

**AN ANALYSIS OF MARKET FOR SUNFLOWER SEEDS
-A STUDY OF RAICHUR DISTRICT**



NAGARAJA, L.

DEPARTMENT OF AGRICULTURAL MARKETING AND CO-OPERATION

UNIVERSITY OF AGRICULTURAL SCIENCES

GKVK, BANGALORE-560 065

1998

AN ANALYSIS OF MARKET FOR SUNFLOWER SEEDS
- A STUDY OF RAICHUR DISTRICT



NAGARAJA, L.

**Thesis submitted to the
University of Agricultural Sciences, Bangalore
In partial fulfilment of the requirements
For the award of the degree of**

MASTER OF SCIENCE

IN

AGRICULTURAL MARKETING AND CO-OPERATION

BANGALORE

FEBRUARY, 1998

U. A. S.
University Library
DHARWAD.

Acc. No. *TH* 6292

DEPARTMENT OF AGRICULTURAL MARKETING AND CO-OPERATION
UNIVERSITY OF AGRICULTURAL SCIENCES

BANGALORE

CERTIFICATE

This is to certify that the thesis entitled "AN ANALYSIS OF MARKET FOR SUNFLOWER SEEDS - A STUDY OF RAICHUR DISTRICT" submitted by Mr. NAGARAJA, L. for the degree of MASTER OF SCIENCE (AGRICULTURE) in Agricultural Marketing and Co-operation of the University of Agricultural Sciences, Bangalore, is a record of research done by him during the period of his study in this University under my guidance and supervision and the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar titles.

Bangalore

February, 1998



(P.C.RAVI)

Professor of Agricultural Marketing
Department of Agricultural Marketing and
Co-operation

APPROVED BY:

Chairman:



(P. C. RAVI)


Members : 1.

 13/3
(LALITH ACHOTH)

2.


(T. N. VENKATAKA REDDY)

3.

 12/3/98
(M. GOPINATH RAO)

ACKNOWLEDGEMENT

I place on record my deep sense of gratitude and heartfelt thanks to **Dr. P.C.Ravi**, Professor , Department of Agricultural Marketing and Co-operation , University of Agricultural Sciences, Bangalore and the Chairman of my Advisory Committee. I am indebted to him for his excellent guidance, valuable suggestions, close counsel, critical comments and sustained interest throughout the period of study.

I express with utmost sincerity my esteemed and profound sense of gratitude to **Dr. Lalith Achoth**, Associate Professor, Department of Dairy Economics and Business management, University of Agricultural Sciences, Hebbal, Bangalore, **Mr. T.N.Venkata Reddy**, Associate Professor, Department of Agricultural Marketing and Co-operation and **Mr. M. Gopinath Rao**, Associate Professor of Statistics, University of Agricultural Sciences, GKVK, Bangalore for their helpful comments and suggestions as members of my advisory committee.

I acknowledge with profound gratitude the support and inspiration given by **Dr. P.G.Chengappa**, Professor and Head, Department of Agricultural Marketing and Co-operation, and other Staff of the department all through the course of my research work. I am thankful to them for their valuable suggestions and constructive criticisms which have helped me to steer the study in the right direction.

I am thankful to my friends and others to whom I have failed to acknowledge due to the sheer oversight, for having helped me in one way or the other during the course of this study.

During the collection of data for the study I had the good fortune to meet and discuss various aspects of the problems with several people in the area of the research, Mr. Naresh Kumar, Mr. Lacchu Naik, and a host of people whom I would not be able to name for the want of space. I am thankful to them for sparing their valuable time.

I owe the completion of this work to my parents, grand father, brother, sister and brother-in-law and relatives for their continued support and persistent encouragement during my studies.

Finally, I thank all those who rendered me help directly or indirectly during the course of my present study.

BANGALORE
February, ,1998.



(NAGARAJA, L.)

CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
I	INTRODUCTION	01
II	REVIEW OF LITERATURE	10
III	METHODOLOGY	33
IV	RESULTS	63
V	DISCUSSION	90
VI	SUMMARY AND IMPLICATIONS	109
VII	REFERENCES	120
	APPENDICES	128

LIST OF TABLES

Table No.	Title	Page No.
3.1	District wise area under sunflower (1993-94)	34
3.2	List of selected villages	37
3.3	The Linear programming simplex tableau for for the minimum absolute deviation estimator	51
3.4	Specification of attribute levels	59
4.1.1	Purchasing pattern of sunflower seeds (kharif 1996)	65
4.1.2	Source of supply of sunflower seeds	65
4.1.3	Preference for the particular source of supply	66
4.2.1	Theil's Entropy Index	69
4.3.1	Observed percentage share of acreage under different varieties of sunflower	71
4.3.2	Transitional probability matrix for area under different varieties of sunflower (Kharif 1996)	73
4.4.1	Proportion of area under different crops in Raichur district (1989-90 to 1993-94)	76
4.4.2	Transitional probability matrix for cropping pattern changes (Raichur district)	78
4.4.3	Projected cropping pattern of Raichur district up to 2000 AD.	81
4.5.1	Results of Conjoint Analysis	83
4.6.1	Average relative attribute importance, utilities and characteristics of the utility segments	86
4.7.1	Problems in cultivation of sunflower	88
4.7.2	Problems in marketing of sunflower	88

List of figures

Figure No.	Title	Between pages
Figure 1.	Purchasing pattern of sunflower seeds (Kharif 1996)	66-67
Figure 2.	Market share of sunflower seeds	69-70
Figure 3.	Percentage share of acreage under different varieties of sunflower	71-72
Figure 4.	Relative importance of the sunflower seed Attributes	83-84
Figure 5.	Average relative attribute importance for the utility segments	86-87

LIST OF APPENDICES

Appendix No.	Title	Page No.
I	Cropping pattern of sample farmers of Raichur Taluk	128
II	General information of the sample farmers Of Raichur taluk	129

INTRODUCTION

CHAPTER I

INTRODUCTION

Seed is a very vital input and a dynamic instrument for increasing agricultural production. Inputs such as fertiliser, pesticides and irrigation are used to realise the true inherent potential of the seed. Since the inception of organised agriculture, seed is considered as the basic and vital input for enhancing and stabilising productivity. Seed is a well-organised carrier of production technology enabling farmers to obtain better crop yields. Since arable land under cultivation and other resources are limited, no major breakthrough can be achieved unless sustained efforts are made to increase productivity through use of the improved seeds.

In traditional agriculture, the cultivators retained a part of the crop for the seed purposes. With the development of plant breeding in the early twentieth century, improved crop varieties were evolved and their seed production was taken up in the organised sector. Thus, quality seed was made available and the farmers started purchasing seeds giving birth to a new industry. In India, development of seed industry began in earnest only after independence and in the next few decades it has grown to a full-fledged industry with an annual turn over of Rs.600crores in 1991-92 in seed multiplication and distribution alone (Singh and Asokan, 1992).

The Indian seed industry at present consists of two national organisations [National Seed Corporation (NSC) and State Farms Corporation of India (SCFI)], 12 State Seeds Corporation (SSC), about 150 large sized Private Seed Companies (PSC) with 24 such companies set up with foreign collaboration, 19 State Seed Certification Agencies (SSCA) and 86 notified Seed Testing Laboratories (STL). The public sector Seed companies (PSSC) like NSC, SCFI and SSC are producing the bulk of the self pollinated crops seeds of which wheat and paddy account for about 60 per cent, while private seed companies (PSC) deal mostly with hybrids, vegetables and flower seeds accounting for about 50 per cent of the total production of certified seeds in India. The availability of seeds vis-à-vis requirements for different crops shows that we are hardly able to meet 5.3 to 36.4 per cent of the total requirement of the certified seeds in different crops.

The retail seed trade is a well-knit network of distribution channel and is the last link in the chain of the seed marketing. The retailers serve not only as seed sellers but also as a source of information to the farmers about the technology of crop production. The distance of the retail seed outlet from the farm is an important factor determining whether farmers can buy quality seeds. Generally, the radius of the command area of the retail seed market ranges from 40 to 70 kilometres. The National Seed Project and other seed schemes have not focused attention on retail seed trade. Seed business is usually undertaken as a subsidiary business since it is seasonal and hardly

extends to 3 to 4 months in the year and it contributes just 30 to 40 per cent of total business of the retailers.

Oilseeds and oils have assumed crucial importance in the economy of our country. Oilseeds are the major agricultural crops next only to the food grains and contribute approximately five per cent of the India's GNP and ten per cent of the value of all the agricultural commodities. In India, area under oilseeds has risen from 19 million hectares in 1986-87 to 25 million hectares in 1992-93. India accounts for 10 per cent of global oilseeds production but uses 20 per cent of the world's area under oilseeds to produce it. India's oilseeds production has gone up by 70 per cent in the past six years mainly due to the research efforts of many government institutions and their policies and hybrid seeds introduced by the private sector companies. Being essential items in the human diet, oils, oilseeds and their derivatives account for 11 per cent of the cost of living index of Indian people. The important oilseeds crops grown in our country are groundnut, sunflower, sesame, soyabean, safflower, mustard, linseed, niger seed and castor seed.

Today, oilseeds play a crucial role in India's cropping systems. It is importantly a remunerative crop to the farmers in the rainfed areas. Oilseeds cultivation is largely confined to the rainfed areas accounting for about 75 per cent. However, looking at this sector against global standards, the average yield of the Indian farmers is half that of the world standards. India is ranked number one in groundnut production but number 72 in yield, number

two in rapeseed but number 25 in yield, number 5 in sunflower but ranks number 30 in yield and number 5 in soyabean but number 31 in yield. Our productivity levels are clearly lower than what it needs to be.

It is well known fact that only 20 years ago; India was net exporter of vegetable oils. Since then increasing quantities of vegetable oils have been imported to fulfil domestic need. In spite of this, the per capita consumption is very low at 12gms/day/head as against the minimum nutritional requirement of oils of 18gms/day/head. The projected requirement of oils and fats by the end of the century is estimated at around 6.6 million tonnes equivalent to 24 million tonnes of oilseeds as against the present production of 20 million tonnes. One cannot hope for a future increase in the relative prices of oilseeds to attract more acreage. In fact high relative price of oilseeds induced farmers to grow the same oilseed crop repeatedly in the same piece of land, ignoring the sound agronomic practice of crop rotation. As this is bound to affect productivity in the long run, farmers have to correct such aberrant practices. On all these accounts, it can be stated that a limit has been reached as far as acreage expansion is concerned.

There is a tremendous pent up demand for edible oils, which is turning into effective demand with increasing purchasing power. The total consumption is projected to increase at 5.5 to 6 per cent per annum, of which 3.5 to 4 per cent will be on account of rise in population. To meet this tremendous increase in oilseeds demand, oilseeds production should increase

by way of improving the genetic potential of annuals, by introducing the high yielding perennials and annuals of new oilseeds crops. In this context, sunflower cultivation is one of the means to increase oilseeds production whose productivity ranges around 200 to 250 kg/acre with as much as 40 per cent of oil content.

Sunflower (*Helianthus annuus. L.*), a member of the Asteracea is believed to have originated in Mexico and Southern States of USA. It is intensively cultivated in many countries such as former USSR, USA, Canada, Argentina, Rumania, Turkey and some European countries. Its domestication as an oilseed crop was started first in USSR in the early part of the 19th century. Recently the varieties developed there with high seed yield and high oil potential have spread all over the world.

Large scale cultivation of sunflower in India started in 1972 with the introduction of high yielding Russian varieties. This crop is becoming more popular in view of its short duration (90-100 days), wide adaptability and ability to withstand drought. In addition, sunflower has good nutritive value. It contains about 19.8gms of protein, 52.1 gm of fat (oil), 17.9 gm of carbohydrate and 2.8 gm of calcium per 100 gm of seeds.

There is a growing acceptance of sunflower oil as a good substitute for groundnut oil especially for its pleasant flavour with no toxic contents. Sunflower oil is considered as a premium vegetable oil, as it is one of the

most palatable oils in the world and compares well with other vegetable oils in its calorific value and assimilation in the human body. The crude oil is yellow in colour and when refined, it becomes very light yellow or pale. The oil is characterised by a high concentration of linoleic acid (44-72 %), moderate levels of oleic acid (14-34 %), very low level of linolenic acid (0.3 %) and less than 15 per cent of the saturated fatty acids - palmitic and stearic. There is a large variation in the fatty acid composition of sunflower oil and this difference is mostly attributed to varietal differences and environmental variations. The crop grown in warmer locations and at lower latitudes has a lower linoleic acid than those grown in cooler locations and higher elevations.

Sunflower meal is an excellent source of the water soluble B-complex vitamins namely nicotinic acid, thiamine, pantothenic acid, riboflavin and biotin. The concentration of nicotinic acid in sunflower meal is about 170 per cent higher than found in groundnut meal, which perhaps is the best alternative source for the infants suffering from protein-calorie malnutrition.

As already stated sunflower oil contains 44 to 72 per cent of linoleic acid and 14 to 34 per cent of oleic acids. These two are important essential fatty acids and have many roles to play in human nutrition. Linoleic acid is the integral part of the phospholipids, which occur in all cell membranes. A sub optimum level of this acid in the membrane leads to decreased functioning of the cells.

Investigations have shown that an increased blood cholesterol content is the main risk factor for cardiovascular diseases. In general saturated fatty acids, especially lauric acid, myristic acid and palmitic acid raise the blood cholesterol level. Linoleic acid has the reducing effect. It has also been indicated by several studies that increasing the level of dietary linoleic acid normalises the blood pressure, which is an important and frequently found risk factor for cardiovascular disease. In addition, many research studies have indicated that consumption of linoleic acid rich diet reduces the incidence of diabetes. In view of its high dietary qualities, the consumption of sunflower oil is increasing in India so also its cultivation.

In India, sunflower was cultivated in 20.89 lakh hectares during 1992-93 as against an area of about 8.35 lakh hectares during 1984-85, thereby recording an increase of 150 per cent over a period of eight years. The production has increased three folds in just eight years from 4.4 lakh tonnes in 1984-85 to 12.4 lakh tonnes in 1992-93. Karnataka stands first in country's area and production of sunflower occupying 14.69-lakh hectares with a production of 4.78 lakh tonnes during 1993-94. Among the 20 districts of the state, Raichur stands third in area and first in production occupying 236924 hectares and 47101 tonnes respectively, with an average yield of 209 kg/acre.

The demand for quality seeds is increasing year after year. It is necessary to cope with the increasing demand for sunflower in order to attain long term goals of self-sufficiency through higher productivity. This means improvement is to be made both qualitatively and quantitatively in the

supply of seed material. Though there was marked improvements in this direction, a host of bottlenecks and problems are persisting in the system of seed marketing. The private and public agencies involved in the production and marketing of seeds have to face stiff competition. For most varieties, the demand depends on the quality attributes perceived by the farmers. For firms to sustain their market share and profitability, a viable strategy may be to improve the quality of their product. However, a desirable quality strategy can only be successful if producers adopt a consumer-oriented approach based in quality preferences.

In this context, seed research is the real backbone of the seed strategy. No variety would be worth a praise if the seeds are not of proven quality and type, having the desired yield potential. In this direction, the government has encouraged both public and private sector organisations in seed research, particularly for the production of hybrid seeds of all important crops, including sunflower with an application of biotechnology. Regular flow of information, knowledge and material to the organisations/firms from the user sector is needed to achieve the desired results.

Therefore, insight into farmers preferences for quality is useful in varietal development and marketing communications. In view of these facts, the present study is proposed to focus on the various aspects related to the quality preferences and market for sunflower seeds in Raichur taluk.

The specific objectives of the study are:

9

1. To analyse the buying behaviour of sunflower seeds among the farmers
2. To study the market structure, market share and market potential for sunflower seeds
3. To analyse the demand for quality attributes of sunflower seeds and
4. To analyse the problems faced by the farmers in cultivation and marketing of sunflower.

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Any scientific analysis begins with the process of browsing, understanding and critically analysing the past literature available on the problem that is being currently looked into. In this chapter, a brief review of past studies is presented. There are, however, a limited number of studies relating to marketing of sunflower (for seed purpose). The existing literature pertaining to the present study is reviewed and the highlights are presented under the following headings.

2.1 Studies relating to buying behaviour

2.2 Market structure and Markov-chain Analysis

2.3 Conjoint analysis in evaluating the consumer preferences

2.4 Cluster analysis and Market segmentation.

2.1 Studies relating to buying behaviour

Kaurshal *et al* (1976) found that education level significantly influenced the brand loyalties in use of washing soaps. Educated people based their loyalty on easy lather formation, convenience in handling and soaps not affecting skin while less educated people on the basis of price, attractive packing and easy availability in the market. Sellers could adopt suitable marketing strategies dividing high quality products among educated and cheap products among illiterate class.

Godbole (1978) in a study of consumer preferences for durable and non-durable consumer products found that intellectual and middle to high income class of Indian society was more quality conscious in brand preference for consumer durable, while for consumer non-durable's the buyers were price conscious in brand preference and preferred products of nationally known and advertised brands than local ones.

Vijaya sarathy (1980) found that majority of ghee consumers had nuclear or small families and consumed about one kilogram of ghee per month per family. He found consumers are more quality conscious and preferred ghee in one-kilogram packets.

Singh and Singh (1981) found that consumers have single or multi-brand loyalty based on the nature of product like necessities or luxuries. Brand choice and store loyalty was found to affect the brand loyalty. Retailers influenced the most on brand choice and brand loyalty of the consumers. The factors that influence and strengthen loyalty to brands were quality of product, habit of use and ready and regular availability.

Reddy Venkata *et al* (1989) studied the barter system of seeds among farmers. The results of the survey revealed that the highest number of farmers used seeds either borrowed or purchased from other farmers. The next major source was the own saved seeds. The other interesting finding of

the study was that the original source of own saved seeds was seeds obtained from other farmers on barter system.

Rajendra Prasad *et al* (1989) in a survey in the adoption of improved seed technology practices in sunflower in Mysore district of Karnataka revealed that 38 per cent of the respondent farmers were using the seeds borrowed from other farmers either on barter system or on paying price, 35 per cent of the farmers were using their own saved seeds, 17 per cent of farmers had purchased seeds from private seed traders, 8 per cent from State Seeds Corporation and 2 per cent from State Department of Agriculture.

Venkataram and Varadarajan (1992) conducted a study on the fertiliser buying behaviour of farmers in Kanyakumari district of Tamil Nadu. The results of the study indicated that the farmers had a wide choice in selection of fertilisers. Among the various fertilisers, the complex fertilisers were preferred most. Majority of the farmers purchased fertiliser from private sellers and the factors influencing them were the size of the farm, credit and preferences of farmers to specific type of fertilisers.

Sidhu (1996) studied the seed use practices of farmers in Punjab. The results of the study indicated that the farmers judged the purity and quality of the seed purchased from public seed agencies, research organisation, government departments, private seed companies/dealers etc., by their past experience and reputation of the agencies. The result also indicated that

among the institutions/agencies, Punjab Agricultural University had the highest reputation among the selected farmers in the Punjab.

2.2 Market structure and Markov-chain analysis

Patrick (1961) explained the mathematical concept of statistical inference underlying to finite Markov-chain with the problem to draw inferences about the transition probabilities from one long unbroken observation (x_1, x_2, \dots, x_n) on a chain. He has covered Whittle's formula, Chi-square and Maximum Likely Hood methods of estimation of parameters and multiple Markov-chains. At the end, he indicated how these methods could be applied to a process with an arbitrary state, space or a continuous time parameter.

Styan and Smith (1964) demonstrated the use of stochastic Markov-process to study brand loyalties and switching patterns. They observed that the transitional probabilities could be used to indicate which brand in the market place gains (or loses) its customers from (or to) which other brand.

Bhide *et al* (1981) in their study on structural changes in arecanut market in Mangalore, Karnataka observed an increase in market arrivals and sales over the years, while the prices decreased. Markov-chain was used to study the structural changes and their predictions indicated changes towards more competitive structure with an increase in both sellers and buyers.

Chowdary *et al* (1981) examined the structure of arecanut market in Mangalore using Lorenz curve technique. A steady decline in the value of coefficient of inequality was recorded over the period of study. Thus, it was interpreted that there was a steady improvement in the size distribution of shares of intermediaries in the market which in turn increased the degree of competitiveness in the market.

Atkin and Blandford (1982) studied the structural changes in import market shares for apple in the United Kingdom. The changes in the composition of UK apple imports during the period 1963-79 were analysed using First order Markov-model. The results showed that economic community membership increased the share of France in the UK market by more than 26 per cent points and decreased the share of the Australia and South Africa by 18 and 10 per cent points respectively.

Libbin (1982) conducted a study to predict farm numbers in the USA by size class using Markov-chain model. Values of size class were chosen to represent size classes of farms, ranches and non-land based farming operations. A series of USDA indices were chosen for explanatory variables in the Markov problem. Approximately 30 combinations of nine different indices were applied to the Markov model. Model results indicated that the historical decline in farm number would continue to a level of about two

million farms by 1990. The farm number projections were closely tied to growth of remaining firms. 15

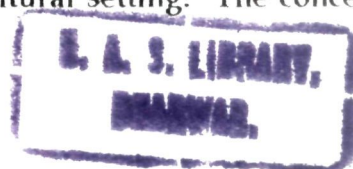
Buckwell *et al* (1983) analysed the changes in the size structure of the dairy industry in the Scottish milk marketing Board area. The projected size distribution of dairy herds was combined with simple projections of average herd size and yield, which indicated the outlook for milk production during 1980's. This suggested that secular increase in Scottish Milk Marketing Board but milk production would decline and could even come to an end during next few years.

Erthridge *et al* (1983) examined the changes in the structure of the Texas high plains cotton ginning industry. Using Markov-chain procedure future industry structure was made under conditions of transitional probabilities. All projections showed declining number of active ginning firms with large decline in number of small firms and increase in number of large firms.

Jayaram *et al* (1983) found a single commission agent handling more than half of the marketing arrivals of bidi tobacco in Nippani market. This high degree of market concentration resulted in traders claiming large trade allowances and carrying out price settling policies.

Mellor (1984) made an attempt to introduce the Markov-chain model as a mechanistic model of behaviour in an agricultural setting. The concept

7# 6202



of time-varying transitional probability was introduced as a feasible alternative to the standard stationary assumptions. The results supported the view that the basic model was simple and benefits from the introduction of explanatory variables influencing the transition probabilities. The results indicted the neglect of important variables lead to an undesirable consequences when the model was used for forecasting purpose.

Rammoorthy *et al* (1984) analysed the structure of tomato marketing in Coimbatore employing Lorenz curve technique. It was observed that the market concentration was high in assembling markets where commission agent dominated while the wholesalers were less concentrated. It was concluded that the competition between buyers and sellers was imperfect.

Edwards *et al* (1985) applied Markov-chain analysis to study the changing distribution of farms by size. They had applied the model to a longitudinal data set for 1974-78 from the census of agriculture. The model predicted reasonably well the actual changes during 1978-82. The results indicated that the future distribution of farms by acres per farm would be more like the present and the present was like the past.

Chavas and Magand (1988) developed a time-varying Markov-process of the aggregate size distribution of farms in an industry. This was used to specify and estimate an economic model of the regional evolution of the number and size of US dairy farms. The results provided evidence that

economics of size, sunk cost and the market price played a role in the evolution of the size distribution of the dairy farms. It was found that dairy farms having less than 50 cows were not size efficient as their number declined in all regions. The results also suggested that the higher output price had a negative impact in the growth of a firm. In general, higher milk prices were found to increase the number of firms in all size categories.

Disney *et al* (1988) conducted a study for analysing the structure of pig meat production industries in the south Atlantic census division. The findings of the study indicated that both total farm number and the size distribution of pig meat farms were highly sensitive to the future pig-maize ratio. The set of models presented provided a tool that could be used to evaluate the effects of reductions in maize price support programmes on pig meat farm distribution. As both maize and pig producers were allowed time to adjust production, the long-term relationship was more difficult to determine.

Sujatha *et al* (1989) analysed the market shares of the top ten intermediaries in the Bangalore regulated market. The results revealed that in rice, the market was less concentrated when compared to potato and onion. In case of potato and onion, there was high degree of market concentration, thereby providing ample scope for price manipulations.

Wilson *et al* (1990) studied importer loyalty in the international wheat market by adopting Markov model. Results showed that, in general, the United States of America had relatively strong import loyalty compared to others such as Canada and the European community.

Gemtessa (1991) analysed the direction of trade using Markov model. The share of the Ethiopian coffee exports in USA drastically declined during 1979 to 1989. However, West German Market indicated to be the potential market for Ethiopian coffee. Further, the loss in the market share of Ethiopian coffee in USA, France, USSR and other countries were diverted to West Germany's Market. It was interesting to note that the Ethiopian coffee exports to Japan, France, Italy moderately increased. Nevertheless, the share of Saudi Arabia was stagnant. The projected share of the Ethiopian coffee exports to West Germany was expected to increase to 32 per cent in 2000 AD mainly because of West Germany's preference for Ethiopian mild coffee.

Veena (1992) analysed the direction of Indian coffee exports. The results revealed that India could not retain its previous market share to USA, Netherlands, Yugoslavia and other importers. However, the actual quantity exported to all these countries had increased owing to increased quantities of Indian Coffee exports. India had retained its previous market share to West Germany, USSR and Italy. West Germany and Italy preferred Indian coffee in the world market. Further, the estimations of Indian coffee market shares

showed that share of Indian Coffee exports to USA, Netherlands and other importer would decline in the coming years.

Kunnal and Shankaramurthy (1994) analysed the share of different firms in the quantities of seeds of different crops marketed in Karnataka State. Their results revealed that the private seed firms/others dominated the seed market in the state with a share of about 67 per cent in seeds of pulse crops and about 85 per cent in seeds of oilseeds crops. The State Seeds Corporation had fairly good share of 28.30 per cent in distribution of seeds of cereal crops but its performance in distribution of seeds of pulse crops and oilseeds crops was not satisfactory. The Karnataka Oilseeds Growers Co-operative Federation (KOF) had captured only about 10 per cent of the seeds market for oilseeds in the state.

2.3 Conjoint Analysis in evaluating consumer preference

Johnson (1974) described conjoint analysis as an approach for exploring and quantifying the value systems of consumers. He suggested that since it is concerned with value system of individual consumer, the method is the most appropriate for product categories where consumer's desires are heterogeneous and markets are highly segmented.

Fenwick Ian (1978) indicated that the conjoint measurement technique finds increasing use both in market research and wider management

decision-making. He outlined the basis of the method, illustrated its application and identified the main problems faced by its users.

Hutchison and Robertson (1979) employed the conjoint analysis to evaluate the effects of form, composition, flower type, flower colour and price on the marketability of roses. The form of arrangement was the most important floral product attribute influencing consumer impulse rose purchasing behaviour. Mixed rose arrangements with carnations and pompon chrysanthemums were more marketable in an impulsive purchasing environment than the traditional rose package. Trade-off analysis of product form, composition and price indicated that as consumer impulse purchasing increased, the red hybrid tea rose lost its competitive position at the expense of non-red floribunda and sweetheart roses. Male and female subjects were shown to have different priorities concerning desirable characteristics of the rose product. Price variation was relatively unimportant in the purchase of roses.

Prince *et al* (1980) evaluated the marketability of arrangements for roses on the basis of unit size, stem length, cultivar, flower condition including openness, bent neck and discoloration and price using the conjoint analysis. Long stemmed, 12 unit red hybrid tea roses lost competitive position in favour of shorter 9 and 5 unit rose arrangements. Price was the major determinant for the favourable consumer acceptance of the smaller sized short stemmed roses in arrangements. The cultivar of rose marketed

and the degree of flower openness were important factors influencing the consumer's purchase decision. Low priced short stemmed roses (40cm) in a tight-bud-stage were the most highly valued; however, 'Sonia' roses evoked a strong consumer appeal regardless of price or stage of bud openness.

Robertson and Chatfield (1980) reported that colour and bunch composition were the most important factors influencing the consumer's purchase decision of loose-bunch merchandising of fresh flowers in Ohio State of USA. Roses had significantly more product appeal than carnations and marguerite daises. Price was judged relatively more important for the mixed loose bunches. Consumers selected the loose bunch with rose at \$5.95 over the loose bunch with five roses at \$ 7.95. The addition of yellow hybrid tea roses increased the marketability of a loose bunch almost as much as the addition of an orange and peach sweetheart and floribunda rose, respectively. For mixed loose bunches, the optimum price range was \$5.95 to \$7.95. For the homogeneous bunches, the most popular price range was \$2.95 to \$4.95. These results were obtained through a Conjoint Analysis.

Shafer and Kelly (1986) conducted a market survey using the conjoint methodology to establish the relative contributions of cultivar, price and longevity of potted chrysanthemums in consumer purchasing decisions. Cultivar characteristics were the most influential in determining whether a consumer would buy a potted chrysanthemum. While price and longevity possessed similar values for the consumer, the survey results indicated that a

consumer's interest in longevity would take precedence over the desire to purchase a chrysanthemum for a given price. A difference in response to potted chrysanthemum attributes was observed between males and females. While females perceived the price to be relatively similar in value to the cultivar characteristics during a purchase decision, males exhibited less price sensitivity and regarded cultivar attributes as possessing the greatest importance to the decision.

Benedict Jan and Steenkamp (1987) applied the conjoint analysis technique to quality evaluation with respect to ham. On an average, packing was the most important quality attribute. Respondents were heterogeneous with respect to the quality evaluation process of ham. They also discussed the contributions, which the conjoint measurement could add to decision making with respect to the marketing of agricultural and food products.

Gineo (1990) studied the product attributes that determined nursery stock sales from wholesalers to retail garden centres and land scapers using conjoint analysis to obtain data on buyer preferences. Data on the purchase decisions of land scapers and retail garden centres when purchasing rhododendrons were analysed using OLS and Logit procedures to determine the attributes that are preferred by the buyers. It was determined that good to excellent quality stock, offering with a full time of additional plants, taller plants and cash discounts were desirable attributes. Quality was the dominant attribute affecting the preferences. Packing the preferred attributes

together significantly increased the possibility of a plant being purchased by buyer.

Anderson and Bottencourt (1993) applied the conjoint approach to model product preferences in the New England market for fresh and frozen salmon. The degree of preference for specific attributes and levels of the products was compared.

Backer and Crosbie (1993) presented an approach to study the consumers valuation of food safety attributes. The conjoint analysis was used to develop individual consumer preference functions for fresh apple products in an experimental market setting in the San Francisco Bay area. All the consumers were willing to pay a moderate amount to ensure that apples met established safety standards. However, a policy which restricts the use of pesticides would likely result in substantial consumer dissatisfaction, unless it could be achieved with little impact on price or quality.

Becker *et al* (1993) conducted a pilot study using a conjoint analysis for comparing age based segmentation strategies in full-service restaurant market. The benefit categories were restaurant type, nutritional quality, menu variety, portion size and menu focus. These were examined to support the research hypothesis that differences do exist between older and younger consumer groups. This relationship did not hold across all variables examined by the conjoint measurement model.

Gan and Luzar (1993) applied conjoint analysis to waterfowl hunting in Louisiana using primary data collected from a survey of 7022 waterfowl hunters. Ordered logic was used to estimate the willingness-to-pay for recreation experience attributes. The conjoint analysis appeared to offer a valuable theoretical and empirical perspective for this form of multi-attribute decision-making process.

Huang and Fu (1993) used conjoint analysis to assess Taiwanese consumer's preferences for Chinese sausage and to identify the underlying important attributes that influence consumer's decision making and choice behaviour. They demonstrated that conjoint analysis was a useful methodological complement to conventional surveys to evaluate consumer's overall judgement of a product.

Vickers (1993) incorporated tasting into a conjoint analysis of taste, health claim, price and brand for purchasing strawberry yoghurt. Taste and health claim had the largest influence on buying intent. Brand had little influence on buying intent.

Halbrendt *et al* (1994) used conjoint measurement to determine consumer preference for fresh pork produced with genetically engineered Porcine Somatotropin (pST). A preference model was constructed based on three pork attributes - degree of fat reduction, price and production

technology that allowed for interactions between attributes to be estimated. Respondents generally preferred leaner pST supplemented pork, but only at fat reduction levels greater than those possible with conventionally produced pork, and at competitive price.

Alvensleben *et al* (1995) studied consumer attitudes to organic milk using conjoint analysis. Overall consumers had a strong positive attitude towards milk in general. The conjoint analysis showed preference of consumers for packaging (44 per cent), fat content (32 per cent) and label (24 per cent). The organic designation was marginal. In organic and health food shops, preferences ranked packaging first, followed by price and fat content. It was concluded that organic producers have not yet succeeded in differentiating their product from other milk sources. A further drawback was the high price of organic milk.

Behe and Nelson (1995) surveyed consumers at two garden centres in Alabama in 1993 to determine their preferences for geranium characteristics which included red, pink, white, coral and lavender flower colour and plain green, green with white zone and green with dark zone patterns of leaf variegation. Conjoint analysis was done to determine the highest and lowest rated plants. The lavender cultivar with a white leaf zone (Danielle) priced at \$1.39 was most preferred. The white cultivar with plain green leaf (snow-white) price at \$2.79 was least preferred. The results were in contrast with previous studies, which revealed that red flowers were most preferred. For

the sample as a whole, flower colour was considered the most important characteristics followed by price.

Gerhardy and Ness (1995) illustrated the use of conjoint measurement for the analysis of consumer preferences for multiple attribute products with an application to freshness and quality attributes of eggs. Heterogeneity was observed in the preference ranking. On an average production method was the most important attribute followed by price and the origin. Freshness was not given much importance. The analysis revealed that the preferences of consumers were highly heterogeneous, but it was possible to identify segments with distinct preferences for particular egg attributes.

Halbrendt *et al* (1995) identified marketing problems and opportunities in mid-Atlantic seafood retailing. Retailer preferences for four aqua culturally produced fish (tilapia, Atlantic salmon, rainbow trout and catfish) were evaluated using conjoint analysis. Freshness and purchase price were the most important fish attributes determining retailer preference for all four species.

Huang and Fu (1995) designed a conjoint analysis to survey and analyse a sample of 174 Taiwanese housewives for their evaluations of various Chinese sausage attributes. A multi nominal logit model was estimated to identify important socio-economic variables that differentiate the market segments. The study assessed the relative importance of the selected

product attributes and drew implications concerning attributes that are most desirable. It was concluded that potential trade-off among attributes were acceptable to the consumers.

Solheim and Lawless (1996) studied the effect of consumer's attitude towards low-fat foods on their purchase probability. The data was collected using conjoint analysis. The purchase probability increased as price and fat content decreased. Evaluations that were based only on survey appeal as shown by preference scores after tasting influenced the purchase probability.

2.4 Cluster Analysis and Market Segmentation

Punj and Stewart (1983) reviewed the applications of cluster analysis to marketing problems. Alternative methods of cluster analysis were presented and evaluated in terms of recent empirical work on their performance characteristics. A two-stage cluster analysis methodology was recommended for preliminary identification of clusters via the Ward's minimum variance method or simple average linkage, followed by cluster refinement by an iterative partitioning procedure. Issues and problems related to the use and validations of cluster analysis methods were discussed.

Benedict Jan and Steenkamp (1987) used conjoint measurement for quality evaluations and subsequently market segmentation with respect to ham. The market was segmented because respondents were rather heterogeneous with respect to the quality evaluation process of ham. Four

segments were identified through cluster analysis. Consumer characteristics were meaningfully different between the segments.

Green and Krieger (1991) described that conjoint analysis is a useful measurement method for implementing market segmentation and product positioning. They proposed a conceptual framework for describing segmentation in the context of conjoint analysis input data. The limitations of this proposed method were also discussed in the context of market segmentation.

Behe *et al* (1992) constructed a profile of consumer groups who purchased floral products from super markets to determine the domain of issues affecting super market floral purchases. Thirty-four factors were identified in factor analysis and formed the basis for cluster analysis. The cluster analysis was performed on survey responses to create five homogeneous consumer segments. Fourteen factors contributed most to the differences between segments, including factors of product assortment, number of purchases, degree of personal use and packing importance.

Backer and Crosbie (1993) presented an approach to study consumer's valuation of food safety product attributes. Consumer segments were constructed by using cluster analysis to form groups, which were

homogeneous with respect to preferences regarding food safety in the case of apple. Although substantial differences existed among the three distinct groups, consumers in all segments were willing to pay a moderate amount to ensure that apples met established safety standards.

Delgado and Caldentey (1993) used the multivariate cluster analysis techniques to decide the population of Cordoba, Spain into two classes, wine drinking and non-drinking. The cluster analysis placed 204 programmes to derive a hierarchical classification. The social attributes of the 10 groups were identified, including indications of age and education and income level. Cluster analysis was proposed as a means of guiding decisions on marketing policy for wines on the local markets.

Anderson (1994) formed homogeneous consumer segments using cluster analysis based on socio-economic and demographic variables, which were often used in classical food demand analysis. The created consumer segments were described as life-cycle segments. Significant differences in food expenditures among these life-cycle segments were found.

Hanson *et al* (1994) characterised five distinct consumer profiles for seafood using cluster analysis. The two most favourable profiles toward seafood were differentiated by alternative views of fish pricing. One group

found fish expensive, the other inexpensive. Another profile was identified by its dislike of sensory characteristics such as “bonniest” and difficulty in preparation. The broad characterisation that fish were nutritious and healthy was shared by four of the five consumer profiles, representing a major marketing advantage for aquaculture producers. Logit regression model suggested that aqua-culturists target specific consumer profiles by recognising unique characteristics of consumers, including income level, family size and presence of children, seasonality preference and other demographic factors.

Hermann *et al* (1994) identified six groups of seafood consumers with similar perceptions of the attributes of fish in New England state using cluster analysis. Demographic and cluster membership variables were employed in the Logit regression to identify the characteristics of frequent at home use and restaurant purchase. At home purchase was more likely to be frequent among the respondents with white-collar occupations, older ages, urban/sub-urban and New England residence, recreational fishing participation and membership in one of the five-attitudinal clusters. Restaurant purchase was more likely to be frequent among whites and among those with higher incomes, white-collar occupations, recreational fishing involvement and among members of two clusters with favourable attitudes towards fish.

Kool (1994) determined three groups of farmers with distinct types of vendor loyalty using cluster analysis. First was farmer with spurious vendor loyalty, second was farmer with true vendor loyalty and third was farmer having behavioural vendor loyalty. The discriminating variables were market penetration of the products, quality-consciousness of the farmers, end product importance of the product and purchase experience of the farmers.

Gurnert and Juhl (1995) used cluster and discriminant analysis to explain environmental attitudes and the relationships between attitudes and buying of organic foods. These were assessed in order to determine which values are relevant for environmentally concerned versus unconcerned consumer behaviour. A positive attitude towards environmental issues was found to be related positively to the buying of organic foods and the frequency of this behaviour.

Huang and Fu (1995) designed conjoint experiment to survey and analyse a sample of 174 Taiwanese housewives for their evaluation of various Chinese sausage attributes. The Ward's method of cluster analysis was employed to form three distinct market segments. A multi-nominal Logit model was then estimated to identify important socio-economic variables that differentiate the market segments.

Gerhardy and Ness (1995) identified consumer preference segments in the market through cluster analysis. The analysis revealed that the preferences of consumers were very heterogeneous but it was possible to identify segments with distinct preferences for particular egg attributes, they identified five clusters. Significant differences between the clusters were substantiated by the discriminant analysis.

Krause *et al* (1995) did global market segmentation for value added agricultural products. Segments were identified using factor and cluster analyses. Twenty-six variables identified by factor analysis were reported. Clusters with the most growth potential in the near future for value added trade were identified along with clusters having less potential in the near future but having long-term potential.

Becker *et al* (1996) studied changes in consumer behaviour regarding meat. They classified the customers in two groups: buying or not buying high quality meat, using cluster analysis. Discriminant analysis showed the degree of information on the guidelines for quality meat production as the most important factor distinguishing quality buyers, but cluster analysis showed no meaningful clusters.

METHODOLOGY

CHAPTER III

METHODOLOGY

This chapter reflects the agro-climatic and economic feature of the study area, the nature and sources of data collected, the analytical tools used/employed for an evaluation of the objectives of the present study. These are presented under the following headings:

3.1 Description of the study area

3.2 Sampling procedure

3.3 Nature and Sources of data

3.4 Analytical tools and techniques.

3.1 Description of the study area

Sunflower is an important crop in the Northern Karnataka. However, the large scale of cultivation of sunflower is concentrated in Bijapur, Gulbarga and Raichur districts. These three districts constituted about 70 per cent to the total area under sunflower in Karnataka. The district wise area under sunflower is shown in Table 3.1. The present study is confined to Raichur district.

The study was conducted in Raichur district of Northern Karnataka. Raichur district is located in the north-eastern part of Karnataka lying between 15°09' and 16°34' North latitude and 75°46' and 76°35' East longitude with an average altitude of 393.3 meter above mean sea level. On the North it is bound by Gulbarga district while on the East by Mehboob

Table 3.1 District wise area under sunflower (1993-94)

<i>District</i>	<i>Area (hectares)</i>
Bangalore (Urban)	186
Bangalore (Rural)	323
Belguam	25985
Bellary	132807
Bidar	35021
Bijapur	443808
Chikmagalore	21333
Chitradurga	93772
Dakshina Kannada	-----
Dharwad	88840
Gulbarga	334844
Hassan	12451
Kodagu	-----
Kolar	3273
Mandya	229
Mysore	26495
Raichur	236924
Shimoga	757
Tumkur	5791
Uttar Kannada	60
State Total	1469302

Source : Directorate of Economics and Statistics, 1995

Nagar district of Andra Pradesh and on the South by Bellary district of Karnataka state. On the south-west and north-west are Dharwad and Bijapur districts of Karnataka state respectively.

The Raichur district consists of 9 taluks, 57 hoblis, 13 towns and 1,506 villages, out of which 1,396 and 110 villages are inhabited and uninhabited respectively. The district is spread over an area of 13945 square kilometres (i.e., 1388338 hectares). The forest land occupies 47618 hectares. The total population of the district is 23.1lakhs.

The climate of Raichur district is characterised by dry weather for major part of the year with average hot summer. The year may be broadly divided into four seasons. The hot summer season beginning by about middle of the February and extending up to the end of May. The south-west monsoon period stretches from June to end of September. The post monsoon period extends from October to November. The period from December to middle of February is comparatively cool. As regards the soil type, the district has relatively large area under mixed red and black soil. The average normal rainfall of the district is 599mm. The major crops of the district are jowar, bajra, cotton, sunflower, groundnut, paddy and pulses.

Multistage random sampling procedure was adapted. Raichur district ranks third in area under sunflower and first in production of sunflower in Karnataka state. Hence Raichur district was chosen at the first stage for the present study.

At the second stage, Raichur taluk was purposively selected for the current study. Raichur taluk is a major sunflower growing taluk of the district with proportion of the irrigated area to both net sown and total geographical area being almost identical with those of the district. Hence it is believed to adequately represent the district.

At the third stage, the circle wise area under sunflower in different villages during 1994-95 were obtained from the offices of the Agricultural Extension Officers at Raichur taluk. Out of the 36 identified ADA circles, 5 circles were randomly selected. From each circle two villages were randomly selected. Thus, from the so selected ten villages, nine farmers growing sunflower were randomly selected from each village, so as to constitute a sample of ninety farmers growing sunflower. The names of the selected villages are presented in Table 3.2.

Table 3.2 List of Selected villages

<i>Sl.No.</i>	<i>Name of the Villages</i>
1.	Chiksugur
2.	Devsugur
3.	Dinni
4.	Ganadhal
5.	Gunjahally
6.	Heggasanahally
7.	Hunasehalhuda
8.	Matmari
9.	Rampura
10	Venktapura

For the purpose of analysing the demand for the quality attributes of sunflower seed, systemic sampling procedure was used. Out of the above selected ample of ninety farmers, every third farmer was chosen so as to constitute a sample of thirty farmers.

3.3 Nature and Sources of data

Primary data were collected from the selected sample farmers during July-August 1997 for 1994-95 and 1995-96 sunflower crop of khariff season by personally interviewing the farmers through a structured pre-tested questionnaires and placards prepared for the purpose.

Secondary data regarding the acreage and production of sunflower crop in the district and taluks were obtained from the office of the District Statistical Officer, Raichur; Offices of the Department of Agriculture, Raichur and Directorate of Economics and Statistics, Bangalore, from 1980 to 1995-96.

3.4 Analytical tools and techniques

3.4.1 Tabular analysis

The buying behaviour of the sunflower seeds among farmers and the problems faced by the farmers in cultivation and marketing of sunflower were analysed based on the data obtained from the sample farmers. These data were analysed statistically by using simple averages and percentages.

3.4.2 Theil's Entropy

The market structure of the sunflower seed industry was studied by means of Theil's entropy $E(X)$. Theil's Entropy $E(X)$ is a measure of the distribution of the market demand among the various seed companies/institutions producing and marketing sunflower seed in the market. The index suggests at whether the market is equitably distributed among the companies/institutions or concentrated in the hands of few companies/institutions engaged in the trade of sunflower seeds.

Thus,

$$E(X) = \sum_{i=1}^n P_i \ln(1/P_i)$$

$$\text{Where } P_i = X_i / \sum_{i=1}^n X_i ;$$

X_i is the quantity of the sunflower seed used by the sample farmers of a particular company/institution and

$\sum X_i$ is the total sunflower seed used by the sample farmers ;

n is the number of companies/institutions involved in sunflower seed production and marketing.

The Value of $E(X)$ ranges between 0 and $\ln(n)$. An index of 0 indicates that the market is concentrated and the value of $\ln(n)$ indicates that all the sunflower seed companies/institutions have equal share in the market. Hence market concentration is inversely related to the indices $E(X)$. Thus, Theil suggested a modification –

$$I(X) = \ln(n) - E(X)$$

which also ranges between $\ln(n)$ and 0, but here $I(X)$ is directly related to concentration. This index $I(X)$ can be bounded within the range of 0 and 1 by dividing the index such

$$M(X) = I(X) \div \ln(n)$$

since $M(X)$ is only an extension of $I(X)$, market concentration is directly proportional to $M(X)$ also.

3.4.3 Markov - Chain Analysis

To study the market share and market potential for different varieties of sunflower seed, Markov-chain analysis was used. For the purpose of studying the market share and thereby the brand switching pattern, the data collected on the area under sunflower of different varieties used by the sample farmers during 1994-95 and 1995-96 khariff were taken into consideration.

Markov chain analysis is a quantitative technique useful for modelling variable that are in the process of changing over time. These changes are encapsulated in the transitional probability matrix, which consists of 'r' states. The matrix gives the probability the variable will move from one state to another.

3.4.3.1 The Markov probability model

The type of stochastic process with which we are concerned may be characterised as one in which

- (i) There are finite number of possible outcomes S_i ($i = 1, 2, \dots, r$) which a discrete random variable x_t ($t=1, 2, \dots, T$) may take a finite number of equidistant time points or trials t in a sample space where each elementary event is an infinite sequence $\{x_0, x_1, \dots\}$;
- (ii) The Probability distribution of an outcome of a given trial depends only on the outcome of the immediately preceding trial and this first order dependence is the same at all stages i.e.,

$$\Pr(x_t / x_{t-1}, x_{t-2}, \dots) = \Pr(x_t / x_{t-1}), \text{ for all } t, \dots\dots(3.4.1)$$

where $\Pr(x_t / \dots)$ denotes the probability density function for x_t . The probability of n ordered set of sequences is reflected by the multiplication law of conditional probability as

$$\Pr(x_0, x_1, \dots, x_r) = \Pr(x_0) \Pr(x_1 / x_0) \Pr((x_2 / x_0) x_1) \dots\dots(3.4.2)$$

which may be written for a Markov process as

$$\Pr(x_0, x_1, \dots, x_T) = \Pr(x_0) \prod_{t=1}^T \Pr(x_t / x_{t-1}) \dots\dots(3.4.3)$$

such a probabilistic mechanism or system is described by the initial probability distribution $\Pr(x_0)$ and the conditional probabilities $\Pr(x_t / x_{t-1})$.

Further it is assumed that if $x_{t-1} = S_i$ and $x_t = S_j$, then

$$\Pr(x_t = S_j / x_{t-1} = S_i) = P_{ij}(t) = P_{ij}, \text{ for all } t \quad \dots\dots\dots(3.4.4)$$

where P_{ij} is the constant transition probability associated with a change from state S_i to S_j . In the present context,

S_j denotes the respective area under different varieties of sunflower during khariff 1995-96

S_i denotes the respective area under different varieties of sunflower during khariff 1994-95.

The transition probabilities P_{ij} which may be arranged as an $(r \times r)$ transition probability matrix $P = [P_{ij}]$, reflecting every pair of states, S_i, S_j , ($i, j = 1, 2, \dots, r$), have the following properties :

$$0 \leq P_{ij} \leq 1, \quad \dots\dots\dots(3.4.5)$$

and $\sum_j P_{ij} = 1, \text{ for } i = 1, 2, \dots, r \quad \dots\dots\dots(3.4.6)$

Since the probabilistic behaviour of a Markov-chain is determined by the transition probability matrix P and a probability distribution over the initial state x_0 , if we are given x_0 and P , we may want to determine the probability distribution for each random variable x_t or possibly we may be interested in the limiting distribution of x_t as $t \rightarrow \infty$, if such a distribution exists. Within this context, if a chain is irreducible and aperiodic and thus ergodic, then there exists a unique row vector $\Pi = (\Pi_1, \Pi_2, \dots, \Pi_r)$, which is a steady state probability vector, with the properties

$$\lim_{t \rightarrow \infty} P_{ij}^{(t)} = \Pi_j; \quad i, j = 1, 2, \dots, r \quad \dots\dots\dots(3.4.7)$$

where $P_{ij}^{(t)}$ is the $(i,j)^{\text{th}}$ element of P^t ,

$$0 \leq \Pi_j \leq 1, \quad \dots\dots\dots(3.4.8)$$

$$\sum_j \Pi_j = 1, \quad \dots\dots\dots(3.4.9)$$

and $\Pi = \Pi P \quad \dots\dots\dots(3.4.10)$

In order to study the market potential and forecast the demand for the sunflower seed for the district relevant information like area under individual crops of the district, gross cropped area were considered. Assuming that the past trend in changes in crop acreage of major crops would continue into the future, a Markov-chain analysis was employed using aggregate quinquennial time series data on cropping pattern from 1990-91 to 1994-95 to estimate the transition probability matrix for cropping pattern changes. Projections for cropping pattern for 2000A.D., were computed from the transitional probability matrix. Thus the area under sunflower and the seed requirement were projected for the future.

Estimation problems while using aggregate data :

When a sample of repeated observations of the chain exists, and the time ordered data which reflect the inter-temporal movements of the micro units over the states are available, then, it yields a likelihood function and serves as a basis for obtaining estimates of the transition probability and making certain tests of hypothesis about these parameters.

Unfortunately, data involving time-ordered detailed changes were not available and was too expensive and incomplete and therefore had to work with their aggregated sample counterparts.

Now the question arises as to whether or not it is possible to use the aggregated outcome data as a basis for estimating the transition probability matrix P which reflect or defines the behaviour of micro unit . In this context several methods are proposed to obtain the transition probability matrix with aggregate data, some of the important ones are quadratic programming and Minimisation of Absolute Deviation. For the present study, Minimisation of the Absolute Deviation was used to serve the purpose.

3.4.3.2 A relation involving the macro data

If the $n_{ij}(t)$ sample observations are not available and only the aggregate outcome data, $n_j(t)$ which is equal to $\sum n_{ij}(t)$, are available, then one way to make use of the observed proportion data in estimating the transition probabilities is, using the notation of eqn.(3.4.1), to make use of the argument of conditional probability in the following way :

$$\Pr (x_{t-1}=S_i, x_t=S_j) = \Pr (x_{t-1}=S_i) \Pr (x_t=S_j / x_{t-1}=S_i) \dots\dots\dots(3.4.11)$$

using the generalised addition law of the probability, then

$$\Pr(x_t=S_j) = \sum_i \Pr(x_{t-1}=S_i) \Pr(x_t=S_j / x_{t-1}=S_i) \quad \dots\dots(3.4.12)$$

$$\text{or } q_j(t) = \sum_i q_i(t-1) P_{ij} \quad \dots\dots\dots(3.4.13)$$

where $q_j(t)$ and $q_i(t-1)$ represent the unconditional probabilities $\Pr(x_t=S_j)$ and $\Pr(x_{t-1}=S_i)$ respectively. If the unconditional probabilities $q_j(t)$ and $q_i(t-1)$ in eqn.(3.4.13) are replaced by the actual observed proportions $Y_j(t)$ and $Y_i(t-1)$, then there will be no set of transitional probabilities that will satisfy this relation with probability one. Thus, if errors are admitted in equation (3.4.13) to account for difference between the actual and estimated occurrence of $Y_j(t)$, based on the right hand side of equation (3.4.13), then the sample observation may be assumed to be generated by the following stochastic relation :

$$Y_j(t) = \sum_i Y_i(t-1) P_{ij} + u_j(t) \quad \dots\dots\dots(3.4.14)$$

Miller (1952) proposed using this stochastic relation as a basis for specifying a linear statistical model for estimating the transition probabilities.

In developing Miller's (1952) approach for estimating the transitional probabilities in (3.4.14) from sample proportion data, let us rewrite the stochastic relation given in (3.4.14) in matrix form as

$$Y_j = X_j P_j + u_j \quad \dots\dots\dots(3.4.15)$$

where $Y_j = \{Y_j(t)\}$ is a $(T \times 1)$ vector of sample proportions, $P_j' = (P_{1j}, P_{2j}, \dots, P_{rj})$ is a $(r \times 1)$ vector of unknown parameters to be estimated, u_j is a $(T \times 1)$ vector of random disturbances and X_j is the following $(T \times r)$ matrix ;

$$X_j = \begin{bmatrix} Y_1(0) & Y_2(0) & \dots & Y_r(0) \\ \vdots & \vdots & \ddots & \vdots \\ Y_1(t-1) & Y_2(t-1) & \dots & Y_r(t-1) \\ \vdots & \vdots & \ddots & \vdots \\ Y_1(T-1) & Y_2(T-1) & \dots & Y_r(T-1) \end{bmatrix} \quad \dots\dots(3.4.16)$$

It is assumed that matrix X_j has rank r . We make the following assumptions about the random disturbance vector u_j in (3.4.15);

$$E(u_j) = 0 \quad \dots\dots(3.4.17)$$

and $E(u_j u_j^l) = \sigma_j \omega_{jj}$, $\dots\dots(3.4.18)$

where ω_{jj} is a $(T \times T)$ positive definite diagonal matrix.¹

The set of equations of which (3.4.14) or (3.4.15) is a part, may then be written as

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_r \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \dots & 0 \\ 0 & X_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & X_r \end{bmatrix} \begin{bmatrix} P_1 \\ P_2 \\ \vdots \\ P_r \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_r \end{bmatrix} \quad \dots\dots(3.4.19)$$

or $Y = XP + u$ $\dots\dots(3.4.20)$

with $Y^l = (Y^l_1, Y^l_2, \dots, Y^l_r)$, $P^l = (P^l_1, P^l_2, \dots, P^l_r)$, $u^l = (u^l_1, u^l_2, \dots, u^l_r)$ and X is the block diagonal matrix on the right hand side of (3.4.19) with $X_1 = X_2 = \dots = X_r$,

¹ For the basis underlying the residual specification, see Madansky (1959)

$$E(u) = 0 \quad \dots\dots\dots(3.4.21)$$

and $E(u u^T) = \Sigma$, $\dots\dots\dots(3.4.22)$

where Σ is a $((Tr) \times (Tr))$ non-diagonal, singular matrix.

Given the multivariate linear statistical model $Y=XP + u$, and assuming T strictly greater than r , Miller (1952) suggested the use of the conventional least squares estimator as a basis for obtaining estimates of the transitional probability i.e., viewing the problem as one of finding the estimate P which minimises the positive definite quadratic form

$$\phi = u u^T = (Y - XP)^T (Y - XP) \quad \dots\dots\dots(3.4.23)$$

Solving this extreme problem in the conventional way yields the minimising solution

$$\tilde{P} = (X^T X)^{-1} X^T Y, \quad \dots\dots\dots(3.4.24)$$

provided that $X^T X$ is non-singular. Since X_j , $j= 1,2,\dots,r$, has been assumed to be of rank r , $X^T X$, a block diagonal matrix with matrices $X_j^T X_j$ on the main diagonal, will be non-singular. Since the matrix $X^T X$ is positive definite (and also symmetric), both the necessary and sufficient conditions for \tilde{P} to minimise (3.4.23) are fulfilled.

Although the set of relations (3.4.19) are 'disturbance related', since $X_1=X_2 = \dots X_r$, the j equations may be estimated separately or as a set (Zellener, 1962) with the same results.

Thus, the unrestricted 'conventional' least square estimator for P_j , a sub-vector of \tilde{P} is from (3.4.24)

$$\tilde{P}_j = (X' X_j)^{-1} X_j' Y, \quad j = 1, 2, \dots, r. \quad \dots\dots\dots(3.4.25)$$

which satisfy the following non-negativity and row sum conditions :

$$0 \leq P_{ij} \leq 1, \quad \dots\dots\dots(3.4.26)$$

and $\sum_j P_{ij} = 1$, for all i or $\dots\dots\dots(3.4.27)$

$$GP = \eta_r \quad \text{where } G \text{ is a } (r \times r^2) \text{ known coefficient matrix } [I_1,$$

$I_2, \dots, I_r]$ with each I_i an $(r \times r)$ identity matrix and η_r is an $(r \times 1)$ column vector with all entries equal to one.²

3.4.3.3 The Minimum Absolute Deviations Estimator

To estimate the transition probabilities for a Markov chain, a set of regression hyperplanes are fitted, which may be written in the multivariate form

$$Y = XP + u \quad \dots\dots\dots(3.4.20)$$

for which no intercepts are involved. An alternative criterion for deriving parameter estimates when equality or inequality restrictions are present is to make use of a sum of absolute deviations, rather than a sum of squared deviations. Use of former criterion yields a minimum absolute deviations (MAD) estimator (Fisher, 1961). If the method of minimising the sum of he

² For discussion of Least square estimation under exact linear restraints see Goldberger (1964) and Theil (1963)

absolute deviations, the problem may be specified as follows : find the vector \vec{P} such that the sum of the absolute deviations

$$a^j \eta_{rT} \dots\dots\dots(3.4.28)$$

is minimised subject to the constraints

$$Y = XP + u \dots\dots\dots(3.4.29)$$

$$GP = \eta_r \quad \text{and} \quad \dots\dots\dots(3.4.30)$$

$$P \geq 0 \quad \dots\dots\dots(3.4.31)$$

where $a^j = (u_1(t), u_2(t), \dots\dots\dots, u_r(t))$, a $(1 \times rT)$ vector with

$u_i(t) = [|u_i(1)|, |u_i(2)|, \dots\dots\dots, |u_i(T)|]$, u is an error term allowing either

positive or negative values and η_{rT} and η_r are unit vectors with dimension rT

and r respectively. Given the observations Y and X , the model (3.4.28 to

3.4.31) may be solved by linear programming.

3.4.3.4 Formulation of linear programming

To formulate the linear programming estimation problem, the deviation vector u has to be modified such that it appears both the objective function (3.4.28) and the constraints (3.4.29) in the same manner. The absolute value $|u_j(t)|$ is denoted by the following expression

$$|u_j(t)| = \max(0, u_j(t)) + \max(-u_j(t), 0) \quad \dots\dots\dots(3.4.32)$$

Then, the value of $u_j(t)$ itself may be written as

$$u_j(t) = \max(0, u_j(t)) - \max(u_j(t), 0) \quad \dots\dots\dots(3.4.33)$$

which may be positive or negative. Let u_1 be the vector of $\max(0, u_i(t))$ and u_2 be the vector of $\max(-u_j(t), 0)$. The resulting u_1 and u_2 have the properties that they are non-negative and that their corresponding elements are counterparts, in the sense that both elements cannot take positive values at the same time. In other words, allowing either positive or negative values for u , a pair of counterparts u_1 and u_2 are formed such that u_1 and u_2 are all non-negative and u_1 stands for positive deviations and u_2 for negative deviations.

3.4.3.5 Minimising the sum of absolute deviations

If the minimisation criterion is that the sum of absolute deviations is to be minimised, then the linear programming problem is :

To minimise

$$(u_1 + u_2)^T \eta_{rT} \dots\dots\dots(3.4.34)$$

Subject to

$$Y = XP + u_1 - u_2 \dots\dots\dots(3.4.35)$$

$$GP = \eta_r \quad \text{and} \quad \dots\dots\dots(3.4.36)$$

$$P, u_1, u_2 \geq 0 \quad \dots\dots\dots(3.4.37)$$

The problem may be solved by employing the simplex algorithm, and the simplex tableau in the form of minimisation problem is given in table 3.3.

In the tableau, the error term u_1 may be introduced initially into the basis as a shortcut to reduce the rounding error due to the iterations. The last constrain $GP = \eta_r$ must have artificial variables as bases. The m stands for the high cost of an artificial variable being in the basis.

Table 3.3 The Linear Programming simplex tableau for the Minimum Absolute Deviation estimator

C_j		0	η_{rT}	η_{rT}
	B_0	P	u_1	u_2
η_{rT}	Y	X	1	-1
m	η_r	G	0	0

For the current study, the crops/crop aggregates considered are jowar, groundnut, paddy, bajra, cotton, sunflower and other crops, for a period of five years, from 1989-90 to 1993-94.

3.4.4 Conjoint Analysis

The conjoint measurement is a versatile marketing technique used in consumer evaluation of value judgements. Hence, it was used to measure consumers evaluation of sunflower seed quality attributes. Originally it was developed for Psychometric research. Now the conjoint measurement technique is increasingly used both in market research and wider management decision making. It has been developed mainly from the theoretical work of Debreu (1960), Luce and Tukey (1964) and Krantz and Tversky (1971) and was introduced into the marketing literature by Green and Rao (1971).

Conjoint measurement is based on the assumption that,

- (i) A product can be described according to the levels of a set of attributes and
- (ii) The consumer's overall judgement in respect to that product is based on these attribute levels.

Both these assumptions are commonly made in Economics and Marketing.

Conjoint measurement is used in the assessment of consumer preference towards a product and focuses on the evaluation of alternative product 'concept' or types which are defined in terms of specific attribute levels. It seeks to quantify and predict the consumer's overall judgement (eg. Evaluation of quality) on the basis of their underlying product attributes.

An appealing feature of conjoint measurement is that it starts with the consumer's overall judgement about the set of product alternatives (i.e., combination of attribute levels) and break the overall judgement down into the contribution of each attribute level. The contribution of the various attributes level to the overall judgements are called part-worth's. This feature facilitates the researcher to identify market segments based on the individual consumer's quality perception instead of classifying respondents *a priori* on socio-economic criteria, which may not always correspond to differences between consumers with respect to the quality evaluation process of the product in question. The conjoint measurement can also be used to explore new product opportunities through combinations of attribute levels that receive high quality evaluations which are not currently met by the existing products.

Conjoint measurement is developed as a model of individual choice behaviour which consisted of a series of tests used to determine whether a person's rank order preferences could be described by a formal composition rule applied to a set of independent variables (Luce and Tukey, 1964 ; Krantz and Tversky, 1971).

In contrast, applied work has involved the assumption that some composition rule holds - possibly with some error. The focus of this type of research has been on estimating the relationship between independent and dependent variables. Green and Srinivasan (1978) called this group of estimation procedures "Conjoint analysis" to distinguish it from its axiomatic roots.

One of the important requirements in the conjoint measurement is the identification of appropriate attributes to describe the product and specific and feasible levels of these attributes (Gerhardy and Ness, 1995). On the basis of the objective attributes, representative indicators for a given quality attribute are chosen. Another important requirement for the use of the technique is the specification of the basic form of relationship between product attributes and overall judgement. In the current study, the additive conjoint model was used instead of other forms like the interactive and the multiplicative models. The additive model is the simplest and by far the most frequently used model. More over, previous studies have shown that this model has comparatively better fit to the data than the other two models.

Further, in this model, the omission of the attribute does not have a major impact on part-worth estimates. The additive model assumes that the overall evaluations are formed by the sum of separate part-worth or utilities of the attribute levels.

Though several estimation procedures can be used (Jain *et al.*, 1979), they all attempt to find a set of part-worth utilities that relate the attribute levels of an object to the overall preference or utility for that object - i.e.,

$$Y_i = \sum_{i=1}^N \beta_i X_{ij} + e \quad \dots\dots\dots(3.4.38)$$

Y_i is the preference or utility for the i^{th} object. The objects are described in terms of $K_j + 1$ ($j = 1, 2, \dots, J$) levels of J attributes. The i^{th} object can be represented by a vector of dummy variables ($X_{i1}, X_{i2}, \dots, X_{iN}$) where $N = \sum K_j$. β_i is the part-worth utility estimate of the i^{th} attribute level.

The relative importance of an attribute for a consumer may be defined in terms of the range of the β_i s across the levels for that attribute i.e.,

$$W_i = \{ \max_j(\beta_i) - \min_j(\beta_i) \}, \text{ for each } i \quad \dots\dots\dots(3.4.39)$$

The attribute importance, W_i , for a consumer may be normalised to ascertain its relative importance with respect to other attributes and across consumers.

Ordinary least squares (OLS) regression analysis is the commonly used procedure to estimate the part-worths as shown above. Research results have shown that regression analysis gives very good results, even if the overall evaluation consists of rank order data. However, if regression analysis is applied to rank order data, the usual significance tests are not valid. The fit of the model to the data is usually assessed in terms of Spearman's rank correlation coefficient between input and estimated values of the dependent variable.

3.4.4.1 Approaches to collect data for conjoint analysis

There are two general approaches to collect data for conjoint analysis.

- (i) Two-factor-at-a-time trade-off method and
- (ii) Full-concept approach

Two-factor-at-a-time trade-off method

In this method respondents are asked to rank cells of a series of matrix crossing the levels one factor with the level of another. This method is hardly ever used today as it suffers from a number of limitations, most notable the lack of realism in asking respondents to judge products using any two attributes simultaneously.

This method is considered as more realistic and ecologically valid method since all factors are considered at a time. In this method the respondents are asked to rank, order or score a set of cards (a combination of factor levels that fully describes a product or a service) according to preference. In this way, a "Full concept" (i.e., a complete product or service) is described on each card.

The respondents' task is to rank or score each card from most to least preferred scale. From these rankings/scores conjoint analysis derives utility scores for each factor level. A potential problem with the full concept method soon becomes obvious if more than a few factors are involved and each factor has a more than a couple of levels. The total number of cards resulting from all possible combinations of the levels becomes too great for respondents to rank or score in a meaningful way. For this reason, frequently only a subset of all possible cards is used in the experiment. The subset, called an "*Orthogonal array*", is a type of design in which only main effects are considered and interactions are assumed to be negligible. In an orthogonal array, each level of one factor occurs with each level of another factor with equal or at least proportional frequencies, assuring independence of the main effect.

An orthogonal array represents the most parsimonious way to estimate all main effects. Even though it is true that estimation improves as the number of cards increases, information is not really lost by omitting such combinations. One restriction on the number of cards is that it must sufficiently exceed the number of factors to allow for the error degrees of freedom.

After conducting a number of depth interview with the respondents (sunflower growing farmers) seven attributes viz., price, seed size, duration, variety, head size, seed thickness and resistant to pest and diseases appeared to be relevant for the decision making process in the current study. This pre-study gave an indication as to the levels of attributes that should be used in this study. After consultations with the sunflower breeders, a final specification of the attribute levels were made. The oil content, an important attribute, has not been included since all the farmers have expressed this quality as the most preferred attribute which did not differ from one farmer to another farmer. The attributes along with their levels selected for the current study are given the table 3.4.

A full-profile approach was chosen for data collection. These attributes and their levels resulted in 648 combinations ($3 \times 3 \times 2 \times 2 \times 3 \times 3 \times 2$). Given the large number of combination it was too large for the consumers to evaluate. Hence, a fractional factorial design was used to bring the number of cards to be evaluated down to an easily administered total of 18. For this

Table 3.4 Specification of Attribute levels

Attributes → Levels ↓	Price	Seed size	Duration	Variety	Head size	Seed Thickness	Resistant to pest & disease
Level 1	< Rs.100/Kg	Bold	Long (80-95 days)	Local	Large	Thick	Resistant
Level 2	Rs.100-180/Kg	Medium	Short (< 80 days)	Hybrid	Medium	Medium	Susceptible
Level 3	> Rs.180/Kg	Small			Small	thin	

purpose an algorithm used in Statistical Package for Social Sciences (SPSS), a computer software was employed to select the 18 subset profiles. Each profile was described on a separate card called placard. Each respondent was shown in randomly mixed set of 18 cards and was asked to rank them according to his/her perception of quality. Before administering these cards to respondents an initial briefing regarding what the different terms on these cards meant and the purpose of the study were explained to them so that the respondents could understand what was expected of them. The ranks given by them to these 18 cards were noted down.

3.4.5 Cluster Analysis

Cluster analysis is an exploratory statistical tool that seeks to identify sequence or pattern within a sample data by operating a matrix of independent variable. The objects to be clustered are sorted out on the basis of various socio-economic and other characteristics. Segments or clusters are formed based on the similarity of scores on the selected socio-economic parameters. The rationale in the cluster formation is the brief that the objects or individuals within groups are similar in respect of their attributes (Sanders, 1980). The cluster analysis presents a wide range of approaches for the segmentation of objects. For the present study, the hierarchical clustering procedure was used to sort the respondents into the group that are alike for sunflower seed. The hierarchical clustering process is described briefly below.

The clustering process is initiated with an assumption that each respondent is assumed to be a separate cluster at the beginning. The two individuals that are most alike, based on the Euclidean distance, are then combined to form a new cluster to give a $(n-1)$ cluster solution. The $(n-1)$ clusters are then compared to find next most identical alike pair based on same criteria and then they are combined. The sequence is repeated until all the original clusters/respondents have been combined into one. This signals that no further clustering is possible. After this one can choose the levels of clustering, that is, number of groups/clusters that the researcher needs to fulfil his objectives (Sanders, 1980). Two criteria are commonly used to select the number of clusters. The first criteria is that the appropriate number of clusters should be taken from the point where further combining of clusters gives a large increase in the error sum of squares. However, this approach has been found to be unsatisfactory. The second criteria is that appropriate number of clusters can be chosen that fits most closely the needs and capabilities of the organisation or the researcher. For the present study the second criteria was chosen considering the amenability of clusters for the comparison.

In the current study, the part-worths and the relative importance scores given to the seven quality attributes obtained from the conjoint analysis were used as the variables for the segmentation of consumers/respondents. The Euclidean distance pertaining to relative

importance given for the attributes were used to form the clusters based on likeness or similarity of respondents. The cluster analysis was done employing an algorithm in the SPSS software. The information collected from the respondents through interview on demographic variables and preferences were used to identify and describe the segments in terms of personality, quality perception, socio-economic and demographic variables.

RESULTS

CHAPTER IV

RESULTS

The results of the study are presented under the following heads in consonance with the objectives specified in chapter I.

1. Buying behaviour of sunflower seeds
2. Market concentration
3. Market share and Brand switching pattern
4. Market potential
5. Preference for quality attributes of sunflower seeds
6. Market segmentation
7. Problems confronted by farmers in cultivation and marketing of sunflower.

4.1 Buying behaviour of sunflower seeds

The details of the buying behaviour of sunflower seeds by the farmers are presented in Tables 4.1.1, 4.1.2 and 4.1.3.

It could be seen from Table 4.1.1 and figure.1 that out of the total quantity of seeds purchased by the sample farmers in khariff in Raichur taluk, unbranded local seeds had the major share with 53.09 per cent followed by the MAHYCO's MSFH-17 with 26.22 per cent and MSFH-8 with 7.61 per cent. ITC-Zeneca's PAC-36 and PAC-8699 had the share of 2.97 and

2.78 per cent respectively. ASFH -17 of Amareshwara Seed Company was the least purchased sunflower seed with 0.40 per cent.

Tables 4.1.2 and 4.1.3 reveals the details of the source of seed supply and the preference for the source of supply respectively. It could be seen from Table 4.1.2 that highest number of farmers using sunflower seeds purchased from private dealer which constituted 62.23 per cent followed by the seeds borrowed/purchased from fellow farmers constituting 32.23 per cent. Karnataka State Seeds Corporation and Karnataka State Department of Agriculture together constituted the rest of the farmers with 2.22 and 3.33 per cent respectively.

The preference for the source of seed supply expressed by the farmers as per the opinion survey conducted are presented in Table 4.1.3. Quality seed material was the single most factor for the farmers preferring private agency/dealer which was opined by 51.11 per cent of the total farmers. The next factor which had influenced to prefer the private agency/dealer was the timely supply of seeds constituting 44.44 per cent farmers. The other factors of preference for private agency/dealer were timely availability of seeds (21.11 per cent), nearness to source of supply (8.89 per cent), provision for technical guidance (8.89 per cent), credit facility (5.55 per cent) and cost consideration (3.33 per cent).

**Table 4.1.1 Purchasing pattern of sunflower seeds
(khariff 1996)**

65

<i>Variety/Brand</i>	<i>Quantity (Kg)</i>	<i>Percentage</i>
ARUN-1	25.00	1.34
ASFH-17	7.50	0.40
GK-2002	50.00	2.70
KBSH-1	12.00	0.65
LOCAL (Unbranded)*	984.00	53.09
MSFH-17	486.00	26.22
MSFH-8	141.00	7.61
PAC-36	55.00	2.97
PAC-8699	51.50	2.78
SH-41	21.50	1.16
SUNBRID-212	20.00	1.08
TOTAL	1853.50	100.00

* Purchased from fellow farmers

Table 4.1.2 Source of supply of sunflower seeds

	<i>Source of supply</i>			
	<i>Private Dealer</i>	<i>Fellow farmer</i>	<i>K.S.S.C</i>	<i>K.S.D.A</i>
No. of farmers	56	29	2	3
Percentage	62.23	32.22	2.22	3.33

Note : 1. KSSC - Karnataka State Seeds Corporation
2. KSDA- Karnataka State Department of Agriculture

Table 4.1.3 Preference for the particular source of supply

	Availability of Sunflower Seeds	Timely supply	Nearness to Source of supply	Credit facility	Cost considerations	Quality seed material	Provision for technical guidance
Private Dealer	19 (21.11)	40 (44.44)	08 (8.89)	5 (5.55)	3 (3.33)	46 (51.11)	8 (8.89)
Fellow farmer	19 (21.11)	28 (31.11)	12 (12.22)	19 (21.11)	26 (28.89)	3 (3.33)	3 (3.33)
KSSC	2 (2.22)	2 (2.22)			2 (2.22)		1 (1.11)
KSDA	1 (1.11)						1 (1.11)

Note : 1. Figures in parenthesis indicate percentage to total farmers

2. KSSC - Karnataka State Seeds corporation

3. KSDA- Karnataka State Department of Agriculture

4. The total number of farmers and percentage of farmers in this table add to more than 90 farmers and more than 100 per cent as some of the farmers expressed more than one preference for a particular source of supply

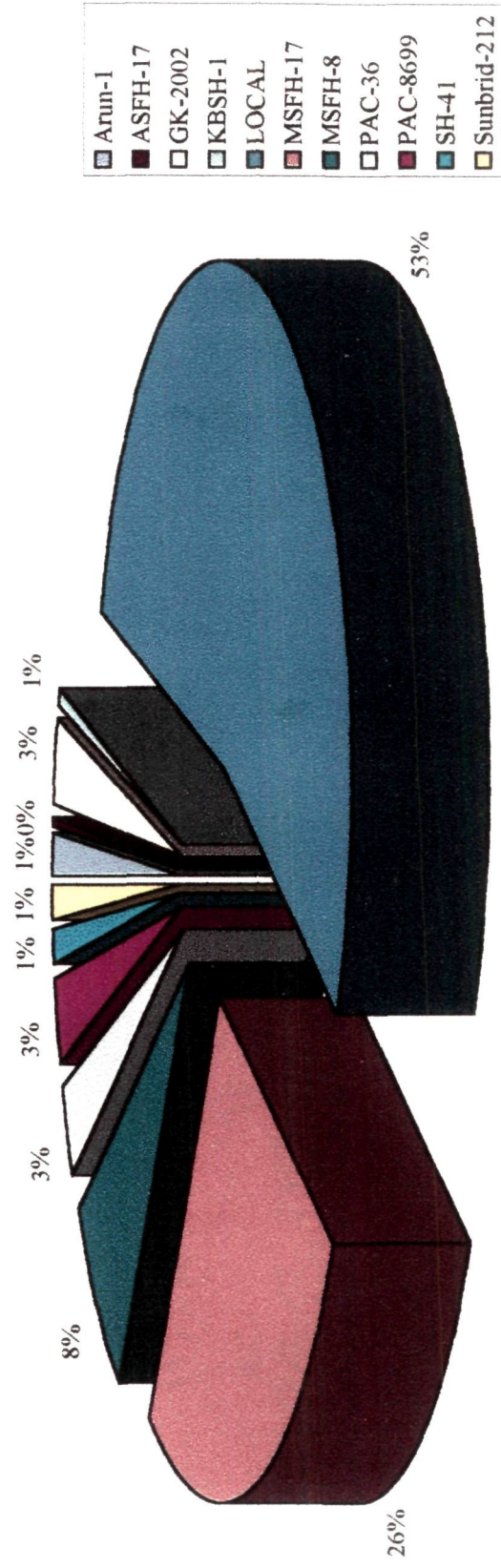


Figure 1. Purchasing pattern of sunflower seeds (Kharif 1996)

Similarly, the preferences for the fellow farmer as a source of supply included factors such as timely supply of seeds (31.11 per cent), cost considerations (28.89 per cent), timely availability of seeds and credit facility to purchase seeds (21.11 per cent each), nearness to source of supply (12.22 per cent) and quality seed material and provision for technical guidance (3.33 per cent each).

The farmers preferring the Karnataka State Seeds Corporation as the source of supply were influenced by four factors in the order of preference viz., availability of seeds, timely supply of seeds, cost considerations (2.22 per cent each) and provision for technical guidance (1.11 per cent).

Karnataka State Department of Agriculture as a source of supply had only two factors which had attracted the farmers viz., timely availability of seeds and provision for technical guidance (1.11 per cent each).

4.2 Market concentration

Theil's entropy is one of the important indicator of market concentration. For this purpose, a sample of 90 farmers were interviewed using the sampling procedure explained in chapter -III. The quantity of different varieties of sunflower seeds purchased during khariff 1995-96 summed up and categorised into their respective seed producing company/institutions.

The details of the shares of each company and the Theil's entropy index is given in Table 4.2.1 and figure.2. The Theils Entropy index was 0.4638 which reflected that the market share was concentrated within few companies/institutions. The major chunk of the market share was captured by the local unbranded sunflower seeds (53.08 per cent) produced by the local farmers and marketed by themselves to other farmers. Maharashtra Hybrid Seed company (MAHYCO) held the second position with 33.83 per cent market share. ITC-Zeneca was the next seed company with 5.74 per cent market share. These three together accounted for 92.65 per cent of the total sunflower seeds purchased by the farmers during khariff 1996.

The rest 7.35 per cent was shared between Ganga Kaveri (2.70 per cent), Indo-American Hybrid Seeds (1.35 per cent), Cargill (1.16 per cent), KSSC/KSDA (0.65 per cent), Sandoz (1.08 per cent) and Amareshwara (0.40 per cent).

4.3 Market Share and Brand Switching Pattern

Markov-process of first order was used to study brand loyalty, switching pattern and to depict the future market shares for the different varieties of sunflower seeds. For the same, 90 farmers were interviewed using the sampling procedure as explained in chapter-III. The acreage under different varieties of sunflower seeds were elicited through personal interview for khariff season during 1995 and 1996. The information so obtained was tabulated and analysed in order to study whether the purchasers were loyal to a particular brand/variety or to see whether there

Table 4.2.1 Theil's Entropy Index

<i>Sl.No.</i>	<i>Seed company/ Institution</i>	<i>Quantity (Kgs)</i>	<i>Proportion P_i</i>	<i>$P_i \times \ln(1/P_i)$</i>
1.	Amareshwara	7.50	0.0040	0.0223
2.	Ganga Kaveri	50.00	0.0269	0.0975
3.	ITC-Zeneca	106.50	0.0574	0.1641
4.	Cargill	21.50	0.0116	0.0517
5.	Fellow Farmer (Local seeds)	984.00	0.5308	0.3362
6.	MAHYCO	627.00	0.3382	0.3667
7.	K.S.S.C	12.00	0.0064	0.0326
8.	IAHS	25.00	0.0134	0.0581
9.	Sandoz	20.00	0.0108	0.0489
	Total	1853.50	1.0000	1.1781

$$E(X) = 1.1781$$

$$I(X) = 1.0191$$

$$M(X) = I(X) + \ln(X) = 0.4638$$

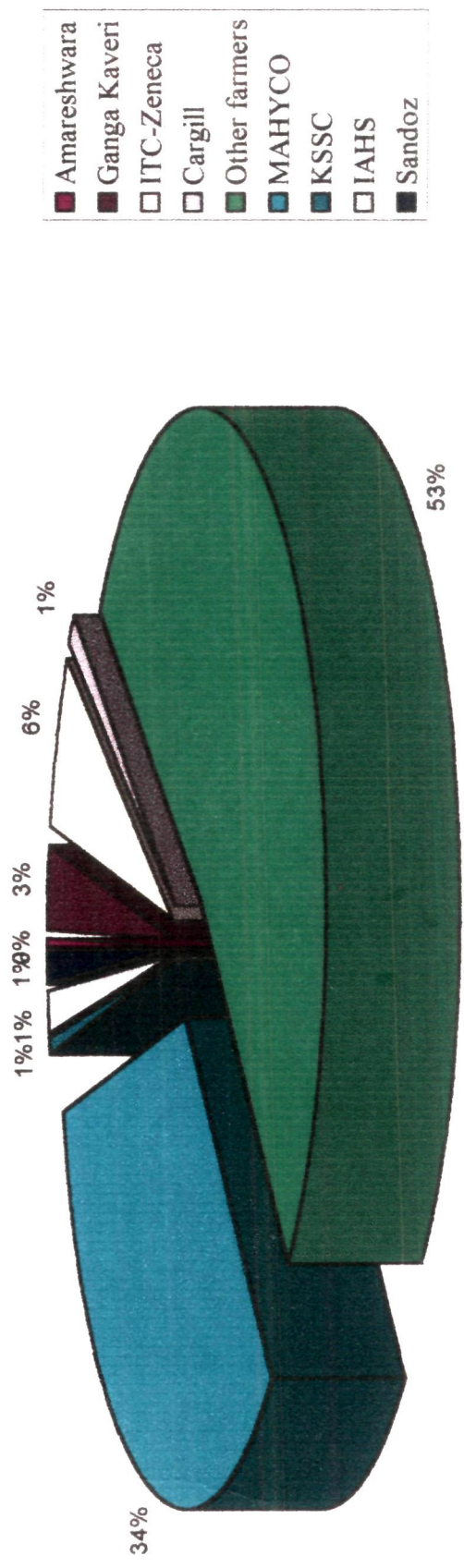


Figure 2. Market share of sunflower seeds

was much switching over from one brand/variety to another. For this purpose, transition probability matrices were formulated using the information on successive purchases. The transition probabilities will indicate the probability acreage retained by a particular brand. Similarly, the transitional probability matrix will provide the information on the net gains or losses of any of the brands and also the inter-relationships among the gains and losses of acreage for each brand.

The market share for different varieties of sunflower seeds as a percentage of acreage under these varieties for the sampled farmers is presented in Table 4.3.1 and figure 3. It can be observed that local unbranded seeds purchased/borrowed from other farmers had the largest share of acreage with 43.91 per cent of total area under sunflower followed by MSFH-17 and MSFH-8 with 29.285 and 7.76 per cent respectively. ITC-Zeneca's PAC-36 and PAC-8699 had the next largest share of acreage under them with 3.75 and 3.56 per cent respectively. These together had 88.27 per cent of acreage under them. The rest 11.73 per cent of market share were shared between GK-2002 of Ganga Kaveri (2.63 per cent), KBSH-1 (2.37 per cent), Sandoz's sunbrid-212 (1.72 per cent), Indo-American Hybrid Seeds's Arun-1 (1.65 per cent), Cargil's SH-41 (1.52 per cent) and Amareshwara's ASFH -17 (1.18 per cent).

Table 4.3.1 Observed percentage share of acreage under different varieties of sunflower.

Sl. No.	Variety/Season	Khariff 1995	Khariff 1996	Average
1.	Arun-1	1.65	1.64	1.645
2.	ASFH-17	1.98	0.39	1.185
3.	GK- 2002	2.65	2.62	2.635
4.	KBSH-1	4.23	0.52	2.375
5.	Local (unbranded)	44.18	43.64	43.910
6.	MSFH-17	26.72	31.85	29.285
7.	MSFH-8	6.28	9.24	7.760
8.	PAC-36	2.98	4.52	3.750
9.	PAC-8699	3.84	3.28	3.560
10.	SH-41	1.79	1.25	1.520
11.	SUNBRID -212	2.38	1.05	1.715
12.	Mordane	1.32	0.00	0.660
Total		100.00	100.00	100.000

- Note:**
1. 5.42 per cent of area under sunflower during khariff 1995 was shifted to other crops during khariff 1996
 2. There was 6.08 per cent increase in area under sunflower during 1996 khariff to 1995 khariff which was shifted from other crops.
 3. There was a net increase in area under sunflower by 0.66 per cent during 1996 khariff to 1995 khariff.

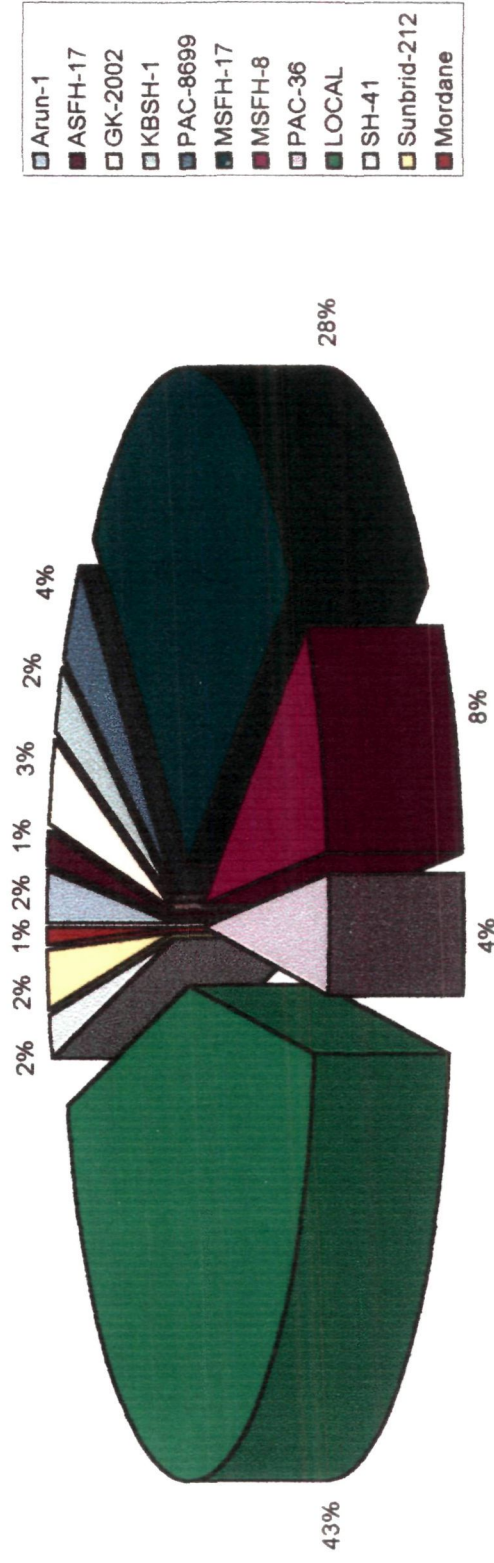


Figure 3. Percentage share of acreage under different varieties of sunflower

The acreage shares of the varieties like unbranded local seeds, MSFH-⁷² 17, MSFH-8 and PAC-36 had increased when compared to its last season, while rest of other varieties had decreased in acreage.

The brand retention's and switching pattern is provided in the form of transitional probability matrix presented in Table 4.3.2. The diagonal elements in the matrix indicate probability of retention of acreage of farmers by the respective brands. Similarly the row values indicate the losses and the column values provide information on gains. An observation of the transition probability matrix indicate that 'GK-2002' brand and Arun-I brand retained the maximum acreage (100 per cent) and Mordane lost entirely to MSFH-8. MSFH-17 brand retained 93.83 per cent of its previous years acreage. It lost 6.17 per cent of its share to other crops. While MSFH-17 brand gained 9.37 per cent from KBSH-1 brand. From local unbranded seeds, the gain was 1.37 per cent of its share. Similarly, the gain from MSFH-8 was 18.18 per cent, 16.67 per cent from PAC-36, 11.38 per cent from PAC-8699, 38.89 per cent from SH-41 and Sunbrid-212 gave away 50 per cent of its acreage to MSFH-17. Lastly, MSFH-17 gained 36.59 per cent of acreage from other crops which was substituted by sunflower during khariff 1996.

Local unbranded seeds which were purchased from fellow farmers retained as high as 90.16 per cent of its original share. It lost 1.37 per cent of its share each to MSFH-17 and MSFH-8. It also lost 7.10 per cent to other

Table 4.3.2 Transitional Probability matrix for area under different varieties of sunflower (Khariff)

	ARUN1	ASFH17	GK2002	KBSHI	LOCAL	MSFH17	MSFH 8	PAC	PAC8699	SH 41	Sunbrid	Mordane	To other crops
ARUN1	1.00												
ASFH17		0.2000							0.8000				
GK2002			1.0000										
KBSHI				0.1250	0.7813	0.0937							0.0710
LOCAL					0.9016	0.0137	0.0137						0.0617
MSFH17						0.9383							0.0909
MSFH 8						0.1818	0.7273						
PAC 36						0.1667		0.8333					
PAC8699						0.1138	0.1243		0.4860				0.2759
SH 41						0.3889				0.6111			
Sunbrid											0.5000		
Mordane												0.0000	
From othercrop					0.2439	0.3659	0.1707	0.0488	0.0976	0.0731			

crops. On the other hand it had gained 78.13 per cent of KBSH-1's share and 24.39 per cent of the acreage from other crops to sunflower.

PAC-36 retained 83.33 per cent of its previous years acreage share and lost only to MSFH-17 by 16.67 per cent of its share. It gained 4.88 per cent of the other crop's acreage to sunflower.

MAHYCO's MSFH-8 brand retained 72.73 per cent of its acreage share and lost 18.18 per cent and 9.09 per cent of its share respectively to MSFH-17 and to other crops. But MSFH-8 brand had gained 1.37 per cent, 12.43 per cent, 100 per cent and 17.07 per cent respectively of their shares from local unbranded seeds, PAC-8699, Mordane and from other crops.

PAC-8699 of ITC-Zeneca's retained 48.60 per cent and lost 11.38 per cent, 12.43 per cent and 27.59 per cent to MSFH-17, MSFH-8 and to other crops respectively of its share. The gain to this variety was from Amareshwara's ASFH-17 by 80 per cent of its share and 9.76 per cent from other crops to sunflower.

SH-41 of Cargill retained 61.11 per cent and lost 38.89 per cent of its share to MSFH-17. It gained only from acreage of other crops to sunflower by 7.31 per cent. KBSH-1 retained only 12.50 per cent and lost 78.13 and 9.37 per cent to local unbranded seeds and MSFH-17 respectively.

Finally, Amareshwaras's ASFH-17 and Sandoz's Sunbrid 212 retained 20 per cent and 50 per cent respectively of their shares and lost 80 per cent and 50 per cent of their shares to PAC-8699 and MSFH-17 respectively.

4.4 Market potential

Demand forecasting is absolutely essential in order to plan the seed production and marketing strategy. Demand forecasting for seed is extremely difficult because of the nature of the product. An attempt was made to forecast the requirement of sunflower seed by predicting the future acreage under sunflower in the Raichur district. A Markov-chain analysis using Minimisation of Absolute Deviation (MAD) method was attempted using the quinquennial time series data on cropping pattern from 1989-90 to 1993-94 to estimate the transition probability matrix for cropping pattern changes. Projection of cropping pattern for 2000 AD was obtained from the matrix.

The crops/crop aggregates considered in the present study were jowar, groundnut, paddy, bajra, cotton, sunflower (these six crops together accounted for about 85 per cent of the gross cropped area) and remaining crops put together under the category other crops. The actual proportion of area under different crops to gross cropped area of Raichur district is shown in Table 4.4.1. Area under paddy and sunflower showed a steady increase while rest of the crops displayed decreasing trend.

Table 4.4.1 Proportion of area under different crops in Raichur district (1989-90 to 1993-94)

YEAR/CROPS	JOWAR	G.NUT	PADDY	BAJRA	COTTON	SUNFLOWER	OTHERS
1989-90	0.3187	0.1287	0.0816	0.1070	0.0969	0.0692	0.1978
1990-91	0.2961	0.1213	0.1022	0.0903	0.0689	0.1510	0.1703
1991-92	0.2486	0.1218	0.1114	0.0786	0.0613	0.1850	0.1933
1992-93	0.2732	0.1086	0.1335	0.0799	0.0603	0.1705	0.1742
1993-94	0.2321	0.1017	0.1493	0.0766	0.0672	0.2162	0.1569

The transitional probability matrix which captures the probability of change of cropping pattern for Raichur district is presented in Table 4.4.2. The stability of the acreage share of these crops and their direction and volume of change over time were caught by the transition probability matrix. The diagonal elements of the matrix indicates the extent of stability of the crops. Hence as diagonal elements approach zero, the crops become less and less stable and as they approach one, the crops become more and more stable over time. The off-diagonal elements are the probabilities of switching between the crops.

From the Table 4.4.2, it could be inferred that paddy appeared to be the crop with highest stability followed by sunflower and bajra. The table also reveals that Raichur farmers retained about 78.78 per cent of previous periods share of paddy area during the current period. Similarly, sunflower and bajra retained 48.93 per cent and 5.49 per cent of their previous period's share of acreage respectively during current period.

Jowar crop lost 35.28 per cent of its previous area to groundnut. Similarly, it lost 5.2 per cent , 6.96 per cent, 17.59 per cent and 34.6 per cent of its previous periods acreage to paddy, bajra, cotton, sunflower and other crops respectively. But it stood to gain 61.52 per cent, 87.24 per cent and 66.88 per cent from groundnut, cotton and other crops previous periods acreage respectively.

Table 4.4.2 Transitional Probability matrix for cropping pattern changes (Raichur district)

CROPS	JOWAR	G.NUT	PADDY	BAJRA	COTTON	SUNFLOWER	OTHERS
JOWAR		0.3528	0.0520	0.0696	0.1759	0.3460	0.0037
G.NUT	0.6152						0.3848
PADDY		0.7878			0.1279	0.0844	
BAJRA		0.0131		0.0549			0.9320
COTTON	0.8724			0.1276			
SUNFLOWER		0.1071	0.1018	0.0146		0.4893	0.2872
OTHERS	0.6688		0.0723	0.2470	0.0119		

Paddy lost 13 per cent and 8 per cent of its area to cotton and sunflower respectively. Meanwhile, it gained 5.2 per cent, 10.18 per cent and 7.23 per cent of jowar, sunflower and other crops acreage respectively.

Major share of groundnut's area i.e., 61.52 per cent was lost to jowar and rest 38.48 per cent to other crops. It stood to gain 35.28 per cent of jowar's area, 1.31 per cent of bajra's area and 10.71 per cent of sunflower's area.

Cotton lost its major chunk of area (87.24 per cent) to jowar and rest 12.76 per cent to bajra. It gained from jowar (17.59 per cent), paddy (12.79 per cent) and other crops (1.19 per cent).

Bajra retained 5.49 per cent of its area, lost 1.31 per cent to groundnut and 93.20 per cent to other crops. It was benefited by jowar (6.96 per cent), cotton (12.76 per cent), sunflower (1.46 per cent) and other crops (24.70 per cent).

Similarly, sunflower retained 48.93 per cent of its previous periods acreage during the current period. It lost 10.71 per cent of its acreage to groundnut, 10.18 per cent to paddy, 1.46 per cent to bajra and 28.72 per cent to other crops. But at the same time it gained 34.60 per cent of jowar's acreage and 8.44 per cent of paddy's acreage of previous period.

The projected cropping pattern for Raichur district is shown in Table 4.4.3. The transitional probability matrix was used to project the cropping pattern of the district for 2000A.D. under the plausible assumption that the forces underlying the observed changes in cropping pattern shifts will remain the same in the future period. The projections for the years 1990-91 to 1994-95 when compared with the actual proportions given in the Table 4.4.1 for respective years would indicate the accuracy of the projections. It can be seen from the Table 4.4.3 that there is a drastic decline in the acreage of the district under major crop jowar. By the end of the century, jowar would occupy only 23 per cent of the gross cropped area. Even then, it stands to be the highest proportion to the gross cropped area by the end of the century.

Sunflower registered a significant growth (15.10 per cent) during 1991-92 as against 7 per cent in 1989-90 and there upon registered a gradual increase to attain 18.63 per cent of the gross cropped area by the end of the century. Paddy, another important crop of the Raichur district shows a gradual increase in acreage in the future and occupy 19 per cent of the gross cropped area by the end of the century.

The potential requirement of sunflower seeds for Raichur district for 2000A.D would likely be 1240.26 quintal. This was obtained by multiplying the projected area (18.63 per cent of the gross cropped area which is approximately equal to 204158 hectares) with the average seed rate for the

Table 4.4.3 Projected cropping pattern of Raichur district up to 2000 AD

YEAR/CROPS	JOWAR	G.NUT	PADDY	BAJRA	COTTON	SUNFLOWER	OTHERS
1990-91	0.2961	0.1213	0.1022	0.0903	0.0689	0.1510	0.1703
1991-92	0.2486	0.1218	0.1236	0.0786	0.0672	0.1850	0.1752
1992-93	0.2577	0.1086	0.1335	0.0799	0.0603	0.1859	0.1742
1993-94	0.2359	0.1157	0.1493	0.0766	0.0672	0.1892	0.1662
1994-95	0.2261	0.1061	0.1630	0.0708	0.0618	0.1987	0.1734
2000	0.2290	0.1021	0.1852	0.0711	0.0655	0.1863	0.1608

district (2.43 Kg/acre), assuming that the gross cropped area does not vary significantly in the short run.

4.5 Preference for the quality attributes of sunflower seeds

Conjoint analysis was used to estimate the preferences for the quality attributes of sunflower seed. Plan cards were administered to sample farmers according to the sampling procedure explained in chapter-III. The respondents were asked to rank/order the placards according to their preferences. The individual data so obtained were aggregated for the entire sample to get an impression of the utility for the target group as a whole. A summary of the results of the aggregate analysis is shown in the Table 4.5.1 and figure.4.

Price (cost) of the seed was by far the most important attribute to explain preference (relative importance 27.38 per cent). Low priced seeds were most preferred (utility 1.10) and medium priced seeds were least preferred (utility -2.0722). Variety as an attribute was of hardly any importance to the total group. The decrease in the utility from hybrid to local could be easily recovered by an addition in utility associated with any other factor.

Table 4.5.1 Results of Conjoint Analysis

Factors	Levels	Utilities	Relative Importance
Price	< Rs.180/Kg	1.1000	
	Rs.100 -180/Kg	-2.0722	27.38
	>Rs.180/Kg	0.9722	
Seed Size	Bold	0.5167	
	Medium	1.3278	18.46
	Small	-0.8111	
Duration	Long	-0.6083	10.50
	Short	0.6083	
Variety	Local	-0.4417	7.62
	Hybrid	0.4417	
Head Size	Large	0.7333	
	Medium	0.5556	11.12
	Small	-0.1778	
Seed Thickness	Thick	0.5722	
	Medium	0.4000	13.33
	Thin	-0.9722	
Resistant to pest and disease	Resistant	0.6708	11.58
	Susceptible	-0.6708	
Constant		9.2208	
Pearson's R	0.9220	Significance	0.0001
Kendall's Tau	0.8380	Significance	0.0056

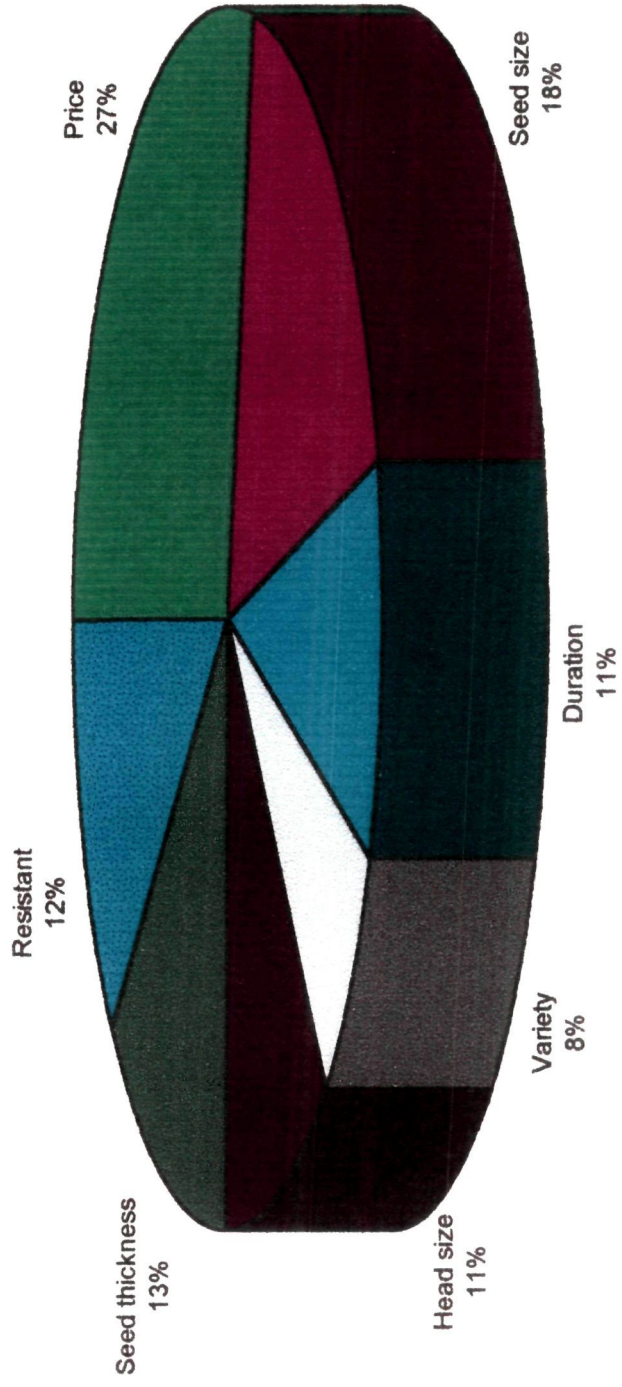


Figure 4. Relative importance of the sunflower seeds attributes

Seed size and seed thickness with relative importance 18.46 and 13.33 per cent respectively were preferred next to cost of the seed. Medium sized seeds were the most preferred and small sized seeds were least preferred. Also thick seeds (less husk) were most preferred and thin seeds (more husk) were least preferred.

The other factors viz., resistant to pest and disease, head size and duration were important to the farmers in order of preference with relative importance 11.58 per cent, 11.12 per cent and 10.50 per cent respectively.

4.6 Market segmentation

The aggregated data are frequently based upon utility structures that differs significantly over groups of respondents. Therefore, it is necessary to check whether any meaningful segments can be distinguished in such a way that respondents within a group have similar attribute utilities, while there exists important differences among groups. For this purpose cluster analysis was used on the relative importance and utilities derived separately for each factor for each respondent.

Table 4.6.1 and figure.5 shows the results clearly indicating the relative importance and utilities for the utility segments for seed attributes. The results also indicate the differences in relative importance and utilities between the segments.

Segment 1 including 16.67 per cent of the sample farmers considered head size, seed size and price(cost) of the seed to be important attributes for the sunflower seeds with average relative importance of 30.05 per cent, 26.99 per cent and 25.47 per cent respectively. They preferred large head size most (utility, 3.37) and small head size least (utility, -3.27). Similarly, medium sized seeds and low price seeds were most preferred. The average seed rate of this segment was 2.70 Kg/acre which was also highest for the entire target groups and the productivity was very low with 7qtl/hac. The average area under sunflower in this segment was 6.40 acres and the education level was up to 10th standard.

Segment 2 including 26.66 per cent of the respondents considered cost of the seed as the major attribute (29.46 per cent relative importance). This segment was characterised by the large farmers (average holding was 10.13 acres) having an average of 8.25 acres under sunflower. They preferred high cost seeds most with medium sized seeds, large head size and hybrid seeds. The average seed rate was 2.44 kg /acre and productivity was 8.38qtl/hac.

Table 4.6.1 Average Relative attribute importance, utilities and characteristics of the utility segments

Quality Attributes	Levels	Segment 1		Segment 2		Segment 3		Segment 4	
		Utilities	Rel. Impt.	Utilities	Rel. Impt.	Utilities	Rel. Impt.	Utilities	Rel. Impt.
Price	High	0.93	25.47	2.62	29.46	0.56	15.56	0.00	7.61
	Medium	-3.27		-3.48		-1.63		0.67	
	Low	2.33		0.85		1.03		-0.67	
Seed Size	Bold	0.97	26.99	-0.44	14.93	-0.85	26.29	-1.33	24.01
	Medium	2.47		1.31		1.74		-1.42	
	Small	-3.43		-0.87		-0.86		2.75	
Duration	Long	-0.35	3.56	-0.38	6.59	-0.25	6.95	-1.25	29.25
	Short	0.35		0.38		0.27		1.25	
	Local	0.00	2.69	-1.44	13.41	-0.14	4.77	0.03	0.36
Variety	Hybrid	0.00		1.44		0.14		-0.03	
	Large	3.37	30.05	0.92	16.01	0.68	13.20	2.92	34.26
	Medium	0.10		-0.17		0.13		3.46	
S. Thickness	Small	-3.27		-0.75		-0.55		-2.54	
	Thick	-0.83	8.75	-1.44	13.19	-0.10	16.28	-0.04	2.39
	Medium	-0.07		0.10		-1.00		0.13	
Resistance	Thin	0.90	2.49	1.33	5.91	1.10	16.95	-0.08	2.13
	Resistant	0.18		0.05		1.39		0.19	
	Susceptible	-0.18		-0.05		-1.39		-0.19	
Age (years)		37.00		31.25		33.00		39.50	
Education level		Up to SSLC		Up to SSLC		Up to SSLC		Up to 7 th Std.	
Land holdings (acres)		7.60		10.13		8.54		7.25	
Area under Sunflower (acres)		6.40		8.25		7.15		6.00	
Seed Rate (Kg/acre)		2.70		2.44		2.42		2.38	
Productivity (Qtl/hac)		7.00		8.38		8.62		7.00	

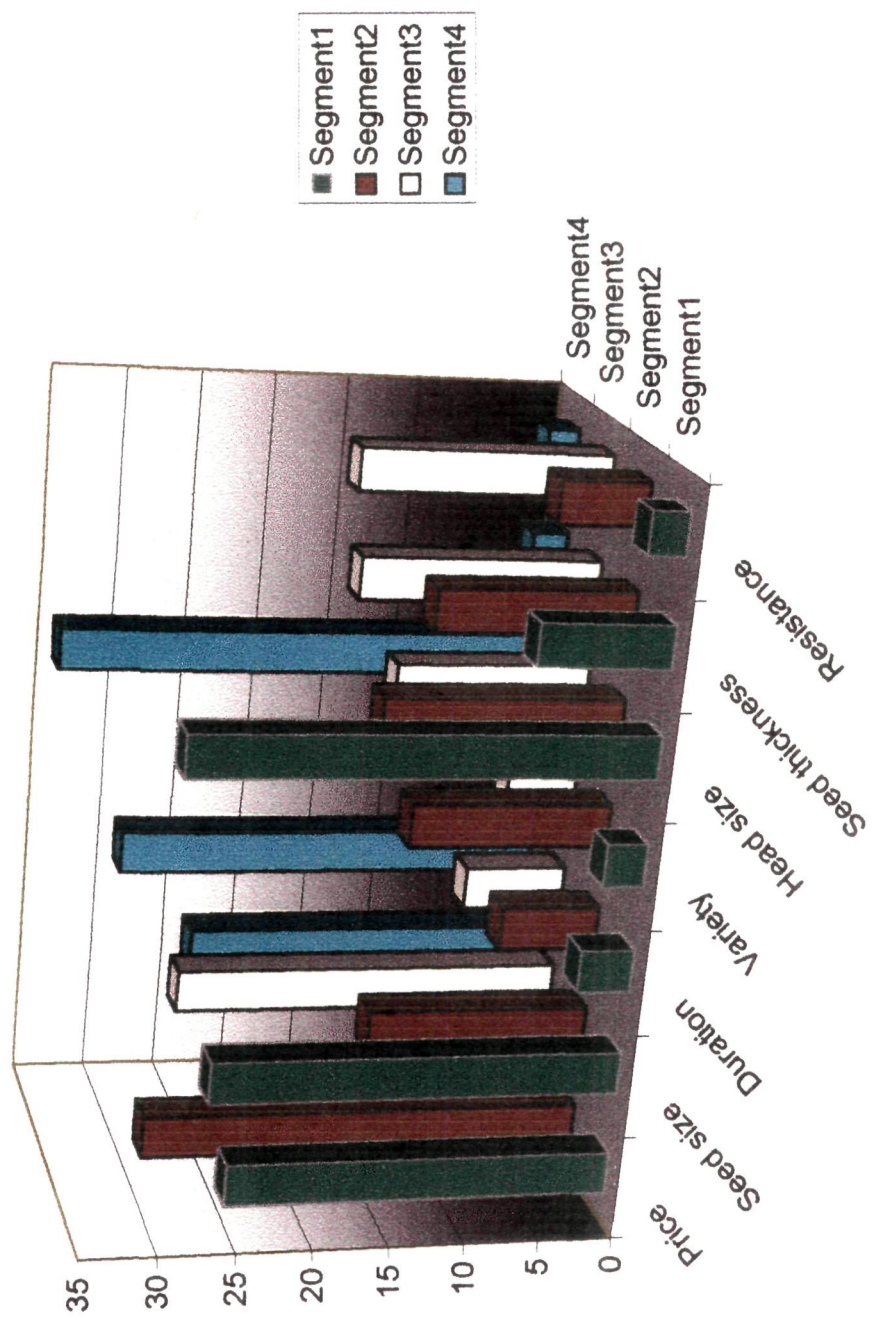


Figure.5. Average Relative attribute importance for the utility segments

Segment 3 consisting of 43.33 per cent of the respondents considered seed size (relative importance of 26.29 per cent), disease resistant variety (relative importance 16.95 per cent) and seed thickness (relative importance 16.28 per cent) as the most important attributes. This segment was characterised by middle aged people with education up to 10th standard, with average land holding of 8.54 acre, an average of 7.15 acre under sunflower cultivation and using 2.42 kg/acre with productivity of 8.62qtl/hac.

Lastly, *Segment 4* including 13.33 per cent of respondents considered head size, duration and seed size as the major attributes. This segment is characterised by lower education level and lower area under sunflower, with lower productivity (7.00qtl/hac) and relatively older people than other segments.

4.7 Problems confronted by farmers in cultivation and marketing of sunflower

As per the opinion survey conducted in the Raichur taluk with 90 farmers, the problems encountered in cultivation and marketing of sunflower are depicted in Table 4.7.1 and 4.7.2.

Table 4.7.1 highlights the problems faced by the farmers in cultivation of sunflower. 81.11 per cent of the farmers opined that there was pest and disease attack, 66.67 per cent expressed that there was instability in yield, 54.44 per cent and 45.56 per cent of the farmers respectively opined that they

Table 4.7.1 Problems in cultivation of sunflower

<i>Sl.No.</i>	<i>Problems</i>	<i>Percentage of farmers</i>
1.	Untimely supply of seeds	2.22
2.	Instability of yield	66.67
3.	Viability problems	54.44
4.	Germination losses	45.56
5.	Pest & disease attack	81.11
6.	Erratic rainfall	90.00
7.	Adulteration	27.78
8.	Lack of technical guidance	33.33

Table 4.7.2 Problems in Marketing of sunflower

<i>Sl.No.</i>	<i>Problems</i>	<i>Percentage of farmers</i>
1.	Price fluctuations	55.56
2.	Lack of storage facility	26.67
3.	Lack of Transportation	26.67
4.	Improper weighment	33.33

experienced viability problems and germination losses of the seeds. About 28 per cent of the sample farmers expressed that the seeds were admixed and 2.22 per cent farmers revealed that there was non-availability of seed supply during appropriate period of sowings. Ninety per cent of the farmers felt that erratic rainfall was the major problem in cultivation of sunflower. Another 33.33 per cent opined that there was lack of technical guidance to cultivate sunflower.

Table 4.7.2 shows the problems confronted in marketing of sunflower. About 55 per cent of farmers expressed that there was price fluctuations. Similarly, 26.67 per cent of farmers opined that there was lack of storage and transportation facility. As many as 33.33 per cent of farmers revealed that there was improper weighment in the with undue deductions for the moisture content, uncleaned products, etc.

DISCUSSION

CHAPTER V

DISCUSSION

The results presented in the previous chapter are discussed in this chapter and are presented under the following heads :

1. The first part deals with the pattern of sunflower seeds purchased by the farmers, sources of purchase and preference for the source of purchase.
2. The second part discusses the market structure, market share, brand loyalty and switching pattern and market potential for sunflower seeds.
3. The third part is devoted to study the farmers preferences for the quality attributes of sunflower seeds and segmentation of the respondents on the basis of their similarity in preferences.
4. Problems confronted by farmers in cultivation and marketing of sunflower are discussed in some detail.

5.1 Buying behaviour of farmers

In this section purchase of different varieties of sunflower seeds, source of supply and preference for the source of supply are discussed (Tables 4.1.1., 4.1.2 and 4.1.3).

The unbranded local seeds purchased/borrowed from fellow farmers had the major share with 53.09 per cent of the total sunflower seed purchased by the sample farmers. MAHYCO's MSFH-17 and MSFH-8 followed the next with 26.22 per cent and 7.61 per cent respectively. ITC-Zeneca's PAC-36 and PAC-8699 had 2.97 and 2.78 per cent respectively. KBSH-1 had the share of only 0.65 per cent and ASFH-17 had the least market share of 0.4 per cent.

Majority of the farmers (62.23 per cent) purchased sunflower seeds from the private dealers. About one third of the total farmers purchased from the fellow farmers who sold the seeds locally and the rest 5.55 per cent farmers purchased from either Karnataka State Seeds Corporation (2.22 per cent) or Karnataka State Department of Agriculture (3.33 per cent).

All the farmers who had purchased from fellow farmers had purchased unbranded seeds. These farmers were highly price conscious in nature which favoured them to opt for the low priced seeds (unbranded) from the fellow farmers. The farmers who were traditionally conservative convinced by the practical demonstrations, purchased seeds locally from farmers who had grown good crops. The other interesting finding of this study was that many large farmers also used local unbranded seeds so as to minimise the risk of cultivation by lowering the input (seed) cost of production while cultivating sunflower on large area. This was due to scanty and erratic rainfall pattern of the region during the kharif season.

The farmers purchasing seeds locally used higher seed rates (2.5 -3.0 kg/acre) than the recommended. This might be due to the following problems as opined by the respondents viz., adulteration of seeds, lower viability of seeds and germination losses. This could be the major reason as to why unbranded local seeds dominated with 53.09 per cent share of the quantity of seeds purchased, even though only 32.22 per cent of farmers purchased from fellow farmers.

The preferences for the purchase of seeds from fellow farmers, as expressed by sample farmers, was mainly due to the timely supply of seeds (31.11 per cent of farmers). This could again be attributed to the erratic rainfall pattern. The farmers take up sowing immediately after rainfall when there is sufficient moisture and timely availability (21.11 per cent) and timely supply of seeds matters the most to the farmers. The credit facility provided by the fellow farmer and the nearness to source of supply, for the immediate purchase, attracted the farmers to prefer fellow farmers as the source of supply (as opined by 21.11 and 12.22 per cent of farmers respectively).

It was also very interesting to note, some farmers opined, that these locally purchased unbranded seeds were either Mordane or EC-68415 varieties which were used up to fourth generation and many-a-times beyond fourth generation also.

Karnataka State Seeds Corporation and Karnataka State Department of Agriculture together accounted to 5.55 per cent of the sample farmers as the source of supply. The share of KSSC and KSDA were 2.22 per cent and 3.33 per cent of farmers respectively. The private seed firms and other agencies were doing a good business in the oilseeds, especially sunflower, because they concentrate more on commercial crops and hence KSSC and KSDA wanted to serve the farmers by supplying the seeds of those crops which were not covered by the private companies or other agencies. The farmers preferred KSSC and KSDA as a source of supply due to the low cost of seeds, timely availability of seeds and provision for technical information.

The study provided an insight that private seed dealers were the agents of the private seed firm who served majority of the farmers (62.23 per cent) in the study area as the source for sunflower seeds. The results of the opinion survey for preference of private dealer as source of supply revealed that the farmers were highly quality conscious (51.11 per cent of the farmers) and timely supply of seeds (44.44 per cent) formed the most important factor. The farmers judged the purity and quality of the seeds by their past experience and reputation of the firms and dealers and the tag attached to guarantee the purity and quality of the seeds. Again the erratic rainfall pattern of this region was important requiring more concern to make timely supply and availability of seeds. Some of the farmers also preferred private agencies as they were of some assistance in providing the technical information (8.89 per cent of farmers) and credit facility (5.55 per cent).

5.2 Market structure, Market share and Market potential

The technological revolution in agriculture has brought about certain structural changes in it. With the introduction of new technology in Indian agriculture during mid-sixties, the use of purchased inputs has increased. Seed is a very vital input for increasing agricultural production.

As the green revolution became popular in Karnataka, there was an increased demand for seeds of high yielding varieties (HYV). Agriculture in the state during the last two decades witnessed a structural transformation in favour of commercial crops, especially oilseeds. Among oilseeds, sunflower is gaining more importance in the state. To meet this increased demand for seeds in the state, a good number of government owned organisations like KSSC, NSC, co-operatives like Karnataka Oilseeds growers Federation (KOF) and private seed firms started working. In this section, an attempt has been made to study the market structure, share and potential of the different firms in terms of the quantities of different varieties of sunflower seeds marketed and the area under these varieties in the Raichur district.

The study revealed that the market was not evenly distributed as it was concentrated with few companies and fellow farmers. The Theil's Entropy Index which is an indicator of market concentration reflected an index of 0.4638 which shows that the market is moderately concentrated. The

fellow farmers producing and marketing seeds locally, Maharashtra Hybrid Seed Company (MAHYCO) and ITC-Zeneca together accounted for 92.65 per cent of the total sunflower seeds purchased by the farmers during khariff 1996 (Table 4.2.1).

It was found appropriate to use the area under different varieties of sunflower to study the market share and market potential rather than the quantity of seeds purchased as it was the acreage and seed rate which determined the quantity of seeds to be purchased. Brand loyalty and brand switching pattern was also studied by using the acreage sown under different varieties of sunflower seeds.

The market shares in terms of acreage under different varieties of sunflower seeds were analysed for two khariff season of 1995 and 1996, for the sample farmers in the study area (Table 4.3.1). It was observed that locally purchased seeds from fellow farmers had the largest share of acreage of 43.91 per cent to total area under sunflower. The integrated efforts by the central government, state governments through their different organisations and private seed entrepreneurs resulted in the supply of quality seeds to the farmers. But the age old form of transaction 'barter system' still exists among the farmers and formed the most popular source of seeds. The majority of the farmers are illiterate and only a few progressive farmers opted for the quality seeds through known sources like KSSC, NSC, Agricultural Universities, private seed traders etc., and demonstrations by extension agencies. Low cost

of seeds, erratic rainfall pattern etc., also motivated people to bring more acreage under locally purchased seeds from other farmers. However, the share of local seeds had decreased when compared to its previous years usage.

Among the private sector seed firms, MAHYCO's MSFH-17 has captured the largest share of acreage. It also figured as the hybrid which had second largest area of sunflower among the sample farmers next only to local seeds (29.285 per cent). It was the most popular hybrid variety among the farmers in the study area. MSFH-8, another hybrid variety released by the same company was also popular in that region. It had encapsulated 7.76 per cent of the sunflower area. MAHYCO had the highest reputation among the farmers particularly in case of sunflower seeds. The product image and advertisement image of this firm was very good when compared to others.

The other seed firm which enjoyed the popularity next to MAHYCO was ITC-Zeneca, with its two brands PAC-36 and PAC-8699, in the study area which shared 3.75 and 3.56 per cent of the sunflower area of the sample farmers respectively.

These two private seed firms had increased acreage for their seeds when compared with the previous year, while rest other seed firms/agencies had the decreasing trend in the acreage share under them. Mordane has shown tendency to lose its entire share in the future years.

The major concern of any producer of a product is to see that it gains undisputed acceptability. In other words, the producer wants his customer to be loyal. However, complete loyalty is seldom found and consumers switch from one brand to another due to advertising, special promotions, prices, dissatisfaction etc. Therefore, it is useful to have information on the switching habit of the seed buyers in the seed market which in turn can aid the firm to adopt suitable market strategies or corrective measures. The brand loyalty and switching patterns for the sunflower varieties popular among farmers in Raichur taluk were examined and the results are discussed below.

As explained earlier, local unbranded seeds enjoyed a major share in the seed market in Raichur taluk. This particular seed covered a major chunk (43.91 per cent) of the sunflower area. MSFH-17 and MSFH-8 had 29.285 per cent and 7.76 per cent respectively, while PAC-36 and PAC-8699 had 3.75 and 3.56 per cent area under sunflower respectively and all other brands together constituted 11.735 per cent (Table 4.3.1). However, it is of great importance for the firms to have information whether these shares were the result of loyal stable buyers or whether there is lot of switching from one brand to another. In order to study this, first order Markov-process was used. As detailed in methodology (chapter-III) transition probability matrix were formulated using the information on acreage under different brands during successive seasons. The transitional probability matrix for different varieties of sunflower seeds is given in Table 4.3.2. This indicates the probability of

brand loyalty as well as net gains and losses for any of the brands and also the interrelationships among the gains and losses for each brand.

The transitional probabilities provided in Table 4.3.2 indicates that local unbranded seeds purchased from the fellow farmer retained 90.16 per cent of its original share. It is likely to lose 1.37 per cent of its share equally to MSFH-17 and MSFH-8 and 7.10 per cent to other crops. On the other hand it had gained 78.13 per cent of KBSH-1's share and 24.39 per cent of the acreage from other crops to sunflower. This suggests that even though local unbranded seeds has fairly high loyalty, a good amount of brand switching is existing among different varieties.

The transitional probability matrix also indicated that the recently introduced hybrids GK-2002 of Ganga Kaveri and Arun-1 of the Indo American Hybrid Seeds Company had retained the maximum proportion i.e., 100 per cent of their previous years acreage under sunflower. Mordane had lost all its acreage to MSFH-8.

MSFH-17 hybrid had high purchaser loyalty as shown by a high retention of 93.83 per cent of its previous years acreage. It also gained 9.37 per cent from KBSH-1, 1.37 per cent from local unbranded seeds, 18.18 per cent from MSFH-8, 16.67 per cent from PAC-36, 11.38 per cent from PAC-8699, 38.89 per cent from SH-41, 50.00 per cent from sunbrid-212 and 36.59 per cent of acreage from other crops to sunflower. But it had lost only to

other crops by 6.17 per cent of its acreage. Thus, it is evident that there was net gain in acreage for this hybrid variety. It was the only brand which had gained from almost all the other brands but had not lost to any other brands except to other crops.

MSFH-8 hybrid had the retention of 72.73 per cent. It had lost 18.18 per cent to MSFH-17 and 9.09 per cent to other crops. But it had gained 1.37 per cent of local unbranded seeds, 12.43 per cent from PAC-8699, 100 per cent of Mordane's acreage and 17.07 per cent of other crops to sunflower.

It is clear from the popularity of two hybrids MSFH-17 and MSFH-8 that MAHYCO is gaining considerable acreage from other seed firms marketing sunflower and also from other crops. On the other hand, MAHYCO had lost only a meagre share to other crops. Thus it is the only firm which has the largest net gain in the market.

PAC-36 had retained 83.33 per cent of previous years acreage. The probability of switching over from PAC-36 to MSFH-17 was 0.1667. It had only gained from other crops area to sunflower by 4.88 per cent of its area and had gained 80 per cent and 9.76 per cent from KBSH-1 and other crops respectively. Meanwhile it had lost 12.43 per cent, 11.38 per cent and 27.59 per cent to MSFH-17, MSFH-8 and other crops respectively.

ASFH-17 of Amareshwara lost 80 per cent to PAC-8699 and its retention was only 20 per cent of its previous years acreage. Similarly, Sandoz's sunbrid-212 lost 50 per cent to MSFH-17 and retained 50 per cent of its acreage. Cargill's SH-41 lost 38.89 per cent to MSFH-17 and retained 61.11 per cent of its previous years acreage and gained 7.31 per cent of other crop's area to sunflower.

The switching pattern revealed that in the long run MAHYCO and local unbranded seeds would have a strong hold in the sunflower seed market. Though GK-2002 and Arun-1 has 100 per cent brand loyalty, their share in the seed market are very meagre and hence they might not have a hold on the seed market of Raichur taluk. However, ITC-Zeneca would also be a gainer in the long-run, but its share in the market will not be conspicuous enough to have a control in the seed market.

Demand forecasting for seeds is extremely difficult because of the nature of the product. However, it could be predicted with minimum errors in the short-run using Markov-chain. In the present study, an attempt has been made to forecast the seed requirement for sunflower in the Raichur district using aggregate quinquennial time series data on cropping pattern from 1989-90 to 1993-94. Minimum Absolute Deviation estimator was used to overcome the problem associated with the usage of aggregate data in the Markov-chain analysis. It was assumed that past trend in change in crop acreage would continue into the future also. Cropping pattern changes were

captured in the transition probability matrix and with the help of which the acreage under sunflower was projected for the years ahead up to 2000 AD. The product of the average seed rate of the district and the projected area gave the potential market for the sunflower seeds for 2000 AD assuming that gross cropped area does not change significantly in the short-run.

The crops/crop aggregates of the present study were jowar, groundnut, paddy, bajra, cotton, sunflower (together accounted for 85 per cent of gross cropped area) and other crops. Table 4.4.1 indicates that area under paddy and sunflower showed a steady increase while rest of the crops displayed decreasing trend.

The transitional probability for the cropping pattern changes for the Raichur district is presented in Table 4.4.2. The stability of the acreage share of these crops and their direction and volume of change over time were caught by the transition probability matrix. Paddy followed by sunflower and bajra showed the highest stability in the district. It was likely that the farmers retained 78.78 per cent of paddy, 48.93 per cent of sunflower and 5.49 per cent of bajra acreage during the current period.

There was a high probability of switching pattern noticed in case of jowar. It is likely that jowar loses to paddy, bajra, cotton, sunflower and other crops by 5.2 per cent, 6.96 per cent, 17.59 per cent and 34.6 per cent respectively. It also stands to gain 61.52 per cent of groundnut, 87.24 per cent

from cotton and 66.88 per cent of other crops acreage. Thus, there is lot of interchange between jowar and groundnut.

Sunflower is likely to lose 10.18 per cent and 10.17 per cent respectively to groundnut and paddy. The major loss of acreage is to other crop aggregates (28.72 per cent). However, it stands to gain 34.6 per cent of jowar area and 8.44 per cent of paddy area. This is mainly due to the fact that jowar is the rabi crop in Raichur, and there is assured rainfall in rabi season. Hence in khariff, the sunflower gains the area from jowar and from other crops and in rabi sunflower loses some of its acreage to crops for which water requirement is more than sunflower.

Using the transition probability matrix, the area under different crops were projected to 2000 AD (Table 4.4.3). The accuracy of the estimation can be judged by comparing the estimated shares with the actual shares given in Table 4.4.1. It was observed that the estimated area compares closely with the actual area under different crops indicating the accuracy of the model. It was estimated that sunflower would cover 18.63 per cent of the gross cropped area in the year 2000 AD. Assuming that gross cropped area does not vary significantly, the estimated area under sunflower would be 2,04,158 hectares. The average seed rate of the study area was 2.43 kg/acre (appendix I). The product of the estimated area and the average seed rate would indicate the market potential for sunflower seeds in Raichur district, and the same would be around 1240.26 quintal by 2000 AD.

5.3 Preferences for the quality attributes of sunflower seeds and market segmentation

Many agribusiness companies face saturated markets for most products. Consumer demand increases only slowly. For firms to sustain their profitability, a viable strategy may be to improve the quality of their product. Further more, such a strategy coincides with a distinct consumer trend to become more demanding about quality. However, a high quality strategy can only be successful if producer adapt a consumer oriented approach as ultimately the consumer decides which product to buy. His decision is largely determined by the way he perceives the quality of the product alternatives. The consumer trade-off quality against other aspects such as price and convenience in making his choice. So a consumer oriented approach to quality requires an insight into consumer's perspective on quality for product development, market segmentation and market communication.

This section deals with preferences of the farmers regarding the quality attributes of sunflower seeds and then the market segments which have similar quality preferences of the sunflower seeds.

In the empirical study, conjoint measurement approach, a versatile technique that can be used to study the consumer quality evaluation, was used to study the preferences for sunflower seeds. Based on the quality perception literature, group discussion with the farmers and sunflower

breeders, seven quality attributes and their levels were considered (Table 3.4). The results of the conjoint analysis are presented in Table 4.5.1.

Price (cost) of the seed was by far the most important attribute to explain preference. It had the highest relative importance of 27.38 per cent. Low priced seeds (less than Rs.100 per kg) were most preferred which was evident by the highest utility derived from the low priced seeds. Surprisingly, the medium priced seeds which ranged between Rs.100 to Rs.180 per Kg were least preferred (utility = -2.0722).

Variety as an attribute hardly bear importance to the total group. Variety as a whole had relative importance of only 7.62 per cent.

Seed size and seed thickness (thickness of the kernel) which were used by the farmers as a proxy to the oil content of the variety had the relative importance 18.46 and 13.33 per cent respectively. Medium sized seeds and thick seeds were most preferred (utilities = 1.3278 and 0.5722 respectively). Bold seeds were less preferred than the medium sized seeds and the small sized seeds were least preferred.

Varieties resistant to pest and disease and head size occupied the fourth and fifth place in the relative importance of attributes with 11.58 and 11.12 per cent respectively. Varieties resistant to pest & disease and having large head size were most preferred with utilities 0.6708 and 0.7333

respectively. This was due to the fact that farmers perceived the yield of the variety by the size of the head and resistant to diseases. Duration as an attribute found itself at the sixth position with relative importance of 10.5 per cent. Short duration varieties (80 to 90 days) were preferred most deriving the utility of 0.6083. As sunflower was grown mainly in the rainfed conditions in the Raichur taluk, they preferred short duration varieties against the long duration so as to ensure a good yield.

The fit of the additive model to the individual data was good; Pearson's $R = 0.922$ at a level of significance of 0.0001. This gives the strong confidence in the suitability of the additive model. Also, the coefficient of concordance, Kendall's Tau was 0.838 which shows that there was a high degree of agreement between the farmers judging the quality of the sunflower seeds.

Formation of market segments based on individual's quality perception instead of grouping respondents *a priori* criteria such as level of education, sex, etc., which may not correspond to differences between consumers with respect to the quality evaluation process of the product in question, would be more meaningful. For this purpose, cluster analysis was used on the relative importance and part-worth's derived separately for each factor and for each individual, which makes no prior assumptions about important differences within the population. The results clearly indicated the

differences in relative importance and utilities between the segments (Table 4.6.1).

Segment 1 including 16.67 per cent of the sample farmers considered head size, seed size and cost of the seed to be the most important attributes for the sunflower seeds. They did not derive any utility from the variety be it a local or an hybrid. This segment was highly yield conscious with low priced seeds. This segment had an average seed rate of 2.7 kg/acre which was also the highest for the entire target group. The productivity was very low when compared to other segments with 7.00 quintal per acre. Thus it is assumed that this was the segment which probably preferred the seeds produced locally by other farmers.

Segment 2 including 26.66 per cent of the respondents considered cost of the seed as the major attribute (29.46 per cent relative importance). The four attributes via., head size, seed size, variety and seed thickness (in order of preference) were almost equally important to this segment. This was highly quality prone segment which was characterised by the large farmers, large area under sunflower, with an average seed rate of 2.44 kg/acre and productivity of 8.38 quintal per acre. This segment preferred a combination of high cost, medium sized seeds, large headed hybrid seeds. This quality conscious segment would be characterised by its strong willingness to trade-off cost against variety (i.e., to pay more for better variety viz., hybrids).

Segment 3 covering 43.33 per cent of the respondents considered seed size, resistant varieties, seed thickness, cost of the seed and head size (in order of preference) as the important attributes. This segment was of mixed category with respect to yield and quality considerations. This segment was categorised by an average age group of 33 years, education level up to 10th standard, average land holding of 17.54 acres and an area of 7.5 acres under sunflower.

Segment 4 capturing 13.33 per cent of respondents was quite an interesting one and differed heavily from the other segments. They considered head size, duration, seed size as the major attributes (in order of preference). They derived maximum utility from medium priced seeds, medium head sized variety and small seed size. They also preferred local seeds deriving high utility than the hybrids. This segment was characterised by slightly older aged people than the other segments, lower education level with low area under sunflower, lower seed rate and low productivity.

5.4 Problems confronted by farmers in production and marketing of sunflower

The problems encountered by the farmers in production and marketing of sunflower are depicted in Table 4.7.1 and 4.7.2 respectively.

In the present study, the farmers were of the opinion that erratic rainfall pattern was the major problem in the production of sunflower. The

other equally important problems were the pest and disease attack, instability of yield, viability and germination losses. These could be attributed to the fact that majority of the seed purchased was dominated by the local unbranded seeds from the fellow farmers who sold in the loose form, which provided greater scope of adulteration. The other problem was the lack of technical guidance in cultivation of sunflower which might be due to the poor extension activity by the extension workers of the Agriculture Department.

Similarly, the major problem in marketing of sunflower was the wide fluctuation in prices. It is true that during peak season there will be glut in the market and prices naturally declines. It is necessary that these farmers are to be educated about the APMC markets and market information and pledge loans are extended to the these farmers. Majority of the farmers sold their produce to the village merchants who made undue deductions for the more moisture content, uncleaned products etc. The farmers sold their produce to the local village merchants as the villages were far located from the APMC markets and there was transportation and storage facilities problems.

SUMMARY AND IMPLICATIONS

CHAPTER VI

SUMMARY AND IMPLICATIONS

Seed is the most vital basic input for attaining sustained growth and production of crops. In fact, seed is the primary input of crop production, while other inputs like water and fertiliser can be regarded as complementary. The fact that cultivable area and other resources are limited, major break-through cannot be achieved unless sustained efforts are made to increase productivity through the use of the improved seeds. Therefore, the development of quality seeds and their supply are crucial for increasing crop production.

Oilseeds and oils have assumed crucial importance in the economy of our country. Oilseeds are the major agricultural crops next to the food grains and contribute approximately 5 per cent of the India's GNP and 10 per cent of the value of all the agricultural commodities. Oilseeds occupy about 13 per cent of the total cultivated area of our country. Being essential items in the human diet, oils, oilseeds and their derivatives account for 11 per cent of the cost of living index of Indian people.

India is a paradise for oilseeds crops. No other country has its range of perennial and annual oilseeds. In terms of area, India ranks first in ground nut, sesamum, linseed, safflower, niger and castor; second in rape seed, mustard; and third in sunflower.

It is well known fact that only 20 years ago, India was a net exporter of vegetable oils. Since then, increasing quantities of vegetable oils have been imported to fulfil domestic needs. In spite of this, the per capita consumption is very low at 12 gms/day/head as against the minimum nutritional requirement of 18 gms/day/head. The projected requirement of oils and fats by the end of the century is estimated at around 6.6 million tonnes equivalent to 24 million tonnes of oilseeds against the current production of 20 million tonnes. To meet this tremendous increase in oilseeds demand, its production should increase by way of improving the genetic potential of annuals by introducing the high yielding perennials and annuals of new oilseeds crops. Therefore, sunflower cultivation is one of the means to increase oilseeds production.

Sunflower (*Helianthus annus .L.*), a member of the Asteracea is believed to have originated in Mexico and southern states of USA. It is intensively cultivated in many countries such as USSR., USA., Canada, Argentina, Rumania, Turkey and some European countries. Its domestication as an oilseed crop was started first in USSR in the early part of the 19th century. Recently the varieties developed there with high seed yield and high oil potential have spread all over the world.

Large scale cultivation of sunflower in India started since 1972 with the introduction of high yielding Russian varieties. This crop is becoming increasingly popular in view of its short duration, wide adaptability and

ability to withstand drought. In addition, sunflower has good nutritive value. It contains about 19.8 gm of protein, 52.1 gm of fat (oil), 17.9 gm of carbohydrate and 2.80 gm of calcium per 100 gm of seeds. Nutritionally, sunflower has one more desirable characteristic feature. Just like safflower oil, sunflower oil is also considered good for patients suffering from cardiovascular diseases and hypertension, as it does not rise the cholesterol level of the blood due to its high content of linoleic acid. The oil meal can form a suitable supplementary food for infants suffering from protein-calorie malnutrition.

In India, sunflower was cultivated in 20.89 lakh hectare during 1992-93 as against an area of about 8.35 lakh hectare during 1984-85, thereby recording an increase of 150 per cent over a period of 8 years and the production has increased nearly three folds in just 8 years from 4.4 lakh tonnes in 1984-85 to 12.4 lakh tonnes in 1992-93. Karnataka stands first in country's area and production of sunflower occupying 14.69 lakh hectares with a production of 4.78 lakh tonnes during 1993-94. Among the 20 districts of the state, Raichur stands third in area and first in production of sunflower occupying 236924 hectares and 47101 tonnes with an average yield of 209kg per acre.

The demand for quality seeds is increasing year after year. It is necessary to cope with the increasing demand for sunflower in order to attain long term goals of self-sufficiency through higher productivity. This means

improvements are to be made both quantitatively and qualitatively in the supply of seed material. Though there was marked improvements in this direction, still a host of bottlenecks and problems are persisting in the system of seed marketing. The private and public agencies involved in the production and marketing seeds have to face stiff competition. For most varieties, the demand depends on the quality attributes perceived by the farmers. For firms to sustain their market share and profitability, a viable strategy may be to improve the quality of their products. However, a desirable quality strategy can only be successful if producers adopt a consumer oriented approach based on quality preferences. Therefore, insight into the farmers preferences for quality is useful in varietal development and marketing communications.

Thus in the present study, an attempt was made to focus on the various aspects related to the marketing of sunflower seeds in Raichur district. The study examined the demand for quality attributes and market potential for sunflower seeds. The specific objectives of the study were

1. To analyse the buying behaviour of sunflower seeds among farmers.
2. To study the market structure, market share and market potential for sunflower seeds.
3. To analyse the demand for quality attributes of sunflower seeds.

4. To analyse the problems confronted by the farmers in cultivation and marketing of sunflower.

The study was carried out in Raichur taluk of Raichur district of Karnataka. The district was purposively selected in view of the fact that the study area was having a high concentration of oilseeds production. As stated earlier, Raichur district ranks third in acreage and first in production of sunflower in Karnataka.

In Raichur taluk, ten villages were selected and from each village 9 farmers growing sunflower were selected randomly. Totally ninety sunflower growing farmers were interviewed through structured pre-tested questionnaire.

Simple tabular analysis was used to study the buying behaviour of sunflower seeds by the farmers and problems confronted in production and marketing of sunflower. Theil's Entropy Index was used to study the market structure. Market share and market potential were studied using First order Markov-chain and Minimisation of Absolute Deviation estimator was used to obtain the transitional probability matrix in the Markov-chain analysis. The preferences for quality attributes were analysed using Conjoint analysis and the market was segmented according to the similarity or likeness of the preferences for the quality attributes using cluster analysis with simple average linkages.

- 6.1 The locally produced and marketed unbranded sunflower seeds by the fellow farmers had the highest market share in the total sunflower seeds purchased by the sample farmers followed by MAHYCO's MSFH-17 and MSFH-8; ITC-Zeneca's PAC-36 and PAC-8699.
- 6.2 Private seed dealers served majority of the farmers, in the study area, as the source for sunflower seeds. Fellow farmers were the next most important source of seed supply to farmers. These two together constituted around 95 per cent of the seed supply in the study area. The rest five per cent was shared by the public sector seed companies.
- 6.3 The preference for private dealer as a source of supply was due to improved service extended by private agencies such as supply of quality seed material, timely supply of seeds, availability of stock, assistance in providing the technical guidance and credit facility (in order of preference). Similarly, the factors that favoured the farmers to choose fellow farmers as source of supply were timely supply of seeds, cost considerations, credit facility and nearness to the source of supply. Public sector seed companies were preferred for the timely supply and provision of technical guidance and cost considerations.
- 6.4 Theil's Entropy Index was estimated to study the extent of market concentration. The resultant index of 0.4638 revealed that the market for sunflower seed was moderately concentrated with few suppliers dominating the trade. Unbranded seeds produced by fellow farmers,

MAHYCO, and ITC-Zeneca accounted for as high as 93 per cent of the total sunflower seeds purchased by the farmers during khariff season.

6.5 The market share for individual brands and their switching pattern was estimated by employing Markov-chain analysis using area sown under different brands of seeds during two successive crop seasons. The analysis revealed that local unbranded seeds had the major share followed by MAHYCO's MSFH-17 and MSFH-8. These three varieties/hybrids constituted 81 per cent of the acreage under sunflower. ITC-zeneca's PAC-36 and PAC-8699 were also popular among the farmers with a share of 7 per cent. The rest of the seed firms/agencies together constituted only 12 per cent of the acreage under sunflower in the study area. A high degree of brand switching was noticed among the different varieties of seeds. However, MSFH-17 of MAHYCO possessed a high degree of brand loyalty among the seed purchasers. Assuming that similar situation would prevail, this particular variety would gain a remarkable market share in the periods ahead.

6.6 The market potential for sunflower seed was estimated by examining the likely changes in the cropping pattern of the district employing first order Markov-chain analysis. The results indicated that among others, sunflower had shown high stability accompanied an increasing trend in the area under the crop, while jowar, the major food crop of the district would lose substantial share of its present area to other crops. It was predicted that sunflower would cover about 18.63 per cent of the gross cropped area in the district by 2000 AD. Accordingly, the estimated

market potential for sunflower seeds would be around 1250 quintal per annum at the rate of 2.43 kg/acre seed rate.

6.7 The preference for the quality attributes were studied using conjoint analysis. Among the seven attributes included, the farmers attached maximum importance for cost factor followed by seed size, seed thickness, pest and disease resistance, head size, duration of the crop and variety in their purchase decisions. The farmers preferred the combination attributes such as low cost, medium sized, thick seeded, disease resistant variety having large head size and short duration hybrids. This combination would give the maximum utility to the farmers.

6.8 The market segmentation based on the likeness or similarity of preferences for quality attributes revealed that *segment 1* (including 16.67 per cent of the sample farmers) considered large heads having medium seed size and low price seeds as the most important attributes while purchasing the seed. *Segment 2* (26.66 per cent of sample farmers) was quality prone segment, who preferred high priced hybrids with medium sized thick seeds having large heads. This segment was characterised by large farmers having more area under sunflower with maximum productivity per acre (8.38qtl/acre). *Segment 3* (43.33 per cent of respondents) considered medium seed size, medium thickness, resistant to diseases and low price as the major attributes. This segment was a mixed category with respect to yield and quality considerations. *Segment 4* (13.33 per cent) considered head size, duration and seed size as the major

attributes. They preferred medium priced seeds having small head size and small seed size of local varieties. This segment was characterised by slightly older people than other segments, smaller land holdings and using low seed rate.

6.9 The farmers growing sunflower in the study area encountered a host of problems in production and marketing of sunflower. The low and erratic rainfall, pest and disease attack were the major problems equivocally expressed by the farmers in the production of sunflower. The other equally important problems in the cultivation were the instability of yield, poor viability of the seeds, germination losses and adulteration of seeds. There still exists the problem of availability of technical and financial help to the growers in spite of the efforts taken by the government and other financial agencies in the study area. The marketing constraints expressed by the growers were the high degree of fluctuation in the prices of sunflower during the peak season, lack of storage, transportation and undue deduction in the weighment.

The following are some of the implications of the study :

1. From the analysis of the buying behaviour and market share for different brands, it is evident that a major proportion of the seed is purchased from fellow farmers. There is no control over the quality of these seeds as the seeds supplied by the farmers are unbranded in loose form. Hence there is a large potential for the private seed firms to tap the market of local

unbranded seeds. The private dealers as agents of private seed firms have good reputation for the supply of quality seeds. The private seed firms can exploit this reputation by using appropriate sales promotion measures.

2. Seed admixtures and viability were the problems expressed by the majority of the farmers. This might be due to purchase of unbranded seeds from the local farmers. The farmers need to be educated on the use of certified or branded seeds to ensure the quality.
3. Farmers preference for attribute could be used by the breeders of public and private seed firms in developing the hybrids of farmers' choice. Apart from the oil content, the farmers in general prefer low priced, medium sized, thick seeded, disease resistant variety with large head size and short duration hybrids.
4. An examination of the likely changes in the cropping pattern of the district has revealed an increasing trend in the area under sunflower in Raichur district, while jowar the major food crop is likely to lose its present share. This means an increase in demand for sunflower seeds. It is predicted that sunflower would cover about 18.63 per cent of the gross cropped area in the district by 2000 AD. The estimated sunflower seed requirement would be 1250 quintal per annum by the end of the century.
5. The wide fluctuations in the prices of sunflower could be controlled by providing proper storage facility and advance loans to farmers in the APMC yards. It would also be helpful by providing link roads to APMC

markets from the villages as the villages are located far from the main road and providing storage facilities at the door steps of the farmers.

REFERENCES

CHAPTER VII

REFERENCES

- Alvensleben, R.V., Ziehlberg, R.V., Von-Alvensleben, R and Von-Ziehlberg, R., 1995, Consumer attitudes to organic milk. *Douische Milchwirstchayt*, **46(3)** : 159-161.
- Anderson, J.L. and Bottencourt, S.U., 1993, A conjoint approach to model product preferences : The new England market for fresh frozen salmon. Working paper on public policies and food system preferences, WP No.32, pp18.
- Anderson, M., 1994, Consumer demand for food-socio-economic and demographic factor impact on Swedish food expenditures. *Avhandlingar*, **10** : 118.
- Atkin, M. and Blandford, D., 1982, Structural changes in import shares for apples in UK. *European Journal of Agricultural Economics*, **9(1)** :313-326.
- Baker, G.A. and Crosbie, P.J., 1993, Measuring food safety preferences : Identifying consumer segments. *Journal of Agricultural and Research Economics*, **18(2)** : 277-287.
- Becker, S.C.B., Weaver, P.A. and Crawford, W.S., 1993, A pilot study utilising conjoint analysis in the comparision of age-based segmentation strategies in the Full Restaurant market. *Journal of Restaurant and Food Service Marketing*, **1(2)** : 71-91.
- Becker, T., Benner, E. and Glitsch, K., 1996, Change in consumer behaviour as regards meat. *Agrarwirtschaft*, **45(7)** : 267-277.

- Behe, B.K. and Nelson, R.G., 1995, Consumer preferences for germanium flower colour, leaf variegation and price. *Highlights of Agricultural Research of Alabama Agricultural Experiment Station*, **42(4)** : 7-8.
- Behe, K.B., Prince, T.A. and Tayama, H.K., 1992, Market segmentation of super market floral customers. *Hort. Science*, **27(5)** : 459-462.
- Benedict Jan, E.M. and Steenkamp, 1987, Conjoint measurement in Ham quality evaluation. *Journal of Agricultural Economics*, **38(3)** : 473-480.
- Bhide, S., Chowdhary, A., Heady, O.E. and Muralidharan, M.A., 1981, Structural changes in an agricultural assembly market. A case study of Arecanut (Betelnut) market in Mangalore, Karnataka State. *Indian Journal of Agricultural Economics*, **36(2)** : 25-34.
- Buckwell, A.E., Shucksmith, D.M. and Young, D.A., 1983, Structural projections of the Scottish dairy industry using micro and macro Markov transition matrices. *Journal of Agricultural Economics*, **34(1)** : 57-68.
- Cattin, Phillipe and Dick R. Wittink, 1982, Commercial use of conjoint analysis - A survey. *Journal of Marketing*, **46** : 44-53.
- Chamola, S.D. and Pannu, R.S., 1996, Behaviour of cost and price margins in Seed marketing. *Agricultural Marketing*, pp 45-47.
- Chavas, J.P. and Magand, D., 1988, A dynamic analysis of the size distribution of firms : The Case of the US dairy industry. *Agribusiness*, **4(4)** : 315-329.
- Chowdhary, A., Earl O. Heady, and Muralidharan, M.A., 1981, Structural Changes in agricultural assembly market : A case study of arecanut market in Mangalore, *Indian Journal of Agricultural Economics*, **34(2)** : 25-29.
- Delgado, M.L. and Caldentey, P., 1993, Market segmentation in wine consumption. *Investigation Agraria, Economia*, **8(2)** : 209-221.

- Disney, W.T., Duffy, D.A. and Hardy, W.E., 1988, A Markov Chain analysis of farm size distribution in the South. *Southern Journal of Agricultural Economics*, **20**(2) : 57-64.
- Edwards, C., Smith, M.G. and Peterson, R.N., 1985, The changing distribution of farm size ; A markkov Analysis, *Agricultural Economic Review*, **37**(4) : 1-16.
- Erthridge, D.E., Roy, S.K. and Myers, D.W., 1983, Changes in the structure of the Texas high plain cotton growing industry, 1967-1979. *Agricultural Economic Review*, **35**(3) : 12-24.
- Fenwick Ian ., 1978, A user's guide to conjoint measurement in marketing. *European Journal of Marketing*, **12** : 203-211.
- Fisher, W.D., 1961, A note on curve fitting with Minimum deviations by linear programming. *Journal of American Statistical Assoc.*, **56** : 359-363.
- Gan, C. and Luzar, E.J., 1993, A conjoint analysis of Waterfowl hunting in Louisiana. *Journal of Agricultural and Applied Economics*, **25**(2) : 36-45.
- Gemtessa, K., 1991, An analysis of the structure of Ethiopian coffee exports. M.Sc (Ag)., Thesis (Unpub.), University of Agricultural Sciences, Bangalore.
- Gerhardy, H. and Ness, M.R., 1995, Consumer preferences for eggs using conjoint analysis. *World Poultry Science Journal*, **51**(2) : 203-214.
- Gineo, W.M., 1990, A conjoint /Logit analysis of nursery stock purchases. *North Eastern Journal of Agril. and Resource Economics*, **19**(1) : 49-57.
- Godbole, S.V., 1978, Preferences for Product class and Brand. A Case study. *Punjab University Management Review*. **1**(1) : 93-102.
- Goldberger, A.S., 1964, *Econometric Theory*, Pub. John Wiley and Sons, New York, pp 260-290.

U. A. S.
University Library
DHARWAD.

Acc. No. *7H* 6292

- Green, P.E. and Krieger, A.M., 1991, Segmenting markets with conjoint analysis. *Journal of Marketing*, **55** : 20-31.
- Green, P.E. and Rao, V.R., 1971, Conjoint measurement for quantifying judgmental data. *Journal of Marketing Research*, **8** :355-363.
- Grunert, S.C. and Jubl, M.J., 1995, Values, Environmental attitudes and Buying of organic foods. *Journal of Economics Psychology*, **16**(1) : 39-62.
- Gurudev Singh, and Asokan, S.R., 1992, Marketing of Seeds in India : Status and Issues, *Indian Journal of Agricultural Marketing*, **6**(2) :34-45.
- Halbrendt, C., Pesek, J., Parsons, A. and Lindner, R., 1994, Consumer preferences for pST-supplement pork. *Australian Journal of Agricultural Economics*, **38**(2) : 189-202.
- Halbrendt, C., Wang-qingbin, Fraiz, C., Dierro, L. and Wang, O.B., 1995, Marketing problems and opportunities in Mid-Atlantic Seafood retailing. *American Journal of Agricultural Economics*, **77**(5) : 1313-1318.
- Hanson, G.D., Rauniyar, G.P. and Herrmann, R.O., 1994, Using consumer profiles to increase the US market for seafood implications for agriculture. *Agriculture*, **127**(4) : 303-306.
- Hermann, R.O., Rauniyar, G.P., Hanson, G.D. and Wang, G.O., 1994, Identifying frequent seafood purchasers in the North-eastern US. *Agricultural and Resource Economics Review*, **23**(2) : 226-235.
- Huang, C.J. and Fu, J.,1993, Consumer preferences and evaluation of a processed meat product. *Journal of Food Distribution Research*, **24**(1) : 149-157
- Huang, C.J. and Fu, J.,1995, Conjoint analysis of consumer preferences and evaluation of processed meat. *Journal of International Food and Agric. Business Marketing*, **7** :35-53.

- Hutchison, N.R. and Robertson, J.L., 1979, Consumer Demand Analysis for Roses *Journal of American Society of Horticultural Sciences*, **104**(3) : 303-308.
- Jayaram, A.P., Hiremath, K.C. and Rathi, S.S., 1983, Efficiency of bidi-tobacco markets in Nippani area of Karnataka state, *Indian Journal of Marketing*, **26**(2) : 1-5.
- Johnson, R.M., 1974, Trade-off Analysis of Consumer Values, *Journal of Marketing Research*, **11**(1) : 121-127.
- Kaurshal, R., Raghubanshi, C.S. and Sinha, B.K., 1976, Purchasing Behaviour Pattern of the consumer and their Brand Preference for Washing Soaps/detergents. A Case Study of Simla. *Indian Journal of Marketing*, **8**(4) : 9-14.
- Kool, M., 1994, Vendor loyalty of farmers : Characterisation, Description and analysis. *European Review of Agricultural Economics*, **21**(2) : 287-307.
- Krantz, D.H. and Tversky, A., 1971, Conjoint measurement analysis of composition rules in Psychology, *Psychological Review*, **78** 151-169.
- Krause, J.H., Wilson, W.W. and Dooleg, F.V., 1995, Global market segmentation for value added products. *Agribusiness New York*, **11**(5) : 195-206.
- Kunnal, L.B. and Shankara Murthy, H.G., 1994, Seed market in Karnataka - A market share analysis. *The Bihar Journal of Agricultural Marketing*, **2**(4) : 347-357.
- Libbin, 1982, An economic analysis of U.S. Farm size. *Journal of Agricultural Economics*, **33**(3) : 182-190.
- Luce, R.D and Tukey, J.W., 1964, Simultaneous conjoint measurement : A new type of fundamental measurement. *Journal of Mathematical Psychology*, **1** : 1-27.
- Madansky, A., 1959, Least Square Estimation in Finite Markov process. *Psychometrica*, **24** : 137-144.

- Math, K.K. and Ganajaxi, 1997, Sunflower Oil - A Premium Vegetable Oil. *Kissan World*, pp 43-44.
- Mellor, C.J., 1984, An application and extension of Markov chain model to cereal production. *Journal of Agricultural Economics*, **35**(2) : 203-218.
- Miller, G.A., 1952, Finite Markov process in Psychology. *Psychometrika*, **17** : 149-167.
- Moore, W.L., 1980, Levels of aggregation in conjoint analysis : An Empirical comparison. *Journal of Marketing Research*, **17** : 516-523.
- Narasimham, N.V., Oppen, M.V. and Rao, P.P., 1985, Consumer preferences for groundnut quality. *Indian Journal of Agricultural Economics*, 524-535.
- Ninan, K.N., 1987, Edible oilseeds – Growth and Area Responses, *Economic and Political Weekly*, **12**(39) : A97-A110.
- Padberg, I.D., 1962, The use of Markov process in measuring changes in market structure. *Journal of Farm Economics*, **41**(1) : 189-199.
- Prince, T.L., Robertson, J.L. and Chatfield, L.M., 1980, Factors affecting marketability of Roses. *Journal of American Society for Horticultural Science*, **105**(3) : 388-393.
- Punj, G. and Stewart, D.W., 1983, Cluster analysis in marketing research : Review and Suggestion for application. *Journal of Marketing*, **20** : 134-147.
- Rajendra Prasad, S., Reddy Venkata, T.N., Sathyanarayana Reddy, Siddappa, B., Ashwathiah, B. and Jagadish, G.V., 1989, A survey on adoption of improved seed technology practices in sunflower in Mysore district. *Seed Tech News*, **19**(4) : 11.

- Ramamoorthy, K., Rajafopalan, V. and Varadarajan, S., 1984, Structure, Conduct and Performance of Tomato Marketing in Coimbatore. *Indian Journal of Marketing*, **14**(5) :19-24.
- Reddy Venkata, T.N., Rajendra Prasad, S., Ashwathiah, B. and Siddappa, B., 1989, Barter system of seeds among farmers. *Seed Tech News*, **19**(4) : 9-10.
- Robertson, J.L. and Chatfield, L.H., 1980, Fresh flower merchandising in loose bunches. *Horticultural Science*, **17**(4) : 593-595.
- Shafer, B.S. and Kelly, J.W., 1986, The influence of cultivar, price and longevity on consumer preferences for potted chrysanthemums. *Horticultural Science*, **21**(6) : 1412-1413.
- Sidhu, M.S., 1996, Seed use practices of farmers in Punjab. *The Bihar Journal of Agricultural Marketing*, **4**(4) : 369-376.
- Singh, J.D. and Singh, R., 1981, A study of brand loyalty in India. *Indian Journal of Marketing*, **11**(11-12) : 15-21.
- Solheim, R. and Lawless, H.T., 1996, Consumer purchase probability affected by attitude towards low fat food. *Food Quality and Preference*, **7**(2) : 137-143.
- Styan, P.H.G., and Smith, H., 1964, Markov Chain applied to marketing. *Journal of Marketing Research*, **1**(1) : 50-55.
- Sujatha, M., Chengappa, P.G. and Ravi, P.C., 1989, Performance of Market intermediaries in a regulated market - A Case study. *Indian Journal of Agricultural Marketing*, **3**(1) :1-4.
- Theil, H., 1963, On the use of incomplete prior information in Regression Analysis. *Journal of American Statistical Assoc.*, **58** : 401-414.
- Veena, U.M., 1992, An Econometric analysis of Indian coffee exports, M.Sc (Ag) Thesis (Unpub.), University of Agricultural Sciences, Bangalore.

Venkataram, R. and Varadarajan, S., 1992, Fertiliser buying behaviour of farmers.

Indian Journal of Agricultural Marketing, **6(2)** : 46-47.

Vickers, Z.M., 1993, Incorporating tasting into a conjoint analysis of Taste, Health claim, price and brand for purchasing strawberry yoghurt. *Journal of Sensory Studies*, **8(4)** : 341-352.

Vijaya Sarathy, R.K., 1980, A case study of consumer opinion survey for dairy products. *Indian Journal of Marketing*, **10(9)** :9-12.

Wilson, W.W., Woo, W.W. and Carter, C.A., 1990, Importer loyalty in the International Wheat Market. *Journal of Agricultural Economics*, **41(1)** :94-102.

Zellner, A., 1962, An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of American Statistical Association*, **57**: 348-368.

APPENDICES

APPENDIX I

General information of the sample farmers of the Raichur taluk

Average size of the Family:	
No. of Males	3.8
No. of Females	3.1
No. of Children	2.3
Average age of the Head of the family (years)	33.23
Education Level (percentage of farmers):	
Primary	23.32
Higher secondary	67.16
Pre university	4.28
Degree	2.87
Post graduate	2.37
Average Land holdings (acres)	9.38
Area under sunflower (Kharif) (acres)	8.82
Average seed rate of sunflower (Kg/ acre)	2.43
<u>Average productivity (quintal/ hac)</u>	<u>8.3</u>

APPENDIX II

Cropping pattern of sample farmers of Raichur taluk (in acres)

Crops	Kharif	Rabi
Sunflower	8.82	0.97
Greengram	3.13	
Jowar	1.91	5.26
Bajra	0.39	
Groundnut	0.97	
Wheat		1.82
Safflower	0.90	
Bengalgram		1.00