An Economic Analysis of Production and Marketing of Fenugreek in Rajasthan

राजस्थान राज्य में मैथी के उत्पादन एवं विपणन का एक आर्थिक विश्लेषण

Thesis

Submitted to the
Swami Keshwanand Rajasthan Agricultural University, Bikaner
in Partial Fulfillment of the Requirement
for the Degree of

Doctor of Philosophy
in the

Faculty of Agriculture
(Agricultural Economics)

By
DEEPA KUMARI KUMAWAT
2014

SWAMI KESHWANAND RAJASTHAN AGRICULTURAL UNIVERSITY, BIKANER

S.K.N. COLLEGE OF AGRICULTURE, JOBNER

CERTIFICATE – I

Dated: ----------

This is to certify that **Ms. Deepa Kumari Kumawat** has successfully completed the preliminary examination held on ---------- as required under the regulation for **Doctor of Philosophy** degree.

(Dr. R.C. Sharma)
Head
Department of Agricultural Economics
S. K. N. College of Agriculture, Jobner

SWAMI KESHWANAND RAJASTHAN AGRICULTURAL UNIVERSITY, BIKANER
S.K.N. COLLEGE OF AGRICULTURE, JOBNER

CERTIFICATE – II

Dated: ----------

This is to certify that the thesis entitled '**An Economic Analysis of Production and Marketing of Fenugreek in Rajasthan.'** submitted for the degree of **Doctor of Philosophy** in the subject of **Agricultural Economics** embodies bonafide research work carried out by **Ms. Deepa Kumari Kumawat** 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----------.

(Dr. R.C. Sharma)
Head of the Department

(Dr. R.C. Kumawat)
Major Advisor

(Dr. G.L. Keshwa)
Dean
S.K.N. College of Agriculture, Jobner

Swami Keshwanand Rajasthan Agricultural University, Bikaner

S.K.N. College of Agriculture, Jobner

CERTIFICATE – III

Dated:……

This is to certify that the thesis entitled **'An Economic Analysis of Production and Marketing of Fenugreek in Rajasthan'** submitted by **Ms. Deepa Kumari Kumawat** to the Swami Keshwanand Rajasthan Agricultural University, Bikaner, 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 advisory committee. The performance of the candidate in the oral examination on this thesis has been found satisfactory. We, therefore, recommend that the thesis be approved.

(Dr. R.C. Kumawat)
Major Advisor

(Dr. S.S. Jheeba)
Advisor

(Dr. K.N. Gupta)
Advisor

(Dr. E. V. D. Shastri)
Advisor

(Dr. M.C. Bhargava)
(Dean, PGS Nominee)

(Dr. R.C. Sharma)
Head
Department of Agricultural Economics
S.K.N. College of Agriculture, Jobner

(……)
External Examiner

Approved

(Dr. G.L. Keshwa)
Dean
S.K.N. College of Agriculture, Jobner

Dean
Post Graduate Studies

SWAMI KESHWANAND RAJASTHAN AGRICULTURAL UNIVERSITY, BIKANER
S.K.N. COLLEGE OF AGRICULTURE, JOBNER

CERTIFICATE – IV

Dated: ____ 2014

This is to certify that **Ms. Deepa Kumari Kumawat** of the **Department of Agricultural Economics**, S.K.N. College of Agriculture, Jobner has made all corrections/ modifications in the thesis '**An Economic Analysis of Production and Marketing of Fenugreek in Rajasthan'** which were suggested by the external examiner and the advisory committee in the oral examination held on ……. The final copies of the thesis duly bound and corrected were submitted on …… are enclosed herewith for approval.

(Dr. R.C. Sharma)
Head of Department

(Dr. R. C. Kumawat)
Major Advisor

(Dr. G.L. Keshwa)
Dean
S.K.N. College of Agriculture, Jobner

APPROVED

Dean,
Post Graduate Studies

ACKNOWLEDGEMENTS

I deem it to be my deepest sense of respect and gratitude to my guide, ***Dr. R. C. Kumawat, 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. S. S. Jheeba****, Associate Professor, Department of Agricultural Economics,* ***Dr. E. V. D. Shastri,*** *Professor, Department of Plant Breeding and Genetics, Rajasthan Agricultural Research Institute, Durgapura,* ***Jaipur, Dr. K. N. Gupta****, Professor and Head, Department of Agricultural Statistics, and* ***Dr. M. C. Bhargava*** *Professor and Head, Department of Entomology, as Dean, PGS Nominee for their constructive suggestions and encouragement during the course of investigation.*

I am equally grateful to ***Dr. R. C. Sharma****, Professor and Head, Department of Agricultural Economics, SKN College of Agriculture, Jobner, Jaipur for providing me valuable guidance as well as 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. P. K. Srivastava*** *(Associate Professor),* ***Sh. Surendra Singh Rao*** *(AAO) and* ***Sh. Gheesa Lal Meena*** *(Peon) for their timely help extended to me during the course of study.*

I feel gratified to ***Dr. G. L. Keshwa****, 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. Anil Kumar****,* ***Dr. B. L. Pooniya*** *and* ***Dr. S. N. Sharma*** *and present Dean PGS, S.K.R.A.U., Bikaner,* ***Dr. S. Gangopadaya*** *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.

A loving family is the greatest force behind my achievement. I shall remain indebted to ***MY Parents, In-laws, husband and loving kids*** *who gave me their due without which I could not have accomplished this task.*

Above all, I pay gratitude to ***The Almighty****, who blessed me with patience and vigour to complete this dissertation work successfully.*

Date :

Place *: Jobner* ***(Deepa Kuamri Kumawat)***

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LIST OF ABBREVIATIONS

S No.	Abbreviation	Full form
1	@	At the rate
2	CV	Coefficient of Variation
3	FYP	Five Year Plan
4	TMO	Technological Mission on Oil Seeds
5	VAT	Value Added Tax
6	VIF	Variance Inflation Factor

Chapter-I

INTRODUCTION

Agriculture continues to be the backbone of Indian economy. Agriculture sector employ 58.2 per cent of the total workforce. It contributed 13.7 per cent of Gross Domestic product (GDP) and accounted for about 13.08 per cent share of total value of country's export during 20012-13 (www.pib.nic.in). This sector supplies bulk of raw materials required by the non-agricultural sectors and raw material for a large section of industry.

Horticulture, being one of the important sectors of Indian agriculture, plays an important role in the economy of the country. There are several horticulture crops suitable for almost all the agro-climatic zones of the country. Currently horticulture contributes 30.04 per cent of agricultural GDP. Country has emerged as the world's largest producer of mango, banana, coconut cashew and spices (www.icar.org.in).

India has been known from time immemorial times as the land of spices. India had a virtual dominance in the international spices trade. India still continues to be the largest producer, consumer, and exporter of spices in the world. It produced 5.80 million tones of spices on an area of 3.10 million hectares. India commands leading position in world spices trade with 48 per cent (502750 tonnes) share in volume and 43 per cent (`5560.5 crores) in value. The seed spices export from India has registered an all time high both in term of quantity (142300 tonnes) and value (` 985.58 crores). The major markets for different seed spices are USA, UAE, UK and South Africa (Annual Report 2012-13, National Research Centre on Seed Spices, Ajmer).

Despite a decline in the total export in the country, Indian spices exports have been able to record strident gains in both volume and

value in rupee terms. It is first time in the history of spices export, the growth in volume registered an all time growth of 22 per cent.

Spices exports have registered substantial growth during the last five years, registering an annual average growth rate of 21 per cent in value and 10 per cent in volume and India commands a formidable position in the World Spice Trade. During the 2012-13, a total of 699170 tonne of spices and spice products valued `11171.16 crores (US$2040.18 million) has been exported from the country, compared to the target of fixed 566000 tonnes valued `8203.50 crores (US$1650 million) for the financial year 2012-13. The achievement is 124 per cent in terms of quantity,136 per cent in rupee and 134 per cent dollar terms of value. (www.indianspices.com). Thus, spices occupy an important position in earning of foreign exchange.

A large number of spices are grown in India, the major being black pepper (*Piper nigrum*; stomachic), cardamom (*Elettaria cardamomum*; aromatic), ginger (*Zingiber officinale*; aromatic stimulant), turmeric (*Curcuma longa*; blood purifier), clove (*Syzygium aromaticum*; dental analgesic), capsicum (*Capsicum annuum*; carminative), garlic (*Allium sativum*; antioxidant), saffron (*Crocus staivus*; food dye), celery (*Apium gravrolens*; stimulant), vanilla (*Vanilla planifolia*; flavouring agent), nutmeg (*Myrisitica argentea*; stimulant), Indian cassia (*Cinnamomum tamala*; flavouring agent), curry leaf (*Murraya koenigii*; antioxidant), garcinia (*Garcinia indica*; astringent), jamaica pepper (*Pimenta dioica*; antiseptic), basil (*Ocimum basilicum*; antidiabetic), rosemary (*Rosemarinus officinalis*; rubefacient), Indian mustard (*Brassica junceae*; emetic), aniseed (*Pimpinella anisum*; carminative), caraway (*Bunium persicum*; antispasmodic), cumin (*Cuminum cyminum*; carminative), coriander (*Coriandrum sativum*; aromatic), fennel (*Foeniculum vulgare*; carminative), fenugreek (*Trigonella foenumgraecum*; carminative), ajwain (*Trachyspermum ammi*; antispasmodic) and Indian dill (*Anethum sowa*; carminative) etc.

Out of the 109 spices listed by the International Organization for Standardization (ISO), India produces as many as 63 owing to its varied agro-climatic regions. Almost all the States and Union territories (UTs) of the country grow one or the other spices. It is a source livelihood and employment for large number of people in the country, both for rural population, who grow them, and the urban population, who process and trade in them. Out of the total 63 spices grown in India, 20 are classified as seed spices with 36 per cent share in area and 17 per cent share in production of total spice in India (annual report 2012-13, National Research Centre on Seed Spices, Ajmer). Main seed spices of India are coriander, cumin, fennel, fenugreek, dill, ajwain, celery, anise nigella and caraway. Seed spice crops are extensively cultivated in the arid and semi arid region of India during rabi season covering an area of 12.20 lakh ha with production of 10.58 lakh tones annually.

In 1951, a high level spices enquiry committee was set up by the planning commission. Accordingly necessary funds were provided to ICAR for implementing various schemes on research, development and marketing of spices in all the regions of the country. The Directorate of Arecanut and Spices Development was established 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 made in the fifth five year plan (1974-79). In the sixth five year plan (1979-84) the development programmes 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 budgetary provisions.

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 started implementing through the state horticulture / agriculture departments. In order to foster these programmes, the basic components, particularly production of high yielding/export oriented varieties, transfer of technology etc. are taken up by the Directorate of Arecanut and Spices Development in association with state agricultural universities, ICAR institutes, state agriculture/horticulture departments etc.

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.

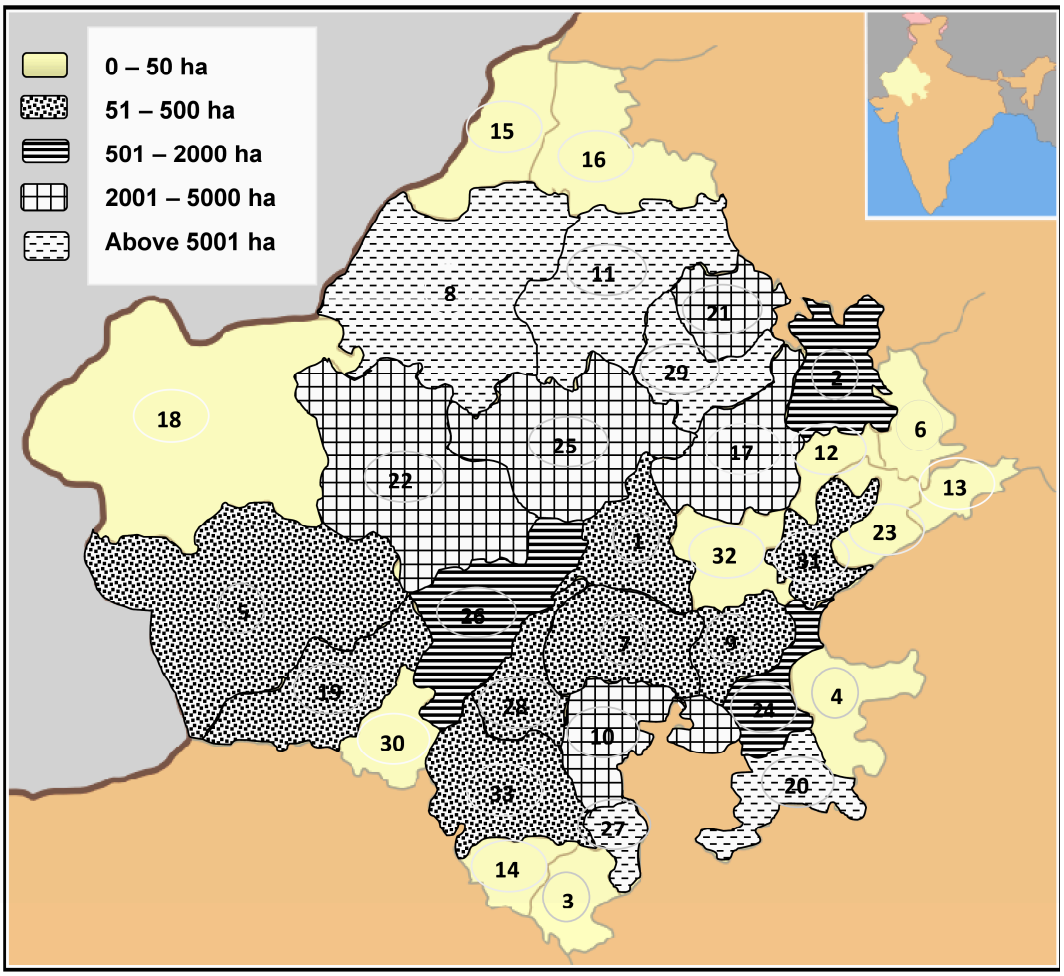
Among the various spices grown in India cumin, coriander, fennel, fenugreek, ajwain and Indian dill are classified as seed spices. The important seed spices producing states in the country are Rajasthan, Gujarat, M.P., Haryana, Punjab, U.P., A.P. and Bihar. Among these states, Rajasthan is the major seed spices producing state. It accounted for 57.66 per cent of the total area and 55.53 per cent of the total production of seed spices in the country (based on the quinquennial average) average of 2008-09 to 2012-13. The main seed spices grown in the state are coriander, cumin, fennel, fenugreek and ajwain.

Out of these seeds spices fenugreek is one of the main seed spices, which is commonly used in the daily food basket of the consumers. Fenugreek seed are used as a spice to improve the flavor and the nutritive value of food. Fenugreek is mainly used in India in preparation of pickles, curry powder and to a small extent in making certain curried vegetables in hotels, restaurants and households. The leaves of fenugreek plant are used as a vegetable in India. Fenugreek has several medicinal values. Fenugreek seeds are known for lowering blood glucose and blood cholesterol level as they have large amount of soluble fibers. They have been recommended in many native remedies for diabetes. They are mucilaginous, demulcent, diuretic, tonic, carminative, astringent, emollient and aphrodisiac. The seeds are, therefore, used in preparation of several ayurvedic medicines. Preparations from seeds are consumed to promote appetite, correct digestive system and also to relieve pain in joint, particularly in old age. In recent years, the importance of fenugreek seeds has further

increased for the important steroids ‘diosgenin’ which it possesses. Diosgenin is used in the preparation of sex hormones and oral contraceptives.

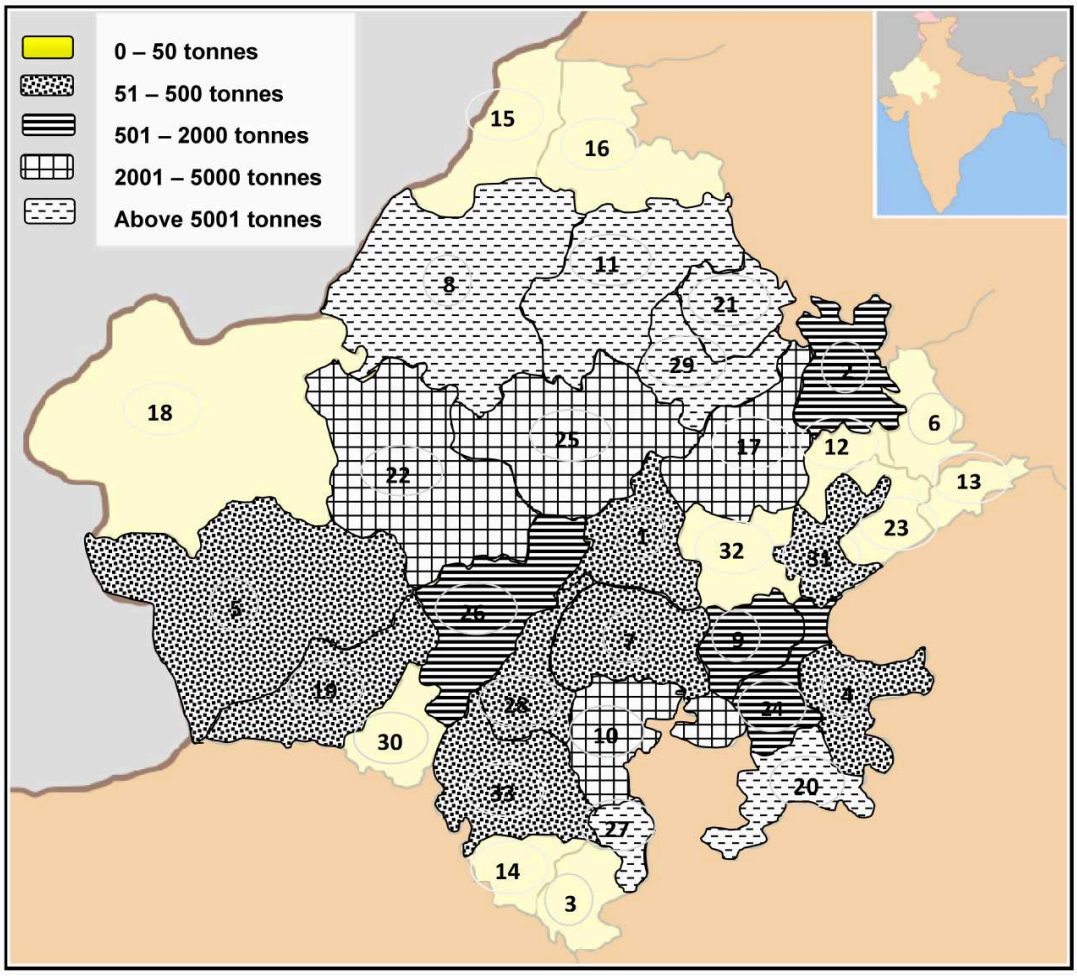
In India, total area under fenugreek cultivation was 93.10 thousand hectares with a production of 112.84 thousand tones in the year 2012-13. The productivity of fenugreek was 1212 kg per hectare during the same period. Total export of fenugreek from India was 31.00 thousand tones valued at ` 10,835 lakh during the year 20012-13. It was exported to the countries like Dubai, Singapore, Malaysia, Europe, USA and Japan.

Rajasthan, Gujarat, Uttar Pradesh and Uttaranchal are the major fenugreek producing states of the country which together accounted more than 90 per cent of the total area and total production of fenugreek in the country. In 2012-13, the total area under fenugreek in Rajasthan state was 82.36 thousand hectares which accounted for 88.45 per cent of the total area (Figure 1.1) and produced 87.38 thousand tones of fenugreek (Figure 1.2), which accounted for 77.43 per cent of the total production under fenugreek in the country.



1.	Ajmer	10	Chittorgarh	18.	Jaiselmer	26.	Pali
2.	Alwar	11	Churu	19.	Jalore	27.	Pratapgarh
3.	Banswara	12.	Dausa	20.	Jhalawar	28.	Rajasamad
4.	Baran	13.	Dholpur	21.	Jhunujhunu	29.	Sikar
5.	Barmer	14.	Dungarpur	22.	Jodhpur	30.	Sirohi
6.	Bharatpur	15.	Ganganagar	23.	Karoli	31.	Swaimadhopur
7.	Bhilwara	16.	Hanumangarh	24.	Kota	32.	Tonk
8.	Bikaner	17.	Jaipur	25.	Nagaur	33.	Udaipur
9.	Bundi						

Figure 1.1: Area under fenugreek cultivation in Rajasthan during 2012-13.



1	Ajmer	10	Chittorgarh	18.	Jaiselmer	26.	Pali
2	Alwar	11	Churu	19.	Jalore	27.	Pratapgarh
3	Banswara	12.	Dausa	20.	Jhalawar	28.	Rajasamad
4	Baran	13.	Dholpur	21.	Jhunujhunu	29.	Sikar
5	Barmer	14.	Dungarpur	22.	Jodhpur	30.	Sirohi
6	Bharatpur	15.	Ganganagar	23.	Karoli	31.	Swaimadhopur
7	Bhilwara	16.	Hanumangarh	24.	Kota	32.	Tonk
8	Bikaner	17.	Jaipur	25.	Nagaur	33.	Udaipur
9	Bundi						

Figure 1.2: Production of fenugreek in Rajasthan during 2012-13.

The state has great potential for increasing the productivity and production of fenugreek seed to meet out the growing export demand. However, area

and productivity and for that matter the production varies from region to region on account of differences in agro climatic conditions and nature of the crop. The knowledge of growth rates in area, production and productivity of the crop enables one to assess its progress and performance over the period under study as also gives an idea about the allocation of resources in different areas. Such information help the policy makers and planners remedy the regional imbalances through formulating appropriate policies for future as well as correcting the weakness in the performance of any crop in terms of existing policies and programmes in force.

The instability in area, production and productivity leads to excessive demand and supply gap in the economy. The fluctuations (year to year) in production induce price instability and inefficiency in production, employment and income distribution. It is, therefore, necessary to take the appropriate policy measures for reducing instability, identification of its sources and means of control. In order to devise strategies for minimizing fluctuations in agriculture a clear-cut idea about the extent or degree of fluctuations in area, production and productivity of fenugreek crop in a particular area is required. The knowledge of instability in the production provides some guidance to agricultural scientists interested in finding the way to reducing it.

The area under fenugreek in the state fluctuated during past twenty three years, ranging from as low as 21.96 thousand hectares in 1991-92 to as high as 107.75 thousand hectares in 2001-02. In 2012-13 the area under fenugreek was 65.51 thousand hectares. Similarly, there were also year to year wide fluctuations in the production of fenugreek in the state. The fluctuation in production of fenugreek was due to the variation in weather conditions, area under the crop and yield of the crop, which affects the employment and income distribution and hamper the economic growth of the state.

Costs in agriculture play a significant role in making the farm sector economically viable and feasible under the pressure of continuous rise in input prices. The level of input use and their prices affect the profitability of the crop enterprise. This mechanism needs to be critically examined for formulating effective policies in relation to costs and output prices for understanding the income path in the farm sector. As such there is a need to study the costs of and returns from fenugreek crop in the state.

Fenugreek being grown as a cash crop by the farmers enjoys comparative advantage in its cultivation over food grains and non food grain crops. The farmers need better marketing facilities for marketing of high value risky crops which is generally reflected through a higher share in consumer's rupee. It is not only essential to obtain higher yields but it is equally essential to market the surplus produce at right time and at right place/market also. It is of immense importance to examine the marketing system, costs, margins and price-spread to devise appropriate product specific marketing strategy.

Productivity in agriculture can be increased through adoption of improved technology. Fertilizers, number of irrigations, human labour, tractor power and others (seed, manures, and plant protection measures) are the most important crucial inputs for increasing agricultural production in India.

Judicious use of resources coupled with proper technology plays an important role in stepping up agricultural production. It is generally noticed that the farmers are not using recommended level of farm resources with proper technology. This results in to a gap between the potential yield and the actual yield. As such there is a need to evaluate the resources use efficiency in production of fenugreek on different size-groups of farms in the state.

Keeping the above facts in view, the present study entitled "An economic analysis of production and marketing of fenugreek in Rajasthan" is therefore, undertaken as a modest attempt in this direction with the following specific objectives.

1.1 Objectives

The specific objectives of the study are:

1. To estimate the growth rates and instability in area, production and productivity of fenugreek in the state of Rajasthan;
2. To estimate the cost of cultivation of fenugreek in the state of Rajasthan;
3. To analyze the marketing costs incurred and margins earned by different agencies involved in the marketing of fenugreek in the state of Rajasthan, and
4. To study the resource use efficiency of fenugreek crop in the state of Rajasthan.

1.2 Plan of thesis

This study is divided into five chapters. Chapter first deals with the introduction, importance and objectives of the study. The review of literature is presented in chapter second. Third chapter deals with the methodology used in the present study. The results of the study and their critical discussion are given in chapter fourth spreading over four sections. Summary, conclusions and policy recommendations of the study are presented in chapter fifth followed by bibliography and appendices.

Chapter II

REVIEW OF LITERATURE

The comprehensive and critical review of past research studies/literature provides a sound base for any scientific investigation. Its main functions, apart from determining the work done before and to assist in delineation of problem areas, are to provide an insight into the methods and procedure adopted by other scientists to suggest changes there in and is also a basis for interpretation of the findings. In this chapter an attempt has been made to present brief and lucid details of the available literature on production and marketing aspects of seed spice crops. The review is presented below under the following heads:

(1) Growth and instability in area, production and productivity of spice crops

(2) Cost of cultivation of spice crops

(3) Marketing costs and margins in marketing of spice crops; and

(4) Resource use efficiency of spice crop in the state of Rajasthan.

2.1 Growth rates and instability in area, production and productivity of spice crops

In this section studies related to the growth and instability in area, production and productivity of different spice crops in the states of India have been reviewed.

Sharma (1988) conducted study on trends and variability in commercial crops of India. It was reported in the study that yield variability was high for cotton, oil seeds, spices and potato crops in the period 1966-67 to 1984-85 as compared to the period 1949-50 to 1965-66. Area variability was more in tobacco, sugarcane, potato, spices and jute crops compared to the yield variability in most of states of the Indian union.

Shad *et al.* (1989) have concluded the disaggregation of trends in production and productivity of ginger under the plan in Himachal Pradesh. He reported that the area under the ginger recorded the highest compound growth rate in the fourth five year plan (7.90 per cent) followed by the first five year plan (6.93 per cent). In the fifth and third five year plans there has been a significant increase in the area under ginger. The area increased by 4.54 per cent and 3.90 per cent per annum in the fifth and third plans followed by the annual plans by 2.23 per cent per annum. The lowest compound growth rate was in the sixth plan when area increased at a compound growth rate of 0.38 per cent per annum only. It was further observed that the production of ginger increased at a compound rate of 8.54 per cent per annum in the fifth plan followed by 8.07 per cent annual increase in the sixth plan. The production of ginger also increased significantly during the first and third five year plans at annual compound rate of 7.93 per cent and 7.45 per cent, respectively. The lowest growth rate in production has been recorded in the annual plans and the fourth five year plan by 0.05 per cent and 0.77 per cent, respectively.

Thomas *et al.* (1989) have conducted study on development of seed spices in India and observed that the average annual area under cultivation of coriander, fennel, cumin and fenugreek crops during the period 1961-62 to 1985-86 was 3.54 lakh hectares with a production of 1.5 lakh tones. Area under these seed spice crops during 1988-89 has been 6.22 lakh hectares with a production of 3.18 lakh tones. It was further concluded from the study that the total growth has been 76 per cent for area and 112 per cent for production with an annual growth rate of 2.3 per cent for area and 2.9 per cent for production for these seed spice crops during the last two and a half decades in the country.

Bakawat (1991) conducted a research on economics of important seed spices cultivation in Jaipur district of Rajasthan. He estimated the growth rates in area, production and productivity of

fenugreek and cumin seed in the state of Rajasthan, in Zone III A and in Jaipur district for the period 1967-68 to 1998-99. It was observed from the study that production of fenugreek increased in the state by 1.40 per cent due to increase in productivity (1.20 per cent per annum). The area under fenugreek although showed a positive growth rate (0.50 per cent per annum) but it was not significant. Production of cumin seed increased in the state by 5.30 per cent per annum which contributed solely by the increase in area (5.20 per cent per annum) under the crop. There was positive rate of growth for the productivity (0.20 per cent per annum) but it was not significant. In the Zone III A, production of fenugreek increased by 5.50 per cent per annum. Area under the crop was increased by 4.30 per cent and productivity by 1.10 per cent per annum. Increase in production of fenugreek was mainly due to increase in the area under the crop. During the study period cumin seed crop exhibited a negative but non-significant growth rates for area, production and productivity. In the Jaipur district, production of fenugreek increased by 5.50 per cent per annum. This increase in production was mainly contributed by the increase in acreage under the crop (4.40 per cent per annum). Increase in productivity also contributed something to the production of fenugreek but was not significant. Cumin seed crop exhibited a significant negative growth in area (-4.61 per cent per annum) and production (-5.31 per cent per annum) and non-significant negative growth rate in productivity (-0.74 per cent per annum).

Gothwal (1991) have conducted a study on an economic analysis of growth rates and instability in area, production and productivity of major spice crops in semi-arid eastern plain zone (zone III A) of Rajasthan. He estimated growth rates for area, production and productivity of cumin seed crop in the state of Rajsthan during 1973-74 to 1989-90. It was observed from the study that area under cumin seed recorded a negative growth in Jaipur (-9.76 per cent) and Tonk districts (-5.31 per cent) of Zone III A. The overall growth rate for the state as a

whole has been 3.44 per cent per annum. Production growth rate was significant in Ajmer district (7.62 per cent per annum) and for the state as a whole (4.79 per cent per annum). Growth in productivity of cumin seed in Ajmer district and Zone III A as a whole was 6.05 per cent and 2.40 per cent per annum, respectively. It was concluded from the study that variability in production of cumin was highest in Jaipur district (95.07 per cent) followed by Tonk district (75.90 per cent) and Zone III A (57.70 per cent). The study brought out that the variability in area (69.69 per cent) and productivity (43.91 per cent) was highest in the Tonk district and lowest in area (43.53 per cent) and productivity (21.87 per cent) for the state as a whole. It was also revealed that in seed spices production instability was more in comparison to area and yield instability.

Vijay (1992) examined the growth rates for coriander crop in Rajasthan state during 1980-81 to 1989-90 and found that production of coriander in the state increased at a compound growth rate of 10.79 per cent per annum. This increase has been both due to the increase in area under the crop as well as by the increase in productivity. Area under coriander crop increased at a compound rate of 6.69 per cent per annum and productivity by 3.77 per cent per annum during the study period. Among the five major coriander producing districts of the state, production of coriander increased in the four districts viz. Jhalawar, Kota, Bundi, and Chittorgarh by 15.21, 9.95, 10.97, 17.56 per cent per annum, respectively. In these districts, the increase in production was there because of the increase in area under the crop which was 9.52 per cent in Jhalawar district, 6.45 per cent in Kota, 4.73 per cent in Bundi and 13.92 per cent in Chittorgarh district. Productivity of the crop increased in Jhalawar (5.14 per cent) and Bundi (5.96 per cent), Kota (3.29 per cent) and Chittorgarh (3.19 per cent) districts. Growth rates for area, production and productivity of coriander crop for the Alwar district were non-significant. It is interesting to note that there has been no significant increase in productivity of the crop even in the

Kota district which commands about half of the coriander production of the state.

Singh (1994) conducted a study marketing of fenugreek in Jaipur district of Rajasthan. It was reported that compound growth rates of area, production and productivity of fenugreek crop in the state during the period 1978-79 to 1992-93 declined by 1.82, 2.27 and 0.46 per cent per annum, respectively. However area and productivity growth rates were non-significant. Production of fenugreek in none of the selected districts (Jaipur, Chittorgarh, Pali, Sikar and Jhalawar) was recorded significant growth rate. Productivity of fenugreek recorded a negative growth in Sikar (-3.395 per cent per annum) and Jhalawar (-1.757 per cent per annum) district and positive growth in Chittorgarh (4.713 per cent per annum) district but non-significant. In other districts productivity has not shown any significant change. Area recorded a negative growth rate of 7.5 per cent per annum in Pali district. Only in Sikar district, area under the crop increased by 2.38 per cent per annum during the study period.

Meena (1995) estimated the variability of cumin seed in Rajasthan state during 1974-75 to 1993-94 and reported that variability of the crop ranged between 50 to 115 per cent for area, 45 to 120 per cent for production and 20 to 70 per cent for productivity in the state and in the selected districts. Among the cumin growing districts of Rajasthan, variability in area, production and productivity of cumin seed was the lowest in Jalore district (52.37, 45.23 and 23.75 per cent) and the highest in Nagaur district (113.65, 118.37 and 66.40 per cent). It was concluded from the study that production of cumin seed in Rajasthan state increased at a compound growth rate of 4.75 per cent per annum. This increase in production was solely due to the increase in area (4.56 per cent per annum) under the crop. Productivity of cumin crop has not shown any change over time in the state. Among the selected districts of the state, area and production increased in the

districts of Ajmer, Barmer, Jalore and Jodhpur, whereas, productivity was increased only in Ajmer district. There has not been any increase in area, production and productivity of cumin crop in Nagaur and Pali districts.

Kumar and Sankaran (1998) has analysed instability in turmeric production in India during period-I (1970-71 to 1979-80) and period-II (1980-81 to 1989-90) in states of India. The area instability was lower in the second period as compared to the first period. The only exception to this trend was there in the Maharashtra. Production instability was slightly higher in the first period at the national level. State wise analysis showed a mixed pattern. Yield instability was higher in second period at the national level as well as in the state of Orissa and Assam. Andhra Pradesh, Tamil Nadu, Maharashtra and Kerala experienced a reverse trend. The study further revealed that the yield instability at all India level increased marginally during the second period over the first period. The decrease in area instability was more than the increase in yield instability resulting in the overall reduction of production instability.

Sharma (1998) has conducted a study on seed spices research in Rajasthan-achievements and prospects and observed that during the year 1995, Rajasthan state contributed 40-50 per cent (137675 ha.) of the total area of coriander, 40-50 per cent (125809 ha.) of cumin, 80-85 per cent (32905 ha.) of fenugreek and 15-20 per cent (2721 ha.) of fennel with a production of 116387, 36033, 40759 and 1997 tonnes, respectively. The study further highlighted that cumin crop is cultivated in the state mainly in the districts of Jalore, Barmer, Tonk, Nagaur (Merta), Ajmer and Bhilwara.

Singh (1999) concluded from his study on an economic analysis of production and marketing of cumin in Nagaur district of Rajasthan that the coefficient of variation for production of cumin seed in the state of Rajasthan was 58.34 per cent for the period 1972-73 to 1997-98. For

the selected districts, the coefficient of variation varied from 68 to 105 per cent during the study period. The coefficient of variation for cumin seed production has been higher for the selected districts compared to the state as a whole which showed that fluctuation in production was more in the selected districts compared to the state as a whole. The area instability for cumin crop was also found to be higher for the selected districts compared to the state as a whole (except for Jalore district). The coefficient of variation in productivity for the state has been 30.84 per cent during the study period. Area under cumin crop in the state was increased by 7.15 per cent per annum. In the selected districts, it recorded positive and significant growth (4.47 to 12.20 per cent per annum). On the other hand, Productivity of the crop was declined by 2.27 per cent per annum in the state. Productivity growth was negative in the entire selected cumin growing district but significant only in Barmer, Jalore and Nagaur districts.

Mishra (2003) observed that the magnitude of instability in production of coriander seed was higher (ranging from 39.58 to 130.09 per cent) as compared to area and productivity in the selected districts as well as in the state as a whole during the entire study period (1972-73 to 1999-2000). The area yield co-variance was dominant source of variance in production in selected district (except Jhalawar) and state which ranged from 37.59 per cent to 41.59 per cent. The instability in production of cumin was higher (ranging from 39.58 to 195.45 per cent) as compared to the instability in both area and productivity, in selected districts as well as in the state as a whole. Area variance was the dominant source of variation in production in Barmer (44.65 per cent) and Pali (37.58 per cent). While, the area-yield co-variance was the dominant source of variation in production in the district of Jalore (39.59 per cent), Nagaur (36.15 per cent), Jodhpur (38.02 per cent) and the state as a whole (39.25 per cent). He also reported that the production of coriander increased significantly in the districts of Jhalawar (8.85 per cent) and Chittorgarh (4.44 per cent) and the state

as a whole (6.02 per cent) during 1972-73 to 1999-2000. Production of coriander in Jhalawar district increased due to the increase in area (8.15 per cent), while in the state it increased due to the increase in both area (3.75 per cent) and productivity (2.17 per cent). Production and area of cumin increased significantly in Barmer (8.5 and 9.2 per cent), Nagaur (11.82 and 11.16 per cent) and Jodhpur (10.51 and 10.83 per cent) districts and in the state as a whole (6.50 and 6.60 per cent) during the entire study period. There was no significant increase in productivity of both the crops, i.e., coriander (except Bundi) and cumin during the study period.

Varghese (2004) conducted a study on trend analysis in area, production productivity and price behaviour of cardamom in Kerala for the period 1970-71 to 2002-03. The Log-quadratic regression function was used for data analysis. He found that the annual trend growth rate in area, production and productivity of cardamom was -1.216 per cent 4.14 per cent and 5.51 per cent respectively indicating that cardamom area was decreasing at diminishing rate and the production increasing at increasing rate. It means that the production of cardamom had an accelerating trend, like production, the productivity of cardamom, too, recorded an upward trend.

Kumawat and Meena (2005) conducted a study on growth and instability in area, production and yield of major spices crops in Rajasthan during pre TMO period (1967-68 to 1985-86) and post TMO period (1986-87 to 2000-10). The compound growth rates of area, production and yield of spice crops were worked out by using the exponential function. They reported that in Rajasthan vis-a-vis India almost all the spices registered significant growth rates in their production in Rajasthan as well as in India during the entire study period mainly due to significant increase in both area and yield during post TMO period. The significant increase in production in coriander was mainly due to significant increase in yield where as in cumin and

fennel, it was due to significant increase in area. In fenugreek, the increase in production was the result of increase in both area and yield. In case of chilli and garlic, both area and yield at the national level and only area at the state level played significant role in increasing the production. They observed that in majority of the spices crop the instability in area and production increase during the post-TMO period over the pre-TMO period in Rajasthan and India as well. However, the magnitude of coefficients of variations was more pronounced at the state level then at the national level. In general, yield instability, on the other hand, decreased during the post-TMO period over the pre-TMO period in both Rajasthan and India. As regards sources of variance of production, area variance played a dominant role in case of coriander, cumin, fennel and garlic. Yield variance pre-dominantly destabilized the production of chilli in Rajasthan and of fenugreek in India. In majority of spices, area-yield covariance helped stabilize the production in Rajasthan as well as in India.

Thumar *et al*. (2006) conducted a study on garlic for the state of Gujarat and its selected districts for the period 1985-86 to 2001-02. The results revealed that the compound growth rates of area, production and yield was positive for Junagarh and Rajkot districts as well as for the state as a whole. But these were statistically significant only for Junagarh district (13.21 per cent). In case of Jamnagar district, the compound growth rate was negative but non-significant (-2.99 per cent) for area.

Rajur (2008) estimated the extent and sources of instability in chilli in Gulbarga, Raichur and Bijapur districts and Karnataka state as a whole during two sub periods i.e. 1991 to 1997 and 1998 to 2004. He concluded that the coefficient of variation for area was found to be higher for the state (69.18 per cent) than for the selected districts namely Raichur (48.07 per cent), Gulbarga (42.16 per cent) and Bijapur (32.49 per cent). In case of production, it was higher for

Raichur district (90.55 per cent) as compared to Bijapur (81.36 per cent) and Gulbarga district (76.96 per cent), while for the whole state, it was less, compared to all the three districts. As far as the productivity of chilli is concerned the coefficient of variation was little higher in Raichur district (73.12 per cent) as compared to Bijapur (61.24 per cent), Gulbarga (53.08 per cent) and even the state of Karnataka state as a whole (68.18 per cent). The exponential function was employed to study the growth rates. The results revealed that in Karnataka state, production of chilli recorded significant growth increased significantly in period I (1991- 1997) mainly due to considerable increase in the area during period I. A district-wise study of growth rates of chilli showed that area and production registered high growth in all the selected districts in general except Bijapur. The growth rate in yield of chilli increased at all locations in period I as well as for the overall study period. Their growth in general was found to be lower due to sudden outbreak of pest and diseases, indicating the scope for improving the productivity of chilli.

Singh (2008) analyzed the compound growth and instability in area, production and productivity of major spices in India during 1970 to 2003. He concluded that the all the studied spices registered significant growth rate in their production in India during entire study period mainly due to significant increase in both area and yield. Area registered maximum positive growth of 2.71 per cent in black pepper followed by turmeric (2.56 per cent). The compound growth rate in area under coriander, cardamom and chilli was observed to be only 0.93, 0.61 and 0.49 per cent, respectively. The production registered highest positive and significant growth rate of 6.01 per cent in turmeric followed by cardamom (4.47 per cent), black pepper (3.97 per cent), coriander (2.83 per cent) and chilli (2.54 per cent). In case of all spices the yield registered positive growth rate. It registered highest yield growth in cardamom 3.77 per cent followed by turmeric (3.47 per cent), chilli (2.03 per cent), and in coriander (1.34 per cent) and black pepper (1.31

per cent) lowest one. He concluded that the variability in production was more as compared to that in yield and area. The coefficient of variation under turmeric was observed to be maximum (59.10 per cent) followed by black pepper (41.60 per cent) and cardamom (40.33 per cent). In case of productivity maximum variability was observed in cardamom (38.81 per cent) followed by turmeric (38.46 per cent). In case of area, the variability of black pepper was higher (28.97 per cent) than turmeric (25.49 per cent) and coriander (21.91 per cent).

Havaldar *et al.* (2011) revealed that the area, production and productivity under chilli decreased in the North Karnataka with highest instability across all the districts of the state and also there was wide range of variation in the area, production, and yield. This was mainly because of changing in cropping pattern of the farmer, varied rainfall pattern, severe influence of pest and diseases and also widely influenced by the fluctuation in the prices of chilli.

Acharya *et al.* (2012) have estimated growth in the area, production and productivity of different crops in Karnataka using the compound growth function. The necessary secondary data were collected for a period of 26 years from 1982-83 to 2007-08. Growth rates showed a significant positive growth in area under pulses, vegetables and spices and fruits and nuts while cereals showed significant negative growth. The area under jowar, bajra, ragi and minor millets are experiencing a substantial annual decrement. The area under rice has recorded a mild annual increment. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly the production of cereals, pulses, vegetables and fruits showed a significant positive growth. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits. Productivity of oilseeds recorded moderately positive growth. The productivity of commercial crops registered

insignificant positive growth and for vegetables the growth in productivity was insignificant and negative.

Bairwa *et al.* (2013) have concluded from the study that productivity of fruits is almost stagnant over last decade and area and production has been almost double from 1991-92 to 2007-08. Citrus, grapes, papaya and sapota are showing higher growth rate in production. Banana, papaya litchi apple and sapota have shown higher instability in production and banana, citrus, mango and papaya have shown higher change in production from 1991-92 to 2007-08. Relative share of mango in total export from India is continuously decreasing and that of grapes is increasing year by year.

Dhakre *et al.* (2013) have presented a study related to the growth and instability of area, production and productivity of vegetables in west Bengal. The study is based on secondary data of vegetables pertaining to various vegetables as a whole for the period of 1997-98 to 2010-11. It has been observed that the growth of area, production and productivity for all vegetables registered are positive and statistically significant and instability index for all the vegetables are also positive, which indicate that there is less risk for cultivation in the state. Compound growth rate in case of productivity for cabbage and cauliflower has been noticed negative but significant. The increase in production is due to increase in area as well as interaction of area and productivity of vegetables in the state.

Jagannath *et al.* (2013) investigated the growth rate and instability of area, production and productivity of three major crops viz. jowar, cotton, soybean. The study was based on secondary data for the period of 23 years (1984-85 to 2006-07) for the districts viz. Buldana, Yavatmal, Akola, Amravati and Amravati division as a whole of western Vidarbha of Maharashtra. The study revealed that overall period the compound growth rate for all most all the district in Ambravati division were declined by 3 per cent per annum in area as

well as production for the Jowar crops. The growth rate of cotton in all most all districts of Ambravati division and also division as a whole was found to be drastically decline in period-II as compared to period-I, except Akola district. The growth rate were also worked out and found to be positive and significant in all districts of Ambravati division in area, production and productivity of soybean. The co-efficient of variation and instability index with regard to both area (8.43 and 10.49 per cent) and productivity (20.29 and 12.40 per cent) were lowest in Yavatmal district among Ambravati division.

Singh *et al.* (2013) estimated growth rate of area, production and productivity of fruit crops in Jharkhand. The study revealed positive growth rate in all selected fruits (litchi, mango, guava and banana) except citrus. It has also been observed that among periods, IV period (2005-10) was found to be favorable for litchi, mango and guava particularly, while negative growth rate was found in banana and citrus. The productivity growth rate was also observed to be positive nearly 2.56 per cent, 2.56 per cent, 1.50 per cent, 5.21 per cent respectively in litchi, mango, guava and banana. This trend resulted in positive growth in volume of these fruits in the state. The study further revealed that variability in area was highest in litchi (71 per cent) due to shifting in area from other fruit crops in the litchi area followed by mango and banana respectively. Similarly variability in productivity was observed to be high in banana and there was no considerable variation in the yield of other fruit crops.

Immanuelraj *et al.* (2014) have conducted a study focused on Maharashtra's onion growth and instability. Erratic weather, volatile market price and lack of adequate storage and market infrastructure caused instability in production through preventing the farmers in taking the optimal decision on allocation of area and raising farm productivity. Study revealed that onion production in Maharashtra is mainly driven by acreage allocation, but in the long-run increasing area under onion

may not be feasible without reducing the area of other important crops. The major reason for the instability of onion production after period from 1990-91 to 1999-00 was mainly due to area instability and partly due to yield instability.

Saleems *et al.* (2014) conducted a study with a view to analyzed growth and trend in area, production and yield of major crops of Khyber Pakhtunkhwa. A time series data from 1980-81 to 2011-12 (32 years) of major crops (wheat, maize, rice and sugarcane) were collected. The compound growth rate as well as trend analysis indicated that the area under wheat crop has decreased over the time due to shifting of area to other rabi crops. The production of wheat during 1981-85 to 2010-12 was increased due the corresponding increase in per hectare yield of wheat crop in Khyber Pakhtunkhwa. The results show that area, production and yield of maize was increased over the time the reason is that more area was brought under hybrid and improved open pollinated maize varieties. The area under rice crop has decreased whereas their production increased due the corresponding increase in per hectare yield of rice crop. It was revealed from the results that area, production and yield of sugarcane crop was increasing at a rate of 0.24 per cent, 0.85 per cent and 0.60 per cent per annum, respectively.

Thus, it may be concluded from the studies reviewed in this section that Rajasthan and Gujarat are the main seed spices producing states of the country as these together accounted for 90 per cent of the country's total area and production. Rajasthan state contributed more than 80 per cent of total area and production of the country. A comprehensive view of growth rates in area, production and productivity of spice crops during various periods as reported in various studies reveals that India recorded a positive growth. Positive growth has also been there in all the seed spices in Rajasthan.

A comparative view of the extent of instability as pointed out by the different studies revealed that production instability in spice crops

was more pronounced as compared to area and yield instability. Rajasthan state experienced high magnitude of instability in production of fenugreek crop, followed by area and yield instability. Most of the studies reviewed in this section used the technique of coefficient of variation as a measure of instability.

2.2 Cost of cultivation of spice crops

Bakawat (1991) has conducted a study on economics of important seed spices cultivars in Jaipur district of Rajasthan and observed that the overall estimated cost of cultivation of fenugreek was ` 6217.02 per hectare during 1989-90. The breakup of overall total cost shows that 24.37 per cent, 20.30 per cent, 16.72 per cent and 15.47 per cent of the total cost was contributed by rental value of owned land, value of family labour, interest on fixed capital and irrigation charges, respectively. The cost of cultivation per hectare was the lowest (` 6014.10) on semi-medium and the highest (` 6576.03) on small sized farms. The operational cost exceeded the overhead cost on all the four size groups of farms. On an average operational cost contributed 52.34 per cent in total cost. It varied from 50.03 per cent on large sized farms to 54.59 per cent on semi-medium sized farms. Among the size groups, the contribution of overhead cost to total cost was highest (49.97 per cent) on large sized farm and lowest (46.06 per cent) on medium sized farms. On an average per hectare cost A_1, A_2, B_1, B_2, C_1 and C_2 were ` 2399.86, 2399.86, 3439.52, 4954.82, 4701.67 and 6217.02 respectively during the same period. The overall cost of production of fenugreek has been ` 493.62 per quintal. Cost of production varied from ` 453.94 on large sized farms to ` 549.38 on small sized farms. On an average gross income per hectare was ` 7608.00 which was lowest (` 7410.00) on semi-medium and highest ` (` 7992.00) on large sized farms. Net income per hectare received by the farmers varied from ` 605.07 (small size) to ` 1945.55 (large size) with

an average of ` 1355.53. On an average return per rupee was ` 1.23, it varied from ` 1.09 on small sized farms to ` 1.30 on large sized farms.

Peter (1995) conducted a research work on trends in production, cultivation, processing and storage of chillies, herbal and miscellaneous spices. It was reported that the cost of cultivation of chillies increased overtime due to the high cost of labour and use of increased quantity of plant protection chemicals. The hired human labour accounted for 18-22 per cent of the total cost of cultivation in Andhra Pradesh. The cost of cultivation was ` 13287 on small and `13762 on large sized farms with an overall average cost of ` 13528 per hectare.

Kumar (1996) has reported the economic analysis of garlic production and marketing in Kurukshetra district of Haryana. It was observed from the study that total cost of cultivation of garlic was ` 34966.81 per hectare. Gross returns from garlic cultivation were ` 64993.21 per hectare from an average yield of 9810 quintal. The cost of production of garlic was `306.07 per quintal and net returns from cultivation of garlic was `30026.40 per hectare during the period 1994-95.

Gaikwad *et al.* (1998) estimated the cost of cultivation of turmeric crop in Maharashtra state during 1995-96 and reported that human labour, seed (rhizomes), manures and fertilizers and imputed value of land were the major cost items accounting for 8.68, 42.61, 8.03 and 22.93 per cent of the total costs, respectively. They further reported that the overall cost A, cost B and cost C were `94648.90, `125836.18 and `132415.63 per hectare, respectively. Gross income was positively associated with the farm size while net income showed reverse trend with the farm size.

Singh (1999) has reported a study on an economic analysis of production and marketing of cumin seed in Nagaur district of Rajasthan. It was concluded from the study that per hectare cost of cultivation (cost C_2) has been lowest (`16152.00) on large sized farms and was highest (`18195.65) on small sized farms with an overall average of `17178.98 during the period 1997-98. The breakup of overall total cost shows that 32.06 per cent, 23.04 per cent, 10.56 per cent, 5.94 per cent and 5.89 per cent of the total cost was contributed by rental value of owned land, human labour, depreciation, seed and machine labour, respectively. The operational cost exceeded the overall cost on all the four size groups of farms. On an average operational cost contributed 52.88 per cent to the total cost. Among the size groups, the contribution of operational cost to the total cost varied from 50.30 per cent on medium sized farms to 59.20 per cent on small sized farms. On an average per hectare cost A_1, A_2, B_1, B_2, C_1 and C_2 were `8098.05, 8098.05, 8866.17, 14373.27, 11671.88 and 17817.98 during the same period. The overall cost of production of cumin has been `3325.66 per quintal. Cost of production varied from `3076.57 on large sized farm to `3567.77 on small sized farms. On an average per hectare gross income was `27535.49, which was lowest (`24735.00) on small sized farms and highest (`30901.50) on large sized farms. Net income per hectare of cumin cultivation ranged from `6539.35 (small sized farms) to `14749.50 (large sized farms) with an average of `10356.51. The overall farm business income, return over variable cost and family labour cost was `19437.43, `18450.51 and `13162.22, respectively. Per rupee return from cumin cultivation was highest (Rs 1.91) on large sized farms and was lowest `1.36 on small sized farms with an average of `1.61 during the study period.

Singh (2001) conducted a study entitled “an economic analysis of fennel production in Sirohi district of Rajasthan” and reported that the operational cost of production of fennel crop in the study area was `32226.36 per hectare in 2000-2001, out of which about 33 per cent cost was accounted for human labour Among other remaining cost items, important ones were irrigation and fertilizer. Gross income from the production of fennel crop was estimated at `46964.15 and net income over variable cost was `14737.79 per hectare. The returns per rupee invested were `1.46.

Doke (2002) conducted a study which was exclusively based on primary data collected from Bhadravati Taluka of Chandrapur district of Maharastra (1994-95). Out of six villages 60 turmeric growing farmers were selected randomly on the basis of area under it. The average total per hectare cost of cultivation ` 54249.00 .It was observed that 67.54 per cent (`36637/ha) of the total cost was accounted for by Cost ‘A’ (variable cost) 32.46 per cent (`50470.15/ha) was imputed cost i.e. fixed cost and 6.93 per cent (`3778.85/ha) was observed as the average value of unpaid family labour. A large portion of the total cost (as variable cost) i.e. 1/3 cost (`17690.73 or 32.61 per cent) was constituted by the cost of seed suckers and 1/4 cost (`12852 or 23.69 per cent) was constituted by cost of human labour. He concluded that turmeric cultivation was profitable under the existing farm level technology.

Mishra (2003) noted the cost of cultivation of coriander to be ranging from ` 19251.81 to `25893.49 per ha, while in cumin crop total cost of cultivation ranged from `22933 to ` 35726.36 per ha. Human

labour cost accounted for major share in total operational cost for coriander (35.05 to 46.16 per cent) and cumin (23.99 to 45.44 per cent). The average cost of production of coriander seed was ` 1057.50 per quintal. Net income per hectare of coriander cultivation ranged from ` 12505.50 to ` 23327.51 and in cumin cultivation from ` 29466.47 to ` 61919.01 on different sized farms. The return per rupees with an average was ` 1.67 in coriander crop and in cumin crop ` 2.36.

Shah and Zala (2006) concluded that average cost of cultivation of ginger a highly capital intensive crop was ` 202260/ha. The information was based on the data collected from 128 ginger growers spread over 16 villages of four talukas, covering two ginger-growing districts of middle Gujarat region during 2004-05. The average paid out cost was found as ` 157368. The cost on seed was found to be the highest (64129/ha) being 32 per cent of total cost, followed by human labour (18.04 per cent), organic manures (10.79 per cent), and irrigation charges (10.32 per cent).Human labour requirement for ginger cultivation was found to be of 730 man days /ha. The average yield of ginger in the study area was found 133 q/ha. The overall gross return, farm business income, family labour income and farm investment income were estimated to be ` 382600, ` 225230, ` 217100 and ` 203139 per hectare, respectively. The net profit per hectare over cost was found as ` 180338 and input-output ratio as 1:1.97 on the basis of cost C2 for all the farms. The over all cost of production was found as ` 1566 per quintal which was much lower than the market price (2000-5000 per quintal) during the study period, indicating that the ginger cultivation is quite remunerative in the area even at lowest price.

Purohit (2007) in his study entitled “analysis of cumin production in Jodhpur district of Rajasthan”, observed that per hectare cost of

cumin cultivation ranged between ` 13265.11 on small farms to ` 12346.67 on large farms with an overall average of ` 12957.88 per hectare. Cost $A_1$, $A_2$, $B_1$, $B_2$, $C_1$, $C_2$ and $C_3$ were worked out to be` 9512.07, ` 9738.25, ` 10273.03, `11299.21, ` 11931.70, ` 12957.88 and `14253.66, respectively. Cost of production for cumin varied between `2494.27 per quintal on large farms to ` 2840.49 per quintal on small farms with an overall average of ` 2737.25 per quintal. On an average, the farm business income and family labour income were ` 23633.25 per hectare and ` 21876.12 per hectare, respectively. Net income in cumin crop ranged between ` 19424.89 to ` 22303.33 per hectare on different sized farms and on an overall basis, the net income was ` 20217.45. Cultivation of cumin crop was a profitable proposition in the study area.

Roy *et al.* (2007) examined the average cost of cultivation and net returns for fenugreek, fennel, black cumin, ajwain and coriander. Findings showed that all the seed spices offered positive and good returns. Highest net returns per bigha (=$1/7^{th}$ of a hectare) were ` 4,295 obtained from black cumin followed by fennel (` 1,944), fenugreek (` 1,820), coriander (` 1,565) and ajwain (` 1,470).

Rajur *et al.* (2008) studied economics of chilli production in the state of Karantaka during 2005-06. In the study multistage random

sampling technique was adopted in designing sampling frame for the study. In first stage, upper Krishna project command area was selected purposively. In second stage three districts viz., Gulbarga (37.36 per cent), Raichur (24.85 per cent) and Bijapur (27.99 per cent) were selected on the basis of the highest area under chilli. In third stage two talukas and 20 farmers from each taluka were selected at random. The results showed that cost A_2 accounted for 30.70 per cent in Gulbaraga, 28.81 per cent in Raichur and 32.30 per cent in Bijapur district. Cost B_2 accounted for 47.09 per cent, 44.54 per cent and 50.25 per cent in the respective districts. In cost C_3 use of family labour was more in case of Bijapour district than the Gulbarga and Raichur districts due to non-availability of hired labour during peak period. Cost of cultivation per hectare was highest in Raichur district (` 34955.50) followed by Gulbarga (` 33870.40) and Bijapur (`28836.26) districts.

Singh *et al.* (2009) conducted a study on economics of production and supply chains of high value enterprises with special reference to chillies in Punjab. The returns over variable costs for red chilli (sathi) in Amritsar district were found to be ` 19504 per acre in the case of small farmers. The corresponding figures for the semi-medium, medium and large farmers were ` 21227, ` 20824 and ` 22268 per acre, respectively. The returns over variable cost were estimated to be ` 27296 per acre in the case of small farmers in Patiala district. The corresponding figures for semi-medium, medium and large farmers

were estimated to be ` 28989, ` 31561 and ` 31448 per acre, respectively in above said districts.

Gote *et al.* (2010) conducted a study on 90 farmers of Palanpur and Deesa talukas of Banaskantha district of Gujarat state for estimating the cost of groundnut production. Multistage stratified random sampling technique was adopted to select the farmers. The requisite data was collected through personal interviews with the farmers with the help of pre-tested comprehensive schedules related to Kharif groundnut crop for the year 2005-06. It was calculated that the average cost of cultivation and net income per hectare of groundnut crop was `22526 and `3581, respectively for the year 2005-2006. The total cost and gross return over Cost-A, Cost-B, Cost-C1 and Cost-C2 of small farmers was highest and decreased with increase in the size of holding.

Sridhara (2010) studied the cost of production of chilli under contract farming in Bilagi and Mudhol taluks of Bagalkot district in Karnataka. The primary data were collected from 127 chilli farmers. The result revealed that per acre cost of chilli cultivation was ` 38721.36, ` 41238.37 and ` 39882.74 in Bilagi, Mudhol and overall study area, respectively. The per acre yield of chilli obtained was 1122.98, 1088.67 and 1096.49 Kg in Bilagi, Mudhol and overall study area, respectively.

Niranjan *et al.* (2011) conducted a study on cost analysis and profitability of major rabi and kharif crops in Madhya Pradesh during the year 2007-08. It was concluded the cropping intensity was on an average, 167.66 and 143.22 per cent on adoption and non-adoption farm situation respectively. The average gross return from cultivation of paddy on adopted farm was found to `20138 per hectare which gave the net return to the average `8926 per hectare. On the other hand the

average gross return from non-adopted farms of paddy cultivation was on average `17031 with the net return of `7300 and 1.75 of cost benefit ratio respectively. The average gross return from cultivation of wheat on adopted farms was found to be `26926 per hectare which gave net return to the average `14056 per hectare. The average benefit cost ratio of wheat cultivation was found to be 2.08. On the other hand, the gross return from non-adopted farms of wheat cultivation was found to on an average `22214 with the net return of `11072 and 1.99 of cost benefit ratio respectively. In case of gram the farm income of adopted farms was `11955 per hectare against only `9658 of non-adopted farms.

Nirmala *et al.* (2013) have conducted a study on economics and major constraints in rice cultivation in Kaithal district of Haryana during 2007-08. Total costs in rice production amounted to be ` 33778.68/ha. Average yield was 4.99 t/ha. Benefit-cost ratio worked out to be 1.27. Pests and disease incidence, lack of remunerative price and labour shortage were the major constraints in rice production. It was concluded that machine labour and human labour constituted major costs in the total variable costs.

Sreedhara *et al.* (2013) have analysed economics of capsicum production under protected conditions in Northern Karnataka. The cost of establishment of capsicum production under protected condition was ` 251109 per unit (0.25 acre). The total cost of cultivation of capsicum production under protected conditions was ` 55080 per units. The total variable cost was ` 20374 per unit. Among the variable costs, the labour cost was highest (` 10291), followed by expenditure on material cost (` 8487). Among the total cost of cultivation, the proportion of total fixed cost was highest (` 34707) compared to total variable cost (` 20373). The total yield of capsicum production under protected

conditions was 5.50 tons per unit. The total returns and net returns from capsicum production under protected conditions were ` 54734 per unit and ` 15279 per unit, respectively.

From the studies reviewed under this section, it can be concluded that the cost of cultivation of spice crops was the highest on small sized farms and lowest on large sized farms. Important cost components were human labour, machine labour, bullock labour and seed. The overall gross and net income was found to increase with the increase in farm size.

2.3 Marketing costs and margins of spice crops

Lohar (1991) conducted a study on marketing of turmeric in Sangli market of western Maharashtra for the period from 1978-79 to 1988-89. He noted the per quintal total marketing cost of turmeric to be ` 44.29. The share of commission agent was 40.08 per cent in consumers rupees followed by transportation charges (23.75 per cent) and the value of gunny bags (19.69 per cent). Octroi shared the minimum cost (1.42 per cent).

Agarwal and Sharma (1992) conducted a study on marketing of red chillies in Rajasthan. They found that producer's share in consumer's rupee was 51.47 per cent when farmers marketed chillies in wet form compared to semi-dried (55.43 per cent) and dried forms (56.44 per cent) in the year 1989-90. Marketing cost as per cent of consumer's price was higher when chillies were marketed in wet form (13.05 per cent) compared to semi-dried (11.46 per cent) and dried (7.80 per cent) forms because of higher transportation cost for wet and semi dried ones. Marketing margins were 35.48, 33.11 and 35.76 per cent for wet, semi-dried and dried chillies, respectively. These margins were shared both by wholesaler and retailers. Further, retailers earned higher margin compared to wholesalers due to low turnover.

Agarwal and Vijay (1993) in their study on marketing of coriander in Kota district of Rajasthan during the year 1992 reported that the share of producer farmer in consumer's rupee has been 65.86 and 65.97 per cent in channel-I (producer-retailer-consumer) and channel-II (producer-wholesaler-retailer-consumer), respectively. Marketing margin carried by the retailer has been 25 per cent of consumer's price in channel-I. In channel-II, marketing margins of wholesaler and retailer accounted for 11.37 and 12.67 per cent of the consumer's prices. Costs incurred in marketing of coriander seed were `122.26 and `161.24 per quintal in channel-I and channel-II, respectively during the study period.

Agarwal and Singh (1997) have 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 Renwal regulated market and 24 per cent farmers' 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).

Agarwal (1998) has 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 of 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.

Singh (1999) has conducted a study on economic analysis of production and marketing of cumin seed in Nagaur district of Rajasthan. It was 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) conducted study on marketing of fennel in Tonk district of Rajasthan. It was observed from the study that a total cost in sale of fennel seed has been `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 the producer-farmers in the sale of fennel seed both at village and mandi. Among the middlemen cost incurred by 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 farmer-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.

Killedar *et al.* (2002) have conducted a study on economics of production and marketing of ginger in Satara district of Western Maharashtra. It was estimated the per quintal cost of marketing of ginger as ` 402.62 and total marketing charges as ` 402.62/qt of this packing charges accounted for ` 24.55 (6.1per cent), octori ` 2.00 (0.5 per cent), labour charges ` 4.05 (1.00 per cent), weighing charges ` 5.88 (1.46 per cent), market fees ` 0.80 (0.20 per cent), transportation charges ` 49.98 (12.41 per cent), commission charges ` 304.64 (75.67 per cent) and others were ` 10.72 (2.66 per cent), respectively. It was noticed that the highest share in total marketing cost was of commission charges (75.67 per cent), followed by transport (12.41 per cent) and packaging charges (6.10 per cent). More than eighty per cent of ginger growers sent their produce to Mumbai and Pune markets for marketing of ginger.

Tripathi *et al.* (2006) conducted a study on marketing of ginger in Ri-Bhoi district of Meghalaya. They identified four marketing channels involved in ginger marketing: Channel-I: producer – village traders / commission agent at village level – retailer - consumer; Channel-II: producer –commission agent at local market – wholesaler - retailer – consumer; Channel-III: producer –commission agent (market) – retailer – consumer; Channel-IV: producer – small trader - commission agent - retailer – consumer. The marketing costs per quintal for channel I, II, III, and IV were `477/qt, `519/qt, `443/qt and `357/qt, respectively. Deduction charges for loss in weight and others (including market fee and cost of packing material charges) shared the maximum in the marketing cost. Margins retained by traders were `700 / qt (channel-III) which accounted for 24.56 per cent of consumer's

price, followed by retailer `578/qt (20.28 per cent) in channel IV. Comparative picture of producer's share and marketing margins retained by various intermediaries indicated that the producer's share was highest in channel III (60.59 per cent) followed by channel IV (42.64 per cent), 40.90 per cent in channel II and 38.64 per cent in channel I. The producer's share in consumer's rupee was the highest in channel III because the producer directly sold the produce to the retailer in secondary market.

Ghorbani (2008) concluded that during the period 2000-01 to 2005-06 revealed that out of many marketing channels, the second channel, i.e. (producer-wholesaler-domestic consumer) was most efficient that had marketing margin and producer share in consumer price equal to 12 per cent and 88 per cent, respectively. Marketing margin of saffron was high so the produces received less than 65 per cent of final price of consumer.

Singh and Chahal (2008) have reported a study on economic analysis of green chilli marketing in Punjab identified following two widely used marketing channels: Channel I: producer – itinerant merchant / local trader – wholesaler - retailer – consumer; Channel II: producer –wholesaler – retailer – consumer. They observed that the producer received higher share in the consumer's rupee in channel-II. The marketing cost in both the channels was almost the same. The share of intermediaries decreased from 33 per cent to 30 per cent in channel-II as compared to channel-I in Patiala market. Similarly in Amritsar market the share decreased from 32 to 27 per cent. In spite of this on the whole the producer received only about 50 per cent share in consumer's price. This clearly showed that the chilli markets are not conducive to the interests of the producer as lions share of consumer's price was shared by various functionaries involved in the marketing of chilli. They also suggested that through group marketing, cooperative

marketing and contract farming the net price of the producer can be increased.

Singh *et al.* (2009) conducted a study on economics of production and supply chains of high value enterprises with special reference to chillies in Punjab. The results related to the sales outlet revealed that 45.83 per cent sample producers sold the produce at their village level in Patiala district. While the figure for Amritsar district turned out to be 14.58 per cent. The results revealed that 39.58 and 20.83 per cent of the sample producers sold their produce in the local town market in Amritsar and Patiala district respectively [Channel-I]. About 45.83 per cent of the selected farmers in Amritsar district disposed off their produce through farm gate sales [Channel-II]. The corresponding figure for Patiala district was estimated to be 33.33 per cent. The analysis of marketing efficiency showed that the channel- III was found to be more efficient as compared to channel I in both the sample market. This was mainly due to the fact that an additional intermediary was involved in channel I which further inflated the price spread.

Kaur and Singh (2010) concluded that the per quintal total marketing cost of kinnow was estimated to be the highest when the produce was sold through commission agent to wholesaler in the wholesale market as compared to produce sold through other marketing channels. As for producer's share in consumer rupee, the average category of kinnow orchardists had an overall average of 61.71 per cent share in the consumer's rupee in the domestic marketing. Channel III (producer-retailer–consumer) was the best channel for local marketing, whereas channel I (producer- pre harvest contractor –wholesaler –retailer – consumer) was found to be the best channel from consumer's point of view.

Studies reviewed in this section revealed that in case of spice crops, there existed the tendency of sale in villages among the farmers

over the regulated market to the extent of 15-20 per cent of the total surplus. The tendency of sale of spice crops immediately after the harvest i.e. in the first quarter and subsequent quarters has been positively associated with the increase in farm size groups. There was wide variation in producer's share in the consumer's rupee in spice crops i.e. it varied from 39 to 82 per cent. It varied between regions and within the region with the marketing channels adopted by the farmers in marketing of spice corps. The summarized results of various studies revealed that on an average, producer's share in the consumer's rupee was 64 to 74 per cent for seed spice crops.

2.4 Resources use efficiency of spice crops

Kumawat (1982) conducted a study in Dudu Panchayat simiti in Jaipur district of Rajasthan in order to visualize the impact of mechanized irrigation on farm incomes, employment and resource-use efficiency. It was concluded from the study that the MVP of irrigated land was `580.58 on pump operated farms and `629.14 on charsa operated farms. The high MVP of irrigated land on charsa operated farms indicated that it was possible to increase farm income by increasing the irrigated area on these farms. The study further concluded that mechanization of irrigation also increased the efficiency of labour and improved technology.

Anjeneyule *et al.* (1984) conducted study on resource use and productivity of turmeric crop in Guntur district of Andra Pradesh for the period of 1980-81. 64 farmers of turmeric crop were selected for two taluks Emani and Mangaligiri of Guntur district using stratified random sampling technique. Cobb-Douglas production function was estimated for determination of gross income in rupees from turmeric per farm by using different inputs (X_1 = land in acres per farm; X_2 = human labour in man work days per farm; X_3 = bullock labour in days per farm; X_4 = seed in kg per farm; X_5 = manures and fertilizers in rupees per farm; X_6 = irrigation charges in rupees per farm). They concluded that carious

patterns of changes in efficiency use of input (X_1 to X_6) among overall turmeric farm are reflected directly in the ratios of marginal return to opportunity cost and the maximum efficiency in resource use occurs when this ratio is equal to unity. For all strata of turmeric farms as indicated by the ratio, all the inputs (X_1 to X_6) were used in excess of the requirement.

Bahadur (1988) in his study conducted at Ibrahim patam block in Hyderabad district to study the resource use efficiency in dry farming used Cobb-Douglas production function for determination of output (in rupees per farm) by using different inputs (X_1 = area under crops in acres; X_2 = human labour in man per days of eight hours per farm; X_3 = cattle labour in per days of eight hours per farm; X_4 = manures and fertilizers in rupees per farm). The results of study revealed that the production elasticities of human labour, cattle labour, manures and fertilizers had turned out to be significant on small farms. Human labour and cattle labour alone were significant on medium farms. In respect of large size farms and for the sample as a whole, the production elasticities of cattle labour and manures and fertilizers were significant. Thus, it was evident that the cattle labour had its influence on production irrespective of farm of size.

Khan and Alam (1988) observed that in Kashmir valley on progressive farms, MVPs of land and labour use were highest on marginal farms. It decreased with increase farm size. In this category, therefore, land and human labour appeared to have been utilized optimally on smaller farms. However, on non-progressive farms, MVP of land worked out to be the lowest on marginal farms and which increased with increase in the farm size. The MVP of labour was worked out be the highest on small farms followed by marginal and medium farms.

Shekawat and Acharya (1989) carried out a study on farm firm in Rajasthan Canal Project Area. The Cobb-Douglas production

function was estimated for the purpose. They also worked out the MVP-FC ratios which revealed that efficiency in farm could be increased to a level. Return from investment in the form of human labour and farm power was ` 1.47 to 1.61 per rupee while return from investment in the form of irrigation, manures and fertilizers was ` 2.39 to 2.47 per rupee. This indicated the scope for more intensive farming in the area which in turn could increase yields and income. The return from investment in manures and fertilizers was expected to be more than in power and human labour under limited capital situation.

Singh and Beena (1996) have conducted a study on resource use efficiency in cash crops of Pune district (Maharastra). Output-input ratios were more than one in all the six classes of holding and for both crops indicating that these crops were in profitable proposition. For estimating Cobb-Douglas production function they used farm size (ha), human labour (man days), bullock labour (in pair days) and fertilizers and manures as independent variables and output in quintals as dependent variable. The land resource had shown a scope for increasing the area under sugarcane. The coefficient of human labour was positive and significant in onion indicating that there was an excess use of fertilizer in this crop. The comparison of MVP with rental value of land per hectare revealed that MVP to factor cost ratio was more than five for sugarcane and more than one for onion indicating sufficient scope for increasing the use of these resources in both the crops to maximize profit.

Singh *et al.* (1998) examined the impact of development and adoption of improved technology on output and energy use efficiency in the cultivation of principal crops like wheat, cotton and paddy in Punjab. The study was conducted at three points of these were development stages during the post green revolution period 1972-73, 1982-83 and 1993-94. It was concluded that with the development and adoption of improved technology, both productivity and energy use

efficiency per hectare of the crops raised consistently increased. Since productivity increased at a faster rate then the increased in energy use, the energy use efficiency has considerably improved over time for all the three major crops of the state.

Kale *et al.* (2005) estimated per hectare costs and returns as well as resources use efficiency for chilli in Thane district of Maharashtra state. Six villages having maximum area under chilli cultivation were selected purposively for the period 2002-03. Cobb-Douglas production function was fitted to the data to examine the input output relationship. The results of this study indicated that there was positive relationship between the size groups and the use of fertilizer ingredients and manure. The overall average per hectare cost of cultivation was worked out to ` 58648. In a nutshell, the human labour, bullock labour and number of irrigations had significant influence on the value of output. The MVP-MC ratio for the land variable was greater than unity denoting higher resources use efficiency. The magnitudes of MVP-MC ratio revealed efficient use of most of the resources except fertilizer and other ingredients.

Haque (2006) conducted a study on resource use efficiency in Indian agriculture. A double log regression equation was worked out to find out whether farmers in different regions used various inputs in crop production efficiently during 1981-82 to 2002-03. It was observed that human labour continued to influence productivity of paddy in Punjab, cotton in Gujarat and sugarcane in Uttar Pradesh significantly, while machine labour influenced wheat productivity positively and significantly in Uttar Pradesh. The expenditure on irrigation had negative elasticiities in almost all cases, excepting sugarcane in Maharashtra and cotton in Punjab. The relationship between irrigation expenditure and crop productivity was noted to be positively, but statistically non-significant. The expenditure on fertilizers had negative elasticities in both Punjab and Haryana for paddy, in Uttar Pradesh for

wheat and sugarcane and in Maharashtra for sugarcane. Also the expenditures on seed had negative elasticities for paddy in Punjab and Haryana, wheat in Punjab, UP and MP and cotton in both Gujarat and Punjab.

Lindara *et al.* (2006) conducted a study on technical efficiency in the spice based agro-forestry sector by selecting 127 agro-forestry farmers in six divisional secretariats in Matale district of Sri Lanka during the period of October to December 2002. Stochastic frontier production function with Cobb -Douglas model was used for data analysis. They observed that hired labour, organic fertilizer, inorganic fertilizers, land size and soil conservation measures showed significant positive effect on the agro-forestry production. The technical efficiency of the spice based agro-forestry system was 84.32 per cent.

Fernandez and Peter (2009) have identified the sources of input use inefficiency in sugarcane production. A total number of 140 respondents were interviewed in Negros Island by using random sampling method. They concluded that the overall technical efficiency of sugarcane farmers in Central Negros was positively related to farmers' age and experience, access to credit, nitrogen fertilizer application, and soil type and farm size.

Huque and Arshad (2010) studied the level of technical efficiency for chilli production in the administrative district Jamalpur of Bangladesh. The Cobb- Douglas stochastic production frontier model was used to analyze the data. They observed that on an average, there appeared 23 per cent technical inefficiency, this implied that the output per farm could be increased, on an average, by 23 per cent through chilli production using the prevailing technology and without incurring any additional production cost. Side by side advanced technology (high yielding variety, disease and pest management) could be adapted to increase production of chilli in the study area.

Kumar *et al.* (2012) studied the economic analysis of senna cultivation in the Tirunelvei district of Tamil Nadu in the year 2011. The economics has been worked out by comparing costs and returns at different stages by the conventional method. The linear production function has been fitted to evaluate the resources-use efficiency in the production of senna cultivation. The study has shown that the major portion of operational cost is shared by hired labour, interculture operations, distillation charges, irrigation and machine or tractor charge. The result of overall benefit-cost ratio indicated a higher profit for farmers on less investment in senna cultivation and also independent variables like human labour, machinery, manures and fertilizer, irrigation charges and intercultural operations have shown a positive and significant impact on the returns of senna crop in the study area. The most vital problems faced by the farmers are high input cost, erratic supply of electricity, lack of adequate information, infrastructural facilities, regulated markets and energy-efficient distillation units.

Murugasamy and Veerachamy (2012) conducted the study for critical review of the literature on resource use efficiency in agriculture, majority of the studies analysed the resource use efficiency in maize, paddy, groundnut, wheat, tomato, potato, tobacco and other crops. They analysed the resource use efficiency and total economic efficiency and technical efficiency in various crops and various agricultural regions. The studies covered major farm inputs such as human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure and irrigation. Though, the studies fail to incorporate the ideologies of resource use efficiency in the context of head, mid and tail reaches of the cannel irrigation.

Nimoh *et al.* (2012) conducted a study to determine the resource use efficiency in rice production. Seventy farmers were selected by simple random sampling technique. The Cobb-Douglass production function was fitted to the data to examine the input output relationship.

The regression results indicated that the farmers were in the second stage of production function, which were decreasing returns to scale. The MVP results indicated that land (6.63), fertilizer (1.76) and seed (10.84) were underutilized and labour (0.000036) and chemicals were highly over utilized in the study area.

Studies reviewed in this section reveal that MVP of land, labour, fertilizers and manures were the lowest on marginal farms and increased with increase in the farm size. The magnitudes of MVP-MC ratio revealed efficient use of most of the resources except fertilizer and other ingredients.

Chapter III

METHODOLOGY

This chapter describes the methodology adopted for the study under reference and covers the selection of crops, districts, regulated markets, villages, sample of producer-farmers and markets, collection of data and technique used in the analysis of the collected data. The various concepts and terms used in the study have also been discussed.

3.1 Selection of crop

The important seed spices grown in the state of Rajasthan are coriander, cumin, fennel, fenugreek and ajwain. Out of these seed spices fenugreek was selected for the detailed study. Rajasthan state occupies first position in area and production of fenugreek in the country with 88.45 per cent of area and 77.43 per cent of the country's total production in 2012-13. Moreover, such type of study has not been conducted in the state so far.

3.2 Selection of districts

The selection of districts for in depth study was done as follows:

1. A list of top 10 districts having highest area under fenugreek crop based on the quinquennial averages ending the latest year was prepared.
2. Similarly, a list of top ten districts having highest production under fenugreek crop was prepared which was also be based on quinquennial averages ending the latest year.
3. The districts common in both the lists were selected.
4. The per cent share of these districts in total area under and production of fenugreek in the state were examined for adequacy of sample districts (more than 86 per cent) (Table

3.1). Sikar, Chittorgarh, Jhunujhunu, Nagour, Kota, Jhalawar, Jaipur, Churu, Bikaner and Bundi districts were selected for detailed study. However, primary data and its analysis confined to only two districts namely: Sikar and Jaipur.

Table 3.1: Quinquennial average of area under and production of fenugreek in top ten districts of Rajasthan during 2005-06 to 2009-10.

District	Area in hectares	Production in metric tonnes
Sikar	8845.60	9211.40
Chittorgarh	5145.40	6457.20
Nagaur	4722.40	5039.00
Jhalawar	3699.40	4681.20
Jhunujhunu	4157.60	4186.40
Kota	3922.20	7052.40
Jaipur	3241.80	3112.40
Churu	2753.80	1672.40
Bikaner	2816.00	2865.40
Bundi	2240.80	2976.60
Total of districts	41545.00	47254.40
Rajasthan	47983.00	52739.80
Per cent share of total ten districts in Rajasthan	86.58 Per cent	89.60 Percent

3.3 Selection of regulated markets

For selection of regulated markets, two districts viz., Sikar and Jaipur were selected randomly from the selected ten districts for the studying the cost of cultivation, marketing cost and resource use efficiency. One regulated market from each of these two districts, Shri Madhopur mandi (Sikar) and Chomu mandi (Jaipur) were purposively

selected on the basis of highest arrivals of fenugreek production during the past three years.

3.4 Selection of villages

Separate lists of all the villages falling with in the catchment area of the regulated markets were prepared. 3 villages from each of the lists so prepared were randomly selected. The selected villages are as follows:

A. In Sikar district
   I. Likhma ka bas
   II. Chack kalash
   III. Nada

B. In Jaipur district
   I. Kishan-manpura
   II. Gurlya
   III. Asticala

3.5 Selection of farmers

A list of all the fenugreek growing farmers of the selected villages was prepared from the information provided by the village patwaries. The total number of fenugreek growing farmers in the sample villages was 261 and 354, in Sikar and Jaipur districts, respectively.

All the farmers were divided into following five size groups on the basis of size of their land holdings:

a. Marginal	Less than 1 hectare
b. Small	1 – 2 hectares
c. Semi-medium	2 – 4 hectares
d. Medium	4 – 10 hectares
e. Large	10 hectares and above

Out of 615 farmers, a sample of 150 farmers was selected on the basis of systematic sampling. The numbers, thus, obtained were 23

(marginal), 35 (small), 41 (semi-medium), 34 (medium) and 17 (large) farmers (Table 3.2).

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

Type of farmers	Number of farmers		Total number of farmers
	Sikar	Jaipur	
Marginal (<1 hac.)	9	14	23
Small (1-2 hac.)	13	22	35
Semi-medium (2-4 hac.)	20	21	41
Medium (4-10 hac.)	14	20	34
Large (10 hac. & above)	7	10	17
Total	63	87	150

3.6 Selection of market functionaries

Five numbers of market functionaries in each category namely; village trader, wholesaler and retailer involved in the marketing of fenugreek were selected through random sampling for study purpose.

3.7 Data collection

Both primary and secondary data were used for the study. The primary data in respect of cost of cultivation, cost of production, resources use, sale pattern, costs and margins in marketing of fenugreek crop were collected from the respondent farmers, village traders, wholesalers and retailers through personal interview method with the help of a set of schedule which was specifically prepared (standardized) for the study. The secondary data in respect of area,

production and productivity of fenugreek were collected from the records and reports of the Directorate of Economics and Statistics and Directorate of Agriculture, Government of Rajasthan, Jaipur. Information regarding prescribed marketing costs in the selected mandies was collected.

3.8 Analysis of data

The collected data were analysed by using the following tools and techniques to achieve the specific objectives of the study.

3.8.1 Growth rates and instability in area, production and productivity

3.8.1.1 Compound growth rates

The compound growth rates in area, production and productivity of fenugreek crop were worked out using exponential function of the form:

$$Y_t = a\, b^t U_t$$

Where,

Y_t = area/production/productivity of fenugreek in district in year 't'

a = intercept; b = regression coefficient

t = time element which takes the value 1, 2, 3…..n,

U_t = disturbance term such that OLS assumptions are satisfied for its logarithmic transformation, and a and b are constant or parameters to be estimated.

By taking logarithms of both the sides, the equation takes the form

$$\text{Log } Y_t = \text{Log } a + t \log b + \text{Log} U_t$$

The compound growth rates were worked out as follows:

$$g = \left(\hat{b} - 1\right) \times 100$$

Where; g = estimated compound growth rate in per cent per year

$$\hat{b}=\text{Antilog of } \log b, \text{ i.e. } \log\hat{b}$$

The standard errors of the growth rates were computed by using the formula:

$$\text{S.E. (g)} = \frac{100\,\hat{b}}{\text{Log}_{10}e}\sqrt{\frac{\left[\sum(\log Y)^2-\left(\sum \log Y\right)^2/N\right]-\left[\left(\sum t^2\right)-\left(\sum t\right)^2/N\right]\left(\log\hat{b}\right)^2}{(N-2)\left[\left(\sum t^2\right)-\left(\sum t\right)^2/N\right]}}$$

$\text{Log}_{10}e$ = 0.4343; N = number of observations. Student 't' test was used for testing the significance of the compound growth rates.

$$t = \frac{g}{\text{S.E.}(g)};\quad \text{d.f.}=N-2$$

Where; g = compound growth rate in per cent per year

S. E. (g) = standard error of compound growth rate

t = the variable which follows the 't' distribution with N-2 degrees of freedom at chosen level of significance.

The quinquennial average of data of area, production and productivity of fenugreek for the period 1885-86 to 2012-13 were arranged according to various five year plans taking seventh five year plan as the base. The quinquennial averages of area, production and productivity were calculated for respective five year plan for the selected districts. Assuming seventh five year plan as 100 per cent the increase or decrease in area, production and productivity during the different FYPs were calculated

3.8.1.2 Instability

The magnitude of instability in production of the crops was measured by working out the coefficient of variation (C.V.) based on detrended time series data. Area and yield data of selected crop were detrended using the linear equation (Hazells, 1982).

$$Z_t = a + bt + U_t$$

Where; Z_t = Dependent variable (Area/yield); a = Intercept

b = Parameters to be estimated; t = Time variable (Years);

U_t = Error term with usual assumptions

After detrending, the residuals (U_t) were centered on the mean area and mean yield $\overline{Z}$ for each district. The detrended time series data for area and yield were calculated as:

$$\hat{Z} = U_t \pm \overline{Z}$$

Time series detrended production indices for fenugreek was calculated as the product of detrended area and yield indices. i.e. Q = (AY). To investigate further into the variables explaining the changes in relative production instability, sources of variance of production in fenugreek crop was estimated. The variance of production was decomposed into its constituent sources viz; area variance, yield variance, area-yield covariance and higher order interaction between area and yield to examine the source of instability. The variance of production V (Q) can denoted as:

$$V(Q) = \overline{A}^2 V(Y) + \overline{Y}^2 V(A) + 2\overline{A}\,\overline{Y}\ \mathrm{Cov}\ (A,Y) - \mathrm{Cov}(A,Y)^2 + R$$

Where; V (Q) = production variance;

$\overline{A}$ = mean area; $\overline{Y}$ = mean yield;

V(Y) = yield variance; V(A) = area variance;

Cov (A,Y) = area-yield co-variance;

Cov $(A,Y)^2$ = higher order co-variance between area and yield;

R = residual

3.8.2 Study of cost of cultivation, cost of production and returns

The cost of cultivation of fenugreek was worked out by considering the following cost items:

- Value of hired human labour
- Value of owned machine labour
- Value of hired machine labour
- Value of owned seed
- Value of purchased seed
- Value of owned farm yard manure
- Value of purchased from yard manure
- Value of fertilizer and insecticides
- Irrigation charges
- Land revenue
- Interest on working capital
- Depreciation
- Miscellaneous expenses
- Rent paid for leased in land
- Interest on fixed capital
- Rental value of owned land
- Value of family labour

3.8.2.1 Estimation of cost for irrigation

All the sample farmers of the study area were using tube well (electric motor) for irrigation. Costs incurred on electricity/diesel and repairs were included in the operational cost while depreciation and interest on fixed capital were included in fixed cost. The cost of electricity/diesel was computed for the actual hours of use for a crop based on per hour consumption and prevailing prices which were paid by the farmers.

3.8.2.2 Interest on working capital

Working capital or variable cost included the expenses on items like seed, manure, fertilizers, chemicals, fuel and electricity, labour (family labour plus hired labour), repair and maintenance of machinery and machines hired for farm operations. The actual price paid out by the farmers for these items were taken into account. The interest on variable cost excluding owned resources like family labour was also be considered as variable cost and was calculated on each item separately and added in the cost of respective items.

The interest was calculated at the 7 per cent per annum for half of the length of crop production period (i.e. for 3 months).

3.8.2.3 Depreciation

It represents the amount by which a farm resource decreases in value as a result of cause other than a change in the general price of the item. In other words, it is a decline in the value of a given asset as a result of the use, wear and tear and time obsolescence.

Depreciation was computed for items of fixed capital like farm buildings, wells and irrigation structures and machinery such as electric motors, diesel engine, thresher and other items excluding tractor. Depreciation was also computed on minor agricultural implements used in crop production. Depreciation of assets was calculated by using the straight line method. The formula is as follows:

$$\text{Depreciation} = \frac{\text{Purchase price of an asset - junk value}}{\text{Number of useful years of life (expected life)}}$$

After calculating the total annual depreciation on the various assets of the farm, the depreciation for a particular crop was computed. This was calculated as follows:

$$\text{Depreciation for crop 'X'} = \frac{\text{Total annual depreciation}}{\text{Total cropped area}} \times \text{Area under crop 'X'}$$

Depreciation on tractor and its accessories and bullock/camel labour was not included as these were evaluated on the basis of hire charges.

3.8.2.4 Interest on fixed capital

Interest on fixed capital was charged at the rate of 12 per cent per annum. Interest was computed for all those items for which depreciation was computed. After calculating the total interest, it was apportioned for the particular crop as per method used in apportioning of the depreciation.

3.8.2.5 Land revenue

Land revenue actually paid to revenue department was considered.

3.8.2.6 Rental value of owned land

It was calculated on the basis of prevailing rates in the sample villages which were one fifth of the gross product.

3.8.2.7 Cost concepts

In order to compute the returns to different factors of production, the various cost items were categorized into following cost groups:

Cost groups	**Items of cost included**
Cost A_1	Sum of variable cost items that actually incurred in production

Cost A_2	Cost A_1 + rent paid for leased in land
Cost B_1	Cost A_1 + interest on fixed capital
Cost B_2	Cost B_1 + rent paid for leased in land + rental value of owned land
Cost C_1	Cost B_1 + value of family labour
Cost C_2	Cost B_2 + value of family labour
Cost C_3	Cost C_2 + 10 per cent Cost C_2 (on account of managerial functions performed by farmers)

Operational cost (O.C.): It is the variable cost which varies with the level of production. It is expressed as:

O.C. = Cost A_1 - Land revenue - Depreciation + Family labour charge

Over-head cost (O.H.C.): It is the fixed cost which is incurred irrespective of the volume of production. It is expressed as:

$$O.H.C. = \text{Cost } C_2 - \text{Operational cost}$$

Cost of production: Cost of production was worked with the help of following formula:

$$\text{Cost of production (per quintal)} = \frac{\text{Cost of cultivation - Value of by-product}}{\text{Quantity of main product}}$$

3.8.2.8 Income measures

Gross income (G.I.): It is the total value of main product as well as of by-product.

$$G.I. = Q_m \times P_m + Q_b \times P_b$$

Where,

G.I. = Gross income; Q_m = Quantity of main product

P_m = Price of main product; Q_b = Quantity of by-product

P_b = Price of by-product

Farm business income (F.B.I.): It refers to the returns to family labour, owned land, owned fixed capital and management. It is expressed as follows:

Farm Business Income (F.B.I.) = Gross income - Cost A_2

Returns, over variable cost (R.O.V.C.): It is the net return over variable cost. It was worked out after deducting all the items of variable costs from gross income. It is expressed as:

Return over variable cost = Gross income - Total variable cost

Family labour income (F.L.I.): It is the return to family labour (including management). It is expressed as:

Family labour income = Gross income - Cost B_2

Net income (N.I.): It is the net profit after deducting all the cost items (i.e. variable and fixed costs) from the value of gross output. It is expressed as :

Net income = Gross income - Total cost (cost C_2)

Return per rupee (R.P.R.): It is defined as return per rupee invested in the production process. It is expressed as:

Return per rupee = Gross income/Total cost (cost C_2)

3.8.3 Marketing behaviour, marketing costs and margins in marketing of fenugreek

The marketing behaviour of farmers in respect of place of sale, time of sale, agency adopted in sale of the surplus produce was analysed by using the tabular analysis. The data pertaining to marketing costs and margins were analysed as under:

3.8.3.1 Total cost of marketing

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

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

Where; C = total cost of marketing of the commodity

C_F = cost paid by the producer-farmer from the time the produce leaves the farm till it is sold

C_{mi} = cost incurred by the i^{th} middleman in the process of buying and selling.

3.8.3.2 Marketing margin

The absolute margin earned by a middleman was calculated as:

$$A.M. = S_p - (P_P + C_m)$$

Where; S_p = sale price of fenugreek per unit of out put

P_P = purchase price of fenugreek per unit of out put

C_m = per unit cost incurred in marketing the middleman

$$\text{Percent margin} = \frac{S_p - (P_P + C_m)}{S_p} \times 100$$

3.8.3.3 Producer's share

It represents the per centage 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

3.8.3.4 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 breakup of costs, margins and share of the producer farmer and different market middleman were worked out in the consumer's price in simple per centage terms.

3.8.4 Resource use efficiency

Regressions using the ordinary least squares method were run to study factors responsible for gross returns with farmers. The model and explanatory variables selected and discussed were as under:

3.8.4.1 Selection of the variables and their definitions

Gross return is affected by a large number of factors depending upon the climatic and socio-economic conditions and prices of the crop. However, all the factors cannot be taken into account due to a variety of reasons like non-availability of desired data, multicollinearity among the explanatory variables, problems in their quantificationc.

To get rid of such problems only a few but most probable variables are taken into account. In the present investigation, based on the theoretical a priori reasons, the following variables were selected to study the resource use efficiency: (a) machine labour, (b) seeds, (c) manures, (d) fertilizers, (e) plant protection expenditures, (f) Irrigation, (g) human labour. The variables included in the model are defined as follows:

Gross returns (Y): Gross income was defined as the value of main and by-products of the crop. This variable was taken as dependent variable of the regression model and was measured in money terms.

Machine labour (X_1): Machine labour charges were obtained by adding all types of operational costs incurred due to machine use on farm during production activities.

Seed (X_2): The extent of seeds used for sowing purpose for crop production during the season and it was expressed in monetary terms.

Manure (X_3): The amount of farm yard manures in monetary terms that was used for productive purposes was included in this variable.

Fertilizers (X_4): It included the amount of chemical fertilizers in monetary terms for productive purposes like nitrogen, phosphorus, etc.

Plant protection expenditures (X_5): The expenditures incurred on various items like herbicides, fungicides and insecticides etc., as measured in monetary terms were considered as plant protection expenditures.

Irrigation (X_6): Numbers of irrigation given by the farmers on various duration of crop season was added in monetary terms to arrive at total irrigation charges.

Human labour (X_7): Human labour was defined as the charges of owned and hired labour during the crop season. It was expressed in man days and was included as an independent variable in the function.

3.8.4.2 Specification of the regression model for the study

The factors affecting gross return of fenugreek crop on the farms in the study area were identified by regressing gross returns on the following explanatory variables (all measured in rupees/ha except human labour which was measured in man days):

Functional relationship

$$Y = f (X_1, X_2, X_3, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots, X_7)$$

Where; Y = gross income, X_1 = machine labour, X_2 = seed, X_3 = manures, X_4 = fertilizers, X_5 = plant protection expenditures, X_6 = irrigation, X_7 = human labour.

Both linear and log-linear (Cobb-Douglas) forms of the multiple regression function as shown below were fitted to the data.

I. Multiple linear functional forms

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots\ldots\ldots\ldots + b_7 X_7 + U$$

II. Multiple log-linear (Cobb-Douglas) functional form

$$Y = a X_1^{b1} X_2^{b2} X_3^{b3} \ldots\ldots\ldots\ldots\ldots\ldots X_7^{b7} U$$

II. Which on log transformation takes the following form:

$$\text{Log } Y = \text{Log } a + b_1 \text{ Log } X_1 + b_2 \text{ Log } X_2 + \ldots\ldots + b_7 \text{ Log } X_7 + U$$

Based on the magnitude of R^2 (coefficient of determination) and significance of the estimated regression coefficients multiple log-linear (Cobb-Douglas) relationship was chosen for further study.

The resource use efficiency could be judged based on the MVP (marginal value productivities), which indicates the increase in the gross return from the use of an additional unit of a given input while keeping the level of other inputs constant. The marginal value productivity of the i^{th} input was measured by using the following formula:

$$MVP = b_i \frac{\overline{Y}}{\overline{X_i}}$$

Where; bi = regression coefficient of i^{th} factor, $\overline{Y}$ = geometric mean of gross returns (in rupees), $\overline{Xi}$ = geometric mean of i^{th} input (in rupees)

3.8.4.3 Testing the significance of regression coefficients

The reliability of the regression coefficients (b_i) was tested through the student's 't' test of the form:

$$t = \frac{b_i - \hat{b}_i}{SE(\hat{b}_i)}$$

Where;

i = 0,1,2,3 ---- K-1 (K – being the total number of parameters estimated)

t = The variable which follows the 't' distribution with (n-k) degrees of freedom at chosen level of significance

$\hat{b}_i$ = Estimate of the regression parameter (b_i); and

$SE(\hat{b}_i)$ = Standard error of the estimate (b_i)

For testing the reliability of b_i, it was hypothesized that there was no linear/log-linear relationship between the explanatory variable X_i and the dependent variable Y; i.e., $b_i = 0$

Symbolically it was denoted as $H_O : b_i = 0$

To decide about the acceptance or rejection of null hypothesis, $H_O : b_i = 0$, vis-à-vis alternative hypothesis, $H_A : b_i \neq 0$, the calculated value of 't' was compared with the table value of 't' for (n-k) degrees of freedom at α (α = 1%, 5% and 10%) level of significance which defined critical region for a two tailed test (a test in which the critical region lies on both the tails of the distribution curve, half area lying on each tail for a test of α level of significance).

The decision in regard to acceptance or rejection of the null hypothesis ($H_O: b_i = 0$) was made as follows:

A. When the absolute value of the calculated 't' was higher than the theoretical (tabulated) value of 't'; i.e., $|t| > t$, the null hypothesis was rejected.

B. When $|t| < t$, the null hypothesis was not rejected in favor of the alternative hypothesis. In other words the b_i was not considered statistically significant at chosen level of significance.

Multicollinearity: To test the presence of multicollinearity (high degree of correlation among the explanatory variables), simple

correlation matrices as well as variance inflation factor (VIF) were worked out. For testing multicollinearity on the basis of correlation coefficients, Klein's (1962) observation was taken into consideration that the effect of multicollinearity was tolerable if the correlation between any pair of independent variables (r_{ij}) included in the model did not exceed in magnitude to the multiple correlation coefficient (R), that is, $|r_{ij}| < |R|$. Where r_{ij} is the simple correlation coefficient between i^{th} and j^{th} variables.

For understanding the working out procedure for VIF, consider the following linear model with k independent variables:

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_j X_j + \ldots\ldots\ldots\ldots + b_k X_k + e$$

The standard error of the estimate of b_j is $\sigma (X'X)^{-1}_{j+1,\, j+1}$, where X is regression design matrix – a matrix such that $X_{i,j+1}$ is the value of the j^{th} covariate for the i^{th} case or observation, and $X_{i,1}$ equals 1 for all *i*. It turns out that this variance can be equivalently expressed as

$$Var(\hat{b}_i) = \frac{\sigma^2}{(n-1)Var(\hat{X}_i)} \frac{1}{1-R_i^2}$$

Where;

R_j^2 = Multiple R^2 for the regression of X_j on the other covariates (a regression that does not involve the response variable Y). This identity separates the influences of several distinct factors on the variance of the coefficient estimate.

σ^2 = Scatter in the data around the regression surface

n = Sample size; $Var(\hat{X}_i)$ = Variability in the covariates

The remaining term, $1 / (1 - R_j^2)$ is the VIF.

Calculation of VIF involved the following steps:

Step one

K number of VIFs (equal to the number of explanatory variables) were calculated, one for each X_i by first running an ordinary least square regression that had X_i as a function of all the other explanatory variables in the first equation. If i = 1, for example, the equation would be

$$X_1 = \propto_2 X_2 + \propto_3 X_3 + \ldots\ldots + \propto_k X_k + C_0 + e$$

Where c_0 is a constant and e is the error term.

Step two

Then, VIF factor for b_i was calculated with the following formula:

$$Var(\hat{b}_i) = \frac{1}{1 - R_i^2}$$

Where R^2_i is the coefficient of determination of the regression equation in step one.

Step three

To analyze magnitude of multicollinearity by considering the size of the VIF $(\hat{b}_i)$, a common rule of thumb followed was that if $\hat{VIF}$ $(b_i) > 10$ then, it was taken to mean high multicollinearity (Kutner, 2004).

Autocorrelation: The term autocorrelation is defined as "correlation between members of series of observations ordered in time (as in time series data) or space (as in cross sectional data)". In the regression context the classical linear regression model assumes that such autocorrelation does not exist in the disturbances Ui. Symbolically, E (Ui Uj) = 0 i ≠ 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 Ui (William and Kendall, 1971). 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;

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

$H_o : \rho = 0$ $H_A : \rho > 0$ (Positive autocorrelation)

If 'd' $< d_L$ rejected H_o in favor of positive autocorrelation

If $dL <$ 'd' $< du$ inconclusive; If $du <$ 'd' did not reject Ho

$H_O : \rho = 0$ $H_A : \rho < 0$ (Negative autocorrelation)

If 'd' $< 4-du$ did not reject H_O

If $(4-du) <$ 'd' $< (4-d_L)$ inconclusive

If $(4-d_L) <$ 'd' rejected H_O in favor of negative autocorrelation

Where;

H_O = Null hypothesis; H_A = Alternative hypothesis

ρ = Autocorrelation coefficient; d = Durbin – Watson statistic

d_L = Lower limit for critical value; du = Upper limit for critical value

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

(i) $0 - d_L$, i.e. , $0<d<d_L$ Positive autocorrelation

(ii) d_L - du , i.e. , d_L<d<du Inconclusive

(iii) du – (4-du) , i.e. , du <d<(4-du) No autocorrelation

(iv) (4-du)- (4–d_L) , i.e. , (4-du) < d <(4-d_L) Inconclusive

(v) (4 – dL) – 4 , i.e. , (4-dL) < d< 4 Negative autocorrelation

For testing autocorrelation, following procedure was followed.

(i) From the Durbin–Watson tables, the d_L and du values were noted down for 'n' number of observations, 'K' number of explanatory variables excluding the constant term and required level of significance.

(ii) Then 'd' value was calculated from the sample errors.

Finally, the region in which the estimated value of 'd' lay was located and the inference was drawn in a manner as stated above.

Return to scale

The sum of elasticity coefficients (Σb_i) indicates the returns to scale and the statistical test for the significant difference of the value of coefficient from unity is given as: (Kumar *et al.,* 2011)

$$F_{(1,\ N-K)} = [(\sum \text{bi} - 1)^2 /1]/[(\sum_{i=1}^{k} var\ bi)/(N-K)]$$

Where, N = sample size, K = number of exogenous variables

3.9 Limitations of the study

Though all possible efforts have been made to make the study objective and comprehensive but certain discrepancies do remain in the social studies. The important ones are:

a) Secondary data in respect of area, production and productivity of fenugreek crop were obtained from the official records and published reports. Hence, the results are valid to the extent the data are accurate and reliable.

b) Primary data pertaining to cost of cultivation, marketing costs and margins were collected through the survey method. The information provided by the farmers was based on their recall memory. Though every effort were made to elicit correct information. However, chances of error might be there due to forgetfulness nature of the respondents.

c) Some findings of this study as estimated for the agricultural year 2010-2011, may not be valid fully in the successive years, mainly due to changes in input-output prices and other technological developments taking place in the production of crop enterprises.

d) Though the total number of farmers in the sample size was 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.

e) 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 fenugreek crop.

Chapter - IV

RESULTS AND DISCUSSION

In this chapter efforts have been made to discuss growth rates and instability in area, production and productivity of fenugreek in the state of Rajasthan, cost of cultivation of fenugreek in selected farms of study area of Rajasthan (Jaipur and Sikar districts), marketing costs incurred and margins earned by different agencies involved in the marketing of fenugreek in selected farms of study area of Rajasthan, resource use efficiency of fenugreek crop in selected farms of study area of Rajasthan. The collected data were classified, tabulated and analyzed in the light of objectives of the study. The results obtained are presented and discussed under the following four sections:

Section-4A : Growth rates and instability in area, production and productivity of fenugreek in the state of Rajasthan.

Section-4B : Cost of cultivation of fenugreek in state of Rajasthan.

Section-4C : Marketing costs incurred and margins earned by different agencies involved in the marketing of fenugreek in state of Rajasthan.

Section-4D : Resource use efficiency of fenugreek crop in state of Rajasthan.

SECTION – A

GROWTH RATES AND INSTABILITY IN AREA, PRODUCTION AND PRODUCTIVITY OF FENUGREEK IN THE STATE OF RAJASTHAN

In this section an attempt has been made to measure the growth rates and instability in area, production and productivity of fenugreek in the major fenugreek producing districts of the state as well as in the state of Rajasthan as a whole. The growth rates and instability were worked out for the period from 1985-86 to 2012-13. The growth rates and instability in area, production and productivity of fenugreek crop have been discussed under two sub-sections. The first sub-section deals with the compound growth rates in area, production and productivity of fenugreek crop while, in the sub- section second extent and magnitude of instability in fenugreek production and source of variance in its production have been presented.

4A.1 Compound growth rates in area, production and productivity of fenugreek crop

4A.1.1.Compound growth rate

Production is a function of change in area and productivity. Any technological change would push productivity. The knowledge of growth rate of crop group/crop enables one to assess the progress and performance of agricultural sector in a particular area/region. It gives an idea about the allocation of resources in different areas and this in turn helps in remedying regional imbalance through appropriate policy measures. The knowledge of relative growth of area, production and productivity in different areas in the past is immensely useful for the people engaged in policy formulation with the objective of promoting balanced regional development strategy.

Table 4A.1: Compound growth rates of area, production and productivity of fenugreek crop in selected districts of Rajasthan for the period 1985-86 to 2012-13.

(Per cent per annum)

Districts	Area	Production	Productivity
Sikar	2.45**	2.50**	0.04
	(1.26)	(1.23)	(0.75)
Chittorgarh	0.66	0.42	-0.23
	(1.12)	(1.25)	(0.36)
Nagaur	10.00***	11.36***	1.23
	(1.26)	(1.29)	(0.72)
Jhalawar	0.95	3.21***	2.24**
	(1.10)	(1.26)	(0.69)
Jhunjhunu	11.08***	10.00***	-0.88
	(2.21)	(2.23)	(0.44)
Kota	18.64***	24.75***	5.18***
	(3.27)	(3.89)	(1.00)
Jaipur	-3.49***	-3.32***	0.18
	(0.32)	(0.58)	(0.63)
Churu	34.54***	36.90**	1.75*
	(1.91)	(2.86)	(1.28)
Bikaner	22.94***	27.63***	3.82***
	(3.19)	(3.65)	(0.94)
Bundi	18.71***	23.19***	1.82*
	(7.85)	(7.76)	(0.70)
All Rajasthan	3.79***	4.30***	0.49
	(0.69)	(0.75)	(0.27)

Figures in parentheses are standard errors; *** Significant at one per cent level of significance; ** Significant at five per cent level of significance; * Significant at ten per cent level of significance

To estimate the trends of growth in area, production and productivity of fenugreek crop in the state and in its major producing districts, exponential function was used. The standard errors of the compound growth rates were also estimated to test their significance.

Compound growth rates of area, production and productivity of fenugreek crop in selected districts of Rajasthan and in the state as a whole are presented in Table 4A.1. It is evident from the table that there was significant growth in area and production of fenugreek in all the selected districts (except Sikar, Nagaur, Jhunjhunu, jaipur and state as a whole in productivity and Chittorgarh in all the three i.e area, production and productivity) and the state as a whole during the period 1985-86 to 2012-13. However, significant increase in production of this crop was found in all the selected districts (except Chittorgarh) and the state as a whole (4.30 per cent). Production of fenugreek in the district of Sikar, Nagaur, Jhunjhunu, Jaipur and the state as a whole increased due to increase in area and in Jhalawar district due to increase in productivity while in Kota, Churu, Bikaner and Bundi, it increased due to increase in both area and productivity. In Jaipur district, the production of fenugreek significantly decreased due to significant decrease in area. Area of fenugreek in Chittorgarh district increased at a non-significant compound rate of 0.66 per cent per annum but this positive contribution was negated by non-significant growth in productivity (-0.23 per cent).

It may be concluded that production in selected districts (except in Jaipur and Chittorgarh district) and the state as a whole increased significantly in the study period. The increase in the production of fenugreek in the state was due to the increase in both area and productivity. In half of the selected districts and the state as a whole the productivity of the crop did not register any significant growth implying that the existing technology was not able to sustain the existing level of

productivity of the crop and there was an urgent need to evolve and popularize the new and improved production technology in the state.

4A.1.2. Per cent increase/decrease in area, production and productivity of fenugreek different five year plan over 7th five year plan in selected districts of Rajasthan

The per cent increase or decrease in area, production and productivity of fenugreek in different five year plans (FYPs) spreading during the period 1985-86 to 2012-13 over the 7th five year plan in the state of Rajasthan are presented in tables 4A.2 through 4A.4. The quinquennial average of data of area, production and productivity of fenugreek for the period 1885-86 to 2012-13 were arranged according to various five year plans to know the effect on the area, production and productivity of fenugreek crop in Rajasthan (as a seed spice crop) after TMO programme, taking seventh five year plan as the base. It was aimed to study the effect of TMO programme on area, production and productivity of fenugreek in different five year plans over the seventh five year plan in Rajasthan. The quinquennial averages of area, production and productivity were calculated for respective five year plan for the selected districts. Assuming seventh five year plan as 100 per cent the increase or decrease in area, production and productivity during the different FYPs were calculated and discussed as under:

4A.1.2.1 Per cent change in area

A perusal of table 4A.2 reveals that out of the ten districts, three districts viz.; Jhunujhunu, Jaipur and Bikaner registered negative growth in 8th five year plan, while in 9th five year plan all the districts (except Jaipur) had positive growth. In 10th five year plan, two districts namely; Jhalawar and Jaipur have recorded negative growth while remaining eight districts recorded positive growth. Positive growth was shown in 11th five year plan by all the districts except Jaipur. There was

no area under fenugreek during 7th and 8th five year plan in Bundi district. Therefore 9th plan was assumed as the base year (i.e. 100 per cent). During following five year plans it recorded positive growth.Very interestingly, only Churu district continuously recorded positive growth in all the five year plans.

Table 4A.2: Per cent increase/decrease in area under fenugreek during different FYPs over 7th five year plan in the selected districts of Rajasthan

District	Area in hectares as 100 per cent	Per cent increase/decrease over 7th five year plan in area			
	7th plan (1985-90)	8th plan (1992-97)	9th plan (1997-02)	10th plan (2002-07)	11th plan (2007-12)
Sikar	5918 (100)	28.29	12.91	67.56	82.22
Chittorgarh	3605 (100)	57.42	48.24	68.82	16.53
Nagaur	773(100)	55.50	599.87	506.73	557.18
Jhalawar	3158(100)	30.62	58.11	-3.01	30.94
Jhunujhunu	1207 (100)	-13.42	132.39	128.83	386.99
Kota	157 (100)	377.71	4484.08	2341.40	2980.25
Jaipur	7970 (100)	-35.75	-37.25	-45.76	-59.46
Churu	9 (100)	566.67	12444.44	20000.00	70900.00
Bikaner	125 (100)	-41.60	443.20	1010.40	6130.40
Bundi	0.00	0.00	467 (100.00)	26.12	524.41
Total of selected	22922 (100)	11.87	73.23	67.78	140.99
Rajasthan	29296 (100)	7.84	60.82	46.16	128.24

Figures in parentheses are the per cent of their respective column; the study period for Bundi was 1998-99 to 2012-13.

On the contrary, Jaipur district deficited negative growth. Other selected districts had no set pattern for growth in area; although Sikar, Chittorgarh, Nagaur and Kota districts had positive growth in respect to base year during all the five year plans. The maximum growth in area was shown by Churu district which was 709 times more as compared to the base year. The area under fenugreek in the state of Rajasthan showed positive growth during all the five year plans.

4A.1.2.2 Per cent change in production

Like area, the production of fenugreek, too, recorded decline in three districts, namely; Jhunujhunu, Jaipur and Bikaner during 8th five year plan. Other selected districts showed positive growth.

Table 4A.3: Per cent increase/decrease in production during different FYPs over 7th five year plan of selected districts of Rajasthan

District	Production in MT as 100 per cent	Per cent increase/decrease over 7th five year plan in production			
	7th plan (1985-90)	8th plan (1992-97)	9th plan (1997-02)	10th plan (2002-07)	11th plan (2007-12)
Sikar	5911 (100)	106.85	64.54	106.12	90.15
Chittorgarh	4439 (100)	88.49	51.97	61.88	19.51
Nagaur	569 (100)	116.34	558.70	748.33	886.64
Jhalawar	2453 (100)	60.58	131.92	77.33	89.03
Jhunujhunu	1692 (100)	-38.06	67.61	54.14	300.24
Kota	139 (100)	532.37	6935.97	4224.46	6145.32
Jaipur	7773 (100)	-42.15	-49.62	-45.66	-58.72
Churu	6 (100)	600.00	23700.00	25000.00	55950.00
Bikaner	76 (100)	-52.63	315.79	1761.84	10935.53
Bundi	0.00	0.00	465 (100.00)	36.56	734.19
Total of selected	23108 (100)	39.93	93.64	94.93	164.93
Rajasthan	29196 (100)	29.31	86.56	72.60	152.17

Figures in parentheses are the per cent of their respective column;
MT = Metric tonnes. The study period for Bundi was 1998-99 to 2012-13.

All the selected districts had positive growth in production of fenugreek during 9th, 10th and 11th five year plans over 7th FYP production. Churu and Nagaur had shown continuous increase in production of fenugreek during all the five year plans. In other districts, the production of fenugreek recorded increase across all the FYPs but the pattern (magnitude) of increase was not the same.

There was no area and production reported in Bundi during 7th and 8th five year plan, so assuming 9th five year plan as base year (i.e. 100 per cent) and the change in production was estimated. The maximum growth in production was recorded by Churu followed by Bikaner, Kota, Nagaur, Bundi and Jhunujhunu district during the 11th FYP.

4A.1.2.3 Per cent change in productivity

As in area and production in productivity, too, the districts of Jhunujhunu, Bikaner and Jaipur registered negative change during 8th five year plan over the base 7th FYPs. All districts had registered positive change in productivity during the 8th plans the positive change ranged from 16.73 per cent in Jhalawar district to 60.16 per cent in Sikar district.

A perusal of the table reveals that in Jhunujhunu district, the crop recorded decrease in productivity in all the FYPs over the base five year plan. Similarly, the productivity of the crop decrease in 9th and 10th FYPs in Chittogargh district and in Nagaur and Jaipur district during the 9th FYPs. The maximum positive change in productivity in 11th five year plan was recorded in Kota (146.44 per cent) followed by Bikaner (106.69 per cent), Nagaur (49.53 per cent), Jhalawar (35.21 per cent) and Bundi district (34.30 per cent) as compared to base FYPs.

It was concluded that during different five year plans the area, production and productivity recorded no particular growth sequence

either increase or decrease, and fluctuated during different five year plans except in few districts. The reasons of fluctuations in area may be attributed to low rainfall, low prices of fenugreek in past years and reasons of fluctuations in production and productivity were also attributed to law rainfall, insects, pests, diseases and natural hazards.

Table 4A.4: Per cent increase/decrease in productivity during different FYPs over 7th five year plan of selected districts of Rajasthan.

District	Productivity in Kg/hectare as 100 per cent	Per cent increase/decrease over 7th five year plan in productivity			
	7th plan (1985-90)	8th plan (1992-97)	9th plan (1997-02)	10th plan (2002-07)	11th plan (2007-12)
Sikar	999 (100)	60.16	58.96	20.02	5.01
Chittorgarh	1219 (100)	20.75	-0.82	-1.97	3.77
Nagaur	741 (100)	39.95	-4.99	35.90	49.53
Jhalawar	801 (100)	16.73	66.29	70.91	35.21
Jhunujhunu	1346 (100)	-20.21	-24.67	-30.31	-15.16
Kota	730 (100)	44.66	72.74	122.88	146.44
Jaipur	979 (100)	-10.21	-15.93	0.10	1.53
Churu	531 (100)	35.59	138.42	54.99	7.72
Bikaner	508 (100)	-2.56	23.43	93.50	106.69
Bundi	0.00	0.00	1000 (100.00)	11.60	34.30
Total of selected	860 (100)	16.86	25.12	30.70	30.70
Rajasthan	996 (100)	18.47	15.56	17.67	10.04

Figures in parentheses are the per cent of their respective column.

The study period for Bundi was 1998-99 to 2012-13.

4A.2 Instability in area, production and productivity of fenugreek

The instability in area, production and productivity of crops widens the demand and supply gap in the economy leading to unstable income to the farmers. The knowledge of the extent of instability in area, production and productivity of important crops at state/district level is crucial in the formulation of policies and in planning strategies for increasing their production and minimizing imbalances in agricultural development in the area. This helps in finding the areas in which the crop has faired better. It also aims at identifying relatively stable areas in respect of area, production and productivity of the crop in question.

To estimate the extent of instability in area, production and productivity of selected fenugreek crop, the coefficients of variation were calculated. The coefficients of variation in area, production and productivity of fenugreek crop were estimated from detrended time series data for the period from 1985-86 to 2012-13 for the state and major fenugreek crop producing districts of Rajasthan. Time series detrended production indices for each district was then calculated as the product of detrended area and yield indices divided by 100, i.e., $(AY)\ 100^{-1}$. To analyse the sources of variance explaining the change in instability in production of fenugreek, production variance were decomposed into area variance, yield variance and area-yield co-variance for the selected districts and state of Rajasthan using Hazells (1982) decomposition technique.

4A.2.1 Instability in fenugreek crop

Instability in area, production and productivity of fenugreek crop in Rajasthan state and major producing districts of the state is presented in Table 4A.5.

Table 4A.5: Coefficient of variation (per cent) for detrended area, production and productivity (yield) of fenugreek crop in the selected districts of Rajasthan (1985-86 to 2012-13) (Per cent)

District	Area	Production	Productivity
Sikar	31.52	35.88	26.23
Chittorgarh	43.74	48.09	14.63
Nagaur	55.92	64.30	33.19
Jhalawar	42.54	43.66	20.86
Jhunjhunu	43.95	53.43	20.61
Kota	71.06	85.93	46.98
Jaipur	16.44	37.50	34.68
Churu	73.28	81.97	42.17
Bikaner	74.11	76.49	14.65
Bundi	90.45	96.38	27.61
Rajasthan	24.87	28.92	14.14

Note: The study period for Bundi was 1998-99 to 2012-13

Table 4.5 shows the coefficient of variation in area, production and productivity after removal of trend. These data reveals the actual scenario of change in their magnitude.

It is evident from the table that the coefficient of variation for area under fenugreek crop in the state was 24.87 per cent during the period 1985-86 to 2012-13. The variation in area was higher (C.V more than 50 per cent) in Nagaur, Kota, Churu, Bikaner and Bundi districts and relatively lowers in Jaipur and Sikar district. The highest coefficient of variation was for Bundi district (90.45 per cent) and lowest for Jaipur district (16.44 per cent). The area instability in fenugreek crop was

found to be higher for the selected districts except Jaipur as compared to the state as a whole.

The coefficient of variation for production of fenugreek in the state of Rajasthan was 28.92 per cent during the period of 1985-86 to 2012-13. The variation in production was high (C.V more then 50 per cent) in Nagaur, Jhunujhunu, Kota, Churu, Bikaner and Bundi districts and relatively low in Sikar (35.88) and in Jaipur (37.50). For the selected districts, the range of variation was observed to range between as low as 35.88 per cent in Sikar to as high as 96.38 per cent in Bundi. The coefficient of variation for fenugreek production was related to be higher for the selected districts as compared to the state as a whole. It indicates that fluctuation in production was more in the selected districts compared to the state as a whole. In other words, high growth in production was accompanied by increased variability in production.

The table reveals that the coefficient of variation for productivity of fenugreek for the state was 14.14 per cent during the period 1985-86 to 2012-13. Among the districts, variation in productivity of fenugreek crop was highest (46.98 per cent) in Kota district and lowest (14.63 per cent) in Chittorgarh district.

It may be concluded that the magnitude of instability in production of fenugreek was high mainly due to high instability in area in the selected districts and in the state as a whole.

4A.2.2 Sources of variance in fenugreek production

Sources of variance in fenugreek production in the selected districts of Rajasthan and state as a whole are presented in Table 4A.6. The variance analysis of fenugreek production for the period 1985-86 to 2012-13 (Table 4A.6) indicated that yield variance was a dominant source of variation in production of fenugreek crop in all the selected districts (except Jaipur district) and state as a whole. It ranged

from 64.43 pre cent in Jhunujhunu district to 91.71 pre cent in Bikaner district. In Jaipur district the yield variance was only 19.77 per cent. As regards area variance except in Jaipur (87.99 per cent) and Sikar (55.76 per cent) district, it was low ranging from 3.58 per cent in Bikaner district to 29.85 per cent in Churu district.

Table 4A.6: Sources of variance in fenugreek production in selected districts of Rajasthan (1985-86 to 2012-13)

(per cent)

District	Area variance	Yield variance	Area yield covariance	Higher order covariance
Sikar	55.76	80.50	- 35.88	0.38
Chittorgarh	9.08	81.09	9.89	0.06
Nagaur	27.39	77.77	- 5.13	0.03
Jhalawar	23.85	99.23	- 22.85	0.23
Jhunujhunu	14.16	64.43	21.75	0.34
Kota	28.73	65.72	5.61	0.06
Jaipur	87.99	19.77	- 7.74	0.02
Churu	29.85	90.12	- 19.43	0.54
Bikaner	3.58	91.71	4.74	0.03
Bundi	8.15	87.43	4.47	0.05
Rajasthan	23.85	73.79	2.36	0.00

Note: Sum of variance = 100; study period for Bundi district was 1998-99 to 2012-13

Further area-yield covariance in half of selected districts was estimated to be positive accounting for 9.89, 21.75, 5.61, 4.74, 4.47 and 2.36 per cent in the districts of Chittorgarh, Jhunujhunu, Kota, Bikaner, Bundi, and state as a whole, respectively. It means that the combined positive effect of area and yield variance in production variance of fenugreek crop was relatively low in the above cited

districts as well as in the state. The area-yield co-variance negatively affected the production variance of fenugreek in the districts of Sikar (-35.88 per cent), Nagaur (-5.14 per cent), Jhalawar (-22.85 per cent), Jaipur (-35.88 per cent) and Churu (-19.43 per cent) indicating thereby that area-yield co-variance has a stabilizing effect on fluctuation in their production brought about mainly by yield instability of fenugreek crop production. The effect of higher order covariance was negligible.

It was evident from the foregoing discussion that yield variance was the major source of total variation in production and had a dominant role in destabilizing the production in most of the selected districts as well as in the state as a whole. On the contrary, area variance played a dominant role in destabilizing the production of fenugreek in the districts of Jaipur. Area-yield covariance helped stabilized the production in majority of the selected districts.

SECTION – B

COST OF CULTIVATION OF FENUGREEK

This section deals with the cost of cultivation of fenugreek incurred by the selected farmers of study area of Rajasthan (Jaipur and Sikar districts). Component wise description of cost incurred in the cultivation of fenugreek in both the districts and state as a whole are presented and discussed as under:

4B.1 Cost structure (components of total costs) in Jaipur district

Various components of the total costs (operational costs + overhead costs) incurred in the cultivation of fenugreek by sample farmers in Jaipur district of Rajasthan are presented in table 4B.1.

4B.1.1 Operational costs

It is revealed from the table that among the various components of operational cost incurred in the cultivation of fenugreek, human labour was the major component of expenditure on sample farms. It accounted for 28.33, 26.65, 25.04, 23.33 and 22.19 per cent of the total cost on marginal, small, semi-medium, medium and large farms, respectively. It was observed that the share of human labour was the maximum on marginal farms followed by small, semi-medium, medium and large farms (The lowest share). The overall share of human labour was 25.20 per cent of the total cost. Its share was found to decrease with the increase in size of land holding. Machine labour was the second important item of operational cost. On an average, the share of machine labour in total cost was 20.61 per cent. Its share increased with the increase in farm size. The overall share of manure was 7.56 per cent. Its share was maximum 8.54 per cent on marginal farms and minimum 6.27 per cent on large farms. The share of this component was found to decrease with the increase in size of land holdings.

Table 4B.1: Components of total costs incurred in the cultivation of fenugreek in Jaipur district of Rajasthan (2010-2011). (`/ha.)

Particulars	Size- Groups					Over all
	Marginal	Small	Semi-medium	Medium	Large	
Operational cost						
Machine Labour	4441.03	4780.00	5061.80	5261.14	5388.49	4974.02
	(19.46)	(19.95)	(20.76)	(21.33)	(21.74)	(20.61)
Seed	1175.26	1270.36	1327.23	1492.89	1532.37	1350.05
	(5.15)	(5.30)	(5.44)	(6.05)	(6.18)	(5.59)
Manures	1948.72	1914.29	1863.87	1734.60	1553.96	1824.93
	(8.54)	(7.99)	(7.64)	(7.03)	(6.27)	(7.56)
Fertilizers	728.21	811.43	956.07	1056.64	1131.29	926.09
	(3.19)	(3.39)	(3.92)	(4.28)	(4.56)	(3.84)
Plant protection chemical	287.18	391.43	431.41	696.30	902.88	513.18
	(1.26)	(1.63)	(1.77)	(2.82)	(3.64)	(2.13)
Irrigation charges	1226.54	1137.19	1014.79	969.25	958.63	1062.89
	(5.37)	(4.75)	(4.16)	(3.93)	(3.87)	(4.40)
Interest on working capital	171.62	183.58	203.32	231.50	249.58	205.02
	(0.75)	(0.77)	(0.83)	(0.94)	(1.01)	(0.85)
Human labour	6464.87	6384.57	6105.03	5754.70	5499.67	6083.51
	(28.33)	(26.65)	(25.04)	(23.33)	(22.19)	(25.20)
Total operating cost	16443.42	16872.85	16963.54	17197.01	17216.88	16939.70
	(72.05)	(70.42)	(69.56)	(69.72)	(69.46)	(70.18)
Over head cost						
Depreciation	987.85	1656.82	1972.03	2017.19	2112.94	1760.53
	(4.33)	(6.91)	(8.09)	(8.18)	(8.52)	(7.29)
Rental value of owned land	5000.00	5000.00	5000.00	5000.00	5000.00	5000.00
	(21.91)	(20.87)	(20.50)	(20.27)	(20.17)	(20.71)
Land revenue	30.00	30.00	30.00	30.00	30.00	30.00
	(0.13)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)
Interest on fixed capital	361.07	401.21	420.12	422.83	428.58	407.43
	(1.58)	(1.67)	(1.72)	(1.71)	(1.73)	(1.69)
Total over head cost	6378.92	7088.03	7422.15	7470.03	7571.52	7197.96
	(27.95)	(29.58)	(30.44)	(30.28)	(30.54)	(29.82)
Total Cost/CostC2	22822.34	23960.88	24385.68	24667.03	24788.40	24137.66
	(100)	(100)	(100)	(100)	(100)	(100)

Figures in parentheses are the per cent of the total cost (cost C2)

Seed and Irrigation charges accounted for 5.59 and 4.40 per cent to the total cost, respectively. The share of seed was maximum (6.18 per cent) on large farms and minimum (5.15 per cent) on marginal farms. The share of irrigation charges varied from 3.87 per cent on large farms to 5.37 per cent on marginal farms. The overall share of fertilizers, plant protection measures and interest on working capital was 3.84, 2.13 and 0.85 per cent, respectively of the total cost (Cost C_2). It was observed from the results that the share of manures, irrigation charges and human labour cost in total cost decreased with the increase in size of holding whereas, the share of costs of machine labour, seed, fertilizers, interest on working capital and plant protection measures increased with the increase in the size of land holding.

4B.1.2 Overhead costs

Among the various components of overhead costs, rental value of owned land was the major component of expenditure on sample farms. Rental value of owned land share was 21.91, 20.87, 20.50, 20.27 and 20.17 per cent of the total cost (Cost C_2) on marginal, small, semi-medium, medium and large size farms, respectively. The overall share of rental value of owned land was 20.71 per cent of the total cost. In absolute terms, it amounted to `5000/hac. On overall basis, the share of depreciation was 7.29 per cent. Its share was maximum (8.52 per cent) on large farms and minimum (4.33 per cent) on marginal farms. On an average interest on fixed capital and land revenue was accounted 1.69 and 0.12 per cent respectively of the total cost.

4B.1.3 Cost groups

Various types of costs included in the cultivation of fenugreek are presented in table 4B.2. Cost C_3 is the cost of production which is made after including 10 per cent of cost C_2 (on account of managerial functions performed by farmers) in cost C_2. It is evident from the table that on an average over all cost of cultivation (Cost C_3) per hectare of

fenugreek cultivation was ` 26551.42. Among the different size groups of farms, it was ` 25104.57 on marginal, ` 26356.97 on small, ` 26824.25 on semi-medium, ` 27133.74 on medium and ` 27267.24 on large farms in the study area. Further, the cost of cultivation of fenugreek was highest on large farms followed by medium, semi-medium, small and marginal farms. It was found to increase with the increase in size of farm.

Table 4B.2: Cost groups in cultivation of fenugreek in Jaipur district of Rajasthan (2010-2011). (`/ha.)

Particulars	**Size- Groups**					**Over all**
	Marginal	**Small**	**Semi-medium**	**Medium**	**Large**	
Total operating cost	16443.42 (72.05)	16872.85 (70.42)	16963.54 (69.56)	17197.01 (69.72)	17216.88 (69.46)	16939.70 (70.18)
Total over head cost	6378.92 (27.95)	7088.03 (29.58)	7422.15 (30.44)	7470.03 (30.28)	7571.52 (30.54)	7197.96 (29.82)
Cost A_1	10996.40 (48.18)	12360.81 (51.59)	13823.88 (56.69)	15507.05 (62.87)	16654.35 (67.19)	13711.19 (56.80)
Cost A_2	10996.40 (48.18)	12360.81 (51.59)	13823.88 (56.69)	15507.05 (62.87)	16654.35 (67.19)	13711.19 (56.80)
Cost B_1	11357.47 (49.76)	12762.02 (53.26)	14244.00 (58.41)	15929.88 (64.58)	17082.93 (68.92)	14118.62 (58.49)
Cost B_2	16357.47 (71.67)	17762.02 (74.13)	19244.00 (78.92)	20929.88 (84.85)	22082.93 (89.09)	19118.62 (79.21)
Cost C_1	17822.34 (78.09)	18960.88 (79.13)	19385.68 (79.50)	19667.03 (79.73)	19788.40 (79.83)	19137.66 (79.29)
Cost C_2	22822.34 (100)	23960.88 (100)	24385.68 (100)	24667.03 (100)	24788.40 (100)	24137.66 (100)
Cost C_3	25104.57	26356.97	26824.25	27133.74	27267.24	26551.42

Figures in parentheses are the per cent of the total cost (cost C2)

The operational cost of fenugreek cultivation on overall basis was ` 16939.70. It accounted for 70.18 per cent of the total cost (Cost C2). This cost varied on different size group of farms. The operational cost was ` 16443.42 on marginal, ` 16872.85 on small, ` 16963.54 on semi-medium, ` 17197.01 on medium and ` 17216.88 on large farms

In absolute terms, it also increased with the increase in size of land holdings. The operational cost exceeded the overhead cost on all the size groups of farms. On an average, the overhead cost was ` 7197.96. In absolute terms, the overhead cost also increased with the increase in farm size. It was ` 6378.92 on marginal, ` 7088.03 on small, ` 7422.15 on semi-medium, ` 7470.03 on medium and ` 7571.52 on large sized farms.

On an average the cost A_1, A_2, B_1, B_2, C_1 and C_2 were ` 13711.19, ` 13711.19, ` 14118.62, ` 19118.62, ` 19137.66 and 24137.66, respectively. The cost $A_1$ was same as cost $A_2$ on all the size groups of farms because none of the sample farmers leased-in any land for cultivation of fenugreek in the study area. Cost $B_1$ was `11357.47, ` 12762.02, ` 14244.00, ` 15929.88 and ` 17082.63, respectively on marginal, small, semi-medium, medium and large sized farms.

Cost B_2 was ` 16357.47, ` 17762.02, ` 19244.00, ` 20929.88 and ` 22082.93, respectively on marginal, small, semi-medium, medium and large sized farms. Further, cost $B_1$ and $B_2$ were found to increase with the increase in farm size. Cost $C_1$ was ` 17822.34 on marginal farms, ` 18960.88 on small farms, ` 19385.68 on semi-medium farms, ` 19667.03 on medium farms and ` 19788.40 on large sized farms. Cost C_2 that is total cost ranged from as low as ` 22822.34 on marginal farms to as high as 24788.40 on large farms. Thus results shows that cost A_1, A_2, B_1, B_2, C_1, C_2 and C_3 increase with increase in farm size.

4B.1.4 Returns

The per hectare returns from cultivation of fenugreek crop on different size groups of farms have been presented in the table 4B.3. The table reveals that among the various components of returns, overall gross income was ` 46085.74 per hectare from fenugreek cultivation. It was ` 40930.40 on marginal, ` 43520.45 on small, ` 46100.00 on semi-medium, ` 49429.62 on medium and ` 52229.14 on large sized farms. It was observed that the gross income from fenugreek cultivation increased with the increase in size of land holdings. Farm business income was ` 29934.00, ` 31159.64, ` 32276.12, ` 33922.57 and ` 35574.78, respectively on marginal, small, semi-medium, medium and large categories of farms. Overall, the farm business income was ` 32374.55. It was also found to increase with the increase in farms size.

Table 4B.3: Returns from cultivation of fenugreek in Jaipur district of Rajasthan (2010-2011). (`/ha.)

Particulars	Size- Groups					Over all
	Marginal	Small	Semi-medium	Medium	Large	
Gross income	40930.40	43520.45	46100.00	49429.62	52229.14	46085.74
Farm business income	29934.00	31159.64	32276.12	33922.57	35574.78	32374.55
Return over Operating cost	24486.98	26647.61	29136.46	32232.61	35012.26	29146.04
Family labour income	24572.93	25758.43	26856.00	28499.74	30146.21	26967.12
Net income	18108.06	19559.57	21714.32	24762.59	27440.74	21948.08
Return per rupee	1.79	1.82	1.89	2.00	2.11	1.91
Cost of production (per qt.)	1178.90	1171.68	1161.22	1100.37	1048.89	1154.25

The net income per hectare was found highest on large farms followed by medium, semi-medium, small and marginal farms. The overall net income from fenugreek cultivation was ` 21948.08. The net income was highest ` 27440.74 on large farms and lowest ` 18108.06 on marginal farms. On an average, returns over operating cost, family labour income and returns per rupee were ` 29146.04, ` 26967.12 and ` 1.91, respectively. The per rupee return was maximum (` 2.11) on large farms and minimum (` 1.79) on marginal farms.

Cost of production per quintal of fenugreek was ` 1178.90 on marginal, ` 1171.68 on small, ` 1161.22 on semi-medium, `1100.37 on medium and `1048.89 on large farms. The overall cost of production per quintal of fenugreek was ` 1154.25. Further, the cost of production of fenugreek was lowest ` 1048.89 on large farms and highest ` 1178.90 on marginal farms.

4B.2 Cost structure (components of total cost) in Sikar district

Table 4B.4 shows that on an average, total cost (cost C_2) incurred in cultivation of fenugreek was ` 23399.93 per hectare. Among different size groups, it was ` 21154.78 on marginal, ` 22447.28 On small, ` 23740.33 on semi-medium, ` 24369.73 on medium and ` 25143.58 on large sized farms. Total cost (operational cost and over head) incurred in cultivation of fenugreek was highest on large sized farms followed by medium, semi-medium, small and marginal sized farms.

4B.2.1 Operational cost

The operational cost of cultivation of fenugreek in Sikar district was more than the overhead cost on all size groups of farms. The overall operational cost of cultivation of fenugreek was `16852.02 (72.02 per cent) per hectare.

Table 4B.4: Components of total costs incurred in the cultivation of fenugreek in Sikar district of Rajasthan (2010-2011). (`/ha.)

Particulars	Size- Groups					Over all
	Marginal	Small	Semi-medium	Medium	Large	
Operational Cost						
Machine Labour	4100.00	4579.49	5048.95	5669.05	6120.77	5073.40
	(19.38)	(20.4)	(21.27)	(23.26)	(24.34)	(21.68)
Seed	1008.93	1128.72	1237.89	1361.43	1480.87	1237.11
	(4.77)	(5.03)	(5.21)	(5.59)	(5.89)	(5.29)
Manures	1964.29	1948.72	1852.63	1771.43	1672.13	1850.31
	(9.29)	(8.68)	(7.80)	(7.27)	(6.65)	(7.91)
Fertilizers	714.29	850.00	977.37	1020.00	1148.91	942.04
	(3.38)	(3.79)	(4.12)	(4.19)	(4.57)	(4.03)
Plant protection measures	291.43	393.85	480.42	671.24	939.89	529.01
	(1.38)	(1.75)	(2.02)	(2.75)	(3.74)	(2.26)
Irrigation charges	1241.50	1153.27	1081.86	963.88	926.78	1075.95
	(5.87)	(5.14)	(4.56)	(3.96)	(3.69)	(4.60)
Interest on working capital	163.11	189.41	206.15	224.00	250.33	205.42
	(0.77)	(0.84)	(0.87)	(0.92)	(1.00)	(0.88)
Human labour	6237.14	6184.10	6145.52	5611.24	5163.93	5938.77
	(29.48)	(27.55)	(25.89)	(23.03)	(20.54)	(25.38)
Total operating cost	15720.67	16427.55	17030.80	17292.26	17703.61	16852.02
	(74.31)	(73.18)	(71.74)	(70.96)	(70.41)	(72.02)
Over head cost						
Depreciation	821.88	1344.75	1960.65	2289.17	2612.83	1816.35
	(3.89)	(5.99)	(8.26)	(9.39)	(10.39)	(7.76)
Rental value of owned land	4000.00	4000.00	4000.00	4000.00	4000.00	4000.00
	(18.91)	(17.82)	(16.85)	(16.41)	(15.91)	(17.09)
Land revenue	30.00	30.00	30.00	30.00	30.00	30.00
	(0.14)	(0.13)	(0.13)	(0.12)	(0.12)	(0.13)
Interest on fixed capital	582.23	644.97	718.88	758.30	797.14	701.56
	(2.75)	(2.87)	(3.03)	(3.11)	(3.17)	(3.00)
Total over head cost	5434.10	6019.72	6709.53	7077.47	7439.97	6547.91
	(25.69)	(26.82)	(28.26)	(29.04)	(29.59)	(27.98)
Total Cost/CostC2	21154.78	22447.28	23740.33	24369.73	25143.58	23399.93
	(100)	(100)	(100)	(100)	(100)	(100)

Figures in parentheses are the per cent of the total cost (cost C_2)

It varied for different size groups of farms and was ` 15720.67 (74.31 per cent), `16427.55 (73.18 per cent), `17030.80 (71.74 per cent), ` 17292.26 (70.96 per cent) and ` 17703.61 (70.41 per cent) per hectare on cultivation of fenugreek in Sikar district on marginal, small, semi-medium, medium and large sized farms, respectively. Thus, in absolute terms it was found to increase with the increase in size of farms.

It is evident from the table that human labour was the most important component of the operational cost. It alone accounted for 25.38 per cent of the total cost (Cost C_2). The share of human labour cost in total cost varied from 20.54 per cent on large farms to 29.48 per cent on marginal farms. Further, the share of human labour cost was maximum (29.48 per cent) on marginal farms. It's share was found to decrease with the increase in size of holding. Machine labour was the second important item of operational cost. On an average, the share of machine labour in total cost (cost C_2) was 21.68 per cent. It's share was minimum (19.38 per cent) on marginal farms and maximum (24.34 per cent) on large farms. The share of machine labour cost was found to increase with the increase in size of land holding. The share of manures in total cost ranged from as low as 6.65 per cent on large farms to as high as 9.29 per cent on marginal farms. Manure exibited negative relationship with the size of holdings. Seed was the fourth important item of operational cost. The seed cost was higher on large (5.89 per cent) and less on marginal farms (4.77 per cent) as compared to other sized farms due to use of local variety with more quantity of seed rate. On an average, the share of irrigation charges in the total cost was 4.60 per cent.

The share of irrigation charges in total cost ranged from as low as 3.69 per cent on large farms to as high as 5.87 per cent on marginal farms. Irrigation cost had negative relationship with the size of holdings because farmers of relatively smaller size of holding purchased water

from big farmers at higher cost. The share of fertilizer cost in total cost ranged from 3.38 to 4.57 per cent on different sized farms with an average of 4.03 per cent. The cost of fertilizers was positively associated with the size of holdings (increased with the increase in size of holdings). On an average, the cost of plant protection measures and interest on working capital accounted for 2.26 and 0.88 per cent of the total cost, respectively. It was observed that the cost of machine labour, seeds, fertilizers and plant protection measures increased with the increase in the size of land holding, whereas, manures, irrigation charges and human labour cost decreased with the increase in size of holdings.

4B.2.2 Overhead cost

On an average, the total over head cost in cultivation of fenugreek in Sikar district was ` 6547.91 (27.98 per cent). On different size groups, the share of overhead costs in the total costs varied from 25.69 per cent to 29.59 per cent on different sized farms. Among the individual items of overhead cost, rental value of owned land was the single largest item which accounted for 17.09 per cent of the total cost. The other items of over head cost were interest on fixed capital, depreciation and land revenue which on an average accounted for 3.00, 7.76 and 0.13 per cent, respectively of the total cost.

4B.2.3 Cost groups

Different cost groups for cultivation of fenugreek in the district of Sikar are presented in table 4B.5. It is obvious from the table that on an average, the total cost (Cost C_2) per hectare of fenugreek cultivation was ` 23399.93 for the sample farmers of the study area.

On an average, over all cost of cultivation (Cost C_3) per hectare of fenugreek cultivation was ` 25739.92. Among the different size groups of farms, it was ` 23270.26 on marginal, ` 24692.00 on small, `

26114.36 on semi-medium, ` 26806.70 on medium and ` 27657.93 on large farms of the study area.

Table 4B.5: Cost groups in cultivation of fenugreek in Sikar district of Rajasthan (2010-2011). (` /ha.)

Cost Groups	Size- Groups					Over all
	marginal	Small	Semi-medium	Medium	Large	
Operating cost	15720.67	16427.55	17030.80	17292.26	17703.61	16852.02
	(74.31)	(73.18)	(71.74)	(70.96)	(70.41)	(72.02)
Over head cost	5434.10	6019.72	6709.53	7077.47	7439.97	6547.91
	(25.69)	(26.82)	(28.26)	(29.04)	(29.59)	(27.98)
Cost A_1	10335.41	12387.44	13977.03	15343.05	17197.81	13790.21
	(48.86)	(55.18)	(58.87)	(62.96)	(68.40)	(58.93)
Cost A_2	10335.41	12387.44	13977.03	15343.05	17197.81	13790.21
	(48.86)	(55.18)	(58.87)	(62.96)	(68.40)	(58.93)
Cost B_1	10917.64	13032.41	14695.91	16101.35	17994.95	14491.77
	(51.61)	(58.06)	(61.90)	(66.07)	(71.57)	(61.93)
Cost B_2	14917.64	17032.41	18695.91	20101.35	21994.95	18491.77
	(70.52)	(75.88)	(78.75)	(82.48)	(87.48)	(79.02)
Cost C_1	17154.78	18447.28	19740.33	20369.73	21143.58	19399.93
	(81.09)	(82.18)	(83.15)	(83.59)	(84.09)	(82.91)
Cost C_2	21154.78	22447.28	23740.33	24369.73	25143.58	23399.93
	(100)	(100)	(100)	(100)	(100)	(100)
Cost C_3	23270.26	24692.00	26114.36	26806.70	27657.93	25739.92

Figures in parentheses are the per cent of the total cost (cost C_2)

It was observed that the cost of cultivation of fenugreek increased with the increase in the size of holding due to use of more inputs and higher expenses on labour, seed material, fertilizer and plant protection measures with size of land holdings.The operational cost exceeded the

overhead cost in all size groups of farms. On an average, the share of operational costs was 72.02 per cent of the total cost (Cost C_2) on the sample farms. In absolute terms it was ` 16852.02 on the sample farms of the selected villages. The overall Cost $A_1$, Cost $A_2$, Cost $B_1$, Cost $B_2$, and Cost $C_1$ were ` 13790.21, ` 13790.21, `14491.77, `18491.77 and 19399.93 per hectare on different sized farms. Cost A_2 was same as cost A_1 on all size groups of farms because none of the sample farmers leased-in any land for cultivation of fenugreek in the study area.

4B.2.4 Returns

The per hectare returns from cultivation of fenugreek on different size groups of farms have been presented in table 4B.6. On an average gross income from cultivation of fenugreek was ` 45423.14 per hectare. It was estimated to be ` 39412.70, ` 42176.66, ` 45496.58, ` 48288.44 and ` 53239.66, respectively on marginal, small, semi-medium, medium and large sized farms. Thus, the gross income from fenugreek cultivation was found to have positive relationship with the in size of land holding.

The overall farm business income, return over operating cost and family labour income from per hectare of fenugreek cultivation were ` 31632.93, ` 28571.13, and ` 26931.37, respectively. Net income, a measure of pure profit per hectare of crop, was computed by deducting cost $C_2$ (total cost) from the gross income. The overall net income was ` 22023.22 per hectare and it increased with the increase in size of land holding. The return per rupee was ` 1.86, 1.88, 1.92, 1.98 and 2.12 on marginal, small, semi-medium, medium and large sized group of farms, respectively. On an average, return per rupee was estimated at ` 1.94. The overall cost of production per quintal of fenugreek was ` 1111.78. The cost of production was lowest (` 1045.74) on large farms and highest (`1139.10) on marginal sized

farms. Cost of production decreased with increase in the size of farms. The study results revealed that the cultivation of fenugreek on sample farms of the study area was a profitable crop enterprise.

Table 4B.6: Returns from cultivation of fenugreek in Sikar district of Rajasthan (2010-2011). (` /ha.)

Particulars	Size- Groups					Over all
	Marginal	Small	Semi-medium	Medium	Large	
Gross income	39412.70	42176.66	45496.58	48288.44	53239.66	45423.14
Farm business income	29077.29	29789.22	31519.55	32945.39	36041.85	31632.93
Return over operating cost	23692.03	25749.11	28465.78	30996.18	35536.05	28571.13
Family labour income	24495.06	25144.25	26800.67	28187.09	31244.71	26931.37
Net income	18257.92	19729.38	21756.25	23918.71	28096.08	22023.22
Return per rupee	1.86	1.88	1.92	1.98	2.12	1.94
Cost of production (per qty.)	1139.10	1134.04	1119.27	1095.85	1045.74	1111.78

4B.3 Cost structure (components of total costs) in the state

Various components of the total costs (operational costs + overhead costs) incurred in the cultivation of fenugreek by sample farmers in state of Rajasthan are presented in table 4B.7.

4B.3.1 Operational costs

It is revealed from the table 4B.7 that among the various components of operational cost incurred in the cultivation of fenugreek, human labour was the major component of expenditure on sample farms.

Table 4B.7: Components of total costs incurred in the cultivation of fenugreek in the state of Rajasthan (2010-2011). (`/ha.)

Particulars	Size Group					Over all
	Marginal	Small	Semi-medium	Medium	Large	
(A) Operational cost						
Machine Labour	4307.58 (19.43)	4705.52 (20.11)	5055.53 (21.00)	5429.10 (22.12)	5690.02 (22.82)	5015.76 (21.05)
Seed	1110.17 (5.01)	1217.75 (5.20)	1283.65 (5.33)	1438.76 (5.86)	1511.16 (6.06)	1302.62 (5.47)
Manures	1954.81 (8.82)	1927.08 (8.24)	1858.39 (7.72)	1749.77 (7.13)	1602.62 (6.43)	1835.59 (7.70)
Fertilizers	722.76 (3.26)	825.76 (3.53)	966.46 (4.02)	1041.55 (4.24)	1138.55 (4.57)	932.79 (3.91)
Plant protection measures	288.84 (1.30)	392.33 (1.68)	455.32 (1.89)	685.98 (2.79)	918.12 (3.68)	519.83 (2.18)
Irrigation charges	1232.39 (5.56)	1143.16 (4.89)	1047.51 (4.35)	967.04 (3.94)	945.52 (3.79)	1068.38 (4.48)
Interest on working capital	168.29 (0.76)	185.75 (0.79)	204.70 (0.85)	228.41 (0.93)	249.89 (1.00)	205.19 (0.86)
Human labour	6375.76 (28.76)	6310.11 (26.97)	6124.78 (25.44)	5695.63 (23.21)	5361.42 (21.50)	6022.72 (25.28)
Total operating cost	16160.60 (72.89)	16707.45 (71.4)	16996.35 (70.61)	17236.23 (70.22)	17417.30 (69.85)	16902.87 (70.94)
(B) Over head cost						
Depreciation	922.91 (4.16)	1540.91 (6.59)	1966.48 (8.17)	2129.18 (8.67)	2318.78 (9.30)	1783.97 (7.49)
Rental value of owned land	4608.70 (20.79)	4628.57 (19.78)	4512.20 (18.75)	4588.24 (18.69)	4588.24 (18.40)	4580.00 (19.22)
Land revenue	30.00 (0.14)	30.00 (0.13)	30.00 (0.12)	30.00 (0.12)	30.00 (0.12)	30.00 (0.13)
Interest on fixed capital	447.61 (2.02)	491.75 (2.10)	565.86 (2.35)	560.96 (2.29)	580.34 (2.33)	530.96 (2.23)
Total over head cost total	6009.21 (27.11)	6691.23 (28.6)	7074.53 (29.39)	7308.39 (29.78)	7517.35 (30.15)	6924.94 (29.06)
Cost/CostC2 (A+B)	22169.82 (100)	23398.69 (100)	24070.88 (100)	24544.61 (100)	24934.65 (100)	23827.81 (100)

Figures in parentheses are the per cent of the total cost (cost C_2)

It accounted for 28.76, 26.97, 25.44, 23.21 and 21.50 per cent of the total cost on marginal, small, semi-medium, medium and large farms, respectively. It was observed that the share of human labour was the maximum on marginal farms followed by small, semi-medium, medium and large farms (the lowest share). The overall share of human labour was 25.28 per cent of the total cost. Its share was found to decrease with the increase in size of land holding. Machine labour was the second important item of operational cost. On an average, the share of machine labour in total cost was 21.05 per cent. Its share increased with the increase in farm size. The overall share of manure was 7.70 per cent. Its share was maximum 8.82 per cent on marginal farms and minimum 6.43 per cent on large farms. The share of this component was found to decrease with the increase in size of land holdings.

Seed and Irrigation charges accounted for 5.47and 4.48 per cent to the total cost, respectively. The share of seed was maximum (6.06 per cent) on large farms and minimum (5.01 per cent) on marginal farms. The share of irrigation charges varied from 3.79 per cent on large farms to 5.56 per cent on marginal farms. The overall share of fertilizers, plant protection measures and interest on working capital was 3.91, 2.18 and 0.86 per cent, respectively of the total cost (Cost C_2).

It was observed from the results that the share of manures, irrigation charges and human labour cost in total cost decreased with the increase in size of holding whereas, the share of costs of machine labour, seed, fertilizers, interest on working capital and plant protection measures increased with the increase in the size of land holding.

4B.3.2 Overhead costs

Among the various components of overhead costs, rental value of owned land was the major component of expenditure on sample farms. Rental value of owned land share was 20.79, 19.78, 18.75,

18.69 and 18.40 per cent of the total cost (Cost C_2) on marginal, small, semi-medium, medium and large size farms, respectively. The overall share of rental value of owned land was 19.22 per cent of the total cost. In absolute terms, it amounted to `4580/hac. On overall basis, the share of depreciation was 7.49 per cent. Its share was maximum (9.30 per cent) on large farms and minimum (4.16 per cent) on marginal farms. On an average interest on fixed capital and land revenue was accounted for, 2.23 and 0.13 per cent respectively of the total cost.

4B.3.3 Cost groups

Various types of costs included in the cultivation of fenugreek are presented in table 4B.8. It is evident from the table that on an average over all cost of cultivation (Cost C_3) per hectare of fenugreek cultivation was ` 26210.59. Among the different size groups of farms, it was ` 24386.80 on marginal, ` 25738.55 on small, ` 26477.96 on semi-medium, ` 26999.08 on medium and ` 27428.11 on large farms in the study area. Further, the cost of cultivation of fenugreek was highest on large farms followed by medium, semi-medium, small and marginal farms. It was found to increase with the increase in size of farm.

The operational cost of fenugreek cultivation on overall basis was ` 16902.87. It accounted for 76.24 per cent of the total cost (Cost C2). This cost varied on different size group of farms. The operational cost was ` 16160.60 on marginal, ` 16707.45 on small, ` 16996.35 on semi-medium, ` 17236.23 on medium and ` 17417.30 on large farms. In absolute terms, it also increased with the increase in size of land holdings. The operational cost exceeded the overhead cost on all the size groups of farms.

On an average, the overhead cost was ` 6924.94. In absolute terms, the overhead cost also increased with the increase in farm size. It was ` 6009.21 on marginal, ` 6691.23 on small, ` 7074.53 on semi-

medium, ` 7308.39 on medium and ` 7517.35 on large sized farms. On an average the cost A_1, A_2, B_1, B_2, C_1 and C_2 were ` 13744.38, ` 13744.38, ` 14275.34, ` 18855.34, ` 19247.81 and 23827.81, respectively. The cost A_1 was same as cost A_2 on all the size groups of farms because none of the sample farmers leased-in any land for cultivation of fenugreek in the study area.

Table 4B.8: Cost groups in cultivation of fenugreek in the state of Rajasthan (2010-2011). (` ha.)

Particulars	Size- Groups					Over all
	Marginal	Small	Semi-medium	Medium	Large	
Total operating cost	16160.60	16707.45	16996.35	17236.23	17417.30	16902.87
	(72.89)	(75.36)	(76.66)	(77.75)	(78.56)	(76.24)
Total over head cost	6009.21	6691.23	7074.53	7308.39	7517.35	6924.94
	(27.11)	(30.18)	(31.91)	(32.97)	(33.91)	(31.24)
Cost A_1	10737.75	12370.70	13898.59	15439.52	16878.13	13744.38
	(48.43)	(55.80)	(62.69)	(69.64)	(76.13)	(62.00)
Cost A_2	10737.75	12370.70	13898.59	15439.52	16878.13	13744.38
	(48.43)	(55.80)	(62.69)	(69.64)	(76.13)	(62.00)
Cost B_1	11185.36	12862.45	14464.44	16000.49	17458.47	14275.34
	(50.45)	(58.02)	(65.24)	(72.17)	(78.75)	(64.39)
Cost B_2	15794.06	17491.02	18976.64	20588.72	22046.70	18855.34
	(71.24)	(78.90)	(85.60)	(92.87)	(99.44)	(85.05)
Cost C_1	17561.12	18770.11	19558.68	19956.38	20346.42	19247.81
	(79.21)	(84.67)	(88.22)	(90.02)	(91.78)	(86.82)
Cost C_2	22169.82	23398.69	24070.88	24544.61	24934.65	23827.81
	(100)	(100)	(100)	(100)	(100)	(100)
Cost C_3	24386.80	25738.55	26477.96	26999.08	27428.11	26210.59

Figures in parentheses are the per cent of the total cost (cost C_2)

Cost B_1 was `11185.36, ` 12862.45, ` 14464.44, ` 16000.49 and ` 17458.47, respectively on marginal, small, semi-medium, medium and large sized farms. Cost $B_2$ was ` 15794.06, ` 17491.02, ` 18976.64, ` 20588.72 and ` 22046.70, respectively on marginal, small, semi-medium, medium and large sized farms. Further, cost B_1 and B_2 were found to increase with the increase in farm size. Cost C_1 was ` 17561.12 on marginal farms, ` 18770.11 on small farms, ` 19558.68 on semi-medium farms, ` 19956.38 on medium farms and ` 20346.42 on large sized farms. Cost $C_2$ that is total cost ranged from as low as ` 22169.82 on marginal farms to as high as ` 24934.65 on large farms. Thus results shows that cost A_1, A_2, B_1, B_2, C_1, C_2 and C_3 increase with increase in farm size.

4B.3.4 Returns

The per hectare returns from cultivation of fenugreek crop on different size groups of farms have been presented in the table 4B.9. The table reveals that among the various components of returns, overall gross income was ` 45807.45 per hectare from fenugreek cultivation. It was ` 40336.52 on marginal, ` 43021.33 on small, ` 45805.65 on semi-medium, ` 48959.52 on medium and ` 52645.24 on large sized farms. It was observed that the gross income from fenugreek cultivation increased with the increase in size of land holdings.

Farm business income was ` 29598.77, 30650.63, 33520.20, 33520.2 and 35767.10, respectively on marginal, small, semi-medium, medium and large categories of farms. Overall, the farm business income was ` 32063.07. It was also found to increase with the increase in farms size. The net income per hectare was found highest on large farms followed by medium, semi-medium, small and marginal farms.

Table 4B.9: Returns from cultivation of fenugreek in the state of Rajasthan (2010-2011). (`/hac.)

Particulars	Size- Groups					Over all
	Marginal	Small	Semi-medium	Medium	Large	
Gross income	40336.52	43021.33	45805.65	48959.72	52645.24	45807.45
Farm business income	29598.77	30650.63	31907.06	33520.20	35767.10	32063.07
Return over Operating cost	24175.91	26313.88	28809.30	31723.49	35227.94	28904.58
Family labour income	24542.46	25530.31	26829.01	28371.00	30598.53	26952.11
Net income	18166.70	19622.64	21734.77	24415.11	27710.59	21979.64
Return per rupee	1.82	1.84	1.90	1.99	2.11	1.92
Cost of production (per qty.)	1163.33	1157.70	1140.76	1098.51	1047.59	1128.04

The overall net income from fenugreek cultivation was ` 21979.64. The net income was highest ` 27710.59 on large farms and lowest ` 18166.70 on marginal farms. On an average, returns over operating cost, family labour income and returns per rupee were ` 28904.58, ` 26952.11 and ` 1.92, respectively. Per rupee return was maximum (` 2.11) on large farms and minimum (` 1.82) on marginal farms. Cost of production per quintal of fenugreek was ` 1163.33 on marginal, ` 1157.70 on small, ` 1140.76 on semi-medium, ` 1098.51 on medium and ` 1047.59 on large farms. The overall cost of production per quintal of fenugreek was ` 1128.04. Further, the cost of production of fenugreek was lowest ` 1047.59 on large farms and highest ` 1163.33 on marginal farms.

SECTION-C

MARKETING BEHAVIOUR, COSTS AND MARGINS IN MARKETING OF FENUGREEK

The decision of a farmer in regard to the sale of his produce determines the flow of the produce in the marketing channel and the decision of sale itself is influenced by a number of factors like proximity to market, availability of transportation facilities, availability of storage facilities, his economic soundness, etc.

In this section, an attempt has been made to analyse the marketing behaviour of farmers in respect of sale, cost incurred and margin earned by the different agencies involved in marketing of fenugreek in regulated markets (Krishi Upaj Samiti, Chomu, Jaipur and Krishi Upaj Mandi Samiti, Sri Madhopur, Sikar) in state of Rajasthan. District-wise study results are presented and discussed as under:

4C.1 Marketing system of fenugreek in Jaipur district of Rajasthan

An efficient marketing system is one of the pre-requisites for raising the income of farmers. The available marketing facilities and different marketing channels bring variation in the net price received by the producer-farmers for the produce disposed of by them. The farmers' behaviour with respect to sale of their surplus produce and the pattern of flow of surplus produce in the marketing channels are influenced by number of factors such as proximity to market, price of the produce in the market, availability of transport facilities, available storage facilities, financial position of the farmers etc.

The marketing behaviour of the selected fenugreek growing farmers with respect to the place, time and agency adopted by them in sale of fenugreek is presented under following sub-sections:

(i) Place-wise sale pattern of fenugreek

(ii) Time-wise sale pattern of fenugreek

(iii) Agency-wise sale pattern of fenugreek

4C.1.1 Place-wise sale pattern of fenugreek

The farmers sold the surplus of fenugreek in their own village as well as in nearby Krishi Upaj Mandi Samiti, Chomu (Jaipur). The quantity of fenugreek marketed by the farmers at this place is present in table 4C.1.

Table 4C.1: Place-wise disposal pattern of fenugreek seed by the sample farmers in Jaipur district. (Quantity in quintals)

Size groups	No of farmers	Village sale	Mandi sale	Total
Marginal	14	75.50*	-	75.50*
(< 1 ha.)		5.39**	-	5.39**
		(100.00)		(100.00)
Small	22	273.00*	-	273.00*
(1-2 ha.)		12.40**	-	12.40**
		(100.00)		(100.00)
Semi-medium	21	222.00*	190.00*	412.00*
(2-4 ha.)		10.57**	9.05**	19.62**
		(53.88)	(46.12)	(100.00)
Medium	20	89.00*	384.00*	473.0*
(4-10 ha.)		4.45**	19.20**	23.65**
		(18.82)	(81.18)	(100.00)
Large	10	-	657.00*	657.00*
(10 ha. & above)		-	65.70**	65.70**
			(100.00)	(100.00)
Overall	87	659.50*	1231.00*	1890.50*
		7.57**	14.15**	21.72**
		(34.88)	(65.12)	(100.00)

Figures in parentheses are the per cent of total sale by the respective size group of farmers; * total quantity; ** per farm quantity

The table show that 65.12 per cent produce of fenugreek was sold by the selected farmers in the mandi and 34.88 per cent in their village markets. Among the size groups, there existed large variation. All the marginal and small farmers sold the crop produce in their own villages. As against this, all the large farmers sold their fenugreek produce in the nearby regulated market. The semi-medium and medium farmers sold their fenugreek at both the places. The semi-medium farmers sold 53.88 per cent produce in the village and 46.12 per cent in regulated market. The medium sized farmers sold 81.18 per cent produce in the regulated market and rest 18.82 per cent in the village itself.

Thus, from the above results it could be concluded that the sale of fenugreek in the regulated market increased with the increase in size of farm holding because of the low quantity of produce available with famers of small land holdings.

4C.1.2 Time-wise sale pattern of fenugreek

The sale pattern of fenugreek at different times of the year by the farmers of different size groups in Jaipur district is shown in table 4C.2. The sale pattern according to time was studied after dividing the year in to four seasons each of three months duration. The peak arrival season of fenugreek was during March to May (first quarter) after the harvest of the crop.

Farmers of all sized groups sold on an average 66.11, 23.45, 8.23 and 2.21 per cent surplus in the first, second, third and fourth quarters of the year, respectively. This showed that large farmers sold low quantity in the first quarter of the year probably because of low prices prevailing in this season due to heavy arrival of the produce. Among the size groups semi-medium, medium and large sized farmers sold 63.60, 60.05 and 54.03 per cent of their total surplus in the first quarter of the year i.e. immediately after harvest to meet the cash

needs for domestic necessities as well as for clearing the loan obligations. Sale in the second quarter by the semi-medium, medium and large sized farmers was 36.40, 24.52 and 26.94 per cent of total marketed surplus, respectively.

Table 4C.2: Time pattern of disposal of fenugreek seed by the sample farmers in Jaipur district (Quantity in quintals)

Size groups	No of selected farmers	I Quarter (March to May)	II Quarter (June to Aug.)	III Quarter (Sept. to Nov.	IV Quarter (Dec. to Feb.)	Total Sale
Marginal	14	75.5*	-	-	-	75.50*
(< 1 ha.)		5.39**	-	-	-	5.39**
		(100.00)				(100.00)
Small	22	273.00*	-	-	-	273.00*
(1-2 ha.)		12.40**	-	-	-	12.40**
		(100.00)				(100.00)
Semi-	21	262.00*	150.00*	-	-	412.00*
medium		12.48**	7.14**	-	-	19.62**
(2-4 ha.)		(63.60)	(36.40)			(100.00)
Medium	20	284.00*	116*	73.00	-	473.00*
(4-10 ha.)		14.20**	5.80**	3.65	-	23.65**
		(60.05)	(24.52)	(15.43)		(100.00)
Large	10	355.00*	177*	83.00	42.00	657.00*
(10 ha. & above)		35.50**	17.70**	8.30	4.20	65.70**
		(54.03)	(26.94)	(12.64)	(6.39)	(100.00)
Overall	87	1249.50*	443.00*	156.00	42.00	1890.5*
		14.36**	5.08**	1.80	0.48	21.72**
		(66.11)	(23.45)	(8.23)	(2.21)	(100.00)

Figures in parentheses are the per cent of total sale by the respective size group of farmers; * total quantity; ** per farm quantity

This shows that medium and semi-medium sized farmers sold their produce in this quarter heavily. Only 27 per cent farmers from large size group sold their surplus produce in this quarter. Marginal, small and semi-medium farms did not sale in the third quarter as they had no surplus for disposal. The medium and large sized farmers sold 15.43 and 12.64 per cent of their marketed surplus in this quarter. In the fourth quarter, only large sized farmers sold the produce. This was 6.39 per cent of their total marketed surplus.

The results revealed that there was tendency of sale immediately after harvest among the marginal and small farmers. The semi-medium farmers sold the total surplus in the first and second quarters of the years. The medium farmers sold their produce in first three quarters of the year. The large farmers sold their produce in all the four quarters of the year but more quantity was sold in first and second quarter of the year.

4C.1.3 Agency-wise sale pattern of fenugreek

Distribution of producer-farmers adopting different channels in sale of their fenugreek surplus is presented in table 4C.3 and in figure 4C.1. Selected farmers adopted following two channels in marketing of their fenugreek:

(i) Marketing channel adopted for selling fenugreek in village was

Producer farmer-Village trader-Wholesaler-Retailer -consumer

(ii) Marketing channel adopted for selling fenugreek in regulated market

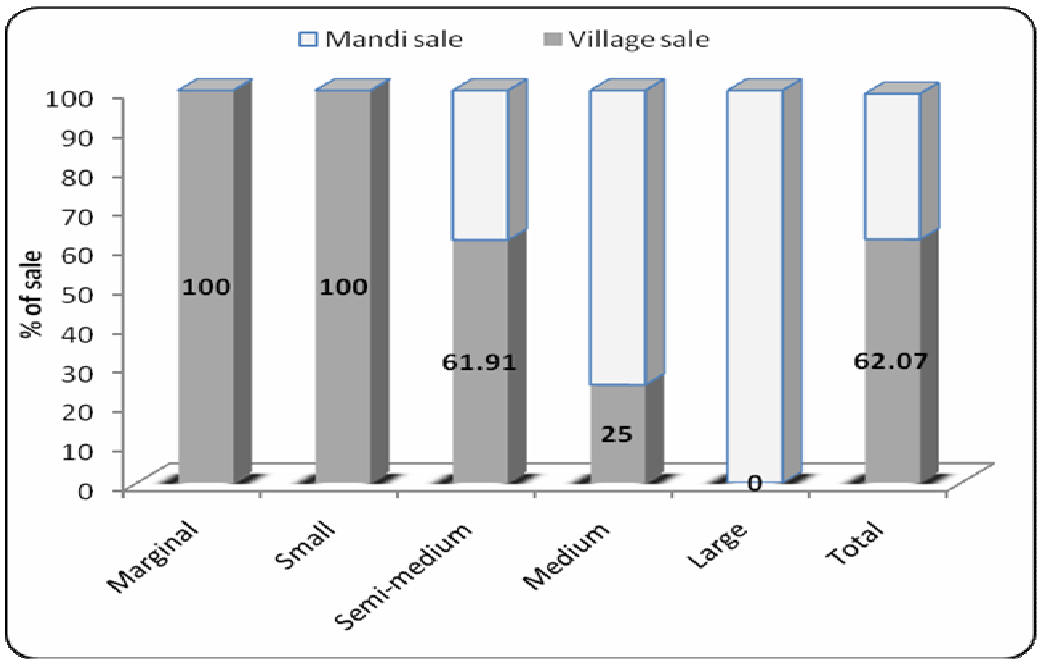
Producer farmer – wholesaler – retailer – consumer

62.07 per cent farmers marketed fenugreek in the village to the village traders. Village traders purchased fenugreek from the producers at the price indicated by them as most of the farmers had no knowledge of the prevailing market prices.

Table 4C.3 Distribution of producer farmers adopting different marketing channels in marketing of fenugreek seed in Jaipur district.

Marketing channels & Size group	Village sale (Producer-village trader-wholesaler-retailer-consumer)	Mandi sale (Producer-wholesaler-retailer-consumer)	Total
Marginal	14 (100.00)	-	14 (100.00)
Small	22 (100.00)	-	22 (100.00)
Semi-medium	13 (61.91)	8 (38.09)	21 (100.00)
Medium	5 (25.00)	15 (75.00)	20 (100.00)
Large	-	10 (100.00)	10 (100.00)
Total	54 (62.07)	33 (37.93)	87 (100.00)

Figures in parentheses are the per cent of their respective column total.



Village sale (Producer-village trader-wholesaler-retailer-consumer)
Mandi sale (Producer-wholesaler-retailer-consumer)

Figure 4C.1: Distribution of producer farmers adopting different marketing channels in marketing of fenugreek seed in Jaipur district

Out of the 87 farmers selected for the study 54 farmers (62.07 per cent) marketed fenugreek in their own village. Among the size groups cent per cent marginal and small farmers and 61.91 per cent semi-medium and 25 per cent medium farmers marketed their fenugreek in the village to the village traders. Further interrogation revealed that they preferred to market in village due to lesser quantity of fenugreek available with them as well as due to high unit cost incurred in marketing of small lots of produce in the regulated market. None of the large farmers sold fenugreek in the village. Adoption of village sale by the farmers revealed declining trend with the increase in farm size.

Arrivals of fenugreek in the market started from the month of March and reached to a peak in the month of April and May. It was noted that 37.93 per cent selected farmers brought surplus fenugreek in Chomu mandi for sale. Among the size groups: 38.09 per cent semi-medium, 75.00 per cent medium and cent per cent large farmers brought their fenugreek in the mandi for sale. The study results revealed that number of farmers adopting mandi sale increased in number with increase in farm size.

4C.1.4 Marketing costs, margins and price-spread in marketing of fenugreek in Jaipur district

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 margin 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.

4C.1.4.1 Marketing charges

Marketing charges at village level

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

(A) Transportation charges

Farmers transported the fenugreek 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 ` 7.5 per quintal on average basis.

(B) Cost of gunny bags

Village traders carried their produce in Jute gunny bags. The cost of a new gunny bag was ` 40.00. The working life of a gunny bag was expected to last for 5 years. The carrying capacity of a gunny bag was 100 kg. The depreciation charge for a gunny bag was estimated at ` 8.00 and Sutli charges to ` 0.40 per quintal.

(C) Loading and unloading charges

Prevailing charges for this were ` 5.00 per bag of 100 kg and was borne by the village trader.

(D) Weighing charges

Weighing charges at the rate of `1.20 per bag of 100 kg was borne by the village trader.

(E) Filling and stitching charges

This operation was done mostly by family labour but prevailing rate of filling and stitching charges for 100.00 kg bag was ` 2.50.

(F) Karda

Village trader deducted Karda charges from the producer-farmers @ 2 kg per bag of 100 kg valued at ` 43.20 on an average basis.

(G) Cleaning and sieving charges

The village-trader incurred ` 5.00 per bag carrying 100 kg of fenugreek for its cleaning and sieving.

Marketing charges at mandi level

Cost of performing various functions in sale of fenugreek at mandi as prescribed by Krishi Upaj Mandi Samiti, Chomu (Jaipur) is presented in table 4C.4.

Table 4C.4: Market charges in sale of fenugreek seeds in Krishi Upaj Mandi Samiti, Chomu – Jaipur

Particulars	Unit	Rate in `	Charges borne by
VAT	per 100 rupees worth of produce	5.00	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 bag of 100 kg	5.00	These charges are borne by the seller upto arrival of the produce in the mandi & thereafter these are borne by the buyer
Unloading	per bag of 100 kg	5.00	
Weighing	per bag of 100 kg	1.20	Buyer

Source: Records of Krishi Upaj Mandi Samiti, Chomu, Jaipur

(A) Transportation charges

Transportation cost was paid by the farmer sellers on the basis of number of bags of fenugreek. This also varied with the distance between farm and mandi. The selected villages were situated about 20-22 km. away from Chomu mandi (Jaipur). Mini trucks and tractor trolleys were common means used in transportation. The average cost of transportation borne by the farmer was ` 20.00 per quintal at Chomu mandi.

(B) Cost of gunny bags

The carrying cost of fenugreek in jute gunny bags per trip from the farmer's field to mandi was estimated at ` 8.40 per quintal.

(C) Loading and unloading charges

Loading of fenugreek bags in mini truck/ tractor trolley was done by the family labour of the farmers. At mandi unloading was done at prescribed charges of ` 2.50 per 50 kg bag. This cost was born by the producer seller as it was incurred prior to the sale. The cost of loading and unloading was thus ` 5.00 per 100 kg bag.

(D) Weighing charges

Weighing charges @ `1.20 per bag was borne by the buyer of fenugreek.

(E) Filling and stitching charges

The prevailing charges for filling and stitching a bag were ` 2.50 per bag of 100 kg.

(F) Karda

Karda was deducted by the wholesaler from the producer-seller @ 2 kg per 100 kg of fenugreek valuing at ` 43.20 per quintal.

(G) VAT (value added tax)

VAT was charged from the buyer at the rate of 5 per cent of the value of the produce (fenugreek) by the commission agent for depositing the same in the government account.

(H) Mandi fee

Mandi fee was realized by the mandi samiti @ ` 1.60 per ` 100 worth of fenugreek and was borne by the buyer.

(I) Commission

Commission agents charged commission at the rate of two per cent of the value of fenugreek from the buyers.

(J) Cleaning and sieving charges

The wholesalers incurred ` 5.00 per bag of 100 kg for cleaning of fenugreek.

4C.1.4.2 Channel-wise marketing cost of fenugreek

Costs incurred in marketing of fenugreek at village and at mandi through different channels are presented in table 4C.5.

(A) Cost of marketing at village sale

Total cost incurred in marketing of fenugreek at village level was noted to be ` 385.74 per quintal of fenugreek. Of this ` 66.60 (17.27 per cent), ` 47.10 (12.21 per cent), ` 239.94 (62.20 per cent) and ` 32.10 (8.32 per cent) were incurred by the producer, village trader, wholesaler and retailer, respectively. Agency wise break-up of the marketing cost in sale of fenugreek revealed that wholesalers incurred the major share in total marketing costs. Component wise break-up of marketing cost indicated that VAT, mandi fee, commission, cost of gunny bags, transportation cost and karda were the major cost items and these items together accounted for over 85.98 per cent of the total marketing costs.

Table 4C.5: Marketing costs incurred in sale of fenugreek seed at village and mandi in Jaipur district (`/qtl)

Particulars of cost	Village sale				Total costs
	Producer	Village trader	Wholesaler	Retailer	
VAT	-	-	122.00 (50.85)	-	122.00 (31.63)
Commission	-	-	48.80 (20.34)	-	48.80 (12.65)
Mandi fee	-	-	39.04 (16.27)	-	39.04 (10.12)
Cleaning and sieving	-	5.00 (10.62)	-	-	5.00 (1.30)
Filling & stitching	2.50 (3.75)	2.50 (5.31)	2.50 (1.04)	2.50 (7.79)	10.00 (2.59)
Bag and sutli charges	8.40 (12.61)	8.40 (17.83)	8.40 (3.50)	8.40 (26.17)	33.60 (8.71)
Transportation	7.50 (11.26)	20.00 (42.46)	7.50 (3.13)	10.00 (31.15)	45.00 (11.67)
Weighing	-	1.20 (2.55)	1.20 (0.50)	1.20 (3.74)	3.60 (0.93)
Collection for association	-	-	0.50 (0.21)	-	0.50 (0.13)
Karda	43.20 (64.86)	-	-	-	43.20 (11.20)
Loading	5.00 (7.51)	5.00 (10.62)	5.00 (2.08)	5.00 (15.58)	20.00 (5.18)
Unloading	-	5.00 (10.62)	5.00 (2.08)	5.00 (15.58)	15.00 (3.89)
Total	66.60 (100.00) [17.27]	47.10 (100.00) [12.21]	239.94 (100.00) [62.20]	32.10 (100.00) [8.32]	385.74 (100.00) [100.00]
	Mandi sale				
VAT	-	-	122.00 (50.85)	-	122.00 (34.26)
Commission	-	-	48.80 (20.34)	-	48.80 (13.70)
Mandi fee	-	-	39.04 (16.27)	-	39.04 (10.96)
Cleaning & sieving	5.00 (5.95)	-	-	-	5.00 (1.40)
Filling & stitching	2.50 (2.97)	-	2.50 (1.04)	2.50 (7.79)	7.50 (2.11)
Bag & sutli charges	8.40 (9.99)	-	8.40 (3.50)	8.40 (26.17)	25.20 (7.08)
Transportation	20.00 (23.78)	-	7.50 (3.13)	10.00 (31.15)	37.50 (10.53)
Weighing	-	-	1.20 (0.50)	1.20 (3.74)	2.40 (0.67)
Collection for association	-	-	0.50 (0.21)	-	0.50 (0.14)
Karda	43.20 (51.37)	-	-	-	43.20 (12.13)
Loading	5.00 (5.95)	-	5.00 (2.08)	5.00 (15.58)	15.00 (4.21)
Unloading	-	-	5.00 (2.08)	5.00 (15.58)	10.00 (2.81)
Total	84.10 (100.00) [23.62]	- -	239.94 (100.00) [67.37]	32.10 (100.00) [9.01]	356.14 (100.00) [100.00]

Figures in parentheses are the per cent of total marketing cost incurred by the respective middleman. Figures in square brackets are the per cent of total marketing cost incurred in each channel.

(B) Cost of marketing at mandi sale

The table reveals that the selected farmers incurred ` 84.10 (23.62 per cent) per quintal in taking the produce to mandi. Component wise, transportation and karda were the major items of cost which together accounted for 75.15 per cent of total cost.

Wholesaler incurred ` 239.94 per quintal (67.37 per cent) in mandi sale. Component wise, VAT, commission and mandi fee were the major cost items accounting for 87.46 per cent of the total cost. Cost of transportation, gunny bags, loading and unloading charges accounted for 10.79 per cent of the total marketing costs. Wholesaler sold fenugreek to retailers in the mandi. Retailers took the purchased fenugreek to their place of business and incurred ` 32.10 per quintal (9.01 per cent) of fenugreek in marketing to the consumers. Producer, wholesaler and retailers together incurred a cost of ` 356.14 per quintal in sale of fenugreek. The share of producer, wholesaler and retailer in total cost of marketing was of the order of 23.62, 67.37, and 9.01 per cent, respectively. Comparison of cost incurred in marketing of fenugreek at village and mandi revealed that marketing costs were higher in village sale by ` 29.60 per quintal than that in mandi sale.

4C.1.4.3 Marketing margins and price spread

Marketing margin and price-spread in sale of fenugreek in both the channels i.e. at village and mandi are presented in table 4C.6 and in figure 4C.2.

(A) Price-spread in marketing of fenugreek at village

Producer got a net price of ` 2050 per quintal or 58.57 per cent of the price paid by the consumer in sale of fenugreek at village. Marketing cost incurred by the middlemen was ` 385.74 or 11.02 per cent of the consumer's price.

Intermediaries earned a total margin of ` 1064.26 or 30.41 per cent of the price paid by the consumer in sale of fenugreek. Agency-wise break up of the gross margin revealed that the village trader, wholesaler and retailer got 6.30, 9.23 and 14.88 per cent of the consumer price, respectively. Further the share of retailer in the total margin has been much higher (48.94 per cent) due to the demand of fenugreek in small quantity by the consumers.

Table 4C.6: Price-spread in marketing of fenugreek seeds at village and mandi sale in Jaipur district.

Particulars	Village sale		Mandi sale	
	` / quintal	Share in consumer's ` (per cent)	` / quintal	Share in consumer's ` (per cent)
Producer's net price	2050.00	58.57	2300.00	65.71
Cost incurred by				
Producer	66.60	1.90	84.10	2.40
Village trader	47.10	1.35	-	-
Wholesaler	239.94	6.86	239.94	6.86
Retailer	32.10	0.92	32.10	0.92
Total cost	385.74	11.02	356.14	10.18
Margin earned by				
Village trader	220.40	6.30	-	-
Wholesaler	323.00	9.23	323.00	9.23
Retailer	520.86	14.88	520.86	14.88
Total margin	1064.26	30.41	843.86	21.25
Consumer's price	3500.00	100.00	3500.00	100.00

(B) Price-spread in marketing of fenugreek in mandi

In sale of fenugreek in Chomu (Jaipur) mandi, producer-farmers got a net price of ` 2300 per quintal or 65.71 per cent of the price paid by the consumers.

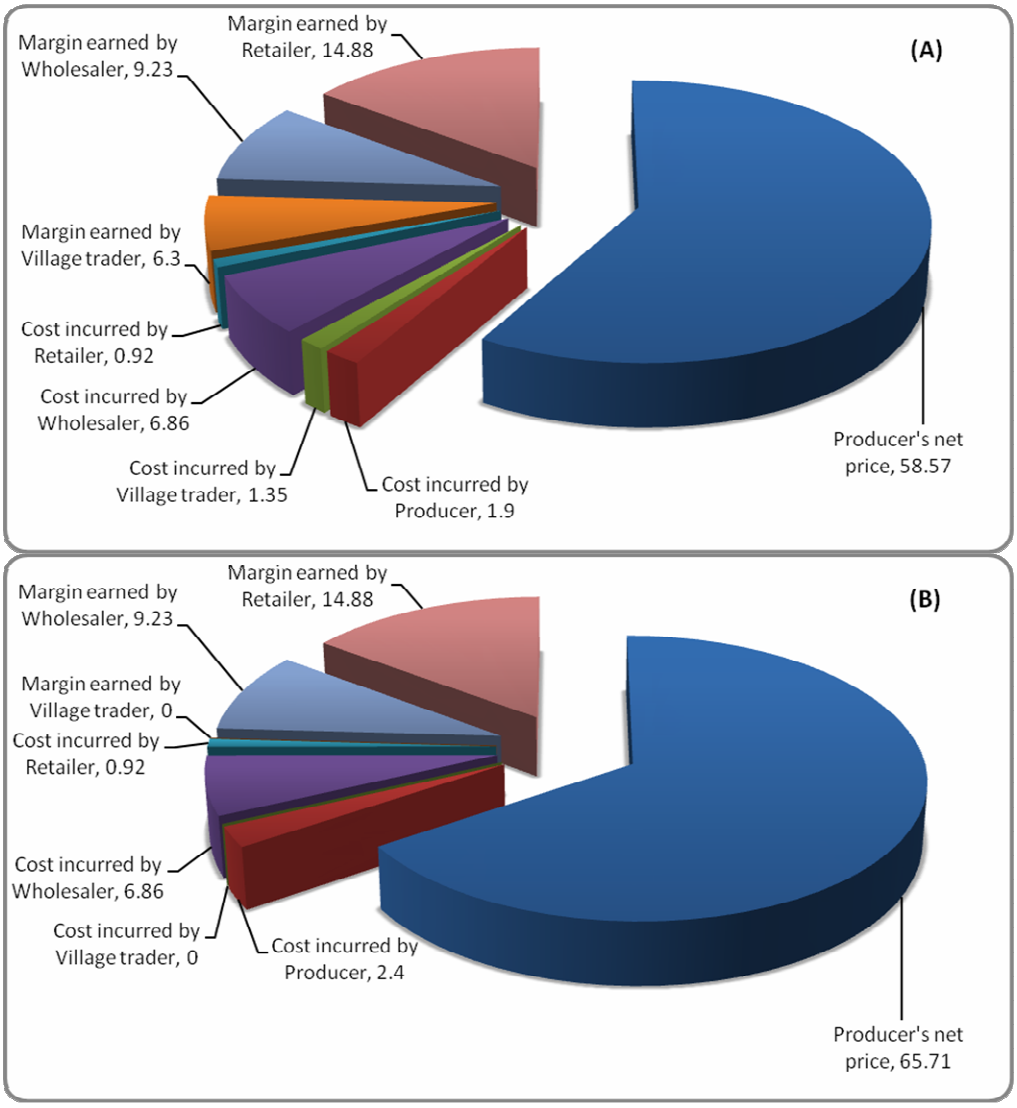


Figure 4C.2: Price-spread in marketing of fenugreek seeds at village (A) and mandi sale (B) in Jaipur district.

Marketing cost incurred by different middlemen was ` 356.14 or 10.18 per cent of consumer's price. Middleman in sale of fenugreek earned a margin of 843.86 or 21.25 per cent of the price paid by the consumers. Among the various middlemen, retailer's margin was ` 520.86 (14.88

per cent) which was higher by 5.65 per cent than the wholesaler's margin. Farmers got 7.14 per cent higher share in sale of fenugreek in the mandi than in the village. Margins earned by the middlemen were observed to be higher than by 6.30 per cent in sale of feungreek in the village sale than the regulated market.

From the above discussion, it may be concluded that the net price received by the producer farmer in village sale was lower than that of the mandi sale by the farmer.

4C.2 Marketing system of fenugreek in Sikar district of Rajasthan

In this section, marketing system of the selected fenugreek growing farmers located in command area of Krishi Upaj Mandi samiti, Srimadhopur (Sikar) has been presented. The marketing system of the selected farmers in accordance with place, time and agency adopted by them is presented under following sub- heads:

(i) Place –wise sale pattern of fenugreek

(ii) Time–wise sale pattern of fenugreek

(iii) Agency –wise sale pattern of fenugreek

4C.2.1 Place-wise sale pattern of fenugreek

The farmers of the selected villages sold fenugreek in their own villages to the village traders as well as in the nearby Krishi Upaj Mandi Samiti, Srimadhopur (Sikar). The quantity of fenugreek marketed by different categories of selected farmers at these places is presented in table 4C.7.

Table 4C. 7: Place-wise disposal pattern of fenugreek seed by the sample farmers in Sikar district (Quantity in quintals)

Size groups	No. of farmers	Village sale	Mandi sale	Total
Marginal	9	51.00*	-	51.00*
(<1 ha.)		5.67**	-	5.67**
		(100.00)		(100.00)
Small	13	113.00*	-	113.00*
(1-2 ha.)		8.69**	-	8.69**
		(100.00)		(100.00)
Semi-medium	20	217.00*	184.00*	401.00*
(2-4 ha.)		10.85**	9.20**	20.05**
		(54.11)	(45.89)	(100.00)
Medium	14	100.00*	367.00*	467.00*
(4-10 ha.)		7.14**	26.21**	33.35**
		(21.41)	(78.59)	(100.00)
Large	7	-	391.00*	391.00*
(10 ha. & above)		-	55.86**	55.86**
			(100.00)	(100.00)
Overall	63	481.00*	942.00*	1423.00*
		7.64**	14.95**	22.59**
		(33.79)	(66.21)	(100.00)

Figures in parentheses are the per cent of total sale by the respective size group of farmers; * total quantity; ** per farm quantity

The table revealed that the selected farmers marketed 66.21 per cent fenugreek in Sikar regulated market and remaining 33.79 per cent in their own villages. Among the size groups, marginal and small farmers sold cent per cent quantity of fenugreek in their own villages.

Semi-medium and medium farmers sold 54.11 and 21.41 per cent quantity in the villages where as, the quantity sold by these categories of farmers in the mandi was 45.89 and 78.59 per cent, respectively. As against this, cent per cent large farmers sold their produce in Sikar regulated market. The tendency of village sale increased with the decrease in the size of holdings due to lesser quantity of fenugreek available with them. The tendency of mandi sale was found to be positively associated with the increase in the farm size, i.e. mandi sale increased with the increase in the size of holdings.

An overview of results revealed that the bigger farmers preferred to market their fenugreek produce in the regulated market of Sikar with the expectation of getting higher prices.

4C.2.2 Time-wise sale pattern of fenugreek

The sale pattern of fenugreek at different quarters of the year by the farmers of different size groups is shown in table 4C.8. The sale pattern according to time was studied after dividing the year in to four seasons each of three months duration. On overall basis, the selected farmers sold 90.44 per cent of fenugreek in the first two quarters of the year, i.e. during the month of March to August and 9.56 per cent quantity was sold by them in other two quarters of the year, i.e. during the month of September to February. The farmers of all size groups sold 69.42, 21.02, 7.44 and 2.12 per cent fenugreek in the first, second, third and fourth quarters of the year, respectively. Among the size groups, semi-medium, medium and large farmers sold 77.06, 63.38 and 56.01 per cent fenugreek, respectively in the first quarter. The quantity marketed by them in the second quarter was 22.94, 22.70 and 25.83 per cent, respectively.

Medium and large farmers sold 13.92 and 10.49 per cent quantity of fenugreek in the third quarter of the year. Only large farmers sold 7.67 per cent quantity of fenugreek in the fourth quarter.

Table 4C.8: Time pattern of disposal of fenugreek seed by the sample Farmers in Sikar district. (Quantity in quintals)

Size groups	No. of selected farmers	I Quarter (March to May)	II Quarter (June to Aug.)	III Quarter (Sept. to Nov.)	IV Quarter (Dec. to Feb.)	Total Sale
Marginal	9	51.00*	-	-	-	51.00*
(<1 ha.)		5.67**	-	-	-	5.67**
		(100.00)				(100.00)
Small	13	113.00*	-	-	-	113.00*
(1-2 ha.)		8.69**	-	-	-	8.69**
		(100.00)				(100.00)
Semi-	20	309.00*	92.00*	-	-	401.00*
medium		15.45**	4.60**	-	-	20.05**
(2-4 ha.)		(77.06)	(22.94)			(100.00)
Medium	14	296.00*	106.00*	65.00*	-	467.00*
(4-10 ha.)		21.14**	7.57**	4.64**	-	33.35**
		(63.38)	(22.70)	(13.92)		(100.00)
Large	7	219.00*	101.00*	41.00*	30.00*	391.00*
(10 ha. & above)		31.28**	14.43**	5.86**	4.29**	55.86**
		(56.01)	(25.83)	(10.49)	(7.67)	(100.00)
Overall	63	988.00*	299.00*	106.00*	30.00*	1423*
		15.68**	4.75**	1.68**	0.48**	22.59**
		(69.42)	(21.02)	(7.44)	(2.12)	(100.00)

Figures in parentheses are the per cent of total sale by the respective size group of farmers; * total quantity; ** per farm quantity

As against this, all the marginal and small farmers sold their total fenugreek in the first quarter of the year, i.e. immediately after harvest. The study revealed that of the total fenugreek available with the farmers, 69.42 per cent fenugreek was marketed only in the first quarter, i.e. during the month of March to May and remaining 30.58 per cent in other three quarters of the year. Among the size groups, marginal and small farmers marketed their total produce immediately after harvest, i.e. in the first quarter. An overview of the results revealed that the increase in farm size and quantity of fenugreek marketed in the subsequent quarters of the year had shown positive association. Medium and large farmers continued to dispose of their fenugreek produce up to the third and fourth quarters of the year due to their better financial position as also the availability of storage facilities with them.

4C.2.3 Agency–wise sale pattern of fenugreek

Distribution of producer-farmers adopting different channels in sale of their fenugreek surplus is presented in table 4C.9 and in figure 4C.3. Selected farmers adopted two channels for marketing of fenugreek which were as follows. :

(i) Marketing channel adopted for selling fenugreek in the villages was:

Producer farmer-Village trader-Wholesaler-Retailer-Consumer

(ii) Marketing channel adopted for selling fenugreek in the regulated market was:

Producer farmer- Wholesaler-Retailer-Consumer

(A) Village sale of fenugreek

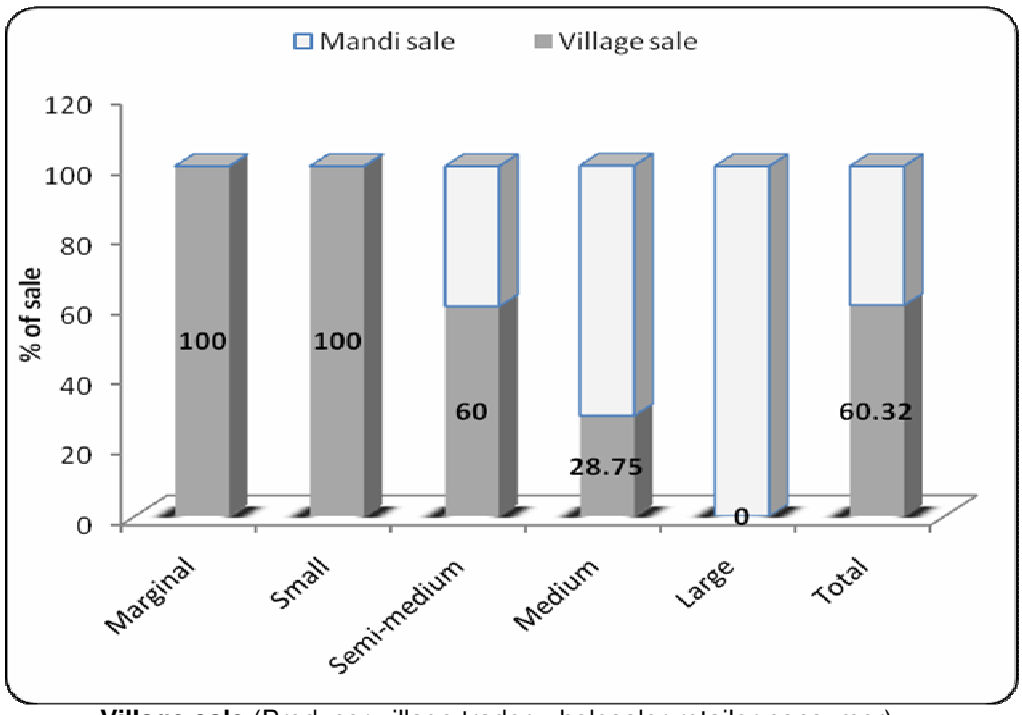
It is revealed from the table that 60.32 per cent farmers sold fenugreek in the villages to the village traders. Village traders directly established relationship with the fenugreek producer-farmers by advancing loans and other basic necessities from time to time. Village

traders purchased fenugreek from the producers at the price indicated by them as most of the farmers had no knowledge of the prevailing market prices. Out of the 63 farmers selected for the study, 38 farmers (60.32 per cent) marketed fenugreek in their own villages. Of this cent per cent farmers were from marginal and small sized categories, whereas 60.00 and 28.57 per cent farmers were from semi-medium and medium categories (Table 4C.9). None of the large farmers sold fenugreek in villages to the village traders. Adoption of village sale by the farmers recorded declining trend with the increase in farm size.

Table 4C.9 Distribution of producer farmers adopting different marketing channels in marketing of fenugreek seed in Sikar district.

Marketing channels & Size group	**Village sale** (Producer-village trader-wholesaler-retailer-consumer)	**Mandi sale** (Producer-wholesaler-retailer-consumer)	**Total**
Marginal	9 (100.00)	-	9 (100.00)
Small	13 (100.00)	-	13 (100.00)
Semi-medium	12 (60.00)	8 (40.00)	20 (100.00)
Medium	4 (28.57)	10 (71.43)	24 (100.00)
Large	-	7 (100.00)	7 (100.00)
Total	38 (60.32)	25 (39.68)	63 (100.00)

Figures in parentheses are the per cent of their respective column total.



Village sale (Producer-village trader-wholesaler-retailer-consumer)
Mandi sale (Producer-wholesaler-retailer-consumer)

Figure 4C.3: Distribution of producer farmers adopting different marketing channels in marketing of fenugreek seed in Sikar district

(B) Mandi sale of fenugreek

Sikar mandi was the principal fenugreek market in the state of Rajasthan in respect of fenugreek. Arrivals of fenugreek in the market were on the peak in the months of March, April and May. 39.68 per cent farmers sold fenugreek in the regulated market of Sikar. Further, 40.00 per cent semi-medium, 71.43 per cent medium and cent per cent of the large farmers sold their fenugreek in the mandi. None of the farmers from marginal and small categories sold fenugreek in mandi. Farmers adopting mandi sale were positively associated with the increase in size of holding and the quantity of fenugreek surplus.

4C.2.4 Marketing costs, margins and price-spread in marketing of fenugreek in Sikar district

4C.2.4.1 Marketing charges

Marketing charges at village sale

Following costs were incurred in the sale of fenugreek at village level. All these costs were borne by the producer-farmers. Cleaning and sieving charges, costs of gunny bags and sutli (jute twine), filling and stitching charges, loading and unloading charges were reported same as village sale in Jaipur district. Producer-farmers transported fenugreek by camel carts or tractor trolleys for sale to the village traders shop and bear transportation cost @ ` 10.00 per bag of 100 kg Village traders transported the purchased quantity of fenugreek by tractor trolleys to the Krishi Upaj Mandi Samiti, (Sri Madhopur) Sikar and incurred ` 45.00 per bag of 100 kg as cost of transportation. Village traders charged Karda from producer-farmers @ two kg per bag of 100 kg on an average the cost of Karda was ` 46.20 per bag.

Marketing charges at mandi sale

Costs of performing various functions in sale of fenugreek at mandi as prescribed by the Krishi Upaj Mandi Samiti, (Srimadhopur) Sikar are as presented in table 4C.4 for Jaipur district. All charges such as mandi fee, VAT (value added tax), commission charges, cost of gunny bags and sutli, loading and unloading charges, filling and stitching charges, weighing charges, cleaning and sieving charges were reported similar for mandi sale as reported in Jaipur district except transportation charges and karda. This also varied with the distance between farm and the mandi. The selected villages were situated about 40-50 km away from Srimadhopur mandi. Mini-trucks and tractor trolleys were common means used in transportation of fenugreek from these villages. The average transportation cost per

quintal was ` 50. Karda was deducted by the wholesaler from the producer-sellers @ two kg per bag of 100 kg valued at ` 46.20.

4C.2.4.2 Channel-wise marketing cost of fenugreek

Costs incurred in marketing of fenugreek at village and at mandi through different channels are presented in table 4C.10.

(A) Costs of marketing of fenugreek at village sale

Total costs incurred in marketing of fenugreek at village level were ` 421.86 per quintal. Of this, ` 72.10 (17.09 per cent), ` 72.10 (17.09 per cent), ` 235.56 (55.84 per cent) and ` 42.10 (9.98 per cent) were incurred by the producer-farmers, village traders, wholesalers and retailers, respectively. Agency-wise break-up of the marketing costs in sale of fenugreek revealed that wholesalers incurred the major share in total marketing costs. Component-wise break-up of marketing costs indicated that VAT, mandi fees, commission, karda and transportation cost were the major items of costs as these together accounted for 79.21 per cent of the total marketing costs. Out of these items, VAT alone accounted for 27.97 per cent of the total marketing costs.

(B) Cost of marketing of fenugreek in mandi sale

The table reveals that selected farmers incurred a cost of ` 117.10 per quintal in taking produce to mandi. Wholesalers incurred ` 235.00 per quintal (59.69 per cent of the total marketing costs). Component-wise, VAT, commission, mandi fees, karda and transportation cost were the major cost items which together accounted for 83.39 per cent of the total marketing cost. Wholesalers sold fenugreek to the retailers in the mandi. Retailers took the purchased fenugreek to their place of business and incurred ` 42.10 per quintal (10.66 per cent) in sale of fenugreek to the consumers. Producers, wholesalers and retailers together incurred a cost of ` 394.76 per quintal in sale of fenugreek. Further the share of producers, wholesalers and retailers in total cost of marketing was 29.66, 59.69 and 10.66 per cent, respectively.

Table 4C. 10: Marketing costs incurred in sale of fenugreek seed at village and mandi in Sikar district. (`/qt)

Particulars of cost	Village sale				Total costs
	Producer	Village trader	Wholesaler	Retailer	
VAT	-	-	118.00 (50.09)	-	118.00 (27.97)
Commission	-	-	47.20 (20.04)	-	47.20 (11.19)
Mandi fees	-	-	37.76 (16.03)	-	37.76 (8.95)
Cleaning & sieving	-	5.00 (6.93)	-	-	5.00 (1.19)
Filling & stitching	2.50 (3.47)	2.50 (3.47)	2.50 (1.06)	2.50 (5.94)	10.00 (2.37)
Bag & sutli charges	8.40 (11.65)	8.40 (11.65)	8.40 (3.57)	8.40 (19.95)	33.60 (7.96)
Transportation	10.00 (13.87)	45.00 (62.41)	10.00 (4.25)	20.00 (47.51)	85.00 (20.15)
Weighing	-	1.20 (1.66)	1.20 (0.51)	1.20 (2.85)	3.60 (0.85)
Collection for association	-	-	0.50 (0.21)	-	0.50 (0.12)
Karda	46.20 (64.08)	-	-	-	46.20 (10.95)
Loading	5.00 (6.93)	5.00 (6.93)	5.00 (2.12)	5.00 (11.88)	20.00 (4.74)
Unloading	-	5.00 (6.93)	5.00 (2.12)	5.00 (11.88)	15.00 (3.56)
Total	72.10 (100.00) [17.09]	72.10 (100.00) [17.09]	235.56 (100.00) [55.84]	42.10 (100.00) [9.98]	421.86 (100.00) [100.00]
Mandi sale					
VAT	-	-	118.00 (50.09)	-	118.00 (29.89)
Commission	-	-	47.20 (20.04)	-	47.20 (11.96)
Mandi fees	-	-	37.76 (16.03)	-	37.76 (9.57)
Cleaning &sieving	5.00 (4.27)	-	-	-	5.00 (1.27)
Filling & stitching	2.50 (2.13)	-	2.50 (1.06)	2.50 (5.94)	7.50 (1.90)
Bag & sutli charges	8.40 (7.17)	-	8.40 (3.57)	8.40 (19.95)	25.20 (6.38)
Transportation	50.00 (42.70)	-	10.00 (4.25)	20.00 (47.51)	80.00 (20.27)
Weighing	-	-	1.20 (0.51)	1.20 (2.85)	2.40 (0.61)
Collection for association	-	-	0.50 (0.21)	-	0.50 (0.13)
Karda	46.20 (39.45)	-	-	-	46.20 (11.70)
Loading	5.00 (4.27)	-	5.00 (2.12)	5.00 (11.88)	15.00 (3.80)
Unloading	-	-	5.00 (2.12)	5.00 (11.88)	10.00 (2.53)
Total	117.10 (100.00) [29.66]	- -	235.00 (100.00) [59.69]	42.10 (100.00) [10.66]	394.76 (100.00) [100.00]

Figures in parentheses are the per cent of total marketing cost incurred by the respective middleman. Figures in square brackets are the per cent of total marketing cost incurred in each channel.

4C.2.4.3 Marketing margins and price-spread

Marketing margins and price-spread in sale of fenugreek in both channels; at village sale and mandi sale are presented in table 4C.11 in figure 4C.4.

Table 4C. 11: Price-spread in marketing of fenugreek seeds at village and mandi sale in Sikar district.

Particulars	Village sale		Mandi sale	
	`/ quintal	Share in consumer's ` (per cent)	`/ quintal	Share in consumer's ` (per cent)
Producer's net price	2000	58.82	2250	66.18
Cost incurred by:				
Producer	72.10	2.12	117.10	3.44
Village trader	72.10	2.12	-	
Wholesaler	235.56	6.93	235.56	6.93
Retailer	42.10	1.24	42.10	1.24
Total cost	421.86	12.41	394.76	11.61
Margin earned by:				
Village trader	219.60	6.46	-	-
Wholesaler	281	8.26	281	8.26
Retailer	477.54	14.05	474.24	13.95
Total margin	978.14	28.77	755.24	22.21
Consumer's price	3400	100.00	3400	100.00

(A) Price-spread in marketing of fenugreek at village

In sale of fenugreek in Srimadhopur (Sikar) mandi, producer-farmers got a net price of ` 2000.00 per quintal or 58.82 per cent of the price paid by the consumer in sale of fenugreek at village. Total marketing costs incurred by the middlemen including that of the producer was ` 421.86 per quintal or 12.41 per cent of the consumer's

price. Intermediaries earned a total margin of ` 978.14 per quintal or 28.77 per cent of the price paid by the consumers in sale of fenugreek. Agency-wise break-up of the gross margin revealed that the village traders, wholesalers and retailers got 6.46, 8.26 and 14.05 per cent of the consumer's price, respectively. Further, the share of retailers in the total margin has been higher (48.82 per cent) due to the demand of fenugreek in small quantity by the consumers.

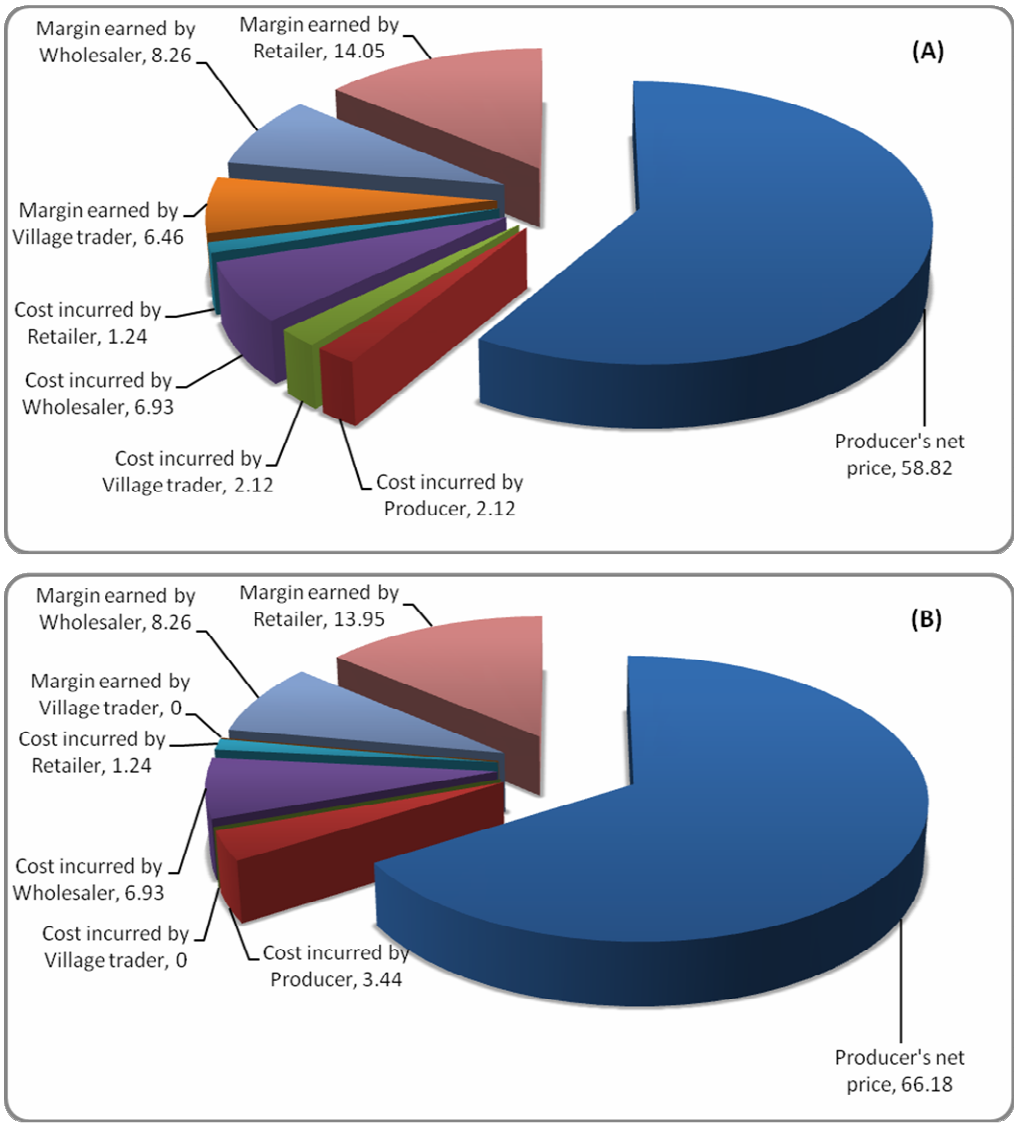


Figure 4C.4: Price-spread in marketing of fenugreek seeds at village (A) and mandi sale (B) in Sikar district.

(B) Price-spread in marketing of fenugreek in mandi

In the sale of fenugreek in Srimadhopur (Sikar) mandi, producer-farmers got a net price of ` 2250.00 per quintal or 66.18 per cent of the price paid by the consumers. Total marketing costs incurred by different middlemen including the producer was ` 394.76 per quintal or 11.61 per cent of the consumer's price.

Middlemen in sale of fenugreek earned a total margin of ` 755.24 per quintal or 22.21 per cent of the price paid by the consumers. Among the various middlemen, retailer's margin was ` 474.24 i.e. 13.95 per cent of the consumer's price. Retailer's margin was higher by 5.69 per cent than the wholesaler's margin. Margin earned by the middlemen has been higher by 6.56 per cent in sale of fenugreek in the village sale than the regulated market.

4C.3. Marketing system of fenugreek in the state of Rajasthan

The marketing behaviour of the selected fenugreek growing farmers with respect to the place, time and agency adopted by them in sale of fenugreek is presented under following sub-sections:

(i) Place-wise sale pattern of fenugreek

(ii) Time-wise sale pattern of fenugreek

(iii) Agency-wise sale pattern of fenugreek

4C.3.1 Place-wise sale pattern of fenugreek

The farmers sold the surplus of fenugreek in their own village as well as in nearby Krishi Upaj Mandi Samities. The quantity of fenugreek marketed by the farmers at this place is present in table 4C.12. The table show that 65.50 per cent produce of fenugreek was sold by the selected farmers in the mandi and 34.50 per cent in their village market. Among the size groups, there existed large variation.

All the marginal and small farmers sold the crop produce in their own villages. As against this, all the large farmers sold their fenugreek produce in the nearby regulated market. The semi-medium and medium farmers sold their fenugreek at both the places. The semi-medium farmers sold 53.99 per cent produce in the village and 46.01 per cent in regulated market. The medium sized farmers sold 80.12 per cent produce in the regulated market and rest 19.88 per cent in the village itself. Thus, from the above results it could be concluded that the sale of fenugreek in the regulated market increased with the increase in size of farm holding because of the low quantity of produce available with famers of small land holdings.

Table 4C.12: Place-wise disposal pattern of fenugreek seed by the sample farmers in state of Rajasthan. (Quantity in quintals)

Size groups	No of farmers	Village sale	Mandi sale	Total
Marginal	23	65.91*	-	65.91*
(< 1 ha.)		2.87**	-	2.87**
		(100.00)		(100.00)
Small	35	213.57*	-	213.57*
(1-2 ha.)		6.10**	-	6.10**
		(100.00)		(100.00)
Semi-medium	41	219.56*	187.07*	406.63*
(2-4 ha.)		5.36**	4.56**	9.92**
		(53.99)	(46.01)	(100.00)
Medium	34	93.53*	377.00*	470.53*
(4-10 ha.)		2.75**	11.09**	13.84**
		(19.88)	(80.12)	(100.00)
Large	17	-	547.47*	547.47*
(10 ha. & above)		-	32.20**	32.20**
			(100.00)	(100.00)
Overall	150	584.53*	1109.62*	1694.15*
		3.90**	7.40**	11.29**
		(34.50)	(65.50)	(100.00)

Figures in parentheses are the per cent of total sale by the respective size group of farmers; * total quantity; ** per farm quantity

4C.3.2 Time-wise sale pattern of fenugreek

The sale pattern of fenugreek at different times of the year by the farmers of different size groups in state of Rajasthan is shown in table 4C.13. Farmers of all sized groups sold on an average 67.27, 22.58, 7.97 and 2.18 per cent surplus in the first, second, third and fourth quarters of the year, respectively.

Table 4C.13: Time pattern of disposal of fenugreek seed by the sample farmers in state of Rajasthan (Quantity in quintals)

Size groups	No of selected farmers	I Quarter (March to May)	II Quarter (June to Aug.)	III Quarter (Sept. to Nov.	IV Quarter (Dec. to Feb.)	Total Sale
Marginal	23	65.91*	-	-	-	65.91*
(< 1 ha.)		2.87**	-	-	-	2.87**
		(100)				(100)
Small	35	213.57*	-	-	-	213.57*
(1-2 ha.)		6.10**	-	-	-	6.10**
		(100)				(100)
Semi-	41	284.93*	121.71*	-	-	406.63*
medium		6.95**	2.97**	-	-	9.92**
(2-4 ha.)		(70.07)	(29.93)			(100)
Medium	34	288.94*	111.88*	69.71*	-	470.53*
(4-10 ha.)		8.50**	3.29**	2.05**	-	13.84**
		(61.41)	(23.78)	(14.81)		(100)
Large	17	299.00*	145.71*	65.71*	37.06*	547.47*
(10 ha. & above)		17.59**	8.57**	3.87**	2.18**	32.20**
		(54.61)	(26.61)	(12.00)	(6.77)	(100)
Overall	150	1139.67*	382.52*	135.00*	36.96*	1694.15*
		7.60**	2.55**	0.90**	0.25**	11.29**
		(67.27)	(22.58)	(7.97)	(2.18)	(100)

Figures in parentheses are the per cent of total sale by the respective size group of farmers; * total quantity; ** per farm quantity

This showed that large farmers sold low quantity in the first quarter of the year probably because of low prices prevailing in this season due to heavy arrival of the produce. Among the size groups semi-medium, medium and large sized farmers sold 70.07, 61.41 and 54.61 per cent of their total surplus in the first quarter of the year i.e. immediately after harvest to meet the cash needs for domestic necessities as well as for clearing the loan obligations.

Sale in the second quarter by the semi-medium, medium and large sized farmers was 29.93, 23.78 and 26.61 per cent of total marketed surplus, respectively. Marginal, small and semi-medium farms did not sale in the third quarter as they had no surplus for disposal. The medium and large sized farmers sold 14.81 and 12.00 per cent of their marketed surplus in this quarter. In the fourth quarter, only large sized farmers sold the produce. This was 6.77 per cent of their total marketed surplus.

The results revealed that there was tendency of sale immediately after harvest among the marginal and small farmers. The semi-medium farmers sold the total surplus in the first and second quarters of the years. The medium farmers sold their produce in first three quarters of the year. The large farmers sold their produce in all the four quarters of the year but more quantity was sold in first and second quarter of the year.

4C.3.3 Agency-wise sale pattern of fenugreek

Distribution of producer-farmers adopting different channels in sale of their fenugreek surplus is presented in table 4C.14 and in figure 4C.5. Selected farmers adopted following two channels in marketing of their fenugreek:

(i) Marketing channel adopted for selling fenugreek in village was.

Producer farmer-Village trader-Wholesaler-Retailer -consumer

(ii) Marketing channel adopted for selling fenugreek in regulated market.

Producer farmer – wholesaler – retailer – consumer

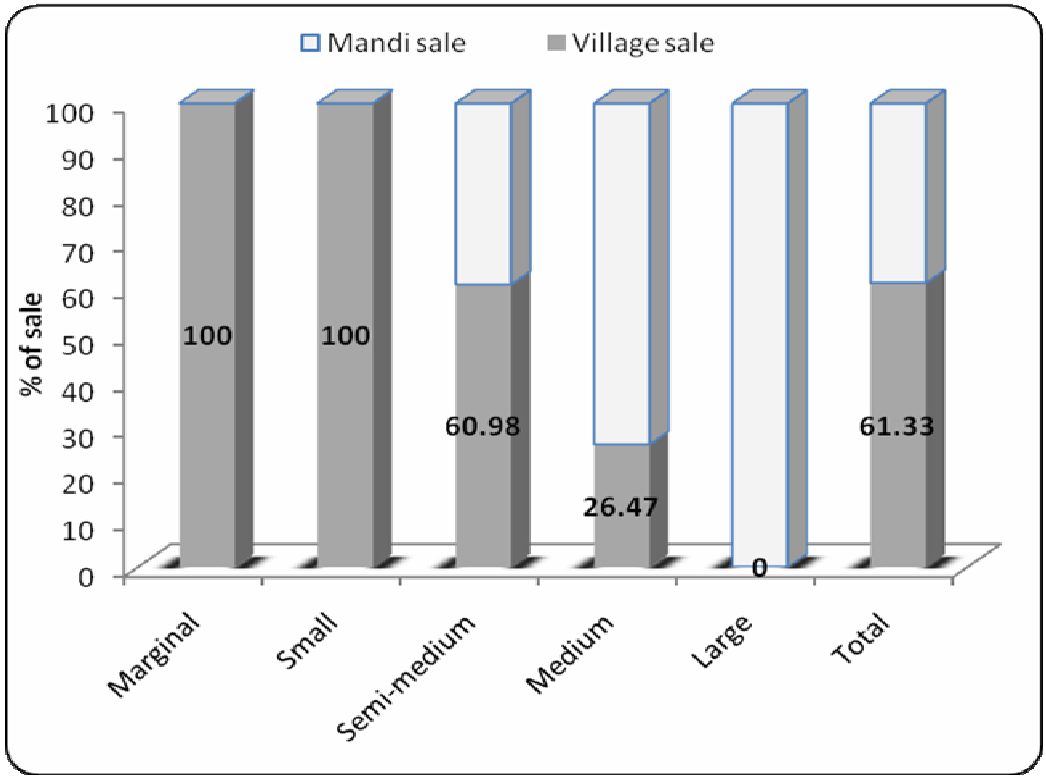
Out of the 150 farmers selected for the study 92 farmers (61.33 per cent) marketed fenugreek in their own village. Among the size groups cent per cent marginal and small farmers and 60.98 per cent semi-medium and 26.47 per cent medium farmers marketed their fenugreek in the village to the village traders. Further interrogation revealed that they preferred to market in village due to lesser quantity of fenugreek available with them as well as due to high unit cost incurred in marketing of small lots of produce in the regulated market. None of the large farmers sold fenugreek in the village. Adoption of village sale by the farmers revealed declining trend with the increase in farm size.

Table 4C.14 Distribution of producer farmers adopting different marketing channels in marketing of fenugreek seed in state of Rajasthan.

Marketing channels & Size group	**Village sale** (Producer-village trader-wholesaler-retailer-consumer)	**Mandi sale** (Producer-wholesaler-retailer-consumer)	**Total**
Marginal	23 (100.00)	-	23 (100.00)
Small	35 (100.00)	-	35 (100.00)
Semi-medium	25 (60.98)	16 (39.02)	41 (100.00)
Medium	9 (26.47)	25 (73.53)	34 (100.00)
Large	-	17 (100.00)	17 (100.00)
Total	92 (61.33)	58 (38.67)	150 (100.00)

Figures in parentheses are the per cent of their respective column total.

Arrivals of fenugreek in the market started from the month of March and reached to a peak in the month of April and May. It was noted that 38.67 per cent selected farmers brought surplus fenugreek in regulated market for sale. Among the size groups: 39.02 per cent semi-medium, 73.53 per cent medium and cent per cent large farmers brought their fenugreek in the mandi for sale. The study results revealed that number of farmers adopting mandi sale increased in number with increase in farm size.



Village sale (Producer-village trader-wholesaler-retailer-consumer)
Mandi sale (Producer-wholesaler-retailer-consumer)

Figure 4C.5. Distribution of producer farmers adopting different marketing channels in marketing of fenugreek seed in state of Rajasthan.

4C.3.4 Marketing costs, margins and price-spread in marketing of fenugreek in state of Rajasthan

4C.3.4.1 Marketing charges

Marketing charges at village level

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

(A) Transportation charges

The average cost of transportation of the produce to the village traders shop was estimated ` 8.55 per quintal.

(B) Cost of gunny bags

The charge for a gunny bag was estimated at ` 8.40.

(C) Loading and unloading charges

Prevailing charges for this were ` 5.00 per bag of 100 kg and was borne by the village trader.

(D) Weighing charges

Weighing charges at the rate of `1.20 per bag of 100 kg was borne by the village trader.

(E) Filling and stitching charges

The filling and stitching charges for 100.00 kg bag was ` 2.50.

(F) Karda

Village trader deducted Karda charges from producer-farmers @ 2 kg per bag of 100 kg valued at ` 44.46 on an average basis.

(G) Cleaning and sieving charges

The village-trader incurred ` 5.00 per bag carrying 100 kg of fenugreek for its cleaning and sieving.

Marketing charges at mandi level

Cost of performing various functions in sale of fenugreek at mandies is as similar as presented in table 4C.4.

(A) Transportation charges

The average cost of transportation borne by the farmer was ` 32.60 per quintal at mandi.

(B) Cost of gunny bags

The carrying cost of fenugreek in jute gunny bags per trip from the farmer's field to mandi was estimated at ` 8.40 per quintal.

(C) Loading and unloading charges

The cost of loading and unloading was ` 5.00 per 100 kg bag.

(D) Weighing charges

Weighing charges @ `1.20 per bag was borne by buyer.

(E) Filling and stitching charges

The prevailing charges for filling and stitching a bag were ` 2.50 per bag of 100 kg.

(F) Karda

Karda was deducted by the wholesaler from the producer-seller @ 2 kg per 100 kg of fenugreek valuing at ` 44.60 per quintal.

(G) VAT (value added tax)

VAT was charged from the buyer at the rate of 5 per cent of the value of the produce (fenugreek) by the commission agent for depositing the same in the government account.

(H) Mandi fee

Mandi fee was realized by the mandi samiti @ ` 1.60 per ` 100 worth of fenugreek and was borne by the buyer.

(I) Commission

Commission agents charged commission at the rate of two per cent of the value of fenugreek from the buyers.

(J) Cleaning and sieving charges

The wholesalers incurred ` 5.00 per bag of 100 kg for cleaning of fenugreek.

4C.3.4.2 Channel-wise marketing cost of fenugreek

Costs incurred in marketing of fenugreek at village and at mandi through different channels are presented in table 4C.15.

(A) Cost of marketing at village sale

Total cost incurred in marketing of fenugreek at village level was noted to be ` 403.36 per quintal of fenugreek. Of this ` 68.91, 59.60, 237.75 and 37.10 were incurred by the producer, village trader, wholesaler and retailer, respectively. Agency wise break-up of the marketing cost in sale of fenugreek revealed that wholesalers incurred the major share in total marketing costs. Component wise break-up of marketing cost indicated that VAT, mandi fee, commission, cost of gunny bags, transportation cost and karda were the major cost items and these items together accounted for over 86.59 per cent of the total marketing costs.

(B) Cost of marketing at mandi sale

The table reveals that selected farmers incurred ` 97.96 (26.28 per cent) per quintal in taking produce to mandi. Component wise, transportation and karda were major items of cost which together accounted for 78.67 per cent of total cost. Wholesaler incurred ` 237.75 per quintal (67.77 per cent) in mandi sale. Component wise, VAT, commission and mandi fee were major cost items accounting for 87.81 per cent of total cost. Cost of transportation, gunny bags, loading and unloading charges accounted 11.41 per cent of total marketing costs.

Table 4C.15: Marketing costs incurred in sale of fenugreek seed at village and mandi in state of Rajasthan (`/qtl)

Particulars of cost	Village sale				Total costs
	Producer	Village trader	Wholesaler	Retailer	
VAT	-	-	120.00 (50.47)	-	120.00 (29.75)
Commission	-	-	48.00 (20.19)	-	48.00 (11.90)
Mandi fee	-	-	38.40 (16.15)	-	38.40 (9.52)
Cleaning and sieving	-	5.00 (8.39)	-	-	5.00 (1.24)
Filling & stitching	2.50 (3.63)	2.50 (4.19)	2.50 (1.05)	2.50 (6.74)	10.00 (2.48)
Bag and sutli charges	8.40 (12.19)	8.40 (14.09)	8.40 (3.53)	8.40 (22.64)	33.60 (8.33)
Transportation	8.55 (12.41)	32.50 (54.53)	8.75 (3.68)	15.00 (40.43)	64.80 (16.07)
Weighing	-	1.20 (2.01)	1.20 (1.50)	1.20 (3.23)	3.60 (0.89)
Collection for association	-	-	0.50 (0.21)	-	0.50 (0.12)
Karda	44.46 (64.52)	-	-	-	44.46 (11.02)
Loading	5.00 (7.26)	5.00 (8.39)	5.00 (2.10)	5.00 (13.48)	20.00 (4.96)
Unloading	-	5.00 (8.39)	5.00 (2.10)	5.00 (13.48)	15.00 (3.72)
Total	68.91 (100.00)	59.60 (100.00)	237.75 (100.00)	37.10 (100.00)	403.36 (100.00)
	[17.08]	[14.78]	[58.94]	[9.20]	[100.00]
	Mandi sale				
VAT	-	-	120.00 (50.47)	-	120.00 (32.19)
Commission	-	-	48.00 (20.19)	-	48.00 (12.88)
Mandi fee	-	-	38.40 (16.15)	-	38.40 (10.30)
Cleaning & sieving	5.00 (5.10)	-	-	-	5.00 (1.34)
Filling & stitching	2.50 (2.55)	-	2.50 (1.05)	2.50 (6.74)	7.50 (2.01)
Bag & sutli charges	8.40 (8.57)	-	8.40 (3.53)	8.40 (22.64)	25.20 (6.76)
Transportation	32.60 (33.28)	-	8.75 (3.68)	15.00 (40.43)	56.35 (15.12)
Weighing	-	-	1.20 (0.50)	1.20 (3.23)	2.40 (0.64)
Collection for association	-	-	0.50 (0.21)	-	0.50 (0.13)
Karda	44.46 (45.39)	-	-	-	44.46 (11.93)
Loading	5.00 (5.10)	-	5.00 (2.10)	5.00 (13.48)	15.00 (4.02)
Unloading	-	-	5.00 (2.10)	5.00 (13.48)	10.00 (2.68)
Total	97.96 (100.00)	-	237.75 (100.00)	37.10 (100.00)	372.81 (100.00)
	[26.28]	-	[63.77]	[9.95]	[100.00]

Figures in parentheses are the per cent of total marketing cost incurred by the respective middleman. Figures in square brackets are the per cent of total marketing cost incurred in each channel.

Wholesaler sold fenugreek to retailers in the mandi. Retailers took the purchased fenugreek to their place of business and incurred ` 37.10 per quintal (9.95 per cent) of fenugreek in marketing to the consumers. Producer, wholesaler and retailers together incurred a cost of ` 372.81 per quintal in sale of fenugreek. The share of producer, wholesaler and retailer in total cost of marketing was of the order of 26.28, 63.77, and 9.95 per cent, respectively. Comparison of cost incurred in marketing of fenugreek at village and mandi revealed that marketing costs were higher in village sale by ` 30.55 per quintal than that in mandi sale.

4C.3.4.3 Marketing margins and price spread

Marketing margin and price-spread in sale of fenugreek in both the channels i.e. at village and mandi are presented in table 4C.16 in figure 4C.6.

(A) Price-spread in marketing of fenugreek at village

Producer got a net price of ` 2029 per quintal or 58.81 per cent of the price paid by the consumer in sale of fenugreek at village. Marketing cost incurred by the middlemen was ` 403.36 or 11.69 per cent of the consumer's price. Intermediaries earned a total margin of ` 1017.64 or 29.50 per cent of the price paid by the consumer in sale of fenugreek. Agency-wise break up of the gross margin revealed that the village trader, wholesaler and retailer got 6.38, 8.75 and 14.37 per cent of the consumer price, respectively. Further the share of retailer in the total margin has been much higher (48.70 per cent) due to the demand of fenugreek in small quantity by the consumers.

(B) Price-spread in marketing of fenugreek in mandi

In sale of fenugreek in mandies, producer-farmers got a net price of ` 2279 per quintal or 66.06 per cent of the price paid by the consumers. Marketing cost incurred by different middlemen was `

372.81 or 10.81 per cent of consumer's price. Middleman in sale of fenugreek earned a margin of `798.19 or 23.14 per cent of the price paid by the consumers.

Table 4C.16: Price-spread in marketing of fenugreek seeds at village and mandi sale in state of Rajasthan.

Particulars	Village sale		Mandi sale	
	`/ quintal	Share in consumer's ` (per cent)	`/ quintal	Share in consumer's ` (per cent)
Producer's net price	2029.00	58.81	2279.00	66.06
Cost incurred by				
Producer	68.91	2.00	97.96	2.84
Village trader	59.60	1.73	-	
Wholesaler	237.75	6.89	237.75	6.89
Retailer	37.10	1.08	37.10	1.08
Total cost	403.36	11.69	372.81	10.81
Margin earned by				
Village trader	220.00	6.38	-	-
Wholesaler	302.00	8.75	302.00	8.75
Retailer	495.64	14.37	496.19	14.38
Total margin	1017.64	29.50	798.19	23.14
Consumer's price	3450	100.00	3450	100.00

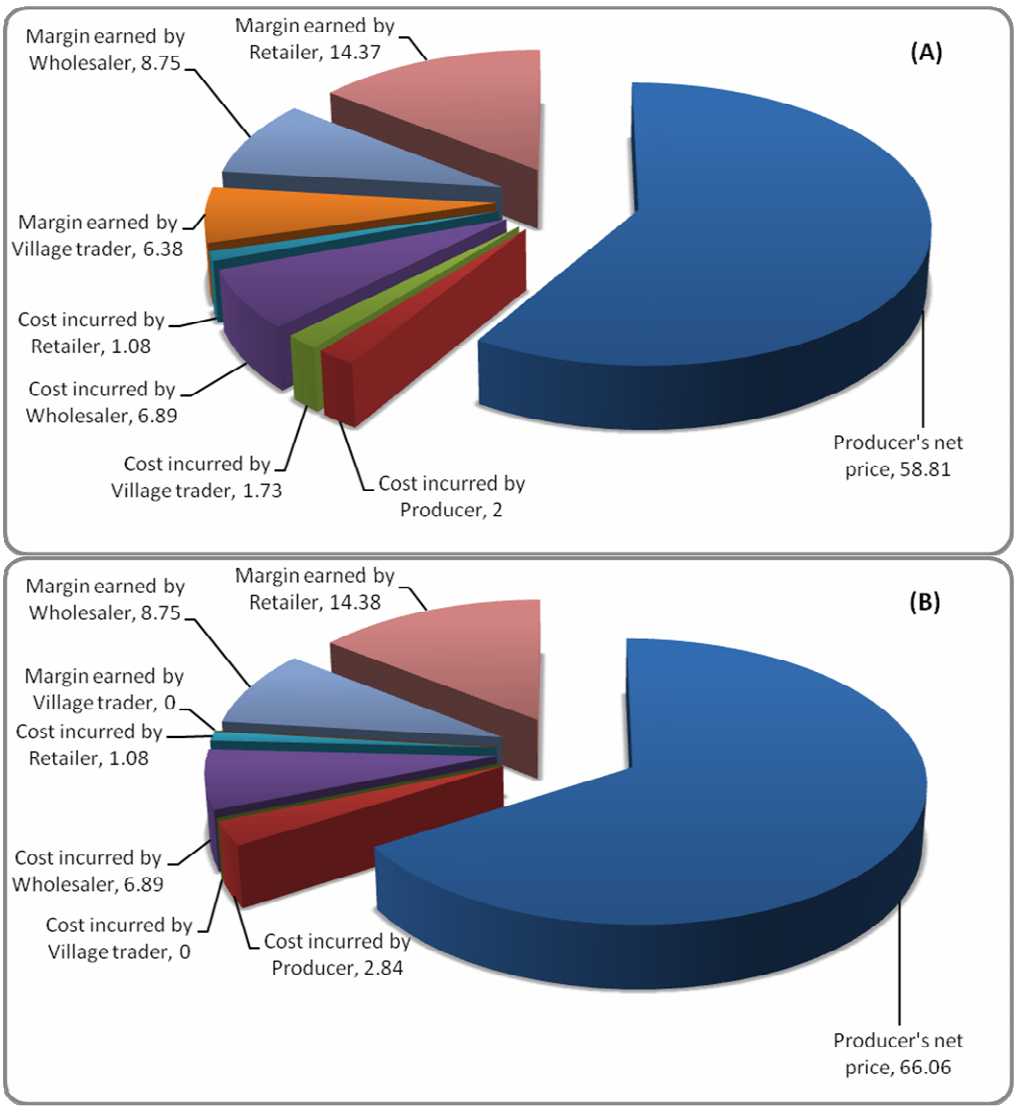


Figure 4C.6: Price-spread in marketing of fenugreek seeds at village (A) and mandi sale (B) in state of Rajasthan.

Among the various middlemen, retailer's margin was ` 496.19 (14.38 per cent) which was higher by 5.63 per cent than the wholesaler's margin. Farmers got 7.25 per cent higher share in sale of fenugreek in the mandi than in the village. Margins earned by the middlemen were observed 6.36 per cent high in sale of feungreek in the village sale than the regulated market. From the above discussion, it may be concluded that the net price received by the producer farmer in village sale was lower than that of the mandi sale by the farmer.

SECTION – D

RESOURCES USE EFFICIENCY IN FENUGREEK

The term 'resource use efficiency in agriculture' may be broadly defined to include the broad concept of technical efficiency, allocative efficiency and environmental efficiency. An efficient farmer allocates his land, labour, water and other resources in an optimal manner, so as to maximize his income, at least cost, on sustainable basis.

In this section an attempt has been made to study and compare the efficiency of existing factor combinations of Jaipur and Sikar farmers. The Cobb-Douglas production function was applied to work out the resource use efficiencies in fenugreek crop in both regions so as to suggest changes in combinations of resources in the optimal direction. This section is divided into following sub-heads.

4D.1 Distribution of farmers

One hundred fifty farmers were selected from two districts i.e. Jaipur and Sikar (Table 3.2) in the ratio of 58:42, respectively. Out of these, maximum 41 farmers belonged to semi-medium group followed by small (35), medium (34), marginal (23) and large group (17) farmers were selected. In Jaipur district, maximum numbers of selected farmers were in small group; while in Sikar district the maximum numbers of selected farmers were in semi-medium group of farmers.

4D.2 Regression analysis

For analysing resource use efficiency in fenugreek crop on different size groups of farmers of Jaipur and Sikar districts, multiple regression functions were estimated by taking gross return as the dependent variable (Y) and machine labour (X_1), seed (X_2), manure (X_3), fertilizers (X_4), plant protection measures (X_5), irrigation (X_6) and

human labour (X_7), as the independent variables. Both linear and log-linear (Cobb-Douglas) forms of production relationships were estimated using the ordinary least squares (OLS) technique. Overall analysis was also attempted to identify the causal factors of gross return in the study area at the aggregate level. Based on the value of R^2 and 't' test (*i.e.*, standard errors of the regression coefficients) the Cobb-Douglas production function was used due to higher value of coefficient of multiple determination obtained and preferred because of the computational ease and theoretical fitness to agriculture data.

The possibility of autocorrelation among the estimated residuals was also tested with the help of Durbin–Watson test as specified in chapter III. For deciding on the presence of multicollinearity as well as the best set of explanatory variables for the regression model, the stepwise regression method (stepwise forward regression) was followed. In this method one variable at a time was included in the model. The decision to add a variable was made on the basis of the contribution of that variable to the error sum of squares as judged by the F-test. The Cobb-Douglas production function results for Jaipur, Sikar and Rajasthan farmers are presented in tables 4D.2 to 4D.19 and discussed as under:

4D.2.1 Regression results for farmers of Jaipur district

(A) Marginal farmers

The results of multiple log-linear regression estimates based on stepwise forward method for marginal category of Jaipur farmers are presented in table 4D.1. The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables.

Table 4D.1 Estimated Cobb-Douglas production function for marginal farmers of Jaipur district

Dependent variable (y) = gross return
Number of farmers (N) = 14

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.288**	**0.184**	**-**
2.	**Seed (X_2)**	**0.636*** **	**0.129**	**4.775**
3.	**Manure (X_3)**	**0.430****	**0.120**	**1.959**

- **Coefficient of multiple correlation (R) - 0.984**
- **Coefficient of determination R^2 - 0.968**
- Adjusted coefficient of determination ($\overline{R^2}$) - 0.962
- **'d' statistic - 1.794**
- **'F' value (with 2, 11 d.f.) - 163.971**
- **Returns to scale - 1.066**
- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

The estimated 'd' value was compared with table value corresponding to n = 11 and K = 2 (K being the number of explanatory variables excluding the intercept) at 1 per cent level of significance. Since the computed 'd' value (1.794) lay within the bounds of du < 1.794 < 4 –du, *i.e.,* of 1.297 < 1.794 < 2.284 indicating no autocorrelation among the estimated residuals at 1 per cent level of significance.

The coefficient of seed (X_2 = 0.636) was significantly positive at 1 per cent level of significance. It means the gross return increased with the increase in expenditure on seed because Jaipur farmers used

small quantity of seeds. The coefficient of manure (X_3 = 0.430) was significantly positive at 5 per cent level of significance. These two explanatory variables together accounted for 96.80 per cent variation in the gross return (*i.e.* dependent variable Y). The observed F-value (163.97) for R was higher than the tabulated F value with (2, 11) degrees of freedom indicating regression to be significant.

The elasticity coefficients of gross return with respect to seed and manure were estimated to be 0.636 and 0.430, respectively. This indicated that 1 per cent increase in expenditure on seed and manure led to increase in the gross return by 0.636 per cent and 0.430 per cent, respectively. The sum total of elasticity coefficients (1.066), *i.e.,* returns to scale of production was non significant on marginal farms in the district implying constant returns to scale.

(B) Small farmers

The finally selected regression results for small category of Jaipur farmers are presented in table 4D.2. The table reveals that three explanatory variables namely; machine labour (X_1), human labour (X_7) and fertilizer (X_4) significantly affected the gross return. No problem of multicollinearity and autocorrelation was observed among these variables.

The regression coefficient for machine labour (X_1 = 0.416) and human labour (X_7 = 0.278) were significantly positive at 1 per cent level of significance. The coefficient of fertilizer (X_4 = 0.213) was significantly positive at 5 per cent level of significance.

The coefficient of determination (R^2) was 0.965 indicating that 96.50 per cent of the variation in gross return was explained by the explanatory variable included in the model. The observed F-value (164.95) for R was higher than the tabulated F value with (3, 18) degrees of freedom indicating regression to be significant, *i.e.*, the

explanatory variables included in the model were significant explanatory factors of the variation in the gross return.

Table 4D.2 Estimated Cobb-Douglas production function for small farmers of Jaipur district

Dependent variable (Y) = gross return
Number of farmers (N) = 22

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**2.048**	**0.245**	**-**
2.	**Machine labour (X_1)**	**0.416*** **	**0.098**	**5.019**
3.	**Human labour (X_7)**	**0.278*** **	**0.088**	**5.901**
4.	**Fertlizer (X_4)**	**0.213** **	**0.091**	**6.429**

- **Coefficient of multiple correlation (R) - 0.982**
- **Coefficient of determination (R^2) - 0.965**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.959**
- **'d' statistic - 1.569**
- **'F' value (with 3, 18 d.f.) - 164.947**
- **Returns to scale - 0.907****
- ** Significant at 5 per cent level of significance
- ** *Significant at 1 per cent level of significance

The elasticity coefficients of gross return with respect to the explanatory variables, *i.e.,* machine labour, human labour and fertilizer were estimated to be 0.416, 0.278 and 0.213, respectively. This indicated that one per cent increase in expenditure of

machine labour, human labour and fertilizer increased the gross return by 0.416 per cent, 0.278 per cent and 0.213 per cent implying that gross return was relatively inelastic to the changes in amount of machine, human labour, and fertilizer. The return to scale of production on small farms was significant at 5 per cent level of significance (the value of sum of regression coefficient being 0.907) implying decreasing returns to scale, i.e. if all the inputs are increased by 1 per cent the yield will increase but at a magnitude of less than one percent.

(C) Semi-medium farmers

In case of semi-medium farms the explanatory variables that significantly and positively affected the gross return were irrigation (X_6), machine labour (X_1) and fertilizer (X_4) (Table 4D.3). The table reveals that there were no multicollinearity and autocorrelation problem among the selected variables.

Table 4D.3 Estimated Cobb-Douglas production function for semi-medium farmers of Jaipur district

Dependent variable (Y) = Gross return
Number of farmers (N) = 21

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.385**	**0.155**	**-**
2.	**Irrigation (X_6)**	**0.206***	**0.118**	**9.425**
3.	**Machine labour (X_1)**	**0.408*****	**0.068**	**2.803**
4.	**Fertilizer (X_4)**	**0.373*****	**0.114**	**8.374**

- **Coefficient of multiple correlation (R) - 0.985**
- **Coefficient of determination (R^2) - 0.970**

- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.965**
- **'d' statistic - 1.473**
- **'F' value (with 3, 17 d.f.) - 182.860**
- **Returns to scale - 0.987***
- *** Significant at 10 per cent level of significance**
- ***** Significant at 1 per cent level of significance**

The regression coefficient for irrigation (X_6 = 0.206) significant at 10 per cent and machine labour (X_1 = 0.408) and fertilizer (X_4 = 0.373) were significantly positive at 1 per cent level of significance. These variables explained 97.00 per cent of the variation in gross return.

The elasticity coefficients for gross returns were estimated to be 0.206, 0.408 and 0.373 for irrigation, machine labour and fertilizer respectively. This indicated that one per cent increase in the expenditure on irrigation, machine labour and fertilizer increased the gross return by 0.206, 0.408 and 0.373 per cent, respectively indicating the gross return to be relatively inelastic to the changes in these variables. The sum of elasticity coefficients was significant at 10 per cent level of significance, implying decreasing returns to scale on such farms in the production of fenugreek.

(D) Medium farmers

Table 4D.4 reveals that irrigation (X_6), machine labour (X_1) and fertilizer (X_4) were the significant factors that affected the gross return on medium farmers in the district. The values of VIF revealed that there was no multicollinearity problem among these variables. The estimated value of Durbin–Watson 'd' statistic indicated no autocorrelation (neither positive or nor negative) among the estimated residuals.

The regression coefficients of the selected explanatory variables, *i.e.*, irrigation (X_6 = 0.299), machine labour (X_1 = 0.394) were significant at one per cent and fertilizer (X_4 = 0.280) were found to be

statistically significant at 5 per cent level of significance implying that with the increase in the expenditure on irrigation, machine labour and fertilizer the gross return increased. The variables together accounted for 98.10 per cent variation in the gross return. The observed F-value (259.56) for R was higher than the tabulated F value with (3, 16) degrees of freedom indicating regression to be significant.

Table 4D.4 Estimated Cobb-Douglas production function for medium farmers of Jaipur district

Dependent variable (Y) = Gross return
Number of farmers (N) = 20

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**2.474**	**0.143**	**-**
2.	**Irrigation (X_6)**	**0.299*** **	**0.083**	**7.552**
3.	**Machine labour (X_1)**	**0.394*** **	**0.081**	**5.388**
4.	**Fertilizer (X_4)**	**0.280** **	**0.096**	**8.195**

- **Coefficient of multiple correlation (R) - 0.990**
- **Coefficient of determination (R^2) - 0.981**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.977**
- **'d' statistic - 1.760**
- **'F' value (with 3, 16 d.f.) - 269.565**
- **Returns to scale - 0.973**
- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

The elasticity coefficients for gross return with respect to the selected explanatory variables indicated that one per cent increase in expenditure on irrigation, machine labour and fertilizer increased the gross return by 0.299 per cent, 0.394 per cent and 0.280 per cent, respectively. This revealed that gross return was relatively inelastic to the changes in amount put to irrigation, machine labour and fertilizer. Returns to scale of production on semi-medium Jaipur farms was non significant implying constant returns to scale.

(E) Large farmers

Table 4D.5 shows only two explanatory variables namely; machine labour (X_1) and fertilizer (X_4) significantly affected the gross return on large Jaipur farms. The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables.

Table 4D.5 Estimated Cobb-Douglas production function for large farmers of Jaipur district

Dependent variable (Y) = Gross return
Number of farmers (N) = 10

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.630**	**0.422**	**-**
2.	**Machine labour (X_1)**	**0.540****	**0.199**	**5.367**
3.	**Fertilizer (X_4)**	**0.340****	**0.137**	**3.264**

- **Coefficient of multiple correlation (R) - 0.976**
- **Coefficient of determination (R^2) - 0.956**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.938**

- **'d' statistic - 1.711**
- **'F' value (with 2, 11 d.f.) - 69.095**
- **Returns to scale - 0.880**

**** Significant at 5 per cent level of significance**

The Durbin –Watson test also indicated that there is no autocorrelation (neither positive nor negative) among the estimated residuals. The effect of machine labour (X_1 = 0.540) and fertilizer (X_4 = 0.340) on the gross return was significantly positive.

These two explanatory variables together accounted for 95.60 per cent variation in the gross return. The elasticity coefficients of gross return with respect to both the explanatory variables were estimated to be 0.540 and 0.340 for machine labour (X_1) and fertilizer (X_4), respectively indicating that the gross return was relatively inelastic to the change in machine labour and fertilizer. Return to scale of production on large farmers was non significant implying constant returns to scale.

(F) Overall farmers

The overall regression results for farmers of Jaipur district revealed that only four explanatory variables namely; machine labour (X_1), irrigation (X_6), human labour (X_7) and seed (X_2) significantly affected the gross return (Table 4D.6).

The results of VIF indicated that there was no multicollinearity problem among these variables. The estimated value of Durbin – Watson 'd' statistic (1.702) lay within the bounds of du < 1.702 < 4 – du, *i.e.,* 1.630 < 1.702 < 2.263 indicating no autocorrelation (positive or negative) among the estimated residuals at 1 per cent level of significance corresponding to n = 82 and k = 4.

The regression coefficients for machine labour (X_1 = 0.467), irrigation (X_6 = 0.200) and human labour (X_7 = 0.182) and seed (X_2 =

0.137) had significant influence on the amount of gross return. The results indicated that the effect machine labour, irrigation, human labour and seed were positive and significant at 1 per cent level of significance.

Table 4D.6 Estimated Cobb-Douglas production function for overall farmers of Jaipur district

Dependent variable (Y) = Gross return
Number of farmers (N) = 87

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.584**	**0.083**	**-**
2.	**Machine labour (X_1)**	**0.467*** **	**0.044**	**3.660**
3	**Irrigation (X_6)**	**0.200*** **	**0.039**	**4.516**
4	**Human labour (X_7)**	**0.182*** **	**0.041**	**9.077**
5	**Seed (X_2)**	**0.137*** **	**0.037**	**8.752**

- **Coefficient of multiple correlation (R) - 0.994**
- **Coefficient of determination (R^2) - 0.987**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.984**
- **'d' statistic - 1.702**
- **'F' value (with 4, 82 d.f.) - 161.185**
- **Returns to scale - 0.986***
- ***** Significant at 1 per cent level of significance**
- ***Significant at 10 per cent level of significance**

The coefficient of multiple determinations (R^2) was 0.987 indicating that 98.70 per cent of variation in gross return was explained by the explanatory variables included in the model. The observed F-value (161.18) for R was higher than the tabulated F value with (4, 82) degrees of freedom indicating regression to be significant.

The elasticity coefficients of gross return with respect to all the selected explanatory variables were estimated to be 0.467, 0.200, 0.182 and 0.137 for machine labour, irrigation, human labour and seed, respectively. This indicated that 1 per cent increase in expenditure on machine labour, irrigation, human labour and seed increased the gross return by 0.467, 0.200, 0.182 and 0.137 per cent, respectively. This was taken to mean that the gross return was inelastic to change in machine labour, irrigation, human labour and seed. The sum of elasticity coefficients, *i.e.,* the overall returns to scale of production. Jaipur farms was significant at 10 per cent level of significance, implying decreasing returns to scale, i.e. if all the inputs are increased by 1 per cent the yield will increase but at a magnitude of less than one percent.

4D.2.2 Regression results for farmers of Sikar district

(A) Marginal farmers

The regression results reveled that manure and seed were the significant factors affecting gross returns on the marginal farms of Sikar district (Table 4D.7).

The values of VIF for these explanatory variables ranged for 5.334 to 1.097 indicating no multicollinearity problem among them. The estimated 'd' value indicated no autocorrelation (neither positive nor negative) among the estimated residuals at 1 per cent level of significance. The effect of manure (X_3 = 0.792) was significantly positive at 1 per cent level of significance and that of seed (X_2 = 0.248) at 5 per cent level of significance. These two explanatory variables together accounted for 98.90 per cent variation in the gross return. The observed F-value for R was higher than the tabulated F value indicating regression to be significant.

Table 4D.7 Estimated Cobb-Douglas production function for marginal farmers of Sikar district

Dependent variable (Y) = Gross return
Number of farmers (N) = 9

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**0.945**	**0.252**	**-**
2.	**Manure (X_3)**	**0.792*** **	**0.134**	**5.334**
3.	**Seed (X_2)**	**0.248****	**0.078**	**1.097**

- **Coefficient of multiple correlation (R) - 0.995**
- **Coefficient of determination (R^2) - 0.989**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.985**
- **'d' statistic - 1.681**
- **'F' value (with 2, 6 d.f.) - 272.200**
- **Returns to scale - 1.040**
- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

The elasticity coefficients for gross returns with respect to both explanatory variables were estimated to be 0.792 and 0.248 for manure and seed, respectively. This indicated that one per cent increase in human labour led to increase in the gross return by 0.792 per cent and manures by 0.248 per cent implying that gross return was relatively inelastic to the changes in amount of seed and manures. Returns to scale of production for marginal farmers was non significant implying constant returns to scale.

(B) Small farmers

The results for small category of farmers are presented in table 4D.8. The table reveals that human labour (X_7), irrigation (X_6) and fertilizer (X_4) significantly affected the gross return on the small farms. The results show that there were no problems of multicollinearity and autocorrelation among these variables.

Table 4D.8 Estimated Cobb-Douglas production function for small farmers of Sikar district

Dependent variable (Y) = Gross return
Number of farmers (N) = 13

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**2.462**	**0.186**	**-**
2.	**Human labour (X_7)**	**0.434*** **	**0.094**	**8.897**
3	**Irrigation (X_6)**	**0.301** **	**0.104**	**9.193**
4.	**Fertilizer (X_4)**	**0.217** **	**0.084**	**7.321**

- **Coefficient of multiple correlation (R) - 0.995**
- **Coefficient of determination (R^2) - 0.989**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.986**
- **'d' statistic - 1.943**
- **'F' value (with 3, 9 d.f.) - 247.508**
- **Returns to scale - 0.952**
- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

The regression coefficients for human labour (X_7 = 0.434) was significantly positive at 1 per cent level of significance and for irrigation (X_6 = 0.301) and fertilizer (X_4 = 0.217) were significantly positive at 5 per cent level of significance. These variables together explained 98.90 per cent variation in gross returns. The observed F-value was higher than the tabulated F value indicating regression to be significant. The elasticity coefficient for gross return with respect to the explanatory variables*, i.e.,* fertilizer, irrigation and human labour were estimated to be 0.217, 0.301 and 0.434, respectively.

This indicated that one per cent increase in expenditure increased the gross return by 0.434 per cent, 0.301 per cent and 0.217 per cent, respectively. Returns to scale of production on small farms was non significant implying constant returns to scale.

(C) Semi-medium farmers

Table 4D.9 shows that irrigation (X_6), machine labour (X_1) and plant protection measure (X_5) significantly affected the gross return on semi-medium farms. The regression coefficients for irrigation (X_6 = 0.613), machine labour (X_1 = 0.299) were estimated to be significantly positive at 1 per cent level of significance and plant protection measure (X_5 =0.020) was significantly positive at 5 per cent level of significance.

These variables together explained 98.60 per cent of the variation in gross return. The observed F-value was higher than the tabulated F value indicating regression to be significant.

The elasticity coefficients for gross returns were estimated to be 0.613, 0.299 and 0.020 for irrigation, machine labour and plant protection measure respectively indicating that one per cent increase in expenditure increased the gross return by 0.613 per cent, 0.299 per cent and 0.020 per cent, respectively. This implied that gross return was relatively inelastic to the changes in irrigation, machine labour and plant protection measure. The sum

of elasticity coefficients, *i.e.,* returns to scale of production on these farms was significant at 1 per cent level of significance, implying decreasing returns to scale.

Table 4D.9 Estimated Cobb-Douglas production function for semi-medium farmers of Sikar district

Dependent variable (Y) = Gross return
Number of farmers (N) = 20

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.607**	**0.108**	**-**
2.	**Irrigation (X_6)**	**0.613*** **	**0.056**	**4.226**
3.	**Machine labour (X_1)**	**0.299*** **	**0.059**	**4.443**
4	**Plant protection (X_5)**	**0.020** **	**0.008**	**1.142**

- **Coefficient of multiple correlation (R) - 0.993**
- **Coefficient of determination (R^2) - 0.986**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.983**
- **'d' statistic - 1.781**
- **'F' value (with 3, 16 d.f.) - 365.607**
- **Returns to scale - 0.932*** **
- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

(D) Medium farmers

In case of medium farmers irrigation (X_6 = 0.447), machine labour (X_1 = 0.395) and fertilizer (X_4 0.160) were found to be

statistically significant (table 4D.10). The regression coefficients for irrigation, machine labour and fertilizer were significantly positive at 5 per cent level of significance. These variables together accounted for 98.60 per cent of the total variation in the gross return.

The elasticity coefficients for gross return with respect to the selected explanatory variables, *i.e.*, irrigation, machine labour and fertilizer were estimated to be 0.447, 0.395 and 0.160. This implied that gross return was inelastic to the changes in expenditure on irrigation, machine labour and fertilizer. The sum total of elasticity coefficients was worked out to be 1.002 which is non significant implying constant returns to scale.

Table 4D.10 Estimated Cobb-Douglas production function for medium farmers of Sikar district

Dependent variable (Y) = Gross return
Number of farmers (N) = 14

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.368**	**0.174**	**-**
2.	**Irrigation (X_6)**	**0.447****	**0.153**	**6.613**
3	**Machine labour (X_1)**	**0.395****	**0.151**	**6.335**
4.	**Fertilizer (X_4)**	**0.160****	**0.070**	**4.316**

- **Coefficient of multiple correlation (R) - 0.973**
- **Coefficient of determination (R^2) - 0.986**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.987**
- **'d' statistic - 1.755**
- **'F' value (with 3, 10 d.f.) - 235.082**

- **Returns to scale - 1.002**
- **** Significant at 5 per cent level of significance**

(E) Large farmers

Table 5D.11 shows that on large farms machine labour (X_1) and irrigation (X_6) significantly affected the gross return. The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables. The Durbin–Watson test also indicated no autocorrelation (neither positive nor negative) among the estimated residuals.

Table 4D.11 Estimated Cobb-Douglas production function for large farmers of Sikar district

Dependent variable (Y) = Gross return
Number of farmers (N) = 7

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.678**	**0.154**	**-**
2.	**Machine labour (X_1)**	**0.646*** **	**0.087**	**1.251**
3.	**Irrigation (X_6)**	**0.204****	**0.072**	**7.864**

- **Coefficient of multiple correlation (R) - 0.997**
- **Coefficient of determination (R^2) - 0.995**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.993**
- **'d' statistic - 1.963**
- **'F' value (with 2, 4 d.f.) - 389.394**
- **Returns to scale - 0.850****

- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

The regression results revealed that the coefficient of machine labour (X_1 = 0.646) was significantly positive at one per cent and that of irrigation (X_6 = 0.204) was negatively significant at 5 per cent level of significance. These explanatory variables together accounted for 99.50 per cent variation in the gross return .The observed F-value was higher than the tabulated F value indicating regression to be significant.

The elasticity coefficients of gross return with respect to both the explanatory variables indicated that one per cent increase in expenditure on irrigation and plant protection increased the gross return by 0.646 per cent and 0.204 per cent, respectively indicating the gross return to be relatively inelastic to the change in irrigation and plant protection. The sum of elasticity coefficients, *i.e.,* returns to scale of production on these farms was significant at 5 per cent level of significance, implying decreasing returns to scale.

(F) Overall farmers

The regression results for overall farmers of Sikar district revealed that only four explanatory variables namely; machine labour (X_1), seed (X_2), fertilizer (X_4) and human labour (X_7) significantly affected the gross return (Table 4D.12). The results of VIF indicated that there was no multicollinearity problem among these variables. The estimated 'd' statistic indicated no autocorrelation (positive or negative) among the estimated residuals.

The regression coefficients for machine labour (X_1= 0.369), seed (X_2= 0.283), fertilizer (X_4= 0.270) were significantly positive at one per cent level of significance and human labour (X_7= 0.063) was significantly positive at 5 per cent level of significance. The coefficient of multiple determination (R^2) was 0.989 indicating that 98.90 per cent of variation in gross return was explained by the explanatory variables

included in the model. The observed F-value was higher than the tabulated F value indicating regression to be significant.

Table 4D.12 Estimated Cobb-Douglas production function for overall farmers of Sikar district

Dependent variable (Y) = Gross return
Number of farmers (N) = 63

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.476**	**0.092**	**-**
2.	**Machine labour (X_1)**	**0.369*** **	**0.058**	**6.875**
3.	**Seed (X_2)**	**0.283*** **	**0.049**	**4.284**
4	**Fertilizer (X_4)**	**0.270*** **	**0.053**	**6.967**
5	**Human labour (X_7)**	**0.063** **	**0.031**	**5.557**

- **Coefficient of multiple correlation (R) - 0.995**
- **Coefficient of determination (R^2) - 0.989**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.986**
- **'d' statistic - 1.777**
- **'F' value (with 4, 58 d.f.) - 622.966**
- **Returns to scale - 0.985***
- ***** Significant at 1 per cent level of significance**
- **** Significant at 5 per cent level of significance**

The elasticity coefficients for gross return with respect to ; machine labour (X_1), seed (X_2), fertilizer (X_4) and human labour (X_7)

were estimated to be 0.369, 0.283, 0.270 and 0.063 respectively. This indicated that one per cent increase on machine labour, seed, fertilizer and human labour increased the gross return by 0.369, 0.283, 0.270 and 0.063 per cent, respectively. This was taken to mean that the gross return was inelastic to change in machine labour, seed, fertilizer and human labour. The sum of elasticity coefficients was significant at 10 per cent level of significance, implying decreasing returns to scale on such farms in the production of fenugreek.

4D.2.3 Regression results for farmers of state of Rajasthan

(A) Marginal farmers

The regression results reveled that manure and seed were the significant factors affecting gross returns on the marginal farms of state of Rajasthan (Table 4D.13).

Table 4D.13 Estimated Cobb-Douglas production function for marginal farmers of state of Rajasthan

Dependent variable (Y) = Gross return
Number of farmers (N) = 23

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.657**	**0.136**	**-**
2.	**Manure (X_3)**	**0.497*** **	**0.087**	**4.588**
3.	**Seed (X_2)**	**0.438*** **	**0.079**	**1.462**

- **Coefficient of multiple correlation (R) - 0.982**
- **Coefficient of determination (R^2) - 0.965**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.961**
- **'d' statistic - 1.464**

- **'F' value (with 2, 20 d.f.) - 274.331**
- **Returns to scale - 0.935****
- ***** Significant at 1 per cent level of significance**

The values of VIF for these explanatory variables ranged for 1.462 to 4.588 indicating no multicollinearity problem among them. The estimated 'd' value indicated no autocorrelation (neither positive nor negative) among the estimated residuals at 1 per cent level of significance.

The effect of manure (X_3 = 0.497) and seed (X_2 = 0.438) significant at one per cent level of significance. These two explanatory variables together accounted for 96.50 per cent variation in the gross return. The observed F-value for R was higher than the tabulated F value indicating regression to be significant.

The elasticity coefficients for gross returns with respect to both explanatory variables were estimated to be 0.497 and 0.438 for manure and seed, respectively. This indicated that one per cent increase in human labour led to increase in the gross return by 0.497 per cent and manures by 0.438 per cent implying that gross return was relatively inelastic to the changes in amount of seed and manures. Returns to scale of production for marginal farmers was estimated to be 0.935. It was significant at 5 per cent level of significance implying decreasing returns to scale, i.e. if all the inputs are increased by 1 per cent the yield will increase but at a magnitude of less than one percent.

(B) Small farmers

The results for small category of farmers are presented in table 4D.14. The table reveals that machine labour (X_1), human labour (X_7) and fertilizer (X_4) significantly affected the gross return on the small farms. The results show that there were no problems of multicollinearity and autocorrelation among these variables. The regression coefficients for machine labour (X_1 = 0.394), human labour (X_7 = 0.306) and

fertilizer (X_4 = 0.218) were significantly positive at one per cent level of significance

These variables together explained 97.00 per cent variation in gross returns. The observed F-value was higher than the tabulated F value indicating regression to be significant. The elasticity coefficient for gross return with respect to the explanatory variables*, i.e.,* machine labour, human labour and irrigation were estimated to be 0.394, 0.306 and 0.218, respectively. This indicated that one per cent increase in expenditure increased the gross return by 0.394 per cent, 0.306 per cent and 0.218 per cent, respectively. Returns to scale of production on small farms were 0.918 i.e. significant at 1 per cent level of significance implying decreasing returns to scale.

Table 4D.14 Estimated Cobb-Douglas production function for small farmers of state of Rajasthan

Dependent variable (Y) = Gross return
Number of farmers (N) = 35

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**2.075**	**0.184**	**-**
2.	**Machine labour (X_1)**	**0.394*** **	**0.081**	**7.031**
3	**Human labour (X_7)**	**0.306*** **	**0.064**	**5.730**
4.	**Fertilizer (X_4)**	**0.218*** **	**0.064**	**5.891**

- **Coefficient of multiple correlation (R) - 0.985**
- **Coefficient of determination (R^2) - 0.970**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.967**
- **'d' statistic - 1.629**

- **'F' value (with 3, 31 d.f.) - 329.008**
- **Returns to scale - 0.918*****
- ***** Significant at 1 per cent level of significance**

(C) Semi-medium farmers

Table 4D.15 shows that machine labour (X_1), irrigation (X_6) and seed (X_2) significantly affected the gross return on semi-medium farms. The regression coefficients for machine labour (X_1 = 0.325), irrigation (X_5 = 0.409) and seed (X_2 = 0.223) were significantly positive at one per cent level of significance. These variables together explained 97.40 per cent of the variation in gross return. The observed F-value was higher than the tabulated F value indicating regression to be significant.

Table 4D.15 Estimated Cobb-Douglas production function for semi-medium farmers of state of Rajasthan

Dependent variable (Y) = Gross return
Number of farmers (N) = 41

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.558**	**0.097**	**-**
2.	**Machine labour (X_1)**	**0.325*** **	**0.049**	**3.767**
3.	**Irrigation (X_6)**	**0.409*** **	**0.038**	**2.723**
4	**Seed (X_2)**	**0.223*** **	**0.029**	**2.081**

- **Coefficient of multiple correlation (R) - 0.987**
- **Coefficient of determination (R^2) - 0.974**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.972**
- **'d' statistic - 0.996**

- **'F' value (with 3, 37 d.f.) - 462.939**
- **Returns to scale - 0.957*****
- ***** Significant at 1 per cent level of significance**

The elasticity coefficients for gross returns were estimated to be 0.325, 0.409 and 0.223 for machine labour, irrigation and seed respectively indicating that one per cent increase in expenditure increased the gross return by 0.325 per cent, 0.409 per cent and 0.223 per cent, respectively. This implied that gross return was relatively inelastic to the changes in irrigation, machine labour and seed. The sum of elasticity coefficients was significant at 1 per cent level of significance, implying decreasing returns to scale on such farms in the production of fenugreek.

(D) Medium farmers

In case of medium farmers fertilizer (X_4 = 0.510), irrigation (X_6 = 0.358) and plant protection measure (X_5 = 0.069 were found to be statistically significant (table 4D.16).

Table 4D.16 Estimated Cobb-Douglas production function for medium farmers of state of Rajasthan

Dependent variable (Y) = Gross return
Number of farmers (N) = 34

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.899**	**0.089**	**-**
2.	**Fertilizer (X_4)**	**0.510*****	**0.061**	**4.345**
3	**Irrigation (X_6)**	**0.358*****	**0.055**	**3.980**
4.	**Plant Protection measure (X_5)**	**0.069*****	**0.016**	**1.306**

- **Coefficient of multiple correlation (R) - 0.986**

- **Coefficient of determination (R^2) - 0.972**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.969**
- **'d' statistic - 1.983**
- **'F' value (with 3, 30 d.f.) - 344.536**
- **Returns to scale - 0.937*****
- ***** Significant at one per cent level of significance**

The regression coefficients for fertilizer, irrigation and plant protection measure were significantly positive at one per cent level of significance. These variables together accounted for 97.20 per cent of the total variation in the gross return. The elasticity coefficients for gross return with respect to the selected explanatory variables, *i.e.*, fertilizer, irrigation and plant protection measure were estimated to be 0.510, 0.358 and 0.069. This implied that gross return was inelastic to the changes in expenditure on fertilizer, irrigation and plant protection measure. The sum of elasticity coefficients, *i.e.,* returns to scale of production on these farms was significant at 1 per cent level of significance, implying decreasing returns to scale.

(E) Large farmers

Table 5D.17 shows that on large farms machine labour (X_1) and plant protection measure (X_5) significantly affected the gross return. The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables. The Durbin–Watson test also indicated no autocorrelation (neither positive nor negative) among the estimated residuals. The regression results revealed that the coefficient of machine labour (X_1 = 0.464) and plant protection measure (X_5 = 0.420) were significant at one per cent level of significance. These explanatory variables together accounted for 97.50

per cent variation in the gross return .The observed F-value was higher than the tabulated F value indicating regression to be significant.

The elasticity coefficients of gross return with respect to both the explanatory variables indicated that one per cent increase in expenditure on machine labour and plant protection measure increased the gross return by 0.464 per cent and 0.420 per cent, respectively indicating the gross return to be relatively inelastic to the change in machine labour and plant protection measure. The return to scale of production on large farms was significant at 1 per cent level of significance implying decreasing returns to scale.

Table 4D.17 Estimated Cobb-Douglas production function for large farmers of state of Rajasthan

Dependent variable (Y) = Gross return
Number of farmers (N) = 17

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.720**	**0.159**	**-**
2.	**Machine labour (X_1)**	**0.464*** **	**0.097**	**6.633**
3.	**Plant protection measure (X_5)**	**0.420*** **	**0.092**	**5.127**

- **Coefficient of multiple correlation (R) - 0.988**
- **Coefficient of determination (R^2) - 0.975**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.972**
- **'d' statistic - 1.627**
- **'F' value (with 2, 14 d.f.) - 276.176**
- **Returns to scale - 0.884*** **

- ***** Significant at 1 per cent level of significance**

(F) Overall farmers

The regression results for overall farmers of state of Rajasthan revealed that only five explanatory variables namely; machine labour (X_1), seed (X_2), fertilizer (X_4), irrigation (X_6), and human labour (X_7) significantly affected the gross return (Table 4D.18). The results of VIF indicated that there was no multicollinearity problem among these variables. The estimated'd' statistic indicated no autocorrelation (positive or negative) among the estimated residuals.

The regression coefficients for machine labour (X_1= 0.343), seed (X_2= 0.203), fertilizer (X_4= 0.213), irrigation (X_6 = 0.125) and human labour (X_7= 0.056) were significantly positive at one per cent level of significance. The coefficient of multiple determinations (R^2) was 0.987 indicating that 98.70 per cent of variation in gross return was explained by the explanatory variables included in the model. The observed F-value was higher than the tabulated F value indicating regression to be significant.

Table 4D.18 Estimated Cobb-Douglas production function for overall farms of state of Rajasthan

Dependent variable (Y) = Gross return
Number of farmers (N) = 150

S.No.	Explanatory variable	Regression coefficient	Standard error	VIF
1.	**Intercept (a)**	**1.437**	**0.062**	**-**
2.	**Machine labour (X_1)**	**0.343*****	**0.035**	**3.843**
3.	**Seed (X_2)**	**0.203*****	**0.023**	**6.332**
4	**Fertilizer (X_4)**	**0.213*****	**0.031**	**1.103**
5	**Irrigation (X_6)**	**0.125*****	**0.028**	**9.252**
6	**Human labour (X_7)**	**0.056*****	**0.027**	**8.382**

- **Coefficient of multiple correlation (R) - 0.993**

- **Coefficient of determination (R^2) - 0.987**
- **Adjusted coefficient of determination ($\overline{R^2}$) - 0.986**
- **'d' statistic - 1.898**
- **'F' value (with 5, 144 d.f.) - 725.364**
- **Returns to scale - 0.940*****
- ***** Significant at 1 per cent level of significance**

The elasticity coefficients for gross return with respect to ; machine labour (X_1), seed (X_2), fertilizer (X_4), irrigation (X_6) and human labour (X_7) were estimated to be 0.343, 0.203, 0.213, 0.125 and 0.056 respectively. Thus, gross return was inelastic to change in machine labour, seed, fertilizer irrigation and human labour. The sum of elasticity coefficients, *i.e.,* returns to scale of production was 0.940 which was significant at 5 per cent level of significance overall farms implying decreasing returns to scale.

4D.2.4 Regression analysis for Jaipur vs. Sikar and state of Rajasthan

Out of seven explanatory variables, only four variables namely; machine labour (X_1), seed (X_2), irrigation (X_6) and human labour (X_7) for Jaipur district and machine labour (X_1), seed (X_2), fertilizer (X_4) and human labour (X_7) for Sikar farms were significant factors influencing gross return. Though, their effect was not the same across the categories of Jaipur and Sikar farms. It varied from category to category. In case of marginal farms of both Jaipur and Sikar districts it was seed and manure that influenced the gross return positively and significantly. In case of small of farms of Jaipur district, machine labour, human labour and fertilizer and in case of Sikar farms human labour, irrigation and fertilizer had positive influence on the gross return. This indicates that human labour, machine labour, seed, irrigation,

fertilizer and manure led to increases in gross return on marginal and small farms in the study area.

In case of semi-medium farms of Jaipur district, irrigation, machine labour and fertilizer and for Sikar farms, irrigation, machine labour and plant protection measures influenced the gross return positively and significantly. In case of medium farms of Jaipur and districts, irrigation, machine labour and fertilizer positively and significantly affected the gross return. In case of large farms of Jaipur district these were machine labour and fertilizer expenses and for Sikar farms machine labour and irrigation expenses that influenced the gross return positively and significantly. At aggregate level human labour, machine labour, seed, fertilizer, and irrigation had significantly positive effect on the quantum of gross return of the Jaipur as well as Sikar farms.

A look into factor-wise influence revealed that human labour positively and significantly influenced the gross return on overall categories of Jaipur and Sikar farms. Machine labour had significantly positive effect on the gross return of small, semi-medium, medium, large and overall size group of Jaipur farms and Sikar farms. Seed; too, had significantly positive effect on the gross return of marginal and overall categories of Jaipur farm and Sikar farms.

Manure significantly and positively influenced gross return of marginal farms of Jaipur and Sikar farms. Fertilizer positively and significantly influenced the gross return on small, semi-medium, medium and large categories of Jaipur and on small, medium and overall categories of Sikar farms. Plant protection positively significantly on semi-medium farm of Sikar influenced the gross return. Irrigation positively and significantly influenced the gross return of semi-medium, medium and overall category of Jaipur farms and small, semi-medium, medium and large category

of Sikar farmers. Human labour significantly and positively influenced gross return of small or over all group of farms of Jaipur and Sikar farms.

For overall Rajasthan, only five variables machine labour, seed, fertilizer, irrigation and machine labour were significantly affect the gross return. On marginal farms manure and seed; for small farms machine labour, human labour and fertilizer; for semi-medium machine labour, seed, and irrigation; for medium farms fertilizer, irrigation and plant protection measure; for large farms machine labour and plant protection measure; overall farms machine labour, seed, fertilizer, irrigation and human labour were significantly affect the gross return.

Factor wise influence revealed that first machine labour was significant on small, semi-medium and overall farms; second seed was significant on marginal, semi-medium and overall farms; third manure was significant on marginal farms; fourth fertilizer was significant on small, medium and overall farms; fifth plant protection measure was significant on medium and large farms; sixth irrigation was significant on semi-medium, medium and overall farms and last one human labour was significant at small and overall farms of Rajasthan.

4D.3 Marginal value productivity, factor costs and economic efficiency

In order to enable comparison of the absolute output response per unit of factor input, it is necessary to compute the marginal value productivity of each factor input. The marginal value productivity (MVP) of input was estimated by taking partial derivatives of return with respect to input concerned at the geometric mean level of inputs. The regression coefficient (elasticity coefficient) of an explanatory variable indicates the per cent change in gross farm output associated with one per cent change in factor input. An input factor is considered to be most efficient if its marginal value product is just sufficient to off-set its cost.

Equality of marginal value product to factor cost is the basic condition that must be satisfied to obtain efficient resource use. The ratio of marginal returns to acquisition costs *i.e.,* economic efficiency for all variables were calculated by dividing the marginal value productivities by the marginal factor costs. The marginal factor cost (MFC) was assumed to be constant, *i.e.* 1 unit for each input.

4D.3.1 Marginal value productivities (MVPs) of different inputs used in fenugreek production in Jaipur district

The estimated ratios of marginal value productivities (MVPs) to respective factor cost of variable inputs for farmers of Jaipur district are presented in table 4D.19. The average period of operating expenses was taken as three months during which funds were tied up in a crop.

Table: 4D.19 Marginal value productivities (MVP) of different input of famers for fenugreek production in Jaipur district

Variables	Category of Farmers					
	Marginal	**Small**	**Semi-medium**	**Medium**	**Large**	**Overall**
Machine labour (X_1)	-	3.06 (3.01)	3.09 (3.03)	3.24 (3.19)	4.46 (4.36)	3.65 (3.59)
Seeds (X_2)	25.44 (25.00)	-	-	-	-	4.85 (4.76)
Manure(X_3)	9.20 (9.04)	-	-	-	-	-
Fertilizer (X_4)	-	11.16 (10.97)	18.01 (17.70)	13.54 (13.31)	15.83 (15.56)	-
Plant protection (X_5)	-	-	-	-	-	-
Irrigation (X_6)	-	-	9.32 (9.16)	15.72 (15.45)	-	8.63 (8.49)
Human labour (X_7)	-	437.52 (429.99)	-	-	-	323.44 (317.88)

The marginal factor cost was assumed to be constant i.e. 1 for each input

Figures in parentheses are the ratio of marginal returns to acquisition costs adjusted for time value of money

Taking 7 per cent interest rate per annum on short term loans, the interest charge on variable expenses investment was 1.75 (3.5/2) per cent. After deducting this 1.75 per cent interest cost, the values of marginal value productivity were obtained. The table indicates that marginal value productivities of factor costs were more than one, varying from ` 3.06 for machine labour (small farms) to ` 437.52 for human labour (small farms). The MVP for machine labour (X_1) was ` 3.06, 3.09, 3.24, and 4.46 on small, semi-medium, medium and large farmers, respectively with an overall average of ` 3.65. It shows that an increase of one unit in variable factor would be accompanied by an increase in the gross income of ` 3.06, 3.09, 3.24, and 4.46 on small, semi-medium, medium and large farmers, respectively, holding other inputs constant at their respective geometric mean levels. The MVP for seed was ` 25.44 for marginal and ` 4.85 for overall categories of farms. In case of manure ($X_3$) the gross marginal value productivity was ` 9.20 and net MVP was ` 8.20 on marginal farmers. In case of remaining categories it was not significant. The gross marginal value productivity of fertilizer input ($X_4$) per rupee investment was ` 11.16 on small, ` 18.01 on semi medium, ` 13.54 on medium and ` 15.87on large categories of farms.

The marginal value productivity of plant protection measures (X_5) was non-significant for all categories of farms. The MVP of irrigation (X_6) per rupee investment was ` 9.32, 15.72 and 8.63 on semi-medium, medium and overall size groups of farms, respectively. The net MVP was ` 8.32, 14.72 and 7.63 for sem-medium, medium and over all farm size groups. Among all the variable factors the MVP of human labour was noted to be the highest. The gross marginal value productivity was ` 437.52 and 323.44 on small and over all farm size, respectively. This shows that an additional unit spending of mandays on human labour gives a net profit of ` 237.52 and 123.44 on small and overall size group of farms in Jaipur district.

4D.3.2 Marginal value productivities (MVPs) of different inputs used in fenugreek production in Sikar district

The estimated ratios of marginal value productivities (MVPs) to different factor costs affecting the crop yield in Sikar district are presented in table 4D.20. The table indicates that marginal value productivities of factor costs were more than one, varying from `1.73 for plant protection measures (semi-medium farms) to ` 716.37 for human labour (small farms).

Table: 4D.20 Marginal value productivities (MVP) of different input of farmers for fenugreek production in Sikar district

Variables	Category of Farmers					
	Marginal	Small	Semi-medium	Medium	Large	Overall
Machine labour (X_1)	-	-	2.24 (2.21)	3.04 (2.99)	5.49 (5.40)	2.83 (2.79)
Seeds (X_2)	11.26 (11.06)	-	-	-	-	10.77 (10.59)
Manure(X_3)	15.87 (15.60)	-	-	-	-	-
Fertilizer (X_4)	-	10.91 (10.71)	-	7.57 (7.44)	-	13.20 (12.97)
Plant protection (X_5)	-	-	1.73 (1.69)	-	-	-
Irrigation (X_6)	-	11.38 (11.18)	25.30 (24.87)	22.49 (22.11)	11.75 (11.54)	-
Human labour (X_7)	-	716.37 (704.05)	-	-	-	113.09 (111.05)

The marginal factor cost was assumed to be constant i.e. 1 for each input
Figures in parentheses are the ratio of marginal returns to acquisition costs adjusted for time value of money

The gross marginal value productivity of machine labour (X_1) on semi-medium, medium, large and overall categories of farms were ` 2.24, 3.04, 5.49 and 2.83, respectively as assuming MFC of human labour to be constant at ` 1.00. The net profit was ` 1.24, 2.04, 4.49 and 1.83 on semi-medium, medium, large and overall categories of farms, respectively by holding other inputs constant at their respective geometric mean levels.

The (gross) marginal value productivity of seed (X_2) was ` 11.26 and 10.77 on marginal and overall size group, respectively. This shows that additional spending of one rupee on seed gives us a net profit of ` 10.26 and 9.77. In case of mannure (X_3) the (gross) marginal value productivity was ` 15.87 and net MVP was ` 14.87 on marginal farmers. The gross marginal value productivity per rupee investment on fertilizer (X_4) was ` 10.91 for small, 7.57 for medium and 13.20 for overall categories and net MVP ` 9.91, 6.57 and 12.20 for small, medium and overall categories of farms, respectively.

The gross MVP of plant protection measures (X_5) was `1.73 for semi-medium farms and the net marginal variable productivity ` 0.73. The marginal value productivity of irrigation (X_6) per rupee investment was ` 11.38, 25.30, 22.49 and 11.75 for small, semi-medium, medium and large size groups of farms, respectively. The gross MVP (return per unit i.e. mandays) of human labour ($X_7$) was ` 716.37 and 113.09 for small and overall farms, respectively.

4D.3.3 Marginal value productivities (MVPs) of different inputs used in fenugreek production in state of Rajasthan

The estimated ratios of marginal value productivities (MVPs) to different factor costs affecting the crop yield in state of Rajasthan are presented in table 4D.21. The table indicates that marginal value

productivities of factor costs were more than one, varying from ` 2.45 for machine labour (semi-medium farms) to ` 490.07 for human labour (small farms). The MVP for machine labour (X_1) was ` 2.90, 2.45 and 3.88 on small, semi-medium and large farmers, respectively with an overall average of ` 3.44. It shows that an increase of one unit in variable factor would be accompanied by an increase in the gross income of ` 2.90, 2.45 and 3.88 on small, semi-medium and large farmers, respectively, holding other inputs constant at their respective geometric mean levels.

Table: 4D.21 Marginal value productivities (MVP) of different input of famers for fenugreek production in state of Rajasthan

Variables	Category of Farmers					
	Marginal	**Small**	**Semi-medium**	**Medium**	**Large**	**Overall**
Machine labour (X_1)	-	2.90 (2.85)	2.45 (2.41)	-	3.88 (3.81)	3.44 (3.38)
Seeds (X_2)	17.60 (17.30)	-	8.26 (8.12)	-	-	7.40 (7.28)
Manure(X_3)	10.37 (10.19)	-	-	-	-	-
Fertilizer (X_4)	-	11.25 (11.05)	-	24.46 (24.04)	-	7.09 (6.97)
Plant protection (X_5)	-	-	-	5.88 (5.78)	24.59 (24.16)	-
Irrigation (X_6)	-	-	17.68 (17.38)	18.50 (118.18)	-	5.32 (5.22)
Human labour (X_7)	-	490.07 (481.64)	-	-	-	153.48 (150.84)

The marginal factor cost was assumed to be constant i.e. 1 for each input
Figures in parentheses are the ratio of marginal returns to acquisition costs adjusted for time value of money

The MVP for seed was ` 17.60 for marginal, ` 8.26 for semi-medium and `7.40 for overall categories of farms. In case of manure ($X_3$) the gross marginal value productivity was ` 10.37 and net MVP was ` 9.37 on marginal farmers. In case of remaining categories it was not significant. The gross marginal value productivity of fertilizer input ($X_4$) per rupee investment was ` 11.25 on small and ` 24.56 on medium categories of farms.

The marginal value productivity of plant protection measures (X_5) was 5.88 on medium and 24.59 on large categories of farms. The MVP of irrigation (X_6) per rupee investment was `17.68, 18.50 and 5.32 on semi-medium, medium and overall size groups of farms, respectively. The net MVP was ` 16.68, 17.50 and 4.32 for semi-medium, medium and over all farm size groups. Among all the variable factors the MVP of human labour was noted to be the highest. The gross marginal value productivity was ` 490.07 and 153.48 on small and over all farm size, respectively. This shows that an additional unit spending of mandays on human labour gives a net profit of ` 390.07 on small and for overall size group it was not profitable.

4D.3.4 Marginal value productivities (MVPs) for Jaipur vs. Sikar and state of Rajasthan

From the above discussion, it may be concluded that the marginal value productivities on different size groups were positively influenced factor inputs on Jaipur, Sikar districts and state as a hole. The MVP analysis suggested a significant scope for raising crop productivity by adjustment/reallocation of important farm inputs on both the districts and state as a hole. This would lead to enhance production and productivity of fenugreek crop in Jaipur, Sikar districts and state of Rajasthan.

These results indicated a need to create awareness among the farmers through extension services. Institutional support was also required to improve the access of fenugreek producing farmers to input marketing and credit institutions.

CHAPTER – V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

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

5.1 Introduction

Agriculture plays an important role in economy of India. Presently, it provides livelihood to about 58.2 per cent of the total population of the country. It contributes 13.7 per cent to Gross Domestic product (GDP) of the country. It accounted for about 13.08 per cent share of total value of country's export during 2012-13. This sector supplies bulk of wage goods required by the non-agricultural sector and raw material for a large section of industries.

India still continues to be the largest producer, consumer, and exporter of spices in the world. It produced 5.80 million tones of spices on an area of 3.10 million hectares. A large number of spices are grown in India, out of the 109 spices listed by the International Organization for Standardization (ISO), India produces as many as 63 owing to its varied agro-climatic regions.

Almost all the States and Union territories (UTs) of the country grow one or other spices. It is a source of livelihood and employment for large number of people in the country, both for rural population, who grow them, and the urban population, who process and trade in them. Out of the total 63 spices grown in India, 20 are classified as seed spices with 36 per cent share in area and 17 per cent share in production of total spices in India (Annual report NRC Seed spices).

Main seed spices of India are coriander, cumin, fennel, fenugreek, dill, ajwain, celery, anise nigella and caraway. Seed spice crops are extensively cultivated in the arid and semi arid region of India. The important seed spices producing states in the country are Rajasthan, Gujarat, M.P., Haryana, Punjab, U.P., A.P. and Bihar. Among these states, Rajasthan is the major seed spices producing state with 57.66 per cent of the total area and 55.53 per cent of the total production of seed spices in the country.

Out of these seed spices, fenugreek is one of the main seed spices, which is commonly used in the daily food basket of the consumers. Fenugreek is used as a spice to improve the flavour and the nutritive value of food. In India, total area under fenugreek cultivation was 93.10 thousand hectares with a production of 112.84 thousand tonnes in the year 2012--13.

The productivity of fenugreek was 1212 kg per hectare during the same period. Rajasthan, Gujarat, Uttar Pradesh and Uttaranchal are the major fenugreek producing states of the country which together accounted for more than 90 per cent each of the total area and total production of fenugreek in the country.

In 2012-13, the total area under fenugreek in Rajasthan state was 82.359 thousand hectares which accounted for 88.45 per cent of the total area and 87.38 thousand tones of fenugreek production, which accounted for 77.43 per cent of the total production under fenugreek in the country. The state has great potential for increasing the productivity and production of fenugreek crop to meet out the growing export demand.

Thus, fenugreek is an important cash crop. However, there were certain questions raised in cultivation of fenugreek that:

I. At what extent or degree of fluctuations in area, production and productivity of fenugreek?

II. Whether and to what extent the fenugreek farming benefited to the farmers in terms of costs and returns from the cultivation of fenugreek?

III. What are the marketing channels, their costs, margins and price-spread in marketing of fenugreek in the study area?

IV. What are the resource use patterns of fenugreek farms?

These were some of the questions that were attempted to answer in the present study.

5.2 Objectives

The specific objectives of the study were:

1. To estimate the growth rates and instability in area, production and productivity of fenugreek in the state of Rajasthan;
2. To estimate the cost of cultivation of fenugreek in the state of Rajasthan;
3. To analyse the marketing costs incurred and margins earned by different agencies involved in the marketing of fenugreek in the state of Rajasthan, and
4. To study the resource use efficiency of fenugreek crop in the state of Rajasthan.

5.3 Methodology

Rajasthan state occupies first position in area and production of fenugreek in the country with 88.45 per cent of area and 77.43 per cent of the country's total production. A list of top 10 districts having highest area under fenugreek crop based on the quinquennial averages ending 2005-06 to 2009-10 year was prepared. Those districts which stood common in both the lists were selected. The per cent share of these districts in total area under and production of fenugreek in the state

were examined for adequacy of sample districts. Sikar, Chittorgarh, Jhunujhunu, Nagaur, Kota, Jhalawar, Jaipur, Churu, Bikaner and Bundi districts were selected for detailed study of growth and instability.

Two districts Sikar and Jaipur were selected randomly from the selected ten districts for study of cost of cultivation, marketing cost and resource use efficiency. One regulated market from each of these two districts, Shri-Madhopur mandi (Sikar) and Chomu mandi (Jaipur) were selected on the basis of highest arrivals of fenugreek production during the past three years. Separate lists of all the villages falling with in the catchment area of the regulated markets were prepared. Three villages from each of the lists so prepared were randomly selected in proportion.

A list of all the fenugreek growing farmers of the selected villages was prepared from the information provided by the village patwaries. The total number of fenugreek growing farmers in the sample villages was 261 and 354, in Sikar and Jaipur districts, respectively. All the farmers were divided into following five size groups on the basis of size of their land holdings; marginal (less than 1 hectare), small (1-2 hectares), semi-medium (2-4 hectares), medium (4-10 hectares), large (10 hectares and above). The cumulative total of fenugreek growing farmers in selected village was 615, from which a sample of 150 farmers was selected on the basis of systematic sampling. The numbers, thus, obtained were 23 (marginal), 35 (small), 41 (semi-medium), 34 (medium) and 17 (large) farmers of selected village

Both primary and secondary data were required to achieve the stated objectives. The primary data in respect of cost of cultivation, cost of production, returns from fenugreek, marketing channels, costs and margins from fenugreek were collected from the producers as well as marketing intermediaries through personal interview method with the help of a pretested schedule specifically prepared for the purpose.

Primary data were collected for the Agricultural year 2010-11 for which the information was readily available.

The secondary data in respect of area and production of fenugreek crop for the state and its major producing districts were collected for the period 1985-86 to 2012-13 from the records and reports of the Directorate of Economics and statistics, and Directorate of Agriculture, Government of Rajasthan, Jaipur. Productivity of the selected crops was computed by dividing the total production of the crop in a particular year in the district by the corresponding area under that crop in that district. Mainly tabular analysis was done and simple averages; per centages, standard deviation, variance, co-variance and coefficient of variation were calculated. For estimating resource use efficiency, regression analysis was resorted to arrive at some conclusion.

5.4 Results and Discussions

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

5.4.1 Growth rates and instability in area, production & productivity

The results of growth rate analysis indicated that there was significant growth in area, production and productivity of fenugreek in all the selected districts (except Chittorgarh) and the state as a whole during the period 1985-86 to 2012-13. However, significant increase in production of this crop was found in all the selected districts (except Chittorgarh) and the state as a whole (4.30 per cent). Production of fenugreek in Sikar, Nagaur, Jhunjhunu, Jaipur districts and the state as a whole increased due to increase in area and in Jhalawar district due to increase in productivity while in Kota, Churu, Bikaner and Bundi, it increased due to increase in both area and productivity. Area of fenugreek in Chittorgarh district increased at a compound rate of 0.66

per cent per annum but this positive contribution was negated by non-significant growth in productivity (-0.23 per cent).

The quinquennial average of data of area, production and productivity of fenugreek for the period 1885-86 to 2012-13 were arranged according to various five year plans taking seventh five year plan as the base. Assuming seventh five year plan as 100 per cent the increase or decrease in area, production and productivity during the different FYPs were calculated. Out of the ten districts, three districts viz.; Jhunujhunu, Jaipur and Bikaner registered negative growth in 8th five year plan, while in 9th five year plan all the districts (except Jaipur) had positive growth. There was no area under fenugreek during 7th and 8th five year plan in Bundi district. Therefore 9th plan was assumed as the base year (i.e. 100 per cent). Only Churu district continuously recorded positive growth in all the five year plans. On the contrary, Jaipur district depicted negative growth. The maximum growth in area was shown by Churu district which was 709 times more as compared to the base year. The area under fenugreek in the state of Rajasthan showed positive growth during all the five year plans.

All the selected districts had positive growth in production of fenugreek during 9th, 10th and 11th five year plans over 7th FYP production. Churu and Nagaur had shown continuous increase in production of fenugreek during all the five year plans. In other districts the production of fenugreek recorded increase across all the FYPs but the pattern (magnitude) of increase was not the same. The maximum growth in production was recorded by Churu followed by Bikaner, Kota, Nagaur, Bundi and Jhunujhunu district during the 11th FYP.

As in area and production in productivity, too, the districts of Jhunujhunu, Bikaner and Jaipur registered negative change during 8th five year plan over the base 7th FYP. All districts had registered positive change in productivity during the 8th plans, the positive change ranged from 16.73 per cent in Jhalawar district to 60.16 per cent in Sikar

district. The maximum positive change in productivity in 11th five year plan was recorded in Kota (146.44 per cent) followed by Bikaner (106.69 per cent), Nagaur (49.53 per cent), Jhalawar (35.21 per cent) and Bundi district (34.30 per cent) as compared to base FYP.

A coefficient of variation for area under fenugreek crop in the state was 24.87 per cent during 1985-86 to 2012-13. The variation in area were high (C.V more then 50 per cent) in Nagaur, Kota, Churu, Bikaner and Bundi. The highest coefficient of variation was in Bundi district (90.45 per cent) and lowest in Jaipur district (16.44 per cent). The area instability for fenugreek crop was found to be higher for the selected districts compared to the state. The coefficient of variation for production of fenugreek in the state of Rajasthan was 28.92 per cent during the period of 1985-86 to 2012-13.

The variation in area were high (C.V more then 50 per cent) in Nagaur, Jhunujhunu, Kota, Churu, Bikaner and Bundi districts. For the selected districts, the range of variation was observed between 35.88 per cent in Sikar to 96.38 per cent in Bundi. The coefficient of variation for fenugreek production has been higher for the selected districts compared to the state as a whole. It was indicated that fluctuation in production was more in the selected districts compared to the state as a whole. In other words, high growth in production is accompanied by increased variability in production, thus increasing the risks associated in the production of these districts.

The coefficient of variation for productivity of the fenugreek for the state revealed that this was 14.14 per cent in period of 1985-86 to 2012-13. Among the districts, variation in productivity of fenugreek crop was highest (46.98 per cent) in Kota district and lowest (14.63 per cent) in Chittorgarh district.

Yield variance was a dominant source of variance in production of fenugreek crop in all the selected districts and state as a whole (73.79 per cent) and in Jaipur district area variance (87.99 per cent)

was a dominant source of variance in production of fenugreek crop. Further area-yield covariance was of smaller magnitude compared to yield variance.

The area-yield co-variance accounted for 9.89, 21.75, 5.61, 4.74, 4.47 and 2.36 per cent in the districts of Chittorgarh, Jhunujhunu, Kota, Bikaner, Bundi, and state as a whole, respectively. It means the combined forces of area and yield have affected production of fenugreek crop in selected districts as well as in the state. The area-yield co-variance has been negative in the districts of Sikar (-35.88 per cent), Nagaur (-5.14 per cent), Jhalawar (-22.85 per cent), Jaipur (-35.88 per cent) and Churu (-19.43 per cent) indicating thereby that area-yield co-variance has a stabilizing effect on fluctuation in their production brought about mainly by yield instability of fenugreek crop production. Higher order covariance was negligible indicated its no effect on production variance.

5.4.2 Cost of cultivation

The per hectare average total cost (cost c_2) of cultivation of fenugreek on Jaipur and Sikar farms were ` 24137.66 and 23399.93 per hectare, respectively. Among the different size groups of farms it ranged from ` 22822.34 (marginal) to ` 24788.40 (large) sized farms in Jaipur district and `21154.78 (marginal) to ` 25143.58 (large) sized farms in Sikar district.

The operational costs on overall basis were ` 16939.70 and 16852.02 on Jaipur and Sikar farms, respectively. It accounted for 70.18 per cent and 72.02 per cent of the total cost (cost c_2) for respective districts. Among the various components of operational cost incurred in the cultivation of fenugreek, human labour was the major component of expenditure on sample farms; it was 25.20 per cent and 25.38 per cent on Jaipur and Sikar farms. The utilization of machine labour on Jaipur and Sikar farms was ` 4974.02 and ` 5073.40 per

hectare, respectively. Per hectare manure charges amounted to ` 1824.93 on Jaipur farms and ` 1850.31 on Sikar farms. Seed utilization was found to be ` 1350.05 on Jaipur farms and ` 1237.11 on Sikar farms. The irrigation charges, fertilizers and plant protection measures accounted for 4.40, 3.84 and 2.13 per cent of the total costs of cultivation on Jaipur farms, respectively. The respective figures were 4.60, 4.03 and 2.26 per cent per hectare for Sikar farms.

The interest on working capital and fixed capital were 0.85 per cent and 1.69 per cent on Jaipur farms and 0.88 per cent and 3.00 per cent on Sikar farms. The average overhead costs were ` 7197.96 (29.82 per cent) on Jaipur farms and ` 6547.91(27.98) on Sikar Farms. In absolute terms the total cost, operational cost and overhead cost increased with the increase in farm size.

On an average, the cost A_1, A_2, B_1, B_2 and C_1 were ` 13711.19, ` 13711.19, ` 14188.62, ` 19118.62 and ` 19137.66, respectively on Jaipur farms and these respective costs were `13790.21, ` 13790.21, ` 14491.77, ` 18491.77 and ` 19399.93 on Sikar farms. Cost C_3 was estimated at ` 26551.42 on Jaipur farms and ` 25439.92 on Sikar farms. The cost A_2 was same as cost A_1 on all the size groups of farms because none of the sample farmers leased-in any land for cultivation of fenugreek in the study area.

On an average, gross income, farm business income, return over operating cost and family labour income per hectare of fenugreek cultivation were ` 46085.74, ` 32374.55, ` 29146.04 and ` 26967.12 respectively on Jaipur farms and these parameters (i.e. gross income, farm business income, return over operating cost and family labour income,) were ` 45423.14, ` 31632.93, ` 28571.13 and ` 26931.37 respectively on Sikar farms. The net income ranged from ` 18108.06 on marginal farms to ` 27440.74 on large farms under Jaipur farms and

from ` 18257.92 to ` 28096.08 on the same categories of Sikar farms. The per rupee return from cultivation of fenugreek crop ranged from ` 1.79 on marginal sized farms to ` 2.11 on large sized farm with an average of ` 1.91 on Jaipur farms and there range were 1.86 (marginal) to 2.12 (large) with an average of ` 1.94 on Sikar farms. The overall cost of production per quintal of fenugreek crop was ` 1154.25 on Jaipur farms and ` 1111.78 on Sikar farms.

Per hectare average total cost (cost c_2) of cultivation of fenugreek on state of Rajasthan was ` 23827.81. The operational costs on overall basis were ` 16902.87 and overhead cost was ` 6924.94. On an average, the cost $A_1$, $A_2$, $B_1$, $B_2$ and $C_1$ were ` 13744.38, 13744.38, 14275.34, 18855.34 and 19247.81, respectively on state of Rajasthan farms. On an average, gross income, farm business income, return over operating cost and family labour income, net income per hectare of fenugreek cultivation were ` 45807.45, 32063.07, 28904.58, 26952.11 and 21979.64 respectively on state farms. Per rupee return from cultivation was ` 1.92 and overall cost of production per quintal was ` 1128.04.

5.4.3 Marketing costs incurred and margins earned by different agencies

Marketing channels observed in marketing of fenugreek crop for both the districts at village and mandi level were:

(I) Marketing channel at village level:

Producer/farmer-village trader-wholesaler-retailer-consumer

(II) Marketing channel at mandi level:

Producer/farmer-wholesaler-retailer-consumer

Out of the selected farmers in Jaipur district, 62.07 per cent farmer's marketed 34.88 per cent fenugreek crop in the villages to the village traders and 37.93 per cent farmers sold 65.12 per cent fenugreek crop in the regulated market of Chomu (Jaipur). Similarly, 0.32 per cent farmer's marketed 33.79 per cent produce to village trader and 39.68 per cent farmer sold their 66.21 produce in regulated market of Sikar (Shri-madhopur).

In both of districts the number of farmers and quantity of fenugreek sold by them in the regulated market were positively associated with the increase in size of holding. Cent per cent farmers from marginal and small categories sold their cent per cent quantity of fenugreek crop in village to village trader. Whereas, cent per cent large sized farmers sold their whole quantity in the regulated market.

Out of the total fenugreek crop available with the farmers, 66.11 per cent quantity was marketed only in the first quarter i.e. during the month of March to May and rest 33.89 per cent quantity was marketed in the remaining three quarters of the year in Jaipur and 69.42 per cent quantity was marketed in first quarter and remaining 30.58 per cent quantity was marketed in the remaining three quarters in Sikar district. Among the size groups, marginal and small sized farmers marketed their total produce immediately after harvest i.e. in the first quarter. The increase in farm size and quantity of fenugreek crop marketed in the subsequent quarters of the year had shown positive association. Medium and large sized farmers carried their fenugreek crop up to the third and fourth quarters of the year.

Total cost in sale of fenugreek crop has been ` 385.74 and ` 356.14 per quintal, respectively at village and mandi in Jaipur district and ` 422.76 and ` 392.36 per quintal in Sikar district. Marketing costs were higher by ` 29.60 per quintal in sale at village as compared to that

in mandi in Jaipur and ` 30.40 per quintal in Sikar district, because of involvement of more number of middlemen.

Agency-wise breakup of the total marketing costs in sale of fenugreek crop revealed that wholesalers incurred the major share in total marketing costs which accounted 62.20 per cent and 67.37 per cent, respectively in village sale and mandi sale in Jaipur district and these ratios were 55.79 per cent and 60.11 per cent in Sikar district.

The component-wise breakup of the total marketing costs through marketing channel indicated that VAT, commission, mandi fee, transportation, and karda were the major cost items as these together accounted for 77.27 per cent and 81.58 per cent at village level and mandi level of the total marketing cost in Jaipur district and these ratios were 79.04 per cent and 83.12 per cent in Sikar district.

Producer's share in the consumer's rupee has been 58.57 per cent in village sale and 65.71 per cent in mandi sale in Jaipur district and these ratios were 58.82 per cent and 66.18 per cent in Sikar district. Farmers selling fenugreek crop in mandi got 7.14 per cent higher share than the village sale in Jaipur and 7.36 per cent in Sikar district.

Total marketing margin earned by the middlemen in sale of fenugreek crop accounted about one third of the consumer's price (30.41 per cent) in channel-I and one fourth (24.11 per cent) in channel-II in Jaipur and 28.74 per cent at village sale and 22.28 per cent at mandi level in Sikar district. Margin earned by the middlemen has been higher by 6.30 per cent in sale of fenugreek in the village sale than the mandi in Jaipur and 6.56 per cent higher in village sale sale than mandi in Sikar district.

In state of Rajasthan as a whole, on an average 61.33 per cent farmer's marketed 34.50 per cent fenugreek crop in the villages to the village traders and 38.67 per cent farmers sold 65.50 per cent

fenugreek crop in the regulated market. The quantity of fenugreek sold by them in the regulated market was positively associated with the increase in size of holding. 67.27 per cent quantity was marketed only in the first quarter i.e. during the month of March to May and rest 32.73 per cent quantity was marketed in the remaining three quarters of the year.

Total cost in sale of fenugreek crop has been ` 403.36 and ` 372.81 per quintal, respectively at village and mandi of the state. Marketing costs were higher by ` 30.55 per quintal in sale at village as compared to that in mandi because of involvement of more number of middlemen in village sale of the state. Producer's share in the consumer's rupee has been 58.81 per cent in village sale and 66.04 per cent in mandi sale. Total marketing margin earned by the middlemen in sale of fenugreek crop accounted about one third of the consumer's price (29.50 per cent) in channel-I and about one fourth (23.14 per cent) in channel-II. Margin earned by the middlemen has been lesser by 6.36 per cent in sale of fenugreek in the mandi than the village sale of the state.

5.4.4 Resource use efficiency

Out of seven explanatory variables, only four variables namely; machine labour (X_1), seed (X_2), irrigation (X_6) and human labour (X_7) for Jaipur district and machine labour (X_1), seed (X_2), fertilizer (X_4) and human labour (X_7) for Sikar farms were significant factors influencing gross return. Though, their effect was not the same across the categories of Jaipur and Sikar farms, which varied from category to category.

In case of marginal Jaipur and Sikar farms, it was seed and manure that influenced the gross return positively and significantly. In case of small farms; machine labour, fertilizer and human labour on Jaipur farms and fertilizer, human labour and irrigation on Sikar farms had positive influence on the gross

return. This indicates that human labour, machine labour, seed, manure, fertilizer and irrigation led to increase in gross return on marginal and small farms in the study area. In case of semi-medium farms; machine labour, fertilizer and irrigation on Jaipur farms and machine labour, plant protection measure and irrigation on Sikar farms that influenced the gross return positively and significantly.

In case of medium Jaipur farms, machine labour, fertilizer and irrigation and on Sikar farms machine labour, fertilizer and irrigation positively and significantly affected the gross return. In case of large Jaipur farmers these were machine labour and fertilizer and on Sikar farms machine labour and irrigation that influenced the gross return positively and significantly. At aggregate level machine labour, seed, fertilizer, irrigation and human labour had significantly positive effect on the quantum on gross return of the Jaipur as well as Sikar farms.

For overall Rajasthan, only five variables machine labour, seed, fertilizer, irrigation and machine labour were significantly affect the gross return. On Jaipur, Sikar and state farms the MVPs of different factor inputs on different size groups positively influenced the gross return. It was taken to mean that all factors were underutilized on Jaipur, Sikar and state farms.

5.5 Conclusions

From the results of the study, following conclusions were drawn:

1. Production in selected districts (except Chittorgarh) and the state as a whole increased significantly in the study period. The increase in the production of fenugreek in the state during the study period was contributed by increase in both area and productivity. The significant increase in productivity was reported low.

2. The area under fenugreek in the state of Rajasthan showed positive growth during all the five year plans. The maximum growth in production was recorded by Churu followed by Bikaner, Kota, Nagaur, Bundi and Jhunujhunu district during the 11^{th} FYP. The maximum positive change in productivity in 11^{th} five year plan was recorded in Kota followed by Bikaner, Nagaur, Jhalawar and Bundi district as compared to base FYPs.

3. The magnitude of instability in production of fenugreek crop was higher compared to area and productivity in the selected districts as well as in the state as a whole. It implied that the destabilizing effect was more on production than that of area and productivity.

4. Yield variance was the major source of total variance in production and had a dominant role in destabilizing the production in most of the selected districts in the state as a whole whereas; area variance was the dominant source of variance in production in the district of Jaipur. Area-yield covariance helped stabilized the production in majority of the selected districts.

5. The operational cost was higher on Jaipur and overhead cost was estimated to be higher on Sikar farms. All types of cost concepts *viz.,* costs A_1, A_2, B_2, C_2 and C_3 were higher on Jaipur farms than on the Sikar farms and the cost B_1 and C_1 were higher in Sikar district the reason being that Sikar farms invested more on interest on fixed capital and family labour.

6. **All types of farm incomes *viz.,* gross income, family labour income, farm business income were higher on Jaipur farms than on the Sikar farms. The returns per rupee and net income per hectare of fenugreek were higher on the Sikar farms as compared to the Jaipur farms. It was attributed to higher price and more physical output than realized on Sikar farms.**

7. In state of Rajasthan, per hectare average total cost (cost C_2) of cultivation, per rupee return from cultivation, per hectare net income and overall cost of production per quintal of fenugreek were ` 23827.81, 1.92, 21979.64 and 1128.04.

8. The sale of fenugreek in the regulated market increased with the increase in size of farm holding because of the low quantity of produce available with famers of small land holdings.

9. There was tendency of sale immediately after harvest among the marginal and small farmers. The semi-medium farmers sold the total surplus in the first and second quarters of the years. The medium farmers sold their produce in first three quarters of the year. The large farmers sold their produce in all the four quarters of the year but more quantity was sold in first and second quarter of the year.

10. The common marketing channels observed in sale of fenugreek by the farmers of the study area at village and mandi level were:

    (a) At village level sale:

    Producer/farmer-village trader – wholesaler-retailer-consumer

    (b) At mandi level sale:

    Producer/farmer-wholesaler-retailer-consumer

    The number of farmers adopting mandi sale increased in number with increase in farm size.

11. The net price received by the producer farmer in village sale was lower than that of the mandi sale by the farmer.

12. **Out of seven explanatory variables, only four variables namely; machine labour, seed, irrigation and human labour for Jaipur district and machine labour, seed, fertilizer and human labour for Sikar farms and five variables namely machine labour, seed, irrigation, fertilizer and human labour**

for state were significant factors influencing gross return. Though, their effect was not the same across the categories of farms.

13. **The marginal value productivities of machine labour, seed and human labour positively influenced the gross return on Jaipur, Sikar and state farms, respectively.**

5.6 Recommendations

1. In half of the selected districts and the state as a whole the productivity of the crop did not register any significant growth implying that the existing technology was not able enough to increase the productivity of the crop in the state. And, therefore, there is a need to develop and popularize the new species/varieties and production technology in the state.

2. Expansion of area under irrigation through development of watersheds, and development of low water requiring varieties resistant to insects, pests and climate stress could be some of the measures for reducing variability in area, and thereby in production.

3. Out of the total selected farmers of Jaipur and Sikar districts, 62.07 per cent and 60.32 per cent, respectively sold their produce in villages to the village traders. Regarding the time of sale of fenugreek in Jaipur and Sikar districts, 66.11 per cent & 69.42 per cent quantity, respectively were sold immediately after harvest to meet the financial obligations. This practice may be overcome by providing adequate credit facilities to the farmers at right time and on easy terms and conditions. Arrangements for marketing their product may be promoted through the co-operative marketing societies for better return. The farmers should be enrolled as the active members of the co-operative

societies and co-operative feeling should be induced in them so that they may get better prices of their produce.

4. Marginal value productivities on different size groups of farms suggested scope for raising crop productivity through readjustment/ reallocation of farm inputs in the study area.

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AN ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF FENUGREEK IN RAJASTHAN

Deepa Kumari Kumawat* — Ph.D. Scholar

Dr. R. C. Kumawat* — Major Advisor

ABSTRACT

Rajasthan state occupies first position in area and production of fenugreek in the country with 88.45 per cent of area and 77.43 per cent of the country's total production. The present investigation was undertaken with a view to study: (i) growth rates and instability in area, production and productivity in fenugreek (ii) cost of cultivation, cost of production and returns of fenugreek, (iii) marketing behaviour in respect of sale, costs and margins of fenugreek, and (iv) resource use efficiency of fenugreek crop in the state of Rajasthan. Top ten districts having highest area under and production of fenugreek in the state were examined for adequacy of sample districts. Sikar, Chittorgarh, Jhunujhunu, Nagaur, Kota, Jhalawar, Jaipur, Churu, Bikaner and Bundi districts were selected for detailed study of growth and instability. Two districts Sikar and Jaipur were selected randomly from the selected ten districts for study of cost of cultivation, marketing cost and resource use efficiency. One regulated market from each district, Shri Madhopur mandi (Sikar) and Chomu mandi (Jaipur) were selected on the basis of highest arrivals of fenugreek production. Three villages from each district were randomly selected. From these villages, 150 farmers of different categories were selected randomly.

Primary data were collected for the agricultural year 2010-11. The secondary data were collected from the records maintained by Directorate of Agriculture, Directorate of Economics and Statistics, Government of Rajasthan and regulated markets of the study area. The conventional budgeting technique and multiple regression functions were used to analyze the data. The results of study revealed that there was significant growth in area, production and productivity of fenugreek in all the selected districts (except Chittorgarh) and the state as a whole (4.30 per cent) during the period 1985-86 to 2012-13.

Production of fenugreek in the district of Sikar, Nagaur, Jhunjhunu, Jaipur and the state as a whole increased due to increase in area and in

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* Ph.D. Scholar, Department of Agricultural Economics

** Professor, Department of Agricultural Economics, S.K.N. College of Agriculture, Jobner (Swami Keshwanand Rajasthan Agricultural University, Bikaner, Campus - Jobner).

Jhalawar district due to increase in productivity while in Kota, Churu, Bikaner and Bundi; it increased due to increase in both area and productivity.

Growth during different five year plans (FYPs) the area, production and productivity of methi recorded no particular growth sequence either increase or decrease except in few districts. The magnitude of instability in production of fenugreek was higher mainly due to higher instability in area than productivity in the selected districts (except Jaipur) of the state and state as a whole. The yield variance was dominant source of variation in production of fenugreek in all the selected districts (except Jaipur) and state as a whole. In Jaipur district, area variance was the major source of variation in production of fenugreek.

On an average, total cost (Cost C_2) per hectare of fenugreek cultivation was ` 24375.66, 23399.93 and 23827.81 on Jaipur, Sikar and state farms. All types of incomes *vis.;* gross income, family labour income, farm business income and cost of production per quintal were higher on the Jaipur farms than on the Sikar farms. The net income and return per rupee were ` 21979.64 and 9.92 on state farms, respectively.

The sample farmers disposed 66.11 per cent fenugreek produce in Jaipur, 69.42 per cent in Sikar District and 67.27 per cent in state in first quarter (March to May). Remaining 33.89 per cent, 30.58 per cent and 32.73 percent were sold in subsequent quarters of the year (June to February) in Jaipur, Sikar and state farms, respectively. Total marketing cost in sale of fenugreek was ` 403.36 and 372.81 per quintal at village and regulated market in state of Rajasthan, respectively, while these were higher in Sikar and lesser in Jaipur than state as a whole. Producer's share in consumer's rupee in sale of fenugreek was 58.57 per cent, 58.82 per cent and 58.81 per cent in village sale of Jaipur, Sikar and state farms respectively, while 65.71 per cent, 66.18 per cent and 66.06 per cent in regulated market of Jaipur, Sikar and Rajasthan state, respectively.

The regression results revealed that out of seven explanatory variables, three common variables namely; machine labour, seed, and human labour for Jaipur, Sikar and state farms were significant factors influencing gross return. In addition to above factors, irrigation for Jaipur and state and fertilizer for Sikar and state influenced gross return.

Thus, it was concluded that production of fenugreek increase in state due to increase in both area and productivity. There was no set pattern of growth in production of fenugreek during FYPs. Cultivation of fenugreek in Sikar district was profitable. Fenugreek sale was more profitable in regulated market then village sale. Out of seven explanatory variables, most of the variables were under utilized.

राजस्थान राज्य में मैथी के उत्पादन एवं विपणन का एक आर्थिक विश्लेषण

दीपा कुमारी कुमावत (शोधकर्ता)

डॉ. आर. सी. कुमावत (मुख्य सलाहकार)

सारांश

राजस्थान राज्य देश में मैथी के कुल 88.45 प्रतिशत क्षैत्रफल तथा 77.43 प्रतिशत उत्पादन के साथ क्षैत्रफल तथा उत्पादन में प्रथम स्थान पर अधिकृत है। प्रस्तुत अन्वेषण राजस्थान में: (1) मैथी के क्षैत्रफल, उत्पादन एवं उत्पादकता में विकास एवं अस्थिरता, (2) मैथी के कृषि फर्म तथा उत्पादन में लागत एवं प्रतिफल, (3) मैथी के विक्रय लागत तथा सुरक्षित अंश के सम्बन्ध में विपणन व्यवहार, (4) राजस्थान राज्य में मैथी फसल उत्पादन में प्रयुक्त साधनों की उपयोग दक्षता के उद्देश्यौ को प्राप्त करने के लिए किया गया।

दस जिले जो कि राजस्थान राज्य में मैथी के क्षैत्रफल एवंम उत्पादन में शिखर पर थे उन्हे चयनित किया गया तथा उनको क्षैत्रफल एवंम उत्पादन की पर्याप्तता के लिया परीक्षण किया गया। सीकर, चित्तौड़गढ़, झुन्झुनू, नागौर, कोटा, झालावाड, जयपुर, चुरू, बीकानेर एवं बूंदी जिलो को विकास एवं अस्थिरता के विस्तृत अध्ययन के लिए चयनित किया गया। दो जिलो सीकर एवंम जयपुर को दस जिलो में से संयोगिक तौर पर कृषिकर्म लागत, विपणन लागत एवंम प्रयुक्त साधनो की उपयोग दक्षता के अध्ययन के लिए चयनित किया। मैथी उत्पादन की अधिकतम आवक के आधार पर प्रत्येक जिले से एक कृषि उपज मंडी, श्रीमाधोपुर मंडी (सीकर) एवंम् चौमू मंडी (जयपुर) का चयन किया गया। प्रत्येक जिले से तीन गांवों का चयन किया गया। इन गांवों से अलग–अलग श्रेणी के 150 किसानों का संयोगिक चयन किया गया।

प्राथमिक आंकड़े कृषि वर्ष 2010–11 के लिए एकत्रित किये गये। अध्ययन क्षैत्र से संबंधित द्वितीयक आंकड़े कृषि निर्देशालय, आर्थिक एवं सांख्यकी निर्देशालय राजस्थान सरकार एवंम कृषि उपज मंडी द्वारा तैयार अभिलेखो से एकत्र किये गये। आंकड़ो को विश्लेषित करने के लिए परम्परागत आय–व्यय तकनीक और एकाधिक प्रतीपगमन फलनो का उपयोग किया गया।

अध्ययन के परिणामों से ज्ञात हुआ कि, मैथी के क्षैत्रफल, उत्पादन एवं उत्पादकता में राजस्थान तथा सभी चयनित जिलो में 1985–86 से 2012–13 तक की अवधि में अर्थ विकास पाया गया। सीकर, नागौर, झुन्झुनु, जयपुर एवं सम्पूर्ण राजस्थान में मैथी उत्पादन में वृद्धि क्षैत्रफल में वृद्धि के कारण हुई एवम् झालावाड जिले में उत्पादकता वृद्धि के कारण जबकि कोटा, चुरू बीकानेर एवंम बूंदी में यह वृद्धि क्षैत्रफल एवम् उत्पादकता में वृद्धि के कारण हुई।

* विद्या वाचस्पति छात्र, कृषि अर्थशास्त्र विभाग

** आचार्य, कृषि अर्थशास्त्र विभाग, श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर (स्वामी केशवानन्द राजस्थान कृषि विश्वविद्यालय, बीकानेर)।

कुछ जिलों को छोड़कर विभिन्न पंचवर्षीय योजनाओं में मैथी के क्षेत्रफल उत्पादन एवं उत्पादकता विकास में वृद्धि एवं कमी का विशेष विकास अनुक्रम प्राप्त नहीं हुआ।

सम्पूर्ण राजस्थान तथा चयनित जिलों में (जयपुर के अलावा) मैथी उत्पादन में परिमाण अस्थिरता, उत्पादकता के बजाय क्षैत्रफल में अतिअस्थिरता के कारण ज्यादा है। राजस्थान तथा चयनित जिलो में (जयपुर के अलावा) उत्पादन अंतर भेद का प्रमुख स्त्रोत उत्पादकता अंतरभेद पाया गया। जयपुर जिले में मैथी उत्पादन में अंतर भेद का प्रमुख स्त्रोत क्षेत्रफल अंतरभेद था।

मैथी उत्पादन में औसतन लागत प्रति हेक्टेयर रूपये 24375.66 जयपुर, रूपये 23399.93 सीकर एवंम रूपये 23827.81 राज्य के प्रक्षेत्रों में थी । सभी तरह की आय अर्थात समग्र आय, पारिवारिक श्रम आय, प्रक्षेत्र निवेश आय तथा प्रति क्विंटल उपज लागत, सीकर प्रक्षेत्रों की तुलना में जयपुर प्रक्षेत्रों पर अधिक थी। मैथी के कुल शुद्ध प्राप्तियां तथा प्रति रूपये प्राप्ति विनियोग रूपये 21979.64 एवंम रूपये 9.92 राज्य के प्रक्षेत्रों में पायी गयी।

मैथी उत्पाद का 66.11 प्रतिशत जयपुर, 69.42 प्रतिशत सीकर एवंम 67.27 प्रतिशत निस्तारण राजस्थान में नमूना किसानो के द्वारा प्रथम चतुष्क (मार्च से मई) में किया जाना पाया गया। बाकी 33.89 प्रतिशत जयपुर, 30.58 प्रतिशत सीकर और 32.73 प्रतिशत राज्य में का निस्तारण बाकी तीन चतुष्क (जून से फरवरी) में किया गया। मैथी की प्रति क्विटंल विक्रय लागत क्रमशः रूपये 403.36 तथा 372.81 गांव में एवंम राज्य कृषि उपज मंडी में पाई गई जबकि ये लागत सीकर में जयपुर से ज्यादा पायी गयी।

मैथी विक्रय में उपभोक्ता मूल्य में उत्पादक हिस्सा 58.57 प्रतिशत, 58.82 प्रतिशत एवंम 58.81 प्रतिशत गांव में विक्रय पर क्रमशः जयपुर, सीकर तथा राज्य में तथा 65.71 प्रतिशत, 66.18 प्रतिशत एवं 66.06 कृषि मंडी में विक्रय क्रमशः जयपुर, सीकर तथा राज्य में पाया गया।

प्रतीपगमन के परिणामों से पता लगा कि सात परिवर्तनशील कारको में से केवल तीन चर अर्थात मशीन श्रम, बीज एवं मानव श्रम जयपुर, सीकर तथा राज्य के प्रक्षेत्रों के लिए सकल प्रक्षेत्र आय को प्रभावित करने वाले सार्थक कारक थे। सिंचाई जयपुर तथा राज्य एवं उर्वरक सीकर तथा राज्य की सकल प्रक्षेत्र आय को प्रभावित करते थे।

इस प्रकार परिणामों से ज्ञात हुआ कि राज्य में मैथी उत्पादन में वृद्धि दोनों क्षैत्रफल तथा उत्पादकता में वृद्धि के कारण पाई गई। विभिन्न पंचवर्षीय योजनाओ में मैथी उत्पादन में वृद्धि का कोई निश्चित क्रम नहीं पाया गया। मैथी उत्पादन सीकर जिले में लाभदायक पाया गया। मैंथी का मंडी विक्रय, गांव में विक्रय की तुलना में लाभदायक है। मैथी प्रक्षेत्रों में ज्यादातर परिवर्तनशील कारक कम उपयोग में लाए जाते हैं।

S.K. RAJASTHAN AGRICULTURE UNIVERSITY: BIKANER

Department of Agricultural Economics, S. K. N. College of Agriculture, Jobner, Jaipur

Title: An Economic Analysis of Production and Marketing of Fenugreek in Rajasthan

Name of Scholar: Deepa Kumari Kumawat

APPENDIX – I

Schedule for Farmers

1. Name of farmer: Mr……..S/O; Mr……..……

2. Name of village……..…Tehsil……District……

3. Distance of village from district headquarter:…….…… Km

4. Labour

A. Family labour

S.No.	Name	Age	Sex	Occupation	Remark

B. Permanent hired labour

S.No.	Name	Period for which employed	No. of days worked on farm	Wage rate	Remark

C. Casual hired labour

S. No.	Period for which employed	No. of Days worked on the farm	Wage rate	Remark

5. Land

A. Operational holding (cultivated area in acres / bjghas)

S. No.	Particulars	Irrigated	Un-irrigated	Total
1	Owned land			
2	Rented in			

3	Rented out			
	Total			

B. Land rent/revenue

i. Land revenue assessed on owned land in cash `……

Land rent on leased-out land in cash `……

ii. Land revenue on leased –in land in cash `……

6. Irrigation system

S.No.	Source of irrigation	Share	Capacity per day (Acre/bigha)	Cost of electricity/diesel per irrigation
1				
2				

7. Production of fenugreek

S.No.	Area under fenugreek in hectare/acre/bigha	Average productivity (kg/hec) of fenugreek	Total production of fenugreek
1			
2			

8. Farm buildings and fences

S. No.	Particulars	Size	Condition (Kaccha/ Pacca)	Present value	Remaiming expected value	Depreciation
1						
2						

9. Farm machinery and equipment

S No	Particulars	Number	Expected Life (years)	Purchase value (`)	Junk value (`)
1	M B Plough				
2	Deshi Plough				
3	Disc Plough/ harrow				

4	Seed Drill				
5	Thresher				
6	Tractor				
7	Trolly				
8	Pata/ Leveler				
9	Spade				
10	Sickle, khurpi & phaura etc				
11	Sprayer/ duster				
12	Chaff cutter				
13	Bullock/ camel cart				
14	Well/ tubewell				
15	Diesel engine				
16	Electric motor				
17	Sprinkler set				
18	Irrigation structure				
19	Others				

10. FYM…….Cart load…….

11. Milk production……..liters/day

12. Custom hired bullock `…….....

13. Renting out of irrigation water `…….……

14. Non-farm income `……..……

15. Other income `……..……

APPENDIX – II

Schedule for crop budget

1. Crop……..……..Area……

2. Expenses

A. Input used

S No	Particulars	Quantity	Rate	Amount (`)
1	Seed • Owned • Purchased			
2	Farm yard manure • Owned • Purchased			
3	Fertilizers			
4	Plant protection chemicals • Insecticides • Pesticides • Seed treatment			
5	Human labour • Family labour • Hired labour			
6	Cost of diesel oil used in irrigation by diesel engine			
7	Cost of electricity used in irrigation by pumping set			
8	Interest on working capital			
9	Interest on fixed capital			
10	Depreciation on machine used for cultivation			
11	Land revenue			
12	Rent paid for leased in land			

B. Operations

S No	Name of operation	Time per operation (hrs)	Human Labour		Animal labour		Machine labour	
			Family	Hired	Owned	Hired	Owned	Hired
1	Land preparation							
2	Manuring							
3	Plaughing							
4	Pre-sawing irrigation							
5	Leveling/ pata							
6	Plaughing after palewa							
7	Fertilizer application							
8	Bed preparation							
9	Sowing/ broad casting measures							
10	Irrigation							
11	Intercultural operation							
12	Plant protection measures							
13	Harvesting							
14	Collection							
15	Cleaning							
16	Transport							
17	Others							

3. Crop out put

A. Quantity of main product (Qt.)…….Value (`)……..

B. Quantity of by product (Qt.)…… Value (`)……..

4. Disposal of main product

a. Sold quantity (Qt.)…….

b. For seed (Qt.)……..……..

c. Home consumption (Qt.)……..……

d. Others disposal (Qt.)……..…….

5. Disposal pattern of fenugreek crop

S.No. of lots	Quantity sold	Place of sale	Date of sale	Agency adopted for sale of produce	Rate of sale (`/qt.)	Total value of product

6. Marketing cost incurred in sale of fenugreek crop

S.No.	Component of cost items	Channel I (village sale)			Channel II (Mandi sale)		
		Qty (qt.)	Rate (`)	Amount (`)	Qty (qt.)	Rate (`)	Amount (`)
1	Cost of gunny bag and sutli charges						
2	Cleaning /filling /Stitching charges						
3	Loading charges						
4	Transportation charges						
5	Unloading charges						
6	Weighing						

7. Net price received by the farmers……..
   (Sale price-cost incurred by farmers)

8. Problems

A. Problems faced by the farmers during the process of marketing in village

   i. Low price……..

   ii. No ready market…….

   iii. Mal practice (specify)…….

   iv. Any other……

B. Problem faced by the farmers during the process of marketing in Mandi in respect of:

   i. Transportation of produce to Mandi…….

   ii. Sale of produce in Mandi…….

   iii. Getting price information…….

   iv. Problem of staying ……..

   v. Problem of weighing of produce……

   vi. Problem of getting payment of the value of produce……

C. Any other problem ……

D. Suggestion for improvement in fenugreek marketing

   i. ……

   ii. ……

APPENDIX – III

Schedule for Krishi Upaj Mandi Samiti

1. Name of Krishi Upaj Mandi Samiti……

2. Date of establishment……

3. Area commended……..

4. Information about different agricultural products handled by mandi

Particulars	Arrivals of products in years (Qt/S)		
	2008	2009	2010
Name of different agricultural products handled A. B.			
Fenugreek handled			

5. Information about market functionaries

Category of middle men	Total no of registered middle men in mandi	No of middle men dealing in fenugreek during last two years

6. Prescribed market charges in sale of fenugreek at mandi

Charges	Rate (`)	Borne by
Market fees		
VAT (Value added tax)		
Cleaning / filling/ stitching charges		
Loading charges		
Unloading charges		
Commission charges		
Weighing charges		
Any other charges (specify)		

7. Common marketing channels in marketing of fenugreek

   a) ……

   b) ……

   c) ……

8. Area from where fenugreek seed comes for sale in mandi

   a) ……

   b) ……

   c) ……

9. Area to which fenugreek seeds are taken by the trades of the mandi for the further sale

   a) Within the state……..

   b) Within the state……

10. Method of weighing or sale followed in fenugreek…….

    ……

11. Suggestions (regarding improvement of fenugreek marketing)

    a) ……

    b) ……

    c) ……

APPENDIX – IV

Schedule for village trader

1. **Name of trader……..…..S/O Mr…….……**

2. **Purchase of fenugreek by the village trader:**

S. No.	Date	Place of purchase	Quantity purchased	Rates (`/Qt)

3. Cost incurred by village trader in purchasing of fenugreek

S No	Particulars	Quantity(Qt)	Rates (`/Qt)	Amount (`)
1	Filling and stitching			
2	Bag and sutli charges			
3	Transportation			
4	Weighing			
5	Loading			
6	Unloading			
7	Any other cost (Specify)			

4. Disposal of fenugreek by the village trader

Lot No	Month	Date of sale	Quantity sold (Qt)	Rate (`/Qt)	Amount (`)	Place of sale	To whom sold

APPENDIX – V

Schedule for wholesaler

1. Name of wholesaler……..S/O Mr. …….

2. Purchase of fenugreek by wholesaler:

S. No.	Date	No. of begs purchased	Weight (qt.)	From whom purchase	Purchase price (`/qt)
A					
B					

3. Cost incurred by the whosaler in purchase of fenugreek

S. No.	Particulars of cost	Quantity(qt.)	Rate (`/qt.)	Amount (`)
1.	VAT (Value added tax)			
2.	Mandi tax			
3.	Commission to commission agent			
4.	Loading charges			
5.	Unloading charges			
6.	Weighing charges			
7.	Charges for sorting			
8.	Charges for grading			
9.	Cost of basket/carts/bags used			
10.	Qty. loss during the Period of Purchase and sale			
11.	Other costs			

4. Disposal of fenugreek

S. No.	Date of sale	Qty. sold (qt.)	Rate (`/qt.)	Amount (`)	Place of sale

5. Net price received by the wholesaler……..

APPENDIX – VI

Zero-order correlation coefficient between different variables on marginal Jaipur farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.123	.964	.946	.451	.350	-.024	.802
Machine labour (X_1)		1.000	.063	.094	-.005	.371	-.184	-.125
Seed (X_2)			1.000	.889	.430	.343	-.100	.700
Manure(X_3)				1.000	.491	.280	.043	.783
Fertilizer (X_4)					1.000	.298	-.185	.505
Plant protection (X_5)						1.000	-.388	.154
Irrigation (X_6)							1.000	.149
Human labour (X_7)								1.000

APPENDIX – VII

Zero-order correlation coefficient between different variables on small Jaipur farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.946	.354	.044	.937	.193	.923	.940
Machine labour (X_1)		1.000	.369	.089	.877	.119	.886	.865
Seed (X_2)			1.000	.269	.382	.021	.376	.323
Manure(X_3)				1.000	-.070	-.285	-.007	-.008
Fertilizer (X_4)					1.000	.233	.903	.896
Plant protection (X_5)						1.000	.076	.130
Irrigation (X_6)							1.000	.854
Human labour (X_7)								1.000

APPENDIX – VIII

Zero-order correlation coefficient between different variables on semi-medium Jaipur farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.911	.864	.067	.936	.315	.938	.336
Machine labour (X_1)		1.000	.749	.232	.771	.287	.800	.422
Seed (X_2)			1.000	-.086	.838	.141	.781	.316
Manure(X_3)				1.000	.047	.353	.072	.640
Fertilizer (X_4)					1.000	.308	.938	.279
Plant protection (X_5)						1.000	.404	.394
Irrigation (X_6)							1.000	.330
Human labour (X_7)								1.000

APPENDIX –IX

Zero-order correlation coefficient between different variables on medium Jaipur farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.953	.907	-.566	.957	.957	.957	-.032
Machine labour (X_1)		1.000	.847	-.538	.889	.939	.879	-.008
Seed (X_2)			1.000	-.485	.878	.877	.869	-.080
Manure(X_3)				1.000	-.529	-.551	-.507	.252
Fertilizer (X_4)					1.000	.887	.922	-.092
Plant protection (X_5)						1.000	.903	-.089
Irrigation (X_6)							1.000	-.160
Human labour (X_7)								1.000

APPENDIX –X

Zero-order correlation coefficient between different variables on large Jaipur farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.953	-.495	-.687	.949	.822	.892	.163
Machine labour (X_1)		1.000	-.465	-.703	.902	.807	.833	.266
Seed (X_2)			1.000	.210	-.575	-.547	-.333	-.059
Manure(X_3)				1.000	-.713	-.644	-.670	-.037
Fertilizer (X_4)					1.000	.831	.893	-.018
Plant protection (X_5)						1.000	.637	.053
Irrigation (X_6)							1.000	-.017
Human labour (X_7)								1.000

APPENDIX –XI

Zero-order correlation coefficient between different variables on overall Jaipur farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.984	.950	-.370	.949	.564	.963	.955
Machine labour (X_1)		1.000	.929	-.378	.930	.528	.941	.933
Seed (X_2)			1.000	-.339	.902	.557	.917	.909
Manure(X_3)				1.000	-.329	-.209	-.352	-.293
Fertilizer (X_4)					1.000	.527	.920	.941
Plant protection (X_5)						1.000	.563	.545
Irrigation (X_6)							1.000	.916
Human labour (X_7)								1.000

APPENDIX –XII

Zero-order correlation coefficient between different variables on marginal Sikar farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	-.207	.962	.976	.350	.754	-.207	-.788
Machine labour (X_1)		1.000	-.119	-.308	.246	.265	.480	.443
Seed (X_2)			1.000	.901	.431	.762	-.129	-.638
Manure(X_3)				1.000	.298	.665	-.301	-.808
Fertilizer (X_4)					1.000	.372	-.503	.056
Plant protection (X_5)						1.000	-.024	-.541
Irrigation (X_6)							1.000	.116
Human labour (X_7)								1.000

APPENDIX –XIII

Zero-order correlation coefficient between different variables on small Sikar farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.974	-.254	-.077	.953	.226	.967	.978
Machine labour (X_1)		1.000	-.265	.064	.966	.178	.933	.949
Seed (X_2)			1.000	.203	-.152	.370	-.287	-.227
Manure(X_3)				1.000	.006	.039	.004	-.077
Fertilizer (X_4)					1.000	.305	.914	.911
Plant protection (X_5)						1.000	.240	.190
Irrigation (X_6)							1.000	.930
Human labour (X_7)								1.000

APPENDIX –XIV

Zero-order correlation coefficient between different variables on semi-medium Sikar farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.936	.925	-.159	.864	.378	.974	.076
Machine labour (X_1)		1.000	.864	-.253	.808	.348	.873	.166
Seed (X_2)			1.000	-.146	.838	.437	.897	.064
Manure(X_3)				1.000	-.206	.509	-.151	.379
Fertilizer (X_4)					1.000	.267	.846	-.003
Plant protection (X_5)						1.000	.275	.534
Irrigation (X_6)							1.000	-.017
Human labour (X_7)								1.000

APPENDIX –XV

Zero-order correlation coefficient between different variables on medium Sikar farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.980	.890	.154	.908	.491	.982	.585
Machine labour (X_1)		1.000	.895	.090	.868	.500	.967	.639
Seed (X_2)			1.000	-.046	.890	.465	.852	.522
Manure(X_3)				1.000	-.021	-.038	.180	.213
Fertilizer (X_4)					1.000	.445	.871	.449
Plant protection (X_5)						1.000	.470	.169
Irrigation (X_6)							1.000	.627
Human labour (X_7)								1.000

APPENDIX –XVI

Zero-order correlation coefficient between different variables on large Sikar farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.993	-.120	.459	.960	.992	.963	.245
Machine labour (X_1)		1.000	-.132	.439	.969	.985	.934	.176
Seed (X_2)			1.000	.248	-.218	-.079	.014	.293
Manure(X_3)				1.000	.382	.452	.442	.062
Fertilizer (X_4)					1.000	.966	.887	-.021
Plant protection (X_5)						1.000	.944	.198
Irrigation (X_6)							1.000	.403
Human labour (X_7)								1.000

APPENDIX –XVII

Zero-order correlation coefficient between different variables on overall Sikar farms

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.982	.976	-.030	.980	.466	.936	.911
Machine labour (X_1)		1.000	.952	-.079	.960	.489	.926	.900
Seed (X_2)			1.000	-.041	.956	.434	.910	.882
Manure(X_3)				1.000	-.021	-.037	-.050	.000
Fertilizer (X_4)					1.000	.479	.923	.890
Plant protection (X_5)						1.000	.408	.483
Irrigation (X_6)							1.000	.880
Human labour (X_7)								1.000

APPENDIX – XVIII

Zero-order correlation coefficient between different variables on marginal farms in state of Rajasthan

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.044	.953	.954	.010	.317	-.092	-.321
Machine labour (X_1)		1.000	.121	-.050	.060	.244	.274	.241
Seed (X_2)			1.000	.884	.145	.284	-.067	-.280
Manure(X_3)				1.000	-.025	.261	-.097	-.262
Fertilizer (X_4)					1.000	-.040	-.353	.100
Plant protection (X_5)						1.000	-.027	-.347
Irrigation (X_6)							1.000	.116
Human labour (X_7)								1.000

APPENDIX – XIX

Zero-order correlation coefficient between different variables on small farms in state of Rajasthan

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.958	.127	-.001	.935	.202	.927	.947
Machine labour (X_1)		1.000	.113	.070	.898	.157	.888	.895
Seed (X_2)			1.000	.221	.172	.168	.178	.145
Manure(X_3)				1.000	-.026	-.141	-.019	-.048
Fertilizer (X_4)					1.000	.261	.873	.873
Plant protection (X_5)						1.000	.135	.151
Irrigation (X_6)							1.000	.882
Human labour (X_7)								1.000

APPENDIX –XX

Zero-order correlation coefficient between different variables on semi-medium farms in state of Rajasthan

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.922	.807	-.046	.895	.355	.908	.211
Machine labour (X_1)		1.000	.721	-.019	.792	.310	.795	.292
Seed (X_2)			1.000	-.088	.705	.209	.579	.215
Manure(X_3)				1.000	-.082	.418	-.049	.516
Fertilizer (X_4)					1.000	.300	.873	.141
Plant protection (X_5)						1.000	.358	.451
Irrigation (X_6)							1.000	.127
Human labour (X_7)								1.000

APPENDIX –XXI

Zero-order correlation coefficient between different variables on medium farms in state of Rajasthan

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.709	.903	-.449	.956	.576	.926	.183
Machine labour (X_1)		1.000	.589	-.356	.698	.306	.625	-.146
Seed (X_2)			1.000	-.397	.872	.464	.824	.143
Manure(X_3)				1.000	-.440	-.236	-.362	.210
Fertilizer (X_4)					1.000	.483	.865	.105
Plant protection (X_5)						1.000	.404	.188
Irrigation (X_6)							1.000	.133
Human labour (X_7)								1.000

APPENDIX –XXII

Zero-order correlation coefficient between different variables on large farms in state of Rajasthan

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.969	-.230	-.060	.949	.967	.884	.169
Machine labour (X_1)		1.000	-.266	-.141	.933	.922	.847	.173
Seed (X_2)			1.000	.223	-.252	-.209	-.134	.187
Manure(X_3)				1.000	-.150	.052	.149	-.031
Fertilizer (X_4)					1.000	.925	.769	.074
Plant protection (X_5)						1.000	.884	.146
Irrigation (X_6)							1.000	.109
Human labour (X_7)								1.000

APPENDIX –XXIII

Zero-order correlation coefficient between different variables on overall farms in state of Rajasthan

Variables	**(Y)**	**(X_1)**	**(X_2)**	**(X_3)**	**(X_4)**	**(X_5)**	**(X_6)**	**(X_7)**
Gross income (Y)	1.000	.981	.939	-.282	.957	.526	.949	.940
Machine labour (X_1)		1.000	.904	-.299	.938	.507	.935	.917
Seed (X_2)			1.000	-.272	.886	.508	.871	.888
Manure(X_3)				1.000	-.241	-.159	-.262	-.218
Fertilizer (X_4)					1.000	.503	.920	.918
Plant protection (X_5)						1.000	.496	.522
Irrigation (X_6)							1.000	.895
Human labour (X_7)								1.000