

**Marketing and Price behaviour of Coriander in
Rajasthan**

राजस्थान में धनिये का कीमत एवं विपणन व्यवहार

Thesis

**Submitted to the
Sri Karan Narendra Agriculture University, Jobner
in partial fulfilment of the requirements for
the degree of**

Doctor of Philosophy

In the

**Faculty of Agriculture
(Agricultural Economics)**

By

Vinod Kumar Verma

2017

Sri Karan Narendra Agriculture University, Jobner
S.K.N. College of Agriculture, Jobner

CERTIFICATE - I

Date: **09-12- 2016**

This is to certify that **Mr. Vinod Kumar Verma** has successfully completed the comprehensive examination held on **19-06-2013** as required under the regulation for Doctor of Philosophy

(Dr. R.C. Sharma)

Professor & Head

Department of Agricultural Economics

S.K.N. College of Agriculture, Jobner

Sri Karan Narendra Agriculture University, Jobner
S.K.N. College of Agriculture, Jobner

CERTIFICATE - II

Date: -----2016

This is to certify that this thesis entitled **“Marketing and price behaviour of coriander in Rajasthan”** submitted for the degree of **Doctor of Philosophy** in the subject of **Agricultural Economics** embodies bonafide research work carried out by **Mr. Vinod Kumar Verma** under my guidance and supervision and that no part of this thesis has been submitted for any other degree. The assistance and help received during the course of investigation have been fully acknowledged. The draft of the thesis was also approved by the advisory committee on **04-08-2016**.

(R.C. Sharma)
Professor & Head
Department of Agricultural Economics

(S.S. Jheeba)
Major Advisor

(R. C. Kumawat)
Dean
S.K.N. College of Agriculture, Jobner

Sri Karan Narendra Agriculture University, Jobner
S.K.N. College of Agriculture, Jobner

CERTIFICATE - III

Date: -----2016

This is to certify that this thesis entitled “**Marketing and price behaviour of coriander in Rajasthan**”, submitted by **Mr. Vinod Kumar Verma** to the Sri Karan Narendra Agriculture University, Jobner in partial fulfillment of the requirements for the degree of **Doctor of Philosophy** in the subject of **Agricultural Economics**, after recommendation by the external examiner was defended by the candidate before the following members of the examination committee. The performance of the candidate in the oral examination on his thesis has been found satisfactory. We therefore, recommend that the thesis be approved.

(S. S. Jheeba)
Major Advisor

(R.C. Sharma)
Advisor

(S.K. Khandelwal)
Advisor

(B.K. Sharma)
Advisor

(Dhirendra Singh)
Director Education, Nomine

(R.C. Sharma)
Professor & Head
Department of Agricultural economics

(Virendra Kumar)
External Examiner

(R. C. Kumawat)
Dean

Approved

S.K.N. College of Agriculture
Jobner

Director Education
Sir Karan Narendra Agriculture University, Jobner

Sri Karan Narendra Agriculture University, Jobner
S.K.N. College of Agriculture, Jobner

CERTIFICATE - IV

Date: ----- 2016

This is to certify that **Mr. Vinod Kumar Verma** of the Department of **Agricultural Economics** S.K.N. College of Agriculture, Jobner has made all corrections/ modifications in the thesis entitled “**Marketing and Price behaviour of Coriander in Rajasthan**”, which were suggested by the external examiner and the advisory committee in the oral examination held on **18-02-2017**. The final copies of the thesis duly bound and corrected were submitted on -----are enclosed herewith for approval.

(S. S. Jheeba)
Major Advisor

(R.C. Sharma)
Professor and Head
Department of Agricultural Economics

(R. C. Kumawat)
Dean

S.K.N. College of Agriculture, Jobner

Approved

Director Education
Sri Karan Narendra Agriculture University, Jobner

ACKNOWLEDGEMENTS

I deem it to be my deepest sense of respect and gratitude to my guide, **Dr. S. S. Jheeba**, **Associate Professor**, Department of Agricultural Economics, S.K.N. College of Agriculture, Jobner, Jaipur under whose supervision and able guidance I could carry out the present investigation and prepare the manuscript.

I am highly grateful to the members of my advisory committee, **Dr. R. C. Sharma**, Professor & Head, Department of Agricultural Economics, **Dr. K. N. Gupta**, Professor & Head, Department of Agricultural Statistics, **Dr. S. K. Khandawal**, Professor, Department of Horticulture, **Dr. K. Ramakrishna** Professor & Head, Department of Plant Breeding and Genetics, and **Dr. Dhirendra Singh** Professor, as Dean, PGS Nominee for their constructive suggestions and encouragement during the course of investigation.

I am also grateful to **Dr. R. C. Sharma**, Head, Department of Agricultural Economics, SKN College of Agriculture, Jobner, Jaipur for extending all facilities needed during the course of my study programme.

I am also thankful to other staff members of the Department of Agricultural Economics, namely; **Dr. Pradeep Kumar** (Associate Professor), **Sh. Surendra Singh Rao** (AAO) and **Sh. Gheesa Lal Meena** (Peon) for their help extended to me during the course of study.

I feel gratified to **Dr. G.L. Keshwa**, **Dr. S. N. Sharma** and **Dr. R. C. Kumawat**, Dean, S.K.N. College of Agriculture, Jobner, Jaipur for providing me with necessary facilities during the course of investigation.

I express my sincere thanks to former Dean PGS, **Dr. B. L. Pooniya** SKRAU, Bikaner and present Dean PGS, S.K.N.A.U., Jobner, **Dr. B.S. Khangrawat** for providing necessary facilities during the course of investigation.

I acknowledge the whole hearted co-operation and response given by selected farmers and market intermediaries.

I am very much thankful to my seniors and juniors whose list is too large to mention here for extending their cooperation and sparing valuable time whenever I was in need of.

I am highly grateful to the UGC, New Delhi for awarding me the **Rajiv Gandhi National Fellowship** to carry out and accomplish the present research work.

With most humble sense of regards and reverence, I am thankful to my loving mother & father (**Mrs. Manphool Devi – Mr. Girdhari Lal**), for their determined support, ordant love and blessing which enabled me to accomplish my studies. My brothers C. D. Verma, Mohan Lal, Ramesh, Suresh and Jitendra & Nephew Dinesh, Durgesh and Jyoti my all my family members deserve deep appreciation for their incessant love, support and encouragement, which brought the present task to completion. Last but not least the most cordial appreciation goes to my wife **Smt. Lalita Verma** and My **daughter Diwanshi** whose patience and moral support led me to complete my academic mission.

Last but not the least: I would like to pray the **BABA RAM Dev Ji** to bestow her best wish and blessing that made it possible to complete this task.

Date : 09-12-2016

Place : Jobner

(Vinod Kumar Verma)

List of Contents

S. No.	PARTICULARS	PAGE NO.
	CERTIFICATE-I	-----
	CERTIFICATE-II	-----
	CERTIFICATE-III	-----
	CERTIFICATE-IV	-----
	ACKNOLEDEGOMENTS	-----
	LIST OF CONTENTS	-----
	LIST OF TABLES	-----
	LIST OF FIGURES	-----
	LIST OF APENDICES	-----
	LIST OF ABBREVIATIONS	-----
Chapter-1	INTRODUCTION	-----
1.1	Objectives	-----
1.2	Plan of thesis	-----
Chapter-2	REVIEW OF LITERATURE	-----
2.1	Marketing channels, costs and price spread	-----
2.2	Trend, cyclical, irregular and seasonal price behaviour	-----
2.3	Comparison of spot price with forecast	-----

	price	
2.4	Integration in spot and future markets	-----
Chapter-3	Research Methodology	-----
3A	Selection	-----
3A.1	Selection of crop	-----
3A.2	Selection of study area	-----
3A.3	Selection of districts	-----
3A.4	Selection of tehsils	-----
3A.5	Selection of villages	-----
3A.6	Selection of farmers	-----
3A.7	Selection of markets	-----
3A.8	Selection of market functionaries	-----
B	Collection of data	-----
C	Analysis of data	-----
3C.1	Marketing channels, costs and price spread	-----
3C.1.1	Total marketing costs	-----
3C.1.2	Marketing margins in marketing of coriander	-----
3C.1.3	Price spread in marketing of coriander	-----
3C.2	Trend, cyclical, irregular and seasonal price behaviour	-----

3C.2.1	Measurement of price behaviour	-----
3C.2.1.1	Analysis of trend in prices	-----
3C.2.1.2	Autocorrelation	-----
3C.2.2	Analysis of cyclical component	-----
3C.2.3	Analysis of irregular component	-----
3C.2.4	Analysis of seasonal component	-----
3C.2.4.1	Intra-year price variation	-----
3C.2.4.2	Extent of intra year price rise	-----
3C.2.4.3	Average seasonal price variation	-----
3C.2.4.4	Coefficient of variation	-----
3C.3	Comparison of spot price with forecast prices	-----
3C.3.1	Introduction of ARIMA	-----
3C.3.2	Exponential smoothing model	-----
3C.3.2.1	Single exponential smoothing model	-----
3C.3.2.2	Double exponential smoothing model	-----
3C.3.3	Correlation analysis	-----
3C.4	Integration in spot and futures market	-----
3C.4.1	Johansens co integration	-----
3C.4.2	Engle-granger causality	-----
3C.5	Limitations of the study	-----

Chapter-4	RESULTS AND DISCUSSION	-----
Section- A	Marketing channels, costs and price spread of coriander in Rajasthan	-----
4A.1	Marketing channels of coriander in Rajasthan	-----
4A.1.1	Overall marketing charges in marketing of coriander in Rajasthan	-----
4A.1.1.1	Market charges at village sale in Rajasthan	-----
4A.1.1.2	Market charges at mandi sale in Rajasthan	-----
4A.1.2	Channel-wise marketing cost of coriander in Rajasthan	-----
4A.1.2.1	Overall marketing costs incurred in sale of coriander at village sale in Rajasthan (Channel -I)	-----
4A.1.2.2	Overall marketing costs incurred in sale of coriander at mandi sale in Rajasthan (Channel- II)	-----
4A.1.3	Overall price spread in marketing of coriander in Rajasthan	-----
4A.1.3.1	Overall price-spread in marketing of coriander at village sale in Rajasthan (Channel-I)	-----
4A.1.3.2	Overall price-spread in marketing of coriander at mandi sale in Rajasthan (Channel-II)	-----

4A.2	Marketing costs and price-spread in marketing of coriander in Jhalawar district of Rajasthan	-----
4A.2.1	Marketing channels in Jhalawar district of Rajasthan	-----
4A.2.2	Marketing charges in Jhalawar district of Rajasthan	-----
4A.2.2.1	Marketing charges at village sale	-----
4A.2.2.2	Marketing charges at mandi sale in selected district of Rajasthan	-----
4A.2.3	Channel-wise marketing cost of coriander in Jhalawar district of Rajasthan	-----
4A.2.3.1	Costs incurred in sale of coriander at village sale in Jhalawar district of Rajasthan (Channel- I)	-----
4A.2.3.2	Costs incurred in sale of coriander at mandi sale in Jhalawar district of Rajasthan: (Channel- II)	-----
4A.2.4	Price spread in marketing of coriander in Jhalawar district of Rajasthan	-----
4A.2.4.1	Price-spread in marketing of coriander at village sale in Jhalawar district of Rajasthan: (Channel-I)	-----
4A.2.4.2	Price-spread in marketing of coriander at mandi sale in Jhalawar district of Rajasthan: (Channel-II)	-----
4A.3	Marketing costs and price-spread in marketing of coriander in Baran	-----

	district of Rajasthan	
4A.3.1	Marketing channels in Baran district of Rajasthan	-----
4A.3.2	Marketing charges in Baran district of Rajasthan	-----
4A.3.2.1	Marketing charges at village sale	-----
4A.3.2.2	Marketing charges at mandi sale	-----
4A.3.3	Channel-wise marketing cost of coriander in Baran district of Rajasthan	-----
4A.3.3.1	Costs incurred in sale of coriander at village sale in Baran district of Rajasthan (Channel- I)	-----
4A.3.3.2	Costs incurred in sale of coriander at mandi sale in Baran district of Rajasthan: (Channel- II)	-----
4A.3.4	Price spread in marketing of coriander in Baran district of Rajasthan	-----
4A.3.4.1	Price-spread in marketing of coriander at village sale in Baran district of Rajasthan: (Channel-I)	-----
4A.3.4.2	Price-spread in marketing of coriander at mandi sale in Baran district of Rajasthan: (Channel-II)	-----
4A.4	Marketing costs and price-spread in marketing of coriander in Kota district of Rajasthan	-----
4A.4.1	Marketing channels in Kota district of	-----

	Rajasthan	
4A4.2	Marketing charges in Kota district of Rajasthan	-----
4A.4.2.1	Marketing charges at village sale	-----
4A.4.2.2	Marketing charges at mandi sale	-----
4A.4.3	Channel-wise marketing cost of coriander in Kota district of Rajasthan	-----
4A.4.3.1	Costs incurred in sale of coriander at village sale in Kota district of Rajasthan (Channel- I)	-----
4A.4.3.2	Costs incurred in sale of coriander at mandi sale in Kota district of Rajasthan: (Channel- II)	-----
4A.4.4	Price spread in marketing of coriander in Kota district of Rajasthan	-----
4A.4.4.1	Price-spread in marketing of coriander at village sale in Kota district of Rajasthan: (Channel-I)	-----
4A.4.4.2	Price-spread in marketing of coriander at mandi sale in Kota district of Rajasthan: (Channel-II)	-----
Section- B	Trend, cyclical, irregular and seasonal prices behaviour of coriander in Rajasthan	-----
4B.1	Linear trend in monthly wholesale prices of coriander in selected mandies of Rajasthan	-----

4B.2	Cyclical, irregular and seasonal prices behaviour of coriander in Rajasthan	-----
4B.2.1	Cyclical component in wholesale prices of coriander in the selected mandies of Rajasthan	-----
4B.2.2	Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan	-----
4B.2.3	Seasonal indices of monthly prices of coriander in selected Mandies of Rajasthan	-----
4B.2.3.1	Coefficients of average seasonal variation of coriander in the selected mandies of Rajasthan	-----
Section- C	Comparison of spot prices with forecast prices of coriander in Rajasthan	-----
4C.1	Comparison of spot prices with forecast prices of coriander at Bhawani mandi	-----
4C.1.1	Identification of the model	-----
4C.1.2	Model estimation	-----
4C.1.3	Diagnostic checking	-----
4C.1.4	Exponential smoothing for price forecasting of coriander at Bhawani mandi	-----
4C.1.5	Extent of accuracy through different criterion at Bhawani mandi	-----
4C.1.6	Forecasting for coriander prices of the Bhawani mandi	-----

4C.1.7	Comparison of spot price with forecast prices of coriander at Bhawani mandi	-----
4C.2	Comparison of spot price with forecast prices of coriander at Baran mandi	-----
4C.2.1	Identification of the model	-----
4C.2.2	Model estimation	-----
4C.2.3	Diagnostic checking	-----
4C.2.4	Exponential smoothing for price forecasting of coriander at Baran mandi	-----
4C.2.5	Extent of accuracy through different criterion at Baran mandi	-----
4C.2.6	Forecasting for coriander prices of the Baran mandi	-----
4C.2.7	Comparison of spot price with forecast prices of coriander at Baran mandi	-----
4C.3	Comparison of spot price with forecast prices of coriander at Kota mandi	-----
4C.3.1	Identification of the model	-----
4C.3.2	Model estimation	-----
4C.3.3	Diagnostic checking	-----
4C.3.4	Exponential smoothing for price forecasting of coriander at Kota mandi	-----
4C.3.5	Extent of accuracy through different criterion at Kota mandi	-----

4C.3.6	Forecasting for coriander prices of the Kota mandi	-----
4C.3.7	Comparison of spot price with forecast prices of coriander at Kota mandi	-----
Section -D	Integration in spot and future markets of coriander in Rajasthan	-----
4D.1	Co-Integration between spot and future markets of coriander in selected mandies of Rajasthan	-----
4D.1.1	Unit root test in selected mandies of Rajasthan	-----
4D.1.2	Multiple co-integration analysis for coriander in selected mandies of Rajasthan	-----
4D.1.3	Pairwise granger causality test in selected mandies of Rajasthan	-----
Chapter-5	SUMMARY, CONCLUSION AND POLICY IMPLICATIONS	-----
5.1	Introduction	-----
5.2	Objectives	-----
5.3	Methodology	-----
5.4	Results and Discussions	-----
5.4.1	Marketing costs and price spread in marketing of coriander	-----
5.4.2	Trend, cyclical, irregular and seasonal price behaviour of coriander	-----
5.4.3	Comparison of spot price with forecast prices in Rajasthan	-----

5.4.4	Integration of spot and future markets of coriander in Rajasthan	-----
5.5	Conclusions	-----
5.6	Policy implications	-----
	BIBLIGRAPHY	-----
	ABSTRACT IN ENGLISH	-----
	ABSTRECT IN HINDI	-----
	APPENDIES	-----

List of Tables

Table No	Particulars	Page No
1.1	Major coriander growing districts of the state of Rajasthan	-----
3.1	Details of selected villages in Rajasthan	-----
3.2	Distribution of coriander growing farmers in different size groups in Rajasthan	-----
4A.1	Distribution of farmers adopting different marketing channels in Rajasthan	-----
4A.2	Overall marketing charges in sale of coriander in Rajasthan	-----
4A.3	Overall marketing cost of coriander incurred in channel-I in Rajasthan: 2012-13	-----
4A.4	Overall marketing cost of coriander incurred in channel-II in Rajasthan: 2012-13	-----
4A.5	Overall price spread in marketing of coriander in channel –I in Rajasthan: 2012-13	-----
4A.6	Overall price spread in marketing of coriander in channel- II in Rajasthan: 2012-13	-----
4A.7	Distribution of farmers adopting different marketing channels in Jhalawar district of Rajasthan	-----
4A.8	Marketing charges in sale of coriander in selected mandies of Rajasthan	-----
4A.9	Marketing cost of coriander incurred in channel-I in Jhalawar district of Rajasthan: 2012-13	-----
4A.10	Marketing cost of coriander incurred in channel-II in Jhalawar district of Rajasthan: 2012-13	-----
4A.11	Price spread in marketing of coriander in channel-I in Jhalawar district of Rajasthan: 2012-13	-----
4A.12	Price spread in marketing of coriander in channel-II in Jhalawar district of Rajasthan: 2012-13	-----

4A.13	Distribution of farmers adopting different marketing channels in Baran district of Rajasthan	-----
4A.14	Marketing cost of coriander incurred in channel -I in Baran district of Rajasthan: during 2012-13	-----
4A.15	Marketing cost of coriander incurred in channel -II in Baran district of Rajasthan: during 2012-13	-----
4A.16	Price spread in marketing of coriander in channel-I in Baran district of Rajasthan: 2012-13	-----
4A.17	Price spread in marketing of coriander in channel-II in Baran district of Rajasthan: 2012-13	-----
4A.18	Distribution of farmers adopting different marketing channels in Kota district of Rajasthan	-----
4A.19	Marketing cost of coriander incurred in channel- I in Kota district of Rajasthan: during 2012-13	-----
4A.20	Marketing cost of coriander incurred in channel- II in Kota district of Rajasthan: during 2012-13	-----
4A.21	Marketing cost of coriander in channel- I in Kota district of Rajasthan: during 2012-13	-----
4A.22	Marketing costs of coriander in channel- II in Kota district of Rajasthan: during 2012-13	-----
4B.1	Estimates of linear trend in wholesale prices of coriander in selected mandies of Rajasthan (2000-01 to 2013-14)	-----
4B.2	Cyclical component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)	-----
4B.3	Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)	-----
4B.4	Seasonal indices for monthly wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)	-----
4B.5	Intra Year wholesale price rise in coriander in selected mandies of Rajasthan (2000-01 to 2013-14)	-----
4C.1	Autocorrelation and partial autocorrelation coefficients of the coriander price in Bhawani mandi	-----

4C.2	ARIMA models selected for forecasting the price of coriander on the basis of least AIC & SBC in Bhawani mandi	-----
4C.3	Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price in Bhawani mandi	-----
4C.4	Different exponential smoothing criterion for forecast model for coriander price in Bhawani mandi	-----
4C.5	Selected price forecasting models for coriander based on MAD, MSE & MAPE criteria in Bhawani mandi	-----
4C.6	Forecast price of coriander by different models in Bhawani mandi	-----
4C.7	Comparison of spot price with forecast prices of coriander in Bhawani mandi	-----
4C.8	Autocorrelation and partial autocorrelation coefficients of the coriander price in Baran mandi	-----
4C.9	ARIMA models selected for forecasting the price of coriander on the basis of least AIC & SBC in Baran mandi	-----
4C.10	Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 2) model for the coriander price in Baran mandi	-----
4C.11	Different exponential smoothing criterion for forecast model of coriander price in Baran mandi	-----
4C.12	Selected price forecasting models for coriander based on MAD, MSE & MAPE criteria in Baran mandi	-----
4C.13	Forecast price of coriander by different models in Baran mandi	-----
4C.14	Comparison of spot price with forecast prices of coriander in Baran mandi	-----

4C.15	Autocorrelation and partial autocorrelation coefficients of the coriander price in Kota mandi	-----
4C.16	ARIMA models selected for forecasting the price of coriander on the basis of least AIC & SBC in Kota mandi	-----
4C.17	Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price in Kota mandi	-----
4C.18	Different exponential smoothing criterion for forecast model of coriander price in Kota mandi	-----
4C.19	Selected price forecasting models of coriander based on MAD, MSE & MAPE criteria in Kota mandi	-----
4C.20	Forecast price of coriander by different models in Kota mandi	-----
4C.21	Comparison of spot price with forecast prices of coriander in Kota mandi	-----
4D.1	Unit root test (ADF) for prices of coriander in selected mandies of Rajasthan	-----
4D.2	Johansen's multiple co-integration analysis for monthly spot prices of coriander in selected mandies of Rajasthan	-----
4D.3	Johansen's multiple co-integration analysis for monthly future prices of coriander in selected mandies of Rajasthan	-----
4D.4	Pair wise granger causality tests results for coriander spot prices in selected mandies of Rajasthan	-----
4D.5	Pair wise granger causality tests results for coriander future prices in selected mandies of Rajasthan	-----

List of Figures

Figure No	Particulars	Page No
4B.1	Graphical presentation of linear trend in whole sale prices of coriander in selected mandies in Rajasthan (2000-01 to 2013-14)	-----
4B.2	Graphical presentation of cyclical component in whole sale prices of coriander in selected mandies in Rajasthan (2000-01 to 2013-14)	-----
4B.3	Irregular component of whole sale prices of coriander in selected mandies in Rajasthan (2000-01 to 2013-14)	-----
4B.4	Seasonal indices of monthly wholesale prices of coriander in selected mandies in Rajasthan (2000-01 to 2013-14)	-----
4C.1	Autocorrelation and partial autocorrelation coefficients of the coriander price at Bhawani mandi	-----
4C.2	Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price at Bhawani mandi	-----
4C.3	Forecast accuracy of coriander price in ARIMA (0, 1, 1) model at Bhawani mandi	-----
4C.4	Comparison of spot price with forecast price of coriander at Bhawani mandi	-----
4C.5	Autocorrelation and partial autocorrelation coefficients of the coriander price at Baran mandi	-----
4C.6	Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 2) model for the coriander price at Baran mandi	-----
4C.7	Forecast accuracy of coriander price in ARIMA (0, 1, 2) model at Baran mand	-----
4C.8	Comparison of spot price with forecast price of	-----

	coriander at Baran mandi	
4C.9	Autocorrelation and partial autocorrelation coefficients of the coriander price at Kota mandi	-----
4C.10	Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price at Kota mandi	-----
4C.11	Forecast accuracy of coriander price in ARIMA (0, 1, 1) model at Kota mandi	-----
4C.12	Comparison of spot price with forecast price of coriander at Kota mandi	-----

LIST OF APPENDICES

Appendix No	Particulars	Page No
I	Schedule for Farmer	-----
II	Schedule for village trader	-----
III	Schedule for commission agent cum wholesaler	-----
IV	Schedule for Retailer	-----
V	Schedule for Krishi Upaj Mandi Samiti	-----
VI	Monthly wholesale price and arrivals of coriander crop in selected markets of Rajasthan during Jan-2000 to Dec- 2013.	-----
VII	Estimates of curvilinear (Linear) trend in wholesale price of coriander in selected mandies of Rajasthan (2000-01 to 2013-14)	-----
VIII	Cyclical component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)	-----
IX	Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)	-----
X	Seasonal indices for monthly arrivals and prices of coriander in the selected mandies of Rajasthan (2000 to 2013)	-----
XI	Intra year wholesale price rise in coriander in selected mandies of Rajasthan (2000-01 to 2013-14)	-----

LIST OF ABBREVIATION

Abbreviation	Full form
₹	Rupees
@	At the rate
ACF	Asymmetric Critical Value
ACF	Autocorrelation function
ADFV	Augmented Dickey fuller value
ADL	Autoregressive distributed lag
AIC	Akaike Information Criterion
ARIMA	Auto Regressive Integrated Moving Average
ASPV	average seasonal price variation
CV	Coefficient of Variation
DES	Double exponential smoothing
EGC	Engle-granger causality
FMC	Forward market commission.
HSPI	Highest seasonal price index
IPR	Intra-year price rise
KUMS	<i>Krishi Upaj Mandi</i> Samiti
LSPI	Lowest seasonal price index
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percentage Error
MSE	Mean Standard Error
PACF	Partial Auto Correlation Function
SBC	Schwarz Bayesian Criteria
SES	Single exponential smoothing
TES	Triple Exponential Smoothing
VAT	Value added tax

Chapter-1

INTRODUCTION

India is known as the “Home of Spices” and produces a large number of varieties and quantity of spices. About sixty-three varieties of spices are grown in the country which includes Pepper (King of Spices), Cardamom (Queen of Spices), Chillies, Ginger, Turmeric, Coriander, Cumin, Fenugreek and many others.

India is the largest producer, consumer and exporter of spices and its products in the world. The production of spices in India was 59.51 lakh tonnes from an area of about 32.12 lakh hectare during 2011-2012. It plays a major role in spice trade. It has about 52 % share in world trade of spices. The country registered substantial increase in area and production of spices over last fifteen years with average annual growth rate of 2.7 per cent and 6.2 per cent per annum respectively (Directorate of Arecanut & Spices Development).

In 1951 a high level Spices Enquiry Committee was set up by the Planning Commission. The Government of India accepted its recommendations (1953) and accordingly provided necessary funds to ICAR for implementing various schemes on research, development and marketing of spices in all the regions of the country. Central Spices and Cashewnut Committee was set up in September 1965. The Directorate of Arecanut and Spices Development came in to existence on 1st April, 1966 at Calicut in Kerala for paying adequate attention to

different aspects of crop development during third five year plan (1961-66). In the fourth five year plan (1969-74) development programmes were concentrated for large scale production and distribution of high yielding varieties of important spices with establishment of All India Coordinated Spices and Cashew Improvement Project (AICSCIP). A well organized effort for spices development was mooted in the fifth five year plan (1974-78). In the sixth five year plan (1980-85) the development programmers on spices were assigned to state governments as their mandate on the recommendations of the National Development Council. However, the central sector scheme continued with the union territories and autonomous organizations like state agricultural universities and ICAR institutes with the limited financial resources made available.

Majority of the state governments continued the development programmes on spices till 1986-87. During annual plans 1990-91 and 1991-92, centrally sponsored schemes for the development of spices were intensified by increasing the financial outlay. The integrated programme for spices development was further intensified in the eighth plan (1992-97) for the overall development of 27 commercially important spice crops grown in India. The developmental efforts made in the eighth plan were further intensified in the ninth plan with increased outlay and wider area of operation. During tenth plan, the development programmes on spices were implemented through the state horticulture / agriculture

departments. In order to foster this programme, the basic components, particularly production of high yielding / export oriented varieties, transfer of technology, etc. were taken up by the Directorate of Arecanut and Spices Development in association with state agricultural universities, ICAR institutes, state agriculture /horticulture departments etc. Under planting material production programme, the planting materials of spices were produced and distributed during the period 2002-05. Government of India has launched National Horticulture Mission for an integrated development of various horticultural crops including spices, medicinal and aromatic plants during 2005-06.

Out of 109 spices listed by International Standard Organization in the world, 63 are grown in India. Among these Indian spices, 20 are classified as seed spices which accounted for 36 per cent share in area and 17 per cent share in production during 2010-11. Major growing belt of seed spices is spread from arid to semi-arid regions covering large area of Rajasthan, Gujarat and parts of Madhya Pradesh. Among these states, Rajasthan and Gujarat have emerged as "Seed Spice Bowl of India" jointly contributing around 27 per cent of the total seed spices produced in the country. Rajasthan is the third largest producer of spices in the country and accounts for 15.98 per cent of total production of all spices. Area and production of spices in Rajasthan state was 9.73 lakh hectares and 9.51 lakh tonnes, respectively during the year 2011-12 (Directorate of Agriculture, Rajasthan). The contribution of the state in

the national production was 82 per cent in fenugreek, 66.51 per cent of coriander, 33 per cent of cumin, 14 per cent of garlic and 6 per cent of fennel. Besides this, the state has sizable production of chilli, ajwain, suwa, ginger, turmeric, dill seed, poppy seed, aniseed, nigella and many other spices.

In Rajasthan, area and production of seed spice was 9.01 lakh hectares and 6.97 lakh tonnes, during the year 2011-12 (Directorate of Agriculture, Rajasthan). The major seed spices are coriander, cumin, fennel, and fenugreek, whereas minor group of seed spices includes ajwain, dill, celery, nigella caraway and aniseed according to National Horticulture Board, Govt. of India.

Coriander belongs to the family Apiaceae. The origin place of coriander is said to be Mediterranean region. Coriander is grown in winter season. Coriander fruits serve as a common flavouring substance for both sweet and savory dishes especially in Europe and India. Leaves of coriander are used very commonly in making chutney, flavouring vegetables, salad, etc. Oil of coriander is used in medicines and flavouring beverages such as gin, whisky and various liquours. The roasted seeds are useful in dyspepsia. The paste made from seed is useful in pain in cephalagia. The juice of fresh plant is applied in erythematic. The decoction with milk and sugar is beneficial during bleeding piles. Coriander reduces intoxicating effects of spirituous liquours

India, Morocco, Canada, Russia, Hungary, Poland, Romania, Guatemala, Iran, Mexico, Egypt, Argentina and USA are important countries where coriander is grown commercially. India is the largest producer of coriander seed and it is cultivated in 5.57 lakh hectares land area with a production of 5.33 lakh tonnes in year 2011-12 (Directorate of Arecanut & Spices Development). The coriander was exported to the tune of 28,100 tonnes valued at Rs. 16,401.85 lakh during the year 2011-12 (DGCI&S Ministry of Commerce and Industries, GOI). The main markets for coriander are Malaysia, U.A.E, U.K, South Africa, Saudi Arabia, and Singapore.

In India, coriander growing states are Rajasthan (62%) and Madhya Pradesh (17%)- remaining 21% is produced by states like Andhra Pradesh, Assam, Tamil Nadu Odisha and Gujarat. Rajasthan is largest producer of coriander and it is cultivated on 2.68 lakh hectares of land area with production of 3.29 lakh MT of coriander in year 2011-12 (Directorate of Agriculture, Rajasthan). Coriander crop in Rajasthan is grown mainly in the districts of Jhalawar, Baran, Kota, Bundi, and Chittorgarh which together accounted for 99.41 per cent of the total area and 99.41 per cent of the total production in the state during 2011-12. The Jhalawar, Baran and Kota districts accounted for 97.28 per cent of the total area and 97.67 per cent of total production in the state of Rajasthan during 2011-12 (Table 1).

Table 1 Major coriander growing districts of the state of Rajasthan during 2011-2012

S. No.	Area (ha)	Production (M T)
Jhalawar	117368 (43.82)	123037 (37.35)
Baran	85432 (31.90)	115321 (35.01)
Kota	57744 (21.56)	83372 (25.31)
Bundi	3337 (1.24)	3041 (0.92)
Chittorgarh	2388 (0.89)	2715 (0.82)
Sawai Modhpur	362 (0.13)	445 (0.13)
Rajasthan	267827	329402

Source: Directorate of Agriculture, Rajasthan

Marketing plays an important role in the economic development, as it stimulates production, prevents negative fluctuations in output and prices and reduces costs of production. However, for attaining these benefits, marketing system and marketing management have to keep pace with the production technology and socio-economic development of the country.

Agricultural marketing plays a significant role in the movement of commodity from the producer to the consumer and in stabilizing the prices. The planned increase in agricultural output must be coordinated

with changes in the demand and supply for agricultural commodities. This can be fruitful only when producer's share in consumer's rupee increases considerably irrespective of the volume of the marketable surplus with the farmers. Therefore, marketing rightly considered as essential activity in addition to improved input like seed and fertilizer in modern agriculture.

Price is a matter of vital importance to the seller and the buyer as well as the traders in a market place. In a competitive market economy, price is determined by free play of supply and demand. If competitive and remunerative prices are paid to the farmers, it acts as an adequate incentive for further production. Price determination is a complex dimension on account of scattered demand of the coriander in the country and the multifarious factors that affect it. Pricing is undoubtedly one of the most important decision areas of marketing.

In general, prices are highly volatile in nature and never remain constant. Prices of different groups of commodities never move in the same direction or with the same speed. Hence, they affect the future of individual group and for the matter, the whole economy in several ways. Prices of the crop are an important variable for boosting the production in addition to the availability of better seeds and use of modern technology. Higher degrees of fluctuations were observed in prices of coriander during last 10 years. Price variation in the magnitude higher than the desired level affect the production of crop adversely; so there is a need to keep a watch on movement of prices of coriander for deriving suitable agricultural

price policy for increasing their production continuously. The study of price behaviour and knowledge of changes in prices over time and space guides the planners in deriving the appropriate price regulation measures for the creation of better marketing facilities.

Agricultural commodities possess more or less uniform price trend overtime due to seasonality in nature. The price behaviour of the agricultural commodities is based on the traditional theory of supply and demand conditions. Due to seasonal behaviour of agriculture, it is viewed that during peak arrivals, the prices would be low and vice versa. However, the demand is spread throughout the year. In these circumstances, the validity of the determination of price of an agricultural commodity based on aggregate demand and supply conditions at a given time is uncertain.

Agricultural prices give signal to both producers and consumers regarding the level of production and consumption. Changes in the relative prices of the various agricultural commodities affect the allocation of resources among agricultural commodities by the producers. Agricultural price movements have been a matter of serious concern for policy makers in our country as the behaviour of agricultural prices adversely affects the steady economic development. Among other things, price plays a strategic role in influencing the cultivation of coriander. Indeed, the price analysis of coriander assumes greater significance not only to the policy makers but also to producers and consumers.

Forecasting is one of the main objectives of time series analyses having the art of saying that what will happen in the future rather than why? There are various forecasting models in use now a day. ARIMA and exponential smoothing can choose his own method of forecasting based on his knowledge and available external information. As the process goes on, this procedure can be modified to address the present conditions and to satisfy the current situation. Different forecasting models may be fitted more or less equally well to the data, but they forecast different future values. Unfortunately, there are many occasions when analysts are not certain what forecasting method or model is better one and there will be situations where it will appear that several models could do the job quite successfully. Even if we are certain of how to make a decision, we might work with different parameters and generate several forecasts, which will, again, raise the question of the best forecasts. Thus, it is very much needed that the forecaster should take care to the best possible because a large number of people are using such forecasts.

Need for the present study

An efficient marketing system is an important means for raising the income level of the farmers. Good marketing facilities, efficient marketing channels and marketing machinery gives better prices for the produce in the market than its operation in haphazard way. There is a need to carry out micro level studies on these aspects in different geographical areas under the varying marketing environments. As such there is need to evaluate the marketing system and estimate costs, margins and price spread in marketing of coriander through different channels in its main production areas.

Agricultural commodities have historically exhibited seasonal price movements that are tied to the annual nature of the crop cycle. The trends in prices are the changes observed in the long run. The trends of prices are associated with increase in population, money supply, increased purchasing power and general price levels. Price analysis is the study of past price movements and the supply and demand factors associated with them. Price analysis, thus, explains how and why prices have behaved over time. It also explains whether there is consistency in the price behaviour of commodities over time and space. The study of trends enables us to indicate the general direction of change in prices in different markets.

Seasonal price pattern can be used as a guide for developing a marketing plan when they are examined along with supply and demand information. The seasonality in production causes fluctuations in prices from season to season. The fluctuation in prices causes wide variation in the income of coriander growers from year to year. Hence, the objective is to know whether variability in the prices of coriander has intensified over time. If yes, then what are the factors that explain these variations in the prices of the coriander? Such a study is useful for the Government, farmers, researchers and policy makers in regulating the available supplies, stabilizing the prices of coriander and bringing the stability in the income of coriander growers.

This kind of study also helps in formulating the appropriate policy measures to contain the over production. One can suggest the proper steps to be carried out by the farmers in order to get remunerative prices for their produce in accordance with the forecasting and these forecasts help the policy makers in formulating effective policies.

One of the important indicators of the efficient functioning of the markets is the existence of integration in the markets. Market integration is measured as an inter relationship between price movements in two or more markets. This explains that whether the markets are integrated or are moving

in isolation. Therefore, looking to the importance of coriander for the producers as well as consumers in terms of marketing and price behaviour, the present study entitled "Marketing and price behaviour of coriander in Rajasthan" with the specific objectives stated below was under taken. Objectives:

The specific objectives of the study:-

- 1 To study the marketing channels, costs and margins in marketing of coriander in the state of Rajasthan.
- 2 To study the price trend in coriander in the state of Rajasthan.
- 3 To compare the spot prices with forecast prices of coriander crop in selected markets.
4. To study the integration in spot and futures market of coriander.

1.2 Plan of thesis

The study has been presented in five chapters. Chapter first deals with introduction, importance, objectives and limitations of the study. The second chapter enlisted the review of the literature which is grouped under four sections namely those related to marketing cost, price spread, trend cyclical, irregular, seasonality, price forecasting and market integration in coriander. The third chapter on material and methods briefly describes the coriander crop selected for the study, the types of data used for investigation, coverage and also the analytical techniques. The fourth chapter is meant for result and discussions which has been classified under different heads. Summary and conclusion of the study is presented in fifth chapter and bibliography is given at the end.

Chapter-2

REVIEW OF LITERATURE

The review of literature provides framework for analytical procedure to be followed and new research opportunities to be identified. Keeping in view the objectives of the present study and the research works done regarding the trend and seasonality, price forecasting, and market integration of coriander have been reviewed and presented in this chapter under the following heads:

- 2.1 Marketing channels, costs and price spread
- 2.2 Trend, cyclical, irregular and seasonal price behaviour
- 2.3 Comparison between spot prices with forecast prices
- 2.4 Integration in spot and future markets

2.1 Marketing channels, costs, margins and price spread

Agarwal (1998) in his study entitled costs, margins and price-spread in marketing of spice crops in Rajasthan concluded that farmers got only 64 per cent of the consumer's price by sale of different spice crops in the village through channel I as against 74 per cent share by selling in the regulated market (channel II). Farmers who sold their surplus spices in the regulated market got 10 per cent higher share which was substantial in absolute terms in all these high value spice crops. Marketing costs accounted for 8 to 9 per cent of the price paid by the

consumers. Sales tax alone accounted for more than half of the total marketing costs.

Agarwal and Singh (1997) studied the marketing of fenugreek in Jaipur district of Rajasthan for the period 1995-96 and reported that 76 per cent producer-farmers sold the fenugreek in Renewal regulated market and 24 per cent farmer marketed fenugreek in the village to village traders. Small and semi-medium sized farmers sold their total surplus fenugreek in the first two quarters of the year (April to September) whereas, medium and large sized farmers carried their produce for sale up to the third and fourth quarters (October to March). It was further reported that marketing costs were higher by ₹ 9.80 in village sale compared to sale in the Renwal market. The share received by producer in consumer's price was higher in market sale (82.77 per cent) as compared to village sale (61.88 per cent).

Agrawal and Singh (2003) in their study entitled cumin seed marketing in Rajasthan revealed that producer-farmers got 69.87 per cent share in the price paid by the consumers for cumin seed in regulated market in the year 1997-98. This share was 8.51 per cent higher than the sale of cumin seed in the village markets to the village traders. Total cost in sale of cumin was ₹ 373.69 and ₹ 366.58 per quintal, respectively in village sale and mandi sale. Marketing costs for cumin were higher by ₹ 7.11 per quintal in village sale as compared to mandi sale. Cost of transportation and cost of gunny bags were the major cost items borne by

the producers. The margin of middlemen had been to the extent of 8.42 per cent in sale of cumin seed in the regulated market.

Choudhary (2000) in his study entitled marketing of fennel in Tonk district of Rajasthan observed that a total cost in sale of fennel seed was ₹ 209.60 per quintal at village and ₹ 207.55 per quintal at Mandi. Marketing costs were higher (₹ 2.05 per quintal) in sale of fennel seed at village level compared to sale at Mandi. Transportation cost and cost of gunny bags were the major cost items borne by producer-farmers in the sale of fennel seed both at village and Mandi. Among the middlemen, wholesalers accounted for a very high share in total marketing costs of fennel seed. Marketing margins accounted for 46.69 per cent of the consumer's price in sale of fennel seed through channel-I (producer farmers- village trader- wholesaler- retailer – consumer) and 33.33 per cent of the consumer's price in sale through channel-II (producer farmer- wholesaler- retailer- consumer). Retailers got higher margin in sale of fennel seed in both the channels compared to the wholesalers. Producer's share in consumer's rupee was 48.65 per cent in sale of fennel seed at village level and 62.05 per cent at regulated market. Farmers selling their fennel seed in the regulated market got 13.40 per cent higher share compared to village sale.

Deshmukh *et al.* (2010) studied marketed surplus and price spread in case of pearl millet in the year 2008-09 in Beed district of Maharashtra. For the study, about 96 pearl millet growers were selected

from Georai tehsil. Price paid by consumer was highest as ₹ 920 per quintal in channel-III in which producers share in consumer's rupee was 66.21 per cent. In case of channel-II, price paid by consumer was ₹ 775 per quintal in which the producer's share in consumer's rupee was 77.80 per cent whereas in channel-I (Producer – consumer), price paid by consumer was less as compared to channel-II and channel-III. It was ₹ 599.00 per quintal in which producer's share in consumer's rupee was highest *i.e.* 97.66 per cent as compared to channel-II and channel-III. Net price received by producer was highest in channel-III which was ₹ 610.00 per quintal than that of channel-II (₹.603.00 per quintal) and channel-I (₹ 585 per quintal). Similarly, price spread was also highest in channel-III which was ₹.311.28 followed by ₹ 172.00 in channel-II and ₹.14.00 in channel-I. It was found that, the channel-III was beneficial to both producer as well as intermediaries.

Dhurwey *et al.* (2016) in their study examined the marketing aspects of cabbage crops in Bemetara district of Chhattisgarh. Hundred farmers were selected randomly from ten villages from Bemetara district. The major findings revealed that there were three marketing channels of cabbage, channel-I: producer-consumer, channel-II: producer – Itinerants (kochia)-consumer, and channel-III: producer-commission agent-retailer-consumer. Price received by cabbage producer was ₹585, ₹465 and ₹498 per quintal in channel-I, channel-II and channel-III, respectively. Net price received by cabbage producers was ₹ 535 per quintal in channel-I ₹ 465

per quintal in channel-II and ₹436 per quintal in channel-III. Marketing cost paid by producers by an amount of ₹ 50 and ₹ 62 in channel-I and III.

Killedar (2002) in his study entitled economics of production and marketing of ginger in Satara district of Western Maharashtra estimated per quintal cost of marketing of ginger as ₹ 402.62. While observing the item wise, marketing total charges were 402.62 ₹ /qt, out of this packing charges ₹24.55 (6.1%), octroi ₹ 2.00 (0.5%), labour charges ₹ 4.05 (1.00%), weighing charges ₹ 5.88 (1.46%), market fees ₹ 0.80 (0.20%), transportation charges ₹ 49.98 (12.41%), commission charges ₹304.64 (75.67%) and others are ₹ 1.0.72 (2.66%) respectively , It was noticed that the highest share (75.67%) in total marketing cost was of commission charges, followed by transport (12.41%) and packaging charges (6.10%). Above eighty percent of ginger growers sent their produce to Mumbai and Pune markets for marketing of ginger.

Kumar and Burark (2011) studied the marketing of coriander in Jhalawar district of Rajasthan the study pertains to Jhalawar district of Rajasthan state where coriander is cultivated extensively. They studied various aspects of marketing of coriander such as assessment of price spread, producer's share in consumer's rupee, marketing cost and margins, marketing practices, channels involved in marketing of coriander. A sample of sixty farmers was drawn from four randomly selected villages in Jhalarapatan teshil. Four marketing channels were identified in the study area for marketing of coriander. Channel I: producer

- commission agent – wholesaler – retailer – consumer. Channel II: producer - commission agent cum wholesaler – retailer – consumer, Channel III: producer– retailer – consumer. Channel IV: producer– consumer. Among these channels, 80 percent quantity of coriander moved through channel-I, 18.62 per cent through channel II, 1.25 per cent through channel-III and 0.13 per cent quantity was moved through channel – IV. Marketing cost in the sale of coriander was ₹ 811.38, ₹723.88, ₹ 226.16 and ₹ 136.38 per quintal in channel I, channel II, channel III and channel IV, respectively. As such marketing cost was the lowest in channel IV and the highest in channel-I. Marketing margins earned by different marketing agencies were the highest in channel – III (₹ 723.87 per quintal) and the lowest in channel II (₹ 276.12 per quintal). The producer's net share was maximum in channel-IV (96.70) and minimum in channel I (76.82 per cent).

Prabhavathi, *et al.* (2013) conducted a study on an efficient supply chain ensuring remunerative prices to the producers for their products and to deliver maximum satisfaction to the end consumers for the price they pay. Two major supply chains have been identified, which reveals that supply chain II is more efficient than the supply chain I because more value goods are delivered to consumer from producer at low marketing costs. The study shows that farmers who bring good quality chillies to market prefer supply chain-II to supply chain-I. But farmers who bring poor quality, discoloured chillies, are preferred supply chain-I. Delay in

payment after sale, problems in fare price evolution process, collection of excess commission and availability of loan through bank on produce were important problems that farmers were facing in this market.

Raju and Rao (1995) studied marketing costs and margins in chillies in Andhra Pradesh. The results of the study indicated that the producer's received ₹ 388 per quintal, which was 50 per cent of consumer's price in the year 1993-94. Village merchant by incurring ₹ 43 received a profit margin of ₹55 (7 per cent). Retailers got highest margin among all the intermediaries *i.e.* ₹130 per quintal (16.68 per cent). Total marketing cost in sale of chilies was ₹ 92 per quintal during the same period.

Rajur and Patil (2015) studied price spread, marketing costs and margins of chilli in Karnataka state. The per quintal cost of marketing incurred by farmers in Raichur district (₹112.65) was comparatively higher than that of Bijapur (₹110.02) and Gulbarga (₹ 103.80) districts. The total cost incurred by commission agent was more in Raichur market followed by Gulbarga and Bijapur, the total cost incurred by wholesaler was more in Gulbarga compared to Bijapur and Raichur. The total cost incurred by retailers was highest in Bijapur (₹47.20) followed by Gulbarga (₹ 46.80) and Raichur (₹44.20). The magnitude of price spread in channel I was more in Gulbarga (818.92) followed by Bijapur and Raichur. Retailers share was the major constituent of the total marketing margin.

Tripathi *et al.* (2006) in their study entitled a study on marketing of ginger in Ri-Bhoi district of Meghalaya observed that during the year 2003-04 the marketable surplus was higher than marketed surplus in all production range, showing that farmers sold the produce at higher prices without keeping portion of production for seed. Marketing cost while ranged for ₹ 357 to ₹ 519 per quintal noted to be higher in channel II. Producer's share in consumer's rupees was 38.64 per cent to 60.59 per cent. The analysis revealed that the producer's share in consumer's rupees was low due to exorbitant margin taken by the village traders / commission agents.

Verma *et al.* (2013) studied on the production and marketing of cumin crop in the Jodhpur district of Rajasthan. It is based on the data collected from 60 cumin-producers in the tehsils of Falodi and Looni during 2009-10. The cumin-producers have been found to follow two channels for the marketing of cumin; Channel-I: farmer → village trader → wholesaler → retailer; and Channel-II: farmer → wholesaler (Mandi) → retailer. The marketing cost has been found to be higher in channel-I due to involvement of more middlemen in the channel. The producer share has been computed as 62.1 per cent in channel-I and 68.1 per cent in channel-II. The study has suggested that measures need to be adopted to increase access of farmers to market information and they should be motivated to market the produce collectively to reduce the cost of transportation.

2.2 Trend, cyclical, irregular and seasonal price behaviour

.Agarwal and Sharma (1990) studied the price behaviour of pulse crops in Rajasthan. They tried to estimate inter-year and intra-year price fluctuations of pulse crops using conventional time series technique. The study revealed that the coefficient of average seasonal price index variation was the highest for gram among the different pulse crops, followed by moth, arhar, moong and urad crops. The study further indicated that the inter-year and intra-year price variation in pulse crops during the study period were in considerable magnitude. They found that prices increased at an alarming rate for all pulse crops during study period 1974-75 to 1989-90. Prices also exhibited seasonality in their behaviour. Thus, the study recommended that there was a need to control the prices of pulse crops by adopting measures of increasing their production by use of new technology as well as by adoption of different price instruments to regulate their prices.

Chahal *et al.* (2004) studied the price behaviour of green peas in Hoshiarpur and Ludhiana (Punjab) markets from 1994 to 2002 and found that correlation coefficient of arrivals of peas in Ludhiana market was positive; where as in Hoshiarpur market it was negative. They also found that correlation coefficient of prices of both the markets were positive. The price analysis of peas showed that the seasonal indices of prices were the lowest during the peak harvesting season. The perishability of the produce can be attributed as the main reason for it. The market arrivals

remained almost constant in Hoshiarpur market while these have undergone increase overtime in Ludhiana market. The reason for increasing trend in the latter market may be due to its locational advantage and higher demand which attracts the sellers and buyers from nearby areas in spite of the fact that area allocated to green peas was comparatively lower as compared to Hoshiarpur market. In both the markets direct sales to consumer has turned out to be the most efficient sales outlets, which showed a clear indication for the elimination of the intermediaries. This could be achieved through group marketing, cooperative marketing and or contract farming. Besides this, they suggested that there is a need to evolve a price policy to protect the interests of the producers as well as that of the consumers.

Choudhari and Pawar (2010) studied seasonal variation and relationship between market arrivals and prices of chickpea for period 1985-86 to 2004-05 for four markets viz., Parbhani, Manvat, Hingoli and Akhadabalapur in Marathwada region of Maharashtra state. The results revealed that highest arrivals of chickpea were found in the month of March in Hingoli and Akhadabalapur markets, while significant negative relationship between arrivals and prices of chickpea was observed in Hingoli market.

Garg and Bhakar (2006) estimated the market efficiency and economic profitability for wheat crop in the regulated markets of Bikaner district of Rajasthan. The study was based on the time series data for the

past ten years drawn from four regulated markets, which cover more than 95 percent of the total arrivals of the whole district. The study has clearly indicated that the annual prices of wheat increased significantly whereas arrivals in the market, though increased, were not significant. The monthly prices for wheat crop have also showed an increasing trend, implying thereby the growth of market. On the basis of seasonal indices, the study has revealed that the consumers can be advised to purchase wheat from Bikaner in August, from Nokha in October, from Loonkaransar in April and from Khajuwala in June. November- December was the perfect time for the sale of wheat by farmers, as observed in the study.

Handiganur and Kunnal (1999) studied trends in chickpea arrivals and prices in six markets in Karnataka, India during the period 1977-78 to 1996-97. Chickpea arrivals witnessed a continuous upward movement in all the markets, except in Bhalki. The indices of arrivals were higher in the months of February, March, April and May as these months coincided with the post harvest period. Four of the six markets revealed a positive relationship between arrivals and prices. Price indices in general fluctuated more than arrival indices. There was a greater temporal integration of the Dharwad, Bidar and Bhalki markets with respect to price formation. More variation in arrivals compared to prices showed a poor integration in arrivals.

Kainth and Mehra (1988) studied various components of time series and relationship between arrivals and prices of potato in Amritsar

market. They observed that there were high seasonal variations and positive trends in arrivals and prices over time. Arrivals and stock of the products in the market affected its price to a great extent. Study concluded that the change in supplies of agricultural products was the most important single factor responsible for wide fluctuations in agricultural product prices. The study pinpointed that the changes in demand as a result of change in population, income, habits, customs and establishment of processing industries for the commodity were the other important factors responsible for positive trend in price of the commodity.

Kasar *et al.* (1996) studied behaviour of price and arrivals of red chillies in Maharashtra. Seasonal indices of arrivals of red wet chillies begin in October and end in April, where as that of red dry chillies start in May and end in September. The arrivals of red wet chillies were maximum during December to March when the corresponding prices were relatively low. The arrivals of red wet chillies were low during October, November and April. During these months prices were relatively at higher level. By and large, it appeared that when the seasonal index of arrivals of red wet chillies was more during December to March, the seasonal index of prices was at a low level. On the other hand, when the seasonal index of arrivals of red dry chillies was low (May to September) the price index of chillies was at a very high level.

Kaur *et al.* (2006) analyzed the seasonal fluctuations and price trend for green pea in Punjab for the period 1994 to 2003. They observed

that when arrivals were high, the prices ruled low and when arrivals were low, the prices ruled high. The arrivals in the peak season were high as compared with those in the mid and lean seasons indicating seasonality of the crop, lack of storage and processing facilities and low holding capacity of the farmers. The higher price indices observed during the month of July to November and lowest for March and kept less than hundred for December to June.

Kolur, *et al.* (2012) studied the market arrivals and prices behaviour of wheat in Bagalkot, Bijapur, Belgaum, Dharwad and Gadag in Karnataka from 1989-90 to 2009-10. The time series data indicated a rising trend and trend coefficients of arrivals and prices were found significant. The results of long-term movements of arrivals were significant at 5 per cent level of significance in Dharwad, Bagalkot and Gadag markets while at 1 per cent level of significance in Belgaum and Bijapur. They also analysed seasonal fluctuations and revealed that during January there were lowest arrivals in the market and prices were highest in February.

Kumar *et al.* (2005) studied the behaviour of market arrivals and prices of major vegetable crops in four metropolitan markets of Delhi, Mumbai, Bangalore and Kolkata from 1990 to 2001. The results showed that in cabbage, the extent of variability in arrivals was lower in Bangalore and higher in Mumbai. Prices were relatively stable in Mumbai but were volatile in Bangalore. There was broadly a similar pattern in the prices

across different months in Kolkata and Delhi markets. The authors also found relationship between market arrivals and prices over the years in all the four metropolitan markets. Across different months, there were several instances of positive relationship between arrivals and prices in all the four markets.

Kumari (2009) studied the seasonal fluctuation in price of maize in the Karimnagar and Nizamabad regulated markets of Andhra Pradesh. She worked out indices of wholesale price of maize during 2002 - 2007 and observed that the seasonal price indices were highest in the month of August followed by July in both the markets mainly due to less arrivals of early sown crop. The analysis of variance indicated significant variation between months and non-significant variation between markets regarding pricing pattern in these two markets. The correlation coefficient (r) valued at 0.52 between the two market prices indicated a positive and significant (significant at $p < 0.1$) relationship in the movement of maize prices in both the markets.

Lal *et al.* (2000) studied the behaviour of prices and market arrivals of food grains in Himachal Pradesh. The results of the study revealed that the wholesale prices of principal food-grains increased overtime. The price of rice showed the highest trend value followed by that of maize and wheat. As expected, the study of seasonal movements in prices and arrivals revealed that the prices of food-grains were the lowest during the post-harvest period and these were higher during the lean season. The

seasonal indices of market arrivals were also found to be greater than average during post harvest period and less than average during the lean period. The prices and arrivals were found to be inversely related to each other. It was inferred that the market arrivals was not only the sole factor of variation in prices but the demand for food-grains also attributed to it.

Nandal and Hasija (1995) in their study on marketing pattern and price behaviour of gram in Bhiwani district of Haryana observed that arrivals during the post harvest period were maximum in all the markets, with the passage of time the arrivals proportionately decreased in lean period and increased in mid period.

Newadkar *et al.* (1992) in their study on arrivals and prices of tur and gram commodities in Pune regulated market of Maharashtra reported that there was a wide fluctuation in the arrivals of tur in the market which may be attributed to the decline in the area under the crop which resulted in low production. There was no specific trend in the arrivals of gram. The increasing trend of average prices was observed in both the pulses; however the price of tur had slightly declined during the year 1984-85.

Patel and Agarwal (1993) studied the inter-year price variation for groundnut crop. They found that during the one and a half decade, prices increased by more than 10 per cent per annum in the different markets of Gujarat state. Prices of the crop also exhibited conspicuous seasonality during the study period. There was a need to minimize price rise for this commodity. This can be done by adopting measures of increasing their production through use of modern location specific technology as well as

by adoption of different price instruments to regulate their prices. A check on the tendency of the farmers of brisk sale in the immediate post harvest months by enhancing storage and credit facilities along with the proper education by better price information system was also suggested.

Prakash and Srivastava (1994) in their study conducted on pattern of market arrivals and price of gram in Uttar Pradesh reported that the inter year variation in market arrivals of gram varied between 86.6 and 120.0 percent from average annual arrivals from 1987-88 to 1991-92. The variation in market arrivals were not directly related with the annual production of gram in the state. The lowest market arrival of gram was recorded during 1988-89 though there was maximum production of gram in the state during that year.

Ravikumar *et al.* (2001) in their study entitled “Determinants of prices of agricultural commodities in the regulated markets of Andhra Pradesh” analyzed the data collected for the period from 1981-82 to 1995-96 for jaggery and groundnut. The study concluded that, in general, arrivals showed mixed trend, whereas, prices showed an increasing trend for the selected commodities in Anakapalle regulated market of Andhra Pradesh. There existed an inverse relationship between seasonal indices of arrivals and prices of selected commodities. Therefore, the policy implication lies in encouraging the farmers to dispose off their produce at the opportune time to get good remunerative prices

Salam *et al.* (2012) price behaviour of major cereal crops in Bangladesh. The key concern of this research was to analyse the extent of the seasonal price fluctuation and spatial price relationship of major cereal crops *viz.*, Boro paddy and wheat in different markets in Bangladesh. This study was entirely based on secondary data from the period of 1986-87 to 2009-10 from different sources. In estimating seasonal price fluctuation of selected crops it was found that crops prices fluctuated in different months within the year. The difference between peak and trough prices was higher for Boro paddy than wheat. Coefficient of variation was also higher for Boro paddy than wheat but these figures were decreasing gradually. The results of empirical evaluation of spatial price linkage through Engle-Granger co-integration method among regional selected markets of Bangladesh using harvest price of Boro paddy and wheat indicated that these markets were well integrated. That means, information about price changes are fully and instantaneously delivered to the other markets in Bangladesh. Price analysis and formation of policy at the aggregate level will be pertinent for policy implementation.

Sangeeta (2004) analyzed the arrivals and prices of onion in Lasalgaon and Pune markets (Maharashtra) from 1999-2002. She observed that in Lasalgaon market the arrivals were more in January and February, where as in Pune market the arrivals began increasing in February and March. The prices showed an upward trend from the month

of June and continue to rise up to November, after which decline was observed.

Sharma *et al.* (1988) used time series analysis in studying the structure and behaviour of prices of Himachal Apple in Indian markets. Using the method of linear trend and seasonal indices, the study indicated that apple prices showed day to day and month to month fluctuations because of variations in demand, arrivals and stock position in the market. The seasonal behaviour of apple prices was more or less similar for the different markets, viz., Shimla, Delhi, Calcutta, Bombay and Madras. The study further explained that price indices varied widely in Delhi market which is the biggest distribution market for apple in India. The coefficient of variation in apple prices was the highest for Delhi, followed by Shimla, Calcutta and Madras, respectively.

Singh (1988) studied the market arrivals and prices variability of soybean in main mandies of Uttar Pradesh by using conventional method of time series analysis. The study indicated that market arrivals of soybean were higher during the period 1986-87 compared to 1983-84. The trend of market arrivals confirmed that a bulk of the soybean was not transacted in the mandies due to lower prices. For improvement of the soybean marketing, it was suggested that government should develop a system to procure the bulk of soybean at a pre-announced purchase price to encourage the soybean growers.

Singh and Kumari (2003) studied monthly time series data on price and arrivals of rice from the selected regulated markets of Bihar for the period 1990-91 to 2000-01. They observed that the arrivals of rice in Narkatiaganj, Bihariganj and Musallapur regulated markets indicated that arrivals of rice were almost evenly distributed throughout the year. However, in primary markets of Narkatiaganj and Bihariganj, more arrival was observed during peak period followed by mid and lean period. They also observed the similar trend of price in all selected markets *i.e.* lower during post harvest months and higher during lean period.

Singh *et al.* (1995) analyzed the seasonal price fluctuations for wheat in Bihar during the period 1980-81 to 1989-90 and concluded that the trends of prices were similar in both primary and secondary markets *i.e.* lowest during peak marketing period (April to July) followed by mid (August to November) and lean period (December to March). The seasonal variation in arrivals of wheat was more apparent in primary markets than in secondary markets. As much as one third of variations in annual arrivals of wheat were governed by the variation in prices in both the primary and secondary markets.

Takle (2002) studied the behaviour of market arrivals and prices of rabi Jowar for the period 1981 to 1995 for seven regulated markets of Marathwara region *i.e.* Aurngabad, Jalna, Parbhani, Beed, Latur, Osmanabad and Nanded. He analysed the seasonal variation of arrivals and showed a higher degree in Jalna market and lower degree in Osmanabad and Parbhani markets. Price of rabi jawor varied to a greater

extent in Parbhani market and to a smaller extent in Nanded market. The annual variation in prices was found to be highest in Latur and Beed market and lowest in Nanded and Parbhani market. He also observed the high negative relationship between arrivals and prices of rabi jowar in selected markets.

Viju (1988) studied the variability in prices, particularly that of pepper and ginger in Kerala. The study showed that the pepper and ginger commodities recorded positive growth rates in the whole period. Intra-year price analysis exhibited that the seasonal index for ginger was lowest (87.96%) in December, which was coinciding with the harvesting season and it was the highest (108.61%) in June and the range of seasonal index was 20.65. In case of pepper, the seasonal index ranged from 92.72 in March to 106.46 in July.

Yogisha *et al.* (2007) in their study entitled trends and seasonal variation in arrivals and prices of potato in Kolar district observed a mixed trend in arrivals and prices of potato in all selected markets. The data pertaining to the study were collected for a period from 1994-95 to 2004-05. The monthly seasonal indices for arrivals of potato, onion, ragi and groundnut were found higher immediately after the harvest in all the markets and the price indices were found to be maximum during lean period and minimum during harvesting period. Hence, the dissemination of information on market arrivals, prices prevailing in the market, crops to

be grown to the season, etc. will result in maintaining uniformity in supply and demand of the produce.

2.3 Comparison of spot price with forecast price

Ansari and Ahmed (2001) applied ARIMA modeling for time series analysis of world tea prices and industrialized countries export prices. The results of the estimated ARIMA equations imply that the information on the current period tea price is sufficient to forecast the next periods and the industrialized countries export prices can be forecasted from information on the prices of the previous two periods. They concluded from the fitted ARIMA models that Autoregressive process generates both price series and there was no influence of external factors.

Bannor *et al.* (2016) in this study explored modelling and forecasting of wholesale groundnut monthly prices in Bikaner district of Rajasthan using the Autoregressive Integrated Moving Average (ARIMA) model and Vector Autoregressive model (VAR). Augmented Dickey fuller test, DF-GLS test and Philips Perron test were used to test for unit root in price series. Autocorrelation (ACF) and Partial autocorrelation (PACF) functions were estimated to assist in deciding the appropriate orders of the Autoregressive model of order p (AR) and Moving Average model of order q (MA). The BIC test was conducted because we were considering several ARIMA models and the model (0, 1, 0) which had the lowest BIC value of 11.612 with R square figure of 84.7% and the mean absolute percentage error of 7.602% was chosen as the best fit model. Vector

autoregressive model used in Model factored in Jaipur, Jodhpur monthly groundnut market prices and cumulative rainfall and rain days per month over the period of 2005-2014. VAR model showed high forecasting error with MAPE of 0.769% compared to ARIMA model of 2.745%. Indicating, VAR model has high forecasting accuracy compared to ARIMA. The Lagrange Multiplier test of VAR showed that there is no serial correlation in the model whereas Jacque-Bera test also indicated, the residuals of the VAR model is normally distributed indicating a good fit model.

Batchelor *et al.* (2007) identified the model that provided the most accurate short-term forecasts of spot and forward prices in the international freight market. Four time series models were considered, namely, the Box-Jenkins ARIMA model, the Vector Auto-regression (VAR) model on price changes, a general Vector Equilibrium Correction model (VECM) suggested for co-integrated variables and a restricted VECM model. The VAR model was considered as a restricted version of the VECM in which the equilibrium correction term was dropped. For evaluation purposes, the data were split into an in-sample estimation set and an out-of-sample forecast set. The various time-series models were initially estimated over the period 16 January 1997 to 30 June 1998 for all routes. The period from 1 July 1998 to 31 July 2000 for the Atlantic routes and the period from 1 July 1998 to 30 April 2001 for the Pacific routes were then used to evaluate independent out-of-sample N-days ahead forecasts

Bhardwaj *et al.* (2012) studied the performance measures of univariate time series methods for gram price forecast based on the time series forecast models which are non structural-mechanical in nature. The model that has been selected for forecasting the prices of gram was autoregressive integrated moving average [ARIMA (0, 1, 1)] model which gave reasonable and acceptable forecasts; it was not performed very well when there existed volatility in the data series. For this reason, generalized autoregressive conditional heteroscedasticity [GARCH (1, 1)] model was used to forecast gram prices. The model performed better than ARIMA (0, 1, 1) because of its ability to capture the volatility by the conditional variance of being non-constant throughout the time. The study concluded that GARCH (1,1) was better model than ARIMA (0, 1, 1) in forecasting spot price of gram. The values for RMSE, MAE and mean absolute percentage error (MAPE) obtained were smaller than those in ARIMA (0, 1, 1) model. The AIC and SBC values from GARCH model were smaller than that from ARIMA model. It showed that GARCH were better model than ARIMA for estimating daily prices of gram.

Bhardwaj *et al.* (2012) study deals with time series models which are non-structural-mechanical in nature. The Box Jenkins Autoregressive integrated moving average (ARIMA) and Generalized autoregressive conditional heteroscedastic (GARCH) models are studied and applied for modeling and forecasting of spot prices of Gram at Delhi market. Augmented Dickey Fuller (ADF) test is used for testing the stationarity of

the series. ARCH-LM test is used for testing the volatility. It is found that ARIMA model cannot capture the volatility present in the data set whereas GARCH model has successfully captured the volatility. Root Mean square error (RMSE), Mean absolute error (MAE) and Mean absolute prediction error (MAPE) were computed. The GARCH (1, 1) was found to be a better model in forecasting spot price of Gram. The values for RMSE, MAE and MAPE obtained were smaller than those in ARIMA (0, 1,1) model. The AIC and SIC values from GARCH model were smaller than that from ARIMA model. Therefore, it shows that GARCH is a better model than ARIMA for estimating daily price of Gram.

Burark *et al.* (2011) in their study entitled price forecast of coriander a case study of Kota market of Rajasthan analyzed the price of coriander in the Kota regulated market of Rajasthan. Monthly time series data on wholesale prices of coriander for the period 2000 to 2010 were collected and used to calculate price forecast with the help of an Autoregressive Integrated Moving Average (ARIMA) model. It was found that on ARIMA model of order (1, 1, 0) fits the data well with lowest percentage error. The price forecasted for harvesting months viz: April to June 2011 was `4000/ q. For the impact assessment of price forecast, two villages from Kota district namely Umerhedi and Khandgaun of Sangod teshil were purposively selected. From these villages, 26 farmers were randomly selected for the impact study. On an average 2.35 ha area was under coriander crop. Average price realized by the farmers before

May 2011 was ₹2330 whereas those who retained coriander and waited for forecasted price realized ₹3980 /q (after May to June 2011). Thus, incremental income was realized to the extent of ₹23477 per hectare by the farmers who sold their produce after May 2011.

Burark and Sharma (2012) in their study entitled price forecasting of coriander: methodological issues. Forecasting of agricultural prices plays a crucial role in planning of farm level crop production. In this paper, the prices of coriander have been forecasted using statistical time-series modeling techniques, viz. Autoregressive Integrated Moving Average (ARIMA), Artificial Neural Network (ANN) and Exponential Smoothing Models. The forecasting performance of these models has been evaluated and compared by using common criteria such as mean square error; mean absolute percentage error and Akaike Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (SBC). The data used in this study include monthly wholesale price of coriander for April 2000 to May 2011. An ARIMA (1, 1, 1) model has been constructed based on the autocorrelation and partial autocorrelation. Finally, forecasts have been made based on the model developed. On validation of the forecasts from these models, ARIMA (1,1,1) model has performed better than other models for coriander in the Kota market of Rajasthan.

Chaudhari and Tingre (2014) in this study aimed to forecast the Green gram prices for Maharashtra by using the time series data of monthly average prices for the period from January 2001 to September

2012 of Akola market. To forecast the Green gram prices ARIMA models introduced by Box and Jenkins (1970) were used. To test the reliability of model R^2 , Mean Absolute Percentage Error (MAPE), and Bayesian Information Criterion (BIC) were used. Model parameters were estimated using the Statistical Package for Social Sciences (SPSS). Among the different models lowest BIC value worked out to 1989 for ARIMA (0,1,0) which was the best fitted model. Based on model results the estimated Green gram prices for Maharashtra would increase from Rs. 4646 per quintal during October 2012 to Rs. 4729 per quintal during February 2013.

Cramer *et al.* (1999) studied the market efficiency of the US rough rice futures market using the Dickey-Fuller test for data stationarity, standard regression models, Johansen's co integration test, and an additive ARIMA model. Stationarity tests indicated that the price series for both cash and futures tended to be non-stationary during the growing season, April to August, but were stationary during the remaining part of the year or the storage season. Initial results indicated that the long-grain rough rice futures market was efficient in Arkansas. Hence, market participants can use this market, in conjunction with other management tools, to manage price risk. These results can be used to evaluate the potential role of futures market in other states.

Iqbal *et al.* (2005) made an attempt to forecast the area and production of wheat in Pakistan up to the year 2022. ARIMA (1, 1, 1) and ARIMA (2, 1, 2) were taken for 20 year ahead and forecasts. The ARIMA

model showed that area and production of wheat would be 8475.1 thousand hectare with the 29774.8 thousand tons in 2002-22. The scope of higher area and production lies in adequate availability of inputs, educating and training the farming community, soil conservation and reclamation, and especially the supportive government policies regarding wheat cultivation in the country.

Krishnankutty (2001) predicted the future prices of teak (*Tectona grandis*) in three girth classes (based on mid-girth, under bark and of logs) in Kerala, India using the autoregressive integrated moving average (ARIMA) models. The data used for price forecasting was based on the average annual current prices of teak girth class 1, 2 and 3.

Kumar *et al.* (2002) made an attempt to build an autoregressive integrated moving average (ARIMA) model for forecasting productivity of wheat in the alluvial plains of Bihar, India for 45 years between 1950-51 to 1996-97 and data from the last 2 years were utilized for testing the validity of forecasting. It was found that an ARIMA model of order (0,1,2) fits the data well with 13.99% percent error of forecast. The model was characterized by properties such as inversibility, parsimoniousness and stability.

Larson (1983) in his study entitled summary statistics and forecasting performance argued that information about the structure of the error term is essential to accurately evaluate any model and its summary statistics. He found that such information is neither generally requested

not provided by most economic journals. In this opinion an effective method for evaluating a model and its forecasting abilities was to compare the net-of-the sample forecasts of complicated models with out-of-the sample forecasts of simple models. Auto Regressive Integrated Moving Average (ARIMA) and Vector Auto Regression (V AR) models were two such models, which provide relatively good forecasts.

Moghaddasi and Badr (2008) made an attempt to forecast of wheat price using different econometric models including structural and time series models for the study period 1966 to 2006. The forecasting performance of these models was evaluated and compared by using common criteria such as root mean square error, mean absolute error, mean absolute percentage error and Theil Inequality Coefficient. They revealed superiority of time series models (unit root and ARIMA (3,2,5)) for forecasting of wheat price.

Nagashree *et al.* (2012) examined the performance of Autoregressive Integrated Moving Average (ARIMA) models through prediction accuracy using monthly data from October 2002 to July 2012 from a leading areca nut market of the country, *viz.* Shimoga in Karnataka. The forecasting performance of alternative models were evaluated by using Akaike Information Criterion (AIC), Mean Absolute Percentage Error (MAPE) and Schwarz's Bayesian Information Criterion (SBC) based on their power of forecasting. On validation of the forecasts from these models, ARIMA (0, 1, 0) model was found to perform better

than the other models. It was also found that models with least Mean Absolute Percentage Error (MAPE) of 5, 5, 6 could be successfully applied to forecast the prices of three varieties of arecanut, viz. *Saraku*, *Bette* and *Edi*, respectively. The forecast accuracy of the three price series ranged between 94 and 99 per cent for the concerned months. The paper has suggested that ARIMA (0,1,0) model can facilitate effective decision-making by the farmers and stakeholders in selling their produce.

Najafi, *et al.* (2007) in their study wholesale prices of selected crops i.e. tomato, onion and potatoes in Fars Province, Iran, were predicted for various time horizons by using common methods of forecasting and artificial neural networks (ANN). Monthly data from September 1998 to June 2005 period were obtained from Ministry of Jihad-e Agriculture. To compare different methods, data collected from September 1998 to December 2004 were utilized, and latest six-month data were mainly used to monitor the power of prediction. The MAE (Mean Absolute Error), MSE (Mean Standard Error) and MAPE (Mean absolute Standard Error) criteria were used to compare the ability of different forecasting methods. Results of this study showed that ANN had the lowest error in prediction of prices for one-to three-months period, but for six-month prediction, all forecasting methods were not statistically different.

Newaz (2008) in this paper an attempt has been made to compare different time series models to forecast exchange rate. Paper uses Box-

Jenkins methodology for building ARIMA model, exponential smoothing, naïve 1 and naïve 2 models. Sample data for the paper were taken from September 1985 to June 2006, out of which data till December 2002 were used to build the model while remaining data points were used to do out of sample forecasting and check the forecasting ability of the model. All the data were collected from various issues of International Financial Statistics published by International Monetary Fund. Result of this study shows that ARIMA models provides a better forecasting of exchange rates than exponential smoothing and Naïve models do. Comparison of the MAE, MEAE, MAPE, MSE and RMSE shows that the proposed ARIMA model is the best among all these models.

Rahman (2010) examined the best fitted ARIMA model for efficient forecast of boro rice production in Bangladesh from 2008-09 to 2012-13. It appeared from the study that local, modern and total boro time series were 1st order homogenous stationary. He observed from the study that the ARIMA (0,1,0), ARIMA (0,1,3) and ARIMA (0,1,2) were the best models for local, modern and total boro rice production, respectively. It was observed from the analysis that short term forecasts were more efficient for ARIMA models. The production uncertainty of boro rice can be minimized if production can be forecasted well and necessary steps can be taken against losses. The government and producer can well use ARIMA models to forecast future production more accurately in the short run.

Rajaraman and Datta (2003) in their study entitled univariate forecasting of state level agricultural production. Forecasted the Agriculture production of five states of India namely Punjab, Rajasthan, Karnataka, Andhra Pradesh and Uttar Pradesh using ARIMA models. They have used Index of Agricultural Production (IAP) rather than Gross State Domestic Product (GSDP) of the states. Models were fitted for the data from 1950-51 to 2000-2001 and forecasted for next three years. The forecast for 2002-2003 showed negative growth for Rajasthan (-1.7%) and Andhra Pradesh (-3.5%). The forecast for Punjab and Karnataka were positive 1.8 and 5.0 per cent, respectively.

Sankar and Prabakaran (2012) made an attempt to forecast milk production in Tamil Nadu, based on data on milk production during the years from 1978 to 2008. The study considered Autoregressive (AR), Moving Average (MA) and Autoregressive Integrated Moving Average (ARIMA) processes to select the appropriate stochastic model for forecasting milk production in Tamil Nadu. Based on ARIMA (p, d, q) and its components ACF, PACF, Normalized BIC, Box-Ljung Q statistics and residuals estimated, ARIMA (1, 1, 0) was selected. Based on the chosen model, it could be predicted that the milk production would increase to 7.15 million tons in 2015 from 5.96 million tons in 2008 in Tamil Nadu.

Sarika, *et al.* (2011) conducted a study on modelling and forecasting time-series data of pigeonpea production In India. Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) time-series

methodology was considered for modelling and forecasting country's pigeonpea production data (1969–70 to 2007–08). The augmented Dicky Fuller test was applied to test stationarity in data set. Root mean square error, Akaike information criterion and Bayesian information criterion were used to identify the best model. The performance of fitted model was examined using mean absolute error; mean per cent forecast error, root mean square error and Theil's inequality coefficients. ARIMA (2, 1, 0) model performed better among other models of ARIMA family for modelling as well as forecasting purpose. One and two-step ahead forecast value for 2006–07 and 2007–08 for India's pigeonpea production was computed as 2.54 and 2.53 million tonnes with standard errors 0.29 and 0.31, respectively.

Sharma (2015) studied the applicability of ARIMA models in wholesale wheat market of Rajasthan: an investigation. In this paper different ARIMA time series models were specified and estimated. Forecasting performance of these models were evaluated and compared by using common criteria such as: root mean square error, mean absolute deviation and mean absolute percentage error. The data used in this study include wholesale prices of wheat for year 2002 to 2012. Empirical results showed that ARIMA (1,1,1) price forecast time series model fitted the price series well and they have correctly predicted the future trend of the price series within the sample period of the study. Thus, ARIMA (1,1,1) was the most representative model for the price forecast of wheat

in Sriganganagar market of Rajasthan. This model can facilitate the farmers and wholesalers in effective decision making.

Sharma *et al.* (2015) Price of cumin in Rajasthan using ARIMA approach. Time Series data for the period of 2007-2014 were used to forecast price. The price was almost stable during the period. The price forecasting was done using Autoregressive Integrated Moving Average (ARIMA) model. The forecasted price for the period Dec 2014 to Feb 2015 was estimated to be approximately Rs10, 090 /Q. These projections help the formers to decide right time to market the produce.

Sher Falak and Ahmad Eatzaz (2008) studied the forecasting of wheat production in Pakistan this study analyzes the future prospects of wheat production in Pakistan. Parameters of the forecasting model are obtained by estimating a Cobb-Douglas production function for wheat, while future values of various inputs are obtained as dynamic forecasts on the basis of separate ARIMA estimates for each input and for each province. Input forecasts and parameters of the wheat production function are then used to generate wheat forecasts. The results of the study show that the most important variables for predicting wheat production per hectare (in order of importance) are: lagged output, labour force, use of tractors, and sum of the rainfall in the months of November to March. The null hypotheses of common coefficients across provinces for most of the variables cannot be rejected, implying that all variables play the same role in wheat production in all the four provinces. Forecasting performance of

the model based on out-of-sample forecasts for the period 2005-06 is highly satisfactory with 1.81% mean absolute error. The future forecasts for the period of 2007-15 show steady growth of 1.6%, indicating that Pakistan will face a slight shortage of wheat output in the future.

Verma *et al.* (2016) cumin price forecasting in Rajasthan: ARIMA model. ARIMA (Box-Jenkins model) was employed to predict the future prices of cumin in Mandor market. The various forms of ARIMA models viz., ARIMA (1,1,0), ARIMA (1,1,1), ARIMA(0,1,1), ARIMA(2,1,1), ARIMA (0,1,2) and ARIMA(2,1,0) were tried. The performance of fitted ARIMA model (0,1,2) was examined by computing various measures of goodness of fit with least Akaike Information Criteria (1432.46), Schwarz Bayesian Criteria (1439.93) and mean absolute percentage error (4.56). Thus, it was the most representative model for the price forecast of cumin in Mandor market of Rajasthan. The developed model can be used as a policy instrument of the producers and stakeholder.

Verma, *et al.* (2016) in this study forecast Pearl millet price using statistical time-series modelling techniques- Autoregressive Integrated Moving Average (ARIMA) Models. The forecasting performance of these models has been evaluated and compared by using common criteria such as: mean absolute percentage error, Akaike Information Criteria (AIC) and Schwarz's Bayesian Information criterion (SBC). The data used in this study include monthly wholesale price of bajra from January 2003 to December 2014. Among all the models tried, the Box-Jenkins ARIMA

model (2, 1, 0) was best fit with least AIC (1557.22), SBC (1566.10) and MAPE (5.78). ARIMA (2, 1, 0) model is constructed based on autocorrelation and partial autocorrelation. Finally, forecasts were made based on the model developed. On validation of the forecasts from these models, ARIMA (2, 1, 0) model performed better than the others for bajra in Renwal market. The validation percentage ranged between 87.33 per cent in December 2015 to 96.67 per cent in July 2015. Thus, ARIMA model can be used to predict the future price of bajra in Renwal market of Rajasthan.

Zakari and Ying (2012) conducted a forecasting of Niger grain production and harvested area. The main purpose of this study was to forecast Niger grain production and harvested area for two main staple crops (Millet and Sorghum) using ARIMA model. The time series data of production and harvested area covering the period 1970-2010 were used in the study. The findings showed that the total harvested area and total grain production in 2030 would be 21317.4 thousand of ha and 12677.9 thousand tons in 2030, respectively. The model also showed that Millet and Sorghum production would be 4503 thousand tons and 1574.8 tons, respectively at the same period. The results of study are expected to help Niger authorities to build strong strategy in reducing population's vulnerability to food insecurity and make policies with regard to relative price structure, production and consumption.

2.4 Integration in spot and future markets

Arshad (1990) in his study entitled integration of palm oil markets in Peninsular Malaysia. The applicability of the Ravalli an method and causality tests in measuring market integration and ascertaining the nature of price relationships in the Malaysian crude palm oil market and found a highly integrated market in short-run. Local factors were proved statistically insignificant. Pierce causality tests indicated an instantaneous or feedback relationship. This suggested each region absorbed new information as and when it became available. The season for this attribute was the setting up of palm oil futures market in Kuala Lumpur, which had increased the accessibility of market information.

Ashra (2003) in his study entitled interactions between industry and agriculture in India, evidence based on a multivariate co-integration and error correction modeling approach made an attempt to test the issue of causality between agricultural, Industrial and Government sectors under dual economy framework during 1950 to 2000. He found that there was an evidence of co integration among agricultural output, industrial price, Government consumption expenditure and investment.

Bannor *et al.* (2015) assessed integration between cluster beans markets pairs in Rajasthan state of India using monthly cluster bean price series of four (4) markets from 2003-2015. The results show high volatility in cluster beans prices ranging from 115.38 percent to 123.93 percent over the said period. Prices of cluster beans peak between March and

May. The prices are also high during November and December. The growth rates of cluster bean prices per annum in all the selected four markets are minimal. The results indicate a long run relationship between Sri Ganganagar and Hanumangarh; Anoopgarh and Sikar and Hanumangarh and Sikar markets. The highest speed of adjustment running was from Anoopgarh to Sikar towards long run equilibrium at a rate of 117.1 percent. The second highest speed of adjustment is at rate of 97.1 percent running from Sri Ganganagar to Anoopgarh market towards long run equilibrium. Furthermore, there is high speed of adjustment running from Sri Ganganagar to Hanumangarh towards long run equilibrium at a rate of 92.7 percent. The results indicate short run bidirectional and unidirectional causality among market pairs. In addition, the results show within a period of one (1) year or twelve (12) months, the response influence of shocks from Sri Ganganagar to Anoopgarh, Hanumangarh and Sikar cluster bean wholesale market prices will be permanent.

Basu and Dinda (2003) in the study the market integration an application of error correction model to potato market in Hooghly district, West Bengal studied the spatial integration of three potato markets of Hooghly district (*viz.*, Champandanga, Sheoraphully and Tarakeswar) of West Bengal using the wholesale and retail prices during January 1998 to December 2000. They found that all three market pairs such as champandanga - sheoraphully, hampandanga – tarakeswar and sheoraphully tarakeswar in terms of both wholesale and retail prices were co integrated. They also found that within one market the wholesale and retail prices were co integrated and concluded that there was a close

proximity and good communication and infrastructure facilities available in Hooghly District.

Burark *et al.* (2013), in their study entitled market integration and price volatility in domestic market of coriander in Rajasthan examined the extent of co-integration of wholesale prices of coriander among major markets (Kota, Baran and Ramganj Mandi) of Rajasthan by using Johansen test, examined the causality by granger causality tests and also captures the speed of adjustment to deviations in long run equilibrium by using vector error correction model. Monthly wholesale price data were used for the study. Out of three markets only two markets were co-integrated. The Pair wise Grangers causality test for Baran and Ramganj markets was significant at 1% level which was indicative of mutual influence exerted by the markets on each other, whereas unidirectional influence was exhibited by Kota Market on Ramganj and Baran markets. The results of the price volatility test pointed out that Kota markets was the leader. The existence of price volatility in coriander prices in Baran market was relatively more volatile than Kota and Ramganj market which was confirmed through GARCH estimation.

Dilipreddy *et al.* (2009) studied the price trends in soyabean and integration of markets for soyabean and soya oil. A study has been conducted on analyzing the relationship of spot prices of soybean and Soya oil with the future prices and also the market integration using econometric models like co integration techniques. The results have

revealed positive and highly significant relationship with forecasted price. The co integration analysis was carried out for working out ADF and ACV values for Soya oil both spot and futures. The critical values were found to be -5.6850 and -5.9874 respectively for Soy oil spot and Soy oil futures. The ADF values are found to be higher than ACV as revealed from the study for both soy oil futures and spot. After testing the hypothesis that domestic and international price series are co-integrated at 10 per cent level is greater than -2.57 (ACV) compared to ADF. Hence, markets are integrated.

Ghosh (2000) in his study entitled co-integration tests and spatial integration of rice markets in India carried out the co integration analysis of 15 Indian markets scattered over four states to find out interstate and intra state market integration. Maximum likelihood method of co integration developed by Johansen (1998) and extended by Johansen and Juselius (1990) was used to examine if intra-state and inter-state regional rice markets are integrated and linked together into a single economic market. The data used was monthly wholesale prices of specific rice varieties for the period from March 1984 to April 1997 for selected states viz., Bihar, Orissa, Uttar Pradesh and West Bengal. Before the conduct of Co integration, ADF test was performed to test the stationarity of the data. The Co-integration results for UP indicated that the regions are integrated well. Bihar, Orissa and West Bengal markets were also

found integrated but not to the extent of law of one price (LOP) to particular variety.

Khatkar *et al.* (2013) the study in co-integration of wholesale prices of Mustard among major markets of Haryana and Rajasthan by using Johansen, Granger Causality Tests and also captures the speed of adjustment to deviations in long run equilibrium in mustard markets by using vector error correction model. The monthly wholesale price data were used for the study. Out of four markets only two markets were co integrated. The pair-wise Grangers Causality Test for Hisar and Sirsa markets was significant statistically which was indicative of mutual influence exerted by the markets on each other. On the other hand Sri-Ganganagar market exhibited unidirectional influence on Rewari market. The results of the price volatility test pointed out that Sirsa market was the leader. The existence of price volatility in mustard prices in Sirsa market was relatively more volatile than Hisar and Rewari markets which were confirmed through GARCH Estimation.

Kumawat and Kumar (2006) studied market integration of rapeseed-mustard among nine selected markets of Rajasthan namely; Alwar, Bharatpur, Baran, Dholpur, Hanumanagarg, Nagaur, Sriganganagar, Sawaimadhopur and Tonk. Market integration was examined by computing price correlation between monthly wholesale prices. Price correlation was estimated at four points 1990-91, 1995-96, 2000-01 and 2003-04. The results revealed that, almost all the selected

markets were mutually integrated. However, the degree of integration varied from the market pair to another within and across the years. In majority of the markets the degree of correlation was more than 0.90.

Meera *et al.* (2015) in their study co-integration of wholesale prices of wheat among major markets of Sriganganagar district of Rajasthan by using Johansen test, examined the causality by granger causality tests and also captures the speed of adjustment to deviations in long run equilibrium in wheat markets by using vector error correction model (VECM). The data used in the co-integration analysis consists of monthly wholesale prices of nine gram dominated markets of Rajasthan for the period from 2005 to 2014. Monthly wholesale price data were for the study. The results of the Augmented Dickey-Fuller (ADF) unit root test for wheat showed that the existing data were non-stationary but their first differences were stationary. After taking first difference, all the series becomes stationary which is obvious from the fact that calculated values (-9.296309 to -14.18193) for all the markets were less than the critical value (- 4.038365) and were free from the consequence of unit root. Johansen's co-integration test for wheat indicated the presence of at least eight co-integrating equation at 5 per cent level of significance. Hence markets were having long run equilibrium relationship. The pairwise granger's causality test for selected markets was significant at 1% level which was indicative of mutual influence exerted by the markets on each other.

Mendoza and Rosegrant (1995) in their study pricing behaviour of Philippines corn markets: Implications for market efficiency examined the dynamics and efficiency of Philippines maize markets through the application of Auto Regressive Conditional Heteroscedasticity model (ARCH), to time series data. The findings of the study revealed that there existed imperfect market integration for Philippines maize markets and

indicated that there may be substantial benefits (i) in developing better infrastructural facilities to effectively link production and market centers and (ii) in improving market knowledge by providing more relevant, accurate and timely public market information.

Schimmelpfennig and Thirtle (1994) in their study entitled co-integration and causality: Exploring the relationship between agricultural research and development and productivity suggested that even the total factor productivity and the research and development were co-integrated, instead of the traditional single equation approach, the error correction model was found to be the logical alternative for the existing techniques.

Vasishit *et al.* (2008) studied the price behaviour in fruits and vegetable markets using co-integration and error correction Analysis techniques. The empirical results on the price behaviour provided evidence of high volatility in the prices of fruits and vegetables in major markets. There was a presence of long-run relationship across some of the state level markets for less perishable commodities like apple. The findings clearly indicated that the horticulture sector in India can thrive for greater benefit of both producers and consumers only if better infrastructural facilities like storage, modern marketing infrastructure, as well as timely availability of market information and better market intelligence are developed fast across all states.

Wani *et al.* (2015) studied the degree of market integration in William Bartlett variety of pear grown in Kashmir, commonly known as Bagughosha, through co-integration analysis on the wholesale weekly prices of its two commercial grades Bagughosha Super and Bagughosha Special, collected from two national fruit markets of India (Delhi and Mumbai), from August, 2005 to October, 2013. The results reveal that Pear markets were co integrated and competitive. A disequilibrium ranging from 16.47 to 50.33% among the selected grades of the fruit was observed. VAR and VECM models were used to study the behaviour of market prices, which revealed that Delhi market turned most dominating market for higher prices of the selected variety and grades.

2.6 Summary of review

Review was collected on four objectives. These were study of the marketing channels, costs and margins in marketing of coriander, price trend and price behaviour of coriander, comparison of spot prices with forecast prices and integration of spot and future market. Agarwal (1998), Agarwal and Singh (1997), Agrawal and Singh (2003), Choudhary (2000), Deshmukh *et al.* (2010), Dhurwey *et al.* (2016), Killedar (2002), Kumar and Burark (2011), Prabhavathi, *et al.* (2013), Raju and Rao (1995), Rajur and Patil (2015), Tripathi *et al.* (2006), Verma, *et al.* (2013). Conducted research on marketing channels, marketing costs and margins of agricultural products and found that producers share in the consumers rupee was higher by 2 to 20 per cent in mandi sale compared to village sale. Review on second objective of the study on behaviour of prices on arrivals showed a mixed effect. Ten studies out of 26 showed positive relations between arrivals and prices whereas 17 studies showed negative relationship. Under third objective twenty seven studies were reviewed for the use of forecasting methods using ARIMA. These studies showed Variety of models as best fit ARIMA. ARIMA (0,1,1), ARIMA (1,1,1), ARIMA (1,1,0), ARIMA (1,2,3), ARIMA (3,2,3), ARIMA (2,1,0) and ARIMA (0,1,2) model were used as basis of minimum AIC and SBC. Under fourth objective fourteen studies were reviewed for testing integration in markets and found that markets were integrated and no disintegration was observed.

Chapter-3

RESEARCH METHODOLOGY

Scientific study of any problem requires a systematic investigation using appropriate methods and procedures in order to arrive at reliable and practical conclusions. This chapter deals with the methods used in present investigation as discussed below under the following sub-heads:

- A. Selection**
- B. Collection of data; and**
- C. Analysis of data**

3A .1 Selection of crop

Coriander crop was selected for the detailed study. Rajasthan state with 48 percent of area and 62 percent of production occupied first position in area as well as production of coriander in the country.

3A.2 Selection of study area

The study was purposively confined to the state of Rajasthan

3A.3 Selection of districts

Three districts namely, Jhalawar, Baran and Kota were selected purposively, as these three districts jointly contribute more than 95 percent of area under the crop in the state. Jhalawar district contributed 43.82 percent share in total area of coriander followed by Baran district (31.90 per cent) and Kota district (21.56 per cent).

3A.4 Selection of tehsils

One Tehsil from each district was selected on the basis of maximum area under the crop. These tehsils were Khanpur (Jhalawar), Autru (Baran) and Sangod (Kota).

3A.5 Selection of villages

Separate lists of all the villages producing coriander were prepared for each tehsil. Three villages from the list of coriander producing villages of each tehsil were selected randomly. Thus, a total number of nine villages were selected for further study. The detail of the villages selected is given in the table 3.1.

Table: 3.1 Details of selected villages in Rajasthan

S. No.	Name of districts	Name of selected Tehsil	Name of selected villages
1	Jhalawar	Khanpur	Borada
			Gulkheri
			Rampura
2	Baran	Autru	Laxmipura
			Ratanpura
			Kachara
3	Kota	Sangod	Umerhedi
			Khandgaun
			Poli

3A.6 Selection of farmers

Separate lists of coriander growers of the selected villages were prepared in ascending order of their land holding. Then a representative sample of producer farmers was selected adopting the random sampling

technique. These farmers were selected on probability proportion method and categorized into five groups viz;

1. Marginal Less than 1 hectare
2. Small 1- 2 hectares
3. Semi medium 2-4 hectares
4. Medium 4-10 hectares
5. Large 10 hectares and above

Source: Ministry of agriculture and irrigation, all India report on agriculture census -1970-71

A random sample of 150 farmers was taken for the study. To make the sampling design self weighing, the number of farmers selected from each category was in proportion to their number in that category. The details of the sample farmers are given in the table 3.2.

Table 3.2: Distribution of coriander growing farmers in different size groups

Type of farmers	Number of farmers						Total Farmer	Total selected Farmer
	Jhalawar		Baran		Kota			
	TF	SF	TF	SF	TF	SF		
Marginal (<1 hac.)	40	8	35	7	55	11	130	26
Small (1-2 hac.)	90	18	105	21	80	16	275	55
Semi-medium (2-4 hac.)	70	14	55	11	70	14	195	39
Medium (4-10 hac.)	50	10	56	11	46	9	152	30
Large (10 hac. & above)*	-	-	-	-	-	-	-	-
Total	250	50	251	50	251	50	752	150

*Not available TF= Total farmers, SF= Selected farmers

3A.7 Selection of markets

Krishi Upaj Mandi, Bhawani Mandi (Jhalawar), Baran mandi (Baran) and Kota mandi (Kota) were selected purposively on the basis of maximum arrivals of the produce.

3A.8 Selection of market functionaries

A separate list of all the village traders and licensed wholesalers-cum commission agents operating in the study area was prepared from information collected from sampling farmers and the records of Krishi Upaj Mandi Samities Bhawani Mandi, Baran mandi and Kota mandi. In all 12, 18 and 15 village traders and 13, 17 and 16 wholesalers –cum-commission agents were operating in command area of Krishi Upaj Mandi Bhawani Mandi, Baran mandi and Kota mandi, respectively. Out of these a random sample of 4, 6 and 5 village traders and 3, 5 and 4 wholesalers –cum-commission agents were selected from Krishi Upaj Mandi Bhawani Mandi, Baran mandi and Kota mandi, respectively. Information pertaining to the costs incurred and margins earned by them in the marketing of coriander was obtained from them.

3B Collection of data

Both primary and secondary data were used for the study. The primary data related to marketing channels, costs, margins and price spread in marketing of coriander crop were collected from the producer farmers, village traders, wholesalers-cum-commission agents and retailers through personal interview method with the help of a set of schedule specifically prepared (standardized) for the study. Primary data were collected for the Agricultural year 2012-13 for which the information was readily available.

The secondary data in respect of area and production of selected crop were collected from the records and reports of the Directorate of Economics and Statistics and Directorate of Agriculture, Government of Rajasthan, Jaipur. The data pertaining to marketing charges for coriander marketing were collected from various records of Krishi Upaj Mandi Bhawani Mandi, Baran mandi and Kota mandi. Information regarding prescribed marketing costs in the selected Mandies was also collected from respective mandies. The monthly time series data on arrivals and prices of selected three markets (Bhawani mandi, Baran mandi and Kota mandi) from 2000-01 to 2013-14 were collected from selected KUMS (*Krishi Upaj Mandi Samiti*) to study the trend, cyclical component, irregular component, seasonal behaviour, price forecasting and market co – integration.

3C Analysis of data

The collected data were analyzed by using the following tools and techniques to achieve the stated objectives.

3C.1 Marketing channels, costs and price spread

The marketing channels adopted in sale of the surplus produce were analyzed by using the tabular analysis. The data pertaining to marketing costs and margins were analyzed as under:

3C.1.1 Total marketing costs

The total cost incurred on marketing of coriander crop by the farmers and the intermediaries involved in the process of marketing was calculated as:

$$C = C_F + C_{m1} + C_{m2} + C_{m3} \dots\dots\dots + C_{mn}$$

where,

C = Total cost of marketing

C_F = Cost borne by the producer-farmer in marketing of coriander crop; and

C_{mi} = Cost incurred by the i^{th} middlemen in the process of marketing

3C.1.2 Marketing margins in marketing of coriander

The average gross margin, absolute margin and percentage margin of middlemen involved in the marketing of coriander crop were calculated as:

$$\text{Average gross margins} = \frac{\text{Total sale value} - \text{Total purchase value}}{\text{Quantity marketed}}$$

$$\text{Absolute margin of } i^{th} \text{ middleman} = P_{Ri} - (P_{pi} + C_{mi})$$

$$\text{Percentage margin of } i^{th} \text{ middleman} = \frac{P_{Ri} - (P_{pi} + C_{mi})}{P_{Ri}} \times 100$$

where,

P_{Ri} = Sale price of the i^{th} middleman

P_{Pi} = Purchase price of the i^{th} middleman; and

C_{mi} = Marketing cost incurred by i^{th} middleman

3C.1.3 Price-spread

Price-spread refers to the difference between the price paid by the ultimate consumer and the price received by the producer for an equivalent quantity of the farm produce. The producer's share, marketing costs and margins of different middlemen in the marketing of coriander crop were worked out for the adopted channels using the formula:

Producer's share

It represents the percentage share of producer in the price paid by the consumer.

$$P_s = \frac{P_f}{P_c} \times 100$$

where,

P_s = Producer's share in consumer's rupee

P_f = Price of the produce received by the farmer; and

P_c = Price of the produce paid by the ultimate consumer

3C.2 Trend, cyclical, irregular and seasonal price behaviour

Time series analysis was done to study the variations in monthly prices of coriander for the period of 13 years. A time series is a complex mixture of four components namely, Trend (T), Cyclical (C), Irregular (I) and Seasonal (S) variations. These four types of movements are frequently found either separately or in combination in a time series. The relationship among these components is assumed to be additive or multiplicative, but the multiplicative model is the most commonly used method in economic analysis, which was used for the study and it can be presented as under:

$$O_t = T \times C \times S \times I$$

where,

O_t = Original observation at time 't'

T = Trend component

S = Seasonal variations

C = Cyclical element

I = Irregular fluctuations

Trend (T): Over a long period of time, time series is very likely to show a tendency to increase or decrease over time. The factors responsible for such changes in time series are mainly the growth of population, change in the taste of people, technological advances in the field, etc. There are different types of trends, some of them are linear and some are nonlinear in their form. For shorter period of time, in most of the situations the straight line provides the best description of trend and for longer period of time, the non-linear form generally provides a good description of the trend. Often, it may be possible to describe such movements with a structured mathematical model. In the absence of such a definite format, approximately a polynomial or a free hand curve describes the movements.

Cyclical movements (C): Cyclical movements are fluctuations which differ from periodic movements. Cyclical movements have longer duration than a year and are periodicity of several years as in business cycles.

Irregular variations (I): Here the effects could be completely unpredictable, changing in a random manner. A given observation is affected by episodic and accidental factors. These are also known as causal series and are affected by the unknown causes. These unknown causes act in an unpredictable manner

Seasonal variation (S): The variation within a year is called as seasonal variation. The main causes of seasonal variations are

production periods, customs, climates, etc. Such seasonal components can be analyzed through harmonic analysis.

3C.2 1 Measurement of price behaviour

The behaviour of prices of coriander was studied by analyzing the trend, cyclical, seasonal and irregular components of time series on prices. It involved separating and studying the nature and behaviour of these components from the price series. It was assumed that the components were joined together in a multiplicative fashion as represented below:

$$P_t = T \times C \times S \times I \text{ (in monthly price series)}$$

$$P_t = T \times C \times I \text{ (in yearly price series)}$$

3C.2.1 .1 Analysis of trend in prices

For examining the trend in prices, linear function was estimated by using the Ordinary Least Squares (OLS) method.

Linear function

$$P_t = B_0 + B_1 T_t + U_t$$

where,

P_t = Monthly index number of wholesale prices of Coriander in year 't',

T_t = Serial of number of the year 't',

U_t = Random disturbance term with usual OLS assumptions,

B_0 , B_1 and B_2 are regression coefficients to be estimated. The best fit model was selected on the basis of statistical significance of the regression parameters and coefficient of determination (R^2)

3C.2.1.2 Autocorrelation

The term autocorrelation is defined as “correlation between members of a series of observations ordered in time (as in time series data) or space (as in cross sectional data)”. In the regression context the exponential model assumes that such autocorrelation does not exist in the disturbances U_i . Symbolically, $E(U_i U_j) = 0, i \neq j$. Violation of this assumption leads to the problem of autocorrelation. Specification bias resulting from excluding some relevant variables from the model or using an incorrect functional form may lead to (spatial) autocorrelation in the cross sectional data. Although the OLS estimates remain unbiased as well as consistent in the presence of autocorrelation, they are no longer efficient. As a result, the usual ‘t’ and ‘F’ tests of significance cannot be applied legitimately. Hence remedial measures are needed depending upon the nature of interdependence among the disturbances U_i . In the present investigation Durbin-Watson test (1951) was used to test the autocorrelation between the residuals. For testing autocorrelation Durbin-Watson ‘d’ statistic was calculated as follows:

$$d = \frac{\sum_{t=2}^n (e_t - e_{t-1})^2}{\sum_{t=1}^n e_t^2}$$

where;

d = Durbin – Watson ‘d’ statistic

e_t are sample residuals. The test for autocorrelation was conducted as follows:

$$H_0 : \rho = 0$$

$$H_A : \rho > 0$$

If 'd' < dL rejected H_0 in favour of positive autocorrelation

If dL < 'd' < du inconclusive

If du < 'd' do not reject H_0

$$H_0 : \rho = 0$$

$$H_A : \rho < 0$$

If 'd' < 4-du do not reject H_0

If (4-du) < 'd' < (4-dL) inconclusive

If (4-dL) < 'd' reject H_0 in favour of negative autocorrelation

where;

H_0 = Null hypothesis

H_A = Alternative hypothesis

ρ = Autocorrelation coefficient

d = Durbin- Watson Statistic

dL = Lower limit for the critical value

du = Upper limit for the critical value

The regions of acceptance and rejection of null hypothesis in Durbin –Watson test were depicted as below-

I 0 – dL 0 < d < dL positive autocorrelation

II dL– du dL < d < du Inconclusive

III du – (4-du) du < d < (4-du) No autocorrelation

IV (4-du) – (4-dL) (4-du) < d < (4-dL) Inconclusive

V (4 – dL) – 4 (4-dL) < d < 4 Negative autocorrelation

For testing autocorrelation following procedure was followed.

- (i) From the Durbin-Watson tables the d_L and d_U values were noted down for 'n' number of observations, 'K' number of explanatory variables and required level of significance.
- (ii) Then 'd' value was calculated from the sample errors
- (iii) Finally, the region in which the estimated value of 'd' lay was located and the inference was drawn in a manner as stated above.

3C.2.2 Analysis of cyclical component

The cyclical component in the yearly price series was worked out by

- (i) Calculating the trend values
- (ii) Dividing the original observations on prices by the estimated trend values and multiplying it by 100, and then
- (iii) Taking three year moving average of (C x I) 100 series.

Symbolically:

$$\frac{P_t}{T_t} \times 100 = \frac{T_t \times C_t \times I_t}{T_t} \times 100 = (C_t \times I_t) 100$$

$$\text{M.A. of } (C \times I) 100 = C \times 100$$

3C.2.3 Analysis of irregular component

The irregular component in an annual series of prices does not have a definite pattern. It was estimated as residual component by using the estimates of trend and cyclical components.

Symbolically:

$$I_t = \frac{P_t}{T_t \times C_t} \times 100 = \frac{T_t \times C_t \times I_t}{T_t \times C_t} \times 100 = I_t \times 100$$

3C.2.4 Analysis of seasonal component

The seasonal pattern in prices was analysed by constructing seasonal index numbers. Seasonal index numbers are a set of numbers showing relative prices during different months of a year the average for the year being 100 and total 1200. Then seasonal indices were worked out for each sub period separately following the percentage of centered 12 months moving average method. The seasonal price indices were compared to know the changes in seasonal pattern overtime. The 12 months centered moving average was a fairly good estimate of the trend and cyclical components combined. The steps involved in the construction of seasonal price index by this method were:

- (i) Generating a series of 12 months moving totals
- (ii) Generating a series of 12 months moving averages
- (iii) Generating a series of centered 12 months moving averages
- (iv) Expressing each original value as a percentage of corresponding centered moving average.
- (v) Arranging the percentages of moving averages in the form of monthly arrays and calculating the average index for each month.
- (vi) Adjusting the averages to make their sum equal to 1200.

This was done by working out the correction factor and multiplying the average for the month by the correction factor which was estimated as follows.

$$K = \frac{1200}{S}$$

where K is correction factor and S is sum of average indices for 12 months.

Multiplication of average for each of the month by the correction factor yielded the index of seasonal prices.

The percentage of Centered 12 months moving average provided an index of seasonal and irregular components combined because.

$$\frac{P_t}{M.A_t} \times 100 = \frac{T \times C \times S \times I}{T \times C} \times 100 = (S \times I) 100$$

The irregular component was removed in the process of averaging each month's ratio over the years and also through correction factor.

This provided a good estimate of seasonal price index. The differences in the seasonal price indices for these periods were compared with the help of F statistic.

3C.2.4.1 Intra-year price variation

The following approaches were used to precisely measure the intra-year price variation.

3C.2.4.2 Extent of intra year price rise

The intra year price rise – the difference between the lowest and highest price within a year – was measured by calculating the following per cent coefficient:

$$IPR = \frac{HSPI - LSPI}{\text{-----}} \times 100$$

LSPI

where,

IPR = Intra-year price rise (expressed in per cent terms)

HSPI = Highest seasonal price index

LSPI = Lowest seasonal price index

Since this measure is affected by the lowest coefficient, another measure called the coefficient of average seasonal price variation (ASPV) was also computed.

3C.2..4.3 Average seasonal price variation

The average seasonal price variation (ASPV) was calculated as

$$\text{ASPV} = \frac{\text{HSPI} - \text{LSPI}}{\frac{\text{HSPI} + \text{LSPI}}{2}} \times 100$$

where:

HSPI = Highest seasonal price index

LSPI = Lowest seasonal price index

3C.2.4.4 Coefficient of variation

The coefficient of variation (CV) to measure intra-year price variation was computed as follows:

$$\text{CV} = \frac{\sigma}{S} \times 100$$

Where CV is coefficient of variation, σ is estimated value of standard deviation of seasonal price indices and S is the arithmetic mean of seasonal price indices.

Since the arithmetic mean of seasonal price indices is always 100, the standard deviation in itself was the coefficient of variation. The standard deviation and arithmetic mean were calculated by the following formula.

$$\sigma = \sqrt{\frac{\sum (S_i - \bar{S})^2}{n - 1}}$$

$$\text{and, } \bar{S} = \frac{\sum S_i}{n}$$

Where S_i is the seasonal index for the i^{th} month ($i = 1$ to 12) and n is the number of months, i.e., 12.

3C.3 Comparison of spot price with forecast prices

To estimate forecast prices ARIMA techniques was used. Autoregressive moving average (ARMA) models, sometimes called Box-Jenkins models after the iterative Box-Jenkins methodology usually used to estimate them, are typically applied to time series data. Given a time series of data X_t , the ARMA model is a tool for understanding and, perhaps, predicting future values in this series.

Box-Jenkins (ARIMA) model was used to measure the relationships existing among the observations within the series. Box-Jenkins time series model written as ARIMA (p, d, q) was first popularized by Box and Jenkins (1976). The acronym ARIMA stands for “Auto-Regressive Integrated Moving Average”. Lags of the differenced series

appearing in the forecasting equation are called “auto-regressive” terms, lags of the forecast errors are called “moving average” terms and a time series which need to be differenced to make stationary is said to be an “integrated” version of a stationary series

The model consists of two parts, an autoregressive (AR) part and a moving average (MA) part. The model is usually then referred to as the ARMA (p, q) model where p is the order of the autoregressive part and q is the order of the moving average part. The model is generally referred to as an ARIMA ($p, d, \text{ and } q$) model where p , d , and q are integers greater than or equal to zero and refer to the order of the autoregressive, integrated, and moving average parts of the model respectively. Given a time series of data X_t where t is an integer index and the X_t are real numbers, then an ARMA (p, q) model is given by

$$(1 - \sum_{i=1}^p \phi_i L^i) X_t = (1 + \sum_{i=1}^q \theta_i L^i) \varepsilon_t$$

Where L is the lag operator, the ϕ_i are the parameters of the autoregressive part of the model, the θ_i are the parameters of the moving average part and the ε_t are error terms. The error terms are generally assumed to be independent, identically, distributed variables sampled from a normal distribution with zero mean.

An ARIMA (p, d, q) process is obtained by integrating an ARMA (p, q) process. That is

$$(1 - \sum_{i=1}^p \phi_i L^i) (1 - L)^d X_t = (1 + \sum_{i=1}^q \theta_i L^i) \varepsilon_t$$

Where d is a positive integer that controls the level of differencing (or, if $d = 0$, this model is equivalent to an ARMA model). Conversely, applying term-by-term differencing d times to an ARIMA (p, d, q) process gives an ARMA (p, q) process. The only necessity is to difference the AR side of the ARMA representation, because the MA component is always $I(0)$.

In fact all choices of parameters produce well-behaved models. In particular, if the model is required to be stationary then conditions on these parameters must be met. Some well-known special cases arise naturally.

For example, an ARIMA $(0, 1, 0)$ model is given by:

$$X_t = X_{t-1} + \varepsilon_t$$

This is simply a random walk.

The dependence of X_t on past values and the error terms ε_t is assumed to be linear unless specified otherwise. If the dependence is nonlinear, the model is specifically called a nonlinear moving average (NMA), nonlinear autoregressive (NAR), or nonlinear autoregressive moving average (NARMA) model.

3C.3.1 Introduction to ARIMA

ARIMA $(p, d, \text{ and } q)$: ARIMA models are, in theory, the most general class of models for forecasting a time series which can be stationeries by transformations such as differencing and logging. In fact, the easiest way to think of ARIMA models is as fine-tuned versions of random-walk and random-trend models: the fine-tuning consists of adding *lags of the differenced series and/or lags of the forecast errors* to the

prediction equation, as needed to remove any last traces of autocorrelation from the forecast errors. The acronym ARIMA stands for "Auto-Regressive Integrated Moving Average." Lags of the differenced series appearing in the forecasting equation are called "auto-regressive" terms, lags of the forecast errors are called "moving average" terms, and a time series which needs to be differenced to be made stationary is said to be an "integrated" version of a stationary series. Random-walk and random-trend models, autoregressive models, and exponential smoothing models (i.e., exponential weighted moving averages) are all special cases of ARIMA models. A non seasonal ARIMA model is classified as an "ARIMA (p, d, q)" model, where:

- p is the number of autoregressive terms,
- d is the number of non seasonal differences, and
- q is the number of lagged forecast errors in the prediction equation.

To identify the appropriate ARIMA model for a time series, you begin by identifying the order(s) of differencing needing to stationerise the series and remove the gross features of seasonality, perhaps in conjunction with a variance-stabilizing transformation such as logging or deflating. If you stop at this point and predict that the differenced series is constant, you have merely fitted a random walk or random trend model. (Recall that the random walk model predicts the first difference of the series to be constant, the seasonal random walk model predicts the seasonal difference to be constant, and the seasonal random trend model predicts the first difference of the seasonal difference to be constant--

usually zero.) However, the best random walk or random trend model may still have auto correlated errors, suggesting that additional factors of some kind are needed in the prediction equation.

The BOX-JENKINS (BJ) methodology

This method consists of four steps,

1. Identification
2. Model estimation
3. Diagnostic checking
4. Forecasting

1. Identification:

To find out the appropriate values of p , d and q . Chief tool identification are the Autocorrelation function (ACF), the partial autocorrelation function (PACF), and the resulting correlograms, which are simply the plots of ACF and PACFs against the lag length. One way of accomplishing this is to consider the ACF AND PACF and the associates correlograms of a selected number of ARMA processes, such as AR(1), AR(2), MA(1), MA(2), ARMA (1,1), ARMA (2) and so on. Since each of these stochastic processes exhibits typical pattern of ACF and PACF, if the time series under study fits one of these patterns we can identify the time series with that process. Of course, we will have to apply diagnostic tests to find out if the chosen ARIMA model is reasonably accurate.

Note: Since in practice we do not observe the theoretical ACFs and PACFs and rely on their sample counterparts, the estimated ACFs and PACFs will not match exactly their theoretical counterparts.

2. Model estimation:

After identifying the appropriate values of p and q the next step is to estimate the parameters of the autoregressive and moving average terms included in the model. Sometime this calculation can be done by simple least squares' but sometimes we will have to resort to non linear (in parameter) estimation method.

3. Diagnostic checking:

In this step we see whether the chosen model fits the data reasonably well. One simple test of the chosen model is to see if the residuals estimated from this model white noise; if they are, we can accept the particular fit; if not, we start over thus the box-jenkins Methodology is an iterative process.

4. Forecasting:

One of the reasons for the popularity of the ARIMA modeling is its success in forecasting. To forecast the values of a time series, the basic BOX-JENKINS strategy is as follows:

- a. First examine the stationarity. This step can be done by computing the autocorrelation function (ACF) and partial autocorrelation (PACF) or by a normal root analysis.
- b. If the time series is not stationary, difference it one or more times to achieve stationarity.
- c. The ACF and PACF of the stationary time series are then computed to find out if the Series is purely autoregressive or purely of the moving average type or a mixture of the two.

d. The tentative model is then estimated.

e. The residuals from this model are examined to find out if they are white noise. If they are, the tentative model is probably a good approximation to the underlying stochastic process. If they are not, the process is started all over again. Therefore, the BOXJENKINS method is iterative. The model finally selected can be used for forecasting

3C.3.2 Exponential smoothing model

For smoothing, the common techniques discussed by Gardner (1985) are Single Exponential Smoothing (SES) and Double Exponential Smoothing (DES).

3C.3.2.1 Single exponential smoothing (SES)

For the time series $Y_1, Y_2, \dots, Y_t$ forecast for the next value Y_{t+1} say, F_{t+1} , is based on the weights α and $(1-\alpha)$ to the most recent observation Y_t and recent forecast F_t respectively, where α is a smoothing constant, the form of the model is :

$$F_{t+1} = F_t + \alpha (Y_t - F_t)$$

The choice of α has considerable impact on the forecast. The optimum value of α corresponding to minimum Mean Square Error (MSE) was then identified.

3C.3.2.2 Double exponential smoothing (DES)

The form of the model is

$$L_t = \alpha Y_t + (1-\alpha) (L_{t-1} + b_{t-1})$$

$$b_t = \beta (L_t - L_{t-1}) + (1-\beta)b_{t-1}$$

$$F_{t+m} = L_t + b_t m$$

Where,

L_t is level of the series at time t

b_t is slope of the series at time t

α and β ($=0.1, 0.2, \dots, 0.9$) are the smoothing and trend parameters

The pair of values of parameters α and β which gave minimum MSE were taken.

3C.3.3 Correlation Analysis

Correlation analysis is evaluation of the relationship between spot prices with forecast prices was worked out by using the formula:

$$r = \frac{\sum XY - \sum X \cdot \sum Y / N}{\sqrt{[\sum X^2 - (\sum X)^2 / N] [\sum Y^2 - (\sum Y)^2 / N]}}$$

where:

r = Correlation coefficient between spot prices (x) and forecast prices (y).

x = monthly spot prices

y = monthly future prices and

N = Number of observations

3C.4 Integration in spot and future market

For examining integration between spot and futures prices, we have used co integration technique. The co integration approach to

market integration is intuitively appealing and straight forward in application. Integrated markets are those where prices are determined interdependently. This has generally been assumed to mean that the price changes in one market will be fully transmitted to the other markets. Markets that are not integrated may convey inaccurate price information that might distort marketing decisions and contribute to inefficient product movements. Two series are said to be co-integrated when there exists a long run equilibrium relationship between them. In other words, two series cannot drift from one another in the long run. That is, there exists an equilibrium mechanism to bring the two series together. Applying this concept to any two given markets, co integration between their price series implies long run dependence between them. Since the very essence of market integration is the price dependence across markets, it follows that co integration between prices in two given markets implies integration of the markets.

To examine the price relation between two markets, the following basic relationship commonly used to test for the existence of market integration may be considered.

$$P_{it} = \alpha_0 + \alpha_1 P_{jt} + \varepsilon_t \text{ ----- (1)}$$

Where P_i and P_j are price series of a specific commodity in two markets i and j . ε is the residual term assumed to be distributed identically and independently. The test of market integration is straight forward if p_i and p_j are stationary variables. Often, However, economic variables are non -stationary in which case the conventional tests are biased towards rejecting the null hypothesis. Thus, before proceeding to further analysis,

it is important to check for the stationarity of the variables (Engle and Granger (1987)).

Stationary series is defined as one whose parameters that describe the series (namely the mean, variance and autocorrelation) is independent of time; or rather exhibit constant mean and variance and have autocorrelation that are invariant through time. Once the non-stationarity status of the variables is determined, the next step is to test for the presence of co-integrating (long run equilibrium) relationship between the variables. The augmented Dickey Fuller test (ADF test)) is used to determine the stationarity of a variable. The test is based on the Dickey Fuller value statistic of B_1 given by the following equation. N

$$\Delta P_t = \beta_0 + \beta_1 P_{t-1} + \sum_{k=1} \delta_k \Delta P_{t-k} + n_t \text{ -----(2)}$$

where,

$$\Delta P_t = P_t - P_{t-1}$$

The test statistic is simply the t statistic. However, under the null hypothesis, it is not distributed as student- t, but this ratio can be compared with critical values given in Dickey Fuller Table. In estimating Equation (2), the null hypothesis is $H_0: P_t$ is I (1), which is rejected [in favour of I (0)] if β_1 is found to be negative and statistically significant. The above test can also be carried out for the first difference of the variables. That is, we estimate the following regression equation:

$$\Delta^2 P_t = \theta_0 + \theta_1 \Delta P_{t-1} + \sum_{k=1} \Phi_k \Delta^2 P_{t-k} + \mu_t \text{ -----(3)}$$

where the null hypothesis is $H_0: P_t$ is I (2), which is rejected [in favour of I (1)] if θ_1 is found to be negative and statistically significant. In

general, a series P_t is said to be integrated of order 'd', if the series achieves stationary after differencing d times, denoted $P_t \sim I(d)$. Consequently, if P_t is stationary after differencing once, this we may denote as $P_t \sim I(1)$. Having established that the variables are non-stationary in level, we may then test for co integration. Only variables that are of the same order of integration may constitute a potential co-integrating relationship.

Alternative and quicker way of finding out whether the two price series are co integrated is the Co-integrating Regression Durbin Watson (CRDW) test. In CRDW we use the Durbin Watson 'd' obtained from the co-integrating regression. Here null hypothesis is $d=0$. In the present study, integration between spot and futures prices was studied by using co integration technique for coriander with respect to national commodity exchange. Co integration analysis will be done without diluting the overall objective of the study of integration between spot and futures prices.

3C.4.1 Johansen's co-integration test

Co integration means that despite being individually non-stationary, a linear combination of two or more time series can be stationary. The series that satisfy this requirement are said to be co-integrated.

Following Granger (1981), a time series x_t which has a stationary, invertible, non-deterministic ARMA representation after differencing d times is integrated of order d and is denoted by $x_t \sim I(d)$. The components of the vector x_t are said to be co integrated of order d , b , denoted $CI(d,b)$, if all the components of x_t are $I(d)$; there exists a vector α' x_t is $1(d-b)$, $b>0$

The vector α is then called a cointegrating vector. A necessary condition for cointegration is that the data series for each variable involved exhibit similar statistical properties, that is, to be integrated to the same order with evidence of some linear combination of the integrated series.

Johansen (1988) developed a multivariate system of equations approach, which allows for simultaneous adjustment of both or even more than two variables. Johansen's approach is also widely used in many bivariate studies as it has some advantages to the single equation approach. First, the multivariate system of equations approach is more efficient than the single equation approach, i.e., it allows estimating the cointegration vector with smaller variance. The second advantage of the multivariate approach is that in the simultaneous estimation it is not necessary to presuppose exogeneity of either of the variables.

3C.4.2 Engle-granger causality test

An autoregressive distributed lag (ADL) model for the Granger-causality test was developed following the Engle and Granger (1987) specification provided below:

$$P_t^1 = \alpha + \beta_0 T + \sum_{j=1}^j \beta_j P_{t-j}^1 + \sum_{k=1}^k h_k P_{t-k}^2 + \varepsilon_t$$

Where T is the time trend, ε_t is the error term, and other terms are as defined in equation.

Lags for the ADL model were selected to minimize the Akaike's Information Criterion. Granger causality tests were specified as:

$$P_t^1 = \alpha + \beta_0 T + \sum_{j=1}^j \beta_j P_{t-j}^1 + \sum_{k=1}^k h_k P_{t-k}^2 + \varepsilon_t$$

$$H_0 : h_1 = h_2 = \dots = h_k = 0$$

$$P_t^2 = \delta + \phi_0 T + \sum_{j=1}^j \Omega_j P_{t-j}^1 + \sum_{k=1}^k \phi_k P_{t-k}^2 + v_t$$

$$H_0 : \phi_1 = \phi_2 = \dots = \phi_k = 0$$

3C.5 Limitations of the study:

Though all possible efforts were made to make the study objective and precise but due to the paucity of time at the disposal of investigator, certain limitations did remain in the study, such limitations are:

- 1 Primary data pertaining to marketing channels, marketing costs and marketing margins were collected through the survey method. The information provided by the farmers was based on their recall memory. Though every effort was made to elicit correct information. yet, chances of error might be there due to forgetfulness of the respondents.
- 2 The study is based on primary and secondary sources of data and hence the accuracy of results depends on the accuracy with which the secondary data were generated.
- 3 The proper time series records about prices of coriander were not available therefore market study area was selected only on the basis of continuous series of available monthly wholesale prices.
- 4 Though the total numbers of respondents in the sample were 150 but on categorization as per the standard classification the numbers of farmers obtained were not sufficient enough in some categories to draw some meaningful conclusion.
- 5 Due to the availability of limited time and funds with the single handed worker, the study is confined to a sample of 150 farmers for selected coriander crop.

Chapter- 4

RESULTS AND DISCUSSION

In the present investigation primary and secondary data were collected and used for achieving the objective oriented results. The triennium averages of area and production of coriander for the triennium ending 2012-13 were calculated for selecting the districts. Based on the triennium averages following three districts of the state of Rajasthan were selected to achieve the specific objectives of the study:

(1) Jhalawar (ii) Baran (iii) Kota

These districts together occupied 97.28 percent of area and contributed 97.67 percent to the production of coriander in the state (Table 3.1). Time series secondary data on monthly wholesale prices of coriander were collected for the period 2000-01 to 2012-13. Index numbers of prices were calculated from the raw data on prices by taking initial three years average as the base year. These data were then subjected to computer analysis and the results so obtained were discussed and presented under the following four sections:

Section A: Marketing channels, costs and price spread.

Section B: Trend, cyclical, irregular and seasonal price behaviour

Section C: Comparison spot prices with forecast prices

Section D: Integration in spot and future markets

Section-4A

MARKETING CHANNELS, COSTS AND PRICE SPREAD OF CORIANDER IN RAJASTHAN

Production of an agricultural commodity is complete only when it reaches the hands of those who need it, *i.e.*, the consumers. All the commodities may not be produced in all the areas, because of variation in agro-climatic conditions. Hence, there arises a need for their movement from producers to ultimate consumers. Here, an attempt has been made to analyze the marketing channels and to estimate the costs and losses incurred and prices received by the various marketing agencies and farmers involved in the marketing of coriander in the study area.

In marketing process, price-spread represents the difference between the price per unit of produce received by the producer-farmer and the price paid for it by the ultimate consumer. It consists of marketing cost incurred by the different agencies for performing the various marketing functions and the margins earned by the various intermediaries involved in the process of movements of the produce from the primary producer to the ultimate consumer.

The importance of study on price spread, marketing costs and margins lies in the fact that such knowledge helps the policy planners in taking decisions regarding reduction in margins earned

by different market intermediaries so that the overall share of the producer-farmer in the consumer's rupee may be increased.

4A.1 Marketing channel of coriander in Rajasthan

Marketing channel is the route through which produce moves from the producers to the ultimate consumers. The length of the channel varies from commodity to commodity depending on the quantity of the produce to be moved, the form of consumer demand and the degree of regional specialization in the production. In the study area, farmers of coriander were observed to adopt the only following channel in marketing of coriander in Rajasthan in table: 4A.1.

Channel -I: Producer → Village trader → Wholesaler cum commission agent → Retailer → Consumer.

Channel-II: Producer → Wholesaler cum commission agent → Retailer → Consumer.

Among these channels, 76 per cent quantity of coriander moved through channel- II and 24 per cent quantity was moved through channel-I (Singh and Singh, 1999).

Table: 4A 1 Distribution of farmers adopting different marketing channels in Rajasthan

S.No	Name of marketing channels	Size Groups					Total farmer
		Margin al	Small	Semi medium	Medium	Large	
1	Producer→ Village Trader→ Wholesale r Cum Commissi on Agent→ Retailer→ Consumer	16 (61.54)	13 (23.64)	6 (15.79)	1 (3.23)	NA	36 (24.00)
2	Producer → Wholesale r Cum- Commissi on Agent→ Retailer→ Consumer	10 (38.46)	42 (76.36)	32 (84.21)	30 (96.77)	NA	114 (76.00)
	Total	26 (100)	55 (100)	38 (100)	31 (100)	NA	150 (100)

NA= Not available

4A.1.1 Overall Marketing charges in marketing of coriander in Rajasthan

4A.1.1.1 Marketing charges at village sale in Rajasthan

Marketing costs borne by the producer farmer and the village trader in the sale of coriander at the village level has been as under:

(A) Transportation charges

The average cost of transportation of the produce to the channel-I was estimated ₹ 150.79 per quintal.

(B) Cost of gunny bags

Farmer carried their produce in Jute gunny bags. Farmer purchased gunny bags @ ₹ 80 per quintal and sold it to village trader @ ₹ 65.56 per quintal, village trader sold to wholesaler cum commission agent @ ₹ 60 per quintal *i.e*, cost of gunny bag borne by the farmer was ₹ 14.44 per quintal.

(C) Loading and unloading charges

Loading and unloading charges were important charges in the marketing of coriander. Prevailing charges for this were ₹. 6.5 and ₹. 3.75 per quintal and borne by the farmer.

(D) Weighing charges

Weighing charges at the rate of ₹ 3.5 per quintal

4A.1.1.2 Marketing charges at mandi sale in Rajasthan

Cost of performing various functions in sale of coriander at mandi as prescribed by Krishi Upaj Mandi Samiti, is presented in table 4A.2.

Table 4A.2: Overall marketing charges in sale of coriander in Rajasthan

Particulars	Unit	Rate in ₹	Charges borne by
VAT	per 100 rupees worth of produce	4.00	Buyer
Mandi fee	per 100 rupees worth of produce	1.60	Buyer
Commission	per 100 rupees worth of produce	2.00	Buyer
Labour charges for :			
Loading	per 100 kg	5.5	These charges are borne by the seller upto arrival of the produce in the mandi & thereafter these are borne by the buyer
Unloading	per 100 kg	3.75	
Weighing	per 100 kg	2.5	

Source: Records of Krishi Upaj Mandi Samiti

(A) Transportation charges

Transportation cost was paid by the farmer sellers on the basis of number of bags of coriander. This also varied with the distance between farm and mandi. The selected villages were situated about 20-22 km. away from Rajasthan. Mini trucks and tractor trolleys were common means used in transportation. The average cost of transportation estimated by channel-II was ₹ 118.96 per quintal in Rajasthan.

(B) Cost of gunny bags

Farmers carried their produce in Jute gunny bags. Farmer purchased gunny bags @ ₹. 80 per quintal and sold to wholesaler cum

commission agent @ ₹. 60 per quintal *i.e*, cost of gunny bag borne by the farmer was ₹. 20 per quintal.

(C) Loading and unloading charges

Loading of coriander bags in mini truck/ tractor trolley was done by the family labour of the farmers. At mandi unloading was done at prescribed charges of ₹ 3.75 per quintal. This cost was born by the producer seller as it was incurred prior to the sale. The cost of loading and unloading was thus ₹ 5.5 and ₹ 3.75 per quintal.

(D) Weighing charges: Weighing charges @ ₹ 2.5 per quintal

(E) VAT (value added tax)

VAT was paid at the rate of 4 per cent of the value of produce (coriander). This tax was charged by the wholesalers- cum- commission agent for depositing to the government.

(F) Mandi fee:

It was collected by the Krishi Upaj Mandi Samiti for rendering various services in the mandi area. The rate of mandi fee was ₹ 1.60 per ₹ 100 worth of produce and this cost was borne by the buyer

(G) Commission charges:

Commission charges were realized by the commission agent at the rate of 2.0 per cent of the value of coriander from the buyer of the produce.

(H) Cleaning charges

The wholesalers incurred ₹ 5.00 per quintal for cleaning of coriander.

4A.1.2 Channel-wise marketing cost of coriander in Rajasthan

Costs incurred in marketing of coriander at village sale and at mandi sale through different channels are presented in table 4A.3 & table 4A.4.

4A.1.2.1 Overall marketing costs incurred in sale of coriander at village sale in Rajasthan (Channel -I)

In this channel, farmers sold their coriander produce to the village traders who in turn sold it to the wholesalers through commission agents and finally, wholesalers sold it to the retailer. Table 4A.1, Show that this channel was adopted by 24 per cent of selected farmers in selling of coriander in the study area. Among the different size groups of farmers, this channel was adopted by 61.54 per cent of marginal, 23.64 per cent of small, 15.79 per cent of semi-medium and 3.23 per cent of medium farmers. In this channel, coriander moved from producer farmers to village traders and then to wholesalers through commission agents and finally to retailer. The perusal of the table 4A.3 showed that the total marketing costs were estimated to be ₹ 1534.13 per quintal channel-I. Out of this ₹ 56.54 (3.68 per cent), ₹ 152.25 (9.92 per cent), ₹ 734.81 (47.90 per cent) and ₹ 590.53 (38.49 per cent) were incurred by the producer farmers, village traders, wholesaler-cum-commission agent and retailer, respectively. It was noticed that the wholesaler-cum-commission agent had borne highest amount due to the payment of the value added tax (₹ 243.68), commission charges (₹121.84) and mandi fee (₹97.47). These findings are in consonance with Verma *et al.* (2013).

Table: 4A.3: Overall marketing cost of coriander incurred in channel-I in Rajasthan: 2012-13

(₹/quintal)

Particulars	Charges paid by					Overall marketing cost
	Producer	Village trader	Wholesaler-cum-commission agent	Retailer	Consumer	
Transportation	8.67 (15.34)	69.95 (45.95)	39.99 (5.44)	32.18 (5.45)	-	150.79 (9.83)
VAT	-	-	243.68 (33.16)	-	-	243.68 (15.88)
Commission Charges	-	-	121.84 (16.58)	-	-	121.84 (7.94)
Mandi Fee	-	-	97.47 (13.26)	-	-	97.47 (6.35)
Loading Charges	6.50 (11.50)	5.50 (3.61)	5.50 (0.75)	5.50 (0.93)	-	23.00 (1.50)
Unloading charges	3.75 (6.63)	3.75 (2.46)	3.75 (0.51)	3.75 (0.64)	-	15.00 (0.98)
Weighing charges	3.50 (6.19)	2.50 (1.54)	2.50 (0.34)	2.50 (0.42)	-	11.00 (0.72)
Grading	-	-	30.00 (4.08)	-	-	30.00 (1.96)
Cost of gunny bags*	14.44 (25.55)	5.56 (3.65)	60.00 (8.17)	-	-	80.00 (5.21)
Value of Quantity losses	11.01 (19.47)	37.54 (24.66)	75.83 (10.32)	32.76 (5.55)	-	157.14 (10.24)
Cleaning	-	-	5.00 (0.68)-	-	-	5.00 (0.33)
Processing	-	-	-	480.56 (81.38)-	-	480.56 (31.32)
Miscellaneous charges**	8.67 (15.33)	27.45 (18.03)	49.26 (6.70)	33.28 (5.64)	-	118.65 (7.73)
Total Cost	56.54 (100.00)	152.25 (100.00)	734.81 (100.00)	590.53 (100.00)	-	1534.13 (100.00)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/ql and sold it to the village trader @ ₹ 65.56 /ql, village trader sold to wholesaler cum commission agent @ ₹ 60/ql i.e., cost of gunny bag borne by the farmer was ₹ 14.44/ql.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges.

4A.1.2.2: Overall marketing costs incurred in sale of coriander at mandi sale in Rajasthan (Channel- II)

This channel was the most common marketing channel adopted by farmers in the study area. In this channel, producer farmers sold coriander through the commission agents to the wholesalers of the mandi. Finally,

these wholesalers stored coriander for sale to the retailer at some later date. Table 4A.1 depicted that 76 per cent of total selected farmers marketed their produce through this channel. Among the different size groups of farmer's 38.46 per cent of marginal, 76.36 per cent of small, 84.21 per cent of semi-medium and 96.77 per cent of medium farmers marketed through this channel. It was the most common method of sale for coriander in the study area. The producer farmers took the produce to the Krishi Upaj Mandi and sold it to the wholesalers through commission agents in the local regulated market. The marketing cost incurred in movement of the produce through this channel is presented in table 4A.4. On average marketing costs were turned out to be ₹ 1430.90 per quintal in channel-II. Out of this, ₹ 105.56, ₹ 734.81 and ₹ 590.53 were incurred by the producer farmer, wholesaler cum-commission agent and retailer, respectively which accounted for 7.38, 51.35 and 41.27 per cent of the total costs of marketing of coriander. The processing (₹480), value added tax (₹243.68), commission charges (₹121.84), mandi fee (₹97.47), value of quantity lost (₹122.24), transportation charges (₹118.96), miscellaneous charges (₹ 96.04) and cost of gunny bag (₹80) were the main items of cost for marketing of coriander which, together accounted for 95.08 per cent of the total costs of marketing. These cost items individually accounted for 33.58, 17.03, 8.51, 6.81, 8.54, 8.31, 6.71 and 5.59 per cent, respectively. These findings are in consonance with Kumar and Burark (2011).

Table: 4A.4: Overall marketing cost of coriander incurred in channel-II in Rajasthan: 2012-13

(₹/quintal)

Particulars	Charge paid by				
	Producer	Wholesaler-cum-commission agent	Retailer	Consumer	Overall marketing cost
Transportation	46.79 (44.33)	39.99 (5.44)	32.18 (5.45)	-	118.96 (8.31)
VAT	-	243.68 (33.16)	-	-	243.68 (17.03)
Commission Charges	-	121.84 (16.58)	-	-	121.84 (8.51)
Mandi Fee	-	97.47 (13.26)	-	-	97.47 (6.81)
Loading Charges	5.50 (5.21)	5.50 (0.75)	5.50 (0.93)	-	16.50 (1.15)
Unloading charges	3.75 (3.55)	3.75 (0.51)	3.75 (0.64)	-	11.25 (0.79)
Weighing charges	2.50 (2.37)	2.50 (0.34)	2.50 (0.42)	-	7.50 (0.52)
Grading	-	30.00 (4.08)	-	-	30.00 (2.10)
Cost of gunny bags*	20.00 (18.95)	60.00 (8.17)	-	-	80.00 (5.59)
Value of Quantity losses	13.65 (12.94)	75.83 (10.32)	32.76 (5.55)	-	122.24 (8.54)
Cleaning	-	5.00 (0.68)		-	5.00 (0.35)
Processing	-	-	480.56 (81.38)	-	480.56 (33.58)
Miscellaneous charges**	13.50 (12.79)	49.26 (6.70)	33.28 (5.64)	-	96.04 (6.71)
Total Cost	105.56 (100.00)	734.81 (100.00)	590.53 (100.00)	-	1430.90 (100.00)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/qlt and sold to wholesaler cum commission agent @ ₹ 60/qlt i.e., cost of gunny bag borne by the farmer was ₹ 20/qlt.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges.

4A.1.3 Overall price spread in marketing of coriander in Rajasthan

Marketing margin and price-spread in sale of coriander in both the channels is discussed below:

4A.1.3.1 Overall price-spread in marketing of coriander at village sale in Rajasthan (Channel-I)

The price spread in marketing of coriander by the producer farmer at village level to the village trader and then to the wholesaler-cum-commission agent and retailer are presented in Table 4A.5. The producer's net share in consumers rupee in the sale of coriander through the channel-I was ₹ 5589.69 (64.80 per cent). In this channel the village traders purchased coriander from the producer-farmers at their own shop on an average price of ₹ 5646.23 per quintal. The village traders took it to the Krishi Upaj Mandi and sold to the wholesaler through the commission agents at an average price of ₹ 6092 per quintal. In this channel of sale the producer farmers and the village traders incurred on an average ₹ 54.56 and ₹ 152.25 per quintal towards marketing costs, respectively. The village traders got a net margin of ₹ 293.46 per quintal. This accounted for 3.38 per cent of the consumer's price. The wholesalers purchased coriander at an average price of ₹ 6092 per quintal and sold it to the retailer at ₹ 7348.64 per quintals. The margin retained by wholesaler was ₹ 521.83 per quintal. The retailer purchased coriander at an average price of ₹ 7348.64 per quintal and sold it to the consumer at ₹ 8632.45 per quintals. The margin of retailer in this process was ₹ 693.28 per quintal. Among the three market functionaries involved in channel-I retailer received the highest margin due to sale of coriander at high prices to the consumers in small quantity. Similar results were reported by Verma *et al.* (2013). The total marketing costs incurred by various intermediaries

constituted 17.17 per cent of the consumer's price. The price spread in this channel was ₹ 3042.30 (35.24 per cent) of consumers price. The small producer farmers preferred to sale coriander in village to the village traders because of their poor economic condition as well as small quantity of produce.

Table: 4A.5 Overall price spread in marketing of coriander in channel –I in Rajasthan: 2012-13

S. No	Particulars	₹/quintal	Share in consumers rupee (in percent)
1	Producers net share	5589.69	64.80
2	Costs incurred by		
	(a) Producer	56.54	0.66
	(b) Village trader	152.25	1.76
	(c) Wholesaler-cum-commission-agent	734.87	8.51
	(d) Retailer	590.53	6.84
	Total costs	1534.19	17.77
3	Margins earned by		
	(a) Village trader	293.46	3.38
	(b) Wholesaler-cum-commission-agent	521.83	6.03
	(c) Retailer	693.28	8.02
	Total margins	1508.57	17.43
4	Consumers price	8632.45	100.00
5	PRICE SPREAD	3042.75	

4A.1.3.2: Overall price-spread in marketing of coriander at mandi sale in Rajasthan (channel-II)

The price spread in marketing of coriander in channel-II is presented in Table 4A.6. In this channel, producer-farmers directly sold the produce in the mandis to the wholesalers through commission agents. The producer's net share in consumers price in the sale of coriander through the channel-II was ₹ 5986.44 (69.35 per cent). The producer - farmer has incurred on an average ₹ 105.56 per quintal of coriander before selling it to the wholesaler at an average price of ₹ 6092 per quintal. In this channel, the producer- farmer and the wholesaler-cum-commission agent have incurred on an average ₹ 105.56 and ₹ 734.81 per quintal, respectively in the disposal of coriander. The wholesaler-cum-commission agent received a net margin of ₹ 521.83 per quintal. This accounted for 6.03 per cent of the consumer's price. The retailer purchased coriander at an average price of ₹ 7348.64 per quintal and sold it to the consumers at ₹ 8632.45 per quintals. The margin of retailer in this process was estimated to be ₹ 693.28 (8.02 percent) per quintal sale of coriander. These finding were in line with Verma *et al.* (2013). Among the two market functionaries involved in channel-II retailers retained the highest margin due to sale of coriander to the consumers in small quantities. The total marketing costs incurred by various intermediaries constituted 16.58 per cent of the consumer's price. The price spread in absolute terms in channel-II was estimated to be ₹ 2646.01 (30.65 percent) in consumers price.

Table: 4A.6 Overall price spread in marketing of coriander in channel- II in Rajasthan: 2012-13

S. No	Particulars	₹/quintal	Share in consumers rupee (in percent)
1	Producers net share	5986.44	69.35
2	Costs incurred by		
	(a) Producer	105.56	1.22
	(b) Wholesaler-cum-commission-agent	734.87	8.51
	(c) Retailer	590.53	6.84
	Total costs	1430.90	16.58
3	Margins earned by		
	(d) Wholesaler-cum-commission-agent	521.83	6.03
	(e) Retailer	693.28	8.02
	Total margins	1215.11	14.08
4	Consumers price	8632.45	100.00
5	PRICE SPREAD	2646.01	

4A.2 Marketing costs and price-spread in marketing of coriander in Jhalawar district of Rajasthan

4A.2.1 Marketing channels in Jhalawar district of Rajasthan

It was found that farmers adopted following two marketing channels of coriander in Jhalawar district of Rajasthan in table: 4A.7.

Channel –I: Producer → Village trader → Wholesaler cum commission agent → Retailer → Consumer.

Channel –II: Producer → Wholesaler cum commission agent → Retailer → Consumer.

Among these channels, 78 per cent quantity of coriander moved through channel- II and 22 per cent quantity was moved through channel-I (Singh and Singh, 1999)

Table: 4A.7 Distribution of farmers adopting different marketing channels in Jhalawar district of Rajasthan

S. No	Name of marketing channels	Size Groups					Total farmer
		Marginal	Small	Semi medium	Medium	Large	
1	Producer→ Village Trader→ Wholesaler Cum Commission Agent→ Retailer→ Consumer	3 (37.50)	4 (22.22)	3 (21.43)	1 (9.09)	NA	11 (22)
2	Producer→ Wholesaler Cum- Commission Agent→ Retailer→ Consumer	5 (62.50)	14 (77.78)	11 (78.57)	10 (90.91)	NA	39 (78)
	Total	8 (100)	18 (100)	14 (100)	11 (100)	NA	50 (100)

NA= Not available

4A.2.2 Marketing charges in Jhalawar district of Rajasthan

4A.2.2.1 Marketing charges at village sale

Marketing costs borne by the producer farmer and the village trader in the sale of coriander at the village level has been as under:

(A) Transportation charges

Farmers transported the produce on camel cart or tractor to the shop of village traders. The average cost of transportation of the produce to the village traders shop was estimated ₹ 6 per quintal on average basis.

(B) Cost of gunny bags

Farmer carried their produce in Jute gunny bags. Farmer purchased gunny bags @ ₹ 80 per quintal and sold it to village trader @ ₹ 65 per quintal, village trader sold to wholesaler cum commission agent @ ₹ 60 per quintal *i.e*, cost of gunny bag borne by the farmer was ₹ 15 per quintal.

(C) Loading and unloading charges

Loading and unloading charges were important charges in the marketing of coriander. Prevailing charges for this were ₹ 6.5 and ₹ 3.75 per quintal.

(D) Weighing charges: Weighing charges at the rate of ₹3.5 per quintal.

4A.2.2.2 Marketing charges at mandi sale in selected district of Rajasthan

Cost of performing various functions in sale of coriander at mandi as prescribed by Krishi Upaj Mandi Samiti, Bhawani mandi (Jhalawar) is presented in table 4A.8.

(A) Transportation charges

Transportation cost was paid by the farmer sellers on the basis of number of bags of produce. This also varied with the distance between farm and mandi. The selected villages were situated about 20-22 km. away from Bhawani mandi (Jhalawar). Mini trucks and tractor trolleys were common means used in transportation. The average cost of

transportation borne by the farmer was ₹ 30.63 per quintal at Bhawani mandi.

Table 4A.8: Market charges in sale of coriander in Krishi Upaj Mandi Samiti, Bhawani mandi, Baran mandi and Kota mandi in Rajasthan

Particulars	Unit	Rate in ₹	Charges borne by
VAT	per 100 rupees worth of produce	4.00	Buyer
Mandi fee	per 100 rupees worth of produce	1.60	Buyer
Commission	per 100 rupees worth of produce	2.00	Buyer
Labour charges for :			
Loading	per quintal	5.5	These charges are borne by the seller upto arrival of the produce in the mandi & thereafter these are borne by the buyer
Unloading	per quintal	3.75	
Weighing	per quintal	2.5	Buyer

Source: Records of Krishi Upaj Mandi Samiti

(B) Cost of gunny bags

Farmer carried their produce in Jute gunny bags. Farmer purchased gunny bags @ ₹ 80 per quintal and sold to wholesaler cum commission agent @ ₹ 60 per quintal *i.e*, cost of gunny bag borne by the farmer was ₹ 20 per quintal.

(C) Loading and unloading charges

Loading of coriander bags in mini truck/ tractor trolley was done by the family labour of the farmers. At mandi unloading was done at prescribed charges of ₹ 3.75 per quintal. This cost was borne by the producer seller as it was incurred prior to the sale. The cost of loading and unloading was thus ₹ 5.5 and ₹ 3.75 per quintal.

(D) Weighing charges: Weighing charges @ ₹ 2.5 per quintal were borne by the buyer.

(E) VAT (value added tax)

VAT was paid at the rate of 4.0 per cent of the value of produce (coriander). This tax was charged by the wholesalers- cum- commission agent for depositing to the government.

(F) Mandi fee:

It was collected by the Krishi Upaj Mandi Samiti for rendering various services in the mandi area. The rate of mandi fee was ₹ 1.60 per ₹ 100 worth of produce and this cost was borne by the buyer

(G) Commission charges: Commission charges were realized by the commission agent at the rate of 2.0 per cent of the value of coriander from the buyer of the produce.

(H) Cleaning charges: The wholesalers incurred ₹ 5.00 per quintal for cleaning of coriander

4A.2.3 Channel-wise marketing cost of coriander in Jhalawar district of Rajasthan

Costs incurred in marketing of coriander at village and at mandi through different channels are presented in table 4A.9 & table 4A.10.

4A.2.3.1 Costs incurred in sale of coriander at village in Jhalawar district of Rajasthan (Channel- I)

In this channel, farmers sold their coriander produce to the village traders who in turn sold it to the wholesalers through commission agents

and finally, wholesalers sold it to the retailer. Table 4A.7, Show that this channel was adopted by 22 per cent of selected farmers in selling of coriander in the study area. Among the different size groups of farmers, this channel was adopted by 37.50 per cent of marginal, 22.22 per cent of small, 21.43 per cent of semi-medium and 9.09 per cent of medium farmers. In this channel, coriander moved from producer farmers to village traders and then to wholesalers through commission agents and finally to retailer. The perusal of the table 4A.9 showed that the total marketing costs were estimated to be ₹ 1466.46 per quintal channel-I. Out of this ₹ 49.47 (3.37 per cent), ₹ 137.55 (9.38 per cent), ₹ 687.81 (46.90 per cent) and ₹ 591.63 (40.34 per cent) were incurred by the producer farmers, village traders, wholesalers and retailer, respectively. It was noticed that the wholesalers had borne highest amount due to the payment of the value added tax (₹232.46), commission charges (₹116.23) and mandi fee (₹92.99). These findings are in consonance with Verma *et al.* (2013).

Table: 4A.9: Marketing cost of coriander incurred in channel-I in Jhalawar district of Rajasthan: 2012-13
(₹/qtls)

Particulars	Charges paid by				Consumer	Total marketing cost
	Producer	Village Trader	Wholesaler-cum-commission agent	Retailer		
Transportation	6.82 (13.79)	65.50 (47.62)	33.18 (4.82)	26.28 (4.44)	-	131.78 (8.99)
VAT	-	-	232.46 (33.80)	-	-	232.46 (15.85)
Commission Charges	-	-	116.23 (16.90)	-	-	116.23 (7.93)
Mandi Fee	-	-	92.99 (13.52)	-	-	92.99 (6.34)
Loading Charges	6.5 (13.14)	5.5 (4.00)	5.5 (0.80)	5.5 (0.93)	-	23 (1.57)
Unloading charges	3.75 (7.58)	3.75 (2.73)	3.75 (0.55)	3.75 (0.63)	-	15 (1.02)
Weighing charges	3.5 (7.07)	2.5 (1.82)	2.5 (0.36)	2.5 (0.42)	-	11 (0.75)
Grading	-	-	30 (4.36)		-	30 (2.05)
Cost of gunny bags*	15 (30.32)	5 (3.64)	60 (8.72)		-	80 (5.46)
Value of Quantity losses	8.60 (17.38)	30 (21.81)	63 (9.16)	25 (4.23)	-	126.60 (8.63)
Cleaning	-	-	5 (0.73)	-	-	5 (0.34)
Processing	-	-	-	500 (84.51)	-	500 (34.10)
Miscellaneous charges**	5.30 (10.71)	25.30 (18.39)	43.20 (6.28)	28.60 (4.83)	-	102.40 (6.98)
Total Cost	49.47 (100)	137.55 (100)	687.81 (100)	591.63 (100)	-	1466.46 (100)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/qlt and sold it to the village trader @ ₹ 65/qlt, village trader sold to wholesaler cum commission agent @ ₹ 60/qlt i.e., cost of gunny bag borne by the farmer was ₹ 15/qlt.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges.

4A.2.3.2: Costs incurred in sale of coriander at mandi in Jhalawar district of Rajasthan: (Channel- II)

This channel was the most common marketing channel adopted by farmers in the study area. In this channel, producer farmers sold coriander through the commission agents to the wholesalers of the mandi. Finally, these wholesalers stored coriander for sale to the retailer at some later date. Table 4A.7 depicted that 78 per cent of total selected farmers marketed their coriander produce through this channel. Among the different size groups of farmer's 62.50 per cent of marginal, 77.78 per cent of small, 78.57 per cent of semi-medium and 90.91 per cent of medium farmers. It was the most common method of sale for coriander in the study area. The producer farmers took the produce to the Krishi Upaj Mandi and sold it to the wholesalers through commission agents in the local regulated market. The marketing cost incurred in movement of the produce through this channel is presented in table 4A.10. On an average marketing costs were estimated to be ₹ 1359.45 per quintal in channel-II. Out of this, ₹ 80.01, ₹ 687.81 and ₹ 591.63 were incurred by the producer farmer, wholesaler cum-commission agent and retailer, respectively which accounted for 5.89, 50.59 and 43.52 per cent of the total costs of marketing of coriander. The processing (₹500), transportation charges (₹90.46), value added tax (₹232.46) commission charges (₹116.23), mandi fee (₹92.99), value of quantity lost (₹96.20), miscellaneous charges (₹81.23) and cost of gunny bag (₹80) were the main items of cost for

marketing of coriander which, together accounted for 94.83 per cent of the total costs of marketing. These cost items individually accounted for 36.78, 6.63, 17.10, 8.55, 6.84, 7.08, 5.98 and 5.88 per cent, respectively. These findings are in consonance with Kumar and Burark (2011).

Table 4A.10 Marketing cost of coriander in channel-II in Jhalawar district of Rajasthan: 2012-13

(₹/qtls)

Particulars	Charges paid by				Total marketing cost
	Producer	Wholesaler-cum-commission agent	Retailer	Consumer	
Transportation	30.63 (38.28)	33.18 (4.82)	26.28 (4.44)	-	90.09 (6.63)
VAT	-	232.46 (33.80)	-	-	232.46 (17.10)
Commission Charges	-	116.23 (16.90)	-	-	116.23 (8.55)
Mandi Fee	-	92.99 (13.52)	-	-	92.99 (6.84)
Loading Charges	5.5 (6.87)	5.5 (0.80)	5.5 (0.93)	-	16.50 (1.21)
Unloading charges	3.75 (4.69)	3.75 (0.55)	3.75 (0.63)	-	11.25 (0.83)
Weighing charges	2.5 (3.12)	2.5 (0.36)	2.5 (0.42)	-	7.5 (0.55)
Grading	-	30 (4.36)	-	-	30 (2.21)
Cost of gunny bags*	20 (25.00)	60 (8.72)	-	-	80 (5.88)
Value of Quantity losses	8.60 (10.25)	63 (9.16)	25 (4.23)	-	96.20 (7.08)
Cleaning	-	5 (0.73)	-	-	5 (0.37)
Processing	-	-	500 (84.51)	-	500 (36.78)
Miscellaneous charges**	9.43 (11.79)	43.20 (6.28)	28.60 (4.83)	-	81.23 (5.98)
Total Cost	80.01 (100)	687.81 (100)	591.63 (100)	-	1359.45 (100)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/ql and sold it to the wholesaler cum commission agent @ ₹ 60/ql i.e., cost of gunny bag borne by the farmer was ₹ 20/ql.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges.

4A.2.4 Price spread in marketing of coriander in Jhalawar district of Rajasthan

Marketing margin and price-spread in sale of coriander in both the channels is discussed below:

4A.2.4.1 Price-spread in marketing of coriander at village sale in Jhalawar district of Rajasthan: (Channel-I)

The price spread in marketing of coriander by the producer farmer at village level to the village trader and then to the wholesaler-cum-commission agent and retailer are presented in Table 4A.11. The producer's net share in consumers rupee in the sale of coriander through the channel-I was ₹ 5409.33 (66.32 per cent). In this channel the village traders purchased coriander from the producer-farmers at their own shop on an average price of ₹ 5458.80 per quintal. The village traders took it to the Krishi Upaj Mandi Bhawani mandi and sold to the wholesaler through the commission agents on an average price of ₹ 5811.58 per quintal. In this channel the producer farmers and the village traders incurred on an average ₹49.47 and ₹137.55 per quintal towards marketing costs, respectively. The village traders got a net margin of ₹ 215.23 per quintal. This accounted for 2.64 per cent of the consumer's price. The wholesalers purchased coriander at an average price of ₹ 5811.58 per quintal and sold it to the retailer at ₹ 6934.65 per quintals. The margins retained by wholesaler were ₹ 435.26 per quintal of coriander. The retailer purchased coriander at an average price of ₹ 6934.65 per quintal and sold it to the consumer at ₹ 8156.53 per quintals. The margin of retailer in this process was ₹ 630.25 per quintal. Among the three market functionaries involved in channel-I retailer received the highest margin due to sale of coriander at high prices to the consumers in small quantity. Similar results were reported by Verma *et al.* (2013). The total marketing costs incurred by various intermediaries constituted 17.98 per cent of the consumer's price. The price spread in this channel was ₹ 2747.20 (33.61) of consumers price. The small producer farmers preferred to sale coriander in village to the village traders because of their poor economic condition as well as small quantity of produce.

**Table 4A.11 Price spread in marketing of coriander in channel-I in
Jhalawar district of Rajasthan: 2012-13**

S.No.	Particulars	₹/quintal	Share in consumer's rupee (in percent)
1.	Producer's net share	5409.33	66.32
2.	Costs incurred by		
	(a) Producer	49.47	0.61
	(b) Village trader	137.55	1.69
	(c) Wholesaler-cum-commission agent	687.81	8.43
	(d) Retailer	591.63	7.25
	Total costs	1466.46	17.98
3.	Margins earned by		
	(a) Village trader	215.23	2.64
	(b) Wholesaler-cum-commission agent	435.26	5.34
	(c) Retailer	630.25	7.72
	Total margins	1280.74	15.70
4.	Consumers price	8156.53	100.00
5.	PRICE SPREAD	2747.20	

**4A.2.4.2: Price-spread in marketing of coriander at mandi sale in
Jhalawar district of Rajasthan: (channel-II)**

The price spread in marketing of coriander in channel-II is presented in table 4A.12. In this channel, producer-farmers directly sold the produce in the mandi to the wholesalers through commission agents. The producer's net share in consumers price in the sale of coriander through the channel-II was ₹ 5731.57 (70.27 per cent). The producer - farmer has incurred on an average ₹ 80.01 per quintal of coriander before selling it to the wholesaler at an average price of ₹ 5811.58 per quintal. In this channel, the producer- farmer and the wholesaler-cum-commission agent have incurred on an average ₹ 80.01 and ₹ 687.81 per quintal, respectively in the disposal of coriander. The wholesaler-cum-commission

agent received a net margin of ₹ 435.26 per quintal. This accounted for 5.34 per cent of the consumer's price. The retailer purchased coriander at an average price of ₹ 6934.65 per quintal and sold it to the consumers at ₹ 8156.53 per quintals. The margin of retailer in this process was estimated to be ₹ 630.25 per quintal. These finding were in line with Verma *et al.* (2013). Among the two market functionaries involved in channel-II retailers retained the highest margin due to sale of coriander to the consumers in small quantities. The total marketing costs incurred by various intermediaries constituted 16.67 per cent of the consumer's price. The price spread in absolute terms in channel-II was estimated to be ₹ 2424.96 (29.73 per cent) of consumers price.

Table 4A.12: Price spread in marketing of coriander in channel-II in Jhalawar district of Rajasthan, 2012-13

S.No.	Particulars	₹/quintal	Share in consumers rupee (in percent)
1.	Producer's net share	5731.57	70.27
2.	Costs incurred by		
	(a) Producer	80.01	0.98
	(b) Wholesaler-cum-commission agent	687.81	8.43
	(c) Retailer	591.63	7.25
	Total costs	1359.45	16.67
3.	Margins earned by		
	(a) Wholesaler-cum-commission agent	435.26	5.34
	(b) Retailer	630.25	7.73
	Total margins	1065.51	13.06
4.	Consumers price	8156.53	100.00
5.	PRICE SPREAD	2424.96	

4A.3: Marketing costs and price spread in marketing of coriander in Baran district of Rajasthan:

4A.3.1. Marketing channels in Baran district of Rajasthan

Two marketing channels were identified in marketing of coriander in the study area in the table: 4A.13.

Channel -I: Producer → Village trader → Wholesaler cum commission agent →Retailer →Consumer.

Channel –II: Producer→ Wholesaler cum commission agent → Retailer →Consumer.

Among these channels, 80 per cent quantity of coriander moved through channel- II and 20 per cent quantity was moved through channel-I (Singh and Singh, 1999)

Table: 4A.13: Distribution of farmers adopting different marketing channels of Baran district of Rajasthan

S. No	Name of marketing channels	Size Groups					Total farmer
		Marginal	Small	Semi medium	Medium	Large	
1	Producer→ Village Trader→ Wholesaler Cum Commission Agent→ Retailer→ Consumer	5 (71.43)	4 (19.05)	1 (10.00)	NA	NA	10 (20)
2	Producer→WholesalerCum Commission Agent→ Retailer → Consumer	2 (28.57)	17 (80.95)	9 (90.00)	12 (100)	NA	40 (80)
	Total	7 (100)	21 (100)	10 (100)	12 (100)	NA	50 (100)

NA= Not available

4A.3.2 Marketing charges in Baran district of Rajasthan

4A.3.2.1 Marketing charges at village sale

Following costs were incurred in the sale of coriander at village level. All these costs were borne by the producer-farmers. Loading and unloading and weighing charges were reported same as village sale in Jhalawar district. Producer-farmers transported coriander by camel carts or tractor trolleys for sale to the village traders shop and borne transportation cost @ ₹8.37 per quintal. Village traders transported the purchased quantity of coriander by tractor trolleys to the *Krishi Upaj Mandi Samiti, (Baran)* Baran and incurred ₹ 67.50 per quintal as cost of transportation and cost of gunny bags (₹13 and ₹7) per quintal.

4A.3.2.2 Marketing charges at mandi sale

Costs of performing various functions in sale of coriander at mandi as prescribed by the *Krishi Upaj Mandi Samiti, (Baran)* Baran is as presented in table 4A.8. All charges such as mandi fee, VAT (value added tax), commission charges, and loading and unloading charges, weighing charges, and cleaning were reported similar for mandi sale as reported in Jhalawar district except transportation charges and cost of gunny bags. This also varied with the distance between farm and the mandi. The selected villages were situated about 40-50 km away from Baran mandi. Mini-trucks and tractor trolleys were common means used in transportation of coriander from these villages. The average transportation and cost gunny bag was ₹52.94 and ₹ 20 per quintal.

4A.3.3 Channel-wise marketing cost of coriander in Baran district of Rajasthan

Costs incurred in marketing of coriander at village sale and at mandi sale through different channels are presented below.

4A.3.3.1 Costs incurred in sale of coriander at village sale in Baran district of Rajasthan (channel- I)

In this channel, farmers sold their coriander produce to the village traders who in turn sold it to the wholesalers through commission agents and finally, wholesalers sold it to the retailer. This table 4A.13 shows that this channel was adopted by 20 per cent of selected farmers in selling of coriander in the study area. Among the different size groups of farmers, this channel was adopted by 71.43 per cent of marginal, 19.05 per cent of small and 10.00 per cent of semi-medium farmers. In this channel, coriander moved from producer farmers to village traders and then to wholesalers through commission agents and finally to retailer (Table 4A.14). It is obvious from the table that the total marketing costs were estimated to be ₹1485.91 per quintal when producer farmers sold coriander through channel-I. Out of this ₹ 54.73 (3.68 per cent), ₹ 143.21 (9.63 per cent), ₹732.28 (49.28 per cent) and ₹555.69 (37.40 per cent) were incurred by the producer farmers, village traders, wholesalers and retailer, respectively. It was noticed that the wholesalers had borne highest amount due to the payment of the value added tax (₹242.95), commission charges (₹121.48) and mandi fee (₹97.18). These findings are in consonance with Verma *et al.* (2013).

4A.14 Marketing cost of coriander incurred in channel -I in Baran district of Rajasthan during 2012-13
(₹/qtls)

Particulars	Charges paid by					Total marketing cost
	Producer	Village Trader	Commission agent cum Wholesaler	Retailer	Consumer	
Transportation	8.37 (15.29)	67.50 (47.13)	38.18 (5.21)	29.28 (5.27)	-	143.33 (9.65)
VAT	-	-	242.95 (33.18)	-	-	242.95 (16.35)
Commission Charges	-	-	121.48 (16.59)	-	-	121.48 (8.18)
Mandi Fee	-	-	97.18 (13.27)	-	-	97.18 (6.54)
Loading Charges	6.5 (11.88)	5.5 (3.84)	5.5 (0.75)	5.5 (0.99)	-	23 (1.55)
Unloading charges	3.75 (6.85)	3.75 (2.62)	3.75 (0.51)	3.75 (0.67)	-	15 (1.01)
Weighing charges	3.5 (6.40)	2.5 (1.75)	2.5 (0.34)	2.5 (0.45)	-	11 (0.74)
Grading	-	-	30 (4.10)	-	-	30 (2.02)
Cost of gunny bags*	13 (23.75)	7 (4.89)	60 (8.19)		-	80 (5.38)
Value of Quantity losses	11.28 (20.61)	34.66 (24.20)	77.00 (10.52)	21.00 (3.78)	-	143.94 (9.69)
Cleaning	-	-	5 (0.68)	-	-	5 (0.34)
Processing	-	-	-	460 (82.78)	-	460 (30.96)
Miscellaneous charges**	8.33 (15.22)	22.30 (15.57)	48.74 (6.66)	33.66 (6.06)	-	113.03 (7.61)
Total Cost	54.73 (100)	143.21 (100)	732.28 (100)	555.69 (100)	-	1485.91 (100)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/qlt and sold it to the village trader @ ₹ 65/qlt, village trader sold to wholesaler cum commission agent @ ₹ 60/qlt i.e., cost of gunny bag borne by the farmer was ₹ 15/qlt.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges.

4A.3.3.2 Costs incurred in sale of coriander at mandi in Baran district of Rajasthan (channel- II)

This channel was the most common marketing channel adopted by farmers in the study area. In this channel, producer farmers sold coriander through the commission agents to the wholesalers of the mandi. Finally, these wholesalers stored coriander for sale to the retailer at some later date. Table 4A.13 depicted that 80 per cent of total selected farmers marketed their produce through this channel. Among the different size groups of farmer's 28.57 per cent of marginal, 80.95 per cent of small, 90.00 per cent of semi-medium and 100 per cent of medium farmers. It was the most common method of sale for coriander in the study area. In this channel, the producer farmers took the produce to the *Krishi Upaj Mandi Baran* and sold it to the wholesalers through commission agents. The wholesalers sold it to the retailer. The marketing cost incurred in movement of the produce through this channel is presented in table 4A.15. On an average marketing costs were estimated to be ₹ 1397.39 per quintal in channel-II. The results revealed that ₹109.42, ₹732.28 and ₹555.69 were incurred by the producer farmer and the wholesaler cum-commission agent and retailer, respectively which accounted for 7.83, 52.40 and 39.77 per cent of the total costs of marketing of coriander. The processing (₹460), transportation charges (₹120.40), value added tax (₹242.95), Commission charges (₹121.76), mandi fee (₹97.18), value of quantity lost (₹109.28), cost of gunny bag (₹80) and miscellaneous charges (₹95.85) were the main items of cost for marketing of coriander which, together accounted for 94.98 per cent of the total costs of marketing. These cost items individually accounted for 32.92, 8.62, 17.39, 8.69, 6.95, 7.82, 5.73 and 6.86 per cent, respectively. These findings are in consonance with Kumar and Bururk (2011).

Table 4A.15: Marketing cost of coriander incurred in channel- II in Baran district of Rajasthan during 2012-13

(₹/qtls)

Particulars	Charges paid by				Total marketing cost
	Producer	Commission agent cum Wholesaler	Retailer	Consumer	
Transportation	52.94 (48.38)	38.18 (5.21)	29.28 (5.27)	-	120.40 (8.62)
VAT	-	242.95 (33.18)	-	-	242.95 (17.39)
Commission Charges	-	121.48 (16.59)	-	-	121.48 (8.69)
Mandi Fee	-	97.18 (13.27)	-	-	97.18 (6.95)
Loading Charges	5.5 (5.03)	5.5 (0.75)	5.5 (0.99)	-	16.50 (1.18)
Unloading charges	3.75 (3.43)	3.75 (0.51)	3.75 (0.67)	-	11 (0.81)
Weighing charges	2.5 (2.28)	2.5 (0.34)	2.5 (0.45)	-	7.50 (0.54)
Grading	-	30 (4.10)	-	-	30 (2.15)
Cost of gunny bags*	20 (18.28)	60 (8.19)	-	-	80 (5.73)
Value of Quantity losses	11.28 (10.38)	77.00 (10.52)	21.00 (3.78)	-	109.28 (7.82)
Cleaning	-	5 (0.68)	-	-	5 (0.36)
Processing	-	-	460 (82.78)	-	460 (32.92)
Miscellaneous charges**	13.45 (12.29)	48.74 (6.66)	33.66 (6.06)	-	95.85 (6.86)
Total Cost	109.42 (100)	732.28 (100)	555.69 (100)	-	1397.39 (100)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/qlt and sold it to the village trader @ ₹ 65/qlt, village trader sold to wholesaler cum commission agent @ ₹ 60/qlt i.e., cost of gunny bag borne by the farmer was ₹ 15/qlt.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges

4A.3.4 Marketing margins and price spread in marketing of coriander in Baran district of Rajasthan

Marketing margin and price-spread in sale of coriander in both the channels is discussed below:

4A.3.4.1: Price-spread in marketing of coriander at village sale in Baran district of Rajasthan (Channel-I)

The price spread in marketing of coriander by the producer farmer at village level to the village trader and then to the wholesaler-cum-commission agent and retailer are presented in Table 4A.16. The producer's net share in consumers rupee in the sale of coriander through the channel-I was ₹ 5562.00 (64.95 per cent). In this channel the village traders purchased coriander from the producer-farmers at their own shop on an average price of ₹ 5616.73 per quintal. The village traders took it to the *Krishi Upaj Mandi Baran* and sold to the wholesaler through the commission agents at on average price of ₹6073.78 per quintal. In this channel of sale the producer farmers and the village traders incurred on an average ₹54.73 and ₹143.21 per quintal towards marketing costs, respectively. The village traders got a net margin of ₹ 313.84 per quintal. This accounted for 3.66 per cent of the consumer's price. The wholesalers purchased coriander at an average price of ₹ 6073.78 per quintal and sold it to the retailer at ₹7323.53 per quintals. The margin of wholesalers retained was ₹517.47 per quintal. The retailer purchased coriander at an average price of ₹7323.53 per quintal and sold it to the consumer at ₹ 8563.34 per quintals. The margin of retailer in this process was ₹ 684.12 per quintal. Among the three market functionaries involved in channel-I, retailers received the highest margin due to sale of coriander at high prices to the consumers in small quantity. Similar results were reported by Verma *et al.* (2013). The total marketing costs incurred by various intermediaries constituted 17.35 per cent of the consumer's price. The price spread in this channel was ₹3001.34 (35.05 per cent) of consumers

price. The small producer farmers preferred to sale coriander in village to the village traders because of their poor economic condition as well as small quantity of produce.

Table 4A.16: Price spread in marketing of coriander in channel-I in Baran district of Rajasthan: 2012-13

S. No.	Particulars	₹/quintal	Share in consumer's rupee (in percent)
1.	Producer's net share	5562.00	64.95
2.	Costs incurred by		
	(a) Producer	54.73	0.64
	(b) Village trader	143.21	1.67
	(c) Wholesaler-cum-commission agent	732.28	8.55
	(d) Retailer	555.69	6.49
	Total costs	1485.91	17.35
3.	Margins earned by		
	(a) Village trader	313.84	3.66
	(b) Wholesaler-cum-commission agent	517.47	6.04
	(c) Retailer	684.12	7.99
	Total margins	1515.43	17.69
4.	Consumers price	8563.34	100.00
5.	PRICE SPREAD	3001.34	

4A.3.4.2: Price-spread in marketing of coriander at mandi sale in Baran district of Rajasthan (Channel-II)

The price spread in marketing of coriander in channel-II is presented in Table 4A.17. In this channel of sale, producer-farmers directly sold the produce in the mandis to the wholesalers through

commission agents. The producer's net share in consumers price on the sale of coriander through the channel-II was ₹ 5964.36 (69.65 per cent). The producer farmer has incurred on an average ₹109.42 per quintal of coriander before selling it to the wholesaler at an average price of ₹ 6073.78 per quintal. In this channel, the produce-farmer and wholesaler-cum-commission agent has incurred on an average ₹109.42 per quintal and ₹732.28 per quintal, respectively, in disposal of coriander. The wholesaler.-cum-commission agent received a net margin of ₹517.47 per quintal. This accounted for 6.04 per cent of the consumer's price. The retailer purchased coriander at an average price of ₹7323.53 per quintal and sold it to the consumers at ₹ 8563.34 per quintals. The margin of retailer in this process was estimated to be ₹684.12 per quintal of coriander. These finding were in line with Verma *et al.* (2013). Among the two market functionaries involved in channel-II retailers retained the highest margin due to sale of coriander at high prices to the consumers in small quantities. The total marketing costs incurred by various intermediaries constituted 16.32 per cent of the consumer's price. The price spread in absolute terms in channel-II was estimated to be ₹ 2598.98 (30.35 per cent) of consumers price.

Table: 4A.17: Price spread in marketing of coriander in channel-II in Baran district of Rajasthan: 2012-13

S.No.	Particulars	₹/quintal	Share in consumers rupee (in percent)
1.	Producer's net share	5964.36	69.65
2.	Costs incurred by		
	(a) Producer	109.42	1.28
	(b) Wholesaler-cum-commission agent	732.28	8.55
	(c) Retailer	555.69	6.49
	Total costs	1397.39	16.32
3.	Margins earned by		
	(a) Wholesaler-cum-commission agent	517.47	6.04
	(b) Retailer	684.12	7.99
	Total margins	1201.59	14.03
4.	Consumers price	8563.34	100.00
5.	PRICE SPREAD	2598.98	

4A.4: Marketing costs, margins and price spread in marketing of coriander in Kota district of Rajasthan

4A.4.1. Marketing channels in Kota district of Rajasthan

Two marketing channels were identified in marketing of coriander in the study area in table 4A.18.

Channel –I: Producer → village trader → wholesaler cum commission agent → retailer → consumer.

Channel –II: Producer → wholesaler cum commission agent → retailer → consumer.

Among these channels, 70 per cent quantity of coriander moved through channel- II and 30 per cent quantity was moved through channel-I (Singh and Singh, 1999).

Table 4A.18: Distribution of farmers adopting different marketing channels of Kota district of Rajasthan

S. No	Name of marketing channels	Size Groups					Total farmer
		Marginal	Small	Semi medium	Medium	Large	
1	Producer→Village Trader→ Wholesaler Cum Commission Agent→Retailer→Consumer	8 (72.73)	5 (31.25)	2 (14.28)	NA	NA	15 (30)
2	Producer→Wholesaler Cum Commission Agent→Retailer→Consumer	3 (27.27)	11 (68.75)	12 (85.72)	9 (100)	NA	35 (70)
	Total	11 (100)	16 (100)	14 (100)	9 (100)	NA	50 (100)

NA= Not available

4A.4.2 Marketing charges in Kota district of Rajasthan

4A.4.2.1 Marketing charges at village sale

Following costs were incurred in the sale of coriander at village level. All these costs were borne by the producer-farmers. Loading and unloading and weighing charges were reported same as village sale in Jhalawar and Baran district. Producer-farmers transported coriander by camel carts or tractor trolleys for sale to the village traders shop and bear transportation cost @ ₹10.23 per quintal. Village traders transported the purchased quantity of coriander by tractor trolleys to the *Krishi Upaj Mandi Samiti*, (Kota) Kota and incurred ₹74.85 per quintal cost of transportation costs of gunny bags (₹15 and ₹5) per quintal.

4A.4.2.2 Marketing charges at mandi sale

Costs of performing various functions in sale of coriander at mandi as prescribed by the *Krishi Upaj Mandi Samiti*, (Kota) Kota is as presented in table 4A.2. All charges such as mandi fee, VAT (value added tax), commission charges, and loading and unloading charges, weighing charges, and cleaning were reported similar for mandi sale as reported in Jhalawar and Baran district except transportation charges and cost of gunny bags. This also varied with the distance between farm and the mandi. The selected villages were situated about 45-50 km away from Kota mandi. Mini-trucks and tractor trolleys were common means used in transportation of coriander from these villages. The average transportation and cost gunny bag was ₹57.78 and ₹ 20 per quintal.

4A.4.3 Channel-wise marketing cost of coriander in Kota district of Rajasthan

Costs incurred in marketing of coriander at village and at mandi through different channels are presented below.

4A.4.3.1: Costs incurred in sale of coriander at village sale in Kota district of Rajasthan (Channel- I)

In this channel, farmers sold their coriander produce to the village traders who in turn sold it to the wholesalers through commission agents and finally, wholesalers sold it to the retailer. Table 4A.18; show that this channel was adopted by 30 per cent of selected farmers in selling of coriander in the study area. Among the different size groups of farmers, this channel was adopted by 72.73 per cent of marginal, 31.25 per cent of small and 14.28 per cent of semi-medium farmers. In this channel, coriander moved from producer farmers to village traders and then to wholesalers through commission agents and finally to retailer (Table 4A.19). It is obvious from the table that the total marketing costs were ₹1616.04 per quintal when producer farmers sold coriander through channel-I. Out of this ₹ 62.93 (3.89 per cent), ₹169.05 (10.46 per cent), ₹ 771.11 (47.72 per cent) and ₹ 612.95 (37.93 per cent) were incurred by the producer farmers, village traders, wholesalers and

retailer, respectively. In this channel the wholesalers had borne highest amount due to the payment of the value added tax (₹252.39), commission charges (₹126.19) and mandi fee (₹100.95). These findings are in consonance with Verma *et al.* (2013).

Table 4A.19 Marketing cost of coriander incurred in channel- I in Kota district of Rajasthan during 2012-13 (₹/qtls)

Particulars	Charges paid by					Total marketing cost
	Producer	Village Trader	Commission agent cum Wholesaler	Retailer	Consumer	
Transportation	10.23 (16.26)	74.85 (44.28)	46.18 (6.07)	38.45 (6.27)	-	169.71 (10.57)
VAT	-	-	252.39 (33.15)	-	-	252.39 (15.62)
Commission Charges	-	-	126.19 (16.58)	-	-	126.19 (7.81)
Mandi Fee	-	-	100.95 (13.26)	-	-	100.95 (6.25)
Loading Charges	6.5 (10.33)	5.5 (3.25)	5.5 (0.72)	5.5 (0.90)	-	23 (1.42)
Unloading charges	3.75 (5.96)	3.75 (2.22)	3.75 (0.49)	3.75 (0.61)	-	15 (0.93)
Weighing charges	3.5 (5.56)	2.5 (1.48)	2.5 (0.33)	2.5 (0.41)	-	11 (0.68)
Grading	-	-	30 (3.94)	-	-	30 (1.86)
Cost of gunny bags*	15 (23.84)	5 (2.96)	60 (7.88)	-	-	80 (4.95)
Value of Quantity losses	12.59 (20.01)	45 (26.62)	84.45 (11.09)	46.30 (7.55)	-	188.34 (11.65)
Cleaning	-	-	5 (0.66)	-	-	5 (0.31)
Processing	-	-	-	480 (78.31)	-	480 (29.70)
Miscellaneous charges**	11.36 (18.05)	32.45 (19.20)	54.20 (7.12)	36.45 (5.95)	-	134.66 (8.32)
Total Cost	62.93 (100)	169.05 (100)	771.11 (100)	612.95 (100)	-	1616.04 (100)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/ql and sold it to the village trader @ ₹ 65/ql, village trader sold to wholesaler cum commission agent @ ₹ 60/ql i.e., cost of gunny bag borne by the farmer was ₹ 15/ql.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges.

4A.4.3.2 Costs incurred in sale of coriander at mandi sale in Kota district of Rajasthan (Channel- II)

This channel was the most common marketing channel adopted by farmers in the study area. In this channel, producer farmers sold coriander through the commission agents to the wholesalers of the mandi. Finally, these wholesalers stored coriander for sale to the retailer at some later date. Table 4A.18 depicted that 70 per cent of total selected farmers marketed their produce through this channel. Among the different size groups of farmer's 27.22 per cent of marginal, 68.75 per cent of small, 85.72 per cent of semi-medium and 100 per cent of medium farmers. It was the most common method of sale for coriander in the study area. In this channel, the producer farmers took the produce to the Krishi Upaj Mandi Kota and sold it to the wholesalers through commission agents. The wholesalers sold it to the retailer. The marketing cost incurred in movement of the produce through this channel is presented in table 4A.20. On an average marketing costs were turned out to be ₹ 1513.69 per quintal in channel-II. Out of this, ₹ 129.63, ₹ 771.11 and ₹ 612.95 were incurred by the producer farmer and the wholesaler cum-commission agent and retailer, respectively which accounted for 8.62, 51.28 and 40.76 per cent of the total costs of marketing of coriander. The processing (₹480), transportation charges (₹142.41), Value added tax (₹252.39), Commission charges (₹126.19), mandi fee (₹100.95), value of quantity lost (₹152.75), miscellaneous charges (₹108.75) and cost of gunny bag (₹80) were the main items of cost for marketing of coriander which, together accounted for 95.98 per cent of the total costs of marketing. These cost items individually accounted for 31.92, 9.47, 19.78,

8.39, 6.71, 10.16, 7.23 and 5.32 per cent, respectively. These findings are in consonance with Kumar and Burark (2011).

Table 4A.20: Marketing cost of coriander incurred in channel- II in Kota district of Rajasthan during 2012-13

(₹/qtls)

Particulars	Charges paid by				Total marketing cost
	Producer	Commission agent cum Wholesaler	Retailer	Consumer	
Transportation	57.78 (44.57)	46.18 (6.07)	38.45 (6.27)	-	142.41 (9.47)
VAT	-	252.39 (33.15)	-	-	252.39 (16.78)
Commission Charges	-	126.19 (16.58)	-	-	126.19 (8.39)
Mandi Fee	-	100.95 (13.26)	-	-	100.95 (6.71)
Loading Charges	5.5 (4.24)	5.5 (0.72)	5.5 (0.90)	-	16.50 (1.10)
Unloading charges	3.75 (2.89)	3.75 (0.49)	3.75 (0.61)	-	11 (0.75)
Weighing charges	2.5 (1.93)	2.5 (0.33)	2.5 (0.41)	-	7.50 (0.50)
Grading	-	30 (3.94)	-	-	30 (1.99)
Cost of gunny bags*	20 (15.43)	60 (7.88)	-	-	80 (5.32)
Value of Quantity losses	22.00 (16.97)	84 (11.09)	46.30 (7.55)	-	152.75 (10.16)
Cleaning	-	5 (0.66)	-	-	5 (0.33)
Processing	-	-	480 (78.31)	-	480 (31.92)
Miscellaneous charges**	18.10 (13.96)	54.20 (7.12)	36.45 (5.95)	-	108.75 (7.23)
Total Cost	129.63 (100)	771.11 (100)	612.95 (100)	-	1513.69 (100)

Figures in parentheses are the percentages of respective column totals.

* Farmers purchased gunny bags @ ₹ 80/ql and sold it to the village trader @ ₹ 65/ql, village trader sold to wholesaler cum commission agent @ ₹ 60/ql i.e., cost of gunny bag borne by the farmer was ₹ 15/ql.

** Miscellaneous charges include cost of sutli, food, tea and mobile charges

4A.4.4 Marketing margins and price spread in marketing of coriander in Kota district of Rajasthan

Marketing margin and price-spread in sale of coriander in both the channels is discussed below:

4A.4.4.1 Price-spread in marketing of coriander at village sale in Kota district of Rajasthan (Channel-I)

The price spread in marketing of coriander by the producer farmer at village level to the village trader and then to the wholesaler-cum-commission agent and retailer are presented in Table 4A.21. The producer's net share in consumers rupee in the sale of coriander through the channel-I was ₹ 5740.42 (63.59 per cent). In this channel the village traders purchased coriander from the producer-farmers at their own shop on an average price of ₹ 5803.35 per quintal. The village traders took it to the *Krishi Upaj Mandi* Kota and sold to the wholesaler through the commission agents at on average price of ₹6309.63 per quintal. In this channel of sale the producer farmers and the village traders incurred on an average ₹ 62.93 and ₹169.05 per quintal towards marketing costs, respectively. The village traders got a net margin of ₹ 337.23 per quintal. This accounted for 3.74 per cent of the consumer's price. The wholesalers purchased coriander at an average price of ₹ 6309.63 per quintal and sold it to the retailer at ₹ 7669.97 per quintals. The margin of wholesalers retained was ₹588.23 per quintal. The retailer purchased coriander at an average price of ₹ 7669.97 per quintal and sold it to the consumer at ₹ 9027.52 per quintals. The margin of retailer in this process was ₹ 745.60 per quintal. Among the three market functionaries involved in channel-I, retailers received the highest margin due to sale of coriander at high prices to the consumers in small quantity. Similar results were reported by Verma *et al.* (2013). The total marketing costs incurred by various

intermediaries constituted 17.89 per cent of the consumer's price. The price spread in this channel was ₹3287.10 (36.41 per cent) of consumers price. The small producer farmers preferred to sale coriander in village to the village traders because of their poor economic condition as well as small quantity of produce.

Table: 4A.21 Price spread in marketing of coriander in channel-I in Kota district of Rajasthan: 2012-13

S.No.	Particulars	₹/quintal	Share in consumer's rupee (in percent)
1.	Producer's net share	5740.42	63.59
2.	Costs incurred by		
	(a) Producer	62.93	0.70
	(b) Village trader	169.05	1.87
	(c)Wholesaler-cum-commission agent	771.11	8.54
	(d) Retailer	612.95	6.78
	Total costs	1616.04	17.89
3.	Margins earned by		
	(a) Village trader	337.23	3.74
	(b) Wholesaler-cum-commission agent	588.23	6.52
	(c) Retailer	745.60	8.26
	Total margins	1671.06	18.52
4.	Consumers price	9027.52	100.00
5.	PRICE SPREAD	3287.10	

4A.4.4.2 Price-spread in marketing of coriander at mandi sale in Kota district of Rajasthan (Channel-II)

The price spread in marketing of coriander in channel-II is presented in Table 4A.22. In this channel, producer-farmers directly sold the produce in the mandis to the wholesalers through commission agents.

The producer's net share in consumers price on the sale of coriander through the channel-II was ₹ 6180 (68.46 per cent). The producer farmer has incurred on an average ₹ 129.63 per quintal of coriander before selling it to the wholesaler at an average price of ₹ 6309.63 per quintal. In this channel, the producer- farmer and the wholesaler-cum-commission agent has incurred on an average ₹129.63 and ₹771.11 per quintal respectively, in the disposal of coriander. The wholesaler-cum-commission agent received a net margin of ₹588.23 per quintal. This accounted for 6.52 per cent of the consumer's price. The retailer purchased coriander at an average price of ₹ 7659.12 per quintal and sold it to the consumers at ₹ 9027.52 per quintals. The margin of retailer in this process was estimated to be ₹ 745.60 per quintal of coriander. These finding were in line with Verma *et al.* (2013). Among the two market functionaries present in channel-II retailers retained the highest margin due to sale of coriander to the consumers in small quantities. The total marketing costs incurred by various intermediaries constituted 16.78 per cent of the consumer's price. The price spread in absolute terms in channel-II was estimated to be ₹ 2847.52 (31.54 per cent) of consumers price.

**Table 4A.22: Price spread in marketing of coriander in channel-II in
Kota district of Rajasthan: 2012-13**

S.No.	Particulars	₹/quintal	Share in consumers rupee (in percent)
1.	Producer's net share	6180.00	68.46
2.	Costs incurred by		
	(a) Producer	129.63	1.44
	(b) Wholesaler-cum-commission agent	771.11	8.54
	(c) Retailer	612.95	6.78
	Total costs	1513.69	16.78
3.	Margins earned by		
	(a) Wholesaler-cum-commission agent	588.23	6.52
	(b) Retailer	745.60	8.26
	Total margins	1333.83	14.78
4.	Consumers price	9027.52	100.00
5.	PRICE SPREAD	2847.52	

Section-4B

TREND, CYCLICAL, IRREGULAR AND SEASONAL PRICES BEHAVIOUR OF CORIANDER IN RAJASTHAN

Price movements were studied by analysing the time series data on prices. On a *priori* basis four time components viz.; trend, cyclical, seasonal and irregular were assumed to be associated in multiplicative fashion with the changes in prices. In this section, trends in wholesale prices of coriander were examined for the state of Rajasthan. Cyclical, irregular and seasonal price behaviour of the crop is presented in the section that follows.

Analysis of trend component in series of annual price data ascertained general direction of the movement of prices over a period of several years. For examining the trend in prices of coriander for the selected districts linear function was estimated by regressing price (wholesale price) on time using the ordinary least squares (OLS) method. The best fit model was selected on the basis of statistical significance of the regression parameters and coefficient of determination (R^2). Presence of autocorrelation among the estimated residuals was tested with the help of Durbin-Watson d' statistic.

Based on the statistical significance of the estimated regression parameters and the coefficients of determination, linear function was

selected for further discussion. The estimated linear functions for wholesale prices are presented in appendices VII respectively.

4B:1 Linear trend in monthly wholesale prices of coriander in selected mandies of Rajasthan

The estimates of linear trend in wholesale prices of coriander for the selected Mandies of the Rajasthan have been presented in the table 4B.1. The table indicates that the regression coefficient B associated with the time element (T) was positive and highly significant at 1 percent level of significance for all the three selected Mandies. The value of regression coefficient for time was estimated to be the highest for Bhawani mandi (245.77) followed by Baran mandi (229.41) and Kota mandi (225.54). The estimates of the coefficient of determination (R^2), as a measure to map the goodness of fit of the regression line to the given data ranged from 0.507 for Kota mandi to 0.537 for Baran Mandi indicating that the time element alone explained 50.70 percent to 53.70 percent variation in the wholesale prices of coriander in the selected mandies during the study period. The values of adjusted coefficient of determination (R^2), adjusted for degrees of freedom ranged from 0.498 to 0.466 for different selected mandies. The highly significant values of calculated F statistics also supported the contention that time element was a significant explanatory factor of the variation in the wholesale prices of coriander.

Durbin - Watson test ('d' statistics) revealed that there was no autocorrelation among the residuals in all the selected mandies.

Table 4B.1 Estimates of linear trend in wholesale prices of coriander in selected mandies of Rajasthan (2000-01 to 2013-14)

Mandies	Intercept (β_0)	Regression coefficient (β_1)	(R^2)	($\bar{R}^2$)	'd' statistic	F statistic
Bhawani Mandi	1096.88	245.77* (66.61)	0.531	0.492	1.61	13.61
Baran Mandi	1208.63	229.42* (61.55)	0.537	0.498	1.74	13.89
Kota Mandi	1220.47	225.54* (64.20)	0.507	0.466	1.77	12.34

*Significant at 1 per cent level of significance

4B.2 Cyclical, Irregular and seasonal prices behaviour of coriander in Rajasthan

Of the four components of time series observations on prices of coriander, trend component has already been dealt with in section 4B.1. This section discusses the cyclical, irregular and seasonal components of wholesale prices of coriander under the following heads:

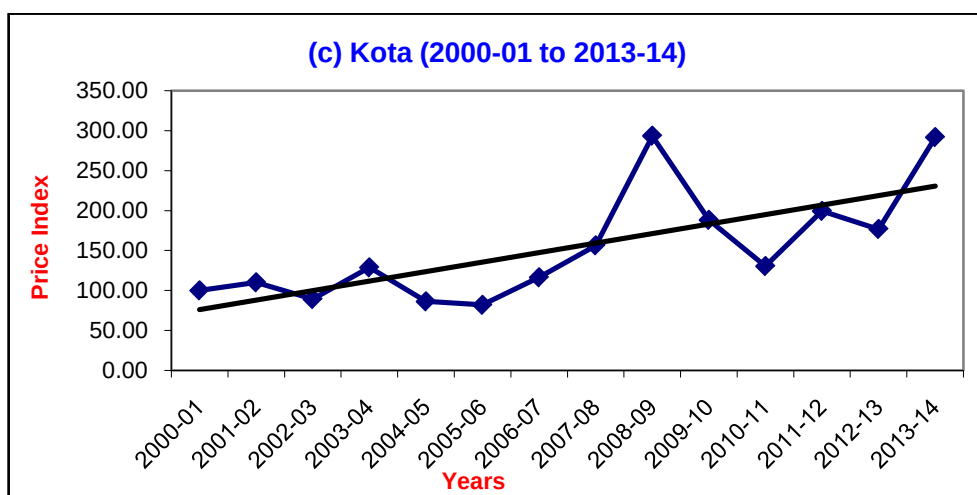
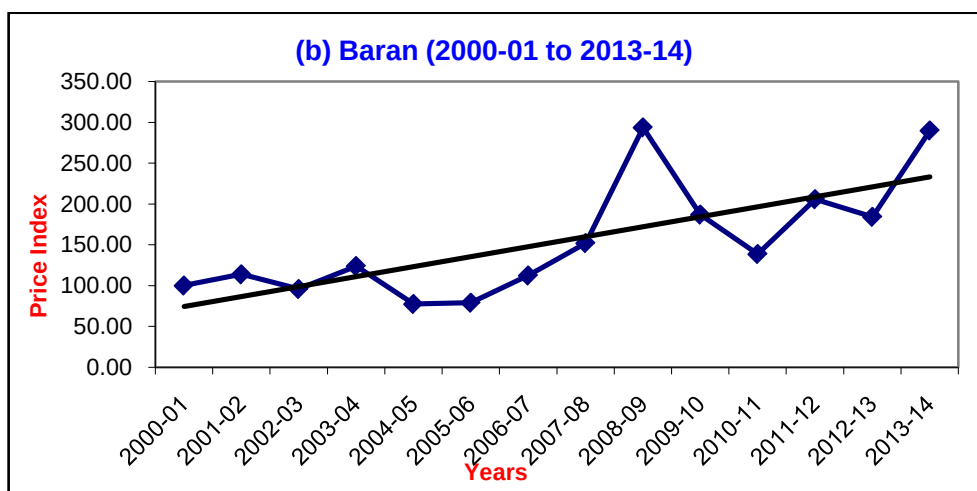
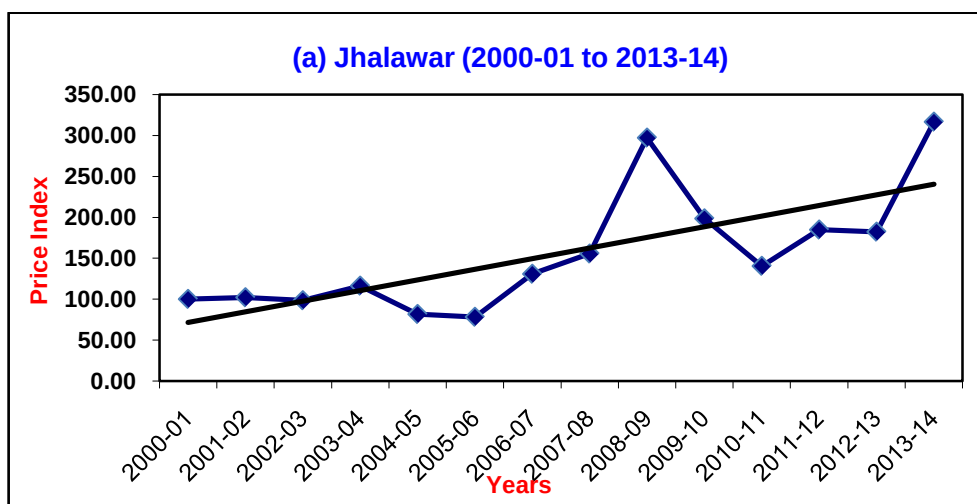


Fig. : 4B.1 (a to c) Graphical presentation of linear trend in whole sale prices of coriander in selected mandies in Rajasthan

4B.2.1: Cyclical component in wholesale prices of coriander in the selected mandies of Rajasthan

Cyclical variation is an oscillatory movement in a time series where the period of oscillation happens to be of more than one year. Oscillating movement of one year periodicity is termed as inter year or cyclical variation. Generally, the cyclical movements take the form of a wave with uneven length (intervening period between one peak and the next or between one trough and the next) and amplitude (extent of upswings and downswings) because of complex combination of forces affecting the equilibrium of demand and supply. These cycles generally exhibit semi-regular periodicity as these are neither as regular as seasonal (intra-year) variations nor as accidental as are random (irregular) fluctuations. Here, an attempt has been made to examine the cyclical behaviour of wholesale prices of coriander in the selected districts of the state. Fourteen years series of price data (2000-01 to 2013-14) of the three selected districts in the form of indices were used to isolate the cyclical component from the wholesale prices of the crop.

Cyclical component of wholesale prices of coriander in Rajasthan is presented in table 4B.2 and panel of graphs [Fig.4B.2 (a to c)]. Wholesale price of coriander in Bhawani mandi exhibited one cycle, which is consisting of 6 years (2006-07 to 2011-12). Both Baran and Kota mandies exhibited one price cycle, Baran mandi had 6 years price cycle (2006-07

to 2011-12) and Jhalawar mandi also had 6 years price cycle (2006-07 to 2011-12). All the price cycles lasted almost for the same time period. The peak price years that emerged were 2008-09 and 2009-10. The probable reason for same length of price cycles in the study area may be attributed the components of weather (total rainfall, distribution of rainfall, temperatures, relative humidity, etc.) which was almost same in the all mandies.

Table 4B.2: Cyclical component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)

Year	Bhawani Mandi	Baran Mandi	Kota Mandi
2001-02	122.11	121.03	115.17
2002-03	109.97	113.37	109.78
2003-04	91.34	90.49	91.35
2004-05	76.53	77.61	81.75
2005-06	70.44	65.75	69.68
2006-07	80.22	76.49	79.11
2007-08	117.49	113.90	116.06
2008-09	123.34	122.33	123.99
2009-10	114.62	114.14	113.60
2010-11	86.85	90.13	88.63
2011-12	78.42	84.11	81.31
2012-13	98.96	102.02	101.15

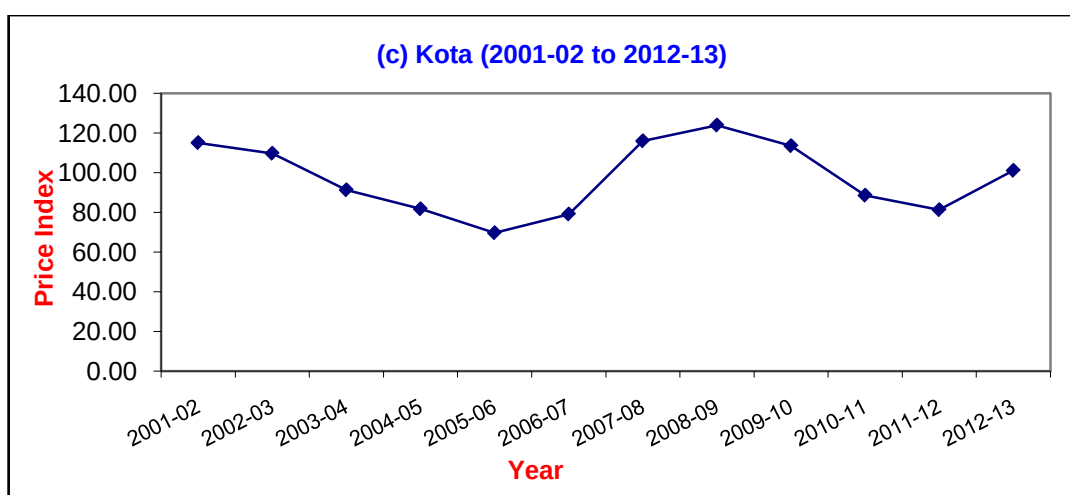
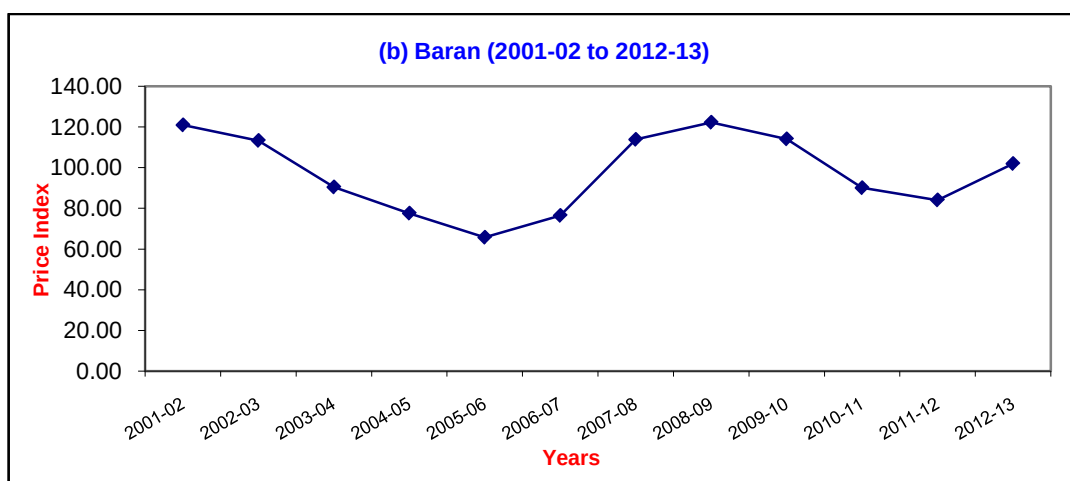
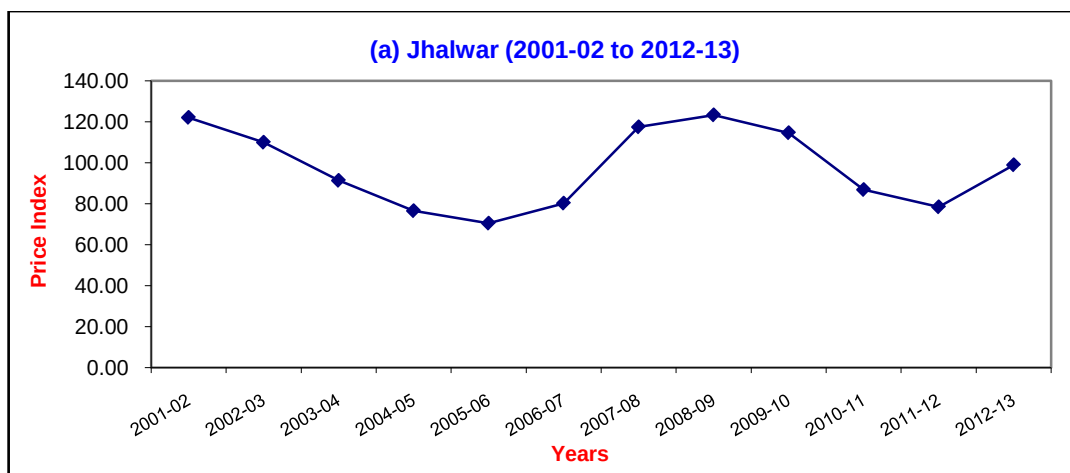


Fig. : 4B.2 (a to c) Graphical presentation of cyclical component in whole sale prices of coriander in selected mandies in Rajasthan

4B.2.2 Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan

Irregular price movements represent that part of the behaviour of prices, which is not systematic. No generalization can be made about such price fluctuations because of the irregularity in their occurrence. An irregular price fluctuation in wholesale prices of coriander is discussed under the following head:

4B.2.2 Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan

The estimated results of irregular components of wholesale prices of coriander in the districts of Rajasthan are presented in table 4B.3 and depicted in panel of graphs [Fig.4B.3 (a to c)]. It is evident from the table that the irregular fluctuations did not exhibit any definite periodicity in their recurrence. In Kota mandi the extent of fluctuations arising as a result of factors other than those causing trend, cyclical and seasonal movements varied from 75.43 (24.57 per cent below 100) in 2011-12 to 138.09 (38.09 per cent above 100) in 2008-09. Eight observations out of 12 fluctuated within the range of 75.43 to 99.74 and the rest within the limits of 108.57 to 138.09. Almost similar type of irregular behaviour in wholesale prices of coriander was observed in Baran mandi and Bhawani mandi. In case of Baran mandi the magnitude of irregular fluctuations was recorded to be 78.24 during 2010-11 and the highest 139.42 (39.42 per cent above 100) during 2008-09. In case of Baran mandi the respective lowest magnitude was of the order of 78.24 indicating 21.76 per cent downward movement from the normal, in the year 2010.11 and the highest 139.42 indicating 39.42 per cent upward movement during 2008-09. In case of Bhawani mandi the magnitude of irregular fluctuations was recorded to be 80.06 during 2010-11 and the highest (137.19) during 2008-09. In case of Bhawani mandi the respective lowest magnitude was of the order of 80.06 indicating 19.94 per cent downward movement from the normal, in the year

2010.11 and the highest 137.19 indicating 37.19 per cent upward movement during 2008-09.

The irregular price fluctuations in the wholesale prices of coriander may be attributed to factors like span and distribution of monsoon, droughts, floods, and the various government policies directly or indirectly affecting the production and consumptions of coriander.

Table 4B.3: Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)

Year	Bhawani Mandi	Baran Mandi	Kota Mandi
2001-02	100.13	108.63	108.57
2002-03	92.59	85.53	81.23
2003-04	115.88	123.39	126.03
2004-05	86.70	80.99	85.31
2005-06	81.48	88.69	86.67
2006-07	109.16	99.47	99.74
2007-08	81.45	83.47	84.48
2008-09	137.19	139.42	138.09
2009-10	91.72	88.80	90.42
2010-11	80.06	78.24	75.43
2011-12	109.55	117.13	118.46
2012-13	80.65	81.65	79.84

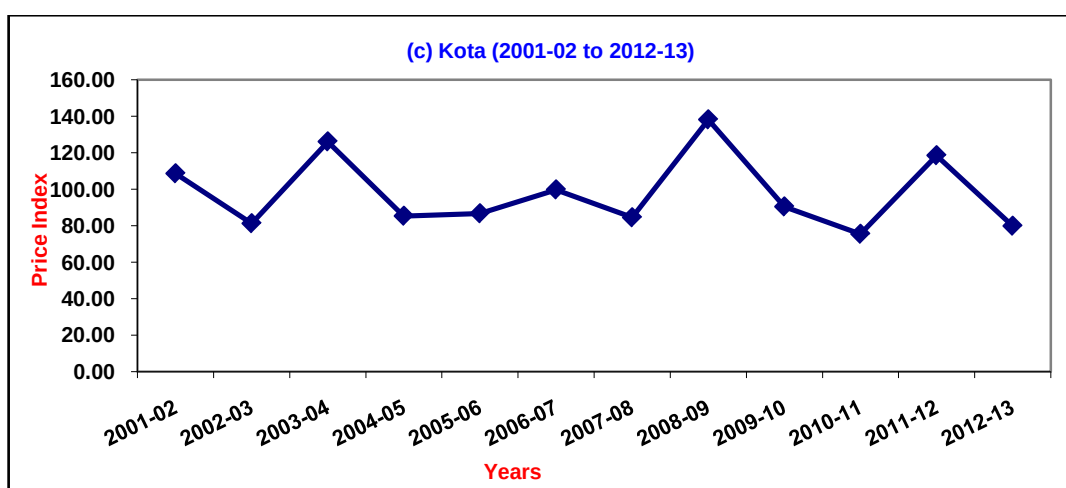
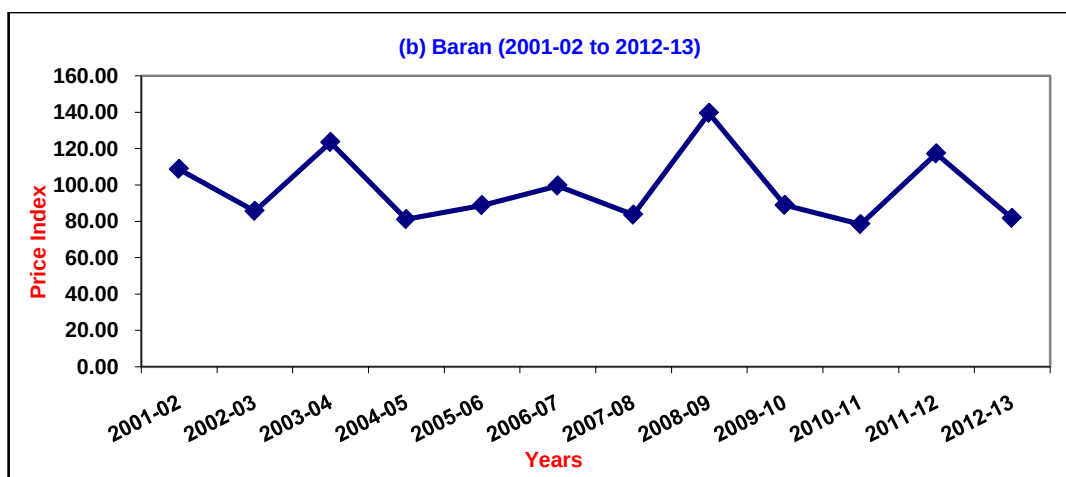
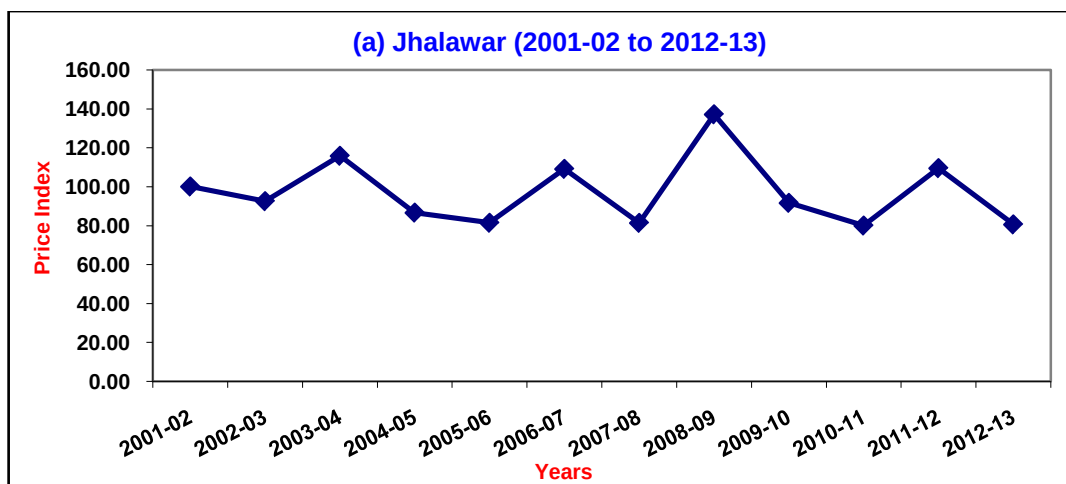


Fig. : 4B.3 (a to c) Irregular component of whole sale prices of coriander in selected mandies in Rajasthan

4B.2.3 Seasonal price behaviour of coriander in the selected mandies of Rajasthan

Price fluctuations within a year introduce an element of uncertainty and depend heavily on the seasonal demand and supply of the commodity as well as the marketing decision making abilities of the buyers and sellers. The up and down swings in prices that occur with some regularity during the year are termed as seasonal price variations. They resemble a sort of intra year price cycle. The extent of price rise during the year reflects the intra year price margin and determines the stocking behaviour of traders and returns to storage. For seasonal analysis of prices, index numbers of monthly wholesale prices of coriander for the selected markets of Rajasthan were calculated from the raw data for the period from January - 2000 to December-2013. Seasonal price indices were, then worked out assuming the following form of the model:

$$P_{it} = T_{it} \times C_{it} \times S_{it} \times I_{it}$$

where:

P_{it} = Monthly price index number for i th month of the t th year

T_{it} = Trend component for the i th month of the t th year

C_{it} = Cyclical component for the i th month of the t th year

S_{it} = Seasonal component for the i th month of the t th year

I_{it} = Irregular component for the i th month of the t th year

i = 1 to 12, and

t = 1 to n (number of years)

Price behaviour for an individual month was assumed to be composed of $T \times C \times S \times I$ elements. Twelve months centered moving average (CMA) was considered to be representative of trend and cyclical components. The ratio of price index to CMA for corresponding month was

calculated to collect the monthly price series for seasonal and irregular components. The ratio so obtained represented seasonal and irregular components only. Irregular component was then eliminated by computing the average (over the years) for each month separately. These seasonal price indices were adjusted (multiplied by correction factor) to make their total 1200. The monthly prices related to the agricultural year, *i.e.*, July to June.

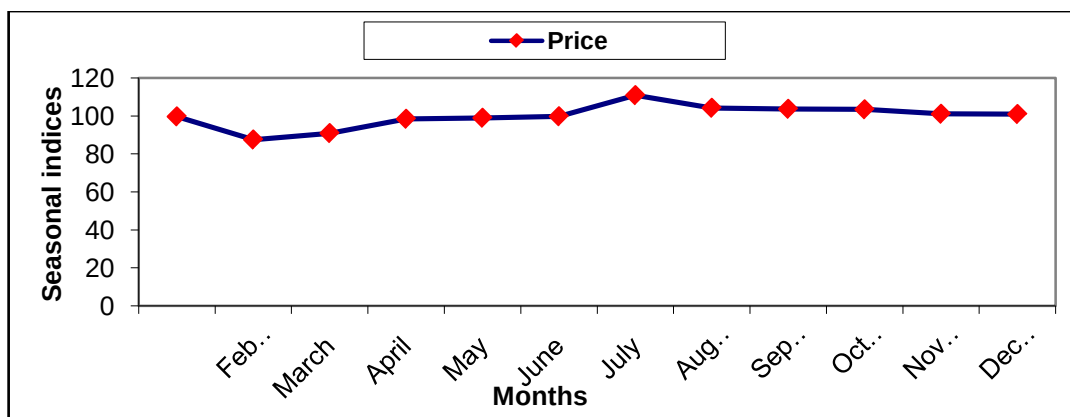
4B.2.3 Seasonal indices of monthly prices of coriander in selected Mandies of Rajasthan

The estimated results of seasonal indices of wholesale prices of coriander in the districts of Rajasthan are presented in table 4B.4 and Fig.4B.4 (a to c). The result clearly indicates the existence of seasonality in prices of coriander in the Bhawani mandi. The table shows that coriander price indices in Bhawani mandi were 87.55 for month of February, which continued to increase up to the month of June and thereafter declined continuously. Coriander price indices in Bhawani mandi continued to increase from 87.55 in the month of February to the month of June (99.01), and thereafter declined continuously from July to December (110.95 to 100.98). In Bhawani mandi the price fluctuations varied from 87.55 to 110.95. Coriander price indices in Baran mandi and Kota mandi also increased from the month of February to June, and thereafter declined continuously from July to December. Price indices in Baran mandi continued to increase from 89.21 in the month of February to the month of June (98.74), and thereafter declined continuously from July to December (109.64 to 101.98). In Baran mandi the price fluctuations varied from 89.21 to 109.64. Price indices in Kota mandi continued to increase from 92.84 in the month of February to the month of June (99.28), and thereafter declined continuously from July to December

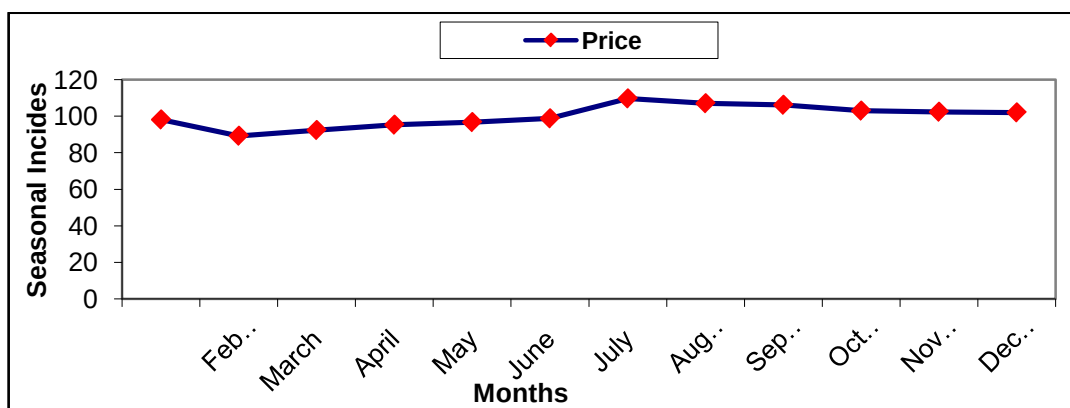
(106.14 to 100.24). In Kota mandi the price fluctuations varied from 92.84 to 106.14 during the study period. As far as the price indices of coriander were concerned, the highest price indices were noticed in the month of July and the lowest price indices were obtained in the month of February. The greater price indices (more than 100) were observed during the months of July to December which is a standing crop period. Lesser fluctuations in coriander prices indicated stability in the prices of all the markets of Rajasthan during study period (2000- 2013). These results are clearly depicted in Fig 4B.4 (a to c).

Table 4B.4: Seasonal indices for monthly wholesale prices of coriander in the selected mandies of Rajasthan (2000 to 2013)

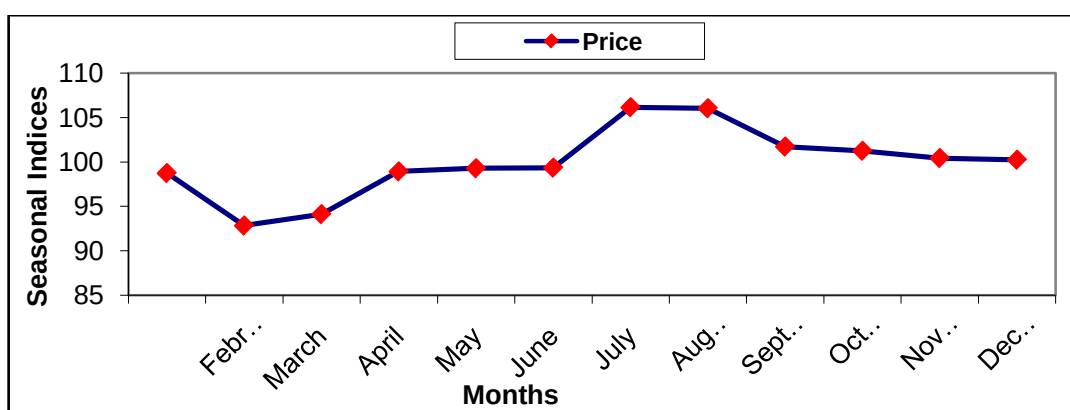
Months	Bhawani Mandi	Baran Mandi	Kota Mandi
January	99.73	98.12	98.74
February	87.55	89.21	92.84
March	90.94	92.34	95.12
April	98.47	95.26	98.92
May	99.01	96.69	99.28
June	99.81	98.74	99.34
July	110.95	109.64	106.14
August	104.26	106.54	106.02
September	103.72	106.14	101.72
October	103.47	102.95	101.24
November	101.11	102.39	100.40
December	100.98	101.98	100.24
Total	1200.00	1200.00	1200.00



(a) Jhalawar seasonal indices



(b) Baran seasonal indices



(c) Kota seasonal indices

Fig 4B.4 (a to c) Seasonal indices of monthly wholesale prices of coriander in selected mandies in Rajasthan (2000 to 2013)

To analyse the arrival pattern of coriander during different months of the year and their impact on price, seasonal indices were computed

adopting 12 months moving averages. Coriander crop can be grown under irrigated conditions. Coriander is grown as a *rabi* season crop in the state. Sowing of the crop is generally over by 15th of October under normal sown conditions. It comes to harvest during February and/or March. Unlike food crops the principle consumer of coriander are mills which purchase it in bulk for operating the mills round the year. It was apparent that the period from March to June has accounted maximum arrivals (more than 100 indices) in the selected markets. Thus the majority of the produce was sold soon after the harvest probably for want of cash or lack of storage facilities. However, farmers who are financially sound can store for longer time to look forward for advantageous period and higher prices.

The lower values of indices were observed during the period from July to February which indicated lean period for the coriander crop in selected markets. The price movement also demonstrates significant seasonal fluctuations in the selected markets. As short term fluctuations one will notice a general finding that the price is low when the arrivals were large and the price was high when the arrivals were low. Thus, market arrivals in coriander crop pick up from March to June and thereafter it started declining upto pre harvest. The highest values of price indices were observed during lean arrivals months of July to December and in remaining months prices were observed moderate in selected markets.

4B.2.3.1 Coefficients of average seasonal variation of coriander in the selected mandies of Rajasthan

The extent of seasonal price variation was determined by using different measures of intra year price variations. The three methods used to measure intra year price variations were the intra-year price rise (IPR), coefficient of average seasonal price variation (ASPV) and the coefficient of variation (CV).

With a view to ascertaining the difference in the magnitude of the seasonal variations in coriander, the analysis was carried out in terms of IPR, ASPV and C.V. For this purpose, the magnitude of fluctuations in seasonal indices of coriander was measured with the help of the coefficient of average seasonal price index variation. The results obtained are presented in Table 4B.5. The results of intra year price rise (Table 4B.5) revealed that the magnitude of lowest seasonal price index ranged from as low as 87.55 to as high as 110.95 for Bhawani mandi with February as the month registering lowest indices for all the three selected mandies. As regards highest seasonal price index, its magnitude ranged from 106.14 for Kota mandi to 110.95 for Bhawani mandi.

The extent of intra year price rise (IPR) varied from as low as 14.32 per cent in Kota market to as high as 22.90 per cent in Baran market. The results of coefficient of average seasonal price variation were in tune with that of the coefficient of variation (C.V.). The coefficient of variation for all the selected markets including the state ranged from 3.78 per cent to 6.45

per cent. The smaller magnitude of C.V. or the mean coefficient of dispersion revealed that there was greater consistency or smaller variability in the monthly prices of coriander in the selected markets of the Rajasthan. The variability in fresh arrivals, stock of the products in market and the demand affects the price to a great extent. Keeping such variations in demand in view, the growers can obtain better prices by matching supply to the market requirements during the period of high seasonal price index.

Table 4B.5: Intra Year wholesale price rise in coriander in selected mandies of Rajasthan (2000-01 to 2013-14)

Markets	Lowest seasonal price index		Highest seasonal price index		Magnitude of variation (%)		
	Month	Seasonal index	Month	Seasonal index	IPR	ASPV	C.V.
Bhawani Mandi	Feb	87.55	July	110.95	19.09	23.58	6.08
Baran Mandi	Feb	89.21	July	109.64	22.90	20.55	6.45
Kota Mandi	Feb	92.84	July	106.14	14.32	13.36	3.78

IPR =Intra year price rise ASPV =Average seasonal price variation CV
=Coefficient of Variation

Section 4C

COMPARISON OF SPOT PRICES WITH FORECAST PRICES OF CORIANDER IN RAJASTHAN

Price forecasting is required by the government organizations, traders and their organizations, farmers, consumers and researchers as well. Government organizations need price forecasting for formulation of plans and policies and also for their effective application. Traders and their organizations require price forecasting for competitive sales, purchases and efficient commercial operations in order to carry out the functions of distribution efficiently. Farmers need price forecasting for proper adjustments in cropping pattern and to decide when, where and how much to sell. Consumer need price forecasting to understand market forces for making purchases in a rational manner. A researcher requires market intelligence in order to assess the efficiency of the marketing system, identify the bottlenecks in marketing programme/projects and for suggesting future remedial steps and strategies.

In this study commodity wise forecasting of coriander price was done using both Auto Regressive Integrated Moving Average (ARIMA) model and Exponential Smoothing model. In single exponential smoothing, equal weights were given to all the observations; the weights were assigned by trial and error method. The weight (W_1) *i.e.*, the alpha (level) value for best performing model.

Double exponential smoothing method also called as trend adjusted exponential smoothing which was improved by introducing a second smoothing constant *i.e.*, trend constant, (W_2); assuming the

coriander price value being influenced by the trend component. This must be chosen in conjunction with W1.

To handle seasonality present in the coriander price series data, the third parameter (W3) was added. Values of the softening constants W1, W2 and W3, were obtained by trial and error method based on the minimization of the mean absolute per cent error (MAPE) of the forecasting.

The principal objective of developing best model for price forecast out of different models for coriander was to generate post sample period price forecasts for coriander. The results of ARIMA and Smoothing model are presented in the following section

4C.1 Comparison of spot price with forecast prices of coriander at Bhawani mandi

The detailed analysis for forecasting of coriander prices in Bhawani mandi is presented as under

4C.1.1 Identification of the model

A model was identified for the wholesale prices of coriander at Bhawani mandi regulated market. The monthly wholesale prices from January- 2000 to December-2013 were used to estimate the ACF and PACF (Appendix I). The price data were tested for stationarity. It can be seen from Table 4C.1 and Fig.4C.1 that the auto correlation function (ACF) declined very slowly from 0.898 to 0.220 and as many ACFs were significantly different from zero and fell outside 95 per cent confidence interval, indicating the price of coriander to be non stationary. The analysis of partial autocorrelation coefficients of coriander prices are depicted in table 4C.1 (Sharma, 2015). The graphical presentation of ACF and PACF of table 4C.1 are given in Fig.4C.1 (a) and 4C.1 (b), respectively. The partial autocorrelation function (PACF) dropped steeply

after the first lag period from 0.898 to -0.075, which also indicated the non-stationarity of the price series.

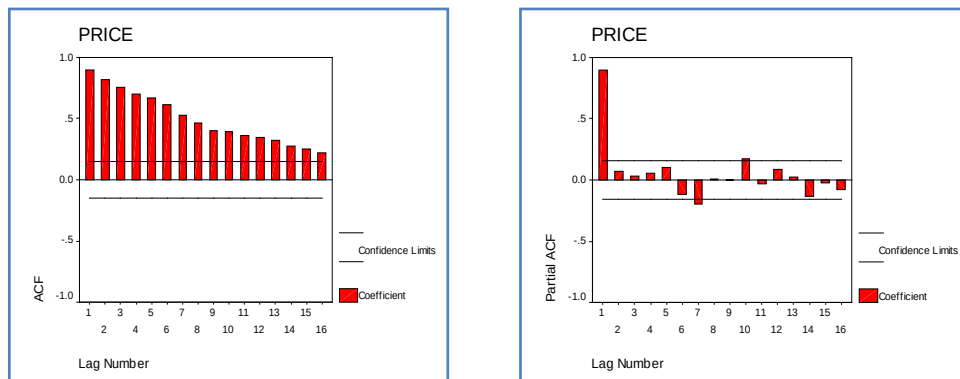
These tables showed that the autocorrelation and partial autocorrelation functions at lag 16 were significantly different from zero and fell outside the 95 % confidence interval. Differencing of price data of coriander was done to make the series stationary. The value of d in the ARIMA model was unity (1) because the differencing was carried out only once to arrive at stationary series.

Table 4C.1: Autocorrelation and partial autocorrelation coefficients of the coriander price at Bhawani mandi

Lags	Auto correlation coefficients		Box-Ljung	Partial autocorrelation coefficients	
	Value	Standard Error		Value	Standard error
1	0.898	0.076	137.835	0.898	0.077
2	0.820	0.076	253.641	0.075	0.077
3	0.755	0.076	352.289	0.033	0.077
4	0.704	0.076	438.482	0.051	0.077
5	0.673	0.076	517.866	0.102	0.077
6	0.616	0.075	584.705	-0.121	0.077
7	0.530	0.075	634.482	-0.194	0.077
8	0.463	0.075	672.673	0.011	0.077
9	0.405	0.075	702.139	0.003	0.077
10	0.392	0.074	729.900	0.174	0.077
11	0.365	0.074	754.149	0.035	0.077
12	0.345	0.074	776.000	0.090	0.077
13	0.322	0.74	795.156	0.020	0.077
14	0.277	0.073	809.358	-0.137	0.077
15	0.249	0.073	820.950	-0.026	0.077
16	0.220	0.073	830.033	-0.075	0.077

The underlying process assumed is independence (white noise).

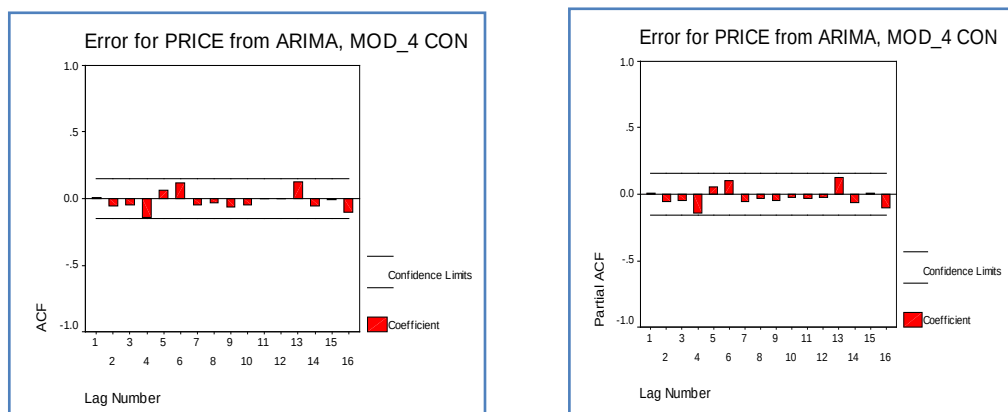
Figure 4C.1: Autocorrelation and partial autocorrelation coefficients of the coriander price at Bhawani mandi



4C.1 (a) Autocorrelation

4C.1 (b) Partial Autocorrelation

Figure 4C.2 Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price at Bhawani mandi



4C.2 (a) Autocorrelation

4C.2 (b) Partial Autocorrelation

4C.1.2 Model estimation: The best model was chosen from the various ARIMA models viz: ARIMA (1, 1, 0); ARIMA (1, 1, 1); ARIMA (0, 1, 1); ARIMA (2, 1,1); ARIMA (0, 1, 2) and ARIMA (2, 1, 0) on the basis of least Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria

(SBC). The models as identified above were estimated through the Marquardt procedure using SPSS 7.5 and SPSS 20 version of the SPSS package. On comparing the alternative models on the basis of statistics such as Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC), it was observed that both AIC (2605.26) and SBC (2611.50) were the least for ARIMA (0, 1, 1) model in table 4C.2. Hence, ARIMA (0, 1, 1) was the most representative model for the price of coriander in Bhawani mandi (Burark and Sharma, 2012).

Table 4C.2 ARIMA models selected for forecasting the price of coriander on the basis of least AIC & SBC at Bhawani mandi

ARIMA (p, d, q)	Akaike Information Criteria (AIC)	Schwarz Bayesian Criteria (SBC)
ARIMA (1,1,0)	2605.84	2612.08
ARIMA (1,1,1)	2605.77	2615.13
ARIMA (0,1,1)	2605.26	2611.50
ARIMA (2,1,1)	2605.12	2617.59
ARIMA (0,1,2)	2606.40	2615.76
ARIMA (2,1,0)	2607.03	2616.39

4C.1.3 Diagnostic checking: The model verification is concerned with checking the residuals of the model to see if they contained any systematic pattern which still could be removed in order to improve the chosen ARIMA, which has been done through examining the autocorrelations and partial autocorrelations of the residuals of various orders. For this purpose, autocorrelation and partial autocorrelation functions of various orders of the residuals of ARIMA (0, 1,1) up to 16 lags were computed and are presented in Table 4C.3. The value of ACF and PACF varied from 0.010 to-0.099 which showed that the autocorrelation and partial correlation functions at lag 16 were significantly different from

zero and fell within the 95% confidence interval. The graphical presentation of ACF and PACF diagnostics is given in Fig 4C.2 (a) and 4C.2 (b), respectively which also confirm the above results. Thus it could be concluded that the selected ARIMA (0,1,1) model was appropriate for forecasting the price of coriander during the period under study.

Table 4C.3: Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price at Bhawani mandi

Lags	Auto Correlation coefficients		Box-Ljung	Probility	Partial autocorrelation coefficients	
	Value	Standard Error			Value	Standard error
1	0.010	0.077	0.017	0.897	0.010	0.077
2	-0.053	0.076	0.500	0.779	-0.053	0.077
3	-0.050	0.076	0.935	0.817	-0.049	0.077
4	-0.139	0.076	4.276	0.370	-0.142	0.077
5	0.060	0.076	4.894	0.429	0.057	0.077
6	0.115	0.076	7.221	0.301	0.099	0.077
7	-0.045	0.075	7.585	0.371	-0.056	0.077
8	-0.028	0.075	7.776	0.461	-0.032	0.077
9	-0.065	0.075	8.488	0.486	-0.045	0.077
10	-0.044	0.075	8.838	0.548	-0.025	0.077
11	0.003	0.074	8.841	0.637	-0.031	0.077
12	0.002	0.074	8.841	0.716	-0.021	0.077
13	0.129	0.074	11.886	0.537	0.130	0.077
14	-0.056	0.074	12.461	0.569	-0.063	0.077
15	-0.009	0.073	12.477	0.643	0.010	0.077
16	-0.099	0.073	14.305	0.576	-0.100	0.077

4C.1.4 Exponential smoothing for price forecasting of coriander at Bhawani mandi

Under exponential smoothing, the weights (W1, W2, and W3) were assigned in geometric progression. All the three techniques (Single, Double and Triple) of exponential smoothing methods were considered for

forecasting the prices of coriander in Bhawani mandi. The results are presented in Table 4C.4.

Table 4C.4: Different exponential smoothing criterion for forecast model for coriander price at Bhawani mandi

Criteria	SES	DES	TES
MAPE	12.53	14	19
MAD	388.71	392	553
MSD	341541	366801	625593

SES- Single Exponential Smoothing, DES- Double Exponential Smoothing, TES- Triple Exponential Smoothing

From the above table, it can be inferred that the SES model is the preferred model for forecasting of coriander price due to the minimum value of MAPE (12.53), MAD (388.71) and MSD (341541) when compared to the other models.

The performance of different coriander forecast models was measured in terms of Mean Absolute Deviation (MAD), Mean Standard Error (MSE) and Mean Absolute Percentage Error (MAPE). The comparative performances of different forecasting models are presented in Table 4C.5.

Table 4C.5: Selected price forecasting models for coriander based on MAD, MSE & MAPE criteria at Bhawani mandi

Criteria	Forecast models	
	SES	ARIMA
MAD	458.71	385.45
MSE	361541	331499.40
MAPE	15.44	12.47

4C.1. 5 Extent of accuracy through different criterion at Bhawani mandi

From the Table 4C.5, it can be inferred that the ARIMA (0,1,1) model is preferred to SES model for forecasting coriander price due to the minimum value of MAD (385.45), MSE (331499.40) and MAPE (12.47).

4C.1.6 Forecasting for coriander prices of the Bhawani mandi

ARIMA model was basically developed to forecast the corresponding variable. The actual prices of coriander in Bhawani mandi from January- 2014 to December- 2014 and the predicted values for these months through various models are presented in Table 4C.6. In order to check the validity of these forecast values, they were compared with the actual values of price of coriander during the post sample forecast period i.e. from January-2014 to December-2014. The accuracy percentages varied from 88.48 per cent to 97.38 per cent in case of selected ARIMA (0,1,1) model. It was observed that the accuracy percentage of prevailing market prices of coriander compared with that based on ARIMA (0,1,1,) model was very close to actual value followed by these predicted through SES model (Fig.4C.3). This proved that the ARIMA (0,1,1,) model was the best fit model for forecasting the price of coriander for Bhawani mandi during the period under study (Verma *et al.*2016).

Table 4C.6: Forecast price of coriander by different models at Bhawani mandi

Months	Actual price	ARIMA	SES
Jan 2014	7183	6355.48(88.48)	6046.55(84.18)
Feb 2014	7215	6656.25(92.26)	6046.55(83.81)
Mar 2014	7139	6845.60(95.89)	6046.55(84.70)
Apr 2014	7189	6596.35(91.76)	6046.55(84.11)
May 2014	7288	6878.39(94.38)	6046.55(82.97)
Jun 2014	7458	7125.26(95.54)	6046.55(81.07)
Jul 2014	7309	6895.36(94.34)	6046.55(82.73)
Aug 2014	7747	7405.90(95.60)	6046.55(78.05)
Sep 2014	7703	7437.66(96.56)	6046.55(78.50)
Oct 2014	7670	7469.42(97.38)	6046.55(78.83)
Nov 2014	7918	7501.18(94.74)	6046.55(76.36)
Dec 2014	7959	7532.94(94.65)	6046.55(75.97)

Figure in parentheses are the percentage of respective actual prices

4C.1.7 Comparison of spot price with forecast prices of coriander at Bhawani mandi

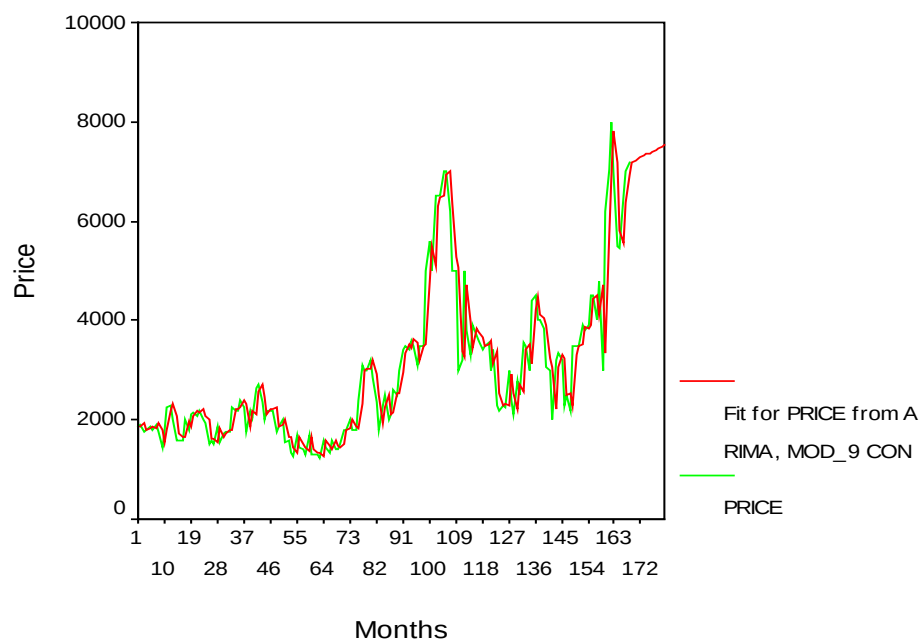
The results of the correlation analysis of the actual (spot) prices of coriander with forecast prices was estimated to be 0.95 indicating significantly positive relationship between the spot prices and forecast prices of the coriander in table 4C.7.

Table 4C.7: Comparison of spot price with forecast prices of coriander at Bhawani mandi

Market	Correlation coefficient
Bhawani mandi	0.950

** 0.01percent level of significant (2 tailed)

Figure 4C.3: Forecast accuracy of coriander price in ARIMA (0, 1, 1) model at Bhawani mandi



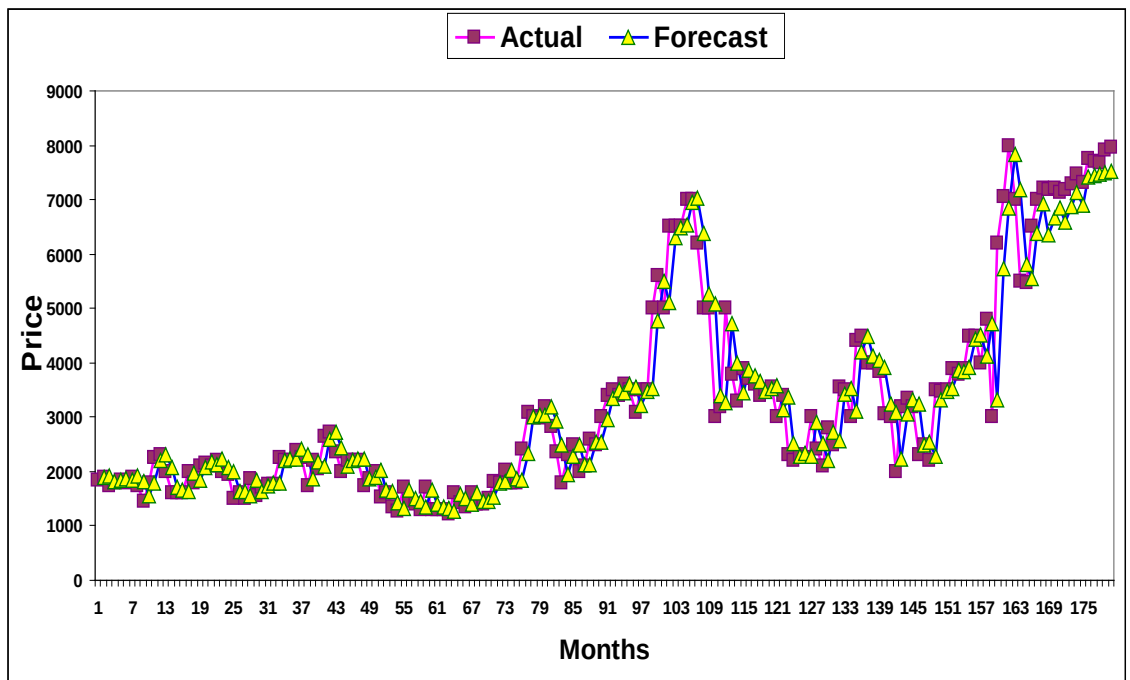


Fig. 4C.4 : Comparison of spot price with forecast prices of coriander at Bhawani mandi

4C.2 Comparison of spot price with forecast prices of coriander at Baran mandi

The detailed analysis for forecasting of coriander prices in Baran mandi is presented as under:

4C.2.1 Identification of the model:

A model was identified for the wholesale prices of coriander at Baran mandi regulated market. The monthly wholesale prices from January- 2000 to December-2013 were used to estimate the ACF and PACF (Appendix I). The price data were tested for stationarity. It can be seen from table 4C.8, that the auto correlation function (ACF) declined very slowly from 0.934 to 0.292 and as many ACFs were significantly different from zero and fell outside the 95 per cent confidence interval,

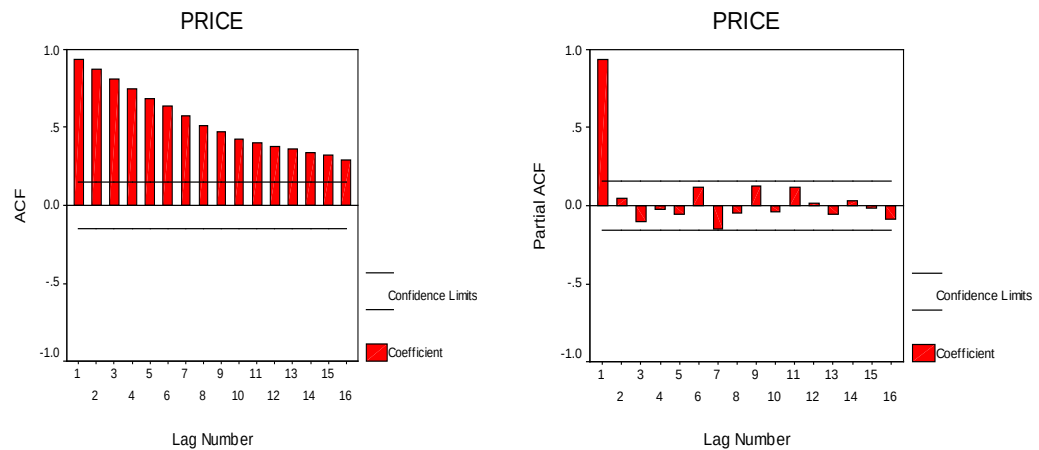
indicating the price of coriander to be non-stationary. The analyses of partial autocorrelation coefficients of coriander prices are depicted in table 4C.8 (Sharma, 2015). The graphical presentation of ACF and PACF of table 4C.8 are given in Fig.4C.5 (a) and 4C.5 (b), respectively. The partial autocorrelation function (PACF) dropped steeply after the first lag period from 0.934 to -0.083, which also indicated the non-stationarity of the price series. These tables showed that the autocorrelation and partial autocorrelation functions at lag 16 were significantly different from zero and fell outside the 95 % confidence interval. Differencing of coriander price data was done to make the series stationary. The value of d in the ARIMA model was unity (1) because the differencing was carried out only once to arrive at stationary series.

**Table 4C.8: Autocorrelation and partial autocorrelation coefficients
of the coriander price at Baran mandi**

Lags	Auto correlation coefficients		Box-Ljung	Partial autocorrelation coefficients	
	Value	Standard Error		Value	Standard error
1	0.934	0.076	149.059	0.934	0.077
2	0.878	0.076	281.544	0.046	0.077
3	0.812	0.076	395.564	-0.101	0.077
4	0.749	0.076	493.165	-0.024	0.077
5	0.682	0.076	574.772	-0.054	0.077
6	0.637	0.075	646.288	0.119	0.077
7	0.573	0.075	704.533	-0.151	0.077
8	0.513	0.075	751.495	-0.048	0.077
9	0.471	0.075	791.298	0.130	0.077
10	0.427	0.074	824.203	-0.038	0.077
11	0.400	0.074	853.374	0.119	0.077
12	0.382	0.074	880.025	0.017	0.077
13	0.359	0.74	903.748	-0.053	0.077
14	0.337	0.073	924.841	0.030	0.077
15	0.321	0.073	944.123	-0.016	0.077
16	0.292	0.073	960.187	-0.083	0.077

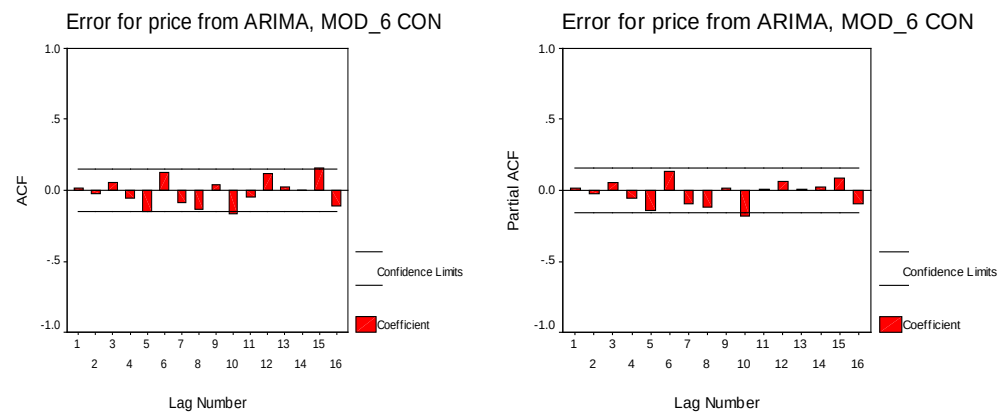
The underlying process assumed is independence (white noise).

Figure 4C.5: Autocorrelation and partial autocorrelation coefficients of the coriander price at Baran mandi



4C.5 (a) Autocorrelation 4C.5 (b) Partial Autocorrelation

Figure 4C.6 Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 2) model for the coriander price at Baran mandi



4C.6 (a) Autocorrelation 4C.6 (b) Partial Autocorrelation

4C.2.2 Model estimation: The best model was chosen from the various ARIMA models *viz*: ARIMA (1, 1, 0); ARIMA (1, 1, 1); ARIMA (0, 1, 1); ARIMA (2, 1,1); ARIMA (0, 1, 2) and ARIMA (2, 1, 0) on the basis of least Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC).The models as identified above were estimated through the

Marquardt procedure using SPSS 7.5 and SPSS 20 version of the SPSS package. On comparing the alternative models on the basis of statistics such as Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC), it was observed that both AIC (2481.74) and SBC (2491.10) were the least for ARIMA (0, 1, 2) model from table 4C.9. Hence, ARIMA (0, 1, 2) was the most representative model for the price of coriander in Baran market (Burark and Sharma, 2012).

Table 4C.9 ARIMA models selected for forecasting the price of coriander on the basis of least AIC & SBC at Baran mandi

ARIMA (p, d, q)	Akaike Information Criteria (AIC)	Schwarz Bayesian Criteria (SBC)
ARIMA (1,1,0)	2485.47	2491.71
ARIMA (1,1,1)	2485.45	2494.80
ARIMA (0,1,1)	2485.62	2491.86
ARIMA (2,1,1)	2484.88	2497.35
ARIMA (0,1,2)	2481.74	2491.10
ARIMA (2,1,0)	2483.11	2492.47

4C.2.3 Diagnostic checking: The model verification is concerned with checking the residuals of the model to see if they contained any systematic pattern which still could be removed in order to improve the chosen ARIMA, which has been done through examining the autocorrelations and partial autocorrelations of the residuals of various orders. For this purpose, autocorrelation and partial autocorrelation functions of various orders of the residuals of ARIMA (0, 1,2) up to 16 lags were computed and are presented in table 4C.10. The value of ACF and PACF varied from 0.015 to -0.110 which showed that the autocorrelation and partial correlation functions at lag 16 were significantly different from zero and fell within the 95% confidence interval. The graphical presentation of ACF and PACF diagnostics is given in Fig.4C.6 (a) and 4C.6 (b), respectively which also confirm the above results. Thus it could

be concluded that the selected ARIMA (0,1,2) model was appropriate for forecasting the price of coriander during the period under study.

Table 4C.10: Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 2) model for the coriander price at Baran mandi

Lags	Auto correlation coefficients		Box-Ljung	Probility	Partial autocorrelation coefficients	
	Value	Standard Error			Value	Standard error
1	0.015	0.077	0.039	0.843	0.015	0.077
2	-0.023	0.076	0.134	0.935	-0.024	0.077
3	0.055	0.076	0.657	0.883	0.056	0.077
4	-0.054	0.076	1.167	0.883	-0.057	0.077
5	-0.147	0.076	4.939	0.423	-0.143	0.077
6	0.0129	0.076	7.858	0.249	0.131	0.077
7	-0.084	0.075	9.095	0.246	-0.093	0.077
8	-0.134	0.075	12.298	0.138	-0.118	0.077
9	0.036	0.075	12.526	0.185	0.014	0.077
10	-0.167	0.075	17.547	0.063	-0.185	0.077
11	-0.045	0.074	17.906	0.084	0.006	0.077
12	0.120	0.074	20.545	0.057	0.066	0.077
13	0.021	0.074	20.628	0.081	0.009	0.077
14	-0.001	0.074	20.628	0.112	0.025	0.077
15	0.160	0.073	25.390	0.045	0.083	0.077
16	-0.110	0.073	27.640	0.035	-0.098	0.077

4C.2.4. Exponential smoothing for forecasting of coriander price at Baran mandi

Under exponential smoothing, the weights (W1, W2, and W3) were assigned in geometric progression. All three techniques (Single, Double and Triple) of exponential smoothing methods were considered for

forecasting the prices in selected market of coriander. The results are presented in Table 4C.11.

Table 4C.11: Different exponential smoothing criterion for forecast model of coriander price

Criteria	SES	DES	TES
MAPE:	9	10	18
MAD:	281	284	540
MSD:	166186	167973	584251

SES- Single Exponential Smoothing, DES- Double Exponential Smoothing, TES- Triple Exponential Smoothing

From the Table 4C.11, it can be inferred that the SES model is the preferred model for forecasting of coriander price due to the minimum value of MAPE (9), MAD (281) and MSD (166186) when compared to the other models.

The performance of different coriander forecast models was measured in terms of Mean Absolute Deviation (MAD), Mean Standard Error (MSE) and Mean Absolute Percentage Error (MAPE). The comparative performances of different forecasting models are presented in table 4C.12.

Table 4C.12: Selected price forecasting models for coriander based on MAD, MSE & MAPE criteria at Baran mandi

Criteria	Forecast models	
	SES	ARIMA
MAD	298	276.34
MSE	173545.56	153501.60
MAPE	12.88	9.20

4C.2.5 Extent of accuracy through different criterion at Baran mandi

From the table 4C.12, it can be inferred that the ARIMA (0,1,2) model is preferred to SES model for forecasting coriander price due to the minimum value of MAD (276.34), MSE (153501.60) and MAPE (9.20).

4C.2.6 Forecasting for coriander prices of the Baran mandi

ARIMA model was basically developed to forecast the corresponding variable. The actual prices of coriander in Baran market from January-2014 to December- 2014 and the predicted values for these months through various models are presented in table 4C.13. In order to check the validity of these forecasted values, they were compared with the actual values of price of coriander during the post sample forecast period *i.e.* from January-2014 to December-2014. The accuracy percentages varied from 87.66 per cent to 97.89 per cent in case of selected ARIMA (0, 1, 2) model. It was observed that the accuracy percentage prevailing market prices of coriander compared with that based on ARIMA (0,1,2,) model was very close to actual value followed by those predicted through SES model (Fig.4C.7). This proved that the ARIMA (0,1,2,) model was the best fit model for forecasting the price of coriander for Baran market during the period under study (Verma *et al.* 2016).

Table 4C.13: Forecast price of coriander by different models at Baran mandi

Months	Actual price	ARIMA	SES
Jan 2014	6391	5602.35(87.66)	5334.56(83.47)
Feb 2014	6400	5840.64(91.26)	5334.56(83.35)
Mar 2014	6588	6288.24(95.45)	5334.56(80.97)
Apr 2014	6662	6165.68(92.55)	5334.56(80.07)
May 2014	6768	6421.47(94.88)	5334.56(78.82)
Jun 2014	6700	6446.74(96.22)	5334.56(79.62)
Jul 2014	6850	6705.46(97.89)	5334.56(77.88)
Aug 2014	6800	6436.88(94.66)	5334.56(78.45)
Sep 2014	6900	6586.05(95.45)	5334.56(77.31)
Oct 2014	7200	6991.92(97.11)	5334.56(73.09)
Nov 2014	7400	6961.03(94.07)	5334.56(72.09)
Dec 2014	7450	6989.06(93.81)	5334.56(71.60)

Figure in parentheses are the percentage of respective actual prices

4C.7 Comparison of spot price with forecast prices of coriander at Baran mandi

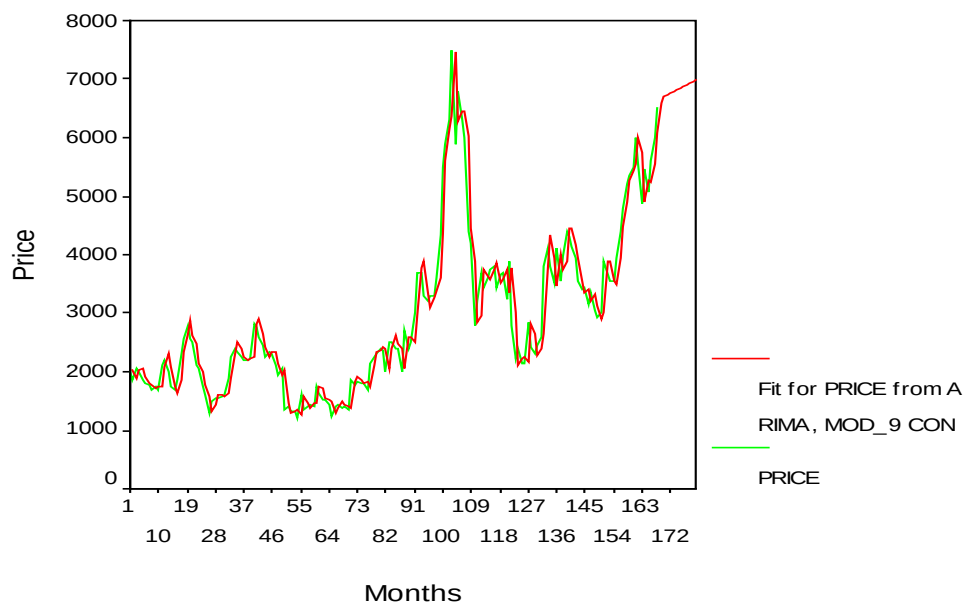
The results of the correlation analysis of the actual (spot) prices of coriander with forecast prices was estimated to be 0.970 indicating significantly positive relationship between the spot prices and forecast prices of the coriander in table 4C.14.

Table 4C.14: Comparison of spot price with forecast prices of coriander at Baran mandi

Market/ Commodity	Correlation coefficient
Baran market	0.970**

** 0.01percent level of significant (2 tailed)

Figure 4C.7: Forecast accuracy of coriander price in ARIMA (0, 1, 2) model at Baran mandi



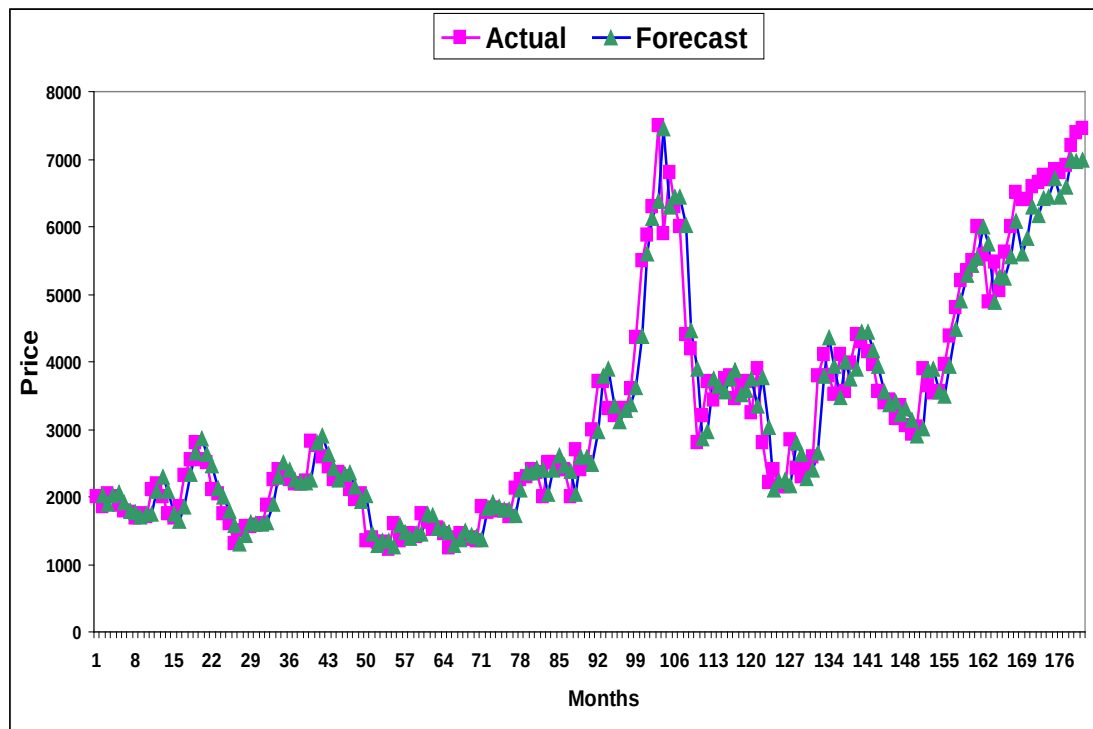


Fig. 4C.8 : Comparison of spot price with forecast prices of coriander at Baran mandi

4C.3 Comparison of spot price with forecast prices of coriander at Kota mandi

The detailed analysis for forecasting of coriander prices in Kota mandi is presented as under:

4C.3.1 Identification of the model:

A model was identified for the wholesale prices of coriander at Kota mandi regulated market. The monthly wholesale prices from January- 2000 to December-2013 were used to estimate the ACF and PACF (Appendix I). The price data were tested for stationarity. It can be seen from table 4C.15 and Fig.4C.9 that the auto correlation function (ACF) declined very slowly from 0.935 to 0.252 and as many ACFs were significantly different from zero and fell outside the 95 per cent confidence interval, indicating

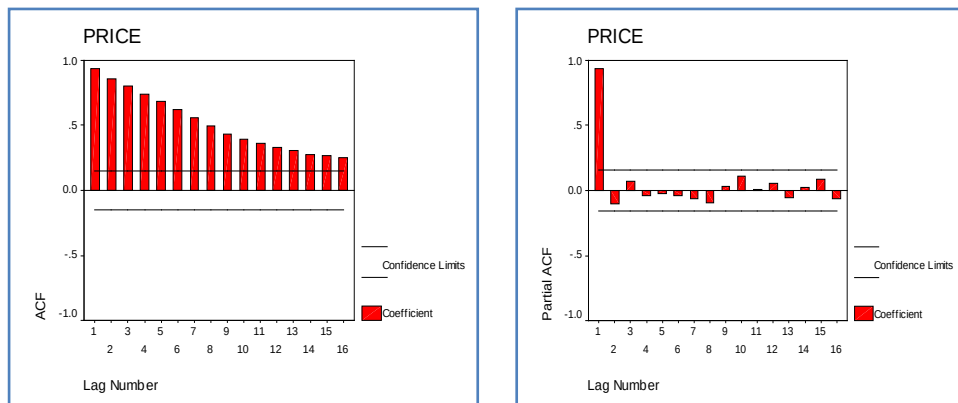
the price of coriander to be non-stationary. The analyses of partial autocorrelation coefficient and coriander prices are depicted in table 4C.15 (Sharma, 2015). The graphical presentation of ACF and PACF of table 4C.15 are given in Fig.4C.9 (a) and 4C.9 (b), respectively. The partial autocorrelation function (PACF) dropped steeply after the first lag period from 0.935 to -0.065, which also indicated the non-stationarity of the price series. These tables showed that the autocorrelation and partial autocorrelation functions at lag 16 were significantly different from zero and fell outside the 95 % confidence interval. Differencing of coriander price data was done to make the series stationary. The value of d in the ARIMA model was unity (1) because the differencing was carried out only once to arrive at stationary series.

Table 4C.15: Autocorrelation and partial autocorrelation coefficients of the coriander price at Kota mandi

Lag	Auto correlation coefficients		Box-Ljung	Partial autocorrelation coefficients	
	Value	Standard Error		Value	Standard error
1	0.935	0.076	149.592	0.935	0.077
2	0.862	0.076	277.364	-0.103	0.077
3	0.802	0.076	388.665	0.075	0.077
4	0.743	0.076	484.842	-0.040	0.077
5	0.684	0.076	566.899	-0.023	0.077
6	0.625	0.075	635.738	-0.041	0.077
7	0.562	0.075	691.852	-0.059	0.077
8	0.493	0.075	735.266	-0.093	0.077
9	0.433	0.075	768.940	0.032	0.077
10	0.394	0.074	797.000	0.110	0.077
11	0.361	0.074	820.675	0.008	0.077
12	0.334	0.074	841.125	0.054	0.077
13	0.304	0.74	858.145	-0.056	0.077
14	0.278	0.073	872.430	0.025	0.077
15	0.266	0.073	885.674	0.087	0.077
16	0.252	0.073	897.618	-0.065	0.077

The underlying process assumed is independence (white noise).

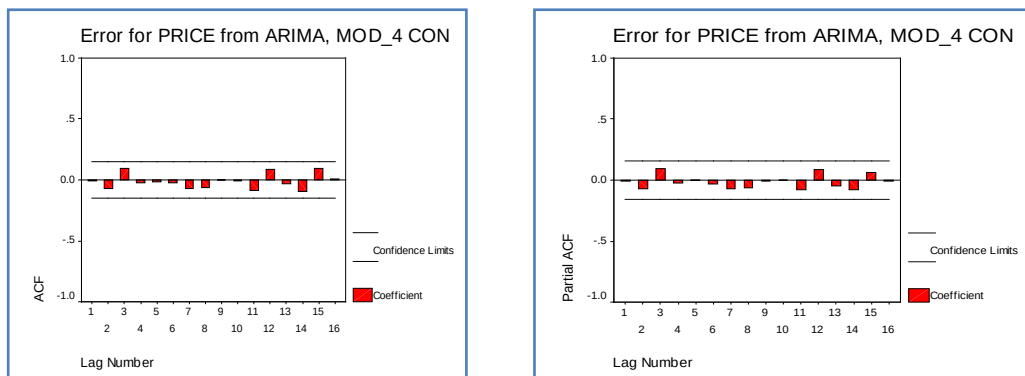
Figure 4C.9: Autocorrelation and partial autocorrelation coefficients of the coriander price at Kota mandi



4C.9 (a) (Autocorrelation

4C.9 (b) Partial Autocorrelation

Figure 4C.10 Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price at Kota mandi



4C.10 (a) (Autocorrelation

4C.10 (b) Partial Autocorrelation

4C.3.2 Model estimation: The best model was chosen from the various ARIMA models viz: ARIMA (1, 1, 0); ARIMA (1, 1, 1); ARIMA (0, 1, 1); ARIMA (2, 1,1); ARIMA (0, 1, 2) and ARIMA (2, 1, 0) on the basis of least Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC).The models as identified above were estimated through the Marquardt procedure using SPSS 7.5 and SPSS 20 version of the SPSS

package. On comparing the alternative models on the basis of statistics such as Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC), it was observed that both AIC (2478.39) and SBC (2484.62) were the least for ARIMA (0, 1, 1) model from table 4C.16. Hence, ARIMA (0, 1, 1) was the most representative model for the price of coriander in Kota mandi (Burark and Sharma, 2012).

Table 4C.16 ARIMA models selected for forecasting the price of coriander on the basis of least AIC & SBC at Kota mandi

ARIMA (p, d, q)	Akaike Information Criteria (AIC)	Schwarz Bayesian Criteria (SBC)
1,1,0	2478.67	2484.90
1,1,1	2478.58	2487.93
0,1,1	2478.39	2484.62
2,1,1	2480.46	2492.93
0,1,2	2479.20	2488.55
2,1,0	2479.79	2489.15

4C.3.3 Diagnostic checking: The model verification is concerned with checking the residuals of the model to see if they contained any systematic pattern which still could be removed in order to improve the chosen ARIMA, which has been done through examining the autocorrelations and partial autocorrelations of the residuals of various orders. For this purpose, autocorrelation and partial autocorrelation functions of various orders of the residuals of ARIMA (0, 1,1) up to 16 lags were computed and are presented in Table 4C.17. The value of ACF and PACF varied from -0.008 to 0.005 which showed that the autocorrelation and partial correlation functions at lag 16 were significantly different from zero and fell within the 95% confidence interval. The graphical presentation of ACF and PACF diagnostics is given in Fig.4C.10 (a) and Fig 4C.10 (b), respectively which also confirm the above results. Thus it could be concluded that the selected ARIMA (0, 1, 1) model was appropriate for forecasting the price of coriander during the period under study.

Table 4C.17: Autocorrelation and partial autocorrelation coefficients of residuals of ARIMA (0, 1, 1) model for the coriander price at Kota mandi

Lag	Auto correlation function (ACF)		Box-Ljung	Probility	Partial autocorrelation function(PACF)	
	Value	Standard Error			Value	Standard error
1	-0.008	0.077	0.012	0.914	-0.008	0.077
2	-0.073	0.076	0.911	0.634	-0.074	0.077
3	0.094	0.076	2.442	0.486	0.094	0.077
4	-0.020	0.076	2.512	0.642	-0.025	0.077
5	-0.017	0.076	2.560	0.767	-0.003	0.077
6	-0.020	0.076	2.631	0.854	-0.033	0.077
7	-0.074	0.075	3.587	0.826	-0.072	0.077
8	-0.061	0.075	4.257	0.833	-0.065	0.077
9	-0.001	0.075	4.257	0.894	-0.008	0.077
10	-0.007	0.075	4.65	0.935	-0.004	0.077
11	-0.086	0.074	5.600	0.899	-0.080	0.077
12	0.088	0.074	7.007	0.857	0.085	0.077
13	-0.031	0.074	7.188	0.892	-0.050	0.077
14	-0.097	0.074	8.921	0.836	-0.081	0.077
15	0.093	0.073	10.524	0.786	0.061	0.077
16	0.005	0.073	10.529	0.837	-0.005	0.077

The underlying process assumed is independence (white noise).

4C.3.4 Exponential smoothing for forecasting of coriander price at Kota mandi

Under exponential smoothing, the weights (W1, W2, and W3) were assigned in geometric progression. All three techniques (Single, Double and Triple) of exponential smoothing methods were considered for

forecasting the prices in selected market of coriander. The results are presented in Table 4C.18.

Table 4C.18: Different exponential smoothing criterion for forecast model of coriander price at Kota mandi

Criteria	SES	DES	TES
MAPE:	8	9	18
MAD:	247	254	535
MSD:	158887	162213	608888

SES- Single Exponential Smoothing, DES- Double Exponential Smoothing, TES- Triple Exponential Smoothing

From the table 4C.18, it can be inferred that the SES model is the preferred model for forecasting of coriander price due to the minimum value of MAPE (8), MAD (247) and MSD (158887) when compared to the other models.

The performance of different coriander forecast models was measured in terms of Mean Absolute Deviation (MAD), Mean Standard Error (MSE) and Mean Absolute Percentage Error (MAPE). The comparative performances of different forecasting models are presented in Table 4C.19.

Table 4C.19: Selected price forecasting models of coriander based on MAD, MSE & MAPE criteria at Kota mandi

Criteria	Forecast models	
	SES	ARIMA
MAD	312	256.29
MSE	184571	159288.10
MAPE	12.56	7.86

4C.3.5 Extent of accuracy through different criterion at Kota mandi

From the Table 4C.19, it can be inferred that the ARIMA (0,1,1) model is preferred to SES model for forecasting coriander price due to the minimum value of MAD (256.29), MSE (159288.10) and MAPE (7.86).

4C.3.6 Forecasting for coriander prices of the Kota mandi

ARIMA model was basically developed to forecast the corresponding variable. The actual prices of coriander in Kota market from January, 2014 to December, 2014 and the predicted values for these months through various models are presented in Table 4C.20. In order to check the validity of these forecasted values, they were compared with the actual values of price of coriander during the post sample forecast period i.e. from January-2014 to December-2014. The accuracy percentages varied from 87.66 per cent to 97.89 per cent in case of selected ARIMA (0,1,1) model. It was observed that the accuracy percentage of prevailing market prices of coriander compared with that based on ARIMA (0,1,1,) model was very close to actual value followed by those predicted through SES model (Fig.4C.11). This proved that the ARIMA (0,1,1,) model was the best fit model for forecasting the price of coriander for Kota market during the period under study (Verma *et al.* 2016)

Table 4C.20: Forecast price of coriander by different models at Kota mandi

Months	Actual price	ARIMA	SES
Jan 2014	6491	5957.44(91.78)	5416.74(83.45)
Feb 2014	6506	6145.55(94.46)	5416.74(83.26)
Mar 2014	6700	6366.88(95.03)	5416.74(80.85)
Apr 2014	6850	6477.23(94.56)	5416.74(79.08)
May 2014	6900	6615.56(95.88)	5416.74(78.50)
Jun 2014	7050	6640.88(94.26)	5416.74(76.83)
Jul 2014	7100	6666.20(93.89)	5416.74(76.29)
Aug 2014	7260	6691.53(92.17)	5416.74(74.61)
Sep 2014	7200	7015.68(97.44)	5416.74(75.23)
Oct 2014	7300	6975.88(95.56)	5416.74(74.20)
Nov 2014	7500	7041.00(93.88)	5416.74(72.22)
Dec 2014	7400	7037.40(95.10)	5416.74(73.20)

Figure in parentheses are the percentage of respective actual prices

4C.7 Comparison of spot price with forecast prices of coriander at Kota mandi

The results of the correlation analysis of the actual (spot) prices of coriander with forecast prices was estimated to be 0.971 indicating significantly positive relationship between the spot prices and forecast price for the coriander in table 21.

Table 4C.21: Comparison of spot price with forecast prices of coriander at Kota mandi

Market/ Commodity	Correlation coefficient
Kota market	0.971**

** 0.01percent level of significant (2 tailed)

Figure 4C.11: Forecast accuracy of coriander price in ARIMA (0, 1, 1) model at Kota mandi

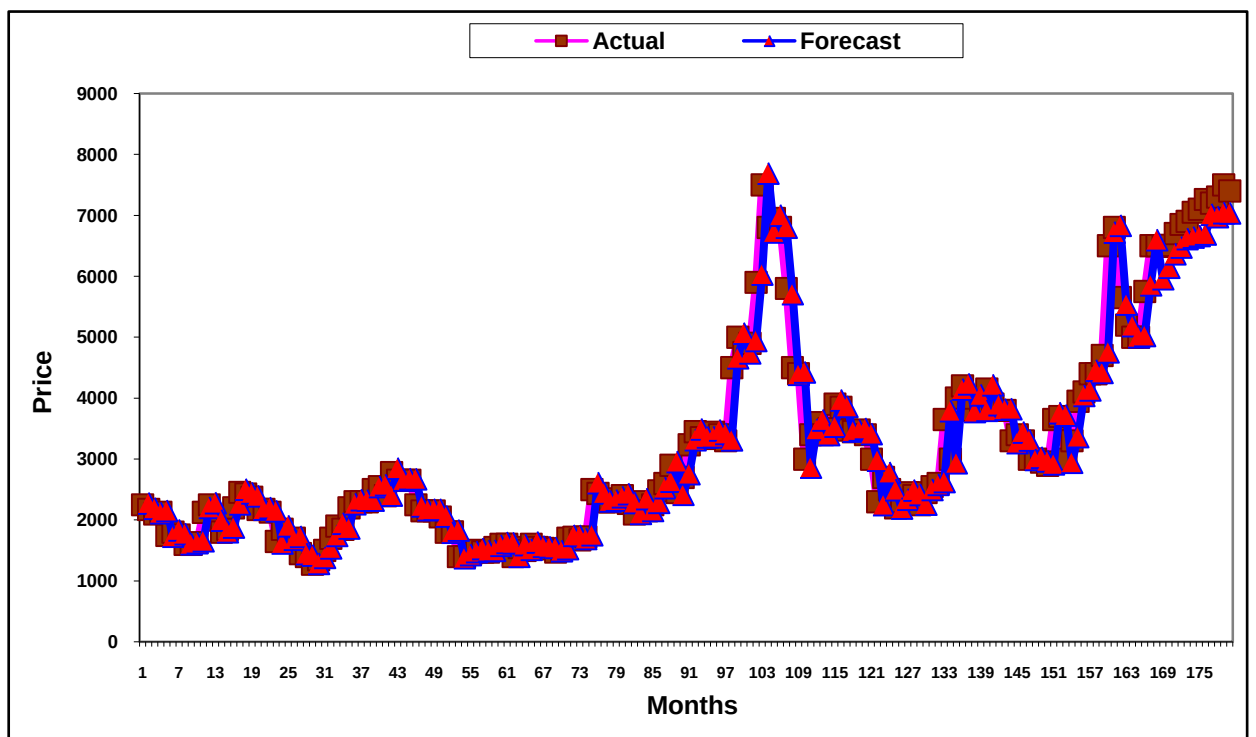
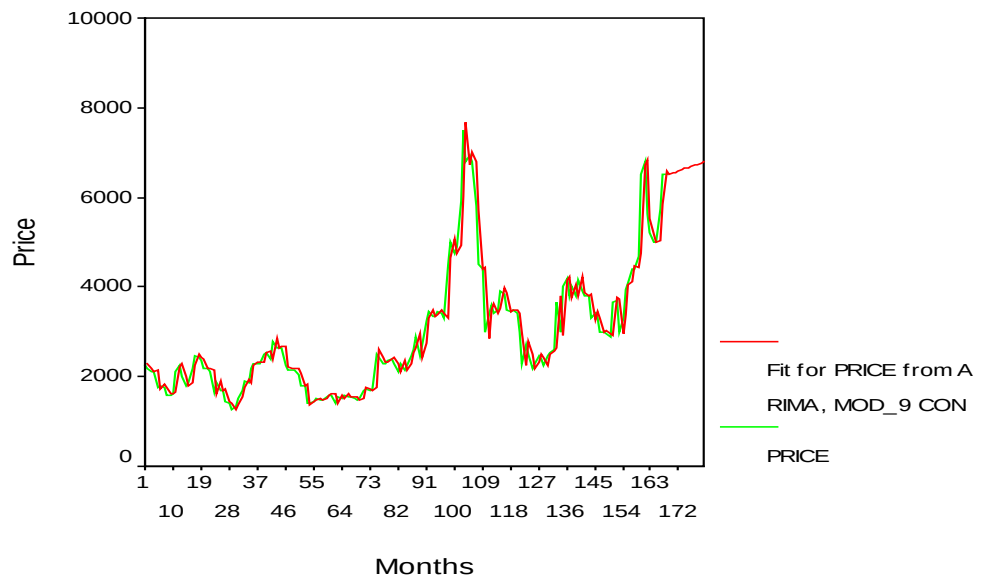


Fig. 4C.12 : Comparison of spot price with forecast prices of coriander at Kota mandi

Section- 4D

INTEGRATION OF SPOT AND FUTURES MARKETS

In this section, an attempt has been made to present the extent of price integration of coriander crop in the selected market pairs based on the degree of correlation coefficient. The prices in any effective integrated markets could be expected to be correlated with the limitations of transportation charges and other related factors associated with it. If correlation coefficient between prices of a commodity in any market pair is unity, the relation is referred to as perfect spatial price integration. The correlation coefficients were worked out using monthly wholesale prices for coriander crop in the selected market pairs during past 14 years (Jan 2000 to Dec. 2013) and results so obtained were discussed as under. The time series data of selected crop with right time monthly wholesale prices in selected markets are given in Appendices VI..

4D.1 Co-Integration between spot and future markets of coriander in selected mandies of Rajasthan

The market integration concept explains the relationship between the prices in the two markets that are spatially separated. When markets are integrated it implies that the markets in the system operate in uniform, as a single market system. Co- integration is an analytic technique for testing of common trends in multivariate time series and modeling long run and short run dynamic. Two or more predictive variables in a time series model are co-integrated when they share a common stochastic

drift. Further variables are considered co-integrated if a linear combination of them produces a stationary time series.

This analysis was carried out to ascertain the response of price change in one market that is transmitted to other markets. The co-integration analysis was carried out for this purpose to know the inter market relationship between the domestic markets. In short, if markets are efficient, then prices in different markets must be co-integrated. To examine the price relation between two markets, Granger and Vector error test basic relationship are commonly used to test for the existence of market integration. Price relations are widely used to indicate the overall market performance as, the usual definition is that integrated markets are those where prices are determined interdependently i.e. the changes in one market will be fully transmitted to the other markets.

In the present study co- integration method has been analysed using E-views 7 software to study the market integration for modal prices of the selected markets. To carry out the analysis, data were made stationary mean that the process of generating the data is in equilibrium around a constant value and that the variance around the mean remains constant over a time. If mean change over time and variance is not reasonably constant then series is non- stationary. To decide the stationarity or non stationarity of the data, for each of the market, ADF test has been conducted.

If calculated value of respective market in ADF test is less than critical value then that market prices data are already stationary. But if

the ADF value is greater than critical value then data are non stationary. Such data are subjected to Ist order differencing or IInd order differencing until it becomes stationary (as specified by calculated value less than critical value). Finally Vector Autoregressive Estimates were calculated for all the markets. The VEC (Vector Error Correction) estimates provide the short term co-integration within the markets and between the markets which were expressed in percentage. The T- statistics were calculated to know the significance of the markets within them and also between markets, which decided on the basis of T- statistics value. If the T- statistics values are greater than 2.0 then the integration values were considered as significant, otherwise non-significant and were not considered for drawing the inferences.

4D.1.1 Unit root test in selected mandies of Rajasthan

The study first examined each market time series for evidence of non- stationarity in the proceeds with co- integration approach. At level 3, all the selected coriander markets prices series in Rajasthan were not stationary. The Augmented Dickey-Fuller (ADF) based unit root test procedure was done to check the stationarity in price series of coriander. From the table 4D.1 it could be inferred that the original data were non-stationary but their first differences were stationary implying the presence of unit roots in the series. Thus, the original price series of coriander had a unit root. The occurrence of unit root in the price data generation process of these commodities gave a preliminary indication of shocks which may have permanent or long-lasting effect.

Table 4D.1: Unit root test (ADF) for prices of coriander in selected mandies of Rajasthan

Markets	Augmented Dickey-Fuller (ADF)				
	ADF Statistics Spot Market		ADF Statistics Future Market		Critical Value (1%)
	Level	1 st difference	Level	1 st difference	- 4.01428
Bhawani Mandi	-3.13695	-14.9010	-2.74357	-12.81156	
Baran Mandi	-2.37547	-13.5873	-2.97688	-10.12310	
Kota Mandi	-2.27562	-11.6632	-2.54425	-12.76801	

Not = H_0 : variables are not stationary or has unit root, H_1 : variable are stationary or does not have unit root, NB : If the absolute value of ADF test statistics is less than their 1% critical value we accept hypothesis. It is also when the MacKinnon (1996) one-sided p-values for Z (t) is significant

From table4D.1 it could be inferred that Augmented Dickey Fuller test values are above the critical value (1%) given by MacKinnon statistical tables at levels implying that the series are non stationary at their levels indicating the existence of unit root. After taking first difference, all the series becomes stationary which is obvious from the fact that the ADF values (-11.66326 to -14.90103) for all the spot markets were less than the critical value (- 4.013946) and similarly (-10.26629 to - 12.98203) for all future markets were less than the critical value thus free from the consequences of unit root.

The price series of spot and futures markets for coriander was found to be stationary at the first difference, implies order of integration is one. Table 4D indicated that the critical value for ADF value was found to

be -4.014288 for coriander spot and futures markets, respectively. After testing the hypothesis that domestic and international price series are co integrated at 0.05 per cent level is greater than -2.57 (ACV) compared to ADF. Hence markets are integrated.

4D.1.2 Multiple Co-integration Analysis for coriander in selected mandies of Rajasthan

Based on the Johansen multiple co-integration procedure, the integration between the markets was analyzed by E-views software. Unrestricted co-integration rank tests (Trace and Maximum Eigen value) indicated the presence of at least two co-integrating equations at 5 per cent level of significance. Hence markets are having long run equilibrium relationship. The results are presented in Table 4D.2 & 4D.3 (Burark *et al.* 2013).

Table 4D.2: Johansen's multiple co-integration analysis for monthly spot prices of coriander in selected mandies of Rajasthan

Lags interval (in first differences): 1to 4

Unrestricted Co integration Rank Test (Trace & Maximum Eigen Test)

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	Max- Eigen statistics	Critical Value (5%)	Prob**
None*	0.1558	44.6714	27.6112	24.2759	0.0000
At most 1*	0.0981	17.0601	16.8364	12.3209	0.0075
At most 2	0.0013	0.2236	0.2236	4.1299	0.6938

Trace test indicates 2 co integrating eqn (s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis(1999) p-value

Table 4D.3: Johansen's multiple co-integration analysis for monthly future prices of coriander in selected mandies of Rajasthan

Lags interval (in first differences): 1to 4

Unrestricted Co integration Rank Test (Trace & Maximum Eigen Test)

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	Max-Eigen statistics	Critical Value (5%)	Prob**
None*	0.1599	48.9225	28.4178	29.7970	0.0001
At most 1*	0.1065	20.5046	18.3629	15.4947	0.0081
At most 2	0.0130	2.1417	2.1417	3.8414	0.1433

Trace test indicates 2 co integrating eqn (s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis(1999) p-value

4D.1.3 Pairwise Granger Causality Test in selected mandies of Rajasthan

In order to know the direction of causation between the markets, Granger Causality test was employed. When a co-integration relationship is present for two variables, a Granger Causality Test (Granger, 1969) can be used to analyze the direction of this co-movement relationship. Theoretically, a variable is said to Granger –because another variable, if the current value of it is conditional on the past value of (1Y2Y2YY11, t1Y-.....)

It was observed that there was a bidirection influence on coriander spot prices of Kota to Baran, Baran to Bhawani mandi. Coriander price shows unidirectional causality with Kota to Bhawani mandi market prices. Since in all these cases the probability value was less than 0.05. Thus, different markets of coriander in Rajasthan were closely linked with each

other for movement of coriander prices. Thus a strong integration (both uni and bi) of different markets for coriander spot prices confirmed through these results of the study in presented table 4D.4.

Table 4D.4 Pair wise granger causality tests results for coriander spot prices in selected mandies of Rajasthan

Null Hypothesis	Obs	F-Statistic	Prob.	Direction
BR does not Granger Cause B_MANDI	166	14.0867	2.E-06	↔
B_MANDI does not Granger Cause BR		4.18824	0.0169	
KT does not Granger Cause B_MANDI	166	25.2776	3.E-10	→
B_MANDI does not Granger Cause KT		0.74375	0.4770	
KT does not Granger Cause BR	166	8.82424	0.0002	↔
BR does not Granger Cause KT		15.8578	5.E-07	

Not: B_ mandi, - Bhawani mandi, B= Baran, KT= Kota

It was observed that there was a bidirection influence on coriander future prices of Baran Grager cause Bhawani mandi bidirectional, Coriander price shows unidirectional causality with Kota to Bhawani mandi market prices. Since in all these cases the probability value was less than 0.05. Thus, different markets of coriander in Rajasthan were closely linked with each other for movement of coriander prices. Thus a strong integration (both uni and bi) of different markets for coriander spot prices confirmed through the results of the study presented in table 4D.5.

4D.5 Pair wise granger causality tests results for coriander future prices in selected mandies of Rajsthan

Null Hypothesis	Obs	F-Statistic	Prob.	Direction
BR does not Granger Cause B_MANDI	166	14.236	2.E-06	↔
B_MANDI does not Granger Cause BR		3.2188	0.0426	
KT does not Granger Cause B_MANDI	166	23.8178	9.E-10	→
B_MANDI does not Granger Cause KT		0.9472	0.3899	
KT does not Granger Cause BR	166	9.10005	0.0002	↔
BR does not Granger Cause KT		17.7894	1.E-07	

Not: B_ mandi, - Bhawani mandi, B= Baran, KT= Kota

Chapter – 5

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

This chapter deals with the summary of the research work including the introduction of problem, methodology used, results obtained and conclusions drawn followed by policy implications. The contents of the chapter are presented under the following sub-heads:

5.1 INTRODUCTION

India is known as the “Home of Spices” and produces a large number of varieties and quantity of spices. About sixty-three varieties of spices are grown in the country which include Pepper (King of Spices), Cardamom (Queen of Spices), Chillies, Ginger, Turmeric, Coriander, Cumin, Fenugreek and many others.

India is the largest producer, consumer and exporter of spices and its products in the world. The production of spices in India was 59.51 lakh tonnes from an area of about 32.12 lakh hectare during 2011-2012. It plays a major role in spice trade. It has about 52 % share in world trade of spices. The country registered substantial increase in area and production of spices over last fifteen years with average annual growth rate of 2.7 per cent and 6.2 per cent, per annum, respectively (Directorate of Arecanut & Spices Development).

Out of 109 spices listed by International Standard Organization in the world, 63 are grown in India. Among these Indian spices, 20 are classified as seed spices which accounted for 36 per cent share in area and 17 per cent share in production during 2010-11. Major growing belt of seed spices is spread from arid to semi-arid regions covering large area of Rajasthan, Gujarat and parts of Madhya Pradesh. Among these states, Rajasthan and Gujarat have emerged as “Seed Spice Bowl of India” jointly contributing around 27 per cent of the total seed spices produced in the country. Rajasthan is the third largest producer of spices

in the country and accounts for 15.98 per cent of total production of all spices. Area and production of spices in Rajasthan state was 9.73 lakh hectare and 9.51 lakh tonnes, respectively (Directorate of Agriculture, Rajasthan). The contribution of the state in the national production is 82 per cent of fenugreek, 66.51 per cent of coriander, 33 per cent of cumin, 14 per cent of garlic and 6 per cent of fennel. Besides this, the state has sizable production of chilli, ajwain, suwa, ginger, turmeric, dill seed, poppy seed, aniseed, nigella and many other spices.

In Rajasthan, area and production of seed spice was 9.01 lakh hectares and 6.97 lakh tonnes, during the year 2011-12 (Directorate of Agriculture, Rajasthan). The major seed spices are coriander, cumin, fennel, and fenugreek, whereas minor group of seed spices includes ajwain, dill, celery, nigella caraway and aniseed according to National Horticulture Board, Govt. of India.

Coriander belongs to the family Apiaceae. The origin place of coriander is said to be Mediterranean region. Coriander is grown in winter season. Coriander fruits serve as a common flavouring substance for both sweet and savory dishes especially in Europe and India. Leaves of coriander are used very commonly in making chutney, flavouring vegetables, salad, etc. Oil of coriander is used in medicines and flavouring beverages such as gin, whisky and various liquors. The roasted seeds are useful in dyspepsia. The paste made from seed is useful in pain in cephalagia. The juice of fresh plant is applied in erythematic. The decoction with milk and sugar is beneficial during bleeding piles. Coriander reduces intoxicating effects of spirituous liquors

India, Morocco, Canada, Russia, Hungary, Poland, Romania, Guatemala, Iran, Mexico, Egypt, Argentina and USA are important countries where coriander is grown commercially. India is the largest producer of coriander seed and it is cultivated in 5.57 lakh hectares land area with a production of 5.33 lakh tonnes in year 2011-12. (Directorate of arecanut and spices development). The coriander was exported to the

tune of 28,100 tonnes valued at ₹16,401.85 lakhs during the year 2011-12 (DGCI&S Ministry of Commerce and Industries, GOI). The main markets for coriander are Malaysia, U.A.E, U.K, South Africa, Saudi Arabia, and Singapore.

In India, coriander growing states are Rajasthan (62 %) and Madhya Pradesh (17%) remaining 21% is produced by states like Andhra Pradesh, Assam, Tamil Nadu Odisha and Gujarat. Rajasthan is largest producer of coriander and it is cultivated on 2.68 lakh hectares of land with production of 3.29 lakh tonne of coriander in year 2011-12 (Directorate of Agriculture, Rajasthan). coriander crop in Rajasthan is grown mainly in the districts of Jhalawar, Baran, Kota, Bundi, and Chittorgarh which together accounted for 99.41 per cent of the total area and 99.41 per cent of the total production in the state during 2011-12. The Jhalawar, Baran and Kota districts accounted for 97.28 per cent of the total area and 97.67 per cent of total production in the state of Rajasthan

Marketing plays an important role in the economic development, as it stimulates production, prevents negative fluctuation in output and prices thus reduces cost of production. However, for attaining these benefits, marketing system and marketing management have to keep pace with the production technology and socio-economic development of the country.

Agricultural marketing plays a significant role in the movement of commodity from the producer to the consumer and in stabilizing the prices. The planned increase in agricultural output must be coordinated with changes in the demand and supply of agricultural commodities. This can be fruitful only when producer's share in consumer's rupee increases considerably irrespective of the volume of the marketable surplus with the farmers. Therefore, marketing rightly considered as essential activity in addition to improved input like seed and fertilizer in modern agriculture.

Price is a matter of vital importance to the seller and the buyer as well as the traders in a market place. In a competitive market economy, price is

determined by free play of supply and demand. If competitive and remunerative prices are paid to the farmers, it acts as an adequate incentive for further production.

Such study helps in formulating the appropriate policy measures to contain the over production. One can suggest the proper steps to be carried out by the farmers in order to get remunerative prices for their produce in accordance with the forecasting and these forecasts help the policy makers in formulating effective policies.

One of the important indicators of the efficient functioning of the markets is the existence of integration in the markets. Market integration is measured as an inter relationship between price movements in two or more markets. This explains the markets are integrated or moving in isolation. Therefore, looking at the importance of coriander for the producers as well as consumers in terms of marketing and price behaviour the present study entitled “Marketing and price behaviour of coriander in Rajasthan” with the specific objectives stated below was under taken. The objectives of the study were as given in heading 5.2.

5.2 OBJECTIVES

1. To study the marketing channels, costs and margins in marketing of coriander in the state of Rajasthan.
2. To study the price trend in coriander in the state of Rajasthan.
- 3 To compare the spot prices with forecast prices of coriander crop in selected markets.
- 4 To study the integration in spot and futures market of coriander

5.3 METHODOLOGY

The study was purposively confined to the state of Rajasthan. Coriander crop was selected for the detailed study. Rajasthan state with 48 percent of area and 62 percent of production occupied first position in

the country. Three districts namely, Jhalawar, Baran and Kota were selected purposively, as these three districts jointly contribute more than 95 percent of area under the crop in the state. One Tehsil having maximum area under the crop was purposively selected from each selected district. These tehsils were Khanpur (Jhalawar), Autru (Baran) and Sangod (Kota). Separate lists of all the villages producing coriander were prepared for each tehsil. Three villages from the list of coriander producing villages of each tehsil were selected randomly. Thus, a total number of nine villages were selected for further study. Separate lists of coriander growers of the selected villages were prepared in ascending order of their land holding. Then a representative sample of producer farmers was selected from each village using probability proportion method. A random sample of 150 farmers was taken for the study. To make the sampling design self weighing, the numbers of farmers selected from each category were in proportion to their number in that category. Krishi Upaj Mandi, Bhawani Mandi (Jhalawar), Baran mandi (Baran) and Kota mandi (Kota) were selected purposively on the basis of maximum arrivals of the produce. Both primary and secondary data were used for the study. The primary data in respect of marketing channels, marketing costs, margins and price spread in marketing of coriander crop were collected from the producer farmers, village traders, wholesalers-cum-commission agents and retailers through personal interview method with the help of a set of schedule specifically prepared (standardized) for the study. Primary data were collected for the Agricultural year 2012-13 for which the information was readily available.

The secondary data in respect of area and production of selected crop were collected from the records and reports of the Directorate of Economics and Statistics and Directorate of Agriculture, Government of Rajasthan, Jaipur. The data pertaining to marketing charges for coriander marketing were collected from various records of Krishi Upaj Mandi Bhawani Mandi, Baran mandi and Kota mandi. Information regarding

prescribed marketing costs in the selected Mandies was also being collected. The monthly time series data on arrivals and prices of selected three markets (Bhawani mandi, Baran mandi and Kota mandi) for the period of 2000-01 to 2013-14 were collected from selected Krishi Upaj Mandies to study the trend, cyclical component, irregular component, seasonal behaviour, price forecasting and market integration.

5.4 RESULTS AND DISCUSSIONS

The results of the study are presented under the following sub-heads:

5.4.1 Costs and price spread in marketing of coriander

In the study area two marketing channels were identified in marketing of coriander crop in selected districts.

(I) Marketing channel in village sale:

(Producer-village trader-wholesaler cum commission agent-retailer-consumer)

(II) Marketing channel in mandi sale:

(Producer-wholesaler cum commission agent -retailer-consumer)

Among these channels, 76 percent quantity of coriander crop moved through channel-II and 24 per cent quantity was moved through channel-I.

Marketing cost was observed to be ₹1534.13 per quintal in village sale and ₹1430.90 per quintal in mandi sale. The difference of ₹ 103 per quintal were due to involvement of more middlemen.

Agency-wise breakup of the overall marketing costs in sale of coriander crop revealed that wholesalers incurred the major share in total marketing cost in village as well as mandi sale in the state which accounted 47.80 per cent and 51.35 per cent, respectively.

The component-wise breakup of the overall marketing cost indicated that processing charge, value added tax, commission charges, mandi fee, transportation, value of quantity losses and cost of gunny bag were the major cost items as these together accounted for 94.50 per cent and 95.08 per cent of marketing cost at village sale and mandi sale, respectively.

Producer's share in the consumer's rupee was 64.80 per cent in village sale and 69.35 per cent in mandi sale in the state of Rajasthan. Farmers selling coriander crop in mandi got 4.55 per cent higher share than the village sale. Overall marketing margin earned by the middlemen accounted for one third of the consumer's price (17.43 per cent) in channel-I and one fourth (14.08 per cent) in channel-II in the state.

5.4.2 Trend, cyclical, irregular and seasonal price behaviour of coriander in Rajasthan

The estimated linear trend equation revealed that the regression coefficients (B_1) associated with the time element (T) was positive and highly significant at 1 per cent level of significance for all the three selected districts. The value of regression coefficient for time was estimated to be the highest for Bhawani mandi (245.77) closely followed by Baran mandi (229.41) and Kota mandi (225.54). The estimates of the coefficient of determination (R^2) ranged from as low as 0.507 to as high as 0.537 indicating that the time element alone explained 50.70 percent to 53.70 percent variation in the wholesale prices of coriander in the selected mandies during the study period. The values of adjusted coefficient of determination (R^2), adjusted for degrees of freedom ranged from 0.498 to 0.466 for different selected mandies. The highly significant values of calculated F statistics also supported the contention that time element was a significant explanatory factor of the variation in the wholesale prices of coriander. Durbin - Watson test ('d' statistics) for autocorrelation revealed the absence of autocorrelation among the estimated residuals in all the selected mandies.

The findings of cyclical fluctuations in wholesale price of coriander in Bhawani mandi exhibited one cycle, which is consisting of 6 years (2006-07 to 2011-12). In case of Baran and Kota mandies both have one price cycle, Baran have 6 years price cycle (2006-07 to 2011-12) and Jhalawar have 6 years price cycle (2006-07 to 2011-12). All the price cycles lasted almost same time. The various peak price years that emerged were 2008-09 and 2009-10. The probable reason for same length of price cycles in the study area may be attributed components of weather (total rainfall, distribution of rainfall, temperatures, relative humidity, etc.) are almost same in the all mandies. The results of irregular fluctuations in wholesale prices of the crop revealed that the extent of irregular component ranged from as low as. In Kota district the extent of fluctuations arising as a result of factors other than those causing trend, cyclical and seasonal movements varied from 75.43 (24.57 per cent below 100) in 2011-12 to 138.09 (38.09 per cent above 100) in 2008-09. Eight observations out of 12 fluctuated within the range of 75.43 to 99.74 and the rest within the limits of 108.57 to 138.09. Almost similar type of irregular behaviour in wholesale prices of coriander was observed in Baran mandi. In case of Baran mandi the magnitude of irregular fluctuations was recorded to be 74.73 during 2011-12 and the highest (138.09) during 2008-09. In case of Baran mandi the respective lowest magnitude was of the order of 78.24 indicating 21.76 per cent downward movement from the normal, in the year 2010.11 and the highest (139.42) during 2008-09. In case of Bhawani mandi the magnitude of irregular fluctuations was recorded to be 80.06 during 2010-11 and the highest (137.19) during 2008-09. In case of Bhawani mandi the respective lowest magnitude was of the order of 80.06 indicating 19.94 per cent downward movement from the normal, in the year 2010.11 and the highest 137.19 (37.19 per cent above 100) during 2008-09.

Coriander is grown as a *rabi* season crop in the state. Sowing of the crop is generally over by 15th of October under normal sown

conditions. It comes to harvest during March- April. Higher indices (more than 100) of market arrivals of coriander were noticed immediately after the harvest (March-April) in selected markets. Thus the majority of the produce was sold soon after the harvest probably for the want of cash or lack of storage facilities. However, farmers who are financially sound can store for longer time to look forward for advantageous period and higher prices.

The price movement also demonstrates significant seasonal fluctuations in the selected markets. To analyse the price pattern of coriander during different months of the year and their impact, seasonal indices were computed adopting 12 months moving averages. As a short term fluctuations it was noticed that the prices were low when the arrivals were large and the prices were high when the arrivals were low. The results of seasonal indices displayed that coriander prices remained the lowest during the months of February and highest in the month of July in all the selected mandies of the state during the study period. After reaching the peak in the month of July, the seasonal price indices continued to declined up to the month of February and thereafter increase continuously in month of July in all the selected mandies.

The extent of intra year price rise (IPR) varied from as low 14.32 per cent in Kota mandi to as high as 22.90 per cent in Baran mandi. The results of coefficient of average seasonal price variation (ASPV) were recorded in Bhawani mandi (23.58 %) and lowest in Kota mandi (13.36%).The coefficient of variation for all the selected mandies ranged from 3.78 per cent to 6.45 per cent. The smaller magnitude of coefficient of variation or the mean coefficient of dispersion revealed that there was greater consistency or smaller variability in the monthly prices of coriander in the selected markets of the Rajasthan.

5.4.3 Comparison of spot price with forecast prices of coriander in Rajasthan

It was observed that the ARIMA models were found to be the most suitable for forecasting the prices of coriander. The details of model and their accuracy percentages are as follows:

The validity of the forecast values of coriander were checked by comparing them with their actual values during the post sample forecast period *i.e.* January 2014 to December 2014. The accuracy percentage between the forecasts and actual value of Bhawani mandi, Baran mandi and Kota mandi were found to be 88-97 per cent, 87-97 per cent and 87-97 per cent, respectively. This proved that ARIMA (0,1,1) models for Bhawani mandi, ARIMA (0,1,2) for Baran mandi and ARIMA (0,1,1) for Kota mandi were found to be the most appropriate models for forecasting the prices of respective markets. This information can be used for further research in the area of price forecasting.

5.4.4 Integration in spot and future markets of coriander in Rajasthan

The results of the Augmented Dickey-Fuller (ADF) unit root test for coriander in selected markets showed that the existing price data were non-stationary but their first differences were stationary. This implies the presence of unit root in the selected market price series of coriander. Hence, integration of price series of coriander was of the order of 1 that is $I(1)$.

Johansen's co-integration test for coriander indicated the presence of at least two co-integrating equations at 5 per cent level of significance. Hence markets were having long run equilibrium relationship. The results of Granger Causality Test depicted that most of the markets had bidirectional influences on coriander price. These markets affected by prices of each other.

5.5 CONCLUSIONS

1. Two marketing channels were observed in the study area that in sale at village and sale at mandi. At village sale the channel was producer-village trader- wholesaler-cum-commission agent-retailer-consumer where as at mandi sale the channel observed was producer- wholesaler cum commission agent-retailer-consumer. The producers share in consumer's rupee was 64.80 per cent in village sale which increased to 69.35 per cent in mandi sale.
2. Significant difference existed in the margins earned by the intermediaries in sale of coriander at village (17.43 per cent) and (14.08 per cent) at mandi.
3. The share and net price received by the producer farmer in sale of coriander at village was lower than that of sale at regulated market.
4. Annual wholesale prices of the crop exhibited significant linear trend over time in all the selected mandies. The time element alone explained 50.70 per cent to 53.70 percent variation in wholesale prices in the selected mandies.
5. Cyclical variation in wholesale prices exhibited one cycles consisting of 6 years duration in the selected mandies.
6. Seasonal indices displayed that coriander prices remained the lowest during the months of February and highest in the month of July in all the selected mandies. After reaching the peak in the month of July, the seasonal price indices continued to increase up to the month of June and thereafter declined continuously up to month of July in all the selected mandies.
7. The extent of intra year price rise (IPR) varied from as low as 14.32 per cent in Kota mandi to high as 22.90 per cent in Baran mandi. In majority of the mandies the extent of IPR was around 14.32 to 22.90 per cent. The smaller magnitude of CV (3.78 to 6.45 per cent) indicated that there greater consistency in the monthly prices of coriander in selected mandies of the state.

- 8 The accuracy percentage between the forecasts and actual value of Bhawani mandi, Baran mandi and Kota mandi were found to be 88-97 per cent, 87-97 per cent and 87-97 per cent, respectively. This proved that ARIMA (0,1,1) models for Bhawani mandi, ARIMA (0,1,2) for Baran mandi and ARIMA (0,1,1) for Kota mandi were found to be the most appropriate model for forecasting the prices of selected mandies. This information can be used for further research in this area of price forecasting.
- 9 Johansen's co-integration test for coriander indicated the presence of at least two co-integrating equations at 5 per cent level of significance. This showed long run equilibrium relationship in markets. The results of Granger Causality Test depicted that most of the markets had bidirectional influences on coriander price. These markets affected by prices of each other.

5.6 Policy Implications

Keeping in view the above results, a few policy measures are suggested below:

- 1 The farmer's should be educated to dispose of their produce in the regulated markets which fetch higher returns as compared to village level marketing.
- 2 Farmers are required to be educated and protected to assure their produce timely of sale
- 3 Adequate and continuous efforts should be made to disseminate the market intelligence and market information, particularly for price forecast to help the stake holder.
- 4 Markets are co-integrated that shows a strong connectivity of markets. This shows that persons involved in trade are were connected and control the market.

BIBLIOGRAPHY

- Agarwal, N. L. and Sharma, K. C., 1990 Price behaviour of pulse crops in Rajasthan, *Indian Journal of Agricultural Marketing*, 4(2):128-139.
- Agarwal, N. L., and Singh, Narendra, 1997 Marketing of fenugreek in Jaipur district of Rajasthan, Published in Edited Book by *Jagdish Prash Encyclopedia of Agricultural Marketing*, 4 Mittal Publications, Delhi, pp. 30-59.
- Agarwal, N.L. and Singh, Narendra, 2003 Cumin seed marketing in Rajasthan, *Agricultural Marketing*, 11(6), pp. 36-42.
- Agarwal, N.L., 1998 Costs margin and price spread in marketing of spices crops in Rajasthan, *Niyamit Mandi*, 8 (2), pp. 13-16.
- Ansari, M. I. and Ahmed, S.M., 2001 Time series analysis of Tea prices: An application of ARIMA modeling and co integration analysis, *Indian Journal of Agricultural Economics*, 48(3), pp. 49-54.
- Arshad Fatimah Mohd, 1990 Integration of palm oil markets in Peninsular Malaysia, *Indian Journal of Agricultural Economics*, 45 (1),pp. 21-30.
- Ashra, S., 2003 Interactions between industry and agriculture in India, evidence based on a multivariate co-integration and error correction modeling approach, *Indian Journal of Agricultural Economics*, 58 (4):715-728.
- Balappa, Shivaraya and Hugar, L.B., 2002 Study of integration of markets for onion and potato in Karnataka state, *Agricultural Marketing*, 45(2): 30-32.
- Bannor, Richard Kwasi., and Dhaka, Surjeet, 2015 Integration of cluster beans markets in Rajasthan State of India, *Economic Affairs*, 60 (3): 529-538
- Bannor, Richard Kwasi., and Sharma, Amita, 2015 Comparing the forecasting power of multivariate var and univariate Arima models: a case of Groundnut prices in Bikaner District of Rajasthan, *Asian Journal of Research in Business Economics and Management*, 5(3), pp. 51-64.
- Basu, J. P., and Dinda, S., 2003 Market integration: an application of error correction model to potato market in Hooghly district, West Bengal. *Indian Journal of Agricultural Economics*, 58(4): 742-751.

- Batchelor, Raj, Amir, Alizadch and ilias, Visvikis, 2007 Forecasting spot and forward prices in the international freight market, *International Journal of Forecasting*, (23) -101-114.
- Bhardwaj, S. P., Paul, Ranjit Kumar, Singh, D. R., and. Singh, K. N., 2014 an empirical investigation of Arima and Garch models in agricultural price forecasting, *Economic Affairs*, 59(3): 415-428.
- Bhardwaj, S.P., Singh, K.N, and Amrender Kumar 2012 Performance measures of univariate time series methods for price forecasting — an empirical study of gram price forecast, *Agricultural Economics Research Review*, 25 (Conference Number): 532.
- Box GEP, and Jenkin GM., 1976 Time series of analysis, Forecasting and Control, Sam Franscico, Holden Day, California, USA.
- Brockwell, P., and Davis, R. 2002 Introduction to time series and forecasting, Springer International Edition.
- Burark, S. S. Pant, D.C. Sharma, Hemant and Bheel, Sandeep, 2011 Price forecasting of coriander a case study of Kota market of Rajasthan, *Indian Journal of Agricultural Marketing* (Conference Special): 25(3):72-79.
- Burark, S. S. and Sharma, Hemant 2012 Price forecasting of coriander: methodological issues, *Agricultural Economics Research Review*, 25 (Conference Number): 530.
- Burark, S.S., Sharma, Hemant and Meena, G.L., 2013 Market integration and prices volatility in domestic market of coriander in Rajasthan, *Indian Journal of Agricultural Marketing*, 27(1); 121-131.
- Chahal S.S., Rohit Singla and Poonam Kataria, 2004 Marketing efficiency and price behaviour of green peas in Punjab, *Indian Journal of Agricultural Marketing*, 18 (1): 115-128.
- Chaudhari, D. J., and Pawar, N. D. 2010 Growth, instability and price analysis of chickpea in Marathwada region of Maharashtra State, *Green Farming*, 13,pp 276-278.

- Chaudhari, D.J., and Tingre, A.S., 2014 Use of ARIMA modeling for forecasting green gram prices for Maharashtra, *Journal of Food Legumes* 27(2): 136-139.
- Choudhary, S.N., 2000 Marketing of fennel in Tonk District of Rajasthan, *Unpublished M.Sc. (Agril. Economics) Thesis*, Rajasthan Agricultural University, Bikaner, Campus-Jobner, pp. 125-128.
- Cramer, G. L., Wailes, E. J., Jiang, B., and Hoffman, L., 1999 Market efficient tests of U.S. rough rice futures market, *Research Series Arkansas Agricultural Experiment Station*, (468): 389-392.
- Deshmukh, D.S, Pawar B.R., Landge V. V and Yeware, P. P., 2009 Marketed surplus and price spread in different channels of pearl millet marketing, *International Journal of Commerce and Business Management*, 3(1): 41-44.
- Dhurwey, Chandresh, Choudhary, V. K., and Shrey, Ravi, 2016 Marketing imperfection of cabbage crop in Bemetara district of Chhattisgarh, *Indian Journal of Economics and Development*, 12 (1a): 129-134 DOI: 10.5958/2322-0430.2016.00052.4
- Dickey D A. and Fuller W A., 1979 Distribution of the estimators for autoregressive time series with a unit root, *Journal of American Statistical Association*, 74: 427–31.
- Dickey, D.A. and Fuller, W. A., 1981 Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49: 1057-1072.
- Dilipreddy, R. A., Yeledhalli, B. Banakar and Vilas, Kulkarni, 2009 Price trends in soyabean and integration of markets for soyabean and soya oil *Karnataka, Journal of Agricultural Science*, 22 (2). 359- 362.
- Engle, F. Robert and Granger, C.W.J. 1987 Co-integration and error correction representation, estimation and testing, *Econometrica*, vol-55 No.2:pp-251-276.
- Fuller, W.A., 1976 Introduction to Statistical Time Series, John Wiley, New York.

- Garg, S., and Bhakar, R., 2006 Arrival and price trends under regulated wheat market at Bikaner district of Rajasthan, *Agricultural Economics Research Review*, 19 (Conference): pp 222.
- Ghosh, M., 2000 Cointegration tests and spatial integration of rice markets in India, *Indian Journal of Agricultural Economics*, 55 (4): 616-626.
- Granger, C. W.J. 1981 Some properties of time series data and their use in econometric model specification, *Journal of Econometrics*, pp-121-130
- Gujarati, D N., 2003 *Basic Econometrics*, 4th edn, pp 465–7, McGraw-Hill Companies Inc., New York.
- Handignur, S. S., and Kunnal, L. B., 1999 Market structure for chickpea in different markets of Karnataka, *Indian Journal of Agricultural Marketing*, 13(3): 28-33.
- Iqbal Najeeb, Khuda Bakhsh, Asif Maqbool, and Ahmad, A. S., 2005 Use of the ARIMA model for forecasting wheat area and production in Pakistan, *Journal of Agriculture and Social Sciences*, 1(2): 120-122.
- Johansen, S. 1988 Statistical analysis of co integration vectors, *Journal of Economic Dynamics Control*, 12(2-3), 231- 254
- Kainth, G. S., and Mehra, P. L., 1988 Seasonality pattern of market arrivals and prices of potato in Punjab, *Indian Journal of Agricultural Marketing*, 2(1):113-120.
- Kasar, D. V., Raut, R.C., and Rasane, V., 1996 Behaviour of prices and arrivals of red chillies-a case study from Maharashtra, *Indian Journal of Agricultural Marketing*, 10(3):78-81.
- Kaur Arjinder, Seti Kiran and Saran, S.K., 2006 Marketing pattern of green peas in Punjab, *Indian Journal of Agricultural Marketing*, 20 (2):15-21.
- Khatkar, R.K., Singh, V.K., Karwasra, J.C., and Bhatia, Jitender Kumar., 2013 Market integration and price volatility in \domestic mustard markets. *Indian Journal of Economics and Development*, 9 (2) 114-123.

- Killedar N. S., 2002 Economics of production and marketing of ginger in Satara district of Western Maharashtra, *Indian Journal of Agricultural Marketing*, 16(2); 76- 77.
- Kolur, Anil, Yeledhali, R.A., Patil, S.L., Chidanand Pattil, Kuldeep Choudhary. 2012 market arrivals and prices behaviour of wheat in Karnataka, *International Journal of Agricultural and Statistical sciences*, 8(1): 313-318.
- Krishnankutty, C. N., 2001 Forecasting of teak prices in Kerala State India, using autoregressive integrated moving average models, *Indian Journal of Forestry*, 24(2): 119-122.
- Kumar, Kuldeep, and Burark, S. S., 2011 Marketing of coriander in Jhalawar district of Rajasthan, *Indian Journal of Agricultural Marketing*, 25(2); 37-49.
- Kumar, M., Bharati, R. C., and Sinha, S. K., 2002 ARIMA model for forecasting wheat productivity in North-West alluvial plain of Bihar, *Journal of Applied Biology*, 12(1/2): 101-104.
- Kumar, Virender, H.R. Sharma and Kamalesh Singh, 2005 Behaviour of market arrivals and prices of selected vegetable crop: A study of four metropolitan markets, *Agricultural Economic Research Review*, 80: 271-290.
- Kumari, Vijya R, 2009 Economic analysis of maize price behaviour in Andhra Pradesh, *Indian Journal of Agricultural Marketing*, 23(2); 17-24.
- Kumawat, R. C., and Kumar, Pradeep, 2006 an Empirical analysis of market integrated of rapeseed-mustard in the State of Rajasthan, *Indian Journal of Agricultural Marketing*, 20 (3); 129-134.
- Lal, Harbans, Thakur, D. S., Saini, A. S., and Thakur, D. R., 2000 Behaviour of prices and market arrivals of foodgrains in Himachal Pradesh, *Encyclopedia of Agricultural Marketing*, 6;pp: 67-74.
- Larson Don 1983 Summary statistics and forecasting performance, *Agricultural Economics Research*: 35(3): pp 10-22.

- Meera, Singh, D.P., and Sharma, Hemant, 2015 Co-integration analysis of wholesale price of wheat in selected market of Sriganganagar district of Rajasthan, *Indian Journal of Economics and Development*, 3 (3), 186-193.
- Mendoza, M. S. and Rosegrant, M. W., 1995 Pricing behaviour of Philippines corn markets: Implications for market efficiency, Research Report, 101, International Food Policy Research Institute, Washington, DC., USA.
- Moghaddasi, Reza and Badr, Bitah Rahimi., 2008 Econometric model for wheat price forecasting in Iran, *International Conference on Applied Economics*, ICOAE: 671-677.
- Nagashree, N., Gracy C. P., and Akshata Nayak, 2012 Use of statistical methods for studying price behaviour of Arecanut application of ARIMA forecasting model, *Agricultural Economics Research Review* 25 (Conference Number): 530.
- Najafi, B., Zibaei, M., Sheikhi, M. H., and Tarazkar, M. H., 2007 Forecasting price of some crop products in Pars province: application of artificial neural network, *Journal of Science and Technology of Agriculture and Natural Resources*, 11: 1(B), 501-512.
- Nandal, D.S., and Hasija, R. C., 1995 Marketing pattern and price behaviour of gram in Bhiwani district of Haryana, *Indian Journal of Agricultural Marketing*, Conf. Spl.,pp.63.
- Newadkar, D.S., Pagire, B.V., Pokharkar, V.G., and Sale D. L., 1992 Arrivals and prices of selected commodities in Pune regulated market of Maharashtra, *Indian Journal of Agricultural Marketing*, 6(2);pp. 8-13.
- Newaz, M.K., 2008 comparing the performance of time series models for forecasting exchange rate, *BRAC University Journal*, 5(2), pp. 55-65.
- Patel, G. N., and Agarwal, N. L., 1993 price behaviour of Groundnut in Gujarat, *Indian Journal of Agricultural Marketing*, 7 (2):171-178.

- Prabhavathi, Y., Krishna Kishore, N T., Seema., 2013 Analysis of supply chain of spices in India: A case study of red chillies, *International Journal of Scientific and Research Publications*, 3(9): pp 1-5.
- Prakash, B. and Srivastava, S., 1994 Pattern of marketing arrivals and price of gram in Uttar Pradesh, *Indian Journal of Agricultural Marketing* 8(1) pp.113-116.
- Rahman, N. M. F. 2010 Forecasting of boro rice production in Bangladesh: an ARIMA Approach *Journal of Bangladesh Agricultural University*, 8(1): 103–112.
- Rajaraman Indra, and Datta, Arivanam 2003 Univariate forecasting of state level agricultural production. *Economic and Political Weekly*: 38 (18): 1800-1803.
- Raju, V.T. and Rao, D.V.S., 1995 Marketing cost and margins of important agricultural commodities in Andhra Pradesh, *Indian Journal of Agricultural Marketing*, Conference Special, pp. 56.
- Rajur, B. C., and. Patil, B. L., 2015 Price spread, marketing costs and margins of chilli in Karnataka state, *Karnataka Journal of Agricultural Science*, 28(3): 364-368.
- Ravikumar, K. N., Raju, V. T. and Sreelakshmi, K., 2001 Determinants of prices of agricultural commodities in the regulated markets of Andhra Pradesh, *Indian Journal of Agricultural Marketing*, 43 (1); 19- 22.
- Salam Shakila, Shamsul Alam and Md. Moniruzzaman., 2012 price behaviour of major cereal crops in Bangladesh, *Journal of Biology, Agriculture and Healthcare*, 2 (2): 57-70.
- Sangeeta, Shroff., (2004), Marketing of Onion in Maharashtra, *Indian Journal of Agricultural Marketing*, 4(1); 45- 50.
- Sankar, T. Jai and Prabakaran. R., 2012 Forecasting milk production in Tamil Nadu, *International Multidisciplinary Research Journal*, 2(1): 10-15.
- Sankar, T., and Prabakaran, R., 2012 Forecasting milk production in Tamil Nadu, *International Multidisciplinary Research Journal*, 2(1): 10-15

- Sarika, Iquebal, M. A., and Chattopadhyay, C., 2009, Modelling and forecasting of pigeon pea production using autoregressive integrated moving average methodology, *Indian Journal of Agricultural Sciences*, 81 (6): 520–523.
- Schimmelpfenning, D., and Thirtle, C., 1994 Co-integration and causality: exploring the relationship between agricultural research and development and productivity, *Indian Journal of Agricultural Economics*, 45(2):220-231.
- Shakila Salam, Shamsul Alam, and Moniruzzaman, Md., 2012 Price Behaviour of major cereal crops in Bangladesh, *Economic Affairs*: 57(3): 309-322.
- Sharma ,B. P., D. K., and Khare, A. P., 2001 Effect of seasonality in market arrivals on prices of wheat in Utter Pradesh, *Indian Journal of Agricultural Marketing*, 15(2); pp 36-42.
- Sharma, Hemant. 2015 Applicability of ARIMA models in wholesale wheat market of Rajasthan: an investigation, *Economic Affairs*, 60(4): 687-691.
- Sharma, K. D., Sharma, H. R., and Thakur, D. S., 1988 Structure and behaviour of prices of Himachal apple in Indian markets, *Indian Journal of Agricultural Marketing*, 2(1):105-112.
- Sharma, R., Chouhan, R. S., Mathur, S., and Solanki, P., 2015 Price of cumin in Rajasthan using ARIMA approach, *International Journal of Seed Spices*, 5(1), 76-78.
- Sher, Falak, and Ahmad Fatzaz, 2008 Forecasting of wheat production in Pakistan, *The Lahore Journal of Economics* 13(1): pp. 57-85.
- Singh, A. K. and Singh, A. K., 1999 Production and marketing of vegetable crops in Varanasi district of Uttar Pradesh, *Indian Journal of Agricultural Marketing*, 13 (2): 40.
- Singh, B. B., Singh R. K. P., and Yadav, R. N., 1995 Seasonal variation in arrivals and their effect on price of wheat in Bihar, *Indian Journal of Agricultural Marketing*, 9 (1):pp 42-47.
- Singh, B.B. and Kumari, Meera, 2003 Study on marketing pattern, trend in arrivals and prices of rice in selected regulated markets of Bihar, *The Bihar Journal of Agricultural Marketing*, 11(1&2)

- Singh, Rajendra, 1988 Extent of price variability and market arrivals for soybean in the important mandies of Uttar Pradesh, *Indian Journal of Agricultural Marketing*, 2(9):125.-130.
- Takle, S. R., 2002 Behaviour of market arrivals and prices of rabi jowar in Marathwada, *Indian Journal of Agricultural Marketing*, 16(2):73-75.
- Tripathi, A. K., Subhasis Mandal, Datta, K .K., and Verma, M. R., 2006 Study on marketing of ginger in Ri-Bhoi district of Meghalaya, *Indian Journal of Agricultural Marketing*, 20 (2); 106-115.
- Vasisht, A. K., Bathla Seema, Singh, D. R., Bharadwaj, S. P., and Prawin Arya, 2008 Price behaviour in fruits and vegetable markets, co integration and error correction analysis, *Indian Journal Agricultural Economics*, 63(3); 357-358.
- Verma, V. K, Jheeba, S. S., Kumar, Pradeep, and Singh, S.P., 2016 Price forecasting of Bajra in Rajasthan: ARIMA model, *International Journal of Agriculture Sciences*. 8(9):pp 1103-1106.
- Verma, V.K., Jheeba, S. S., Sharma, Hemant, and Kumar, Pradeep, 2016 Cumin price forecasting in Rajasthan: ARIMA model, *Indian Journal of Economics and Development*, 12 (1a): 51-55. DOI: 10.5958/2322-0430.2016.00048.2.
- Viju, I. C., 1988 Variability in prices in Kerala: The case of pepper and ginger, *Indian Journal of Agricultural Marketing*, 2(2):122.
- Vinod Kumar Verma, Vishnu Shanker Meena, Pradeep Kumar and R. C. Kuamwat, 2013 Production and marketing of cumin in Jodhpur district of Rajasthan: An Economic analysis, *Agricultural Economics Research Review*, 26(2).pp-287-292.
- Wani, M. H., Paul, Ranjit Kumar, Bazaz Naseer H., and Bhat Arshad, 2015 Market integration and causality in pear in India, *Economic Affairs*, 60(4): 735-740.
- Yogisha, G. M., Karnool, M. N., Vijaya Kumar, H. S., and Basavaraja, H., 2007 Trends and seasonal variation in arrival and prices of potato in Kolar district. *Agricultural Marketing*, 69 (4): 26-28.
- Zakari, seydou., and Ying,Liu., 2012 Forecasting of Niger grain production and harvested area. *Asian Journal of Agricultural Sciences*, 4(4): 308-313.
- Zanias, G. P., 1999 Seasonality and spatial integration in agricultural (product) markets, *Agricultural Economics*, 20 93): 253-262.

Marketing and Price Behaviour of Coriander in Rajasthan

Vinod Kumar Verma*
Ph.D. Scholar

Dr. S.S. Jheeba**
Major Advisor

ABSTRACT

Rajasthan state occupies first position in area and production of coriander in the country with 62 per cent of area and 66 per cent of the country's total production. The present investigation was undertaken to study: (i) Marketing channels, costs and margins of coriander (ii) trend, cyclical, irregular and seasonal behaviour (iii) price forecast and (iv) market integration of coriander crop in the state of Rajasthan. Top three districts having highest area under coriander in the state were selected for sample. These were Jhalawar, Baran and Kota districts. One tehsil having highest area under the crop under study was selected from each selected district. One regulated market having maximum arrivals of coriander produce was purposively selected for studying trend, cyclical, irregular and seasonal behaviour of prices, price forecast, and market integration. Three villages from each tehsil were selected randomly. From these villages, 150 farmers of different categories were selected randomly. Both primary and secondary data were used for the study. Primary data were collected for the agricultural year 2012-13. Secondary data were collected for the period January -2000 -01 to December- 2013-14 and were converted into index number by taking initial three years average as the base. Spatio-temporal behaviour of prices was studied by decomposing time series on prices assuming multiplicative fashion of association among the components.

* Ph.D.Scholar, Department of Agricultural Economics,SKN COA, Jobner.

** Assc. Prof. Department of Agricultural Economics,SKN COA, Jobner.

Seasonal behaviour, price forecasting and market integration of prices was examined by using monthly series on prices.

Results of the study revealed that two marketing channels were identified in marketing of coriander in the study area. The marketing costs of coriander was ₹ 1534.13 and ₹ 1430.90 per quintal at village sale and Mandi sale, respectively, Producer's share in consumer's rupee was estimated 64.80 per cent in village sale and 69.35 per cent in mandi sale.

The regression coefficients for linear trend in wholesale price were highly significant in all the three selected districts. Time element alone explained 50.70 per cent to 53.70 per cent variation in wholesale prices. One cycle of 6 years duration was estimated showing cyclical variation. Irregular fluctuations in the prices were observed to be more operative towards lower side. The seasonal pattern in the wholesale prices showed that prices were the lowest in the month of February and the highest in the month of July in all the selected mandies during the study period. After reaching at lowest point in the month of February, the prices continued to increase up to July and then started to decline up to the month of February. In majority of the mandies the intra year price rise was around 14.32 to 22.90 per cent. The smaller magnitude of CV that there was smaller variability in the monthly prices of coriander in the selected mandies of the state.

The prices of coriander were forecasted by using ARIMA and exponential smoothing models using the 14 years monthly average wholesale prices data. The validity of the forecast values of coriander were checked by comparing them with their actual values during the post sample forecast period. The accuracy percentage between the forecast and actual value of coriander crop was found 80 to 98 per cent. Finally ARIMA model were found to be the best forecasting model by producing

minimum value of MAPE and MSE for coriander in selected market. This showed that ARIMA (0,1,1) models for Bhawani mandi, ARIMA (0,1,2), for Baran mandi and ARIMA (0,1,1) for Kota mandi were found to be the most appropriate for forecasting the prices of selected Mandies. The results of the Augmented Dickey-Fuller (ADF) unit root test for Jhalawar mandi, Baran mandi and Kota mandi showed that the existing data were non-stationary but their first differences were stationary. Johansen's co-integration test for spot market indicated the presence of at least two co-integrating equation and for future market at least two co-integrating equations at 5 per cent level of significance. Hence markets were having long run equilibrium relationship. The results of Granger Causality Test depicted that most of the markets had bidirectional influences on coriander prices. These markets were affected by prices of each other.

राजस्थान में धनियें का विपणन और कीमत व्यवहार

विनोद कुमार वर्मा^{*}
(शोधकर्ता)

डॉ. एस.एस. झीबा^{**}
(मुख्य सलाहकार)

सारांश

राजस्थान राज्य धनियाँ के क्षेत्रफल में और उत्पादन में देश में प्रथम स्थान रखता है, यह देश के 62 प्रतिशत क्षेत्रफल का और 66 प्रतिशत उत्पादन का प्रतिनिधित्व करता है।

वर्तमान अन्वेषण निम्नलिखित उद्देश्यों के अध्ययन हेतु किया गया। (1) विपणन माध्यम, कीमत और लाभ (2) प्रवणता/प्रवृत्ति, चक्रीय अनियमित और मौसमों व्यवहार (3) कीमत की भविष्यवाणी या भावी कीमत (4) राजस्थान राज्य में धनियाँ के बाजार का एकीकरण

तीन जिले जो कि राजस्थान राज्य में धनिया के क्षेत्रफल एवम उत्पादन में शिखर पर थे उन्हें चयनित किया गया तथा उनको क्षेत्रफल एवं उत्पादन की पर्याप्तता के लिया परीक्षण किया गया झालावाड, बारा और कोटा जिलों को प्रांसगिक रूप से विस्तृत अध्ययन हेतु चयनित किया गया था। उसमें से प्रत्येक चयनित जिले से एक तहसील प्रासांगिक रूप से चयनित की गई थी। और प्रत्येक चयनित जिले में धनियाँ के सर्वाधिक आवक वाली एक नियंत्रित मण्डी का चयन किया गया और प्रांसगिक रूप से धनियाँ की कीमत प्रवणता, कीमतों में होने वाले उतार चढ़ाव, चक्रीय उतार चढ़ाव, अनियमित उतार चढ़ाव, मौसमी उतार चढ़ाव भावी कीमत का अनुमान लगाना और बाजार एकीकरण एक तहसील के तीन गाँवों का यादृच्छिक रूप से चयन किया गया और इन गाँवों से विभिन्न वर्गों के 150 कृषकों का यादृच्छिक रूप से चयन किया गया।

अध्ययन में प्राथमिक और द्वितीयक आकड़ों का प्रयोग किया गया, जिसमें प्राथमिक आंकड़े 2012-13 के लिए एकत्रित किये गए। और द्वितीयक

^{*} विद्यावाचस्पति छात्र, कृषि अर्थशास्त्र विभाग, श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर ।

^{**} सह-आचार्य, कृषि अर्थशास्त्र विभाग, श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर ।

ऑकड़ें, जनवरी 2000-01 से दिसम्बर 2013-14 तक की अवधि के लिए एकत्रित किए गए और शुरू के तीन वर्षों के औसत को आधार मानते हुए उनकों सूचकाकों में परिवर्तित किया गया। कीमतों का स्थानिक-कालिक व्यवहार कीमतों की समय श्रेणी के अवयवों में गुणात्मक सम्बन्ध मानते हुए विद्यटन द्वारा किया गया। कीमतों का मौसमी व्यवहार भावी कीमतों का अनुमान तथा बाजार एकीकरण कीमतों का मासिक समय श्रेणी द्वारा परखा गया।

अध्ययन के परिणामों से यह स्पष्ट हुआ है कि धनियाँ के अध्ययन क्षेत्र में हो विपणन माध्यमों को चिन्हित किया गया है। राजस्थान राज्य में गाँवों में विक्रय करने पर औसत लागत 1534.13 रुपये प्रति कुन्टल और मण्डी में विक्रय करने पर 1430.90 रुपये प्रति कुन्टल पायी गई। मण्डी विक्रय लागत की तुलना में गावों में विक्रय लागत अधिक पाई गई।

ग्रामीण क्षेत्र में विक्रय करने पर और मण्डी में विक्रय करने पर उत्पादकों को उपभोक्ता कीमतों में से प्राप्त लाभांश 64.80 प्रतिशत और 69.35 प्रतिशत पाया गया।

थोक कीमतों के रेखिक प्रवणता के समाक्षयण गुणांक सभी तीनों चयनित जिलों में अधिक सार्थक पाये गए। ऐसा देखा गया है कि अकेले समय तत्व ने फसल की क्षेत्र थोक कीमतों में 50.70 और 53.70 प्रतिशत विचरण को स्पष्ट किया। जहाँ तक राजस्थान राज्य के कृषि कीमतों में चक्रीय उच्चावचय का सवाल है। इसमें चयनित मण्डीयों में एक आवर्तन छः वर्ष की अवधि वाला कीमतों में अनियमित उच्चावचन सामान्य से नीचे की दिशा में सक्रिस पाये गये।

जहाँ तक चयनित बाजारों की अध्ययन काल के दौरान धनियाँ के थोक कीमतों में मौसमी प्रतिमान के संदर्भ में फरवरी के महीने में न्यूनतम और जुलाई के महीने में शिखर पर पहुँचने के बाद फरवरी तक लगातार घटी और फिर

जुलाई तक बढ़ी। अधिकांश मण्डियों में कीमतों की बढ़ोतरी 14.32 से 22.90 प्रतिशत के लगभग थी।

विचरण गुणांक के अल्प परिणाम ने यह दर्शाया है कि राज्य की चयनित मण्डियों में धनियों की मासिक कीमतों में अस्थिरता कम थी।

धनियाँ की फसल की कीमतों का पूर्वानुमान एरीमा माडल और घाताकीय माडल की मदद से जो कि 14 वर्षा की अवधि वाले मासिक औसत थोक कीमतों का उपयोग पूर्वानुमान परीक्षण हेतु किया गया। धनियाँ की फसल की कीमतों का पूर्वानुमान लगाने की वैधता को वास्तविक कीमतों से तुलना की गई। यह देखा गया कि पूर्वानुमान की यथार्थता की धनियाँ के सन्दर्भ में 80 से 98 प्रतिशत थी। अन्तः में एरीमा मॉडल चुना बाजार में धनिया के लि एसएपीई और एमएसई का न्यूनतम मूल्य का निर्माण करके अच्छी पूर्वानुमान मॉडल होना पाया गया। यह सिद्ध करता है कि चयनित मण्डियों में कीमतों का पूर्वानुमान एरीमा मॉडल (0, 1, 1) भवानी मण्डी, बारा मण्डी में एरीमा माडल (0, 1, 2) तथा कोटा मण्डी में एरीमा मॉडल (0, 1, 1) उचित रूप में पाये गए।

अध्ययन के परिणामों में यह दर्शाया गया है कि सर्वर्धित डिक्की फुल्लर ईकाई मूल्य परीक्षण में भवानी मण्डी, बांरा मण्डी और कोटा मण्डी की कीमतों के ऑकड़ें अस्थिर थे लेकिन प्रथम अन्तर स्थिर थे। इससे यह पता चलता है कि बाजारों के मध्य एकीकरण प्रथम श्रेणी का था।

जोहान्सन सह— एकीकरण परीक्षण द्वारा यह ज्ञात हुआ कि हाजिर बाजार में धनियाँ में कम से कम दो सह— एकीकरण समीकरण और वायदा बाजार में भी दो सह— एकीकरण समीकरण 5 प्रतिशता सार्थकता स्तर पर दीर्घकालीन साम्य सम्बन्धों में सार्थक पाए गए। (गैन्गर कजुयल्टी रेस्ट) ग्रेगर आकस्मिक परीक्षण द्वारा यह दर्शाया गया है कि ज्यादातर बाजार धनिया की कीमतों के लिए दो तरफ प्रभाव रखते थे और ये सभी बाजार एक दुसरे से कीमतों द्वारा प्रभावित थे।

APPENDIES

Sri Karan Narendra Agriculture University, Jobner

Department of Agricultural Economics

S.K.N. College of Agriculture, Jobner

Title of Research Study : **Marketing and Price behaviuor of Coriander**
: **in Rajasthan**

Investigator : **VINOD KUMAR VERMA**

Reference Year : **2012-13**

Date of Interview :

Appendix –I

Schedule for Farmer

1. Name of Farmer: _____ S/o _____
Cast: _____ Education _____
Family Size: _____ Family Income: _____
2. Name of the Village _____ Tehsil _____
Block: _____ District: _____
- 3 (a) Operational holding (in hectare)

S.No.	Particulars	Irrigated	Unirrigated	Total
1.	Owned			
2.	Rented in			
3.	Rented out			
	Total area under cultivation (1+2)-3			

(b) Land Rent/Revenue _____

(c) Rental value of owned land _____ Rs.

4. Production of coriander

Area under coriander (in ha)	Average productivity of coriander (Kg/ha)	Total production of coriander (qtls/ha)

5 Producers surplus of coriander (quintals)

S.No.	Particulars	Quantity of coriander
1	Last year's stock	
2	Production during the year, current year Total (1 + 2)	
3	Requirements for (a) Family requirements (b) Seed requirements (Based on expected area under the crop in next year)	
	Total requirements (a + b)	
4	Marketable surplus	
5	Quantity actually sold during the year 2012-13	
6	Difference in marketable and marketed surplus	
7	Reasons for the differences in the two surplus	

6 Disposal pattern of the surplus coriander

S.No.	Quantity sold	Place of sale	Date of sale	To whom sold	Rate of sale (Rs/qrtl)	Total expenditure incurred in marketing by the farmers
I						
II						
III						
IV						
Total						

7 Market channels adopted in marketing of coriander by the farmers

Channel	Quantity	Percentage of total produce sold
I.	Sale to village trader	
II.	Sale to commission agent wholesaler	
	Total	

8 Marketing costs incurred in sale of coriander in village trader.

S.No.	Particulars of cost items	Quantity (qtls)	Rate (Rs/ctl)	Amount (Rs)
1.	Cost of gunny bags			
2	Labour charges for loading on farm			
3	Unloading charges in village			
4.	Weighing charges			
5	Commission			
6.	Transportation charges			
7	Any other cost			
	1			
	2			
	Total Cost			

9 Marketing costs incurred in sale of coriander in Mandi.

S.No.	Particulars of cost items	Quantity (qtls)	Rate (Rs/ctl)	Amount (Rs)
1.	Cost of gunny bags			
2.	Cost of transport			
3.	Labour cost			
4.	Unloading charges in Mandi			
5.	Serving and cleaning in charges			
6.	Weighing charges			
7.	Mandi fee (1.6%) of value of produce			
8.	Commission			
9.	Expenditure on food etc., incurred by the farmers during sale in KUMS Mandi			
10.	Loss in quantity			
11.	Any other cost			
	1			
	2			
	Total Cost			

10. I Problems faced by the farmers during the process of marketing in villages.

- a. Low price
- b. No ready market
- c. Malpractices (specify)
- d. Any other

II. Problems faced by the farmers during the process of marketing in Mandi.

- a. In respect to transportation of produce to the Mandi -----
 - b. In sale of produce in Mandi-----
 - c. In getting of price information -----
 - d. Problem of staying -----
 - e. Problem in weighing of produce -----
 - f. Problem in getting payment of the value of produce -----
 - g. Any other problem (specify) -----
11. Suggestions for better marketing of Coriander
- 1.
 - 2.

Appendix- II
Schedule for village trader

Date of interview -----

1. Name of village trader ----- S/o -----

2. Purchase of coriander by the village trader

S.No.	Month	Quantity purchased (qtl.)	From whom purchased (qtls)	Average purchase price (Rs/qtl.)

3. Costs incurred by the village trader in purchase of coriander

S.No.	Particulars	Quantity purchased (qtl.)	Rate (Rs./Qtls)	Amount (Rs.)
1	Qty losses during period of purchase			
2.	Loading charges			
3.	Weighing charges			
4	Cost of gunny bags			
5.	Unloading charges			
6.				
	1			
	2			
	Total cost			

4 Disposal of coriander by the village trader

S No.	Month	Date of sale	Quantity sold (qtl.)	Rate (Rs)	Amount (Rs)	Place of sale

5 Net price received by the village trader -----

Appendix- III

Schedule for Commission agent cum wholesaler

Date of interview -----

1. Name of commission agent ----- S/o -----

2. Purchase of coriander by the commission agent

S.No.	Month	Quantity purchased (qtl.)	From whom purchased (qtls)	Average purchase price (Rs/qtl.)

3. Costs incurred by the commission agent in purchase of coriander

S.No.	Particulars	Quantity purchased (qtl.)	Rate (Rs./Qtls)	Amount (Rs.)
1.	Vat			
2.	Mandi fee			
3.	Commission			
4.	Brokerage			
5.	Weighing charges			
6.	Loading charges			
7.	Unloading charges			
8.	Cost of gunny bags			
9.	Charges of grading			
10.	Charges of society			
11.	Qty losses during period of purchase			
12.	Other costs			
	1			
	2			
	Total cost			

6 Disposal of Coriander

S No.	Month	Date of sale	Quantity sold (qtl.)	Rate (Rs)	Amount (Rs)	Place of sale

7 Net price received by the commission agent -----

Appendix – IV

Schedule for Retailer

1. Name of Retailer ----- S/o -----

2. Purchase of coriander by the Retailer

S.No.	Month	Place of purchase	Agency from which purchased	Quantity purchased (qtls.)	Rate (Rs/qtl)

3. Cost incurred by the retailer in purchase of coriander

S.No.	Particulars	Quantity Handled (Qtl.)	Rate (Rs./Qtls)	Amount (Rs)
1.	Transportation charges from Mandi to the shop			
2.	Labour charges for loading and unloading.			
3.	Storage charges.			
4.	Other costs.			
	1.			
	2.			
	Total costs			

4. Sale of coriander

S.No.	Date of sale	To whom sold	Quantity (qtls)	Rate (Rs)	Amount (Rs)
1.					
2.					
3.					
4.					

5. Net price received by the Retailer -----

Appendix V

Schedule for Krishi Upaj Mandi Samiti

1. Date of establishment
2. Area commanded
3. Information about different agricultural products handled by Mandi

S.No.	Particulars	Quantity in different years (qtls.)		
		2009-10	2010-11	2011-12
1.	Name of different agricultural products handled by the Mandi			
	(a)			
	(b)			
	(c)			
	(d)			
	(e)			
	(f)			
2.	Coriander handled			

4. Information about middlemen in Mandi

S.No.	Category of middlemen	Number of registered middlemen in Mandi	Number of middlemen dealing in coriander during last 2 years
1			
2			

5. Information (General information) about Mandi particularly to Coriander

6. Proscribed charges for sale of coriander in the Mandi.

S.No.	Charges	Rate	By whom payable
1	Mandi fee		
2	Loading charges		
3	Unloading charges		
4.	Sieving and cleaning charges		
5	Commission		
6	Weighing charges		
7	Other charges (specify)		
	1.		
	2.		
	3		

7. Information obtained from Mandi secretary (based on his experience)

(a) Common marketing channels in marketing of coriander -----

I. : -----

II. : -----

III. :-----

IV. :-----

(b) Area from where coriander comes for sale in the KUMS

I. Name of the village

II. Name of state from where coriander comes for sale in the Mandi

(c) Area to which coriander is taken by the traders of the Mandi for further sale

I. Within state

II. Outside the state

(d) Method of sale followed in sale of coriander in the Mandi

(e) Method of weighing followed for coriander -----

(f) Suggestions, if any (regarding improvement in marketing of Coriander) :

1.

2.

3.

4.

5.

Appendix -VI

Monthly wholesale price and arrivals of coriander crop in selected mandies of Rajasthan during Jan- 2000 to Dec- 2013.

Months	Bhawani Mandi		Baran Mandi		Kota mandi	
	Arrival	Price	Arrival	Price	Arrival	Price
Jan-00	2546	1850	8162	1995	10122	2250
Feb-00	6845	1900	6345	1850	8607	2175
Mar-00	13214	1750	13865	2050	6609	2100
Apr-00	11300	1800	23369	1995	35465	2125
May-00	5850	1850	27673	1870	18031	1750
Jun-00	3070	1800	24811	1800	49338	1800
Jul-00	850	1900	6368	1770	5683	1755
Aug-00	950	1749	4011	1685	5040	1600
Sep-00	1460	1460	9800	1750	9252	1600
Oct-00	350	1800	8162	1700	774	1630
Nov-00	725	2248	20195	2100	27946	2125
Dec-00	1150	2300	13866	2200	19740	2250
Jan-01	1050	2000	9878	2000	11379	2000
Feb-01	2550	1600	11564	1750	8626	1800
Mar-01	2750	1600	68189	1680	90208	1850
Apr-01	3070	1600	48359	1850	56920	2200
May-01	4279	2000	58119	2309	55670	2455
Jun-01	35910	1785	17257	2550	24495	2425
Jul-01	287	2099	2296	2800	4925	2375
Aug-01	2062	2147	2824	2550	5217	2175
Sep-01	1108	2090	8762	2500	8455	2175
Oct-01	474	2200	6015	2100	9416	2130
Nov-01	435	2000	5595	2050	7637	1650
Dec-01	472	1940	6735	1750	6609	1850
Jan-02	1268	1508	5687	1600	10122	1680

Cont..

Feb-02	1480	1600	9126	1300	8607	1700
Mar-02	7246	1500	82465	1485	75820	1450
Apr-02	10282	1868	91648	1560	86000	1400
May-02	5229	1561	43953	1550	55670	1275
Jun-02	1540	1714	44132	1575	35600	1350
Jul-02	750	1776	10732	1600	8326	1500
Aug-02	1105	1753	7107	1875	9704	1700
Sep-02	1295	2254	12539	2250	16386	1900
Oct-02	860	2200	16339	2400	20562	1850
Nov-02	2109	2200	15710	2340	15856	2200
Dec-02	711	2399	160541	2256	18482	2300
Jan-03	2375	2249	20622	2200	20812	2300
Feb-03	10942	1749	15473	2200	19605	2300
Mar-03	4522	2199	76451	2235	80828	2500
Apr-03	7366	2049	63469	2819	89920	2550
May-03	1615	2649	23779	2749	40000	2400
Jun-03	1548	2719	30521	2600	29992	2780
Jul-03	1232	2354	7538	2450	12128	2650
Aug-03	1450	2002	4692	2250	6762	2650
Sep-03	2246	2200	12562	2350	10242	2650
Oct-03	2346	2199	16432	2300	12474	2250
Nov-03	3441	2199	9042	2100	12294	2150
Dec-03	1881	1749	11828	1950	14808	2150
Jan-04	1404	1870	8011	2050	12040	2150
Feb-04	6773	2000	8518	1350	13273	2050
Mar-04	7973	1543	63081	1400	101130	1800
Apr-04	15712	1599	60915	1325	110199	1805
May-04	7540	1350	55348	1320	144096	1400
Jun-04	5961	1274	54519	1225	74999	1400
Jul-04	7450	1699	15222	1600	24362	1450
Aug-04	1623	1442	4803	1350	5673	1500
Sep-04	2536	1399	15493	1400	10501	1475

Cont..

Oct-04	3233	1300	21977	1450	31298	1475
Nov-04	1653	1700	22922	1406	36012	1550
Dec-04	4425	1300	23673	1750	32549	1600
Jan-05	2750	1305	19255	1630	18049	1600
Feb-05	9325	1286	15201	1520	12176	1400
Mar-05	27365	1224	30465	1531	65223	1550
Apr-05	28988	1599	50813	1450	98428	1500
May-05	8796	1439	35306	1250	155871	1600
Jun-05	6650	1350	48984	1399	67064	1550
Jul-05	2773	1599	20642	1450	19481	1535
Aug-05	2632	1399	16804	1370	15803	1525
Sep-05	2388	1399	16803	1400	5200	1475
Oct-05	3198	1497	26732	1350	19697	1500
Nov-05	1918	1807	37404	1850	55087	1700
Dec-05	462	1790	24861	1775	47500	1720
Jan-06	363	2023	34201	1825	23351	1675
Feb-06	9457	1799	19588	1800	13350	1725
Mar-06	28350	1799	88235	1800	153284	2500
Apr-06	29200	2400	71581	1700	178763	2435
May-06	6009	3099	64480	2130	149631	2300
Jun-06	2431	3000	38026	2250	109770	2300
Jul-06	2032	2985	14819	2300	57815	2350
Aug-06	2185	3200	16457	2400	31090	2400
Sep-06	2476	2838	27293	2365	27211	2275
Oct-06	1485	2364	15662	2000	43024	2100
Nov-06	1875	1799	16557	2500	36219	2300
Dec-06	2322	2299	18407	2500	23408	2150
Jan-07	2309	2500	12397	2400	34373	2250
Feb-07	21088	2000	16160	2400	26078	2480
Mar-07	15015	2099	79641	2000	104854	2600
Apr-07	57875	2600	66890	2700	130998	2900

Cont..

May-07	13882	2500	62306	2400	96801	2450
Jun-07	7507	3000	28161	2500	57208	2700
Jul-07	7000	3400	21977	3000	41240	3235
Aug-07	2209	3500	12808	3700	25117	3450
Sep-07	3252	3400	9331	3700	23152	3350
Oct-07	1280	3607	8659	3300	40139	3340
Nov-07	2000	3500	8458	3200	21101	3440
Dec-07	1137	3099	15834	3300	18548	3400
Jan-08	1650	3500	11526	3300	18720	3300
Feb-08	10651	3499	9383	3600	17416	4500
Mar-08	5632	5000	48390	4350	61794	5000
Apr-08	30426	5599	47000	5500	146907	4750
May-08	9881	5000	38454	5880	96352	4900
Jun-08	7456	6500	30164	6300	39189	5900
Jul-08	3613	6499	20560	7485	23933	7500
Aug-08	5010	6500	8556	5900	18408	6800
Sep-08	4632	7000	11641	6800	14832	6950
Oct-08	3153	7000	8939	6300	17649	6800
Nov-08	4526	6199	13984	6000	19988	5800
Dec-08	5300	5000	10373	4400	15694	4500
Jan-09	9971	5000	11611	4200	21802	4400
Feb-09	11988	3000	17413	2800	40736	3000
Mar-09	8751	3199	85733	3200	184122	3400
Apr-09	14689	5000	62042	3700	157197	3600
May-09	6814	3799	52148	3430	80175	3400
Jun-09	7391	3299	34050	3600	33598	3500
Jul-09	5370	3900	19895	3750	29349	3900
Aug-09	8449	3699	13140	3800	22584	3850
Sep-09	7615	3600	27617	3450	33470	3475
Oct-09	5129	3399	17792	3650	41136	3450
Nov-09	6070	3500	26844	3700	36114	3475
Dec-09	5341	3549	25906	3250	42055	3400

Cont..

Jan-10	3244	2996	11701	3900	19541	3000
Feb-10	15330	3400	13463	2800	21871	2300
Mar-10	29476	2299	79152	2220	109394	2700
Apr-10	43520	2200	51700	2400	159737	2500
May-10	13864	2299	34996	2150	67154	2200
Jun-10	9683	2249	44496	2150	80364	2300
Jul-10	4915	3000	21491	2850	16128	2450
Aug-10	5000	2400	10086	2430	20062	2400
Sep-10	3107	2099	23844	2300	18185	2250
Oct-10	1632	2799	23714	2450	32262	2450
Nov-10	2575	2499	16962	2600	27057	2550
Dec-10	9550	3560	30904	3800	63810	2600
Jan-11	5243	3499	31693	4100	54032	3650
Feb-11	5954	3000	29633	3800	46542	3000
Mar-11	15416	4399	87228	3525	132668	4000
Apr-11	25594	4500	50151	4110	124625	4200
May-11	7142	4000	41146	3550	127421	3800
Jun-11	352	4000	31924	3985	59805	4000
Jul-11	7400	3850	39869	4400	54384	3800
Aug-11	16401	3069	32306	4300	35843	4150
Sep-11	20288	3000	42288	4150	38880	3900
Oct-11	3347	2000	16762	3950	46889	3800
Nov-11	7512	3194	12356	3550	40050	3800
Dec-11	6925	3339	9788	3400	24660	3300
Jan-12	9924	3199	11856	3425	22571	3400
Feb-12	31397	2299	18132	3150	40340	3300
Mar-12	72468	2500	95431	3350	213963	3000
Apr-12	50188	2199	55030	3050	201385	3000
May-12	11880	3500	65492	2925	102245	2950

Cont..

Jun-12	7997	3476	51008	3025	62337	2900
Jul-12	3675	3499	18481	3900	59687	3650
Aug-12	4649	3899	13308	3650	48345	3700
Sep-12	6454	3799	29864	3544	46678	3000
Oct-12	2740	3893	39258	3550	55772	3300
Nov-12	4461	4499	44075	3950	81585	3950
Dec-12	574	4500	48657	4386	67915	4100
Jan-13	3538	4000	50916	4800	70660	4400
Feb-13	5819	4799	29937	5200	36375	4400
Mar-13	16574	3000	63289	5350	108986	4700
Apr-13	18498	6199	48534	5500	120535	6500
May-13	13621	7050	37658	6000	106342	6800
Jun-13	4963	8000	41094	5580	80196	5650
Jul-13	6111	7000	11988	4885	45852	5200
Aug-13	5517	5500	15512	5476	18115	5000
Sep-13	15557	5460	39954	5060	57950	5000
Oct-13	6054	6500	51840	5611	54140	5750
Nov-13	5995	7000	44107	6000	44878	6500
Dec-13	2647	7200	36401	6500	59532	6500

Appendix -VII

Estimates of curvilinear (Linear) trend in wholesale price of coriander in selected mandies of Rajasthan (2000-01 to 2013-14)

Mandies	Intercept (B ₀)	Regression coefficient (B ₁)	R ²	R ²	d statistics	F statistics
Bhawani Mandi	1069.88	245.77* (66.61)	0.53	0.49	1.61	13.61
Baran Mandi	1208.63	229.42* (61.55)	0.53	0.49	1.74	13.89
Kota mandi	1220.47	225.54* (64.20)	0.50	0.46	1.77	12.34

*Significant at 1 per cent level of significance

Appendix-VIII

Cyclical component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)

Years	Bhawani Mandi	Baran Mandi	Kota Mandi
2001-02	122.11	121.03	115.17
2002-03	109.97	113.37	109.78
2003-04	91.34	90.49	91.35
2004-05	76.53	77.61	81.75
2005-06	70.44	65.75	69.68
2006-07	80.22	76.49	79.11
2007-08	117.49	113.90	116.06
2008-09	123.34	122.33	123.99
2009-10	114.62	114.14	113.60
2010-11	86.85	90.13	88.63
2011-12	78.42	84.11	81.31
2012-13	98.96	102.02	101.15

Appendix-IX

Irregular component of wholesale prices of coriander in the selected mandies of Rajasthan (2000-01 to 2013-14)

Years	Bhawani Mandi	Baran Mandi	Kota Mandi
2001-02	100.13	108.63	108.57
2002-03	92.59	85.53	81.23
2003-04	115.88	123.39	126.03
2004-05	86.70	80.99	85.31
2005-06	81.48	88.69	86.67
2006-07	109.16	99.47	99.74
2007-08	81.45	83.47	84.48
2008-09	137.19	139.42	138.09
2009-10	91.72	88.80	90.42
2010-11	80.06	78.24	75.43
2011-12	109.55	117.13	118.46
2012-13	80.65	81.65	79.84

Appendix-X

Seasonal indices for monthly arrivals and prices of coriander in the selected mandies of Rajasthan (2000 to 2013)

Months	Bhawani Mandi		Baran Mandi		Kota Mandi	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
January	48.84	99.73	53.65	98.12	46.13	98.74
February	99.25	87.55	52.09	89.21	44.98	92.84
March	217.26	90.94	211.61	92.34	229.20	95.12
April	329.30	98.47	245.90	95.26	264.46	98.92
May	113.60	99.01	165.60	96.69	200.15	99.28
June	129.38	99.81	127.60	98.74	110.13	99.34
July	32.12	110.95	38.44	109.64	37.09	106.14
August	38.31	104.26	58.79	106.54	52.90	106.02
September	54.85	103.72	63.66	106.14	40.12	101.72
October	53.58	103.47	56.37	102.95	58.60	101.24
November	43.87	101.11	60.50	102.39	58.76	100.40
December	39.64	100.98	65.79	101.98	57.48	100.24
Total	1200.00	1200.00	1200.00	1200	1200.00	1200.00

Appendix-XI

Intra year wholesale price rise in coriander in selected mandies of Rajasthan (2000-01 to 2013-14)

Mandies	Lowest seasonal price index		Highest seasonal price index		Magnitude of variation (%)		
	Month	Seasonal index	Month	Seasonal index	IPR	ASPV	C.V.for price
Bhawani Mandi	Feb	87.55	July	110.95	19.09	23.58	6.08
Baran Mandi	Feb	89.21	July	109.64	22.90	20.55	6.45
Kota Mandi	Feb	92.84	July	106.14	14.32	13.36	3.78

IPR =Intra year price rise ASPV =Average seasonal price variation CV =Coefficient of variation