2014-15(Est)	
	QTY	VALU E	QTY	VALU E	QTY	VALU E	QTY	VALU E
Malaysia	8856.1	5376.	9252.	5180.	11490.	10857.	11685	13440.
Pakistan	1618.7	765.4	1658.	713.6	2680.0	1821.9	4816.	4271.7
U.A.E	4451.2	2197.	5858.	2891.	4573.3	2911.5	4484.	3903.0
U.K	1907.4	1249.	2006	1264.	2458.8	2221.0	2875.	3220.8
South Africa	1536.7	910.3	2126.	1381.	2464.3	2174.1	2524.	2845.4
Saudi Arabia	2918.4	1653.	3041.	1771.	3174.3	2318.3	2625.	2409.0
U.S.A	556.8	435.9	1085.	1002.	1279.6	1443.2	1185.	1681.3
Sri Lanka	95.58	42.84	335.0	138.5	3524.7	2108.2	1213.	980.7
Singapore	894.7	517.0	822.4	490.4	951.7	862.13	773.6	866.2
Y.A.R	797.4	338.5	1028.	489.3	976.8	668.96	985.5	822.3
TOTAL(INCL.OTHE RS)	28100	16402	35902	20183	45750	37185.7	46000	49812.5

Source: DGCI& S., KOLKATA/EXPORTERS' RETURN/DLE FROM CUSTOMS; <http://indianspices.com/sites/default/files/Major%20Item-%20Country%20wise%20export%20of%20Spices%202016.pdf> (retrieved on 14<sup>th</sup> April 2017)

As per statistics from January 2014 to November 2016, the total value of global coriander exports has been calculated to be USD 162582789. It has been observed that global prices trend export has not improved much as there are no significant increases in value of global coriander exports over the past few months. Instead, the year 2014 proved to be good in

<sup>11</sup> <http://www.infodriveindia.com/india-export-data/coriander-powder-export-data.aspx> (retrieved on 5<sup>th</sup> April 2017)

terms of value of global exports. During the year 2016, the prices have more or less remained at normal levels as compared to the previous years. The following figure shows the total values (in USD) of global coriander exports month wise for the period January 2014 to November 2016:

Figure 18: Global Exports of coriander from India in terms of Value of Export



Source: <https://www.zauba.com/exportanalysis-coriander-report.html> (retrieved on 14th April 2017)

### Import of Coriander into India

The following table reveals the data of the Indian Import market of coriander wherein the quantity and value of the imported commodity has been shown. An increasing trend has been seen in the quantity of coriander imports into India.

Table 5: Import of coriander into India from 2011-12 till 2015-16 (Qty in tons and value in Rs lakhs)

2011-12		2012-13		2013-14(P)		2014-15(E)		2015-16(E)	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
3,775	2722.8	4,470	3526	4,640	5177	9,750	9631	25,305	17467

((E): Estimate (P): Provisional

Source: DLI FROM CUSTOMS / D G C I & S., CALCUTTA;

[http://www.indianspices.com/sites/default/files/MajorItemwiseImport2015\\_2.pdf](http://www.indianspices.com/sites/default/files/MajorItemwiseImport2015_2.pdf) (retrieved on 14th April 2017)

### 1.3. State Scenario

According to trade sources, both area and production has declined during recent years due to weather concerns in Rajasthan. The major buyers of coriander seeds from Rajasthan are spice powder-making industries located in the southern states like Tamil Nadu, Andhra Pradesh and around Delhi.<sup>12</sup>

In Rajasthan, Coriander sowing (in yr 2016) was done on 1, 68, 000 hectares as compared to 1, 83, 400 hectares as of 17<sup>th</sup> December 2015. In Kota 41,500 hectares had been reported as compared to 43,400 hectares, Jhalawar region sowing had been completed on 83,900 hectares as compared to 84,300 hectares; Baran sowing had been completed on 38,000 hectares as compared to 50,200 hectares and in Bundi sowing had been completed on 5,100 hectares as compared to 5,600 hectares. In 2014-15 total area under Coriander sowing was 2, 49, 310 hectares in Rajasthan, while in 2015-16 with the slow progress of sowing, a decline was expected in sowing to approximately 1,98,000 hectares.

<sup>12</sup> [http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports\\_20080820\\_02.pdf](http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports_20080820_02.pdf)

In Rajasthan, the district wise data for last five years from 2006-07 to 2010-11 are given in the table below. The highest area for coriander production was reported in district Jhalawar (42%) followed by Baran (35%) and Kota (20%). The productivity is highest in Kota (1067 kg/ha) followed by Baran (980 kg/ha) and Chittorgarh (913 kg/ha).<sup>13</sup>

**Table 6: District wise area and production of coriander in Rajasthan 2015-16**

Sr. No.	District	Coriander	
		Area	Production
1	Ajmer	151	161
2	Alwar	22	23
3	Banswara	0	0
4	Baran	44953	63645
5	Barmer	2	2
6	Bharatpur	10	11
7	Bhilwara	161	172
8	Bikaner	452	483
9	Bundi	4821	5195
10	Chittor	4771	5213
11	Churu	109	116
12	Dausa	0	0
13	Dholpur	8	9
14	Dungarpur	0	0
15	Gangangar	23	25
16	Hanumangarh	4	4
17	Jaipur	2	2
18	Jaisalmer	21	22
19	Jalore	7	7
20	Jhalawar	98356	89650
21	Jhunjhunu	0	0
22	Jodhpur	949	1014
23	Karuali	5	5
24	Kota	54890	58231
25	Nagaur	92	98
26	Pali	52	56
27	Pratapgarh	807	862
28	Rajsamand	17	18
29	S.Modhpur	1855	1981
30	Sikar	114	122
31	Sirohi	2	2
32	Tonk	58	62
33	Udaipur	11	12
Total		212725	227203

<sup>13</sup> <https://www.scribd.com/document/171112902/Present-and-Future-Prospectus-for-Coriander-Seed-Production-in-South-east-Rajasthan-pdf>

#### 1.4. Approach to Value Chain Analysis

In order to evaluate the value chain of Coriander, consultations were held with major stakeholders in the chain including farmers, Consumers, Processors, traders, supporting public and private service providers and institutions etc. in various parts of the state. Major Coriander producing clusters were considered for survey within Rajasthan.

Table 7: Surveyed major stakeholders for value chain analysis

Surveyed Markets for the Value Chain Analysis	
Within and Outside Rajasthan	<ol style="list-style-type: none"> <li>1. Farmers in Palayatha cluster</li> <li>2. Farmers in Sangod cluster</li> <li>3. Shyam Dhani Industries Pvt Ltd, Jaipur (Processor)</li> <li>4. MDH Masala, Nagaur (Processor)</li> <li>5. M/S Premchand, Kota (Processor)</li> <li>6. Sohan Agro Mills PVT. LTD, Kota (Processor)</li> <li>7. Manish Enterprises, Kota (Processor)</li> <li>8. Khnana Khazana Foods, Ajmer (Processor)</li> <li>9. Mr. Mukesh Agrawal, Nagaur (Processor)</li> <li>10. Azad Agro Enterprises, Kota (Trader)</li> <li>11. Bansilal Nagar, Palathya (Trader)</li> <li>12. Vinay Bansal, Anaj Mandi, Kota (Trader)</li> <li>13. Kamlesah Dhamani, Anaj Mandi, Kota (Trader)</li> <li>14. Mathuresh Trader, Ankit Mehta, Kota (Trader)</li> <li>15. DPM, Dep. of Agriculture, Palathya</li> <li>16. DC, Water recourses, Palathya</li> <li>17. PC, KVK, Baran</li> <li>18. SMS, KVK, Baran</li> <li>19. DD, Dep. of Agriculture, Baran</li> <li>20. ID, Dep. of Agriculture, Palathya</li> <li>21. T.L, NGO, Palathya</li> <li>22. CMS, NGO, Palathya</li> <li>23. PC, KVK, Baran</li> <li>24. Director, Agriculture University, Kota</li> <li>25. PD, ATMA, Kota</li> <li>26. T.L, NGO, Sangod</li> <li>27. SMS, NGO, Sangod</li> </ol>

#### 1.5. Resourcing mapping of value chain

Resource mapping of coriander value chain is done by identification cluster, major mandis, major markets, warehouses, etc. Following is the detail resource mapping of value chain:

Table 8: Resource mapping of value chain

Cluster	Major mandi/s around cluster	Distance from major cities nearby	Major Markets	Warehouses/ Cold store with Capacity in MT	No of FPCs targeted
Palayatha (Baran)	<ol style="list-style-type: none"> <li>a. Atru</li> <li>b. Baran</li> <li>c. Kawai Salpura</li> </ol>	60 Km 30 Km 80 Km	Baran (3), Jalore (1), Chittorgarh (2), Kota (2), Bundi, Neemuch/Guna (M.P.)	Baran (27520) Antah (9200) Atru (5400) Chhabra (11550) Siswali	2

Cluster	Major mandi/s around cluster	Distance from major cities nearby	Major Markets	Warehouses/ Cold store with Capacity in MT	No of FPCs targeted
				(6750)	
Sangod (Kota)	a. Kota b. Baran c. Sangod d. Khanpur	60 Km 40 Km 0 Km 35 Km	Ramganj Mandi- Kota		

### 1.6. Marketable surplus of coriander in Palayatha Cluster

Following is the marketable surplus of coriander in Palayatha cluster:

Table 9: Marketable surplus of coriander in Palayatha cluster

Cluster	Area under crop cultivation (in Ha)	Production (in MT)	Marketable surplus in MT (as % of total production; 95% for Coriander)	Market Value (in Rs Lakh)
Palayatha (Baran)	156	343	326	163

## Chapter 2- Pre Harvest Management

The coriander plant is a thin stemmed, small, bushy herb, 25 to 50 cm in height with many branches and umbels. Leaves are alternate, compound. The whole plant has a pleasant aroma. Inflorescence is a compound umbel comprises 5 smaller umbels. Fruit is globular, 3 to 4 mm diameter, when pressed break into two locules each having one seed. Fruit has delicate fragrance; seeds are pale white to light brown in colour

### 2.1. Major Commercial Varieties Grown in Rajasthan

The improved varieties of coriander being used for cultivation in Rajasthan are given below:

Table 10: Production Varieties of Coriander

Variety	Characteristics
RCr 435	Released by RAU, Jobner.,Plants are bushy, erect, bold seeds, medium sized, medium maturing variety, adapted for irrigated condition moderately resistant to root knot and powdery mildew.110-130 days .Yield 1000kg/ha
RCr 436	Released by RAU, Jobner, Plants semi dwarf, bushy type with quick early growth and bold seeds. Resistant to root rot and root knot nematodes most suitable for limited moisture condition and heavy soils of south Rajasthan.90-100 days,yield 1100 kg/ha
RCr 684	Released by GAU, Jagudan, A variety, resistant to stem gall and less susceptible the powdery mildew. Adapted to medium heavy textured soil and sandy loam soil under irrigation. Seeds of the variety are bold. Plants are tolerant and erect with higher number of seeds per umbel, medium maturity
Gujarat Corinader-1	Released by GAU, Jagudan. High yield, more number of branches, seeds bolder and greenish in colour. Duration 112 days. Yield 1100kg per ha.
Gujarat Coriander-2	Released by GAU, Jagudan. High yield, more branches, dense, foliage, umbels large size, grain purpose variety, bold seeds, no lodging. Duration 110-115 days. Yield 1500kg per ha.
Rajendra Swati	Released by RAU, Dholi. High yield potential, suitable for intercropping, fine seeded, rich in essential oil, resistant to stem gall disease. Duration 110 days. Yield 1200-1400kg per ha.
Rcr-41(karan)	Released by RAU, Jobner. High yield, tall erect, suitable for irrigated areas, resistant to stem gall. Duration 130-140 days. Yield 1200kg per ha.
Swati(CS-6)	Released by APAU, Guntur. High yield, semi erect, suitable for delayed sowing. Duration 80-90 days. Yield 885kg per ha.

Variety	Characteristics
Sadhana(C S-4)	Released by APAU, Guntur. High yield, suitable for rainfed areas, semi erect, resistant to aphid and mites. Duration 95-105 days. Yield 1000kg per ha.
UD-20	Recommended for Irrigated & rainfed , Duration 110-125 days ,Yield 1000-1200 kg per ha.
RCr-480	Recommended for timely sowing in irrigated area ,duration 115-118 days, yield 1800-2000 kg per ha.
Pant haritama	Dual purpose variety useful for seed and green leaf , resistant to stem gal ,yield 1500-1800 kg per ha.

(Source:<https://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Coriander.htm> (retrieved on 6th April 2017))

## 2.2. New initiatives and Practices

Indian Institute of Spices Research initiated a research project in 2015 wherein the following

- have been developed with regards to Coriander:
- Package of practices for different agro-ecological situation developed
- Location specific agro techniques developed/standardized in different spices
- Management packages for major diseases evolved and popularised
- Management packages for major insect-pests evolved and popularised
- Multiplied and distributed seed/planting material for HYV in spices.<sup>14</sup>

Table 11: Improved Varieties of Coriander

Sl. No.	Variety	*Av. yield (kg/ha)	Essential oil %	Duration (days)	Salient features
1	Guj. Cor.1	1100	0.35	112	Suitable for early sowing, erect plant, round bold grains, moderately tolerant to wilt and powdery mildew
2	Co.1	440	0.27	110	A variety with small statured plant, suitable for rainfed areas and for greens and grains, small grain
3	Co.2	520	0.40	90-100	A dual purpose variety, suitable for saline, and alkaline and drought prone areas seeds oblong, medium.
4	Co.3	650	0.38-0.41	85-95	A dual purpose variety, good yielder, medium sized grains, suitable for both rainfed and irrigated condition, <i>rabi</i> as well as <i>kharif</i> season. Field tolerant to powdery mildew, wilt and grain mould.
5	Co(CR).4	600	0.4	65-70	Early maturing variety suitable for both rainfed and irrigated condition; grains oblong and medium; field tolerant to wilt and grain mould
6	Guj.Cor.2	1450	0.40		Semi spreading type, suitable for early sowing, moderately tolerant to powdery mildew, grains oblong, lodging and

<sup>14</sup> <http://www.aicrps.res.in/index.php/download-it/varieties-released>

Sl. No.	Variety	*Av. yield (kg/ha)	Essential oil %	Duration (days)	Salient features
					shattering resistant.
7	Rajendra Swathi	1300	0.65		Medium sized plant with fine, aromatic round grains, Suitable for intercropping, field tolerance to aphids
8	Sadhana	1025	0.20	95-110	A dual purpose, semi-erect variety; Suitable for rainfed condition field tolerance to white fly, mites and aphids. A mid-late variety withstands moisture stress, responded well to input management under optimum moisture level.
9	Swathi	855	0.30	82-85	Plants medium size semi-erect type, early maturing variety, suitable for rainfed condition, and late sown season. Field tolerant to white fly, moderately tolerant to disease. Suits well to the areas where the soil moisture retentiveness in comparably less, being early maturity. It escapes powdery mildew disease.
10	CS 287	600			Early maturing variety, suitable for both rainfed and irrigated condition. Field tolerant to wilt and grain mould.
11	Sindhu	1000	0.40	100-110	Oval medium breakable grains, suitable for rainfed areas, tolerant to wilt, powdery mildew as well as drought condition, medium duration.
12	Hisar Anand	1400	0.35	-	A medium tall dual purpose variety, oval medium sized seeds, wider adaptability to different soil conditions. Resistant to lodging due to spreading habit.
13	Hisar Sugandh	1400			Suitable for irrigated conditions. Resistant to stem gall diseases.
14	Hisar Surabhi	1800	0.4-0.5	130-140	Bushy erect plant type, seed medium, oblong; tolerant to frost, less susceptible to aphids, medium duration
15	Azad Dhan-1	1000	0.29	120-125	Erect early branching, number of umbellate per umbel 5, tolerant to moisture stress, powdery mildew and aphids.
16	Pant haritima	1200	0.4	150-160	Tall erect plant, a dual purpose type, good yielder of leaves, smaller seeds with high oil. Resistant to stem gall..
17	DWA 3*	400	0.27	-	A dual purpose variety and for seed production in rabi crop, moderately tolerant to powdery mildew, black clay soils are best suited
18	CIMPOS-33	2100	1.3	-	Tall erect, compact, profusely branching and flowering, grains small and bold. Mainly recommended for oil production.

Sl. No.	Variety	*Av. yield (kg/ha)	Essential oil %	Duration (days)	Salient features
19	ACR- 01-256(NRCSS ACR-1)	1100	0.35-5	-	Dual purpose variety, long duration, resistant to stem gall and wilt.
20	RCr 20	900	0.25	100-110	Medium sized bushy plant suitable for rainfed crop or limited moisture condition and heavy soils of south Rajasthan. Moderately resistant to stem gall, bold grains, early maturity.
21	RCr.41	909	0.25	130-140	A tall erect plant with thick stem. Grows well under irrigated conditions, resistant to stem gall, wilt and moderately resistant to powdery mildew ;small seeds (9.3g/1000 seed),long duration variety
22	RCr 435	1000	0.33	110-130	Plants are bushy, erect, bold seeds, medium sized, medium maturing variety, adapted for irrigated condition moderately resistant to root knot and powdery mildew.
23	RCr 436	1100	0.33	90-100	Plants semi dwarf, bushy type with quick early growth and bold seeds. Resistant to root rot and root knot nematodes most suitable for limited moisture condition and heavy soils of south Rajasthan
24	RCr446	1200	0.33		Plants tall, are leafy erect with higher number of seeds per umbel. Seeds are medium in size and moderately resistant to stem gall.
25	RCr 684	990	0.32	110-120	A variety, resistant to stem gall and less susceptible the powdery mildew. Adapted to medium heavy textured soil and sandy loam soil under irrigation. Seeds of the variety are bold. Plants are tolerant and erect with higher number of seeds per umbel, medium maturity.

Source: <http://www.aicrps.res.in/index.php/download-it/varieties-released> (retrieved on 6th April 2017)

### 2.3. Seasonal Pattern of Coriander in Rajasthan visa-vis other part of the world

Coriander is mainly a Rabi crop in India and sowing starts in the middle of October and extends until November-end. The crop requires 4-6 irrigations. The sowing of coriander starts post the harvesting of these two crops without much land preparation. The moisture content in the soil left over after harvesting of Kharif crops determines the sowing pattern of coriander. Crop duration of coriander is about 110-140 days and harvested in February – March.<sup>15</sup>

<sup>15</sup> [http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports\\_20080820\\_02.pdf](http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports_20080820_02.pdf) (retrieved on 6th April 2017)

Table 12: Seasonality of Coriander

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Harvesting									Sowing		

The following table shows the global calendar for the sowing and harvesting seasons across the major coriander producing countries. In India, sowing is done towards the start of the year in the months of February and March and the crop becomes suitable for harvesting by the end of the year starting October. On the other hand, in countries like Morocco, Egypt, Bulgaria, Russia and Romania, the sowing is done in the middle of the year during the months of June and July and harvesting is done towards the beginning of the year during February and mostly in March.

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Sep	Oct	Nov	Dec
India		Harvest	Harvest								
Morocco						Sowing	Sowing				
Egypt						Sowing	Sowing				
Bulgaria						Sowing	Sowing				
Romania						Sowing	Sowing				
Russia						Sowing	Sowing				
Canada				Harvest	Harvest			Sowing	Sowing		

Harvest  Sowing 

(Source: <http://www.zernoexport.com/en/catalog/specui/coriander> (retrieved on 6th April 2017))

### 2.3. Land preparation

For raising a rainfed crop like Coriander, the land should be ploughed 2 times following rains and field must be planted immediately to break the clods and to avoid soil moisture. If irrigated, the land is ploughed twice or thrice and beds and channels are formed. First irrigation is given 3 days after sowing and thereafter at 10 to 15 days interval depending upon the soil moisture available in the soil.<sup>16</sup> Saline and alkaline soil is not suitable.

### 2.4. Sowing/Planting/Cultivation

**Seed Treatment:** Coriander seed is split by rubbing on floor and treated with 2 to 3 gm thirum/kg of seed, Trichoderma 8 to 10 gm/kg of seed to protect from wilt.

The seeding rate for coriander production is generally 15 to 20 kg/ha. Some farmers clean their coriander to market specifications and keep the splits for seed. Row spacing can be 6 to 12 in. (15 - 30 cm) in heavy soils up to 40 cm, plant to plant is 20 cm with a seeding depth of 2 - 3 cm. Time of sowing can vary between 15<sup>th</sup> Oct and 15<sup>th</sup> Nov. Sowing can be done with conventional equipment, but press drills appear to produce the best results on a firm, moist seedbed when the danger of frost is over. It is critical that seeding be done on a clean field because the crop may take a long time to emerge and the canopy closes very slowly.<sup>17</sup> Seed rate for Rainfed is 20 kg/ha and for irrigated is 10-16 kg/ha

### 2.5. Climatic and Soil Requirement

Coriander requires cool climate during growth and warm dry climate during seed maturity, so it is mainly cultivated as a Rabi crop in India/Rajasthan. It can be cultivated in all types of soils but comes up well on well drained loamy soils. Coriander is a tropical crop and can be grown throughout the year (except very hot season i.e. March-May) for leaf purpose, but for

<sup>16</sup> <https://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Coriander.htm> (retrieved on 6th April 2017)

<sup>17</sup> [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex121](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex121) (retrieved on 6th April 2017)

higher grain yield it has to be grown in specific season. A dry and cold weather free from frost especially during flowering and fruit setting stage favours good grain production. Cloudy weather during flowering and fruiting stage favours pest and disease incidences. Heavy rain affects the crop. As an irrigated crop, it can be cultivated on almost all types of soils provided sufficient organic matter is applied. A black cotton soil with high retentively of moisture is best under rainfed conditions.<sup>18</sup>

Coriander is well suited to growing on a range of soils, but it performs best on well-drained loam and fine textured soils. Suitable pH ranges are from 4.5 to 8.0, with an optimum of 6.3. It has an optimum growing temperature of 18° C. Hot, dry winds during flowering (anthesis) can lead to the dropping of flowers, resulting in substantial yield reduction. It has also been noted that volatile oil content increases during cool, moist summers. The use of honeybees as pollinators can improve coriander seed yield. The coriander plant is well adapted to the tropical and sub-tropical climatic conditions. Coriander requires cool climate during growth stage and warm dry climate at maturity. It is observed that quality of the seed is superior and essential oil content is more when the crop is grown in cool climatic conditions. The crop matures in 110-140 days, hence under optimum conditions it requires 120-150 days LGP (Length of Growing Period). The production of coriander seeds is regulated by most limiting factor (s). The limitations considered for assessment of soils are climatic, topographic, wetness, salinity yard alkalinity, soil fertility and physical limitation. The criteria of soil depth, slope, texture, erosion, available water content (AWC) and length of growing period (LGP) are very important for assessment of soils suitability.<sup>19</sup>

Coriander prefers a deep, fertile soil which can be either light or heavy, as long as it is well draining.<sup>20</sup>

## 2.6. Nutrients Management

Adequate nutrient supply increases the seed and oil yields by improving the setting pattern of siliquae on branches, number of siliqua/plant, and other yield attributes. Recommended dose of fertilizers (RDF) for different zones changes with climate; soil type, time, and type of cropping systems are followed. About 15 to 20 ton/ha of farmyard manure is applied at the time of last preparation. In addition, the following fertilizers may be applied:

Table 13: Coriander Nutrient Management Table

Name	N		N	P	K
	Basal	At the time of first irrigation	Flowering	Basal	Basal
Irrigated crop	20	20	20	30	20
Rainfed crop	20	-		30	20

Source: <https://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Coriander.htm> (retrieved on 6th April 2017)

The nutrient management system during various stages of production is given below:

### Pre-sowing State

<sup>18</sup> <https://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Coriander.htm> (retrieved on 6th April 2017)

<sup>19</sup> <https://www.scribd.com/document/171112902/Present-and-Future-Prospectus-for-Coriander-Seed-Production-in-South-east-Rajasthan-pdf> (retrieved on 6th April 2017)

<sup>20</sup> <http://herbgardening.com/growingcilantro.htm> (retrieved on 6th April 2017)

- Nutrients should be applied on the basis of soil test report and recommendation for particular agro climatic zone.
- Apply 4-5 tons of farmyard manure or vermi-compost @1.5- 2.0 t/acre at the time of last cultivation (Late cultivation variety) and incorporate in the soil 2 to 3 weeks before sowing.
- Incubate Trichoderma @ 500 g in 100 Kg FYM for 15 days prior to its application in one acer field.

#### **Sowing State**

- Seed inoculation with Azotobacter ( $10^7$  CFU per g) @ 5 g /Kg seed and PSB @ 8-10g/Kg seed.
- Apply 12 Kg of N, 16 Kg P<sub>2</sub>O<sub>5</sub> and 8 Kg K<sub>2</sub>O per acre as a single basal dose in the black cotton soils.
- In light soils under irrigated conditions, apply 18kg of N, 12 Kg of P<sub>2</sub>O<sub>5</sub> and 12 Kg of K<sub>2</sub>O as basal dose at the time of sowing.

#### **Vegetative State**

- Apply 12 Kg of N/acre as top dressing at 30 days after sowing.
- Micro nutrient deficiency should be corrected by foliar spray of particular nutrient, if required.

#### **Flowering/Maturity State**

- Micronutrient deficiency should be corrected by foliar spray of particular micronutrient.<sup>21</sup>

### **2.7. Water management**

Irrigation requirement is depending upon the parameters such as climate, soil moisture level, and the variety used. Standard irrigation schedule is 4–5 irrigations 30–35, 60–70, 80–90, 100–105 and 110–150 days after sowing.<sup>22</sup>Light soils are irrigated at the interval of 20 days & heavy soils at the interval of 40 days .Field should be irrigated lightly in coriander.

### **2.8. Weed Management**

First weeding is done 20 to 25 days after sowing and second weeding in irrigated coriander may be done between 50 and 60 days of sowing depending upon the weed growth. Herbicides may also be applied for weed control. Pre-plant Fluchloralin @ 0.75kg/ha, pre-emergent Oxyfluorfen @ 0.15kg/ha or Pendamithalin @ 1.0kg/ha are effective herbicides.<sup>23</sup> Further, any one of the following recommendations can be used for chemical weed control in Coriander:

- Basalin @ 2.5-3 liters per hectare as pre sowing.
- Stomp @4-5 liters per hectare.
- Combination of Basalin @1.25-1.5 1+ stomp 2.0-2.5 liters per hectare.
- Combination of stomp 2.0-2.5 1+ tribunal 0.7- 1.0 kg per hectare.

#### **Note:**

I. Basalin should be used as pre- sowing incorporated in the soil while other weedicides are to be used as pre- emergence.

<sup>21</sup> <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf> (retrieved on 6th April 2017)

<sup>22</sup> <http://www.agrihortico.com/tutorialsview.php?id=107>(retrieved on 6th April 2017)

<sup>23</sup> <http://www.agrihortico.com/tutorialsview.php?id=107>(retrieved on 6th April 2017)

II. Proper soil moisture at the time of application of weedicide is essential.<sup>24</sup>

Weed management system at different stages of production is as follows:

#### Pre-sowing State

- Summer ploughing should be done in hottest month of the year (May –June).and soil solarization should be done with transparent polyethylene sheet or Adopt stale seed bed in irrigated fields and allow the weed seeds to germinate.
- Then field is cultivated immediately before sowing of crop to destroy the germinating weed seeds.

#### Sowing State

- Always use certified and weed free seeds.
- Line sowing should be done to facilitate inter-culture operations.
- Plant population should be maintained to its optimum right from its beginning to minimize the crop- weed competition or adopt soil

#### Vegetative State

- During early stages of growth, coriander plants grow very slow, hence weeding during this period is very essential to save the plants from weed competition.
- Two hand hoeing should be done at 25 and 50 days after sowing to keep the field weed free before flowering.
- In rain fed crop, first weeding should be done at about 25-30 days after sowing and in irrigated crop about 30-35 days after sowing and second weeding at 50-60 days after sowing.
- Thinning of plants should be done before first irrigation to maintain a spacing of 5 to 10 cm between plants.

#### Flowering/Maturity State

- Left over weeds should be removed from the field to avoid further spread of weed seeds.<sup>25</sup>

### 2.9. Pest & Disease Management

Description of insect pests, mites and nematodes that can cause harm to coriander production:

**a. Whitefly:** The whitefly adult is a soft-bodied, moth-like fly. The wings are covered with powdery wax and the body is light yellow in color. The wings are held over the body like a tent. The adult males are slightly smaller in size than the females. Adults live from one to three weeks. Whiteflies feed by tapping into the phloem of plants, introducing toxic saliva and decreasing the plants' overall turgor pressure. Since whiteflies congregate in large numbers, susceptible plants can be quickly overwhelmed. Further harm is done by mould growth encouraged by the honeydew whiteflies secrete. This may also seriously impede the ability of farms to process cotton harvests.



Figure 19: Whitefly Pest

<sup>24</sup> <http://hortharyana.gov.in/documents/docs/SPICES.pdf>

<sup>25</sup> <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf>

**b. Indigo Caterpillar:** The moth is medium sized and stout bodied with forewings pale grey to dark brown in colour having wavy white crisscross markings. Hind wings are whitish with brown patches along the margin of wing. Pest breeds throughout the year. Moths are active at night. Adults live for 7-10 days. Total life cycle is completed in 32-60 days depending on environmental conditions. There are up to eight generations in a year.



Figure 20: Indigo Caterpillar Pest

**Damage symptoms:**

- In early stages, the caterpillars are gregarious and scrape the chlorophyll content of leaf lamina giving it a papery white appearance.
- Irregular holes are produced on leaves initially and later



Figure 21: Aphid pest

skeletonisation occurs, leaving only veins and petiole

**c. Aphid:** Adults are small, 1 to 4 mm long, soft-bodied insects with two long antennae that resemble horns. Most aphids have two short cornicles (horns) towards the rear of the body.

**Damage symptoms:**

- Infesting tender shoots and under surface of the leaves.
- Curling and crinkling of leaves
- Stunted growth
- Development of black sooty mould due to the excretion of honeydew.

**d. Cutworm:** The adult is fairly large in size, with a wingspan of 40 to 55 mm. The forewing, especially the proximal two-thirds, is uniformly dark brown. The distal area is marked with a lighter irregular band, and a small but distinct black dash extends distally from the bean-shaped wing spot. The hind wings are whitish to gray, and the veins marked with darker scales. The adult pre- oviposition period is about seven to 10 days.



Figure 22: Cutworm Pest

**Damage symptoms:**

- The larva cuts the plants from ground level and makes them to fall down. Infestation of this pest starts at the initial stage of plants resulting in heavy loss to the crop.

**e. Thrips:** Adults are up to 2 mm in size, pale yellow to dark brown in color and have fully developed wings which are very different from other insects. They have a single longitudinal vein in which there is several hairs connected perpendicular to the vein. The wing appears as fringe with hairs. When at rest, the wings are folded along the back of the insect... Besides undersurface of leaves, they can also be found in the flowers.



Figure 23: Thrips Pest

Adults are more mobile than immature and are attracted to yellow and white colors. They often alight on one's clothes or on.

**Damage symptoms:**

- Thrips have a very peculiar feeding behavior. They start the feeding by rasping and sucking and they lacerate the leaf surface with their mouth parts to release the liquids from the plant cells. In this process, thrips release chemicals substances that help to predigest the cell sap. Which they suck up.
- The damaged leaves show silvery patches or streaks that shine in the sun. When damage is severe, these small patches can occupy most of the surface of the leaf and the plant cannot adequately photosynthesize. The plant loses more water than normal through the damaged tissues which are the entry points for plant pathogens.

**f. Mites:** The mites are very small measuring about 0.5 mm in length, metallic brown to black with pale yellow legs. Their forelegs are distinctively longer than the other three pairs.

**Damage symptoms:**

- The mites frequently attack the coriander crop and whole plant becomes whitish yellow and appears sickly. It mostly feeds on young leaves and the infestation is more severe on young inflorescence.
- Mites are seen on the lower side of the leaves and when serious, cause webbing and feed from within the web. Plants get stunted at severe infestation.

**g. Root Knot Nematode: Damage symptoms:**

- Infested plants appear in patches in the field
- Formation of galls on host root system is the primary symptom
- Roots branch profusely starting from the gall tissue

causing a 'beard root' symptom

- Infected roots become knobby and knotty
- In severely infested plants the root system is reduced and the rootlets are almost completely absent hampering their function of uptake and transport of water and nutrients.
- Plants wilt during the hot part of day, especially under dry conditions and are often stunted.
- Nematode infestation predisposes plants to fungal and bacterial root pathogens.



Figure 24: Root Knot Nematode

**Description of Diseases**

**a. Powdery Mildew: Disease symptoms:**

- It appears as small, white, powdery patches on young parts of stems, leaves and buds which increases in size, and coalesce to cover entire area of leaf surface.
- Affected leaves are reduced in size and distorted. Premature sterility is also common. In severe cases, the umbels dry up.



Figure 25: Powdery Mildew Disease

- Seed formation may not take place in affected plants due to this disease.

**b. Wilt: Disease symptoms:**

- The disease can easily be recognized in the field by drooping of the terminal portions, followed by withering and drying up of leaves, eventually resulting in death.
- Discoloration of vascular system of the root is observed. Partial wilting is also found. In partially wilted plants, growth is arrested.
- The leaves become pinkish yellow to yellow. Sterility is often noticed in such plants. Seeds, if formed are immature and light in weight.
- Severe infection in the early stage results in total failure of the crop.



Figure 26: Wilt disease

**c. Stem Gall: Disease symptoms:**

- The disease appears in the form of tumor-like swellings of leaf veins, leaf stalks, peduncles, stems as well as fruits. The infected veins show a swollen hanging appearance to the leaves.
- Initially the tumors are glossy which rupture later on and become rough. They are about 3 mm broad and up to 12.5 mm long.
- Badly affected plants may be killed. In the presence of excessive soil moisture, especially under shaded conditions, when the stem fails to harden and remain succulent, the tumors are numerous.



Figure 27: Stem Gall Disease

**d. Blight Disease: Disease symptoms:**

- Dark brown spots appear on the stem and leaves of infected plants and emerging umbels with young flowers get killed.
- Later in the season when plants are beginning to mature it may be difficult to recognize a diseased field except reduced seed production.



Figure 28: Blight Disease

**e. Stem Rot: Disease symptoms:**

- Infected seeds fail to germinate; rapid death of germinating seeds prior to emergence; water-soaked reddish lesions girdling the stem at the collar region results in the collapsing of emerged seedlings.<sup>26</sup>



Figure 29: Stem Rot Disease

<sup>26</sup> <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf> (retrieved on 6th April 2017)

Pest Management at various production stages are shown below:

#### Pre Sowing

<b>Wilt, blight, root rot**, Nematodes and insects</b>	<b>Cultural control:</b> <ul style="list-style-type: none"> <li>• Select healthy and disease free seeds.</li> <li>• Use resistant /tolerant varieties.</li> <li>• Over irrigation should be avoided to minimize the wilt.</li> </ul>
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#### Vegetative State Pest Management

<b>Aphids</b>	<ul style="list-style-type: none"> <li>• See common cultural and biological practices.</li> <li>• Insecticidal soaps or oils such as neem or canola oil or NSKE 5% are usually the best method of control</li> <li>• Always check the labels of the products for specific usage guidelines prior to use.</li> </ul>
<b>Whitefly</b>	<ul style="list-style-type: none"> <li>• See common cultural and biological practices.</li> </ul>
<b>Indigo caterpillar**</b>	<ul style="list-style-type: none"> <li>• See common cultural and biological practices.</li> </ul>
<b>Mite**</b>	<ul style="list-style-type: none"> <li>• See common cultural and biological practices.</li> <li>• See management practices of Aphids</li> </ul>
<b>Cutworm</b>	<ul style="list-style-type: none"> <li>• See common cultural and mechanical practices.</li> </ul> <b>Biological control:</b> <ul style="list-style-type: none"> <li>• Release of <i>Trichogramma</i> sp. @ 20,000/acre.</li> </ul>
<b>Wilt, stem gall, Stem rot**</b>	<b>Cultural control:</b> <ul style="list-style-type: none"> <li>• Maintain the optimum moisture to minimize the stem gall.</li> <li>• See common cultural and biological practices.</li> </ul>

#### Flowering/Maturity State Pest Management

<b>Thrips**, Seed Chalcid fly</b>	<ul style="list-style-type: none"> <li>• See common cultural and biological practices.</li> </ul>
<b>White fly, aphids, caterpillar, other pests</b>	<ul style="list-style-type: none"> <li>• Same as vegetative stage.</li> </ul>
<b>Stem gall, Stem rot**, wilt</b>	<ul style="list-style-type: none"> <li>• Same as vegetative stage.</li> </ul>
<b>Grain Mould**, Powdery Mildews</b>	<b>Cultural control</b> <ul style="list-style-type: none"> <li>• Harvesting of the mature crop should not be delayed to avoid powdery mildew attack.</li> </ul>

(Source: <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf> (retrieved on 6th April 2017))

## 2.10. Recommended Good Agriculture Practices

### Major Good Crop Production Technologies

#### Under Rainfed Conditions

- Improved agro-production technology for rainfed areas emphasizes the need for timely sowing, line sowing with recommended spacing and optimum seed rate, fertilizer application and thinning at appropriate time.
- During the years of scanty rainfall, irrigation and fertilizer are the most critical inputs whereas, during the years of sufficient rainfall, fertilizer and plant protection measures are the most critical inputs for obtaining sustainable production in the semiarid agro-ecosystem.

#### Under Irrigated Conditions

- Improved agro-production technology emphasizes the need for timely sowing, line sowing with recommended spacing and optimum seed rate thinning, fertilizer application and plant protection at appropriate time in irrigated areas as well.
- Along with improved varieties, fertilizer, plant protection, irrigation, weed control, etc. has been identified as critical inputs for different regions.
- Optimum doses of nutrients have been worked out especially for N, P, K and S. Effects of different levels of nutrient on seed and oil yields have also been studied. Application of micronutrients (Zn and B) having considerable effect on yield has been recommended for deficient soils.<sup>27</sup>

#### Growing a healthy crop:

- Select healthy seeds/seedlings/planting materials
- Select a variety resistant/tolerant to major pests
- Treat the seeds/seedlings/planting materials with recommended pesticides especially bio pesticides.
- Follow proper spacing
- Soil health improvement (mulching and green manuring wherever applicable)
- Nutrient management especially organic manures and bio fertilizers based on the soil test results. If the dosage of nitrogenous fertilizers is too high the crop becomes too succulent and therefore susceptible to insects and diseases. If the dosage is too low, the crop growth is retarded. So, the farmers should apply an adequate amount for best results. The phosphatic fertilizers should not be applied each and every season as the residual phosphate of the previous season will be available for the current season also.
- Proper irrigation
- Crop rotation

<sup>27</sup> [http://www.efreshglobal.com/eFresh/Content/Prod\\_Mustard.aspx?u=hw](http://www.efreshglobal.com/eFresh/Content/Prod_Mustard.aspx?u=hw)(retrieved on 6th April 2017)

**Observe the field regularly (climatic factors, soil and biotic factors); Farmers should:**

- Monitor the field situations at least once a week (soil, water, plants, pests, natural enemies, weather factors etc.)
- Make decisions based on the field situations and Pest: Defender ratio (P: D ratio)
- Take direct action when needed (e.g. collect egg masses, remove infested plants etc.)

**Pre Sowing State – Good Agricultural Practices:**

- Deep ploughing of fields during summer to control nematodes population, to expose pupae, propagules of soil borne pathogens and weeds.
- Soil solarization: Cover the beds with polythene sheet of 45 gauge (0.45 mm) thickness for three weeks before sowing for soil solarization which will help in reducing the soil-borne pests including weeds.
- Timely and line sowing should be done.
- Field sanitation, rogueing
- Destroy the alternate host plants
- Soil test based application of manures and fertilizers.
- Growing castor or marigold as a trap crop for the management of Spodoptera.
- Plant tall border crops like maize, sorghum for the management of mites and thrips.
- Follow crop rotation of non-host crops like cereal crops for 3 years.
- Adopt ecological engineering by growing the attractant, repellent, and trap crops around the field bunds.

**Vegetative State – Good Agricultural Practices:**

- Provide irrigation at critical stages of the crop
- Avoid water stress and water stagnation conditions.
- Enhance parasitic activity by avoiding chemical spray, when larval parasitoids are observed
- Collection and destruction of eggs, and larvae
- Collect and destroy diseased and insect infected plant parts.
- Use yellow sticky traps for whitefly and aphids and blue sticky trap for thrips @ 4-5 traps/acre.
- Use light trap @ 1/acre and operate between 6 pm and 10 pm
- Install pheromone traps @ 4-5 traps/acre for monitoring adult moth activity (replace the lures with fresh lures after every 2- 3 weeks)
- Erecting of bird perches @ 20/acre for encouraging predatory birds such as King crow, common mynah etc.<sup>28</sup>

**2.11. Harvesting**

Harvesting is the primary process of collecting the crop and should be done at optimum time period to ensure production of plant material and the best quality of finished spice product (Douglas et al., 2005). It matures in two to three months after sowing. Its smaller-seed requires a longer growing period of approximately 120 days. Depending upon the

<sup>28</sup> <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf> (retrieved on 6th April 2017)

end use, it can either be harvested green or left to ripe them until fruits turn brown. Green coriander fruits have sharper and more pronounced flavour than ripe seeds. Mature brown seeds can be used and grind to form powder. Seed heads are cut along with certain inches of stalk or plant may be pulled out with roots and hang in bags upside down, when seeds are fully dry these tend to detach from stalk, collected and store in cool, dry location or ground to obtain a fine powder. In order to remove field heat and prolong shelf life after harvesting, it is necessary to pre- cool harvested coriander before transportation.

Seeds turn yellowish- green after maturity when the crop is harvested and dried in the shade to retain the green colour and aroma. Plants are cut early morning to avoid breakage. Seeds are thrashed to separate seeds from the dried plant. Seeds are then cleaned using sieves and graded. Coriander yields about 500-600 kg/ha under rain-fed conditions and about 1200-2000 kg/ha through irrigation.<sup>29</sup>

The crop will be ready for harvest in about 90 to 110 days depending upon the varieties and growing season. Harvesting has to be done when the fruits are fully ripe and start changing from green to brown colour. Delaying of the harvest should be avoided lest shattering during harvest and splitting of the fruits in subsequent processing operations.

The plants are cut or pulled and poled into small stacks in the field to beating with sticks or rubbing with hands. The produce is winnowed, cleaned and dried in partial shade. After drying, the produce is stored in gunny bags lined with paper. The rainfed crop yields on an average 400 to 500 kg/ha and the irrigated crop 600 to 1200kg/ha.<sup>30</sup>

Coriander leaves can be picked any time after the plants are about six inches tall. Harvest the seeds when they turn a light brown, two to three weeks after flowering. The seeds are small — only an eighth inch in diameter — and are split in half and dried after harvesting. The dried seeds can be stored for months in an airtight container. We can freeze or dry the leaves. All parts of the plant are edible, including the root, which is similar in taste to the leaves but has an added nutty flavour.<sup>31</sup>

## 2.12. Pre Harvest constrains

### Insecticide Resistance

Resistance to insecticides may be defined as a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species' (IRAC). Cross-resistance occurs when resistance to one insecticide confers resistance to another insecticide, even where the insect has not been exposed to the latter product.

**Causes of resistance development:** The causes and rate at which insecticide resistance develops depend on several factors, including the initial frequency of resistance alleles present in the population, how rapidly the insects reproduce, the insects' level of resistance, the migration and host range of the insects, the insecticide's persistence and specificity, and the rate, timing and number of applications of insecticide made. For instance, insect pests

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<sup>29</sup>

[http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports\\_20080820\\_02.pdf](http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports_20080820_02.pdf)(retrieved on 6th April 2017)

<sup>30</sup> <https://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Coriander.htm>(retrieved on 6th April 2017)

<sup>31</sup> <http://veggieharvest.com/herbs/cilantro.html>(retrieved on 6th April 2017)

that survive in large populations and breed quickly are at greater advantage of evolving insecticide, especially when insecticides are misused or over-used.

**General strategy for insecticide resistance management:** The best strategy to avoid insecticide resistance is prevention and including insecticide resistance management tactics as part of a larger integrated pest management (IPM) approach.

- **Monitor pests:** Monitor insect population development in fields to determine if and when control measures are warranted. Monitor and consider natural enemies when making control decisions. After treatment, continue monitoring to assess pest populations and their control.
- **Focus on AESA:** Insecticides should be used only as a last resort when all other non-chemical management options are exhausted and P: D ratio is above 2: 1. Apply bio pesticides/chemical insecticides judiciously after observing unfavourable P: D ratio and when the pests are in most vulnerable life stage. Use application rates and intervals as per label claim.
- **Ecological engineering for pest management:** Flowering plants that attract natural enemies as well as plants that repel pests can be grown as border/intercrop.
- **Take an integrated approach to managing pests.** Use as many different control measures as possible viz., cultural, mechanical, physical, biological etc. Select insecticides with care and consider the impact on future pest populations and the environment. Avoid broad-spectrum insecticides when a narrow-spectrum or more specific insecticide will work. More preference should be given to green labelled insecticides.
- **Mix and apply carefully.** While applying insecticides care should be taken for proper application of insecticides in terms of dose, volume, timing, coverage, application techniques as per label claim.
- **Alternate different insecticide classes.** Avoid the repeated use of the same insecticide, insecticides in the same chemical class, or insecticides in different classes with same mode of action and rotate/alternate insecticide classes and modes of action.<sup>32</sup>

### Weather Constraints

The prevailing cold wave condition across Rajasthan's Kota division has impacted coriander crop due to frost. Kota division is known as the coriander bowl of Rajasthan where the fragrant herb is cultivated on more than two lakh hectare and produces more than two lakh metric tonne of the herb that accounts for 90% of coriander cultivated and produced in the state. Apart from Kota, farmers extensively cultivate coriander in Baran and Jhalawar districts of the division.<sup>33</sup>

### Farmer's Problem in crop Protection

- At the seedling stage coriander is often attacked by the leaf eating caterpillars and semi-loopers and at the flowering stage by the aphids. Spraying the crop with methyl demeton (0.05%) is recommended to control the aphids but a flowering stage the use of any insecticide would kill the bee population affecting pollination in the crop.

<sup>32</sup> <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf>(retrieved on 6th April 2017)

<sup>33</sup> <http://www.hindustantimes.com/jaipur/rajasthan-s-coriander-bowl-faces-frost-damage/story-0FzeywtK3AjAZpFBrPkU7O.html>(retrieved on 6th April 2017)

- Powdery mildew (*Erysiphe polygoni*) is a serious disease, which ruin the crop if allowed unchecked in the initial stage itself. Spraying wettable sulphur 0.25% or 0.2% solution of Karathane twice at 10 to 15 days interval is recommended. Grain mould is caused by *Helminthosporium* sp., *Alternaria* sp., *Carvularia* sp. and *Fusarium* sp. It can be controlled by spraying carbendazim 0.1% 20 days after grain set.<sup>34</sup>
- Straight combining coriander when it is fully mature is preferred over swathing and combining, as coriander is prone to shattering. If not straight combining, coriander should be swathed when 80 per cent of the seeds turn purple-brown. Swathes should not be left out too long due to the potential for shattering. Swathing when there is dew or high humidity will reduce shattering losses.
- Combining is usually done when seed moisture content is less than 15 per cent. At 10 per cent moisture, coriander is considered dry, but buyers prefer 9 per cent. Cylinder/rotor speeds should be set at approximately 500 rpm under dry conditions. An initial setting of 0.5 in. (12 mm) at the front and 0.25 in. (6 mm) at the back is suggested. Wind speed should be enough to reduce dockage, return speed should be reduced to the minimum and ground speed should be slowed.
- Crop samples must be free of rodent droppings and have very low foreign material (2 per cent). If samples have greater than 5 per cent split fruit, the shipment is usually discounted by the buyer.<sup>35</sup>

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<sup>34</sup> <https://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Coriander.htm>(retrieved on 6th April 2017)

<sup>35</sup> [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex121](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex121)(retrieved on 6th April 2017)

## Chapter-3: Post-Harvest Management

### 3.1. Post - Harvest Losses, Harvesting Care and Post - Harvest Equipment

The farmers in the Kota region store around 60% of their produce harvested for the period of 3 months to 2 years in order to sell when prices offered for the same is higher in the mandi/market.

#### Post-Harvest Losses

Timely harvesting is necessary to avoid losses by shredding of seeds when over dried crop gets ready for harvest in 110 to 125 days after sowing. It is harvested when 50% of seeds of coriander turn yellow. Weeds and crop is harvested separately to avoid losses.

#### Harvesting Care

Coriander should be stored at less than 10 percent moisture with green material removed as soon as possible. The seed "cures" in early storage, and aeration assists this process. Therefore, aeration is strongly recommended even if the seed is harvested dry. Coriander seed must cure during storage. Natural air drying or aeration is beneficial for curing. Coriander oil is very volatile and hot air drying should be avoided. Green material should be cleaned from the sample as soon as possible. Avoid the concentration of green material such as weed seeds in the bin. The higher density of the green material prevents even airflow during aeration and increased spoilage can occur. The sample must be free of foreign material (<2%) at the time of sale. After drying, seeds are separated by light beating with sticks and winnowing. An average yield of 12–25 q/ha under irrigated condition and 7–8 q/ha under rainfed condition can be easily obtained.<sup>36</sup>

Downgrading or rejection can result from insect parts, rodent droppings, weed seeds, other foreign material, overly dark colour or splits greater than 5 percent. Cleanouts of 15-20 percent are typical. Buyers judge quality according to aroma, colour and purity. Colour should be tan, aroma good and sample greater than 99 percent pure, whole seed. Colour is preserved by ensuring crop does not lay in swath for too long. Aroma is preserved by proper curing and storage. Coriander has a bulk density of approximately 22-25 lb/bu.<sup>37</sup>








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<sup>36</sup> <http://www.agrihortico.com/tutorialsview.php?id=107>(retrieved on 6th April 2017)

<sup>37</sup> [http://www.gov.mb.ca/agriculture/crops/production/print\\_coriander.html](http://www.gov.mb.ca/agriculture/crops/production/print_coriander.html)(retrieved on 6th April 2017)

### Post-Harvest Equipment's

Table 14: List of Harvest/Post-Harvest Equipments

Category A: Stationary, crawling pest/disease			
<b>Vegetative stage</b> i) For crawling and soil borne pests  ii) For small sucking leaf borne pests	Insecticides and fungicides	<ul style="list-style-type: none"> <li>Lever operated knapsack sprayer (Droplets of big size)</li> <li>Hollow cone nozzle @ 35 to 40 psi</li> <li>Lever operating speed = 15 to 20 strokes/min</li> </ul> <b>or</b> <ul style="list-style-type: none"> <li>Motorized knapsack sprayer or mist blower (Droplets of small size)</li> <li>Airblast nozzle</li> <li>Operating speed:</li> </ul>	
			
<b>Reproductive stage</b>	Insecticides and fungicides	<ul style="list-style-type: none"> <li>Lever operated knapsack sprayer (Droplets of big size)</li> <li>Hollow cone nozzle @ 35 to 40 psi</li> <li>Lever operating speed = 15 to 20 strokes/min</li> </ul>	
Category B: Field flying pest/airborne pest			
Vegetative stage	Insecticides and	<ul style="list-style-type: none"> <li>Motorized knapsack</li> </ul>	
Reproductive stage (Field Pests)	fungicides	Sprayer or mist blower (Droplets of small size) <ul style="list-style-type: none"> <li>Air blast nozzle</li> <li>Operating speed: 2/3rd throttle</li> </ul> Or <ul style="list-style-type: none"> <li>Battery operated low volume sprayer (Droplets of small size)</li> <li>Spinning disc nozzle</li> </ul>	 
Mosquito/ locust and spatial application (migratory Pests)	Insecticides and fungicides	<ul style="list-style-type: none"> <li>Fogging machine and ENV (Exhaust nozzle vehicle) (Droplets of very small size)</li> <li>Hot tube nozzle</li> </ul>	 

Source: <http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Coriander.pdf> (retrieved on 6th April 2017)

### 3.2. Grade Specification & Grading at Producer level

Coriander is classified into different grades based on quality of the produce. In general, coriander has been classified into grades like badami, eagle, scooter, single parrot, double parrot, green medium, green extra and green special. After the harvesting of coriander, it is dried in sunlight; the excess drying leads to brown colour and fetch a low price. These brown colour seeds are called the badami grade. The finer quality is called green and it is traded at a premium to all other grades. However, the badami grade has the highest market share, constituting 50% of the total produce. The approximate price difference between these two largest grades is Rs 200 per quintal and this difference has been narrowing in the last few years due to higher prices.<sup>38</sup>

#### Grading as per Spices Grading and Marking Rules, 2005

The following rules were published in the Gazette of India, Part II, Section 3, sub-section (i) dated 21-7-2005 vide G.S.R. 257 (Dated 30-7-2005)

Table 15: Grade designations and quality of Coriander

Grade Designation	Quality/Special Characteristics							
	Organic Extraneous matter, % (m/m) (Max.)	Inorganic extraneous matter, % (m/m) (Max.)	Split fruits, % (m/m) (Max.)	Damaged, discolored, shriveled, insect bored fruits % (m/m) (Max.)	Moisture, % (m/m) (Max.)	Total ash % (m/m) (Max.)	Acid insoluble ash, % (m/m) (Max.)	Volatile Oil % (ml/100 gm) (Min.)
Special	0.8	0.2	5	2	9	7	1	0.2
Standard	3.5	0.5	30	5	10	7	1.5	0.1

Source: <http://agmarknet.nic.in/spices.pdf> (retrieved on 6th April 2017)

- Coriander (Whole) shall be dried mature fruit of *Coriandrum sativum* L.
- It shall not contain any added colouring matter, or preservatives;
- It shall be free from mould growth and living insects and practically free from dead insects, insect fragments and rodent contamination;
- It shall comply with restrictions in regard to Aflatoxins, Metallic Contaminants, Insecticide or Pesticide residue, poisonous metals, naturally occurring Contaminants, Microbial load and the like as specified by the Codex Alimentarius Commission or as per buyer's requirements for Export purposes and the Prevention of Food Adulteration Rules, 1955 for domestic trade.<sup>39</sup>

<sup>38</sup>

[http://www.karvycommodities.com/downloads/karvyspecialreports/karvyspecialreports\\_20080820\\_02.pdf](http://www.karvycommodities.com/downloads/karvyspecialreports/karvyspecialreports_20080820_02.pdf) (retrieved on 6th April 2017)

<sup>39</sup> <http://agmarknet.nic.in/spices.pdf> (retrieved on 6th April 2017)

Table 16: Grading and Designation of Coriander

Grade Designation	Quality/Special Characteristics					
	Moisture, % (m/m) (Max.)	Total ash, % (m/m) (Max.)	Acid insoluble ash, % (m/m) (Max.)	Crude fiber, % (m/m) (Max.)	Non-volatile ether extract % (m/m) (Min.)	Volatile oil % (ml/100gm) (Min.)
Special	9	6.5	1	25	15	0.1
Standard	10	7	1.5	28	12	0.05

(Source: <http://agmarknet.nic.in/spices.pdf> (retrieved on 6th April 2017))

- Coriander Powder shall be obtained by grinding clean, sound, dried and mature fruits of *Coriandrum sativum* L;
- It shall be ground to such fineness that it shall pass completely through a 500-micron sieve. However, for standard grade, 95% of it should pass through 1000-micron sieve;
- It shall have a typical aroma and flavour characteristic of the spice and shall be free from musty odour;
- It shall not contain any added colouring matter, preservatives or any foreign matter;
- It shall be free from living insects and practically free from moulds, dead insects, insect fragments and rodent contamination;
- It shall comply with restrictions in regard to Aflatoxins, Metallic Contaminants, Insecticide or Pesticide residue, poisonous metals, naturally occurring Contaminants, Microbial load and the like as specified by the Codex Alimentarius Commission or as per buyers requirements for Export purposes and the Prevention of Food Adulteration Rules, 1955 for domestic trade.<sup>40</sup>

### 3.3. Major storage Disease and Pest and their Control Measure

Coriander is well dried 10% moisture and stored in cool and dry place. Seeds are sun dried on clean tarpaulins, seeds of weed and other foreign matter is cleaned and clean material is packed in gunny bags to be stored at room temperature. Coriander is very little affected by pest and diseases in storage, however there is chance of decomposing is moisture content in stored material is more than 10%.

<sup>40</sup> <http://agmarknet.nic.in/spices.pdf> (retrieved on 6th April 2017)

## Chapter 4- Cost of production and Net value accruals to producers

Following is an illustration of a typical farmer in Kota. Of about 4.6 ha of his land holding, about 1.84 ha is deployed towards coriander production. The gross yield of coriander seeds is about 1.25 ton per ha. The market rate of the seeds is about Rs. 50000 per ton or Rs. 50 per kg or Rs. 43, 750 per ha. The cost of cultivation is about Rs. 43750 per ha. Net realization (from sales of grains) per ha is about Rs. 27,550 per ha. Out of this about Rs. 5000 is cost of land preparation, seed cost is about Rs. 2500, fertilizer, pesticide and insecticides cost is about Rs. 3750 per ha, sowing cost is about Rs. 1250, irrigation cost is Rs.3750, weeding related (labour cost) is about Rs. 10000 and harvesting cost is about Rs. 7500. Packing cost is about Rs. 750 per ha. Transportation cost to mandi is about Rs. 500 per ha- all totaling to around Rs. 35000 per ha. The fluctuation in prices of Coriander may range from 3500 (at the time of harvesting) to 6500 (during the festive season) in a year. Notably, most farmers have storage facility at their homes and hence are able to store coriander seeds and sell same during the festive season to gain higher realization. The fluctuation in yield of coriander seeds ranges from 0.5 ton to 1.25 ton per ha, depending upon irrigation, weather conditions, etc. Farmers in the district also grade seeds at home and the lower grade is sold at about Rs. 2500 per quintal. The wastage during the threshing process (which is around 5% of the total yield) is used as cattle feed. If the yield loss of about 5% is considered then the net realization per acre comes to about Rs 24375 per ha.

**Table 17: Cost of Production of coriander seeds<sup>41</sup>**

Sr. No.	Particular	Amount (in Rs. Per ha)
<b>A.</b>	<b>Income (1.25 Ton per ha @ Rs. 50000 per Ton)</b>	62500
<b>B.</b>	<b>Cost of Production</b>	
1	Land Preparation Cost	5000
2	Seed Cost	2500
3	Input Cost	3750
4	Sowing cost	1250
5	Irrigation cost	3750
6	Weeding Cost	10000
7	Harvesting Cost	7500

<sup>41</sup> \*\* Costs assumed are as per estimates given by respondents. The costs may vary in different zones, also based on cultivation practices of farmer. This particularly includes quality and type of inputs used.

8	Packing and Transportation Cost	1250
	<b>Total Cost of Production</b>	<b>35000</b>
	<b>Net Profit</b>	<b>27500</b>

## Chapter 5- Supply Chain of commodity

### 5.1. Seasonal Availability

#### 5.1.1. Seasonal Availability and Price Pattern

Seeds turn a yellowish- green after maturity when the crop is harvested and dried in the shade to retain the green colour and aroma. Plants are cut early morning to avoid breakage. Seeds are thrashed to separate seeds from the dried plant. Seeds are then cleaned using sieves and graded. Peak arrivals are seen during Mar-May with monthly arrivals exceeding 150,000 quintals at the mandi. These arrivals recede later, and the lowest arrivals are seen in August and September, with monthly arrivals below 6,000 quintals. Coriander yields about 1.5-2 Q/acre under rain-fed conditions and about 4-5 Q/acre through irrigation.<sup>42</sup>

The following table shows the monthly arrival scenario for coriander. The table shows the monthly arrivals in Bags (1 bag=40 kgs) of coriander in different districts of Rajasthan and Madhya Pradesh.

Table 18: Monthly Arrival Scenario of Coriander in rajasthan and MP<sup>43</sup>

Marke	Sept-16	Aug-16	Sept-15
Guna (MP)	51700	24100	21100
Neemuch(M)	19350	4600	27600
Kota(RJ)	47900	42200	37200
Ramganj(R)	112500	75500	128000
Baran(RJ)	41600	24500	38700
Bhawani(RJ)	15650	7550	12900
Gondal(GU)	9900	4850	5001
Market	Dec-16	Nov-16	Dec-15
Guna (MP)	56300	224	1630
Neemuch	19150	480	1345
Kota (RJ)	56400	312	5250
Ramganj	12150	673	1205
Baran (RJ)	64200	386	4345
Bhawani	12850	753	7950
Gondal	NR	100	5800

Units – Bags (1 bag = 40 kgs)

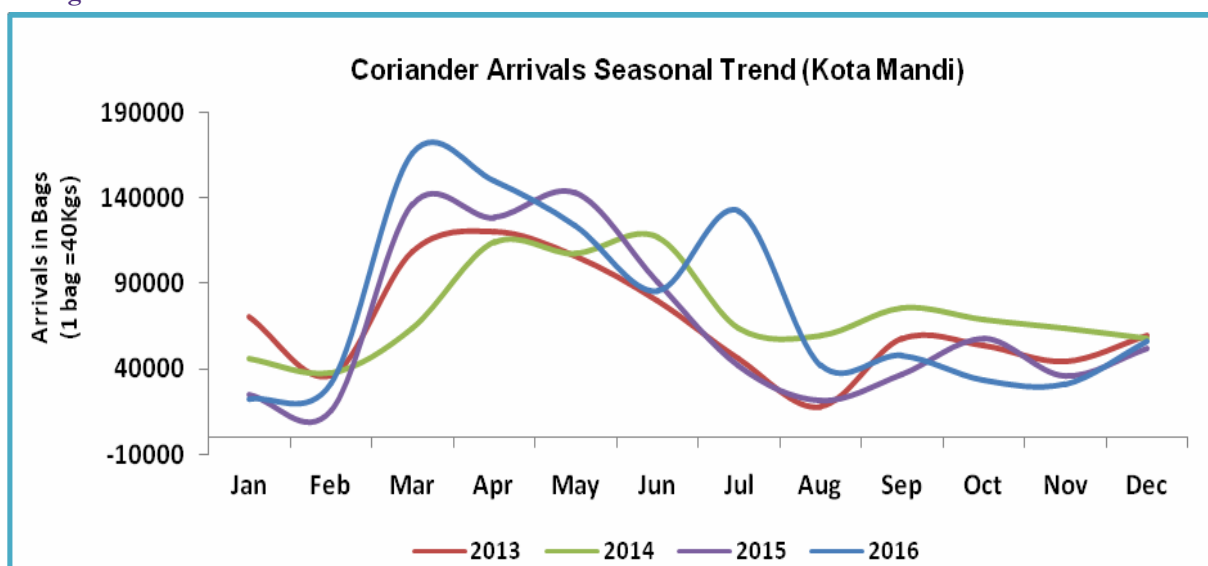
<sup>42</sup>

[http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports\\_20080820\\_02.pdf](http://www.karvycommodities.com/downloads/karvyspecialreports/karvysspecialreports_20080820_02.pdf)(retrieved on 6th April 2017)

<sup>43</sup>[http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product\\_id=200051](http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product_id=200051) (retrieved on 6th April 2017)

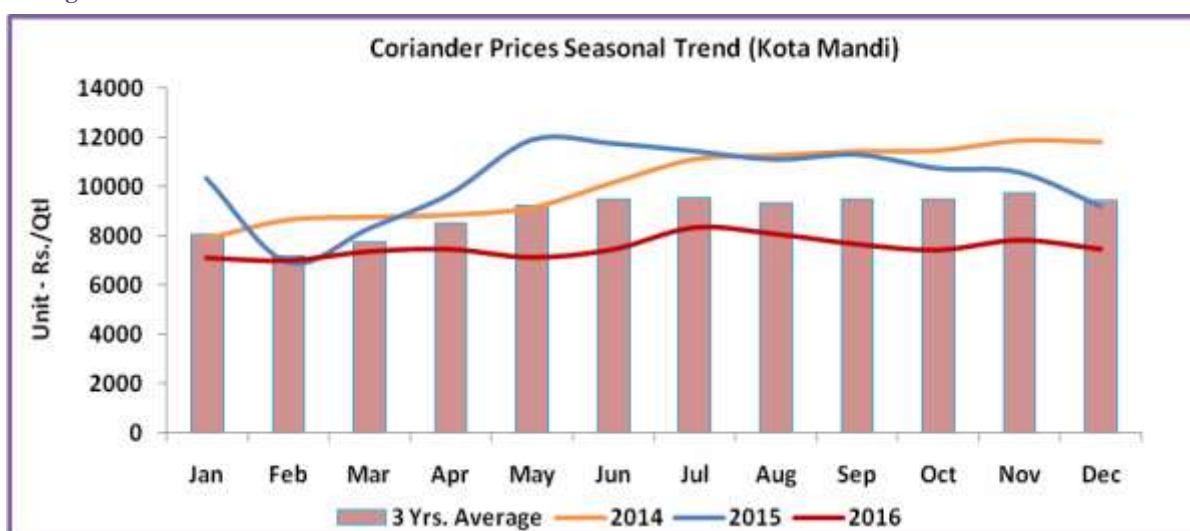
In Kota, coriander market arrivals reported up by 25,200 bags, up by 3,900 bags corresponding period last year. In Ramganj mandi, 2,097,600 bags (1 bag = 40 Kgs) arrivals traded from January till December 2016 month, however in the corresponding period last year it was reported 24,88,400 bags. Apparently, producers hope that prices will move upwards and then they shall release their produce to get higher realization.

Figure 30: Coriander Seasonal Arrival Trend in Kota Mandi<sup>44</sup>



Current year from August month Coriander supply reported radically down in Kota mandi as farmers and stockists holding back their produce at current lower price level.

Figure 31: Coriander Seasonal Price Trend in Kota Mandi<sup>45</sup>



<sup>44</sup> [http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product\\_id=200051](http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product_id=200051) (retrieved on 6th April 2017)

<sup>45</sup> [http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product\\_id=200051](http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product_id=200051) (retrieved on 6th April 2017)

Coriander prices reported down trend in year 2016, as compared to previous year owing to increase in production. Last 2 year prices traded at all-time high due to low arrivals owing to crop damage in growing regions. Coriander prices showed continuous downtrend from August month in the year 2016; with price falling from Rs.8, 100-/Q in August to Rs.7, 473/Q in December due to lower demand. Coriander Spot prices on NCDEX are also estimated to move downwards. Corianders NCDEX spot prices in December month in 2016 reported Rs. 9,192/Q. However, it is expected that Coriander NCDEX spot prices will likely move downwards Rs.7, 200 – 7,000/Q in coming days.<sup>46</sup>

### 5.1.2. Market Arrivals & Prices in Major Markets of Rajasthan

The crop in year 2014-15 was highly profitable year for Coriander traders as prices spiralled upwards from 6000/- per quintal in March 2015 and hit a high of `12700/- in May 2015. In a span of three months' people have seen Coriander prices double. Coriander prices continued to remain on the higher end throughout the year as good demand and low availability of quality stocks kept the market supported.

Coriander prices also witnessed a correction with the onset of sowing season in October 2015. Prices fell from 12000/- quintal in October 2015 and hit a low of 6400/- quintal in January 2016. Higher acreage and favourable weather conditions in the key growing regions of Rajasthan and Madhya Pradesh kept prices under pressure throughout the sowing season.<sup>47</sup>

As per report of Jaipur, Commodities Control, Jul 2016, Coriander gained by Rs 100/100kg in most market of Rajasthan on Friday amid some fresh upcountry demand and lower supplies. However, futures market exhibited weak tone. “Farmers and stockists selling is slow at present as these rates are not attractive for them and waiting for some upward movement”, said a trader from Ramganj. He said “Earlier coriander prices were mostly bearish due to strong selling from Gujarat, but they have already sold most of their stocks and now buyers have to source their requirements from Rajasthan.”<sup>48</sup>

**Table 19: Market Arrival Report for Coriander 2016**

Market	Variety	Arrivals	Min	Max
Guna	Badami	1500	6400	6500
Guna	Scooter		7000	7200
Guna	Eagle		6700	6800
Kota	Badami	1000	6200	6300
Kota	Eagle		6500	6600
Ramganj	Eagle	3000	6700	6800
Ramganj	Badami		6400	6500

<sup>46</sup> [http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product\\_id=200051](http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product_id=200051)

<sup>47</sup> [http://www.nirmalbang.com/Upload/Coriander\\_Crop\\_Survey\\_and\\_Analysis\\_2016.pdf](http://www.nirmalbang.com/Upload/Coriander_Crop_Survey_and_Analysis_2016.pdf)

<sup>48</sup> [http://www.commoditiescontrol.com/eagrtrader/common/newsdetail.php?type=MKN&itemid=408016&comid=&cid1=,2,&varietyid=,11,32,33,34,35,&varid=\(retrieved on 6th April 2017\)](http://www.commoditiescontrol.com/eagrtrader/common/newsdetail.php?type=MKN&itemid=408016&comid=&cid1=,2,&varietyid=,11,32,33,34,35,&varid=(retrieved on 6th April 2017))

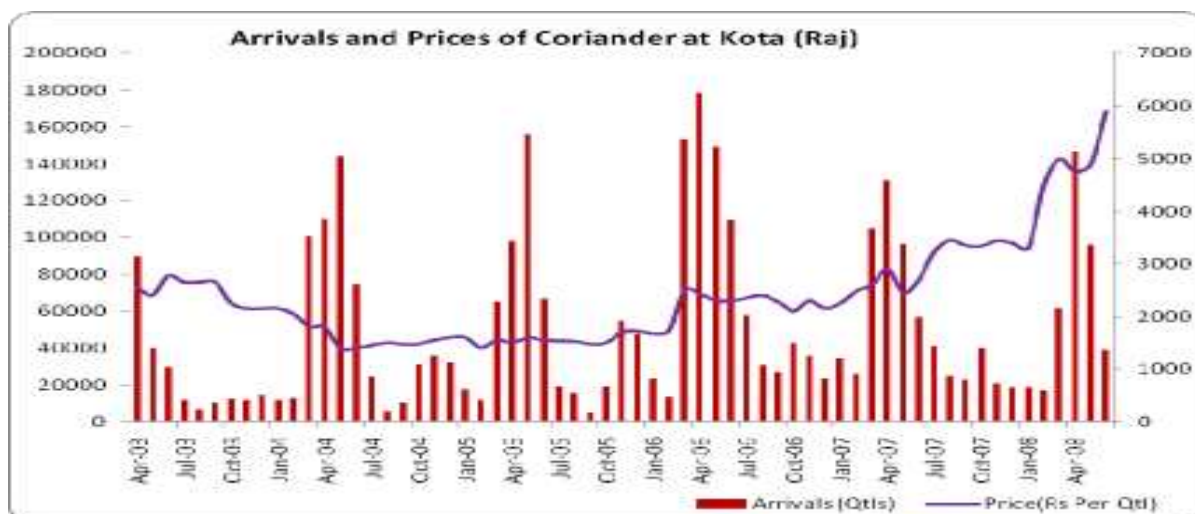
Baran	Eagle	2000	6200	6300
Baran	Badami		6500	6600
Delhi	Badami		8000	8000
Delhi	Eagle		8500	8500

Note: Arrival in Bags of 40Kg | Price in Rs/100Kg

Source: <http://www.commoditiescontrol.com/eagrtrader/common/newsdetail.php?type=MKN&itemid=408016&comid=&cid1=,2,&varietyid=,11,32,33,34,35,&varid=> (retrieved on 6th April 2017)

The monthly arrivals and prices of coriander (2003-08) at Kota, displayed in the figure (below) indicate that while arrivals are seasonal, prices have not followed the same seasonality. Prices of coriander are not perfectly seasonal, and have been gradually increasing in the last few years. Coriander prices come under slight pressure, especially during peak arrivals, and mostly stabilise during the lean season. The prices moved in the range of Rs 1,400-3,300 per quintal during March 2003 – December 2007. However, prices started to rally from January 2008 and touched an all-time high of Rs 9,500 per quintal in July. Lower crop output in Rabi 2008 and strong export demand led to a sharp rise in prices in the last 6-8 months.<sup>49</sup>

Table 20: Monthly Arrivals and Prices of Coriander in Kota



Source: APMC Kota (retrieved on 6th April 2017)

The following table shows the spot prices for coriander as per their grade specifications and the centres of trade for 3 Months period (along with the changes in the prices):

Table 21: Spot prices monthly change data

Coriander Spot Market Prices(Loose): (Rs/Q)					
Grade (New)	Centre	30-Dec-	30-Nov-	30-Dec-	Change
Badami		6500	6300	7500	3.17

<sup>49</sup>

[http://www.karvycommodities.com/downloads/karvyspecialreports/karvyspecialreports\\_20080820\\_02.pdf](http://www.karvycommodities.com/downloads/karvyspecialreports/karvyspecialreports_20080820_02.pdf) (retrieved on 6th April 2017)

<b>Eagle</b>	<b>Guna (M.P.)</b>	6500	6600	8200	<b>-1.52</b>
<b>Scooter</b>		6200	7000	10000	<b>-11.43</b>
<b>Badami</b>	<b>Neemuch (M.P.)</b>	6200	Closed	8100	-
<b>Eagle</b>		6000	Closed	8800	-
<b>Scooter</b>		6200	Closed	10000	-
<b>Eagle</b>	<b>Kota (Raj.)</b>	6500	6800	8500	<b>-4.41</b>
<b>Eagle(Split)</b>		6000	6800	8500	<b>-11.76</b>
<b>Badami</b>		6400	6500	8000	<b>-1.54</b>
<b>Badami(Split)</b>		8100	6500	8000	<b>24.62</b>
<b>Eagle(Split)</b>	<b>Ramganj (Raj.)</b>	5900	6250	8000	<b>-5.60</b>
<b>Eagle</b>		5900	6250	8000	<b>-5.60</b>
<b>Badami</b>		5800	6150	7500	<b>-5.69</b>
<b>Badami(Split)</b>		5800	6050	7500	<b>-4.13</b>
<b>Scooter</b>		6200	6850	10000	<b>-9.49</b>
<b>Eagle</b>	<b>Baran</b>	6050	6900	8100	<b>-12.32</b>
<b>Badami</b>		5850	6700	7800	<b>-12.69</b>
<b>Eagle</b>	<b>Bhawani (Raj.)</b>	6100	6600	8400	<b>-7.58</b>
<b>Badami</b>		5900	6500	8000	<b>-9.23</b>
<b>Scooter</b>		6200	6700	9000	<b>-7.46</b>
<b>Double Parrot</b>		NA	NA	NA	-
<b>Badami</b>	<b>Gondal (Guj.)</b>	NR	NR	8500	-
<b>Eagle</b>		NR	NR	8750	-

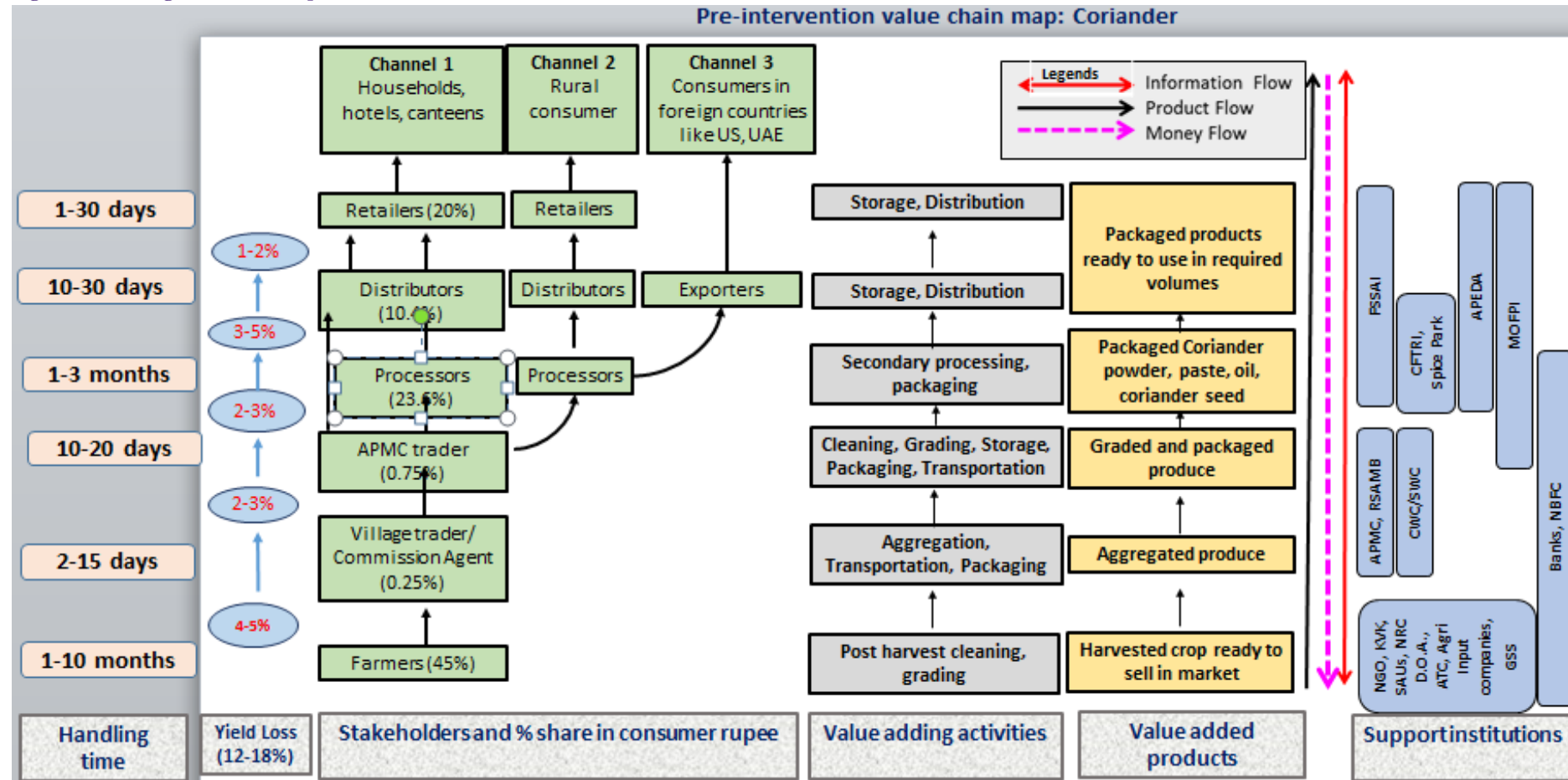
Source:

[http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product\\_id=200051](http://www.agriwatch.com/archivereports.php?freq=M&month=04&year=2017&product_id=200051) (retrieved on 6th April 2017)

## 5.2. Existing Marketing Channels

The present pre-intervention or value chain for Coriander may be viewed as one with two critical production-distribution or activity-marketing channels. The product is largely marketed by farmers through the APMC, local vendors and private food processors. Channel 1 may be viewed in terms of one for table variety and other for processed products of coriander like powder, paste, oil and puree which are consumed by urban households and institutional buyers like hotels and canteens, etc. The channel 2 is actually derived from the mandi itself where the raw coriander seeds are bought by the food processors which not only cater the local national market but also target the export to the countries like US, UAE, etc.

Figure 32: Existing value chain map of Coriander



Yield loss occurs at every stage of the existing value chain of coriander starting from post-harvest to mandi sales and processing. Such yield loss total up to a significant amount of 12-18% of the actual harvested output. The major reasons for such yield loss could be attributed to the poor storage, inefficient transportation and improper handling of the produce till mandi. At processor level, higher percentage of the yield loss occurs due to the use of obsolete technologies which end up giving lower yield. Also the holding time at every stage of stakeholder has been mapped such as farmers, despite lacking adequate storage facilities, have the tendency of holding the harvested coriander from 1-10 months.

### **5.3. Alternative Systems of Marketing**

#### **5.3.1. Direct Marketing**

There is no denying the fact that direct marketing encourages farmers to undertaken grading of farm produce at the farm gate and obviates the necessity to haul produce to regulated market for sale. Direct marketing enables farmers and processors and other bulk buyers to economize on transportation cost and to considerably improve price realization. In South Korea, for instance, as a consequence of expansion of direct marketing of agricultural products, consumer prices declined by 20 to 30 % and producer-received prices rose by 10 to 20 %. This also provided incentive to large scale marketing companies to increase their purchases directly from producing areas.

Direct marketing enables farmers to meet the specific requirements of wholesalers from the farmers' inventory of graded produce and of retail consumers based on consumers' preferences, thus enabling farmers to dynamically take advantage of favourable prices and improve their net margin. Direct marketing thus enables farmers and buyers to economize on transportation costs and to improve price realization considerably.

The promotion of direct marketing is suggested as one of the alternative marketing structure that sustains incentives for quality and enhanced productivity, reduce distribution losses, improving farmer incomes with improved technology support and methods. The market will operate outside the purview of the Agricultural Produce Marketing Act and will be owned by professional agencies in private sector, wholesalers, trade associations and other investors. The government's role should be that of a facilitator rather than that of having control over the management of the markets.

Direct Marketing by farmers to the consumers was experimented in Punjab and Haryana with certain improvements. The concepts also got popularized in A.P & in Tamil Nadu. Considering, the vastness of the country, more and more such markets need to come up in organized sector with private investment so that they can be developed in tune with market requirements with backward and forward linkages. This call for preparation of common code of conduct and modalities with regard to ownership, operation and need based infrastructure and the same to be circulated widely to spread the concept of direct marketing by the farmers.

#### **5.3.2. Contract Farming**

It is significant to note that Indian agriculture is not akin to Agri-business that is prevalent in US or Europe. It is a way of life in India. As a matter of fact, private sector participation in Indian Agriculture is imperative so as to provide much needed impetus for growth. Viewed in this context, contract farming in India is essential so as to promote rural self-reliance in general by pooling local available resources and expertise to meet new

challenges. It will also reduce migrations from rural to urban areas and reduce load of procurement. It will promote processing and value addition.

Challenges in implementing contract farming are many as success stories in a classical mould are few. However, one cannot deny the accomplishments of a range of Indian contract farming models in India viz. Amul, NDDDB, the Maharashtra sugarcane co-ops, the rapid spread of poultry projects etc. In fact, true success and rapid spread will come with deep seated changes in mindset and policy reform.

There is, therefore, need to enact laws of contract farming to facilitate activity between corporate and farmers. This is needed along with strengthening the overall legal framework concerning agriculture. In general, the land holdings have gone down and the challenge for the nation lies in deriving direct benefit from R & D, scientific and technological innovations and knowledge infrastructure created by agriculture scientists and corporate houses for 2 acres of land. Diversification in agriculture to fisheries, horticulture, poultry are very important and hence participation of private sector is crucial. It is envisaged that private participation would create better technologies and improve marketability of agricultural produce.

**In order to encourage this activity, Govt. fiscal support is a must as mentioned below.**

- Food processors involved in contract farming should be exempted from all taxes.
- However, they should be encouraged and induced to invest in lieu in rural infrastructure and farmer's upliftment to the extent of tax exempted.
- No taxes or duties on import of agriculture equipment should be levied.
- Abolish all fees, taxes, cess, duties, levy on procurement effected by a registered contract farming programme.

In order to ensure success of the concept not only contract farming be made legal with adequate institutional arrangement with forward & backward linkages to enable small farmers to participate in it. The contracts should be transparent & participatory and adequate bank finance for small and marginal farmers should be ensured. There should be contract farmer's associations or cooperatives to safe guard their interest which should ensure sustainability of contract & higher income to farmers on stable basis. Above all, strong & adequate infrastructural facilities be provided to farmers and land use planning be suitably taken care of. Last but not the least; it may be stressed that the contract farming could prove counterproductive, unless organized markets exist. In any case the contract farming approach has considerable potential in the light of preponderance of small and marginal farmers who can no longer be competitive without access to modern technology & support.

### **5.3.3. Development of Mega Market**

An efficient agricultural marketing is essential for the development of the agricultural sector, as it provides outlets and incentives for increased production. A well-developed marketing system contributes greatly to the commercialization of subsistence farmers. Worldwide, Government have recognized the importance of liberalizing agricultural markets. Government's policy has to effectively address issues of marketing and help to overcome the constraints faced by various organizations including private sector involved

in agri-marketing. The ever increasing production, spread of latest technologies, changing socio-economic environment, increasing demand for downsizing the distribution chain and reducing the margin between farmers and ultimate consumers as well as challenges emerging out of liberalization and globalization in the post WTO period requires a vibrant, dynamic and assimilative marketing structure and system.

In this context, it may be emphasized that on account of green revolution and other research in agricultural field, the agricultural production in the country has increased manifold and will continue to do so in the years ahead. There is therefore all the more need and justification for development of modern competitive marketing in the form of "Mega Markets" so that with the provision of scientific storage, infrastructure facilities, remunerative price for products could be ensured to the farmers. Thus production cost could be reduced, losses could be minimized and exports could be augmented. Given the comprehensive ultramodern marketing facilities for agricultural produce, the new concept of mega market can revolutionize the entire marketing system and give benefit of value addition to farmers.

It is significant to note that over Rs. 50,000 crores of agricultural produce are being currently wasted which is six times, that of the annual food subsidy of the nation. Besides agri-processing sector has an employment elasticity of two to four times more than that of the manufacturing sector. It is therefore necessary to encourage and facilitate the industry to enter into direct contract with the farmers for the procurement of their raw material by taking measures on the following lines.

## Chapter 6- Processing Infrastructure availability and utilization

### 6.1. Processing

#### 1. Spices – Powder

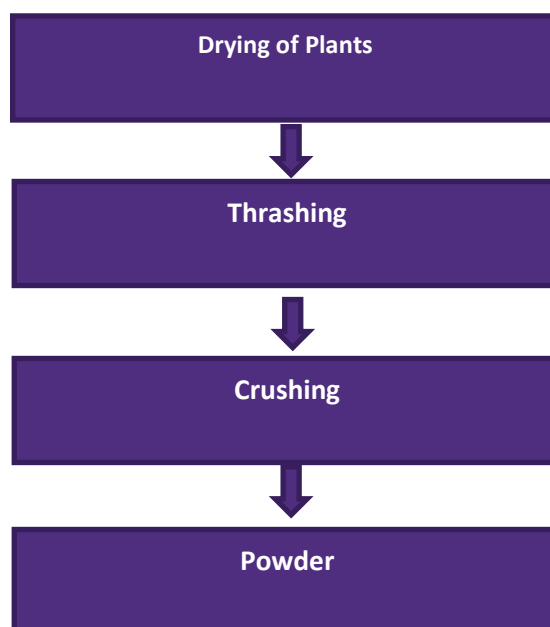


Figure 33: Process flowchart of coriander powder

Harvested plants are dried in the sunlight for 1-2 days to bring the moisture levels down to 18%. This dried plant is then thrashed to remove the seeds. Seeds are further dried in the shade to bring the moisture levels down to 9%. Coriander seed is mainly processed into powder by crushing, and this powder, which enjoys an aroma, is used as a food ingredient. The cleaning process involves separation of whole seeds, splits, and other wastages. To separate these, different hole-size sieves are used in the process. This process involves various costs, including machines, labour, power, etc. A coriander processor in the Kota / Ramganj mandi incurs approximately Rs15-16 per kg above his buying price in the mandi. These costs include commission (3%), mandi cess (1.6%), VAT, labour, cleaning charges, etc. Although coriander seeds are consumed in an unprocessed form; however, its good quantity is also being processed to facilitate the international trade profitability and palatability.

## 2. Vinegar

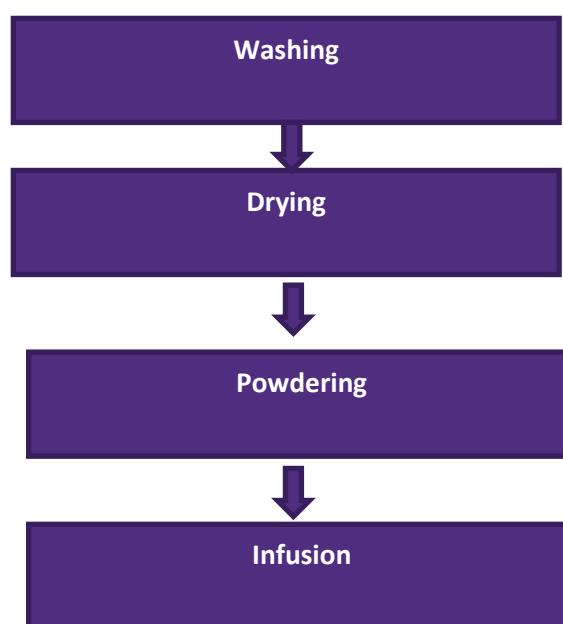


Figure 34: Process flowchart of coriander - vinegar

Coriander leaves after drying may be stored as whole or infused to make delicious vinegar. After harvesting, leaves are properly washed and kept in shade for drying. Drying is followed by powdering in disintegrator and micro pulverizer. Its ground powder is used as a spice in blends. Ground coriander spice loses flavour quickly when stored. This disintegrated product is then standardized, packed and finally distributed. Drying is carried out by number of ways like sun drying, microwave drying, freeze drying etc. Mainly drying depends on air temperature, greater the air temperature much faster drying will be accomplished. One of the important aspects during drying or thermal processing of its leaves is the loss of chlorophyll content. The most common change that occurs in green vegetables during thermal processing is the conversion of chlorophyll to pheophytins, causing a colour change from bright green to olive-brown, which is undesirable to the consumer. Blanching prior to drying can greatly reduce chlorophyll loss. Loss of chlorophyll content of its foliage can also be prevented by opting microwave drying instead of sun drying. It was found that microwave-dried samples had higher chlorophyll content and the green color was preserved better than for the air-dried and freeze-dried samples (Alibas, 2006). This is because microwave drying of coriander is faster than other conventional drying methods which are gradual and slow to reach the final moisture content. Microwave drying is able to reduce the coriander moisture content to the 12% (wb) target within 21 to 22 min (Shaw et al., 2007).

### 3. Essential Oil

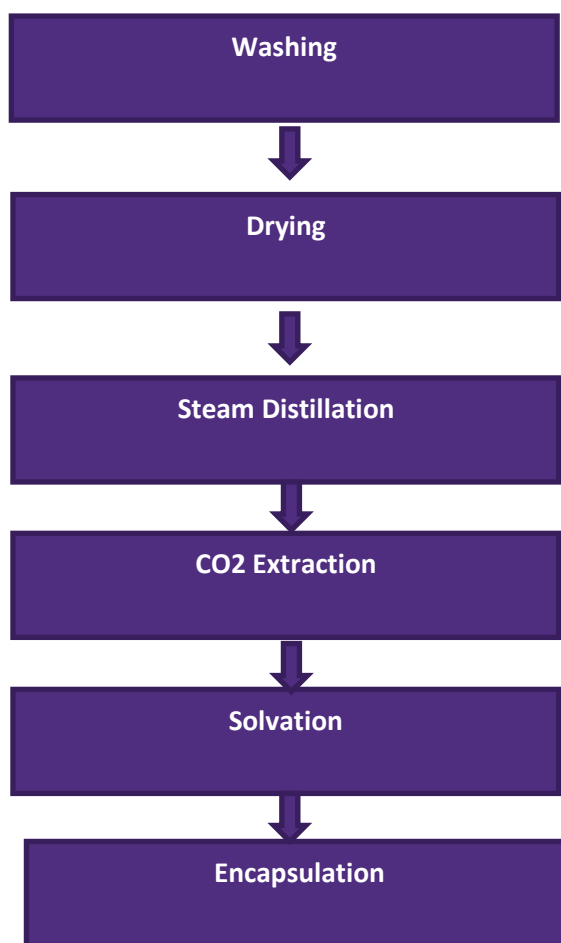


Figure 35: Process flowchart of coriander oil

Seeds, which contain 0.1-1.5% of oils, are also used to extract essential oils. This oil is mainly obtained by steam distillation, super critical CO<sub>2</sub> extraction etc. Oil extraction from its seeds was studied with carbon dioxide and propane as solvents, under sub and supercritical conditions. The ratio of solvent to seed (g/g) required to achieve a complete oil extraction was between 20 and 40 using CO<sub>2</sub> at pressures of 200 and 300 bar and temperature of 35°C. A complete oil recovery was attained with propane or propane-rich solvents at 25°C and 50, 80 and 100 bar. The solvating power of propane and propane-containing solvents was proved to be much higher than that of CO<sub>2</sub> (Illes et al., 2000).

Coriander oil has a characteristic odour of linalool and warm aromatic flavour. This oil is approved for food use by FDA (Food and Drug Administration), FEMA (Foreign Exchange Management Act) and Council of Europe (Silva et al., 2011). In order to preserve the warm aromatic flavour and prevent nutrient loss upto end use, this oil is encapsulated mainly in alginates or chitosans. The aqueous solution of sodium alginate is transformed in gel under the action of calcium ions which form the intermolecular cross-links with the carboxyl groups of guluronate, leading to the well-known “egg-box” structure providing best possible protection to coriander essential oils. The coriander plant is mainly used for making sauces and salsas; on the other hand the fruits are blended into powder for flavouring various products like meat, fish, sodas, pickles, bakery and curry recipes (Ravi et al., 2007).

#### 4. Coriander Puree and Paste

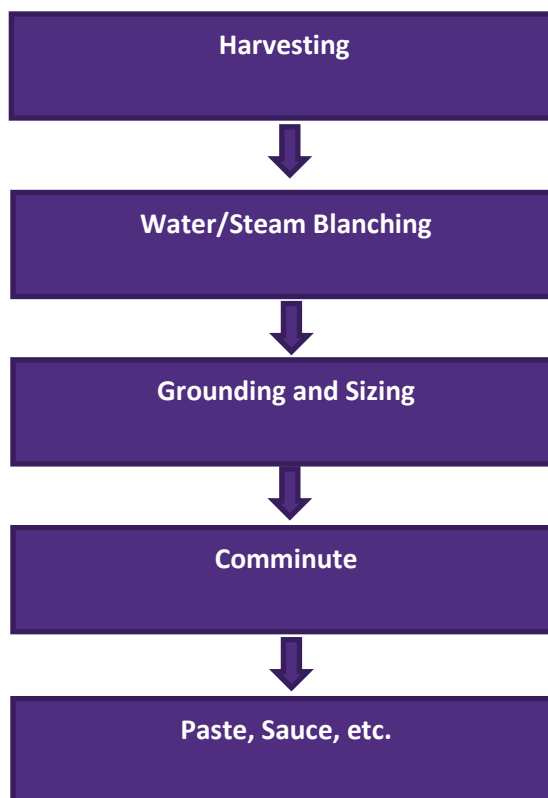


Figure 36: Process flowchart of coriander puree and paste

Coriander leaves may also be processed to form various products like purees and pastes which are tremendously used nowadays in fast food industries. After harvesting of fresh mature plant, degradation of its components starts. Such degradations may be prevented by processing and converting harvested leaves into product formulation like purees, pastes, sauces salsas etc. Coriander sauce gives an intense flavour and deep green colour but is not spicy. In case of powder formation, freshly harvested leaves are blanched at 90°C for at least 2 min so as to inactivate peroxidase enzyme, dried and then ground to uniform size and preserved for further use (Ahmed et al., 2003). Fresh coriander leaves are steam- and water-blانched at 100°C and at 90 and 100°C, respectively, for one to ten minutes and subsequently comminute to form a paste. Pasty products obtained from coriander fruits were processed after water-blانching applying the same time- temperature regimes.

Among the eleven phenolic characterized in leaves by high-performance liquid chromatography coupled to mass spectrometric detection, several caffeic acid derivatives, 5-feruloylquinic and 5-p- coumaroylquinic acids were tentatively identified. In fruits, ten phenolics were detected, whereas rutin, a dicaffeic acid derivative and two feruloylquinic and caffeoylquinic acid isomers were newly detected. Upon steam- blانching for one minute, phenolic contents and anti- oxidant capacities remained virtually unchanged. In contrast, water-blانching and extended steam-blانching even yielded increased levels compared to the unheated control, whereas short-time water-blانching resulted in higher values than prolonged heat treatment. Thus, short- time water-blانching was recommended

as the initial unit in the processing of coriander leaves and fruits into novel pasty products (Kaiser et al., 2013).<sup>50</sup>

## 6.2. Price build up & Marketing Efficiency Analysis

The price spread and values accrued to stakeholders across the chain reflects the profit margins accrued to different stakeholders. Much of the value accruals are accrued to processors and retailers. Producers' incomes are apparently dependent on yield as well as their dependency on the type of end product. (eg. Spices, puree, paste, oil etc.). Here in the existing value chain of coriander, the price build up has been calculated for first channel where the target consumers are the urban households and institutional buyers like hotels, canteens. The product is coriander powder.

The farmers sold the raw coriander at about Rs 5000 per quintal to the traders as per the price last season of coriander. In the local mandis, it was sold by traders to the processors at Rs 5150 per quintal (gross margin 3%). The processors, upon primary and secondary value addition, sold it to the wholesalers at Rs 7725 (gross margin 50%). There upon the wholesale and retail prices are set up at Rs 8884 per quintal and Rs 11105 per quintal with a gross margin of 15% and 25% respectively. Due to limited infrastructure facilities at the dispersal of various stakeholders, marketing efficiency is adversely affected.

## 6.3. Stakeholder's Share in Consumer Rupee

The price spread along with margin at every stage of value chain starting from the farmer till retailer is shown in the table given below.

**Table 22: Price spread table and stakeholder's share in consumer rupee**

Activity	Value per Quintal (Rs.)	Stakeholder's share in Consumer's Rupee (%)
Retailing: Sale by retailer to consumer	About Rs. 11105 per quintal which makes a profit margin of 25%	Retailers 20%
Wholesaling: Sale by wholesalers to retailers	Rs. 8,884 per quintal with a margin of 15%	Wholesalers 10.4%
Processing: Sale after processing to wholesalers	Rs. 7725 per quintal (Gross value on sale with gross profit margin in processing 50%)	Processors 23.2%
APMC: Sale upon trading at the mandi	Rs. 5,150 per quintal (Gross value on sale with gross profit margin of 3% from Mandi)	Traders 1.4%
Production: Cost of production is Rs. 35,000 per ha	Gross value on procurement at Rs. 5000 per quintal (seeds)	Farmers 45%

The existence of a long chain of middle men including the APMC and related commission agents, producers share in consumers' rupee is adversely affected. This mirrors the need for promotion of contract farming options eliminating/minimising the role of the APMC. However, the limitations in contract farming policy & statutes merit correction.

## 6.4. Consumer preference Analysis

The market segmentation of the cluster level coriander consuming population could be done based upon the geographical differences in the clusters of RACP project- rural, rural and urban as well as the taste preferences of these households.

<sup>50</sup> Department of Food Engineering and Technology, Sant Longowal Institute of Engineering and Technology, (Deemed to be University), Longowal-148106, Distt. Sangrur (Punjab), India (retrieved on 6th April 2017)

Rajasthan population in rural and semi urban areas prefer freshly grinded coriander powder. In urban areas branded coriander powder is more preferred. Major brands in the market are namely MDH, Catch, Everest etc. Best quality coriander whole seeds (double parrot, single parrot, scooter variety, eagle variety) have great demand in export market and are exported to US, Europe and Gulf countries.

## Chapter 7- Existing Institutional support and Infrastructure facility

### 7.1. Support at cultivation stage

1. **KVK-** Application of technology/products through assessment, refinement and demonstration for adoption. To achieve the mandate effectively, the following activities are envisaged for each KVK:
  - On-farm testing to identify the location specificity of agricultural technologies under various farming systems.
  - Frontline demonstrations to establish its production potentials on the farmers' fields.
  - Training of farmers and extension personnel to update their knowledge and skills in modern agricultural technologies.
  - Work as resource and knowledge centre of agricultural technologies for supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district.
  - Produce and make available technological products like seed, planting material, bio agents, young ones of livestock etc. to the farmers

Organize extension activities to create awareness about improved agricultural technologies to facilitate fast diffusion and adoption of technologies in agriculture and allied sectors.<sup>51</sup>

#### **Krishi Vigyan Kendras(KVKs) Kota, Bundi, Baran and Jhalawar**

To realize their true potential, farmers must have access to the state-of-the-art technologies, necessary inputs and related information. In this context, the Government of India through Indian Council for Agricultural Research (ICAR) has established a large network of over 600 Krishi Vigyan Kendras (KVKs) across the country with an aim to conduct technology assessment and refinement, knowledge dissemination and provide critical input support for the farmers with a multidisciplinary approach.

Krishi Vigyan Kendras (Farm Science Centre), an innovative science based institutions, were established mainly to impart vocational training to the farmers and field level extension workers. The concept of vocational training in agriculture through KVK grew substantially due to greater demand for improved agricultural technology by the farmers. They not only required knowledge and understanding of the intricacy of technologies, but also

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<sup>51</sup> [http://agritech.tnau.ac.in/kvk/kvk\\_intro.html](http://agritech.tnau.ac.in/kvk/kvk_intro.html)(retrieved on 6th April 2017)

progressively more and more skills in various complex agricultural operations for adoption on their farms. The effectiveness of the KVK was further enhanced by adding the activities related to on-farm testing and Front-Line Demonstration on major agricultural technologies in order to make the training of farmers' location specific, need based and resource-oriented.

KVKs are playing a proactive role in transferring new technology at field level with beneficial impacts. They have an edge in technology transfer over other service providers by virtue of their having better technical expertise and demonstration units.

## 2. India Meteorological Department

The service is provided by the India Meteorological Department, under the Ministry of Earth Sciences of Government of India. The IMD has set up nine agromet field units (AMFU) in the state. After these units get the forecast, they prepare agro advisory with the help of experts. This advisory is sent to IMD where the bulletin is composed and then disseminated to farmers through SMS, radio, newspapers and other means.

## 3. National Research Centre Seed Spices, Ajmer

The Indian Council of Agricultural Research established the National Research Centre on Seed Spices at Ajmer during the IX Five-Year-Plan to initiate research work on seed spices especially aimed to improve the productivity and quality with reference to domestic demand and export and value. The centre came into existence on 22 of April, 2000. A number of technologies including varieties, precision nutrient and water management through drip irrigation, protected cultivation, plant protection and post-harvest handling & processing etc. have been developed at NRCSS for improving the production and quality of seed spices. NRCSS has more than 30 collaborations with various institutes around country and working dedicatedly for betterment of seed spices production in India and its stakeholders.

## 4. Rajasthan State Seeds Corporation

Rajasthan State Seeds Corporation Ltd. (RSSCL) was established under National Seed Project in 28 March 1978 under Indian companies act 1956. The total share capital of the company in Rs. 758.28 lacs out of which Government of Rajasthan holds 84% shares, National seed corporation ltd. holds 14% shares and balance 2% is held by Seed grower farmers of the state. RSSCL has 22 processing units whose seed processing capacity is 16.09 lacs Qs. per year and storage capacity is 8.26 lac Qs.

RSSC seed distribution centers for Coriander seeds are as follows:

Area manager office	Chittorgarh	Durgapura	Mandore	Kota	Bharatpur	Shriganganagar
Branches	Udaipur	Durgapura	Mandore	Kota	Bharatpur	Shriganganagar
	Bhilwara	Tabiji	Sumerpur	Baran	Hindaun	Hanumangarh
	Chittorgarh	Duni	Mohangra h	Jhalawa r	Alwar	Srikanarpur
	Banswara		Nagore			Suratgarh

### Seed Marketing

The major coriander seeds sold by Rajseeds are RCR-436, RCR-480.

Rajseeds has a vast marketing network with co-operatives of the state through RAJFED and no of committed and authorized dealers at almost every important market place of the state. During

Rabi and Kharif seasons Rajseeds are made available at the door steps of the farmers through Beej raths operating at almost every panchayat samitee of the state.

The discount structure for the co-operative and private dealers is as below

- Turnover upto 10 Lacs per annum @10%
- Turnover between 10-25 lacs p.a. @11% from zero
- Turnover between 25-50 lacs p.a. @ 12% on incremental sale
- Turnover between 50-100 lacs p.a. @ 13% on incremental sale
- Turnover between 100-150 lacs p.a. @ 13.5% on incremental sale
- Turnover between 150-200 lacs p.a. @ 14% on incremental sale
- Turnover between 200-250 lacs p.a. @ 14.5% on incremental sale
- Turnover above 250 lacs p. a. @ 15% on incremental sale

#### 5. Department of agriculture, Govt. of Rajasthan:

Established in the year 1949 and expanded in the year 1952. Apart from the production of agricultural commodities in agriculture, the Department of Animal Husbandry is separated from the Agriculture Department. The department was established in 1949. Reconstituted in the year 1955 and the structure of the department came into being at a clause level. Extension is done by the agricultural supervisors working in Panchayat Samitis at the field level. To develop the technology, specialty cell such as botanicals, plant diseases, pest science, science science, chemistry, agricultural statistics etc. were formed and centers and laboratories established at the regional level were established.

#### Horticulture Research Station in Rajasthan:-

- Central Institute of Arid Horticulture, Bikaner.
- Fruit Farmers and Research Centre, Sri Ganganagar, ( S K Rajasthan Agricultural University, Bikaner).
- National Research Centre for Seed Spices, Tabiji, Ajmer.
- National Horticulture Research Development Federations Kishangarh Bas, Alwar.

#### Rajhans Nurseries:

##### Ganeshpura Dausa: Seeds Availability:

Sr. No	Seed Name	Seed Variety	Spices Sowing Area (ha)	Total Production (Qs)	Availability of Seeds (Qs)
2.	Dhania	401	402	403	404

#### ATC Nursery Chittorgarh

ATC Nanta, Kota: 0744-2370849, Dy.Dir.Hort.COE,Kota

#### State Agriculture Marketing Profile:

The Vision of the Department of Agricultural Marketing is to establish agricultural markets in the state and regulate buying and selling process of agriculture commodities. The Department ensures competitive price to the farming community who are left behind in the competitive marketing scenario. To achieve competitive price, effective enforcement of existing act and rules and implementation of new technologies remains always in top priorities of the department. Agricultural Marketing infrastructure plays a pivotal role in fostering and sustaining the tempo for economic development of farmers.

The department has 10 divisions to administer development process of agriculture marketing in the state. There are 136 Agriculture Produce Market Committees to regulate functioning of 136 main market yards and 311 sub market yards. Agricultural Commodities like cereals, millets, pulses, oilseeds, cotton, small forest produce, etc. have been notified for regulation in the state.

RAJEEV GANDHI KRASHAK SATHI SAHAYTA YOJANA gives financial assistance of Rs. Two lakh to the dependent of farmer in case of death of farmer by accident during agriculture operation.

Agmark grading is undertaken through eight AGMARK laboratories to protect the consumers from the ill effects of adulteration. Agmark Grading Laboratories are engaged in grading the notified food products like vegetable oils, ghee, butter, honey, wheat flour, besan flour, ground spices etc. Test oil percent in Mustard ten oil testing laboratories are in operation under various APMCs.

To ensure easy stay of farmers, KISHAN BHAWAN at seven divisional headquarters and 26 at district headquarters are in operation.

Scheme for establishment of Agri trade Towers to provide office space for purchaser of Agriculture produce has been initiated in Sriganganagar, Kota, Khairthal and Jaipur. Objective of the scheme is to ensure increased level of competition for purchase of agriculture produce.

To minimize post-harvest losses of agricultural produce, especially fruits and vegetables, four big pack house, five small pack houses and seven cold storage are in operation through RSAMB and APMCs. 97 units of cold storage, warehouses, grading and sorting, dehydration, cattle feed etc. are in implementation under AGRI PROCESSING AND AGRI BUSINESS POLICY 2010

Market Reforms:

**Consumer Farmer:**

- Any person can develop and operate a consumer-Farmer market in market area of any of the APMC of the State.
- One must have a minimum of 2 hectares of land to set up this type of market and shall be allowed to levy market service charges for the services.

**Direct Purchase**

To reduce the number of market intermediaries' processors, exporters, traders of specific commodity or for value addition, direct purchase from the farmers without going to the market yards has been allowed under section 14(2). Licence is to be issued by concerning APMC under whose jurisdiction the business place covered.

**Contract Farming**

Contract farming of desired variety in required quantity as per buyer's/processor's need, has been allowed. Buyer/processor will supply inputs and technical know-how and farmer will produce the crop for sale to him at an agreed price. This price shall not be lower than minimum support price and title of land shall remain with farmer. Produce will be purchased at buyer/processor's business/factory place.

**Establishment of Private Sub E-market**

To provide an alternative marketing channel without compulsion of selling in local market and bringing together the prospective buyers and seller on digital platform private sector has been allowed to establish e-sub market yard under section 5-A of APMC Act. This shall facilitate a wider choice of business decisions.

**Special Licence**

Special Licence for more than one market area

To provide direct access to traders and processors, provision for special licence (unified or single licence) for undertaking procurement in entire State, has been made under section 14-A. By getting this licence, any buyer can establish purchase centres in market area of any of the APMC of the State and can purchase notified agricultural commodities from farmers directly.

## **7.2. Support at post-harvest, primary and secondary processing stage**

### **Central Warehousing Corporation (CWC)**

CWC was established during 1957. It is the largest public warehouse operator in the country. Apart from storage, CWC also offers services in the area of clearing and forwarding, handling and transportation, distribution, disinfestation, fumigation and other ancillary services like safety and security, insurance, standardization and documentation. The CWC has also introduced a scheme, called the Farmers' Extension Service at selected centres to educate farmers about the benefits of a scientific storage. The CWC is also operating custom bonded warehouses. These bonded warehouses are specially constructed at a seaport or airport and accept imported commodities for storage till the payment of customs duties by the importer of the commodities.

The Central Warehousing Corporation (CWC) is the largest public sector warehouse operator with the Godown established in almost all the states of the country. At present, CWC have already established and operating more than 450 warehouses with a capacity of 93.25 lakh ton (as on 29/02/2004). These are scientifically constructed warehouses which facilitate the farmers to store their produce safely and to derive the benefit of pledge finance during the period of glut situation in the markets. (Refer Annexure 2)

### **State Warehousing Corporations (SWC)**

Different states have set up their own warehouses in the country. The area of operation of the State Warehousing Corporations is district places of the state. The SWCs are under the dual control of the State Government and the CWC. State Warehousing Corporations (SWCs) were established in different states under the purview of concerned state governments and constructed godown at distant places. The SWCs also provides storage facilities for wheat. (Refer Annexure 3)

### **Co-operatives**

The Co-operative storage facilities are provided to the producer at cheaper rates, which reduces the storage cost. These co-operatives also provide pledge loan against the produce and storage is more systematic and scientific than traditional storage. Financial assistance and subsidies are provided by Government organisations/banks to build cooperative storage. To meet the increasing need for storage capacity, the National Cooperative Development Corporation (NCDC) encourages construction of storage facilities by co-operatives, particularly at rural and market level.

### **Pledge Finance system**

The farmers are often compelled to sell their produce immediately after harvest, when the prices are low. Micro level studies indicate that distress sale by the small farmers account for about 50% of the marketable surplus. To avoid such distress sale, Government of India, promoted Pledge Finance Scheme through a network of rural godown and negotiable warehouse receipt system. Through this scheme, small and marginal farmers can get immediate financial support to meet their requirements and retain the produce till they get remunerative price.

According to the RBI guidelines, loan/advances up to 75 percent of the value of the produce stored in the godown can be given as advance to the farmers against pledge/hypothecation of agricultural produce (including warehouse receipts) subject to a ceiling of Rs. 5 lakh per borrower.

Such loan is given for a period of 6 months, which can be extended up to 12 months based on financing banks commercial judgement. The commercial banks/co-operative banks/RRBs provide credit to the farmers for the produce stored in the godown under this scheme. The banking institutions accept the godown receipts on its being duly endorsed and delivered to bank for pledge loan against hypothecation of produce as per RBI guidelines. Farmers are given freedom to take back their produce once the pledge loan is repaid. Facility of pledge finance is extended to all farmers, whether they are the borrowing members of Primary Agricultural Credit Societies (PACS) or not and the District Central Cooperative Banks (DCCBs) can directly finance individual farmers on the strength of the pledge.

#### **Benefits of Pledge finance scheme**

- This increases the retention capacity of small farmers, which consequently also enable farmers to avoid distress sale.
- This minimises farmer's dependency on commission agents as the pledge finance provides financial support to them immediately after harvest period.
- Participation of farmers, irrespective of their land holding size, increases the arrivals in market yard throughout the year.
- This gives a sense of security to the farmers even if their produce is not sold out in the market yard immediately.

#### **APEDA**

APEDA is majorly responsible for development of industries relating to the scheduled products for export by way of providing financial assistance or otherwise for undertaking surveys and feasibility studies, participation in enquiry capital through joint ventures and other reliefs and subsidy schemes. It is also responsible for registration of persons as exporters of the scheduled products on payment of such fees as may be prescribed along with fixing of standards and specifications for the scheduled products for the purpose of exports.

#### **Spice Park, Jodhpur & Kota**

The Spices Park at Jodhpur & Kota, Rajasthan is aimed at setting up of infrastructure and processing facilities for Seed Spices like Coriander and Fenugreek. Other seed spices like cumin and fennel can also be processed in this park. The Regional crop specific Spices Park is a well-conceived approach to have an integrated operation for cultivation, post harvesting, processing for value addition, packaging, storage and exports of spices and spice products. The Spices Park will ensure a better pricing for the produce by eliminating intermediaries from the supply chain system currently followed locally for trading of spices. The facilities available in the Spices Park can be utilized by the farming community for selling their produce directly to the exporters by improving the quality of the products. Hence, the farmer community will get premium price for their produce. Following facilities are provided for coriander processing and storage-

**Warehousing Facilities:** 6 Warehouses are established for storing both the raw materials and finished products of coriander. The details of the warehousing facilities available are as follows:

- Raw Material warehouse : Two raw material Warehouse established exclusively for Coriander having area of 700 sq. meters each
- Raw Material Warehouse: Two raw materials Warehouse for Seed Spices other than coriander having area of 800 sq. meters each.
- Finished Warehouse: Two finished product Warehouse for Seed Spices Other than Coriander having an area of 800. Sq. Meters each

**Processing facilities for Seed Spices:** A full line processing facility for Seed Spices is established in the Park. The capacity of the processing plant installed is of 2 Tons per hour. The facilities included are Pre-cleaning, Grading, Colour sorting, Grinding and Packing etc. The packing facility included in the processing line provide both bulk and consumer pack of 25 gm, 50gm & 100 gm. Major Machinery involved in the process are Precision Air Classifier, Screen Grader, Gravity Separator, Pressure and Vacuum De-stoner, De-bader, Metal detector, Colour Sorter, Roaster, Grinding System, Packing Machines etc.

## Chapter 8- Gap & Constraint Analysis

### 8.1. As Perceived by Producers and Other Stakeholders

#### Producers Case Illustration

Following is an illustration of a typical farmer in Kota. Of about 4.6 ha of his land holding, about 1.84 ha is deployed towards coriander production. The gross yield of coriander seeds is about 1.25 ton per ha. The market rate of the seeds is about Rs. 50000 per ton or Rs. 35 per kg or Rs. 43, 750 per ha. The cost of cultivation is about Rs. 43750 per ha. Net realization (from sales of grains) per ha is about Rs. 27,550 per ha. Out of this about Rs. 5000 is cost of land preparation, seed cost is about Rs. 2500, fertilizer, pesticide and insecticides cost is about Rs. 3750 per ha, sowing cost is about Rs. 1250, irrigation cost is Rs.3750, weeding related (labour cost) is about Rs. 10000 and harvesting cost is about Rs. 7500. Packing cost is about Rs. 750 per ha. Transportation cost to mandi is about Rs. 500 per ha- all totaling to around Rs. 35000 per ha. The fluctuation in prices of Coriander may range from 3500 (at the time of harvesting) to 6500 (during the festive season) in a year. Notably, most farmers have storage facility at their homes and hence are able to store coriander seeds and sell same during the festive season to gain higher realization. The fluctuation in yield of coriander seeds ranges from 0.5 ton to 1.25 ton per ha, depending upon irrigation, weather conditions, etc. Farmers in the district also grade seeds at home and the lower grade is sold at about Rs. 2500 per quintal. The wastage during the threshing process (which is around 5% of the total yield) is used as cattle feed.

#### Critical Constraints:

- Fungal and pest attack during the cultivation.
- Occasionally, due to relatively lower prices prevailing in mandis in close proximity, farmers are forced to transport produce to distant mandis.
- Although producers are successful in storing coriander throughout the year, they follow the traditional methods of storage and grading rather than modern and scientifically proven methods.
- They do not have any centralized place/facility to store coriander at the village level.
- The risk of storage is high, as pest / moisture may lead to damages.

**Based upon the critical constraints discussed with the farmers, who are the key stakeholders of the entire Coriander value Chain, different areas of intervention pre-harvest and post-harvest stage have been suggested in the section 9.1.**

## Processors Case Illustration

### Processors Details

Mr. Ramavatar Agarwal is a typical SME processor and Director of Shyam Dhani Industries Pvt Ltd., VKIA, Jaipur, an ISO 9001:2008 certified company, engaged in manufacturing of all kind of spices. The company is involved in processing, wholesales and exports of their premium spices in brand name- “Shyam”. It has all necessary licenses like Agmark, Mandi License, FSSAI etc.



In a discussion, Mr. Ramavatar Agarwal stated various facts and expressed his opinion about coriander production and processing in Rajasthan. He stated that Rajasthan is the largest producer of coriander in India. He further informed that coriander is processed in three forms- coriander leaves powder, coriander seed and coriander powder. Coriander has a fragrant odour and pleasant aromatic taste. The odour and taste are due to essential oil content which varies from 0.1 to 1.0% in dry seeds. These essential oils are used for flavouring liquors, coca preparation and also to mask the offensive odours in pharmaceutical preparation. The dried coriander seeds are the major ingredients of the curry powder. These seeds are also used to flavour preparations like pickles, sauces and confectionary. The young plants as well as the leaves are used in the preparation of chutney and are also used as seasonings in curries, soups, sauces and chutneys. Coriander is also known for its medicinal properties. Coriander is said to have carminative, diuretic, tonic, stomachic and aphrodisiac properties.

Mr. Ararwal procures coriander from agents in Kota, Baran and Ramganj Mandi at the rate of Rs. 6000-7000 per quintal or Rs. 60-70 per kg. Cleaning and grading of sees is done at his unit premises and the process loss is in the range of 5 to 7%. After processing, coriander seeds are packed in pack sizes of 200 gms, 500 gms, 1 kg and 5 kg. The selling price in the wholesale market is around Rs. 9000 per quintal or Rs.90 per kg. In retail, prices of coriander seeds are in range of Rs. 250 to 300 per Kg.

#### Source of procurement:

1. Rajasthan: Ramganj, Kota, Baran
2. Madhya Pradesh: Neemuch, Kumbhraj
3. Gujarat: Rajkot
4. Tamilnadu: Thiruchirappilly, Virudhunagar
5. Andhra Pradesh P: Guntur, Varavakonda, Nandyal

#### The constraints such typical processor faces in this trade are-

- 1- Despite helping farmers indirectly, they don't get any relaxation in electricity bills and taxes.
- 2- Regular Power cuts reduce the production capacity.
- 3- Fluctuating commodity prices
- 4- Competitive market force to compromise on quality.

#### Competitive Edge-

- Right combination of personnel, machines-the total operating system

- Reputation based on quality, reliability, integrity and complete understanding of the market dynamics
- Prompt deliveries and customer satisfaction--our top priority
- Adoption of stringent quality control measures at each and every stage of production
- Trust and support of a large number of satisfied clients from across the world
- Detailed attention to the valuable feedback and suggestions of our esteemed clients.

## 8.2. SWOT Analysis of the Value Chain of Coriander

Strength	Weakness
<ul style="list-style-type: none"> <li>• India is the largest producer, exporter and consumer of coriander seed.</li> <li>• Largest producer of coriander seed in the country is Rajasthan accounting for about 58% of it</li> <li>• Kota and Ramganj are the biggest mandis with average daily arrivals of more than 15,000 quintals in the peak season.</li> <li>• Citronelol, a component of essential oils in coriander, is an excellent antiseptic.</li> <li>• Coriander, due to its rich aroma because of its essential oils, apart from being an excellent appetizer, helps in proper secretion of enzymes and digestive juices in the stomach, stimulates digestion and peristaltic motion</li> <li>• Coriander has several other therapeutic uses It is also used to treat measles, hemorrhoids, toothaches, worms, and joint pain, as well as infections caused by bacteria and fungus.</li> <li>• Coriander powder is a major ingredient in several blends like garam masala, curry powders, etc.</li> <li>• Large demand for organic coriander in premium and export markets</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of knowledge of PoP for coriander production technologies</li> <li>• About 60% farmers use seed from previous year</li> <li>• Under-ripe coriander seeds have an unpleasant flavor and over-ripe seeds tend to shatter which reduces the yield.</li> <li>• Limited processing units for coriander and its by-products (such as coriander powder unit ) with in-adequate grading &amp; sorting facilities.</li> <li>• Lack of appropriate storage facility</li> <li>• Lack of market information regarding prevailing prices, arrivals etc. force farmers to sell their produce in village itself.</li> <li>• Market drivers in Spices such as Patanjali &amp; MDH don't directly procure from the farmers in want of feasible volumes and uneven quality material</li> <li>• Obsolete techniques are used in processing, which reduces the output.</li> <li>• Most of the seeds are converted into powder and hardly any quantity goes for oil extraction.</li> </ul>
Opportunity	Threat
<ul style="list-style-type: none"> <li>• Scope for tie up of FPOs through CFC with firms like Patanjali, MDH, Catch; coriander processing units/ MSME firms; housing societies in urban areas and retail outlets ;</li> <li>• Facilitation of start-ups from amongst FPOs or individual entrepreneurs, in secondary processing of value added products of Coriander like powder, blends, roasted coriander, etc.</li> <li>• Scope for establishment of quality</li> </ul>	<ul style="list-style-type: none"> <li>• Fluctuation (delay) in sowing due to climate change</li> <li>• Cloudy weather, rainfall at the time of flowering and seed formation (Adverse weather conditions)</li> <li>• Infestation of insect-pest &amp; other disease such as Stem gall disease in coriander</li> <li>• Adulteration Malpractices by competitors to get price advantage</li> <li>• Fluctuations in supply (based on</li> </ul>

<p>sorting and grading facilities by FPOs as part of Farmers Common Service Centre (FCSC), along with facilities for packaging and vehicle to facilitate transportation.</p> <ul style="list-style-type: none"> <li>• Establish storage facilities by FPO as a part of FCSC.</li> <li>• POs to undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. &amp; Custom Hiring under the umbrella of CFC</li> <li>• Large scope of contract farming, buyback contracts and participation in tenders, etc.</li> <li>• Large scope of FPOs taking up Bee farming, which will not only help increase yield, but also lead to additional income through honey and wax obtained in activity.</li> </ul>	<p>production), coupled with export-import dynamics, make prices of coriander unstable which obviously affects producers and consumers both.</p>
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### 8.3. Key constraints in Coriander crop

The constraints detailed out after interaction with the farmers in the clusters of RACP project, under coriander are divided under from different categories, viz Production related constraints, Post-Harvest related constraints and Processing and market infrastructure related constraints.

#### 8.3.1. Production related constraints:

Coriander is important spices cash crop in RACP cluster in rabbi season. Productivity & production level in the cluster is low for following reasons

- a. No seed treatment with Thirum and Tricodarma
- b. Split seeds left after grading are kept as seed for next year.
- c. Proper row /plant spacing and soil depth not maintained while sowing.
- d. Improper field preparation for both rain fed and irrigated crops
- e. Unavailability of good quality seed material
- f. Improper integrated nutrient management
- g. Poor water management practices
- h. Improper protection from pest and diseases followed
- i. Improper weed management

#### 8.3.2. Post-Harvest related constraints:

Coriander should be harvested early in the morning to avoid loses due to breakage /shredding while harvesting. Soft and gentle handling of harvested material is necessary to avoid shredding. When seeds are fully dry these tend to detach from stalk, collected and store in cool, dry location. Delaying of the harvest should be avoided lest shattering during harvest and splitting of the fruits in subsequent processing operations. Harvesting, threshing and grading is totally manual and time consuming

**Inadequate storage facilities in rural areas:** Storage facilities in villages are found to be inadequate which contributes leads to distress sale. Due to lack of storage facilities, substantial quantity of commodity is also lost. Distress sale is obligatory on some farmers as

they have to repay the loan availed from traders during the time of sowing for seed, fertilisers etc.

**Transportation facilities at producers' level:** Due to inadequate facilities of transportation at the village level, producers are forced to sell in the village itself to itinerant merchants or traders directly at low prices. Aggregation and negotiation with buyers is only possible if farmers have volume to trade and transport up to procurement centre.

### **8.3.3. Processing and market infrastructure related constraints:**

Coriander processing can be promoted as house hold enterprise in the cluster by providing proper training and formation of women SHGs and providing adequate infrastructure in the cluster. Coriander is processed very little near the cluster area as no such infrastructure is available near the cluster area.

**Traditional system of marketing:** In the clusters, there is an absence of alternate channels of marketing. So farmers typically sell only through APMCs or village level traders

**Lack of market intelligence services:** Farmers do not receive information on market prices. Some farmers sell crops through village level traders, because due to which they are not realising fair price.

#### **Lack of primary processing infrastructure:**

- i. There is a non-availability of facilities for primary processing: cleaning, grading & sorting at the farm level.
- ii. There is no practice and provision of producer level storage.
- iii. There is acute lack of awareness among farmers regarding FAQ (Fair Average Quality) standards.
- iv. Farmers do not practice the usage of basic equipment like moisture meter and weighing machine.

**Distant markets:** Long distance market leads to farm gate selling where farmers receive non-competitive prices for their produce.

**Fluctuations in prices:** Generally, the prices of commodities go down in the post-harvest period due to heavy arrivals in the market and later shoots up. Farmers in the catchment area do not have storage facility to store and they also don't use a warehouse receipt system.

**Lack of marketing information:** Due to a lack of market information regarding prevailing prices, arrivals etc., most of the producers' market their produce in the Mandi without studying the price trends. This creates glut in market during harvesting period which leads conflict between farmer and traders on rate issue.

**Adoption of grading:** Grading of coriander at the producers' level ensures better prices to producers and better quality to consumers. At present there is no infrastructure available at the farmers' level for primary processing.

**Malpractices in markets:** Many malpractices prevail in the markets i.e. excess weighment, delay in payment, high commission charges, delay in weighing and auction, different kinds of arbitrary deductions for religious and charitable purposes etc.

**Hundekari System** : farmers are compelled to sell the produce to the trader from whom he has received credit for sowing of crops. It was observed that even MSP

procurement is facilitated by the respective trader of that farmer for weighing and bagging of his produce to FCI through Indian warehousing corporation.

**Infrastructure facilities:** Due to inadequate infrastructural facilities available with the producers, traders, millers and at market level, the marketing efficiency is affected adversely

**Long Supply Chain:** The existence of a long chain of middlemen also reduces the producer's share in consumer's rupee.

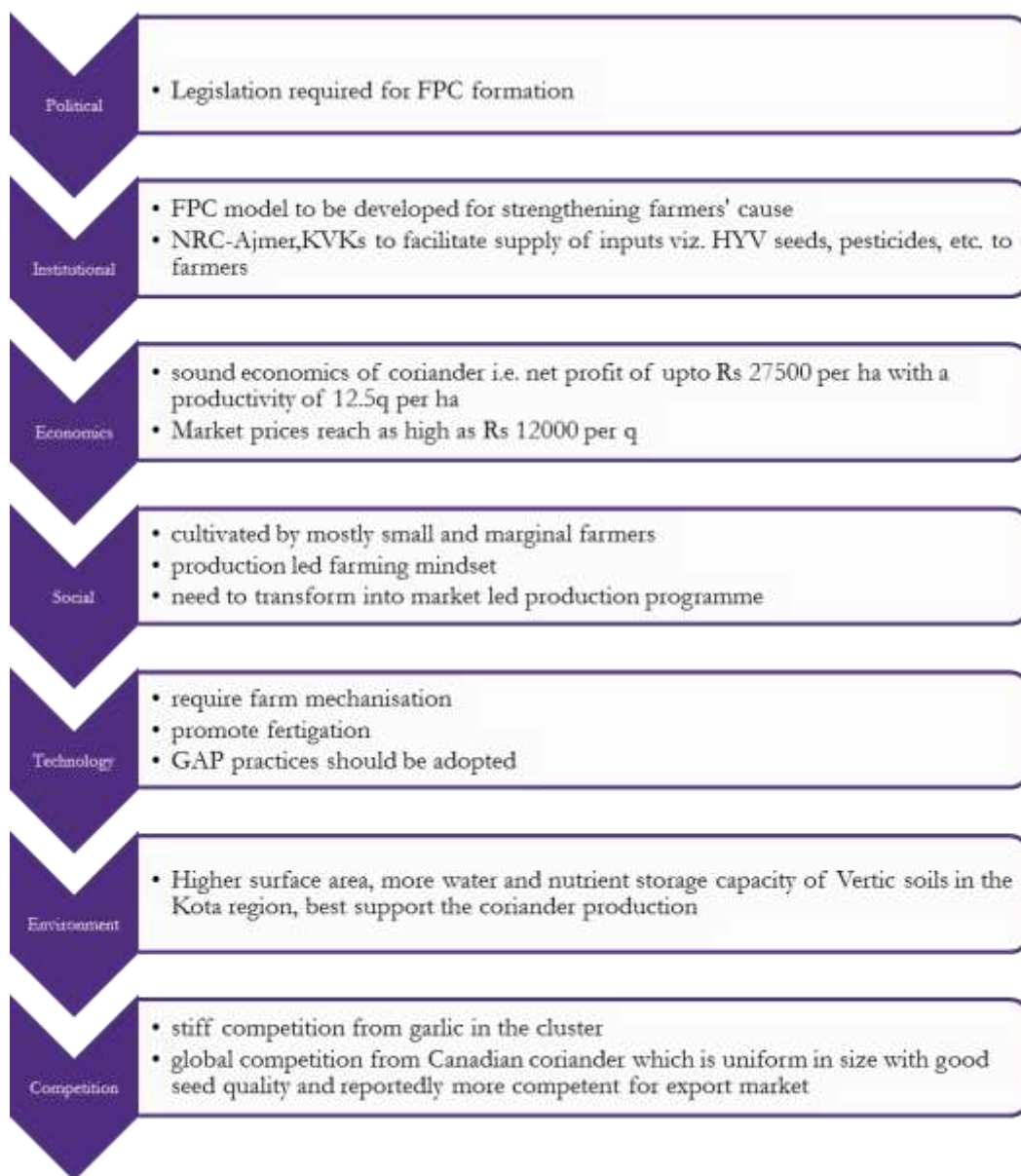
#### 8.3.4. Agribusiness policy related constraints:

**Contract farming:** Rajasthan has adopted a model APMC Act, 2007. In Rajasthan Contract farming of desired variety and quantity as per buyer's/processor's need, has been allowed. Buyer/processors may supply inputs and technical know-how and farmers may produce the crop for sale to buyers at an agreed price. However, this price shall not be lower than minimum support price and title of land shall remain with farmer. Produce will be purchased at buyer/processor's business/factory place. But processors found less interested in registering under contract farming. Team ABPF discussed contract farming issues with some of the processors and related challenges are given below:

- i. **Rule 5** – Each agreement shall be written on stamp paper of the value of Rs.100. This increases cost of procurement and procurement time.
- ii. **Rule 9** – Separate registration form shall be filled for each agreement. Large amount of paper work can be reduced by group registrations or procurement directly from FPCs.
- iii. **Rule 17**-In case the contract farming buyer fails or refuses to purchase the agreed quantity of the agriculture produce from the contract farming producer, he is to pay the amount of the difference between the agreed price and the actual sale price of the contracted produce in the market committee concerned to the producer. Mutual termination of contract should be allowed.
- iv. **Rule 19** – The contract farming buyer need furnish an undertaking equal to 20% of the value of the contracted amount. This amount can be reduced and this will motivate big players to participate in contract farming.

#### 8.4. PIESTEC Framework

Coriander can be summarily considered within the adapted PIESTEC framework as follows:



#### 8.5. Impact of GST over coriander value chain:

The Goods and Services Tax is one indirect tax for the whole nation. GST is a single tax on the supply of goods and services, right from the manufacturer to the consumer. It will be levied at every stage of the product distribution chain by giving the benefit of Input Tax Credit (ITC) of the tax remitted in the previous stages. Therefore, the final consumer will bear only the GST charged by the last dealer in the supply chain, with set-off benefits at all previous stages. GST will replace all Central level taxes such as excise, service tax and custom duty as well as state level taxes like VAT, CST and entertainment tax among others.

**Table 23: Tax Structure**

Transaction	New Regime	Old Regime	Remarks
Sale within the state	CGST+SGST	VAT+ Central Excise/Service tax	Revenue will be shared equally between the Centre and the State
Sale to another state	IGST	Central Sales Tax + Excise/Service Tax	There will only be one type of tax (central) in case of inter-state sales. The Center will then share the IGST revenue based on the destination of goods.

**The impact on the Food Processing Businesses:**

- With the latest information suggesting that the minimum GST rates will be 18% on all products.
- Implementation of the GST is said to increase the prices of agricultural goods. However, the products will be able to reach the consumer faster due to state-level taxes such as Octroi and entry taxes which will significantly reduce the time and hassle of transporting goods across state borders.
- GST will also favour the National Agricultural Market on merging all the different taxation on agricultural goods will improve the marketing and virtual market growth.
- Because GST is a consumption tax, it will be levied only when food products are sold by the manufacturer and not when they are manufactured.
- The Confederation of Indian Industries (CII) has also in its representation called for a zero rate tax on products which have a rate of up to Rs. 10/- and Rs. 20/-. It also demanded that all packaged material used as inputs by the food processing industry should have a zero-percent rate.

**Impact on Restaurants and Food Joints:**

Service tax liability with the credit of input VAT on goods consumed will get submerged into GST and irrespective of goods and services, the credit of input will be available for adjustment against the output liability. This will further optimize the working capital of these restaurants and consumers can expect the superior quality of goods and services.

Please refer to Appendix 4 for product wise GST rates of Food Products.

## Chapter 9- Proposed Intervention and Investments

### 9.1. Intervention areas for Value chain strengthening

The intervention plan of Coriander may be broadly considered in the context of activities and stakeholders in three stages- Production stage, Post-Harvest stage and the processing stage. In the context of shift towards coriander production to greater extent, it is necessary to strengthen by adaption of best package of Agricultural Practices, capacity building of producers so as to evolve governance structures like PC (FPCs).

At the post-harvest stage, constraints in terms of adequate storage facility and lack of drying facility are persistent. Well-designed FCSCs could help address these vices at the farm/producer level. At the processing stage, gaps are most apparent, in terms of awareness amongst processors in the direct procurement option, inadequate producer processor links as well as primary/secondary processing facilities at the farmers' level. These may be reduced through information dissemination, setting up of processing facility and B2B initiatives matched with policy incentives (like mandi tax exemption) to facilitate the same.

**Table 24: Proposed Intervention Plan with stakeholders matrix for the Value Chain of Coriander**

S.no	Stakeholder	Roles & Responsibilities	Pre-intervention Constraints	Post Intervention Action	Action By	Timeline
1		<ul style="list-style-type: none"> <li>Land Preparation</li> <li>Cultivation of crops</li> <li>Harvesting of crops</li> <li>Sell the raw produce</li> </ul>	<ul style="list-style-type: none"> <li>Limited awareness of farmers</li> <li>Availability of improved &amp; good quality varieties of Coriander among</li> </ul>	To promote both table purpose varieties and processing purpose varieties as well as • Farm Information Dissemination through District level exhibition, Kisan Melas, Printed materials, electronic media.	Agriculture University, Agriculture Research Institute & Station, Seed Companies, Extension team of RACP	

S.no	Stakeholder	Roles & Responsibilities	Pre-intervention Constraints	Post Intervention Action	Action By	Timeline
	Farmers		producers			Y1Q1-Y1Q2
		<ul style="list-style-type: none"> <li>Farmers are trained with production lead extension approach till date</li> </ul>	Market led extension approach is necessary to increase farmers income.	Extension team of RACP and Processors (through ABPF)	(6 months after registration of FPC)	
		<ul style="list-style-type: none"> <li>Traditional package of practices followed by farmers</li> </ul>	Increasing Research- Extension – Farmers linkages by organizing farmers–scientists interaction, Field Days and Kisan Goshties, Farmers' Field Schools.	Extension team of RACP, Scientists from Agriculture universities and ABPF agribusiness experts		
		<ul style="list-style-type: none"> <li>Contractual harvesting of Coriander</li> </ul>	Setting up alternate channel to sell directly from FPC to processor or large retail shops.	Large Processor and ABPF		
		<ul style="list-style-type: none"> <li>During harvesting time, prices collapse and hence storage/pack house option could help reduce distress sale.</li> </ul>	Storage facility for farmers as part of FCSC	RACP, KVK and ABPF		
		<ul style="list-style-type: none"> <li>Weather dependent drying of</li> </ul>	Setting up of scientific and artificial drying systems as part of FCSC	ABPF, RACP		

S.no	Stakeholder	Roles & Responsibilities	Pre-intervention Constraints	Post Intervention Action	Action By	Timeline
			coriander seeds			
			<ul style="list-style-type: none"> <li>Due to inadequate facilities of transportation at the village level, producers are forced to sell local merchants or traders directly at low prices</li> </ul>	<ul style="list-style-type: none"> <li>Provision of Pick-up van as part of FPC services to the farmers.</li> </ul>	ABPF, RACP	
			<ul style="list-style-type: none"> <li>Lack of scientific washing (leaves) and cleaning/grading facilities</li> </ul>	<ul style="list-style-type: none"> <li>To make farmer aware about quality parameters of Coriander for processing like value added products; washing/Cleaning &amp; Grading facilities as part of FCSC/s .</li> <li>Additionally, mini pulveriser plants could also be established as part of FCSC/s</li> </ul>	RACP, SPs with inputs from ABPF	
2	Processors	<ul style="list-style-type: none"> <li>Process the raw produce</li> <li>Value addition</li> </ul>	<ul style="list-style-type: none"> <li>Limited adoption of direct procurement and contract farming</li> </ul>	<ul style="list-style-type: none"> <li>Setting up alternate channel to sell directly from PC to processor or large retail shops.</li> </ul>	Large Processor/ Buyer and ABPF, RACP	Y1Q3-Y2Q2 (6 months after registration of FPC)

S.no	Stakeholder	Roles & Responsibilities	Pre-intervention Constraints	Post Intervention Action	Action By	Timeline
		<ul style="list-style-type: none"> <li>Packaging of value added product</li> </ul>	<ul style="list-style-type: none"> <li>Limited processed product available in the market which limits the marketing potential of the commodity</li> </ul>	<ul style="list-style-type: none"> <li>Facilitate the entrepreneur development to set up small scale processed product like Coriander powder</li> </ul>	ABPF, RACP	
			<ul style="list-style-type: none"> <li>Many existing spice processors and budding entrepreneurs are not aware of schemes of the GoI Including CLCSS, cluster Development scheme or “Sampada” for technology upgrading.</li> </ul>	<ul style="list-style-type: none"> <li>Awareness seminars for processors</li> </ul>	ABPF, RACP	
3	NGO	<ul style="list-style-type: none"> <li>Extension services to farmers</li> <li>Disseminate RACP Schemes to the farm level</li> <li>Distribution of seeds and farm kits as per various</li> </ul>	<ul style="list-style-type: none"> <li>Lack of skilled personnel</li> <li>Poor field-farm level coordination</li> <li>Outdated extension activities</li> <li>Lower level of</li> </ul>	<ul style="list-style-type: none"> <li>Training of NGO field staff on market led extension services</li> <li>Business planning training</li> <li>Monthly/Fortnightly review meetings with RACP</li> <li>Feedback of farmers</li> </ul>	<ul style="list-style-type: none"> <li>RACP</li> <li>ABPF</li> <li>KVKs</li> </ul>	Y1Q1-Y2Q4

S.no	Stakeholder	Roles & Responsibilities	Pre-intervention Constraints	Post Intervention Action	Action By	Timeline
		<p>schemes</p> <ul style="list-style-type: none"> <li>Hand holding support to the farmers regarding</li> </ul>	<p>interaction and adoption of RACP/govt. schemes</p>	<p>from service area</p> <ul style="list-style-type: none"> <li>Exposure visits of NGO staff to successful FPCs</li> </ul>		
4.	RACP	<ul style="list-style-type: none"> <li>establish the feasibility of sustainably increasing agricultural productivity and farmer income</li> <li>integrate agriculture water management and agricultural technology,</li> <li>Establish farmer organizations (FPCs) and market innovations in selected locations</li> </ul>	<ul style="list-style-type: none"> <li>Lack of clarity on the form of FPO-Cooperative or FPC</li> <li>Selections of capable leaders for the proposed FPO</li> <li>Low level of awareness among the PMU staff and farmers regarding the concept of FPC</li> <li>Poor or no Market linkages of the value chain crops in clusters</li> <li>Lack of active NGO staff deployed in the cluster</li> </ul>	<ul style="list-style-type: none"> <li>Create basic understanding among the RACP PMU staff about concepts of FPC</li> <li>Clear understanding on fundamental differences between FPC &amp; Cooperative</li> <li>Create market linkages by bringing more big players and processors to the cluster</li> <li>Conduct training of the potential farmer leaders about FPC and its functioning</li> <li>Capacity building training of the NGO staff regarding the extension services to be provided to the farmers</li> </ul>	<ul style="list-style-type: none"> <li>ABPF</li> <li>RACP PMU Line staff</li> <li>NGO</li> </ul>	Y1Q1-Y2Q4

In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of dissemination of benefit of going in for new high yielding varieties. Apt amendments in the contract farming Act could further facilitate this initiative.

Traditional package of practices results in lower yield as against potential. There is therefore need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors.

There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field- level. In this regard, it may be appropriate for ABPF to enable formation of FPOs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC scheme etc. may be explored. The RACP and line departments need also work in coordination with the NGO/service providers and the KVK etc. on high dirt content in harvested gram, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage. The storage facility may be established as an FCSC with assistance under the project.

There is also need for awareness seminars and b2b meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri- marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

The process of formation of Farmer Producer Company, its roles and responsibilities along with the details of the Farmers' common facility centre is discussed in the section 9.2.2.

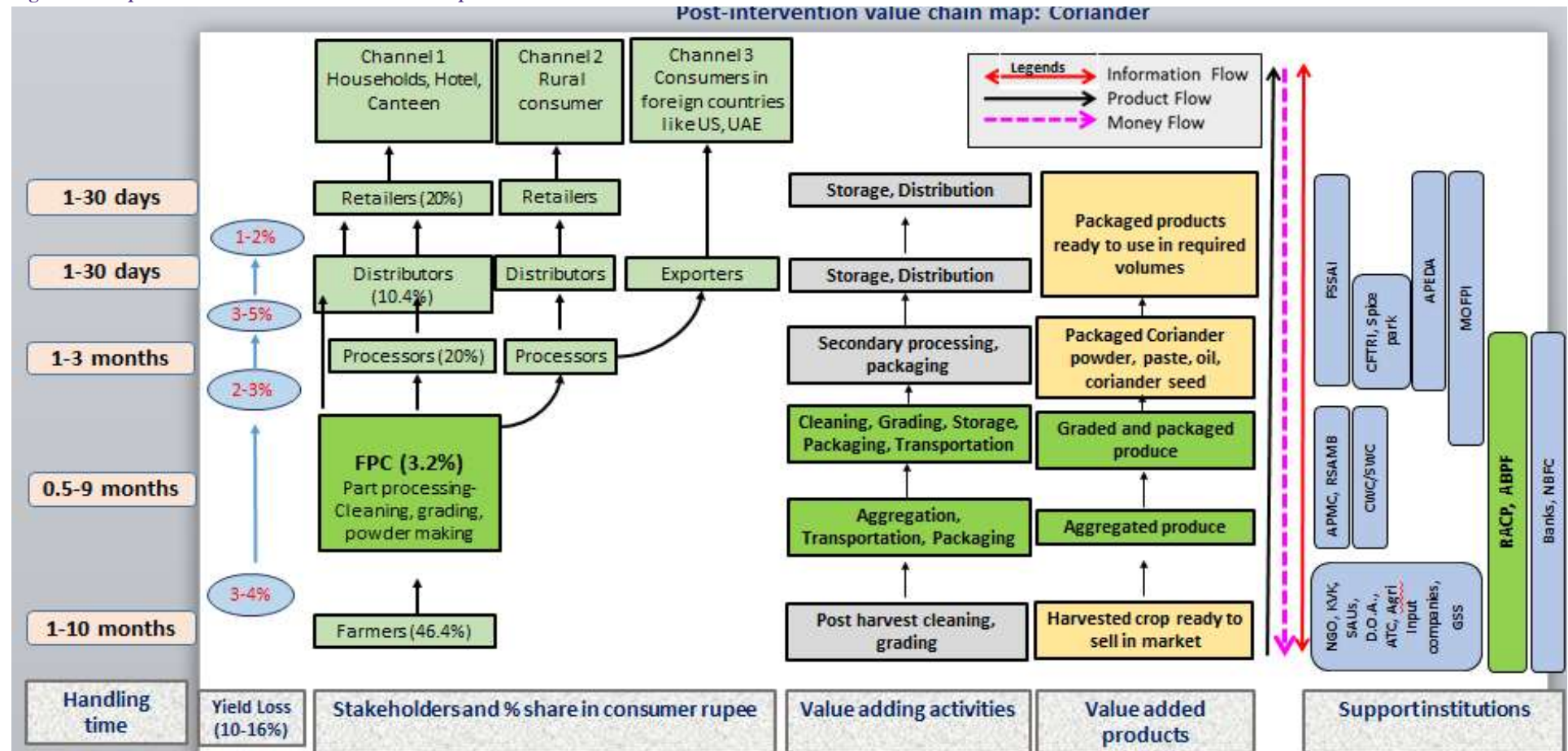
## **9.2. Proposed Post Intervention Value Chain Map of Coriander**

### **9.2.1. Post intervention Value Chain Map: Coriander**

In the envisaged post-intervention value chain of Coriander, FPCs/farmer associations could bypass the APMC and commission agents and undertake the value chain activities like aggregation and operate common facilities (FCSCs) undertaking drying, storage, packaging and transportation. Upon these primary processing and storage activities, the commodity may be supplied to SME as well as large processors like MDH, Patanjali and Everest. They could also bring in another channel i.e. through the village retailers and could aim the rural consumers.

The post intervention value chain map for Coriander may be visualised as one with three production-distribution or activity-marketing channels: raw coriander leaves, coriander seeds and value added products like Coriander powder, paste, oil and puree. It is also envisaged that PCs of producers with FCSCs is evolved. Such FCSCs undertakes storage, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring, facilitating B2B connectivity etc. The gross profit margin which would be directly transferred to the farmers by the virtue of the FPC would be 1-2% (Rs 150 per quintal). These could help in increasing net value accruals to farmers by about 15% to 25% as they would at least get higher returns for the sales of their raw produce by Rs 150 per quintal. Also, as the FPC would supply the best quality seed by tie up with the large input players like Baeyer, etc., the farmer would get HYV at their doorstep. It would positively impact their cost of cultivation, bringing it down significantly.

Figure 37: Proposed Post Intervention Value chain map of Coriander



In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of dissemination of benefit of going in for new high yielding varieties. Traditional package of practices results in lower yield as against potential. There is therefore need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors.

There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field- level. In this regard, it may be appropriate for ABPF to enable formation of FPOs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC scheme etc. may be explored. The RACP and line departments need also work in coordination with the NGO/service providers and the KVK etc. on high moisture content in harvested coriander, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage and drying at farm level. The storage facility may be established as an FCSC with assistance under the project.

There is also need for awareness seminars and B2B meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri- marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

The yield loss which is mentioned in the Post intervention value chain map of Coriander occurs at various stages of entire value chain starting right away from the harvest to storage, transportation, processing and distribution for wholesaling and retailing. Following table describes the yield loss to be expected at various stages along with the reasons and interventions to reduce the yield loss:

**Table 25: Yield loss and interventions for Value chain of coriander**

Stage of value chain	Yield loss (in %)	Reason	Intervention
<b>Harvesting by farmers</b>	3-4	<ul style="list-style-type: none"> <li>Lack of mechanised harvesting</li> <li>Random sowing methods</li> <li>Lack of appropriate storage structure on farm</li> </ul>	<ul style="list-style-type: none"> <li>Training on GAP and advance PoP to farmers</li> <li>Setting up storage structure in the CFC of FPC</li> </ul>
<b>Purchase by Trader/ Processor</b>	2-3	<ul style="list-style-type: none"> <li>Poor storage structure and inefficient handling of harvested produce</li> <li>Loss during transportation due to loose</li> </ul>	<ul style="list-style-type: none"> <li>Centralized aggregation from farmers at CFC of FPC</li> <li>Packaging unit under CFC</li> </ul>

		packaging and poor handling	
<b>Processing</b>	3-5	<ul style="list-style-type: none"> <li>• Use low end and obsolete technologies</li> <li>• Mismatch of capacities of various machine lines</li> </ul>	<ul style="list-style-type: none"> <li>• Set up primary processing units for FPC</li> <li>• Support and guide agri-entrepreneurs for setting up modern and high end machines</li> </ul>
<b>Distribution to wholesalers/retailers</b>	1-2	<ul style="list-style-type: none"> <li>• Poor handling of value added product</li> <li>• Inefficient packaging of product</li> <li>• Improper storage facility</li> <li>• Lower shelf life of product</li> </ul>	<ul style="list-style-type: none"> <li>• Support in storage facility through govt. warehouses</li> <li>• Efficient packaging to prevent leakage and improve shelf life</li> </ul>

### 9.2.2. Interventions through FPC in the coriander value chain crop

#### Introduction to FPC Model

Aggregation is the proposed solution of the constraints farmers are facing at present. It is proposed to form Farmers Producers' Company by bringing farmers together in the form of voluntary groups of about 15 to 20 active farmers and federating 20 to 25 such groups into a Producer Company. These Producer Companies will be functioning on behalf of member farmers and will strive to undertake a range of activities which will result in added value accruals to farmers and value to farmers produce. To form a producer company, producer groups will be mobilized (in some cases, this initiative may have already been completed by NGO's).

It is envisaged that an elected committee of members of Producers Groups will form a management committee and oversee the performance of an incentivized manager/CEO. The manager will be trained in technical issues of post-harvest management, marketing and in operating a transparent accounting system. The ABPF will support the operation of the Producer Company, and accelerate the cross learning of best practices.

## FPC Development Approach

The FPC development approach may be viewed as depicted below:



Figure 38: FPC Development Approach

Following are the steps to be followed for formation of the FPC:

- **PRI of the MTG:** The MTGs will be made aware on the FPC model through PRI and individual farmers will be motivated to join the FPC as shareholder through respective MTGs.
- **Initial discussions with MTG leaders:** After PRI is done, initial discussion will be done with the MTG leaders for further orientation on FPC concept.
- **Identification of MTG leaders:** MTG leaders who show inclination to the concept will be selected in the executive committee for FPC formation.
- **Resource mobilization and FPC planning:** The executive committee will meet 2-3 times to plan further activities of FPC viz. crops, strategy for business etc.
- **Election of BoD and Share collection:** 10-12 BoD will be identified along with 2-3 expert directors one each from Agri, Horti, AH and WS dept. The BoD will decide on share value and initiate collection of share through MTG leaders.
- **FPC registration:** Following identification of FPC BoD, registration will be done. This may take 1-2 months as DIN no of BoD has to be generated first. Care should be take that all elected BoD should have PAN no so that there is no delay in paper formalities for registrations.

- **FPC business:** Following registration of FPC, ABPF will prepare business plan for the FPC and facilitate market linkage for input and output.
- Setup of processing/ financing – ABPF will further facilitate establishment of processing unit setup along with feasibility studies and planning business linkage with market players.

### **Policy and Management**

A FPC will function within the overall policy and regulatory framework as per the Producer Company Act. The management of a FPC will vest with the elected Board from amongst the members. The provision about constitution of managing committee will be made in the byelaws. The management of FPCs will be by an elected Board of Directors. Therefore, the representatives of farmers will actually oversee and manage the affairs of a FPC..

#### **The selection criteria for membership of FPC may be viewed as follows:**

1. A member will express his willingness to become a member of MTG.
2. A member will actively participate in all functions and activities of MTG
3. A member will contribute his equity to the FPC
4. A member will bring all or part of his produce to the FPC for sale.
5. A member will purchase all or part of his farm inputs through the FPC.
6. A member will produce and prepare his produce for marketing as per directions of FPC.
7. A member will contribute his share to the Producer Association as upfront payment for the business development plan of a FPC as needed.
8. A member will contribute his share to the Producer Company towards the reserves of FPC as needed.

#### **Illustrative list of components of a common facility of a Producer Company (Coriander seeds)**

- Godown for storage, drying platforms
- 2-3 MT per hour grain cleaning, grading, and packing machinery with shed
- Additional need based Agricultural Equipment
- Computer with internet connectivity for market information
- Display Board with Accessories
- Auction Hall
- Input Suppliers Shops
- Toilets
- Drinking water & Electricity

**Note:** Though the illustrative infrastructure proposed is shown in the above tables, the actual infrastructure to be developed will be need based and on participative consultation process.

Typically, start-up may be involved in secondary and tertiary processing activities while FPO's may be involved in post-harvest and primary processing activity. In many cases, start-up may emerge firm within FPO members.

#### **The evaluation of success should be evaluated on the parameters as under:**

- I. PCs operating without financial support by the end of 36 months.

- II. The PC operates with a reserve fund to cover short term cash flow deficit and with potential for reinvestment in various activities
- III. The PC has an effective governing structure.
- IV. The PC has a transparent accounting system.
- V. The PC can function as a working example for other farmer organizations to observe and learn from.
- VI. Contribution towards increasing farmers'/members incomes.

### 9.3. Outcomes of value chain study

- 1. Increase in farmers share by 5% through FPC
- 2. Higher price realization for crops by farmers
- 3. Lower cost of production adds to the farmer's net profit through
  - i. Acquire **quality inputs** at **discounted price**
  - ii. Farm Demos on **GAP, PoP**
  - iii. Dissemination of advanced technology through **contract farming** with MNCs & their likes
  - iv. Custom hiring to increase **farm mechanisation**
- 4. FPC led intervention to establish **Processing and storage infrastructure**
  - i. Cleaning & grading
  - ii. Warehouse
- 5. Potential Services by FPC
  - i. **Marketing service** with facilitating charges typically @ between 1-2% of sales value.
  - ii. **NCDEX- linked commodity trading** with user charges at a negotiated rate
  - iii. **Custom hiring services** with nominal charges

### 9.4. Conclusion

This value chain analysis of coriander clearly brings out that unlike any other enterprise, agriculture is critically dependent on external factors like the bounties of nature for its success; be it unseasonal rain, hailstorm, delayed monsoon, less rain, no rain, or excess rain, all of which makes agriculture a high risk and vulnerable proposition. This perpetual environment of high risk and vulnerability has significantly lowered farmers' confidence and suppressed their entrepreneurial instincts as was amply reflected in the discussions held over cluster level meetings.

Till date, farmers have benefitted mainly from government's input driven schemes while market access interventions such as mandis have created more barriers (middlemen) than benefits and resulted into market inefficiencies that eventually exploited farmers. Despite being at the receiving end of market barriers and inefficiencies for generations, individually, small farmers may perhaps never muster enough strength to overcome market challenges. In such a scenario, the intervention of establishing Farmer Producer Companies in the clusters has potential to unleash their suppressed energies and to promote rural entrepreneurship. It would encourage farmers to collectively delve into market operations to compete and design

specific market solutions such as aggregation and sales of produce, operate custom hiring and composite input sales centres.

In the Coriander value chain, despite increasing input costs, all active players such as suppliers, transporters, processors, traders and corporates except producer farmers have benefitted and gained prosperity. For the farmer, increase in input costs, without corresponding increase in output prices, has rendered agriculture unviable. And, in the absence of any other locally available alternate livelihood options farmers cannot even move away from agriculture. Thus, RACP along with the market driven intervention of ABPF also aims towards integration of farmers and help them join hands for a collective cause, assist them to move up the agriculture value chains as to actively participate in market functions, an unexplored but lucrative territory for them so far. This would spur vertical business integration and diversify their market portfolios to reduce their vulnerabilities.

Value chain actors or stakeholders decide sale prices of their produce/products and compete effectively in the markets whereas farmers often depend on Minimum Support Price (MSP) fixed by government agencies to sell grains. Trader's cartelisation ensures that MSP becomes the Maximum Gain Price (MGP) fetched by farmers, further squeezing their revenues. The end result has been a declining contribution of agriculture to the national economy. It is also true that given farmers' inability to deal effectively with market forces, in the absence of MSP, farmers would have been possibly in a much worse off situation.

The major role of ABPF- GT would in this circumstance also be to carry out capacity building initiatives of the potential leaders (BoDs) of the FPC, NGO staff and PMU staff line, conducting value chain studies of the crops (market led), plan interventions to improve the returns to the farmers in the 17 project clusters, develop the business plan for registered producer companies in clusters, support and assist agri start-ups in the region, and thus develop overall market linkages. The formation of FPC supported by RACP ABPF, local NGOs and facilitation centres like KVKs, provides the much needed opportunity to farmers to favourably and positively change their destiny in near future (years to come).

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## Annexure 1: Stakeholder's consulted over the study

Producers	Processors	Traders	Government agencies	Others
<p>25 Farmers in Palayatha cluster</p> <p>25 Farmers in Sangod cluster</p>	<p>1. Shyam Dhani Industries Pvt Ltd. Ramawatar Agarwal, Jaipur 9414062430</p> <p>2. MDH Masala Sharad Rathi, Nagaur 9828535353</p> <p>3. M/S Premchand Premchand ji, Kota 8071680827</p> <p>4. Sohan Agro Mills PVT. LTD Sohanji, Kota 80046041755</p> <p>5. Manish Enterprises Manish Gupta, Kota 9462728025</p> <p>6. Khnana Khazana Foods Manish Gahlot, Ajmer 9587008643</p> <p>7. Mr. Mukesh Agrawal Nagaur 9982827118</p>	<p>1. Azad Agro Enterprises Dineshji, Kota 8003098456</p> <p>2. Bansilal Nagar Palathya 9460004775</p> <p>3. Vinay Bansal Anaj Mandi, Kota 9414187549</p> <p>4. Kamlesah Dhamani Anaj Mandi, Kota 9636012539</p> <p>5. Mathuresh Trader Ankit Mehta, Kota 9829035723</p> <p>6. Manish enterprises Manishji, Kota 9462728025</p>	<p>1. Bhagwan Singh (DPM) Dep. of Agriculture, Palathya 9414285923</p> <p>2. Indersen Singh (DC) Water recourses, Palathya 9116502784</p> <p>3. D. K. Singh (PC) KVK, Baran 9414662038</p> <p>4. K.C. Meena (SMS) KVK, Baran 9602956432</p> <p>5. Mr. Harbalaji (DD) Dep. of Agriculture, Baran 9414488451</p> <p>6. Bharat Ratana (ID) Dep. of Agriculture, Palathya 9413987066</p>	<p>1. Sohil Khan ((T.L) NGO, Palathya 9214363655</p> <p>2. Nural Hasan (CMS) NGO, Palathya 9667082929</p> <p>3. D. K. Singh (PC) KVK, Baran 9414662038</p> <p>4. G.L Keshwa (Director) Agriculture University, Kota 7442321204</p> <p>5. Mr R. K. Sinha (PD) ATMA, Kota 9414448968</p> <p>6. Mr Laxman Yadav (T.L) NGO, Sangod</p> <p>7. Mr Sachin Panchal (SMS) NGO, Sangod 9116889892</p>

## Annexure 2: List of Central Warehousing Corporation (CWCs) in Rajasthan

Warehouse	Project Description	Manager	Phone	Capacity
BHIWADI	C/o Jaquar & Company Pvt. Ltd., SP-496, RIICO Indl Area, Bhiwadi - 301019	A. C. Yadav	01493 297825	4356
ALWAR	A-315, NSC, Oppt. ED, Paryware Pvt. Ltd. Co. Alwar	R. N. Meena	0144 23721	3574
BARAN	Spl. No. 01 ,RIICO Indl Area, Baran Road, Baran	V. K. Jaiswal	9460079493	5000
BHARATPUR	Plot No. G-162 to 165 & F-166 to 171, Brij Ind. Area, Behind Nafed Plant, Phase-II, Hathni Road, Bharatpur	Devendra Prakash	05644- 228654	9674
BIKANER	Behind Sabzi Mandi, Pugal Road, Unit-I, Bikaner	Prit Pal	0151 2212399	25400
BIKANER-II	Opposite Govt. Engineering College, Karni Industrial Area, Ph.II Bikaner-334004	R. D. Punia	0151 211003	5000
SRIGANGANGR-I	Near Power House Sriganganagar-335001	S.S. Brar	0154 2440107	25200
SRIGANGANGR-II	Udyog Vihar Plot No. E-194 to202 Sriganganaga-335001	N.K. Chabra	0154 2494403	10000
KESARISINGHPUR	C/o ARDC Godown,Mizewali Road,Kesrisinghpur Distt.Srigangar	Dhanwat Singh	01501- 233710	10176
HANUMANGARH TOWN	C/o FCI, Opp. Railway Station, Hanumangarh Town	K. D. Dhiman, FCI		13262
HANUMANGARH-I	Sector - 8, New Mandi, Hanumangarh Junction, Hanumangarh	J. R. Sharma	01552 260602	21200
HANUMANGARH-II	RICCO Phase-II , Opposite RICCO, Water Works, Hanumangarh	Bhart Bhushan	01552 211794	15000
TIBBI	10, GGR, Hanumangarh Road, Tibbi, Distt. Hanumangarh	Anupam Kumar	01539 224111	1000

SITAPURA-I	Plot No.SPL-1296,EPIP Sitapura, Ind. Area, Jaipur-302002	S.K. Sharma	0141 2771710 , 2770227	14870
SITAPURA-II	Plot No.SP-1,RIICO Industrial Area,Sitapura, Jaipur	Y.K. Dubey	0141 2770223	11729
KOTPUTLI	Near Cement Factory, Vill.-Ramsinghpura Gopalpura Road,Kotputli, Distt. Jaipur.	Desh Raj	01421 215112 97	5000
JHUNJHUNU	Plot No. SP-287 RICCO Industrial Area,	Raghunath Singh	01592 250138	5000
SURAJGARH	Bhuana Road, Surajgarh-333029	Rampal Singh	01596 2238349	2868
KOTA I	Ind. Area DCM Road, Nr New Grain Market Kota-324007	S N Meena 0744 2363638		36830
KOTA II	Indraprasth md. Area, Road,No. 1, Near Daknia Railway Station Kota-324005	S.S.Meena	0744 2438019	49300
KOTA III	Plot No. SP-1, Kuber Ind. Area, Ranpur, Kota III	S N Panchal		25000
RAMGANJ MANDI	Khairabad Road, Ramganj Mandil Distt.-Kota	OP Mudgil	07459 22264	9893
NAGAUR	Nr. All India Radio Basni Road, Nagaur- 341001	R.S. Mathur	01582 241002	7401
PARABATSAR	C/o ARDC Godown, Near Old Rly. Station.Parbatsar, Distt. Nagaur	Ram Behari	9460462881	28093
SIKAR	Jagmalpura, Via-Katrathal, Post-Bhadwasi ,Sikar-33200 1	Nand Lal Verma	01572 272013	5000
SRIMADHOPUR	Hanspur Road, Srimadhampur-332715	Kishore Prasad	01575 251699	20600
DEOLI	C/o Juptier Metal Pvt. Ltd., NH—12, Deoli Distt : Tonk 01434 239249	Kailash Narayan	01434- 239249	5000
UDAIPUR-I				5000
FATEHNAGAR	MOR Mills Product, Plot No. H-49 Road No.2, RICCO Indl Area, Fatehnagar-313205	V. P. Singh	02955- 220411	3106
Central Warehouse	Opposite Krishna Dharma Kanta, Udaipur By Pass. Beawar, Distt. Ajmer	Raj Raj Kumar Sharma		14849
Certral Warehouse	Katori Wala Tibara, Near Water Works, Tizara Road, Alwar	Rajendra Prasad	1442731026	8133
Central Warehouse	Village MOR ,Kushalgarh Distt.Banswara.	D.C. singh	2965274517	3400
Central Warehous	Plot No.G-162 to 165,F-166 to 171, Behind NAFED Plant, Phase-II, Brij Industrial Area, Hahteni Road, Bharatpur-321301	N. S. Meena	5644228654	9674

Source: [http://farmer.gov.in/CWC\\_Link.aspx](http://farmer.gov.in/CWC_Link.aspx) (retrieved on 6th April 2017)

## Annexure 3: List of State Warehousing Corporation (SWCs) in Rajasthan

Sr. No	District	Name of Warehouse	Warehousing Capacity			Utilization including Reservation	Percentage Utilization
			Own Constt.	Other than own Constt.	Total		
1	Ajmer	1. Ajmer	13350	0	13350	13733	103
		2. Beawar	6300	0	6300	5086	81
		3. Kekri	3500	0	3500	3704	106
		4. Kishangarh	5400	0	5400	4141	77
2	Alwar	5. Alwar	22650	0	22650	18967	84
		6. Khairthal	7400	0	7400	3265	44
3	Banswara	7. Banswara	12200	0	12200	7608	62
4	Baran	8. Baran	27520	0	27520	15344	56
		9. Antah	9200	0	9200	7472	81
		10. Atru	5400	0	5400	1767	33
		11. Chhabra	11550	0	11550	2079	18
		12. Siswali	6750	0	6750	5304	79
5	Barmer	13. Barmer	6840	0	6840	7533	110
		14. Balotra	3600	0	3600	2463	68
6	Bharatpur	15. Bharatpur	22000	0	22000	19499	89
		16. Bayana	4700	0	4700	3995	85
		17. Nadbai	6950	0	6950	4722	68
7	Bhilwara	18. Bhilwara	6750	8950	15700	16366	104
		19. Gulabpura	7550	2000	9550	9505	100
		20. Mandargarh	3600	0	3600	1497	42
8	Bikaner	21. Khajuwala	10800	0	10800	8694	81
		22. Kolayat	4050	0	4050	0	0
		23. Nokha	2700	8900	11600	12460	107
		24. Loonkarasar	5400	0	5400	1510	28
9	Bundi	25. Bundi	24620	0	24620	18536	75
		26. Kapren	6750	0	6750	6523	97

Sr. No	District	Name of Warehouse	Warehousing Capacity			Utilization including Reservation	Percentage Utilization
			Own Constt.	Other than own Constt.	Total		
		27. Keshoraipatan	6000	0	6000	1161	19
10	<b>Chittorgarh</b>	28. Chittorgarh	17250	0	17250	17656	102
		29. Nimbahera	13500	0	13500	13095	97
11	<b>Churu</b>		0	0	0	0	0
12	<b>Dausa</b>	30. Dausa	12900	0	12900	2521	20
		31. Bandikui	13680	0	13680	6031	44
		32. Lalsot	1260	1620	2880	1218	42
1	<b>Ajmer</b>	1. Ajmer	13350	0	13350	13733	103
		2. Beawar	6300	0	6300	5086	81
		3. Kekri	3500	0	3500	3704	106
		4. Kishangarh	5400	0	5400	4141	77
2	<b>Alwar</b>	5. Alwar	22650	0	22650	18967	84
		6. Khairthal	7400	0	7400	3265	44
3	<b>Banswara</b>	7. Banswara	12200	0	12200	7608	62
4	<b>Baran</b>	8. Baran	27520	0	27520	15344	56
		9. Antah	9200	0	9200	7472	81
		10. Atru	5400	0	5400	1767	33
		11. Chhabra	11550	0	11550	2079	18
		12. Siswali	6750	0	6750	5304	79
5	<b>Barmer</b>	13. Barmer	6840	0	6840	7533	110
		14. Balotra	3600	0	3600	2463	68
6	<b>Bharatpur</b>	15. Bharatpur	22000	0	22000	19499	89
		16. Bayana	4700	0	4700	3995	85
		17. Nadbai	6950	0	6950	4722	68
7	<b>Bhilwara</b>	18. Bhilwara	6750	8950	15700	16366	104
		19. Gulabpura	7550	2000	9550	9505	100
		20. Mandalgarh	3600	0	3600	1497	42
8	<b>Bikaner</b>	21. Khajuwala	10800	0	10800	8694	81
		22. Kolayat	4050	0	4050	0	0
		23. Nokha	2700	8900	11600	12460	107
		24. Loonkarasar	5400	0	5400	1510	28
9	<b>Bundi</b>	25. Bundi	24620	0	24620	18536	75
		26. Kapren	6750	0	6750	6523	97
		27. Keshoraipatan	6000	0	6000	1161	19

Sr. No	District	Name of Warehouse	Warehousing Capacity			Utilization including Reservation	Percentage Utilization
			Own Constt.	Other than own Constt.	Total		
10	<b>Chittorgarh</b>	28. Chittorgarh	17250	0	17250	17656	102
		29. Nimbahera	13500	0	13500	13095	97
11	<b>Churu</b>		0	0	0	0	0
12	<b>Dausa</b>	30. Dausa	12900	0	12900	2521	20
		31. Bandikui	13680	0	13680	6031	44
		32. Lalsot	1260	1620	2880	1218	42

## Annexure 4: Product wise GST rates of Food Products

### ➤ GST-28%

1. Molasses
2. Chewing gum/bubble gum and white chocolate
3. Cocoa butter, fat and oil
4. Cocoa powder
5. Cocoa chocolates
6. Malt extract (other than for infant use and mixes and doughs of bakers)
7. Waffles and wafers coated with or containing chocolate
8. Extract, essences and concentrates of coffee
9. Mustard flour and sauces thereof
10. Sugar, lactose and glucose syrups
11. Food flavouring material
12. Churan for pan
13. Custard powder
14. Aerated waters containing added sugar or other sweetening matter

### ➤ GST-18%

1. Condensed milk
2. Malt, whether or not roasted
3. Refined sugar, sugar cubes
4. Sugar confectionery
5. All preparations of cereals, flour, starch or milk for infant use and sold retail
6. Pasta, spaghetti, macaroni, noodles
7. Corn flakes and other cereal flakes
8. Waffles and wafers (other than chocolate coating)
9. Pastries and cakes
10. Extracts, essences and concentrates of tea or mate

11. Soups and broths
12. Ice cream and other edible ice
13. Instant food mixes, soft drink concentrates, sharbat, betel, supari, packaged food
14. Water, including natural or artificial mineral waters and aerated waters not sweetened
15. Ethyl alcohol and other spirits
16. Vinegar and substitutes
17. Curry paste, mayonnaise and salad dressing; mixed condiments and mixed

➤ **GST – 12 %**

1. All meat in unit containers put up in frozen, salted, dried, smoked state
2. All meat and marine products, prepared or preserved.
3. Butter, ghee, butter oil, cheese
4. All goods under Chapter 20 (preparations of vegetables, fruits, nuts or other parts of plants, including pickle, murabba, chutney, jam, jelly)
5. Ketch-up & sauces, Mustard sauces
6. Dry fruits 2
7. Starches
8. Animal fats and oils
9. Fruit and vegetable juices
10. Roasted chicory and coffee substitutes
11. Yeasts and prepared baking powders
12. Namkeens, bhujija, mixture, chabena
13. Bari made of pulses including mungodi
14. Soya milk drinks
15. Fruit pulp or fruit juice based drinks
16. Tender coconut water (in unit container with brand name)
17. Beverages containing milk

➤ **GST – 5 %**

1. All fish variants (except seeds of fish, prawn& shrimp) processed, cured, frozen state
2. Ultra-high temperature milk
3. Milk and cream including skimmed milk powder but excluding condensed milk
4. Yoghurt and other fermented milk and cream
5. Chena or paneer in unit container and branded
6. Egg yolk, fresh or dried
7. Natural honey in branded unit container
8. Vegetables frozen or preserved (but unsuitable in that state for immediate consumption)

9. Edible fruits and nuts; peel of citrus fruit or melons, in frozen or preserved state
10. Coffee, tea, pepper, vanilla, cloves, cardamoms
11. Seeds of anise, coriander, cumin
12. Ginger (other than fresh ginger), saffron, turmeric, other spices
13. Cereal groats, meal and pellets in branded unit container
14. Cereal grains worked upon (hulled, rolled, flaked)
15. Meal, powder, flakes, granules and pellets of potatoes
16. Meal and powder of the dried leguminous vegetables (pulses, sago, tamarind)
17. Wheat gluten
18. Soya beans
19. Ground nuts
20. Copra
21. Linseed, rape seeds, sunflower seeds, other oilseeds like mustard, poppy,
22. Flour and meals of oilseeds
23. Sugar beet and sugar cane (frozen and dried)
24. Vegetable fats and oils (groundnut, olive, palm, sunflower oil etc)
25. Beet sugar, cane sugar, khandsari sugar
26. Cocoa beans, shells and paste
27. Mixes and doughs for preparation of bread, pastry and other baker's wares
28. Pizza bread
29. Seviyan
30. Rusks, toasted bread
31. Sweetmeats
32. Flours, meals, and pellets of meat, fish meant for animal consumption
33. Cashew nuts and cashew nut in shell
34. Raisin 3
35. Ice and snow

➤ **GST – Nil %**

1. Meat (Other than in frozen state and put up in container)
2. Bones and horn cores, bone grist, bone meal etc., hoof meal, horn meal, etc
3. Fish, prawn and shrimp seeds
4. All fish, fresh or chilled (but not processed, cured and frozen)
5. Fresh milk, pasteurized milk but not concentrated, sweetened
6. Eggs (in shell)
7. Curd, lassi, buttermilk
8. Chena or paneer (except in unit container with brand name)
9. Natural honey (no container-no brand)

10. Fresh fruits and vegetables, roots and tubers (except in frozen state or preserved)
11. Dried fruits
12. Leguminous vegetables, shelled or unshelled
13. Dried leguminous vegetables, shelled, whether or not skinned or split (pulses)
14. Coffee beans, unprocessed tea leaves, fresh spices
15. All cereals (no container-no brand)
16. Cereal grains hulled
17. Flour
18. Atta, maida, besan (no container-no brand)
19. Wheat or meslin flour
20. Cereal flour, groats and meals (no container-no brand)
21. Flour of potato, dried leguminous vegetables (no container-no brand)
22. Oilseeds of seed quality
23. Cane jaggery (gur)
24. Palmyra jaggery
25. Puffed, flattened and parched rice
26. Pappad (except when served for consumption)
27. Bread (branded or otherwise) (except when served for consumption and pizza bread)
28. Prasadam
29. Water (other than aerated, sealed etc)
30. Non-alcoholic toddy
31. Tender coconut powder
32. Aquatic, poultry and cattle feed
33. Salt, all types

## Annexure 5: PIESTEC Analysis of Coriander

### **Political circumstance**

Typically farmers in Rajasthan have barely 2-3 acres of holdings each. The small and marginal farmers can hardly be expected to invest in better farming technologies, nor aggregate adequate volumes of commodities as to develop alternate marketing channels away from typical APMC or multiple-trader led channel in vogue. There is, therefore, need for aggregation of such farmers into FPOs / FPCs. Typically, such FPOs / FPCs may have a combined holding of 1000-1500 acres. Such institutional change can occur only with the support of political intervention through legislation.

### **Institutional context**

The globally preferred high income yielding form of coriander is coriander seeds and powder. Given the fluctuations in prices as well as need for technology transfer for high yielding varieties, there is apparently need for more technical knowledge sharing and its dissemination to the farmers. There is requirement of aggregating larger and economically viable volumes at the farmers' end in order to fulfil the requirements of the large buyers cum processors directly. In that case, it is of utmost importance to bring farmers' groups under the umbrella of Farmer producer company which would be able to aggregate large volumes, perform primary processing and then have the stronger negotiation power when compared to the single farmer.

The increase in overall production of coriander seeds in India can be caused mainly by advancement of production technology through the National Agriculture Research System and educating the farmers through various training programmes. Introduction of high yielding varieties, new production techniques, integrated nutrient management and sowing of crops as per soil/land suitability could be the major production factor to enhance the productivity of coriander.

India's Spice Parks located in Jodhpur & Kota can provide excellent processing facilities that are at par with international standards in terms of cleaning, grading, sorting, grinding, packing and warehousing. The objective of setting up Spice Parks in India was to provide common infrastructural facilities for both post-harvest and processing of spices and spice products along with backward integration by providing rural employment. Spice Parks help ensure better pricing of spices by reducing supply chain costs. They provide spice farmers with the necessary infrastructure and facilities to improve spice quality and sell spices directly to spice exporters.

### **Economics**

There is sound economics in coriander seed production and processing with appropriate technical know-how and marketing set up. At present, many small farmers are growing coriander which is with lower seed size, grain filling and is not suitably dried upon harvest (to attain the moisture level of 9% finally before sales).

Coriander prices witnessed a major downturn since October 2015 as new crop sowing and expectations of a rise in production dampened sentiments. Coriander prices fell from 11,636 in October 2015 to 6,400 in January 2016. The overall progress of sowing was slow that year due to severe moisture stress in the key growing regions of Rajasthan and Madhya Pradesh. As per data released by the State Departments of India, sowing of coriander in crop year 2015-16 dropped by 7 percent. Coriander prices remained on the lower end in 2016 as area under Coriander cultivation in major growing areas of Rajasthan, Madhya Pradesh and Gujarat witnessed an increase due to higher returns from the crop in the previous year. While production is expected to rise by 8 percent in the crop year of 2016-17 as post sowing weather conditions have remained conducive during the growth stage.

The gross yield of coriander grain is about 5-6 quintal per acre, and that of coriander leaves is about 6 quintal (in 3 cycles) per acre. The market rate of the seeds is about Rs. 5000 per quintal or Rs. 17,500 per acre. Along with sales of coriander seeds, the gross realization is about Rs. 27,500 per acre. The cost of cultivation is about Rs. 14,000 per acre. Net realization (from sale of leaves and grains) per acre is about Rs. 6,750 per acre. The fluctuation in prices of Coriander may range from 3500 (at the time of harvesting) to 6500 (during the festive season) in a year. Notably, most farmers have storage facility at their homes and hence are able to store coriander seeds and sell same during the festive season to gain higher realization. The fluctuation in yield of coriander seeds ranges from 2 quintal to 5 quintal per acre, depending upon irrigation, weather conditions, etc. Farmers in the district also grade seeds at home and the lower grade is sold at about Rs. 2500 per quintal.

### **Social**

Typically, the small and marginal farmers in Rajasthan go in for coriander at a very small scale and with little post-harvest facility at hand. Agro-ecological condition and soil suitability of southeast Rajasthan clearly suggested a wide acceptability for expanding the area under coriander seed production. This area has been evaluated as highly suitable for this crop. Policy makers, regional planners, extension workers along with line departments in combination with the research institutions of this region contribute in triggering the existing productivity and international export of coriander seed. The demand of coriander seeds in International market is increasing in recent years and it is very remunerative to local farmers of Rajasthan. Therefore, the mind setup of the farmers of southeast Rajasthan especially in four districts viz. Baran, Bundi, Jhalawar and Kota should be intensified by transferring the latest agro-technology in relation to coriander seed production. Such interventions not only increase area under this crop but also augment productivity and seed quality for International export purpose.

### **Technology**

There is need of farm mechanization followed by fertigation in the coriander farms. Drip irrigation is recommended which not only saves water usage but also ensures controlled water input to the crop at different stages of its growth. Other than that, GAP plays an important role in enhancing farm productivity in the farming of coriander. These practices are typically transferred by large processors to farmers across the globe in the case of

coriander. Quality high yielding seeds as well as GAP could together enhance productivity and yield as to increase yield per acre from 0.5 to 1.5 Tonnes.

### **Environment**

The scope for promoting coriander in Rajasthan is very high. The scientist of National Bureau of Soil Survey and Land Use Planning, Regional Centre, Udaipur reported that soil quality and climatic suitability for coriander in Kota, Jhalawar, Baran and Chittorgarh districts of Rajasthan might be one of the reasons for involvement of the coriander crop in cropping systems. Higher surface area, more water and nutrient storage capacity of Vertic soils in the Kota region, best support the coriander production.

### **Competition**

Coriander faces stiff competition from garlic in the cluster while being chosen as crop for cultivation. Farmers generally switch between these two crops depending upon the prices received in the previous season.

Due to global competition, the Canadian coriander is uniform in size with good seed quality and reported more competent for export market. The large-seeded coriander is mainly produced in Canada. It takes approximately 100 days for maturity whereas the smaller-seeded coriander takes a longer growing period. Producers thinking about growing coriander should investigate the current pricing of the crop as prices can vary.

Coriander exports from India have been rising over last two years as supply from the top two competitors i.e. Bulgaria and Romania have dropped as unfavourable weather damaged most of the produce in these countries. India has taken advantage of the situation and ramped up its exports over the last couple of years. Thus, in India, the area under coriander is increasing as per our domestic demand. But when it comes to export variety of coriander seeds, Indian farmers have to focus on the large seeded coriander variety.



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