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**“AN ECONOMIC ANALYSIS OF PRODUCTION AND  
MARKETING OF *RABI* POTATO IN PUNE DISTRICT”**

By

**AMOL TATYASAHEB PATIL**

(Reg. No.04/173)

A Thesis submitted to the

**MAHATMA PHULE KRISHI VIDYAPEETH,  
RAHURI – 413722, DIST. – AHMEDNAGAR,  
MAHARASHTRA STATE (INDIA).**

In partial fulfilment of the requirements for the degree

of

**MASTER OF SCIENCE (AGRICULTURE)**

in

**AGRICULTURAL ECONOMICS**

Approved by Advisory Committee

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**DEPARTMENT OF AGRICULTURAL ECONOMICS,  
COLLEGE OF AGRICULTURE,  
PUNE – 411 005.**

**2007**

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**DEPARTMENT OF AGRICULTURAL ECONOMICS,**

**COLLEGE OF AGRICULTURE,**

**PUNE – 411 005.**

**2007**

## **CANDIDATE'S DECLARATION**

I hereby declare that the thesis entitled, “**AN ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF *RABI* POTATO IN PUNE DISTRICT**” or part thereof has not been submitted by me or any other person to any other university or institute for a Degree or Diploma.

**Place :** College of Agriculture, Pune -5

**Date :**     /     / 2007

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## **CERTIFICATE**

This is to certify that the thesis entitled “**AN ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF RABI POTATO IN PUNE DISTRICT**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist.-Ahmednagar, (Maharashtra) for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS**, embodies the results of a piece of *bona fide* research work carried out by **Mr. AMOL TATYASAHEB PATIL** under my guidance and supervision and that no part of the thesis has been submitted to any other university for any other degree, diploma or publication in any other form.

The assistance and help received during the course of this investigation and source of literature referred to has been duly acknowledged.

**Place :** Pune-5.

**Date :** / / 2007

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**(Chairman and Research Guide)**

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Pune – 411 005.

## **CERTIFICATE**

This is to certify that the thesis entitled, “**AN ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF RABI POTATO IN PUNE DISTRICT**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, District Ahmednagar (Maharashtra) in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL ECONOMICS**, embodies the results of a piece of *bona fide* research work carried out by **Mr. AMOL TATYASAHEB PATIL**, under the guidance and supervision of **Prof. N. K. Kale**, Assistant Professor of Agril. Economics, Department of Agricultural Economics, College of Agriculture, Pune-5 and that no part of the thesis has been submitted to any other university for any other degree, diploma or publication in any other form.

**Place :** Pune-5

**Date :**     /     / 2007

**(R. N. Sabale)**

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*Place : Pune*

*Date : / / 2007*

*(Amol Tatyasaheb Patil )*

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**ABSTRACT****“AN ECONOMIC ANALYSIS OF PRODUCTION AND  
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By

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A candidate for the degree

Of

**MASTER OF SCIENCE (AGRICULTURE)**

COLLEGE OF AGRICULTURE, PUNE-411005

2007

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Research Guide	:	Prof. N.K. Kale
Department	:	Agricultural Economics

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The present investigation was intended to depict the picture of *rabi* potato growing enterprise in Pune district of Maharashtra state. The study was conducted with a view to study the resource use structure in the *rabi* potato cultivation, to estimate per hectare cost and returns from potato and also to identify the problems involved in production and marketing of *rabi* potato.

The data collected relate to the year 2004 – 05. The study covered 120 *rabi* potato cultivators, 40 each from small (0.01 to 2 ha) medium (2.01 to 4 ha) and large (4.01 and above ha.) size groups of holdings and spread over 4 villages from Ambegaon and Khed tahsils of Pune district. For estimating the resource use level and productivity of the sample farm, Cobb – Douglas type of production function was used.

The findings of the study showed that at the overall level, total area under *rabi* potato was 1.55 ha. At the overall level, per hectare use of human labour was 110.10 man days comprising of 64.94 male labour and 67.41 female labour. The per hectare bullock labour, machine labour,

tubers and plant protection use was 6.72 pair days, 10.59 hours, 1480.55 kg and Rs. 2053.39 respectively. While manures and fertilizers used were 10.69 Cartloads and 414.50 kg respectively.

The average total cost of production (cost C) was Rs. 56935.02. The major items of cost of cultivation were tubers, fertilizers and rental value of land. Average gross returns and net profit was Rs. 87772.08 and Rs. 30887.06. The output-input ratio at cost C was 1.54 greater than 1 therefore it is profitable crop.

The per quintal average marketing cost for unstored potato and stored potato were Rs. 95.00 and Rs. 114.95. The major items of marketing cost for stored potato was storage cost that is Rs. 20.83. The other major items of marketing cost for the unstored potato and stored potato were transportation , commission and packing that is nearly Rs.27.00, Rs. 40.00 and Rs. 15.00, while shares of wholesaler and retailer were 4.54 per cent and 6.06 per cent respectively for unstored potato and 2.86 per cent and 4.36 per cent respectively for stored potato.

The per quintal storage cost of *rabi* potato was Rs. 20.83. The loss in monetary value and interest on value of stored potatoes were major items of storage cost of *rabi* potato contributing 84.39 per cent of the total storage cost. Depreciation interest on structure and filling and taking out charges were another items of storage cost contributing 15.60 per cent of the total storage cost of *rabi* potato.

The MVP/F ratio for manures has got negative impact showing that manures use should be minimized. The ratio for MVP/F for all other remaining variable is less than one but more then zero showing sub-optimal use of resourses by way of efficient use, hence efficiency can be increased by minimizing these resourses.

The major constraints faced by the potato growers in production were non availability of quality tubers at cheap rates, high fertilizer and wage rates, non availability of loan facility in time and in marketing major difficulties expressed by farmers were price variation, high commission rates, high transport cost etc.

The study therefore suggest that the *rabi* potato growers should be given adequate and timely supply of input like quality tubers, fertilizers, pesticides etc. at reasonable rate, also supply credit in time to purchase above inputs. Government cold storage facilities should be provided at low cost by the government. Steps should be taken at the government level to regularize the transport charges. Government should fix the support prices as well as ceiling prices at a level fair to both producer as well as consumer. Market information should also be provided to potato growers.

# 1. INTRODUCTION

## 1.1 Importance of Tuber crops

Tuber crops are the third most important food crops of civilised society after cereals and grain legumes. They constitute either staple or important subsidiary food for about a one fifth of the population of the world. Tuber crops are important in seasonal results. They have a higher biological efficiency as food products and show the highest rate of dry matter production per day per unit area among all the crops. They constitute important and cheap source of food and energy especially for the weaker sections of the population. Most of the tuber crops are able to produce economic yields in a variety of marginal soils and environmental conditions. Their capacity to grow under near drought conditions is remarkable. The tubers being rich in starch are being increasingly used as raw materials for many industries and as animal, fish and poultry feed.

Potato belongs to the family solanaceae, genus *Solanum* and species *tuberosum*. Potato (*Solanum tuberosum* L.) is one of the important tuber crops in India. Potato is a native of the High Andes in South America. It occupies the largest area under any single vegetable in the world. It was first introduced in India some time at the end of the 16<sup>th</sup> or the beginning of the 17<sup>th</sup> century. Its commercial cultivation and consumption in large quantities in India, however, began in 1932.

## 1.2 Research and development of potato

Most of the research work on potato is being carried out in India by the Central Potato Research Institute (CPRI) at Shimla and the All India Coordinated Potato Improvement Project (AICPIP) under the Horticulture Division of the Indian Council of Agricultural Research (ICAR). The institute has 10 research stations including the head quarters

located in eight states with 570 hectares of land under control for experimental farming. Most of the state agricultural universities interested in Research and Development work on potato, in close collaboration with CPRI and AICPIP. The CPRI has been active in evolving potato strains suited for the different agro climatic zones of the country. Since 1949, when it was first set up, the institute has developed Kufri Jyoti and Kurfi Badshah, two varieties of potatoes most suitable for tissue culture multiplication and for production of diseases free and healthy tubers for cultivation.

The CPRI has also developed a true potato seed, which is better than hybrid seed and more economical and easier to transport.

### **1.3 Important features of potato crop**

The important features of potato, which are major considerations for exploitation of the crop in Indian Agriculture are

1. Its maturity period is short.
2. It is adaptable to wider variation in regional and climatic conditions and sowing and harvesting periods.
3. It shows marked response to fertilizer.
4. It yields highest amount of food per unit area in the shortest possible time.
5. It fits nicely with relay and rotational crop patterns with other crops.
6. It is easy to cook, boil or bake whole.
7. In its fresh state, it has a good self storage life, which can be extended over a long period by converting into dry products.
8. It blends very well with almost all food stuffs of vegetable or animal origin.

9. The surplus produce can be converted easily into sun dried and other processed product like vapours, chips which are of great demand.
10. As a relay crop using suitable varieties it yields up to 150 – 200 quintals per hectare within 60 to 80 days both during autumn and spring seasons.

#### **1.4 Importance of potato crop in agricultural economy**

Importance of potato crop in the underfed countries in general and in the underdeveloped and socially backward areas in particular has been well established. One of the most important tasks facing the country is that of fighting malnutrition among the vulnerable sections of the society. In India where millions lack a wholesome diet, unexplored food resources must be unearthed and utilized. Potato is a crop which has always been 'poor man's food'. Potato having a high nutritive value and superior quality protein, has the potential of forming a viable subsidiary food crop in India and may remove the nutritional imbalances.

From the point of view of the farm economy it would be very useful to grow potato as it is a cash crop and earns a considerable amount of net profit. This also may help in diversification of farming. It serves as an important source of food to army to meet shortage of food and even as a usual item of food.

In India, the per capita availability and consumption of potato is 25 kg per annum as against 124 kg in Australia, 147 kg in Belgium 680 – 750 kg in Western Europe and North America and 300 to 700 kg in Eastern Europe and a world average of 60 kg per person per annum. Nutritionists are pushing for increased consumption so that not only food and nutritive security is assured but existing pressure on cereals is also

relieved. Qualitatively wheat, rice and potato are not different in their carbohydrate and calorie content.

Potato can be grown even under rainfed conditions in certain parts of the country. It responds well to heavy dose of fertilizer and other forms of inputs resulting in high yields and thereby increasing the income of the potato growers. Use of right varieties, right seed and recommended dose of fertilizers, coupled with proper irrigation and phytosanitary measures will ensure a rich yield to feed the millions. Potato crop has played an important role in solving the food problem of many countries in the world. In Indian agriculture due to varying agro-economic conditions and population growth potato deserves a much more important place than what it occupies currently.

### **1.5 Importance of potato in human diet**

Potato as a vegetable is of great importance in our daily diet. Potato is one of the richest sources of calorie needed to maintain day to day output of human energy. Potato is a wholesome food. Apart from starch, which is rich source it provides essential body building substances such as vitamins, minerals and proteins. Potato provides most of the trace elements many of which are needed for the maintenance of human health.

Potato is valuable food for those who seek to lower their blood process. Potato is rich in potassium; the ash factor of potato is a store house of minerals and inorganic element. Since the ash is rich in alkaline constituents, potato unlike meat, eggs, rice and wheat has a good alkaline effect. In vegetarian diets or diets low in calcium content, potato has a favourable place. Vitamins particularly those belonging to C and B groups are present in potato in sufficient quantities. These are Niacin, Thiamin and Riboflavin and vitamin B group. Besides this it also contains calcium, phosphorus, iron etc.

### 1.6 Area, production and productivity of potato in India (2003-04)

India is the fourth largest among the five major, potato producing countries in the world which include erstwhile USSR, China, Poland and the USA. In India potato is being grown on about 14 lakh hectares of land accounting for 0.72 per cent of the total cropped area.

It is grown in almost all the states under diverse climatic conditions although not all the states are self sufficient in terms of production. Uttar Pradesh, West Bengal and Bihar are the largest producers and account for nearly 75 per cent of area and 82 per cent of production.

Uttar Pradesh has highest area under potato cultivation i.e. 4.43 lakh hectares with 101.63 lakh tonnes followed by West Bengal with 3.49 lakh hectares area and production of 69.02 lakh tonnes. Bihar is third with 1.47 lakh hectares area and 14.42 lakh tonnes production. The per hectare productivity of potato is observed to be the highest in Uttar pradesh (22.94 MT/hectare) followed by Punjab with 20.75 MT/hectare.

**Table 1.1 Major state wise area, production and average yield of Potatoes during (2003-04)**

States	Area (lakh hectares)	Production (lakh tonnes)	Average yield (MT / hectare)
Uttar Pradesh	4.43	101.63	22.94
West Bengal	3.49	69.03	19.77
Bihar	1.47	14.42	9.80
Punjab	0.67	13.90	20.75
Gujarat	0.87	7.80	8.97
Assam	0.76	5.900	7.76
Karnataka	0.51	1.57	3.08
Madhya Pradesh	0.35	4.71	13.46
Uttaranchal	0.18	1.74	9.67
Haryana	0.14	3.21	22.93
Maharashtra	0.38	4.83	12.71
All India	13.37	231.61	17.32

(Source: District statistical office, Agriculture Department, Pune, 2004)

### 1.7 Area, production and productivity of potato in Maharashtra State (2003-04)

In Maharashtra state, potato is one of the major cash crops Pune and Satara are major potato growing districts in Maharashtra State and account for 87 per cent of area and 72 per cent of production. Total area under potato in Maharashtra was 385.2 thousand ha. with production 4827.60 thousand tonnes. In Maharashtra, Pune has an area of about 6363 ha. of land under potato with production of 68341 MT production followed by Satara district with 4805 hectares area and production of 17207 MT. In Pune district potato crop is extensively grown in Ambegaon and Khed tahsils as the principal cash crop. Area under potato in Ambegaon tahsil is 1969 ha (41.96 per cent) and Khed tahsil 1500 ha (31.96 per cent).

**Table 1.2 Major district wise area, production and average yield in Maharashtra (2003-04)**

Sr. No.	District	Area (ha)	Production (MT)	Average yield (mt / ha)
1	Pune	6363	68341	10.74
2	Satara	4805	17207	3.58
3	Ahmadnagar	463	6805	14.70
4	Nashik	501	11104	22.16
5	Kolhapur	267	3900	14.61
6	Sangli	118	2304	19.53
7	Solapur	55	137	2.49
8	Aurangabad	30	750	25.00
9	Latur	24	480	20.00
10	Osmanabad	40	700	17.50
11	Parbhani	95	2215	23.32
12	Buldhana	22	181	8.23
13	Akola	22	148	6.73
14	Yavatmal	15	133	8.87
15	Wardha	2	28	14.00
16	Nagpur	63	910	14.44
17	Bhandara	193	2951	15.29
18	Chandrapur	9	180	20.00

(Source : District statistical office, Agriculture Department, Pune, 2004)

## 1.8 Problems

In Maharashtra state, potato is one of the major cash crops grown in assured irrigated areas. Pune district is leading district in potato cultivation in the state. Potato crop is extensively grown in Ambegaon and Khed tahsils of Pune district as a principal cash crop. However as yet per hectare yield of potato has not reached to its maximum due to various reasons such as lack of cultural and manurial requirement of the crop in relation to variety of soil, climate complex, problem of dormancy, storage and utilization and heavy loss due to diseases and pests both in the field and during storage. The marketing problems arise from fluctuating potato prices, seasonal and perishable nature of the crop and the limited cold storage facilities in Pune district. In the peak marketing months after harvest the supply is much more than the fresh market demand. This results in glut conditions and causes a crash in prices. One of the important problems of agricultural marketing is the existence of a large number of intermediaries between the producer and the consumer. The nature of these intermediaries is often exploitative. They charge a high price from the consumer, but share only a small part of it with the producer. However very few research studies were carried out in Maharashtra exclusively on this aspect. Thus the work on “An Economic Analysis of Production and Marketing of *Rabi* Potato in Pune District” has been undertaken to study various aspects of production and marketing of potato at farmers’ level.

### **1.9 Objectives**

The present study has been carried out with the following specific objectives

1. To study resource use structure of potato production.
2. To estimate production cost, gross income and net returns of potato.
3. To examine the economics of different methods of storage.
4. To analyse cost of marketing, marketing margins and price spread of potato.
5. To study the problems faced by potato growers in production, storage and marketing.

### **1.10 The Hypotheses**

1. Resource requirement of production varies directly with farm size.
2. As the resource requirement of the potato is more, the cost of production of potato is high which results in lowering net returns.
3. Marketing margins received by middleman are high therefore producers share in consumer's rupee is less.

### **1.11 Scope and utility of the study**

The results of the study based on the above objectives would be useful to farmers in knowing the present technology of cultivation of potato and possibilities of increasing the returns through optimum utilization of resources.

The study would provide guidelines and directions for proper use of resources for maximization of profit. It will also be helpful to the Government in framing the price policies and planning and implementing different developmental programs relating to production and marketing of potato.

The findings of the study would be more applicable to Pune district; however the generalization can be useful for other areas too. Moreover as the study is based on the information collected from 120 potato growers, the findings of the study may be taken into consideration accordingly.

#### **1.12 Limitations of the study**

The study is taken on smaller area of both tahsils and based on only one year data. On account of this the result of this investigation cannot be generalized but can be accepted.

## **2. REVIEW OF LITERATURE**

In any systematic research, the review of literature on relevant aspects under study forms an integral part of the research work. The exercise would help in highlighting the methodology and results obtained by different research workers in similar field would serve as a guideline for the research to be carried out. Thus it helps in proper understanding of the concepts, methodological and analytical issues relating to the problem under study. Many a time, it may be true that previous research work might have been carried out under different set of conditions. Nevertheless, such knowledge is always useful for improving efficiency and effectiveness of all acts relating to designing of research problems, adopting suitable methodology and interpreting results of analysis.

This chapter reviews the available literature on different methodological issues and empirical research results arrived at by various research scholars from similar studies. For the sake of convenience, the collected reviews have been grouped under the following major heads which are relevant to the objectives of study.

- 2.1 Resource use structure
- 2.2 Costs and returns
- 2.3 Marketing costs, margins, channels and price spread
- 2.4 Economics of storage
- 2.5 Constraints in production and marketing of potato

## 2.1 Resource use structure

Dahiya and Pandey (1993) made economic analysis of potato cultivation in tribal and hilly areas of Himachal Pradesh. The study revealed that per hectare input use on the sample farms was 10kg of N, 122 kg of P<sub>2</sub>O<sub>5</sub>, 84 kg of K<sub>2</sub>O and 210 man days. Farmers earned net returns of Rs. 2998 and output – input ratio was 1.16.

Rana *et al.* (1993) studied resource use efficiency in seed potato production. They concluded that in Lahaul, Spiti farms MVP to marginal factor cost NFC ratio was higher at 2.35g for nitrogen depicting that if we invest one rupee in nitrogen, the returns were Rs. 2.36. It was then followed by bullock labour, potash and phosphorus respectively. Therefore, the pattern of investment should be the expenditure on nitrogen followed by expenditure on bullock labour, potash and lastly on phosphorus. In Shimla district the marginal value product to factor cost ratios for all the variables indicated that different resources were used below the optimum level and the addition of these resources would help in increasing the income from crops. However, the pattern of investment would be expenditure on bullock labour followed by proper nitrogen application and crop duration were the important factors in maintaining high yields and net profit.

Kadam (1998) studied economics of production of marketing of *Kharif* potato in Satara district. He concluded that the per hectare human labour requirement for potato cultivation was 146.62 man days and its use decreased with an increase in size of holding. It was also noticed that per hectare use of bullock labour, machine labour, tubers and plant protection was 18.01 pair days, 9.62 hours, 1297.39 kg and Rs. 1649.66 respectively. The per hectare use of manures and fertilizers was 24.75 cart loads and 478.37 kg, respectively.

Singh *et al.* (1998) studied economic analysis of potato cultivation in the Eastern Uttar Pradesh. The study revealed that farmers operating at a higher level of technology adoption could reap higher profits from potato cultivation. However, their costs were still high and could be lowered through a reduction in labour and greater use of farm inputs such as fertilizers and irrigation. To conclude, resource utilization pattern was not optimal but profitability increased with an application of technological know – how.

The above reviews clearly indicated that the resources such as labour, fertilizers and seed material are the important resources in potato production. Besides, there also existed a scope for optimization of resource use in the production of potato and thereby to maximize the returns from potato crop on the farms.

Roy (2001) studied low cost technology for potato production. He concluded that planting rate was less important than fertilizer application rate for determining crop yields. Decreasing the optimum NPK rates from 120 : 100 : 100 by 25 or 50 per cent reduced yields at all planting rates. Planting rates of 40 and 30 q/ha performed equally well (tuber yields of 243 and 238 q/ha. respectively) with the full NPK rate.

Verma (2002) attempted economics of production of potato in Indore district of Madhya Pradesh. He observed that amongst all the input items, cost of seed formed the highest percentage of costs at 37.58 followed by hired human labour i.e. 23.09 per cent, manures and fertilizers 17.13 per cent, bullock labour and tractor power 6.76 per cent of the total cost of cultivation.

Nikam (2003) studied economics of production of marketing of Kharif potato in Satara district. She concluded that the per hectare human labour requirement for potato cultivation was found to be 116.47 man days and its use was decreased with an increase in size of holding. It was

also noticed that per hectare use of bullock labour, machine labour, tubers and plant protection was 8.23 pair days, 11.60 hours, 1283.26 kg and Rs. 1708.78 respectively. The per hectare use of manures and fertilizers was 46.17 qtls and 383.39 kg respectively.

## **2.2 Costs and returns**

Ahmed and Mondal (1991) studied economics of potato production for different sizes of farms in Bangladesh. They concluded that the average cost per unit area was higher on large farms and lowest on small farms. The major factors responsible for high cost in large farms were high costs of credit, bullock power and human labour. The production per acre was higher on large farms due to comparatively higher investment in irrigation and fertilizer.

Thakur and Moorti (1991) studied economics of potato in Himchal Pradesh. They found that the per hectare yield is higher in Lahaul than Spiti due to the greater use of fertilizers and better irrigation facilities. The highest gross farm income came from potatoes in Lahaul (Rs. 15215) and from cereals (Rs. 4650) in Spiti.

Sikka and Vaidya (1992) studied production and marketing of potatoes in Himachal Pradesh. The study revealed that cost A was about Rs. 10,107 per hectare. The cost  $A_1$  and  $A_2$  were found to be the same due to absence of any leased in land. The cost C was worked out to be about Rs. 17,698 per hectare at the overall level. After investing this cost, the average production of seed potato in the state was observed to be 123.50 bags of 80 kg per hectare. The cost of production thus calculated was Rs. 123.33 per bag. There was not much variation in cost of production in Shimla Lahaul and Spiti farmers. This was due to the fact that the cost of cultivation in Lahaul, Spiti was higher; the consequent production was

also higher whereas, both of them were observed to be low in the case of Shimia farmers.

Rana *et al.* (1993) studied resource use efficiency in seed potato production. They observed that the farmers of all categories in Lahaul, Spiti area were using more variable inputs and as such were reaping more gross returns. Within Lahaul, Spiti area, gross returns increased with increase in farm size. Gross income was Rs. 44,027 per hectare in Lahaul, Spiti district as against Rs. 7,633 in Lahaul area and Rs. 1,596 in Shimla district. The gap between Shimla and Lahaul, Spiti districts with respect to all costs was also very wide. The output-input ratio at the overall farm situation was 1.21 in Lahaul area and 1.06 in Shimla area. Thus, farmers were reaping more profits in Lahaul, Spiti as compared to Shimla district.

Singh *et al.* (1993) studied marketing of potato in major potato producing areas of Gujarat. They observed that the per quintal average cost of production of field crop was more than the riverbed crop. The cost of field potato ranged from Rs. 65.97 per quintal on medium group to Rs. 69.22 per quintal on small size group. For riverbed crop, it was Rs. 66.67 and 65.3 on small and large farms respectively. The sale price of riverbed crop was higher i.e. Rs. 91.54 per quintal than field crop i.e. 81.65 per quintal. The average yield of the riverbed crop at 332.06 q/ha was also more than the yield of field crop which was 222.73 q/ha., this means that potato grown as a riverbed crop was more productive and also profitable as compared to field crop in Gujarat.

De and Bhukta (1994) reported that among the farm sizes, the marginal and small farmers benefited comparatively more in terms of net returns per hectare than medium and big farmers in potato cultivation in West Bengal.

Verma (2002) studied economics of production and marketing of potato in Indore district of Madhya Pradesh. He observed that the per

hectare total cost cultivation of potato i.e. cost C' came to Rs. 18625 while the cost A' and Cost B' was 89.45 and 95.17 per cent of the total cost. The gross returns worked out to Rs. 36400 per hectare. The average input-output ratio at cost A, cost B and cost C worked out to 1 : 2.18, 1 : 2.05 and 1 : 1.95 respectively. The cost of production per quintal over cost C including marketing charges came to Rs. 65.97 indicating the economic viability of potato crop in Indore district of Madhya Pradesh.

Kadam (1998) studied economics of production of *kharif* potato in Satara district. He concluded that the total cost of cultivation i.e. cost C was Rs. 49,194.01 while the cost A was about 67.24 and 96.45 per cent of the total cost respectively. The output-input ratio at the overall level was 1.98 at cost A, 1.38 at cost B and 1.33 at cost C.

Verma and Rajput (2002) studied costs, returns and marketing of potato in Indore district of Madhya Pradesh. They observed that the gross returns worked out to Rs. 59,400 and the total cost of cultivation i.e. cost C was Rs. 35,035 per hectare. The study showed the average input-output ratio at cost A, cost B<sub>1</sub> cost B<sub>2</sub> cost C<sub>1</sub> and cost C<sub>2</sub> worked out to 1:2.05, 1:2.03, 1:2.93, 1:1.86 and 1:1.70 respectively. The cost of production per quintal over cost C<sub>2</sub> including marketing charges came to Rs. 242.14. The net return over cost C<sub>2</sub> per hectare after deducting the market cost on and average came to only Rs. 11,455.40

Studies on costs and returns structure of potato showed that though the potato crop required a relatively high expenditure, it is an economically viable crop.

Nikam (2003) studied economics of production of *Kharif* potato in Satara district. She concluded that the total cost of cultivation i.e. cost C was Rs. 52196.88 while cost A and Cost B was about 65.90 and 97.32 per

cent of the total cost respectively. The output-input ratio at the overall level was 2.28 at cost A, 1.55 at cost B and 1.50 at cost C.

### **2.3 Marketing costs, margins, channels and price spread**

Srivastava and Arora (1991) studied vegetable marketing in Kumaon division of Uttar Pradesh. They found a relatively higher share of retailer in price spread of vegetables attributable to the higher risk borne by him in vegetables trade. Overall about 50 per cent of consumers rupee was found appropriated by the marketing agencies involved in vegetable trade in Haldwani market which appears to be on higher side.

Sikka and Vaidya (1992) studied production and marketing of potatoes in Himachal Pradesh. They found that total marketing cost came to about Rs. 67 per bag in Lahaul Spiti if produce is marketed through co-operative marketing channel. However, through private traders, the cost came to Rs. 68.38. The cost of transportation worked out to be 58.38 per cent of the total marketing cost. Marketing through depot holders in Shimla was only about Rs. 46 which was considerably lower than that for Lahaul Spiti. The producers net share in consumers rupee was found to be the highest for channel involving depot holders where it was 54.05 per cent as compared to about 52 per cent through co-operative marketing and about 50 per cent through private traders.

Malik and Chamola (1993) attempted a case study of 'Apni mandi' of Panchkula in Haryana. They observed that the producers share in consumers rupee for potato was 52.67 per cent in the wholesale market while in 'Apni mandi' it was 93.86 per cent. The cost borne by the producer was 6.67 per cent in wholesale market and it was 4.8 per cent in 'Apni mandi'. The margin of commission agent and retailer in wholesale

market was 5.67 and 31.67 per cent respectively which was absent in 'Apni mandi'.

Singh *et al.* (1993) attempted economic analysis of production of riverbed and field potato in Dessa taluka of Gujarat. They observed that the per quintal marketing cost of riverbed potato was more (Rs. 16.76) than that of field potato which was about Rs. 14.60. The study revealed that marketing costs borne by producers were high, particularly the traders commission was high. In order to increase the producers' margin, the marketing system needed to be made more efficient by means of enforcing market regulations and strengthening co-operative marketing in order that it could compete effectively.

De and Bhukta (1994) studied marketing of potato in West Bengal. They found that total cost of marketing of potato per quintal was highest in channel B, followed by Channel-C, D and A in successive ranking order. The highest marketing cost in channel-B was due to longer chain of intermediaries each one of them increasing the cost of various items. Marketing margins and price spread indicated that the producers share in consumers' price was the highest (64.69 per cent) in channel D, where producers sold their produce directly to the wholesalers. It was the lowest in channel-B where a large number of intermediaries appropriated the larger share of the consumers' price.

Krishna (1994) studied some emerging aspects of production and marketing of vegetables in Bihar. The study revealed that the marketable surplus of crops like potatoes, sweet potatoes, onions and chillies varied between 78 and 91 per cent. Village sales were high for small farmer but low for larger farmers. Co-operative marketing institution played an important role in Ranchi market but was absent in Jamshedpur market. Marketing margins were high in both the markets, reducing the producers share in consumers' price.

Khushwaha *et al.* (2003) studied marketing of potato in district Muzzaffarpur (Bihar) in the context of diversified agricultural growth. They found that the producers share in the consumers price was lower (i.e. 51 per cent) during 1993-94 than that of 1980-81 (i.e 60 per cent). This indicated the inefficiency of the Governments marketing policy which failed to protect the interests of potato growers.

Vaidya (1995) studied marketing of seed potato in Himachal Pradesh. He observed that there were six major channels of marketing of potato. Of the six channels observed the first one (Producer-> Depot holders -> Commission agent -> Consumer) was the most popular in Shimla and second channel (Producer-> Cooperative society-> Commission agent -> Consumer) was the most popular in Lahaul, Spiti. Producer's share in consumers' price was observed to be 52.32 per cent by adopting the channel of co-operative society, while it was 54.13 per cent by following a channel involving depot holders. The marketing cost incurred by the producers located in Shimla i.e. Rs. 46 per bag of 80 kg was lower than that in Lahaul area i.e. Rs. 67 per bag of 80 kg.

Patil *et al.* (1997) studied marketing of selected vegetables in Gultekadi market, Pune. They concluded that per quintal marketing cost worked out to Rs. 61.00 and Rs. 62.45 in the case of onion and potato, respectively. The transport, packing and commission chargers were the major items of marketing cost. These items together shared 84.42 and 85.10 per cent of the marketing cost in the case of onion and potato respectively. The producers share in consumers' rupee came to about 53 and 57 per cent in onion and potato respectively. It was noted that retailers had larger margin as compared to the wholesalers.

Kadam (1998) attempted economics of production, storage and marketing of *kharif* potato in Satara district. He observed that per quintal cost of marketing was Rs. 51.08. Transport cost had the major share of

marketing cost i.e. about 31.91 per cent. The producers' net share in consumers' rupee was 58.10 per cent. The share of retailers was substantially large (12.57 per cent) followed by wholesalers price.

Sen and Maurya (1999) studied producers share in consumers' rupee in case of vegetables. This study estimated the marketing charges and the producers share in consumers' price for major vegetables grown in Sewapuri block and sold in the vegetable markets of Varanasi city, Uttar Pradesh. The vegetables covered were potato, tomato cauliflower, okra, pea, cucumber, sponge gourd and bitter gourd. Results indicated that the margins of wholesalers varied from 7 to 10 per cent of the price paid by the consumer, whereas the margins of retailers ranged from 10 to 14 per cent.

Studies on marketing costs, margins and price spread of potato pointed out that most of the potato trade goes through wholesalers and retailers. In potato marketing, marketing cost was high due to higher commission charges and higher transportation cost. The cost of transportation, packaging and commission charges were the major items of marketing cost. It is also noted that producers share in consumers rupee in marketing of potato was about 60 per cent. Consumers were paying higher prices while the growers receive relatively a smaller share in consumers rupee which calls for revamping of marketing system for greater efficiency.

Durga (2000) studied public intervention in the marketing of vegetables in Rytu Bazar in Vishakhapatnam. He observed that the price obtained by the producer was Rs. 3.80 per kg while the price obtained by retailer from consumer was Rs. 5.36 per kg in Gnanapuram market. The producers share in consumers' rupee was 70.89 per cent in the above said market while it was 100 per cent in Rytu bazaar and the price obtained by

producer in Rytu Bazar was Rs. 5.42. The wholesalers and retailers margin in Gnanapuram market was 8.40 and 20.17 per cent, respectively.

Verma (2002) studied marketing of potato in Indore district of Madhya Pradesh. The study revealed that the marketing cost per quintal of potato in Indore vegetable Mandi came to Rs. 31.70. The higher marketing cost was due to higher commission charges (44.16 per cent). The producers share in consumers' price came to 67.32 per cent. The marketing costs and margins accounted for 18.68 and 14.00 per cent, respectively.

Nikam (2003) analysed economics of production, storage and marketing of Kharif potato in Satara district. She observed that per quintal cost of marketing was Rs. 88.70; commission of middlemen had the major share of marketing cost i.e. about 44.60%. The producers' net share in consumers' rupee was 70.00 per cent. The share of retailers was substantially large (7.79 per cent) followed by wholesalers (5.17 per cent) which affected the producers share in the consumers price.

Arya (2003) studied pricing efficiency in the marketing of potato crop in Gujarat. The study revealed that the producers share in consumer price was higher during years of high prices and lower during years of low prices. Rise or fall in the producers share was more than proportionate to the rate of rise or fall in the actual price level. It is found that producer's share showed fluctuation over the period.

Reddy and Achoth (2004) studied cost of marketing of irrigated potato in Chikkaballapur taluka in Karnataka state. They indicated that the producers share in the consumers rupee was as high as 63.42 per cent in channel IV (Producer ->commission agent -> wholesaler -> retailer-> consumer) as compared to about 45 per cent in other channels. Channel-IV in which the produce was sold at Bangalore was the most efficient with

the producers receiving the highest price and consumers paying the lowest price.

## **2.4 Economics of storage**

Dahiya *et al.* (1995) attempted economic analysis of cold storage of potatoes in Meerut district. They investigated the pattern of cold storage capacity, utilization and the economic viability of cold storage for potatoes. Cold storage was found to be economically viable at the tariff rates fixed by the government and farmers made a net profit to Rs. 12 per quintal through cold storage of potatoes.

Fuglie *et al.* (1995) measured welfare benefits from improvement in storage technology with an application to Tunisian potatoes. Two types of technical changes were explored. Producers secured most of the benefits from new technology that reduced the cost of marketing inputs, whereas consumers gained more from technologies that reduced storage losses. In an application of the model to potatoes in Tunisia, improved pest control during storage was estimated to have significantly reduced seasonal variation in market prices and quantities. The rate of returns to research on potato storage was estimated to be between 44 and 74 per cent.

Guenther (1995) studied economics of potato storage. Analysis of storing potatoes for sale on the open market showed that price volatility created the opportunity to make money on storage but also the risk of losing money.

Khatana *et al.* (1995) studied indigenous post harvest potato storage technology in Malwa region of Madhya Pradesh. They found that cold stored potatoes were not suitable for processing. The potato growers who stored potatoes in Pakki hodis (pit stores) made the highest net returns of Rs. 229/q followed by the farmers storing in talghar (Rs.

146/q). Rs. 120/q for room storage system, Rs. 82/q for katchi hodi and Rs. 80/q for field heap store.

Verma (2002) studied production, storage and marketing of potato in Indore district. He observed that the average cost of storing per quintal of potato in a cold storage came to Rs. 50.00. By storing potato at the prevailing rate of Rs. 200 per quintal in a cold storage, the producers earned a margin of about Rs. 75.00 per quintal by selling it as seed potato at the rate of Rs. 325 per quintal during the months of September and October of the coming year. It was observed that about 75 per cent of the advantage of cold storage was enjoyed either by the traders or large farmers.

Singh *et al.* (1998) studied economic effects of storage in marketing of potato in district Farrukhabad of Uttar Pradesh. The average storage cost of potato worked out to Rs. 50/q. The total cost in marketing of potato came to Rs. 82/q of which the cost incurred by the producers was highest, being 49 per cent. The producers share in the consumers rupee was the highest i.e. 71.6 per cent, when the potato growers sold it at higher prices in the off season after storing it in cold storage. Against this, during pre storage period producers share came to 61.8 per cent only due to low harvest prices.

Nikam (2003) studied economics of storage of potato She observed that the per quintal storage cost of *Kharif* potato formed 84.32 per cent of the total storage cost. Depreciation, interest on structure and filling and taking out charges were the another items of storage cost contributing about 16 per cent of the total storage cost (19.58) of *Kharif* potato.

## **2.5 Constraints in production and marketing of potato**

Gopalan and Gopalan (1991) studied marketing efficiency of marketing co-operatives in potato region in Tamil Nadu. They concluded that the agricultural marketing system in India suffers from severe constraints like high costs, the existence of middlemen, storage and transport bottlenecks and lack of market information among farmers. They suggested that the co-operatives had weakened the many small monopolies and malpractices of middlemen and had led to a considerable improvement in marketing efficiency. However there is need for more timely and adequate application of farm inputs, better coverage of potato growers, grading schemes and more efficient dispersal of information among other requirements.

Thakur and Moorti (1991) studied economics of potato in Himachal Pradesh. According to them the problems faced by the farmers at Lahaul and Spiti were the non availability of foundation and breeder seed, lack of credit facilities, inadequacy of extension facilities, delay in getting fertilizers and scarcity of human and bullock labour.

Sikka and Vaidya (1992) studied production and marketing of potatoes in Himachal Pradesh. According to them the main problems were

1. Good quality seed was not available.
2. High prices of seed
3. Inadequate storage facilities.
4. Problems in getting their seed certified.
5. High transportation charges.
6. Late information about market and intelligence.
7. Middlemen do not take consent of farmers while selling their produce and also quote lower than actual prices.

Low prices, delay in announcing prices and making part payments were common problems of farmers.

Singh *et al.* (1993) studied behavioural analysis of market arrivals and prices of potato in Gujarat. They indicated a rising trend during the post harvest period. Indices of prices remained high and fluctuated widely. These fluctuations may be attributed to the seasonal and perishable nature of the crops. The government needs to take some initiatives such as announcing some support price programmes for potatoes, purchasing the produce at the support price directly from the producers, increasing cold storage facilities in the state, increasing the retention power of the producers by providing adequate credit facilities and establishing more potato processing units providing employment to the rural community.

De and Bhukta (1994) studied marketing of potato in West Bengal. The study revealed that one of the worst problems in potato marketing is distress sales by small and marginal farmers. It is therefore suggested that the government should lay down rules to make cold stores (1) pay advances to those farmers who keep their potatoes in cold stores or (2) issue a negotiable instrument on the basis of which farmers can obtain advances from a bank.

Johl (1994) studied potato as the problem for market clearance. In this paper efforts have been made to regulate wholesale markets. The retail market is a very bad transmitter of demand and supply forces, with the benefits of higher prices due to increased demand being absorbed by retailers and not communicated back to producers. Development of producer and consumer co-operatives is needed as a linking of them vertically and horizontally is needed in order to improve market communication. Development of cold storage and processing facilities are also required in order to expand the local and national market. The

market price variations and market clearance difficulties influence the demand and supply of seed potato in cyclical manner which creates imbalance in the potato seed market. True potato seed can help in correcting some of these distortions. Dependence of growers on seed tubers should be reduced through facilitating and standardizing true potato seed technology and development of a seed market.

Pandey *et al.* (1994) studied trends in wholesale and retail potato prices in two major producing markets of India. They concluded despite the increase in the general price index, the price indices of potatoes in Guwahati and Jalandar markets showed a declining trend over the period. Out of season, retail and wholesale prices in both markets were considerably higher with less variation. There was 67 to 74 per cent difference in the wholesale and retail prices between the months immediately after harvest and the months immediately before harvest in both regions.

Dahiya and Sharma (1995) studied developments potato agribusiness in India. They concluded that the marketing system is not competitive mainly because of transport and storage bottlenecks. An effective market interaction scheme would assist the development of the potato sector.

Jagtap (1996) studied constraints in adoption of recommended crop production technology of *kharif* potato. The wide extension gap observed to be the main obstacle in adoption of recommended crop production technology. Since in case of all the major practices, lack of knowledge about the recommendations was reported to be the main constraint in adoption.

Patil *et al.* (1997) studied marketing of selected vegetables in Gultekadi market, Pune. They indicated following problems.

1. Costly packing material: The gunny bags which are used for packing of potato are costly.
2. Non availability of transport facilities in time.
3. Costly transport services.
4. The high rate of commission.
5. Lack of storage facilities in the producing areas.
6. The open auction method is not strictly followed in the market.

Kadam (1998) studied the problems faced by potato cultivators in production and marketing. He observed that non availability of quality seed (87.78%) was the main problem of potato cultivators in production. High seed cost (78.89%), high fertilizers cost (66.67%), high wage rates (50.00%) and non availability of loan in time (47.78) were the major problems also observed by him. He also found that about 64 per cent of farmers complained that transportation charges were high. The price variation emerged as an important problem as about 88 per cent of farmers complained about it. About 48 per cent farmers faced the problem of market intelligence. He observed that about 42 per cent farmers complained about lack of cold storage facilities in the producing area and about 39 per cent potato growers were very critical of malpractices adopted by middlemen in various markets such as deduction of more charges and multiplicity of charge, faulty measures, etc.

### **3. METHODOLOGY**

The object of any scientific investigation is to draw the useful conclusions in the light of the objectives of the study. In order to arrive at the conclusions it is essential for the investigator to adopt appropriate methods and procedures. Keeping this in view, this chapter has been devoted to explain the methodology adopted to fulfill the objectives under study. It dealt with the procedure used for the selection of sample, method of data collection, type of data collected, sources of data and analytical procedures used to get the results as per the objectives under study.

#### **3.1 Data requirement**

To study the production and marketing aspects of potato in Pune district, the data on various aspects were required. The major aspects of data requirement were as under

- i. General information of the sample potato growers.
- ii. Detail information regarding resource use, the cost of cultivation and returns from potato crop.
- iii. Information on economics of different storage methods of potato.
- iv. Information on marketing costs and margins.
- v. Information on different problems faced by the sample potato growers in production and marketing of potato.

#### **3.2 Source of data**

The primary source of data for the present study was the selected sample potato growers. The data for production were obtained through survey method from the potato growers in Ambegaon and Khed (Rajgurunagar) tahsils of Pune district. The data for marketing were

obtained from commission agent, wholesaler and retailer by personal interview method in year 2004-2005.

### **3.3 Sampling design**

The sampling design adopted for the investigation was a two stage simple random sampling with sample village as a primary unit of sampling and sample potato grower as a secondary unit of sampling.

#### **3.3.1 Selection of the study area**

Pune district is the leading district growing potatoes in Maharashtra. Ambegaon and Khed tahsils were selected purposively for this study because these tahsils have maximum area under potato crop in Pune district. Two villages *viz.*, Avasari (Bk) and Pimpalgaon from Ambegaon tahsil and two villages *viz.*, Saygaon and Kadus from Khed tahsil were selected randomly. Thirty cultivators from each of the village were selected randomly to constitute a total sample size of 120 potato farmers.

#### **3.3.2 Selection of the sample**

For selection of the cultivators a list of potato growers was prepared for each of the villages. They were grouped into three categories on the basis of their operational holdings *viz.*, small farmers (0.01 to 2 hectares), medium farmers (2.01 to 4 hectares) and large farmers (4.01 ha and above). Thus total sample of 120 potato growers was selected randomly for the present study comprising 40 small farmers, 40 medium farmers and 40 large farmers. The tahsil wise and village wise distribution of selected potato growers is depicted in Table 3.1

**Table 3.1 Distribution of selected potato growers in different size groups of holding**

Sr. No.	Name of tahsil	Size of holding			Total
		Small (below 2 ha)	Medium (2.01 – 4 ha)	Large (above 4ha)	
I	Ambegaon	-	-	-	-
1	Avasari (Bk)	12	8	10	30
2	Pimpalgaon	8	9	13	30
Sub total		20	17	23	60
II	Khed	-	-	-	-
1	Saygaon	8	10	12	30
2	Kadus	12	13	5	30
Sub total		20	23	17	60
Grand total		40	40	40	120

**Table 3.2 Selected marketing functionaries for the study**

Sr. No.	Marketing channel	Number
1	Transport agency (Hundekari)	2
2	Wholesaler	5
3	Retailer	5
4	Consumer	15
5	Export agent	0

After interviewing the selected farmers, the market functionaries were identified and then two transport agencies, five each wholesaler, retailer and 15 consumer were selected for the study. Since none of the selected farmers exported their potato, export agents were not selected for the study.

### **3.4 Collection of the data**

The data were collected by survey method by conducting personal interviews using questionnaire specially designed for the study purpose.

### **3.5 Analysis of data**

The collected data were compiled and analysed with a tabular method of analysis. Simple statistical tools such as arithmetical averages and percentages were worked out for the purpose of interpretation of results.

#### **3.5.1 Resource use pattern**

##### **3.5.1.1 Land**

In the present study, the area under potato crop in hectares has been used as the explanatory variable. Although there are differences in soil fertility within the villages and also some differences among the villages no effort could be made to account for these differences due to lack of information in this regard.

##### **3.5.1.2 Human labour**

Human labour including hired and own family labour required for different operations has been used in terms of man equivalent days of eight hours. The female labour considered equal to 0.67 man equivalent day.

### **3.5.1.3 Bullock labour**

Bullock labour was considered as a separate independent variable and it is measured in pair days.

### **3.5.1.4 Fertilizer**

The nutritive value of fertilizers was worked out in physical terms i.e. in kilogram and as such NPK used in kilograms was taken as independent variables.

## **3.5.2 Estimation of production cost**

The collected data were analysed by applying the usual cost concepts used in farm business analysis. For this simple tabular analysis was done to workout costs, gross returns and output – input ratios. The cost concepts used are as follows.

### **Cost A**

It is also called as paid out cost. This cost approximates the expenditure incurred by the farmer in cash and kind in the cultivation of crop and includes the following items.

1. Hired human labour
2. Owned and hired bullock labour
3. Seeds
4. Manures
5. Fertilizers
6. Plant protection measures
7. Machinery charges
8. Land revenue and other cesses
9. Interest on working capital
10. Depreciation on implements and machinery
11. Repairs of machinery and
12. Irrigation charges

**Cost B**

It includes cost 'A' plus imputed rental value of owned land and interest on fixed capital.

**Cost C**

It includes cost 'B' plus imputed value of family human labour. The cost C represents the total cost of production.

The standard cost concepts mentioned above provide different measures of returns to the cultivator. The difference between gross returns and cost A represents the farm business income. The difference between gross returns and cost C represents net profit or loss to the cultivator.

**3.5.3 Evaluation of inputs****3.5.3.1 Human Labour**

- I. Casual labour was charged at the rate of actual wages paid in cash and kind.
- II. Family male and female labour was charged at the prevailing wage rates in the locality for casual labour.

**3.5.3.2 Bullock labour**

- I. The owned bullock labour was evaluated on the basis of the hiring out rates prevailing in the village for the bullock pair.
- II. In the case of hired bullock labour, the actual rates paid from time to time were considered.

**3.5.3.3 Seeds**

- I. For purchased seed, the actual cost paid and expenditure incurred on procurement was taken into account.
- II. For the own farm produced seed, the price prevailing in the locality at the time of sowing of the crop was considered.

#### **3.5.3.4 Manures**

The cost of farm yard manure produced on the own farm was estimated at the prevailing rates in the locality. In the case of purchased farm yard manure, the actual price paid was taken into account.

#### **3.5.3.5 Fertilizers**

The actual prices paid for fertilizer and their procurement costs were considered.

#### **3.5.3.6 Plant protection**

This includes the actual cost incurred on purchase of insecticides, pesticides, fungicides and hiring charges of appliances.

#### **3.5.3.7 Land revenue**

It includes land revenue and other cesses paid along with land revenue.

#### **3.5.3.8 Implements and machinery**

Owned implements and machinery used were charged at the time of hiring rates prevailing in the locality.

#### **3.5.3.9 Interest on working capital**

The interest on working capital was calculated on cost A (excluding land revenue) for the period of three months i.e. for full life period of the potato crop @ 14 per cent per annum.

#### **3.5.3.10 Irrigation charges**

The actual charges incurred for irrigation by the cultivators for the potato crop were considered.

#### **3.5.3.11 Depreciation on implements**

It is considered as 10 per cent of the value of implements for buildings, machinery and other tools as they were one year old.

### 3.5.3.12 Interest on fixed capital

Interest on present value of fixed assets (excluding land) such as farm irrigation structure and equipments and livestock was charged at the rate of 10 per cent annum on the total fixed investment.

### 3.5.3.13 Rental value of owned land

Rental value of owned land was estimated as 1/6<sup>th</sup> of the value of gross produce.

## 3.5.4 Evaluation of output

The main potato produce was evaluated at the selling prices prevailing at the selling prices at the time of harvest in the nearby market where the harvested produce is sold.

## 3.5.5 Production function analysis

The empirical evidence from previous studies suggested that amongst the many mathematical functions Cobb-Douglas type of production function is the appropriate one for the studies of resource productivities because it gives specific diminishing, increasing or constant returns. The data were therefore, subjected to functional analysis by using the following form of Cobb–Douglas type of production function.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} \dots \dots \dots X_n^{b_n} e^u$$

In this functional form ‘Y’ is dependent variable ‘X<sub>i</sub>’s are independent resource variables, ‘a’ is the constant representing intercept of the production function and ‘b<sub>i</sub>’s are the regression coefficients of the respective resource variables. The regression co-efficients obtained from this function are also elasticities of production which remain constant through – out the relevant ranges of inputs. The sum of regression co – efficients i.e.  $\Sigma$  ‘b<sub>i</sub>’ indicates the nature of returns to scale. When

expressed in logarithmic terms this function transforms in to a linear function of the following type.

$$\text{Log } Y = \text{Log } a + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + \dots + b_n \text{Log } X_n + u \log e$$

### 3.5.5.1 Selection of input variables

For fitting production function in respect of potato crop eight inputs were considered as important factors contributing major proportion of the production of this crop. The equation fitted was of the following form.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} X_8^{b_8} e^u$$

Where,

Y = Output of main produce (kg)

X<sub>1</sub> = Area under crop (hectares)

X<sub>2</sub> = Human labour (man days)

X<sub>3</sub> = Bullock labour (pair days)

X<sub>4</sub> = Manures (CL)

X<sub>5</sub> = N (kg)

X<sub>6</sub> = P<sub>2</sub>O<sub>5</sub> (kg)

X<sub>7</sub> = K<sub>2</sub>O (kg)

X<sub>8</sub> = Plant protection charges

b<sub>1</sub> to b<sub>8</sub> = Elasticities of production

e<sub>u</sub> = Error term

### 3.5.6 Resource use efficiency

The resource use efficiency is judged on the basis of the ratio of marginal value product of the resource to its factor cost and should be greater than or equal to one. Marginal value product (MVP) of factor taken at their prevailing market prices or opportunity cost indicate the efficiency of resources use i.e MVPX<sub>1</sub>/PX<sub>1</sub>.

### 3.5.6.1 Marginal value product (MVP)

This represents a change in total value product (TVP) due to an additional unit of inputs (x).

Thus,

$$\text{MVP} = \frac{\Delta \text{TVP}}{\Delta X}$$

In linear multiple regression,

$$\text{MVP} = b_i P_y$$

Where,

$b_i$  = Regression coefficient

$P_y$  = Price of output

In Cobb-Douglas production function,

$$\text{MVP} = b_i \times \bar{Y} / \bar{X} \times P_y$$

Where,

$b_i$  = Regression coefficient

$\bar{Y}$  = Geometric mean of yield

$\bar{X}$  = Geometric mean of independent variable

$P_y$  = Price of output

### 3.5.7 Storage cost

At the time of survey, it is observed that, the selected farmers used only Airani method for the storage of potato.

Storage cost includes two costs

- i. Fixed cost
- ii. Variable cost

#### 3.5.7.1 Fixed cost

##### i. Depreciation

Depreciation of structure over a period of storage was calculated by deducting the junk value of storage structure from the present value of the

structure and then dividing this value by expected life (in yrs) of that particular structure. Depreciation cost of storing potatoes was worked out by dividing it by the actual capacity of the structure.

**ii. Interest on cost of storage structure**

It is the interest on the money invested in structure at the rate of 10 per cent per annum. Based on this, per quintal interest on storage structure was calculated.

**3.5.7.2 Variable costs**

It includes

**i. Filling and taking out charges**

As cost of filling and taking out the potatoes from the structure were not involved but still opportunity cost was considered.

**ii. Interest on the value of stored potato**

It is the interest on the value of potato stored at the rate of 14 per cent per annum. The value of potato considered was the average market price immediately after the harvest.

**iii. Physical loss in monetary value**

Losses in physical quantity of potato during the storage period were converted into monetary terms by considering the average price of potato for that particular month.

**3.5.8 Estimation of marketing cost, marketing margin and price spread**

Marketing cost includes the transportation charges hamali, weighing charges etc. The cost actually paid by the selected growers was considered and analysed.

**Margin:** Margin of intermediary refers to the difference between the total payments made by him during his transaction. In the present study margins of an intermediary included the profit or loss earned by him, the

cost of storage, transport, interest on capital and overhead cost incurred by him.

**Price spread:** This is the difference between the producers' price and the price paid by the consumer for a unit of the commodity. Price spread in this study thus included the total cost of marketing and the profit or loss to the intermediaries into the process of moving the produce from the farmers to the consumer.

## **4. GENERAL INFORMATION OF THE AREA AND SOCIO-ECONOMIC INFORMATION OF THE SELECTED FARMERS**

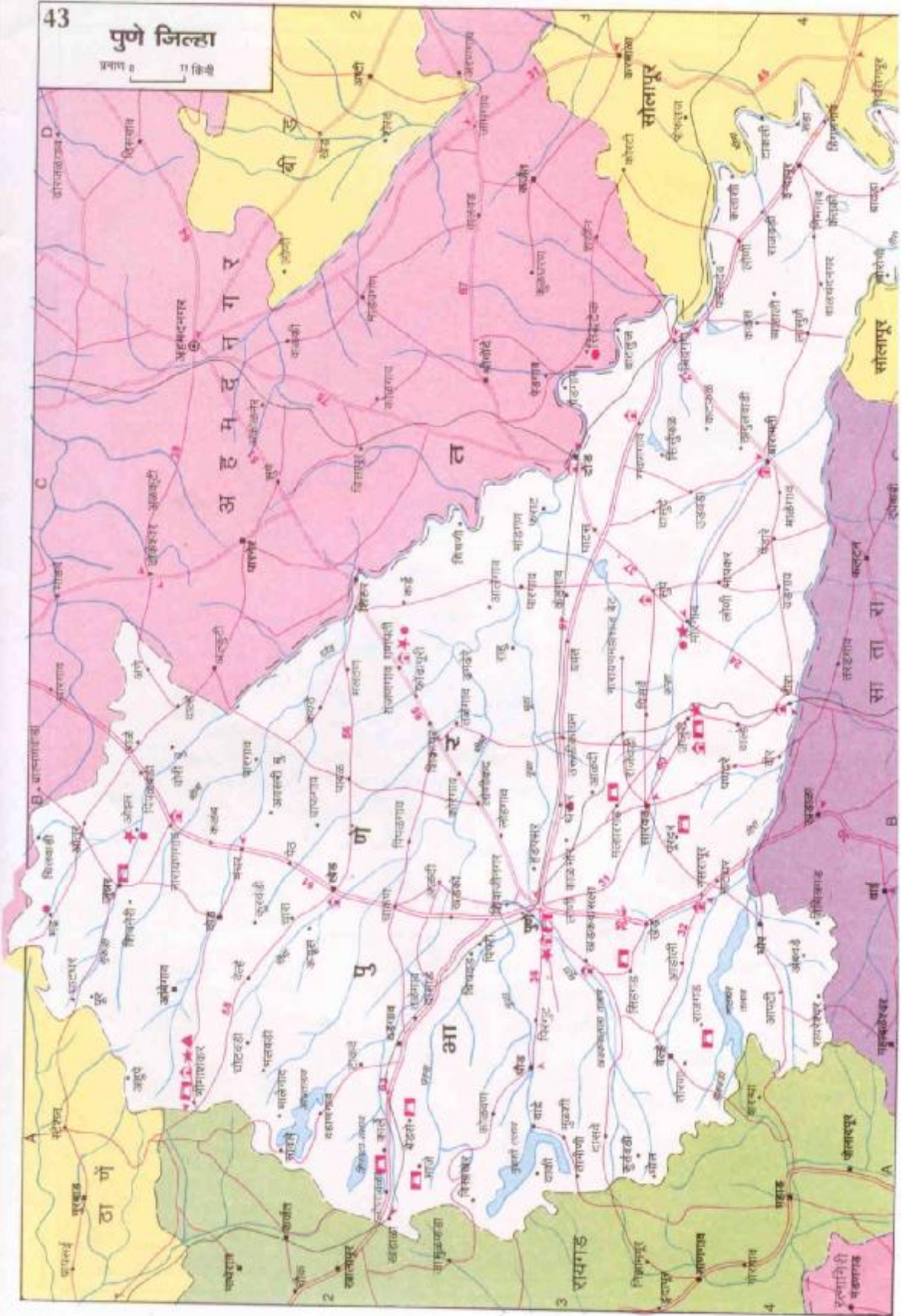
Agriculture is the backbone of the Indian economy. The agricultural production is primarily influenced by the natural resources. The control over natural resources is beyond the limits of human beings. The cultivation and growth of crops depend mainly on soil type and the precipitation. Though these natural factors are beyond the control of man, the crops to be grown and farming technique to be adopted has to be adjusted to the climatic and geographic factors.

This chapter mainly deals with general information of the area under study including physical features and the pattern of agriculture by depicting land use, cropping pattern etc. as farmers carry out their farm activities taking into account the environmental and economic conditions existing in the region. The information pertaining to the region under study and the sample cultivators will be of great utility to understand the rationale behind the results obtained.

### **4.1 Physical features of Pune district**

#### **4.1.1 Location and geographical features**

The Pune district lies between 17.50<sup>0</sup> and 19<sup>0</sup>20' North latitude and 73<sup>0</sup>20' and 75<sup>0</sup>10' East longitude. It is surrounded by Ahmednagar district on the East and North, Satara district on the South and Raigad district on the west, Solapur district on the South – East and Thane district on the North – West. The district is situated mostly in Bhima basin, Nira river lies between Pune and Satara district. The North – South running Sahyadri ranges from the western boundary.



The total geographical area of Pune district is 15642 sq. km. It consists of 14 tahsils, Junner, Ambegaon, Shirur, Khed, Maval, Mulshi, Haveli, Pune city, Daund, Purandar, Velhe, Bhore, Baramati and Indapur. There are 25 towns in that, two are Mahanagarपालिका, three contonment boards and eleven Nagarparishd. According to 2001 census there are 1866 villages, in the district.

#### **4.1.2 Soil**

On the basis of slope of land, Pune district has a three divisions namely Ghatmatha, Maval and Pathar. The soil on the Ghatmatha is light and red in colour. Apart from it the remaining soil in the district is Black, Red and Kirmiji in colour and lime. The study area found to be fertile and responsive.

#### **4.1.3 Climate and rainfall**

Generally, in summer the climate of Pune district is hot. In Indapur, Baramati and Daund, Eastern tahsils of the district having a more hot climate as it is cold in western tahsils of the district. In pune distric rainfall is mainly due to south west monsoon wind. The rainfall is more in western region than in eastern region of the district.

The district receives total rainfall of 673.10 mm and tahsils under study i.e. Ambegaon and Khed received annual rainfall 770.50 and 682.70 mm respectively in the year 2003. Average maximum temperature of Pune district was 37.7<sup>0</sup>C and minimum temperature was 10.5<sup>0</sup>C.

**Table 4.1 Average monthly rainfall at different centers in Pune district (mm)**

Sr. No.	Month	Rainfall in mm		
		Pune city	Ambegaon tahsil	Khed tahsil
1	January	2.00	1.90	7.80
2	February	0.90	0.20	0.80
3	March	3.30	2.10	1.90
4	April	14.90	10.80	8.80
5	May	31.50	28.40	33.20
6	June	104.20	116.40	108.90
7	July	178.40	251.20	183.90
8	August	102.20	134.20	104.90
9	September	121.80	117.10	130.50
10	October	78.00	70.00	70.10
11	November	29.90	34.30	32.80
12	December	6.00	3.90	5.10
	Total	673.10	770.50	682.70
	Average	56.09	64.21	56.89

(Source : Socio-Economic review and District statistical abstract of Pune district 2003 – 04).

#### **4.1.4 Population and literacy**

The total population of the district as per 2001 census was 7233000 of which 3032000 was rural and 4201000 urban. The percentage of urban population to total population worked out to 58.08 per cent i.e. more than rural population. The sex ratio was 919 females per 1000 males. The density of population according to 2001 census was 462 per sq. km.

According to 2001 census, the literacy was 80.45 per cent. The literacy was 88.34 per cent in males and 71.89 per cent in females.

#### **4.1.5 Transport**

The transport facilities are well developed in the district. The total railway length in the district is 311 km. The total road length in the district.

is 13554 km and the length of National highway in the district is 302 km. The length of state highway passing through the district is 1384 km and the state transport bus service is also well developed in most of the villages in the district.

#### **4.1.6 Infrastructural facilities**

The district has 14 tahsils. The district has 12 co-operative sugar factories, 18701 co-operative institutes, 1200 primary agricultural credit co-operative societies, 5 cotton spinning mills, 2422 dairy co-operative societies, 40 hospitals, 95 primary health centres, 4440 primary schools and 1099 secondary schools.

#### **4.1.7 Livestock**

The total livestock population in the district is 2290000 out of which 896000 are cows and bullocks, 287000 are buffaloes and hebuffaloes and 2058000 sheep and goats. Population of poultry is 3942000 in Pune district.

### **4.2 The pattern of agriculture in Pune district**

#### **4.2.1 Land utilization pattern**

Table 4.2 gives an idea about the land utilization pattern of the district and the tahsils under study.

It can be seen from table 4.2 that the net cultivated area in the district was 62.90 per cent of the total geographical area whereas in Ambegaon and Khed tahsils, it was 37.92 and 65.39 per cent of their totals, respectively. It is significant to note that only 13.40 per cent of the total area had been sown more than once in Ambegaon tahsil and 16.17 per cent area in Khed tahsil. The gross cropped area of the district was 74.02 per cent of the total geographical area and it was 51.32 per cent and

**Table 4.2 Land utilization pattern of Pune district and tahsils selected for the study (2003-04)**

(Area '00' ha)

Sr. No.	Land utilization	Pune district		Ambegaon tahsil		Khed tahsil	
		Area	% to the geographical area	Area	% to the geographical area	Area	% to the geographical area
1	Total geographical area	15620.58	100	1042.75	100	1373.54	100
2	Area under forest	1718.09	10.99	243.00	23.30	200.79	14.62
3	Area non available for cultivation	1675.88	10.73	66.62	6.39	93.75	6.83
a	Land put to non agricultural use	633.62	4.06	14.49	1.39	18.42	1.34
b	Barren and uncultivable land	1042.26	6.67	52.13	5.00	75.33	5.48
4	Other uncultivable land excluding fallow land	1241.02	7.94	93.48	8.96	122.30	8.90
a	Culturable waste	329.18	2.11	56.46	5.41	18.52	1.35
b	Permanent pasture and other grazing land	655.77	4.20	30.00	2.88	94.57	6.89
c	Land under misc, tree not included in the area sown	256.07	1.64	7.02	0.67	9.21	0.67
5	Current fallow land	415.04	2.66	84.04	8.06	29.76	2.17
6	Other fallow land	745.91	4.78	160.22	15.37	28.79	2.10
	Total fallow land	1160.95	7.43	244.26	23.42	58.55	4.26
7	Net area sown	9824.64	62.90	395.39	37.92	898.15	65.39
8	Area sown more than once	1737.36	11.12	139.74	13.40	222.08	16.17
9	Gross cropped area	11562.00	74.02	535.13	51.32	1120.23	84.56
10	Cropping intensity in percentage	117.68		135.34		124.72	

(Source : Socio Economic Review and District abstract of Pune district 2003-04).

81.56 per cent of the total geographical area in Ambegaon and Khed tahsils respectively. The cropping intensity for the district worked out to 117.68 per cent whereas; in Ambegaon and Khed tahsils it was 135.34 per cent and 124.70 per cent respectively.

#### **4.2.2 Cropping pattern**

The cropping pattern of the district and tahsils under study is given in Table 4.3.

From the table it can be seen that jowar was main crop in the district occupying 30.67 per cent of the gross cropped area in the district. In Ambegaon and Khed tahsils, the area under jowar crop was 24.97 per cent and 21.41 per cent of the gross cropped area respectively. The other important crops of the district and tahsils were paddy, groundnut, bajra, sugarcane and pulses. Bajra occupied 13.24 per cent, 21.95 per cent and 13.33 per cent of the gross cropped area in Pune district and the Ambegaon and Khed tahsils respectively. Paddy occupied 6.04 per cent, 12.15 per cent of 12.33 per cent of the gross cropped area in the district and Ambegaon and Khed tahsils respectively. Sugarcane occupied 5.46 per cent, 0.75% and N.A. % of the gross cropped area in the Pune district and Ambegaon and Khed tahsils respectively. Wheat, fruits and vegetables occupied 8.19 per cent, 1.17 per cent and 4.96 per cent respectively in the district. Potato occupied 0.41 per cent, 3.68 per cent and 1.34 per cent of the gross cropped area in Pune district and Ambegaon and Khed tahsils respectively. Fibre crops occupied less area in the district and nothing in selected tahsils.

**Table 4.3 Area under different crops in Pune district and in the tahsils under study (ha)**

Sr. No.	Crop	Pune district		Ambegaon tahsil		Khed Tahsil	
		Area (ha)	Gross cropped area	Area (ha)	Gross cropped area	Area (ha)	Gross cropped area
1	Potato	4692	0.41	1968	3.68	1500	1.34
2	Paddy	69780	6.04	6503	12.15	13818	12.33
3	Wheat	94652	8.19	3810	7.12	2902	2.59
4	Jowar	354612	30.67	13341	24.93	23985	21.41
5	Bajara	153071	13.24	11370	21.95	14928	13.33
6	Maize	19744	1.71	0	0	1107	0.99
7	Other cereals	22629	1.96	3136	5.86	3352	2.99
8	Total cereals	714488	61.80	38160	71.31	60092	53.64
9	Total pulses	85935	7.43	7816	14.61	12969	11.58
10	Sugarcane	63115	5.46	404	0.75	NA	NA
11	Spies and condiments	7885	0.68	673	1.26	2041	1.82
12	Fruits	13576	1.17	435	0.81	449	0.40
13	Vegetables	57401	4.96	4821	9.00	8507	7.59
14	Total food crops	952500	82.38	52309	97.75	84058	75.04
15	Total fibre corps	560	0.05	0	0	0	0
16	Groundnut	54274	4.69	827	1.55	22616	20.19
17	Other oil seeds	31971	2.77	323	0.60	1769	1.58
18	Total oil seeds	86245	7.46	1150	2.15	34385	21.77
19	Total fodder crops	112626	9.74	49	0.09	3530	3.15
20	Total nonfodder crops	203700	17.62	1204	2.25	27965	24.96
21	Gross cropped area	1156200	100	53513	100	112023	100
22	Net cropped area	982464	94.97	39539	73.88	89815	80.18
23	Area sown more than once	173736	15.02	13974	26.11	22208	19.82
24	Cropping intensity	117.68		135.34		124.72	

(Source : Socio Economic Review and District abstract of Pune District 2003 – 04.)

### **4.2.3 Irrigation facilities**

Irrigation is the most important and critical input in the cultivation of crops. It plays a crucial role in pushing up the crop yields. In Pune district the gross irrigated area as per 2003-04 statistics was 261636 hectares which is 27% per cent of total area under crops. In Ambegaon and Khed tahsils, the gross irrigated area was 18569 hectares and 19500 hectares which is 35 per cent and 17 per cent of the total area under crops in respective tahsils.

In the tahsils under study, the principal source of irrigation was the wells. The number of wells as per 2003-04 statistics was 161010, 13312 and 18500 in the district and Ambegaon and Khed tahsils respectively.

### **4.3 Socio-economic information of the selected farmers under study**

The cultivation of potato is extensively carried out in Ambegaon and Khed tahsils of Pune district. The farmers have taken up the cultivation of potato mainly to obtain more income. It is the general experience that many of the farmers are not very much conscious about the cultivation and marketing practices and do not work the precise profitability though they try to go in for an enterprise giving more returns. This perhaps may be truer in the case of potato cultivation. It is therefore pertinent to carry out analysis of costs and returns from the production and marketing of potato crop. However it would be appropriate to present the background information and the structure of sample farms for better understanding of economics of potato crop.

It has been observed that in general, the potato crop gives more yield and returns and therefore, the area under the same is increasing. In present study, the potato growers are grouped into 3 classes viz., small, medium and large.

### 4.3.1 Size and composition of sample families growing potato

The information about the size and composition of a family gives an idea about the available labour force and also indirectly indicates the consumption needs of the family. The details about the size and composition of the selected families growing potato is presented in Table 4.4.

**Table 4.4 Size and composition of the families growing potato**

Sr. No.	Particulars	Small	Medium	Large	Overall
1	Adult males	1.62 (27.27)	1.42 (25.40)	1.67 (26.98)	1.57 (26.57)
2	Adult female	1.53 (25.76)	1.56 (27.91)	1.92 (31.02)	1.67 (28.26)
3	Children	2.79 (46.97)	2.61 (46.69)	2.60 (42.00)	2.67 (45.17)
	Total	5.94 (100.00)	5.59 (100.00)	6.19 (100.00)	5.91 (100.00)

(Figures in parentheses indicate the percentages to the total)

It can be seen from the table that the average size of family at the overall level was 5.91 persons consisting 26.57 per cent adult males 28.26 per cent adult females and 45.17 per cent children. The average size of family of small size category was 5.94 persons consisting of 27.27 per cent adult males, 25.76 per cent adult females and 46.97 per cent children. The average size of the family of medium size category was 5.59 persons consisting of 25.40 per cent adult males, 27.91 per cent adult females and 46.69 per cent children. The average number of persons was less in medium size category. The average number of persons in large size category was 6.19 which were more than any other category

consisting 26.98 per cent adult males, 31.02 per cent adult females and 42.00 per cent children.

#### 4.3.2 Education status of the family heads

Education of the family heads is another important factor influencing the skill and ability to use the scarce resources and adoption of new technology. The information regarding the educational status of the family heads is presented in Table 4.5.

**Table 4.5 Education of family heads**

(Number)

Sr. No.	Education	Size of group of holding			Overall
		Small	Medium	Large	
1	Illiterate	18 (45.00)	15 (37.50)	13 (32.50)	46 (38.33)
2	Up to 5 <sup>th</sup> standard	6 (15.00)	7 (17.50)	11 (27.50)	24 (20.00)
3	High school	12 (30.00)	10 (25.00)	9 (22.50)	31 (25.83)
4	College	4 (10.00)	8 (20.00)	7 (17.50)	19 (15.84)
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in parentheses indicate the percentages to the total)

It was observed that at the overall level, 38.33 per cent of the head of families were illiterate, 20.00 per cent were educated up to 5<sup>th</sup> standard. About 25.83 per cent were educated up to highschool and only 15.84 per cent had completed college education. In all the size groups the proportion of illiteracy was relatively higher.

### 4.3.3 Occupational distribution

The farming is the main business of the farmers. However some farmers have to perform secondary occupation for meeting the capital requirement in the farming Table 4.6 shows occupational distribution.

**Table 4.6 Occupational distribution of family heads (Secondary occupation)**

(Number)

Sr. No.	Occupation	Size of group of holding			Overall
		Small	Medium	Large	
1	Agril. Labour	28 (70.00)	24 (60.00)	13 (32.50)	65 (54.17)
2	Service	3 (7.50)	5 (12.50)	8 (20.00)	16 (13.33)
3	Business	3 (7.50)	4 (10.00)	5 (12.50)	12 (10.00)
4	Dairy	6 (15.00)	7 (17.50)	14 (35.00)	27 (22.50)
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in parentheses indicate the percentages to the total)

It can be seen from the table 4.6 that the overall, 54.17 per cent of the farmers were acting as agricultural labours, 22.50 per cent were engaged in dairy enterprise, 10.00 per cent were carrying business and 13.33 per cent were in service. The number of agricultural labours was found to be large in small size group and was to the tune of 70.00 per cent followed by medium size group (60.00 per cent) and large size group with 32.50 per cent.

#### 4.4 Land utilization pattern

The information about the average size of holding and utilization pattern of the selected farmers is given in Table 4.7

**Table 4.7 Land utilization pattern**

(Area in hectare)

Sr. No.	Particulars	Size of group of holding			Overall
		Small	Medium	Large	
1	Total area	1.40 (100.00)	3.15 (100.00)	7.92 (100.00)	4.16 (100.00)
2	Permanent fallow area	0.22 (15.71)	0.30 (9.52)	1.16 (14.65)	0.56 (13.46)
3	Net sown area (NCA)	1.18 (84.29)	2.85 (90.48)	6.76 (85.35)	3.60 (86.54)
4	Area sown more than once (DCA)	1.07 (76.43)	1.66 (52.70)	4.46 (56.31)	2.39 (57.45)
5	Gross cropped area (GCA)	2.25 (160.71)	4.51 (143.17)	11.22 (141.67)	5.99 (143.99)
6	Irrigated area	0.78 (55.71)	1.92 (60.95)	4.71 (59.47)	2.47 (59.38)

(Figure in the parentheses indicate the percentages to the total)

Table 4.7 reveals that the average size of holding in respect of small, medium and large size was 1.40 ha, 3.15 ha and 7.92 ha respectively. The average size of holding at the overall level for all the groups worked out to 4.16 hectares.

It could be observed from the table that the proportion of net sown area to total holding in respect of the potato growers was 84.29 per cent, 90.48 per cent and 85.35 per cent, respectively.

The overall percentage of net sown area to total holding for all the groups together worked out to 86.54 per cent. The percentage of fallow

land to total holding was highest in small size category (15.71 per cent) and lowest in medium size category (9.52 per cent).

The percentage of area sown more than once to total area at the overall level was 57.45 per cent. It was highest in small size category (76.43 per cent) followed by medium (52.70 per cent) and large (56.31 per cent) size categories. The percentage of irrigated area to total area at the overall level was 59.38 per cent. It was highest in medium size category (60.95 per cent) followed by large (59.47 per cent) and small farmers (55.71 per cent) respectively.

#### 4.4.1 Cropping pattern

The cropping pattern is also an important factor influencing the returns from the farm business. The cropping pattern followed by the selected cultivators in different size groups is presented in Table 4.8.

**Table 4.8 Cropping pattern of the selected potato growers**  
(Area in hectare)

Sr. No.	Crops	Size groups of holding			Overall
		Small	Medium	Large	
1	Paddy	0.15 (6.67)	0.66 (14.63)	1.87 (16.67)	0.89 (14.88)
2	Wheat	0.03 (1.33)	0.07 (1.55)	0.23 (2.05)	0.11 (1.84)
3	Jowar	0.12 (5.33)	0.31 (6.87)	0.94 (8.37)	0.46 (7.69)
4	Bajra	0.09 (4.00)	0.12 (2.66)	0.83 (7.39)	0.35 (5.85)
5	Maize	0.03 (1.33)	0.07 (1.55)	0.12 (1.07)	0.07 (1.17)
6	Other cereals	0.02 (0.89)	0.02 (0.44)	0.06 (0.53)	0.03 (0.50)
	<b>Total cereals</b>	0.44 (19.55)	1.25 (27.71)	4.05 (36.08)	1.91 (31.93)
7	Gram	0.04 (1.78)	0.12 (2.66)	0.22 (1.96)	0.13 (2.17)

Sr. No.	Crops	Size groups of holding			Overall
		Small	Medium	Large	
8	Tur	0.03 (1.33)	0.05 (1.11)	0.08 (0.71)	0.05 (0.84)
9	Soybean	0.03 (1.33)	0.04 (0.89)	0.06 (0.53)	0.04 (0.67)
10	Other pulses	0.02 (0.89)	0.03 (0.67)	0.04 (0.36)	0.03 (0.50)
	<b>Total pulses</b>	0.12 (5.33)	0.24 (5.32)	0.40 (3.56)	0.25 (4.18)
11	Groundnut	0.08 (3.56)	0.17 (3.77)	0.29 (2.58)	0.18 (3.00)
12	Sunflower	0.03 (1.33)	0.08 (1.77)	0.11 (0.98)	0.07 (1.17)
13	Other oilseeds	0.02 (0.89)	0.04 (0.89)	0.07 (0.62)	0.04 (0.67)
	<b>Total oil seeds</b>	0.13 (5.78)	0.29 (6.43)	0.47 (4.19)	0.30 (4.85)
14	<b>Sugarcane</b>	0.17 (7.55)	0.21 (4.66)	0.44 (3.92)	0.27 (4.51)
15	<b>Spices and condiments</b>	0.05 (2.22)	0.07 (1.55)	0.12 (1.07)	0.08 (1.34)
16	<b>Fruit crops</b>	0.09 (4.00)	0.12 (2.66)	0.23 (2.05)	0.15 (2.51)
17	Potato	0.56 (24.89)	1.29 (28.60)	2.80 (24.95)	1.55 (25.92)
18	Tomato	0.24 (10.67)	0.31 (6.87)	0.76 (6.77)	0.44 (7.36)
19	Onion	0.29 (12.89)	0.42 (9.31)	0.82 (7.31)	0.51 (8.53)
20	Cabbage	0.08 (3.56)	0.15 (3.33)	0.49 (4.36)	0.24 (4.01)
21	Other vegetables	0.06 (2.67)	0.12 (2.66)	0.58 (5.17)	0.25 (4.18)
	<b>Total vegetables</b>	1.23 (54.67)	2.29 (50.78)	5.45 (48.56)	2.99 (49.99)
22	Total fodder	0.02 (0.89)	0.04 (0.89)	0.06 (0.53)	0.04 (0.67)
	<b>Gross cropped area</b>	2.25 (100.00)	4.51 (100.00)	11.22 (100.00)	5.99 (100.00)

(Figure in the parentheses indicate the percentages to the total)

Table 4.8 reveals that potato crop is the major crop of the selected farmers of all size groups of holding having 24.89 per cent, 28.60 per cent and 24.95 per cent respectively among small, medium and large size group of holding of land and it was 25.92 per cent in overall size group of holding. The area under paddy was 6.67 per cent, 14.63 per cent 16.67 per cent and 14.88 per cent of the gross cropped area respectively among small, medium, large and overall size group of holding of land. The area under total cereals was 19.55 per cent, 27.71 per cent, 36.08 per cent and 31.93 per cent of the gross cropped area respectively among small, medium, large and overall size group of holding of land. The area under total pulses was 5.33 per cent, 5.32 per cent 3.56 per cent and 4.18 per cent of the gross cropped area respective to small, medium, large and overall size group of holding of land. In total pulses, Gram had a more area in all size group of land holdings having 1.78 per cent, 2.66 per cent 1.96 per cent and 2.17 per cent of the gross cropped area respectively. The area under total oilseeds was 5.78 per cent, 6.43 per cent, 4.19 per cent and 4.85 per cent of the gross cropped area respective to small, medium, large and overall size group of holding of land. In that, groundnut had more area in all size group of holding of land with 3.56 per cent, 3.77 per cent, 2.58 per cent and 3.00 per cent of the gross cropped area among to small, medium, large and overall size group of land holding.

The area under sugarcane was 7.55 per cent, 4.66 per cent, 3.92 per cent and 4.51 per cent of the gross cropped area respective to small, medium, large and overall size group of holding of land. The area under spices and condiments was 2.22 per cent, 1.55 per cent, 1.07 per cent and 1.34 per cent of the gross cropped area respectively among small, medium, large and overall size group of holding of land. The area under fruit crops was 4.00 per cent, 2.66 per cent 2.05 per cent and 2.51 per cent of the gross cropped area

respectively among small, medium, large and overall size group of holding of land. The area under total vegetables was 54.67 per cent, 50.78 per cent, 48.56 per cent and 46.99 per cent of the gross cropped area respective to small, medium, large and overall size group of holding of land which was more in area as compared to other crops. The area of total fodder is 0.89 per cent, 0.89 pr cent, 0.53 per cent and 0.67 per cent of gross cropped area respective to small, medium, large and overall size group of holding of land.

At the overall level the average gross cropped area was 5.99 ha. It was 2.25 ha, 4.51 ha. and 11.22 ha in small, medium and large size group of land holding.

#### 4.4.2 Investment in fixed farm assets

The fixed capital assets play an important role in any business, in addition to the variable resources used. The average value of different assets owned by the sample farmers is presented in table 4.9.

**Table 4.9 Average per holding investment in various fixed farm assets by potato growers**

(Value in Rs.)

Sr. No.	Particulars	Size of group of holding			Overall
		Small	Medium	Large	
1	Land	257000.16 (69.72)	521000.20 (73.21)	1721724.5 (80.46)	833241.62 (77.63)
2	Buildings	73290.00 (19.88)	123384.34 (17.34)	228627.41 (10.68)	141767.25 (13.21)
3	Implements	21017.00 (5.70)	43847.43 (6.16)	147498.36 (6.89)	70787.60 (6.59)
4	Bullock	6534.37 (1.77)	9678.68 (1.36)	19178.72 (0.90)	11797.26 (1.10)
5	Milch animals	10787.72 (2.93)	13734.32 (1.93)	22872.00 (1.07)	15798.01 (1.47)
6	Total	368629.25 (100.00)	711644.97 (100.00)	2139900.99 (100.00)	1073391.74 (100.00)

(Figures in parentheses indicate the percentages to the total)

It can be observed that the major share in the total investment in fixed farm assets was of land in all size groups of farms. It ranged between 69.72 per cent in small size to 80.46 per cent in large size. The overall investment in land worked out 77.63 per cent of the total farm assets. The next major item of investment was building. The overall investment in building worked out to 13.21 per cent, the per holding investment in implements and machinery in small, medium and large size groups was 5.70 per cent, 6.16 per cent and 6.89 per cent of the total investment respectively. The overall investment in implements worked out to be Rs. 70787.60 (6.59 per cent). Per holding investment in bullocks was 1.77 per cent, 1.36 per cent and 0.90 per cent in small, medium and large sized farm respectively. It is Rs. 11797.26 (1.10 per cent) at overall level. The investment per holding in milch animals was 2.93 per cent, 1.93 per cent and 1.07 per cent of the total investment in small, medium and large sized farm respectively. The overall investment on milch animals at the overall level was worked out to Rs. 15798.01 (1.47 per cent).

The figures of total investment per holding in fixed farm assets in small, medium and large size categories were Rs. 368629.25, Rs. 711644.97 and Rs. 2139900.99 respectively. The total investment at the overall level worked out to Rs. 1073391.74.

## 5. RESULTS AND DISCUSSION

This chapter deals with presentation and interpretation of the results of the present study. The major objectives of the present investigation were to study per hectare resource use and productivity of potato, to estimate per hectare costs and net returns, to estimate resource use productivities of major inputs and to study storage and marketing of potato.

The data pertaining to the year 2004 – 05 from 120 sample farm families from Ambegaon and Khed (Rajgurunagar) tahsils of Pune district were subjected to the statistical analysis and the results are presented and discussed under the following sub heads.

1. Resource use structure of *rabi* potato.
2. Per hectare cost of cultivation of *rabi* potato.
3. Costs, returns and profitability of *rabi* potato.
4. Production function analysis.
5. Marketing practices.
6. Marketing channels.
7. Marketing cost
8. Market margin and price spread.
9. Storage cost
10. Problems faced by potato growers in production and marketing of *rabi* potato.

### 5.1 Resource use structure in the potato cultivation

The information on per hectare utilization of different resources in cultivation of *rabi* potato by sample farms is presented in Table.5.1

**Table 5.1 Per hectare utilization of inputs by sample potato growers**

Sr. No.	Particulars	Size group of holding			
		Small	Medium	Large	Overall
1	Total human labour (hired+family) (mandays)	117.26	106.34	106.71	110.10
	Male	67.92	63.87	63.04	64.94
	Female	73.65	63.39	65.19	67.41
2	Bullock labour (pair days)	6.49	6.56	7.11	6.72
3	Machine labour (hrs)	10.39	10.53	10.87	10.59
4	Tubers (seeds) (kg)	1465.23	1473.19	1506.24	1480.55
5	Manures (CL)	10.42	10.69	10.96	10.69
6	Fertilizers (kg)				
	Nitrogen (kg)	144.17	150.12	161.38	151.89
	Phosphorus (kg)	118.15	122.23	125.12	121.83
	Potassium (kg)	136.01	140.06	146.28	140.78
	Total (kg)	398.33	412.41	432.78	414.50
7	Irrigation (Rs.)	1228.31	1324.02	1434.46	1328.93
8	Plant protection (Rs.)	1996.48	2016.13	2147.58	2053.39

From table 5.1 it is revealed that the overall per hectare use of human labour and manure were 110.10 man days and 10.69 Carloads respectively and these were higher in small and large size group respectively at 117.26 man days and 10.96 Cartloads. The per hectare use

of bullock labour and fertilizers was 6.72 pair days and 414.50 kg at the overall level and the use was highest in large size group at 7.11 pair days and 432.78 kg respectively. The use of tubers, machine labour and plant protection charges showed increasing trend with an increase in size group of holding. Among the different size groups, these were highest in large size group at 1506.24 kg, 10.87 hours and Rs. 2147.58 respectively and the same were 1480.55 kg, 10.59 hours and Rs. 2053.39 respectively at the overall level.

At the overall level, the use of N, P<sub>2</sub>O<sub>5</sub> and K was 151.89 kg, 121.83 kg and 140.78 kg per hectare i.e. farmers were using more N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O than recommended dose of 150 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 120 kg K<sub>2</sub>O.

From the forgoing discussion, it is clearly indicated that the per hectare use of important inputs varied as per the size group of holdings. Only the per hectare use of human labour was higher in small group while the use of other inputs was higher in large size group of holding.

In sum there existed a great variability in the resource use structure for potato among different size groups. The use of manures was minimum on all the farms. The distinguishing feature in the use of seed for potato in different size group was the optimum seed rate to maintain optimum plant population.

## **5.2 Per hectare cost of cultivation of potato**

The per hectare cost of cultivation of *rabi* potato was worked out by using standard cost concepts normally used in farm management studies. The information on item wise cost of cultivation of potato for different size groups of holding is presented in Table 5.2.

**Table 5.2 Itemwise per hectare cost of cultivation of *rabi* potato  
(Rs/ha)**

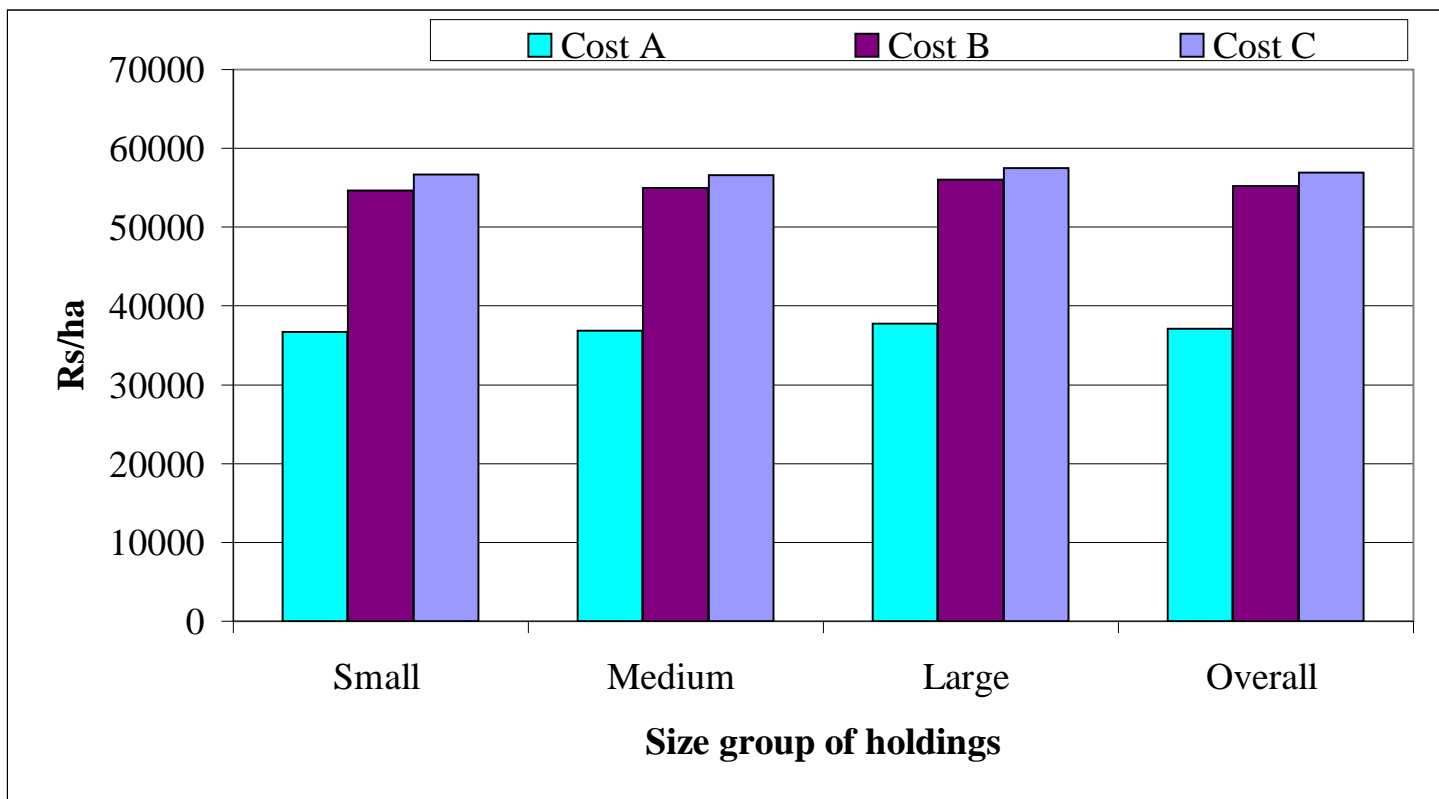
Sr. No.	Particulars	Size group of holding			
		Small	Medium	Large	Overall
1.	Hired human labour				
A	Male (man days)	1767.58 (3.12)	1814.26 (3.20)	1925.49 (3.35)	1835.77 (3.22)
B	Female (man days)	2189.20 (3.86)	1902.60 (3.36)	1984.17 (3.45)	2025.32 (3.56)
2.	Bullock labour (pair days)	1623.84 (2.87)	1640.14 (2.90)	1778.54 (3.09)	1680.84 (2.95)
3.	Machine labour (hrs)	3118.33 (5.50)	3160.12 (5.58)	3261.02 (5.67)	3179.82 (5.58)
4.	Tubers (seeds) (kg)	10235.64 (18.07)	10312.38 (18.21)	10543.73 (18.33)	10363.91 (18.20)
5.	Manures (CL)	3126.83 (5.52)	3209.11 (5.67)	3288.81 (5.72)	3208.25 (5.63)
6.	Fertilizers (kg)	5974.99 (10.55)	6006.23 (10.61)	6176.70 (10.74)	6052.64 (10.63)
7.	Irrigation (Rs.)	1228.31 (2.17)	1324.02 (2.34)	1434.46 (2.49)	1328.93 (2.33)
8.	Plant protection (Rs.)	1996.48 (3.52)	2016.13 (3.56)	2147.58 (3.73)	2053.39 (3.61)
9.	Repairs and incidental charges (Rs.)	528.15 (0.93)	532.14 (0.94)	568.35 (0.99)	542.88 (0.95)
	working capital (1 to 9)	31789.35 (56.12)	31917.13 (56.36)	33108.85 (57.56)	32271.75 (56.68)
10.	Interest on working capital @ 14% per annum	1112.62 (1.96)	1117.09 (1.97)	1158.80 (2.01)	1129.51 (1.98)
11.	Depreciation	3501.76 (6.18)	3563.62 (6.29)	3239.46 (5.63)	3434.94 (6.03)
12.	Land revenue and other cesses	272.35 (0.48)	296.96 (0.52)	215.96 (0.38)	261.75 (0.46)
	<b>Cost A</b>	36676.08 (64.74)	36894.80 (65.15)	37723.07 (65.58)	37097.95 (65.16)
13.	Rental value of land	14914.94 (26.33)	14573.45 (25.73)	14397.64 (25.03)	14628.68 (25.69)
14.	Interest on fixed capital @ 10%	3041.23 (5.37)	3468.36 (6.12)	3878.02 (6.74)	3462.54 (6.08)
	<b>Cost B</b>	54632.25 (96.44)	54936.61 (97.00)	55998.73 (97.35)	55189.20 (96.93)

Sr. No.	Particulars	Size group of holding			
		Small	Medium	Large	Overall
15.	Family labour				
A	Male	1628.70 (2.88)	1379.52 (2.44)	1226.79 (2.13)	1411.67 (2.48)
B	Female	388.58 (0.69)	316.25 (0.56)	297.63 (0.52)	334.15 (0.59)
	<b>Cost C</b>	56649.53 (100.00)	56632.38 (100.00)	57523.15 (100.00)	56935.02 (100.00)
16.	Production (qtls)	156.45	152.27	148.82	152.51
17.	Gross returns (Rs)	89489.68	87440.70	86385.87	87772.08
18.	Per quintal cost of cultivation (Rs.)	362.09	371.92	386.53	373.32

(Figures in the parentheses indicate percentages to the total cost)

It is revealed from the table that at the overall level, per hectare cost of cultivation of potato i.e. cost C worked out to Rs. 56935.02. At the overall level, amongst the different items of cost, the rental value of land was the highest i.e. Rs. 14628.68 i.e. 25.69 per cent of the total cost. The other important items of cost were seed accounting (Rs. 10363.91) for 18.20 per cent followed by fertilizer (10.63 per cent), hired human labour (6.78 per cent), interest on fixed capital (6.08 per cent) and depreciation (6.03 per cent). The expenditure on account of manures, machine labour, plant protection and bullock labour together accounted for 17.77 per cent of the total cost of cultivation.

In overall total cost of cultivation of potato, cost A and cost B was Rs. 37097.98 (65.16 per cent), Rs. 55189.20 (96.93 per cent) respectively. Among the different size groups, the cost A was the highest in large size group (65.58 per cent) followed by medium and small size group while the cost B was also highest in large size group (97.35 per cent) followed by medium and small size group. It was further observed that the total cost was highest among large farmers at Rs. 57523.15 as compared to small and medium size group for which



**Fig. 2** Cost of cultivation of *rabi* potato in different size groups of holdings

the total cost was Rs. 56649.53 and Rs. 56632.38, respectively. These finding of the study have been graphically presented in figure 2.

It could be revealed from the above discussion that the pattern of cost of various items of cost of cultivation was more or less similar among different size group of holding. Similarly the behavioral pattern of input contribution to the total cost of cultivation was observed to be almost the same at the overall level and in the case of individual size group of holdings.

It was also observed from the table, that the per hectare total output received at overall level was 152.51 qtls. It was the highest in small size group (156.45 qtls) followed by medium and large size groups.

The per kg cost of cultivation of *rabi* potato worked out Rs. 3.73 at the overall level. Among the different size groups, the per kg cost of production was the highest in large size group at Rs. 3.86 because of the low productivity and higher cost of cultivation.

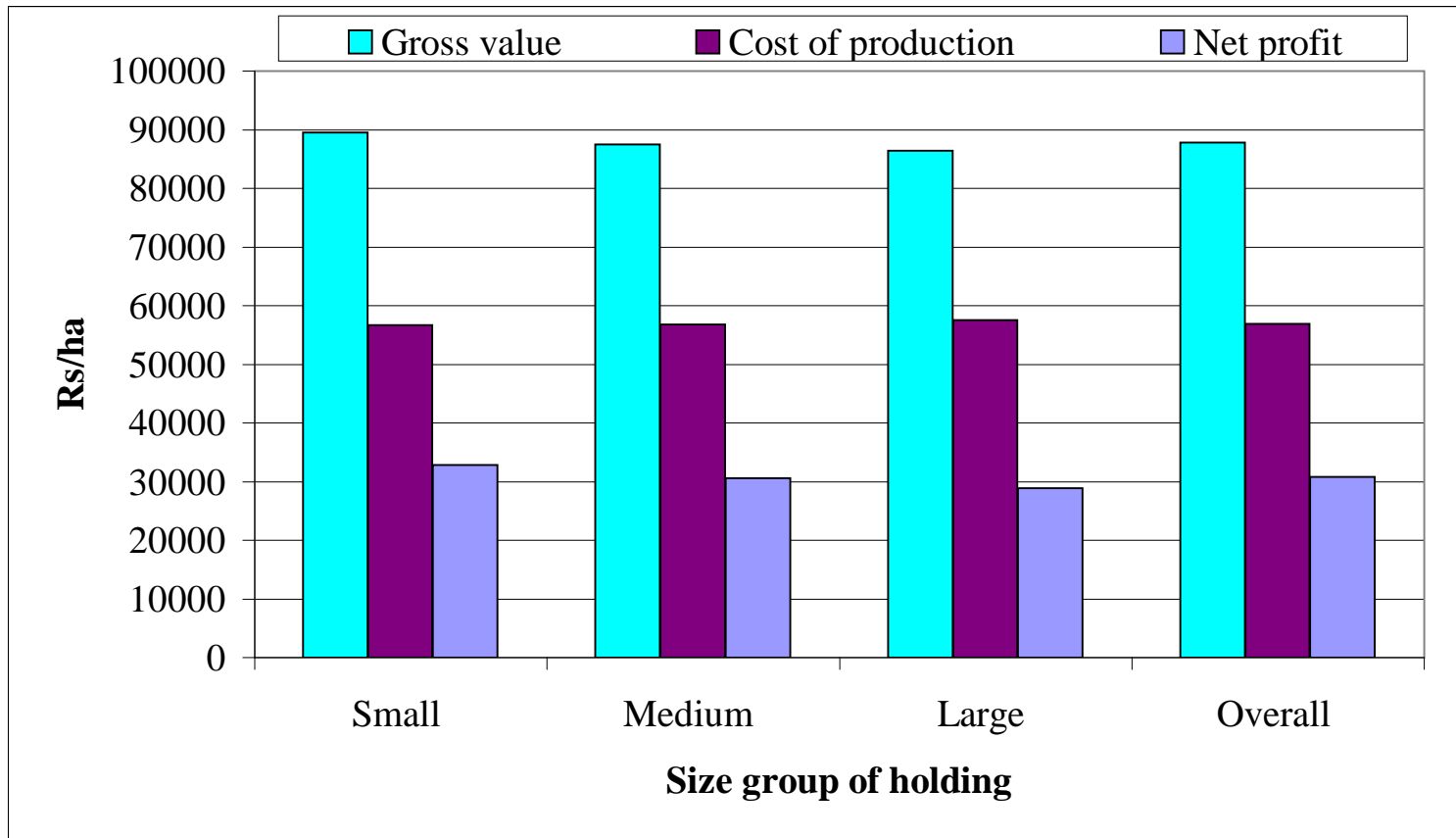
### **5.3 Costs, returns and profitability of *rabi* potato**

An attempt has been made to compare the per hectare yield, cost of production, gross returns and net profit in *rabi* potato cultivation in different size groups of holdings. The details in this respect are given in Table 5.3.

**Table 5.3 Per hectare costs, returns and net returns of *rabi* potato (Rs/ha)**

Sr. No.	Particulars	Size group of holding			
		Small	Medium	Large	Overall
1.	Production (qtls.)	156.45	152.27	148.82	152.51
2.	Gross income	89489.68	87440.70	86385.87	87772.08
3.	Total cost				
	Cost A	36676.08	36894.80	37723.07	37097.95
	Cost B	54632.25	54936.61	55998.73	55189.16
	Cost C	56649.53	56632.38	57523.15	56935.02
4.	Profit at				
	Cost A	52813.60	50545.90	48662.80	50674.13
	Cost B	34857.43	32504.09	30387.14	32582.92
	Cost C	32840.15	30608.32	28862.72	30837.06
5.	Cost of cultivation/kg	3.62	3.71	3.86	3.73
6.	Average price per kg received	5.72	5.74	5.80	5.75
7.	B:C ratio at				
	Cost A	2.44	2.37	2.29	2.36
	Cost B	1.63	1.59	1.54	1.59
	Cost C	1.57	1.54	1.50	1.54

It is noted from the table that, the per hectare total yield obtained from potato at the overall level was 15251 kg. Among the different size group of holdings, the yield was 15645 kg, 15227 kg and 14882 kg in small, medium and large size group of holdings respectively. The gross income received from potato was 87772.08 at the overall level while in small, medium and large size group of holdings, it was Rs. 89489.68, Rs. 87440.70 and Rs. 86385.87 respectively.



**Fig. 3 Per hectare cost and returns in *rabi* potato production**

The per hectare total cost i.e. cost C was the highest in large size group of holdings, followed by small and medium size group of holdings while the same was Rs. 56935.02 at the overall level. The small size group of potato growers received the highest per hectare gross income as compared to medium and large size groups of holdings. Therefore the per hectare net profit was also the highest (Rs. 32840.15) in small size group of holding. At the overall level, it was Rs. 30837.10. In case of large size group of potato growers, the net returns at cost C were the lowest on account of higher per hectare cost of cultivation than the other two size group of holdings.

The output – input ratio which indicates the profitability of investment was observed to be 2.36 at cost A, 1.59 at cost B and 1.54 at cost C at the overall level. At Cost C the output – input ratio was greater than unity indicating that the cultivation of potato was profitable when both direct and indirect costs were taken into account.

Among the size group of holdings, the output – input ratio at cost C was the highest in small size group (1.57) compared to medium (1.54) and large (1.50) size group of holdings. This indicates that the cultivation of potato was more profitable in small size group of holdings than those of medium and large size group of holdings.

#### **5.4 Production function analysis**

This part of the chapter is devoted to discuss the resource productivities of major inputs on *rabi* potato producing sample farms. The production function estimates are deployed to estimate resource productivities in *rabi* potato production process.

In order to examine the relationship between the output of potato crop and factors determining the output, Cobb–Douglas type of production function was fitted to the sample data separately for three size

groups of holdings and at the overall level. The results of the estimated production function are presented in Table 5.4. which gives the elasticities of production, standard errors of regression co-efficients, their significance and co efficient of multiple determination ( $R^2$ ).

The fitted production function was of the following type.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} X_8^{b_8} e^u$$

Where,

Y = Output of main produce (kg)

$X_1$  = Area under crop (hectares)

$X_2$  = Human labour (man days)

$X_3$  = Bullock labour (pair days)

$X_4$  = Manures (CL)

$X_5$  = N (kg)

$X_6$  =  $P_2O_5$  (kg)

$X_7$  =  $K_2O$  (kg)

$X_8$  = Plant protection charges

$b_1$  to  $b_8$  = Elasticities of production

$e_u$  = Error term

**Table 5.4 Results of estimated Cobb-Douglas production function for different size groups of potato cultivators**

Sr. No.	Particulars	Regression coefficients of variables of different size groups			
		Small	Medium	Large	Overall
1.	Constant (a)	1.0160	1.3227	0.2608	-0.3642
2.	Land (ha) (X <sub>1</sub> )	0.7012* (0.2016)	1.0156* (0.0281)	0.5281* (0.1132)	0.2107 (0.1470)
3.	Human labour (Man days) (X <sub>2</sub> )	-0.1604 (0.1602)	0.0257 (0.0224)	0.0070 (0.0919)	0.1897** (0.0618)
4.	Bullock labour (X <sub>3</sub> ) (pair days)	-0.0671 (0.1334)	-0.0192 (0.298)	0.0658 (0.0807)	0.3652** (0.1494)
5.	Manures (CL) (X <sub>4</sub> )	0.11735 (0.0837)	-0.0158 (0.0305)	-0.0324 (0.0344)	-0.0883 (0.1242)
6.	Nitrogen (kg) (X <sub>5</sub> )	-0.2615 (0.1421)	-0.0245 (0.0413)	0.2087** (0.0776)	0.0972 (0.0862)
7.	Phosphorus (kg) (X <sub>6</sub> )	0.2743** (0.0946)	-0.0067 (0.0232)	0.0962 (0.0459)	0.0284 (0.0869)
8.	Potassium (kg) (X <sub>7</sub> )	0.0268 (0.0142)	0.0028 (0.0032)	0.0154** (0.0068)	0.0228 (0.0256)
9.	Plant protection charges (Rs.) (X <sub>8</sub> )	0.1382 (0.1224)	0.0079 (0.0186)	0.0982 (0.0537)	0.2112** (0.1114)
	R <sup>2</sup>	0.82	0.87	0.85	0.84

(Figures in parentheses are the standard errors of respective regression coefficients)

\* Significant at 1% level of significance

\*\* Significant at 5% level of significance

\*\*\* Significant at 10% level of significance

The coefficient of multiple determination ( $R^2$ ) indicates the proportion of total variation in the dependant variable jointly explained by the independent variables. The regression coefficients of individual resource variables are the production elasticities of respective resources in the Cobb – Douglas production function framework which indicate the percentage change in crop out put associated with one per cent change in the concerned input at their geometric mean level.

The values of coefficient of multiple determination were estimated at 0.82, 0.87 and 0.85 in the case of small, medium and large size groups of holdings respectively. It was 0.84 at the overall level. The value of coefficient multiple determination thus indicated that the eight resources together explained 84 per cent variation in the output of potato production activity of all the size groups of holdings pooled together. The proportions of variation in the output explained by the resources were 82.00, 87.00 and 85.00 per cent in the case of small, medium and large size groups of holding respectively.

The regression co efficient of the land ( $X_1$ ) resource variable was positive and non – significant in the production function at the overall level. Whereas it was positive and significant at 1 per cent level for small, medium and large size groups of holdings. This indicates that there is a wide scope to increase land under potato for small, medium and large size groups of holdings. Though results at the overall level were non significant but regression co efficient was positive. The regression co efficient of the human labour ( $X_2$ ) resource variable was positive and significant at 5 per cent level in the production function at the overall level. Whereas it was negative and non significant for small size group of holdings, while it was positive and non significant in medium and large size groups of holdings. This indicates that there is need to decrease human labour in small size group of holdings. As regression coefficient is

positive in medium and large size groups of holdings there is little scope to increase the use of human labours.

The regression coefficient of the bullock labour ( $X_3$ ) resource was positive and significant at 5 per cent level at the overall level. Whereas for small and medium group of holding it was negative and non – significant while it was positive and non – significant for large size group of holding. This indicates that there is excessive use of bullock labour in the case of small and medium size groups of holdings. At the overall level results were significant so there is more scope to increase use of bullock labours.

The regression coefficient of the manures ( $X_4$ ) resource was positive and non – significant for the small size group of holding whereas it was negative and non significant for medium and large size group of holding and at the overall level. This indicates that manures were used excessively in medium and large size groups of holdings and also at the overall level.

The regression coefficient of the nitrogen ( $X_5$ ) resource was positive and non – significant at the overall level. Whereas it was negative and non significant for small and medium size groups of holdings, while it was positive and significant for large level size group of holding at 5 per cent. This indicates excessive use of nitrogen fertilizer in small and medium size groups whereas there is more scope to increase nitrogen fertilizer in large size group of holding and little scope at the overall level.

The regression coefficient of the phosphorus ( $X_6$ ) resource was positive and significant at 1 per cent level for small size group of holding. Whereas it was negative and non significant for medium, while it was positive and non significant for large size group of holding and at the overall level. This indicates that there is more scope to increase use of

phosphatic fertilizers in small size group of holding. Phosphorus was used excessively in medium size group of holding.

The regression coefficient of the potassium ( $X_7$ ) resource was positive and significant at 5 per cent level for large size group of holding whereas it was positive and non significant for small and medium size group of holdings and also at the overall level. This indicates that there is more scope to increase the use of potassic fertilizers in large size group and little scope in small, medium size groups of holdings and also at the overall level.

The regression coefficient of the plant protection expenditure ( $X_8$ ) resource was positive and significant at 5 per cent level at the overall level. Whereas it was positive and non significant for small, medium and large size groups of holdings. This indicates that there is more scope to increase expenditure on plant protection at the overall level.

In the Cobb- Douglas type of production function frame work, the regression coefficients of the individual resource variables are also production elasticities which indicate percentage change in the dependent variable associated with one per cent change in the concerned resource variable, other resource variables remaining unchanged. The production elasticities of only significant variables that were human labour, bullock labour and plant protection charges were 0.0618, 0.1492 and 0.1114 respectively. Among the size groups of land holdings, the production elasticities on human labour, bullock labour and plant protection charges were the highest for small size group of land holding., The production elasticity of manure was negative in the case of large size group of holding that is 0.0344. It shows that the yield decreases by 0.0344 per cent for every one per cent increase in the manures where other inputs are

held constant. The production elasticity on manures was highest for small size group followed by medium and large size groups of land holding

### 5.5 Resource use efficiency for the production of *rabi* potato

An efficiency of resource use on the sample farms was judged with the help of MVP/F ratio and the results of the resource use efficiency are presented in the Table 5.5.

**Table 5.5 Resource use efficiency for the production of *rabi* potato**

Sr. No	Variables	G.M	M.P	MVP	F	MVP/F
1.	Land ( $x_1$ ) (ha.)	160	0.1988	77.805	146280	0.0005
2.	Human labour ( $x_2$ ) (mandays)	110	0.2604	0.03723	50	0.0007
3.	Bullock labour ( $x_3$ ) (pairdays)	14.8	3.1260	0.08252	250	0.0003
4.	Manures ( $x_4$ ) (CL)	204.26	-0.0652	-0.0012	300	-0.0001
5.	Nitrogen ( $x_5$ ) (kg)	107	1.3717	0.5231	15	0.3487
6	Phosphorous ( $x_6$ ) (kg)	151.89	0.0282	0.0108	15	0.0007
7.	Potassium ( $x_7$ ) (kg)	122	0.0282	0.0107	15	0.0007
8.	Plant protection ( $x_8$ ) (Rs.)	141	0.2261	0.006	2053	0.0001

It is observed from the table 5.5 that, MVP/F ratio for the manures has got negative impact showing that the manures use should be minimized. The ratio MVP/F for all other remaining variable is less than one but more than zero showing sub-optimal use of resources by way of efficient use. Hence, efficiency can be increased by minimizing these resources.

## **5.6 Marketing of *Rabi* potato**

Production of any farm commodity completes only when it reaches to the ultimate consumer. The marketing process, therefore, has been regarded as a part and parcel of the production activity. It is said that the Indian farmer is a good producer but a bad marketer. The ultimate success in marketing of any commodity largely depends upon the ease and significance in the marketing of produce; so it is important to study the various market functions involved in marketing of potato.

### **5.6.1 Marketing functions**

Marketing of potato generally involves the following practices

- i) Assembling
- ii) Grading and standardization
- iii) Packaging
- iv) Transportation
- v) Storage
- vi) Selling and buying

#### **i) Assembling**

Assembling is the primary and the most important marketing practice. It implies gathering of farm produce prior to its distribution. Where the producing areas are at a longer distance from the consuming centers, assembling reduces the cost of marketing. It is observed in the

study area that the hundekari (Transport agent) assembles the produce of *rabi* potato and arranges for its transport to the markets.

**ii) Grading and standardization**

Grading and standardization of potatoes help in getting better prices. There are no specific standards and grades known to the cultivators. However, potatoes are graded as small, medium and big on the basis of size.

**iii) Packaging**

Better packing always helps in maintaining the quality and reducing losses during the transit. In packing, the durability of packing material, its cost, suitability for handling and ability for maintaining keeping qualities of potatoes are the important points to be considered in the light of distances of markets and mode of transport. Potatoes are packed in thin Hessian bags weighing about 50 to 60 kg. These Hessian bags are manufactured specially for packing potatoes which permit proper ventilation and aeration.

**iv) Transportation**

Transportation by motor trucks and Tempoes today has become very common owing to need for unloading and delivery of goods at the doors of the consumers quickly. As potatoes are sold in large quantities, bullock carts and trucks are very commonly used for transport of produce right from the field to the markets. Now a day even for shorter distance, trucks, Tempo are readily available for transport of produce. Potato requires quick transport from the producing centre to the consuming centre due to their perishable nature.

**v) Storage**

Potato being a perishable commodity needs proper storage, not only for better prices but also for its regular supply. The potatoes from

*rabi* harvest are stored by the growers from March to June i.e. for about 4 months. At the time of survey, it is observed that, the selected farmers used only Airani method for the storage of potato. However, in pathar region of Ambegaon tahsil, potatoes were not stored this year because of continuous heavy rain.

### **5.7 Marketing channels**

The main marketing agencies through which the potatoes pass from producers to the final consumers are as under :

1. Producer
2. Transport agency (hundekari)
3. Wholesaler
4. Retailer
5. Consumer

#### **1. Producer**

The potato growers usually send the potatoes to Manchar, Chakan, Pune and Mumbai market.

#### **2. Hundekari**

He is the link between the producer and the wholesalers. The cultivators load their produce in the truck in the presence of hundekaries and take the receipt from him. Many a times, the hundekaries also supply the market information to cultivators throughout the season. The hundekaries do not bear any price risk but act as assemblers of produce in the area under study.

#### **3. Commission agent / Wholesaler**

Commission agent locally known as Dalal, plays the main role in disposal of the produce. He is the first agency to receive the produce when it arrives. The commission agent immediately clears transport charges and hamali charges which are later deducted form the sale

proceeds of the consigners. He then sells the produce to the wholesalers or retailers by open auction. After the sale of produce, he sends a sale note locally known as Patti' giving the details of the sale proceeds such as number of lots, selling rate per lot, total value of produce and particulars of deductions such as commission, hamali, transport charges, postage, wataw, total deductions and the net value of the produce to the growers.

Almost most of the commission agents act as wholesalers and even retailers maintaining their regular shops or stalls in different sub-markets.

#### **4. Retailers**

In General, retailers have their own stalls. They create demand by providing potatoes at the doors of consumers and play a very important role in supplying potatoes according to the needs of the consumers.

The retailers though deal with relatively small quantity of potatoes, have high margin of profit more as compared to the other agencies. Of course, these retailers are rendering a good service in the distribution of produce.

#### **5. Marketing channel for *rabi* potato**

Producer – hundekari – commission agent / wholesaler – retailer – consumers.

#### **5.8 Marketing cost**

Cost of marketing affects the producers net share in the consumers rupee. An attempt has been made to work out the item wise per quintal cost of marketing for stored and unstored potato for different size groups of potato cultivators.

##### **5.8.1 Marketing cost of unstored potato**

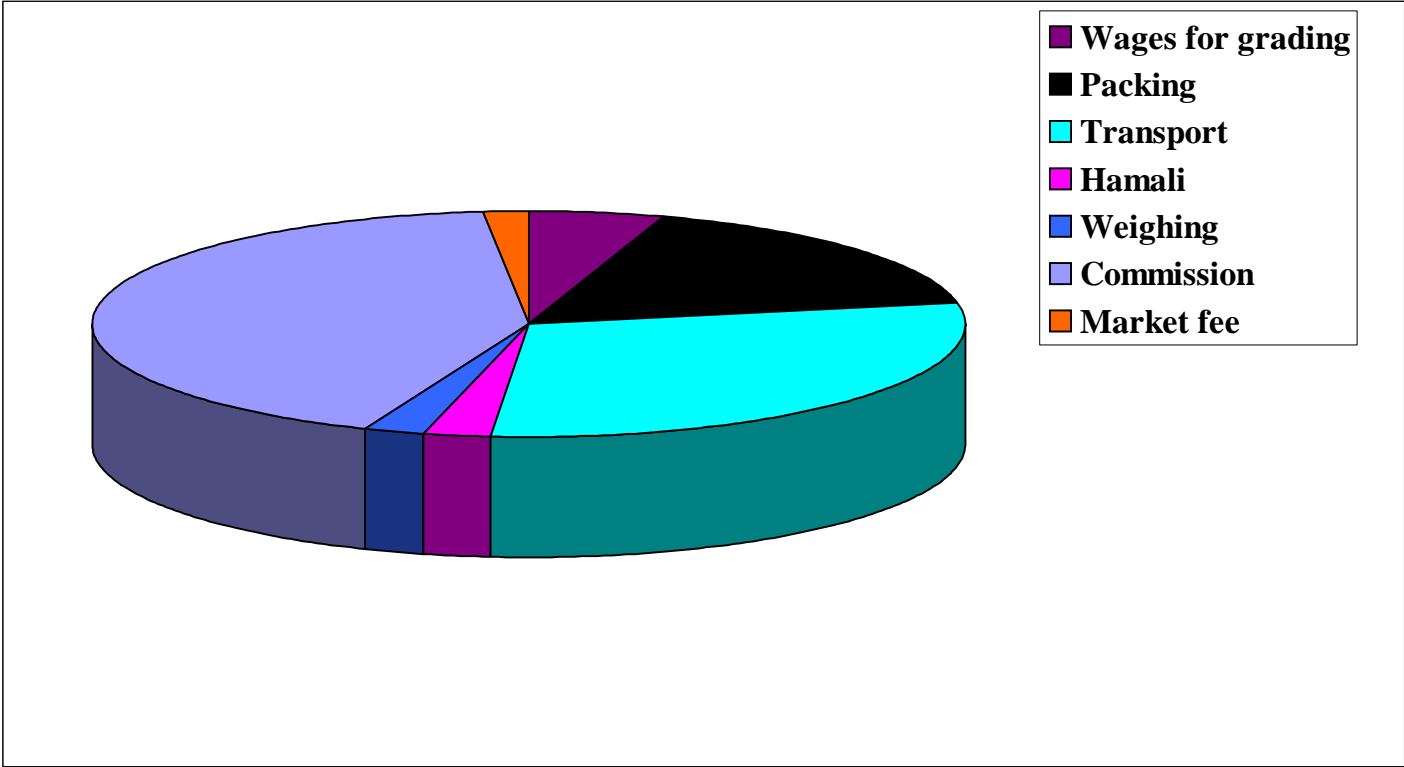
The item wise per quintal marketing cost of unstored potato for different size groups of potato cultivators is presented in Table 5.6

**Table 5.6 Item wise per quintal marketing cost of unstored potato for different size groups of potato cultivators (Rs.)**

Sr. No.	Particulars	Size group of holding			Overall
		Small	Medium	Large	
1.	Wages for grading	4.70 (4.93)	4.75 (5.05)	4.80 (5.02)	4.75 (5.00)
2.	Packing	16.10 (16.89)	15.30 (16.27)	15.40 (16.10)	15.60 (16.42)
3.	Transport	28.10 (29.49)	27.20 (28.92)	27.20 (28.44)	27.50 (28.95)
4.	Hamali	2.50 (2.62)	2.70 (2.87)	2.90 (3.03)	2.70 (2.84)
5.	Weighing	2.20 (2.31)	2.20 (2.34)	2.20 (2.30)	2.20 (2.32)
6.	Commission	40.20 (42.18)	40.40 (42.96)	41.65 (43.54)	40.75 (42.89)
7.	Market fee	1.50 (1.57)	1.50 (1.59)	1.50 (1.57)	1.50 (1.58)
	Per quintal cost of unstored potato	95.30 (100.00)	94.05 (100.00)	95.65 (100.00)	95.00 (100.00)

(Figures in the parentheses indicate percentages to the total cost)

From the above table, it can be observed that, for unstored potatoes the per quintal marketing cost was Rs. 95.00. In the per quintal marketing cost for unstored potato, the items such as commission, transport and packing were observed to be most important cost. The cost of commission, transport and packing was 42.18 per cent, 29.49 per cent and 16.89 per cent respectively for small size group of holding. It was 42.96 per cent 28.92 per and 16.27 per cent respectively for medium size group of holding and 43.54 per cent, 28.44 per cent and 16.10 per cent respectively for large size group of holding. At the overall level, the contribution of commission, transport and packing in marketing cost were 42.89 per cent, 28.95 per cent and 16.42 per cent respectively. The other items like wages for grading, hamali, weighing and market fee were 5.00 per cent, 2.84 per cent, 2.32 per cent and 1.58 per cent respectively at the over all level.



**Fig. 4 Item wise per quintal marketing cost of unstored potato for different size groups of potato cultivators**

### 5.8.2 Economics of storage

Potato being a semi perishable commodity needs proper storage not only for better prices but also for regular supply. Storage plays a very important role in marketing of potato. It helps in adjustment of supply of a particular commodity in relation to its demand in the market. Storage thus helps to eliminate and minimize price fluctuations to a larger extent.

#### Storage cost

The total storage cost includes sum of the fixed cost and variable costs which is given in detail in methodology chapter.

The total storage costs may vary with the type of storage structure and capacity of storage structure. The information on per quintal storage cost in 'Airani' method of storage on sample farms is given in table 5.10

**Table 5.7 Per quintal storage cost of *rabi* potato in 'Airany' method of storage**

Sr. No.	Particulars	Cost (Rs./qtls)
	<b>Fixed cost</b>	
1	Depreciation on structure	1.90 (9.12)
2	Interest on structure	0.05 (0.24)
	Total fixed cost (A)	1.95 (9.36)
	<b>Variable cost</b>	
3	Filling and taking out charges	1.30 (6.24)
4	Interest on value of stored potatoes	5.05 (24.24)
5	Physical loss in monetary value	12.53 (60.15)
	Total variable cost (B)	18.88 (90.64)
	Total storage cost (A+B)	20.83 (100.00)

(Figures in the parentheses indicates percentages to the total storage cost)

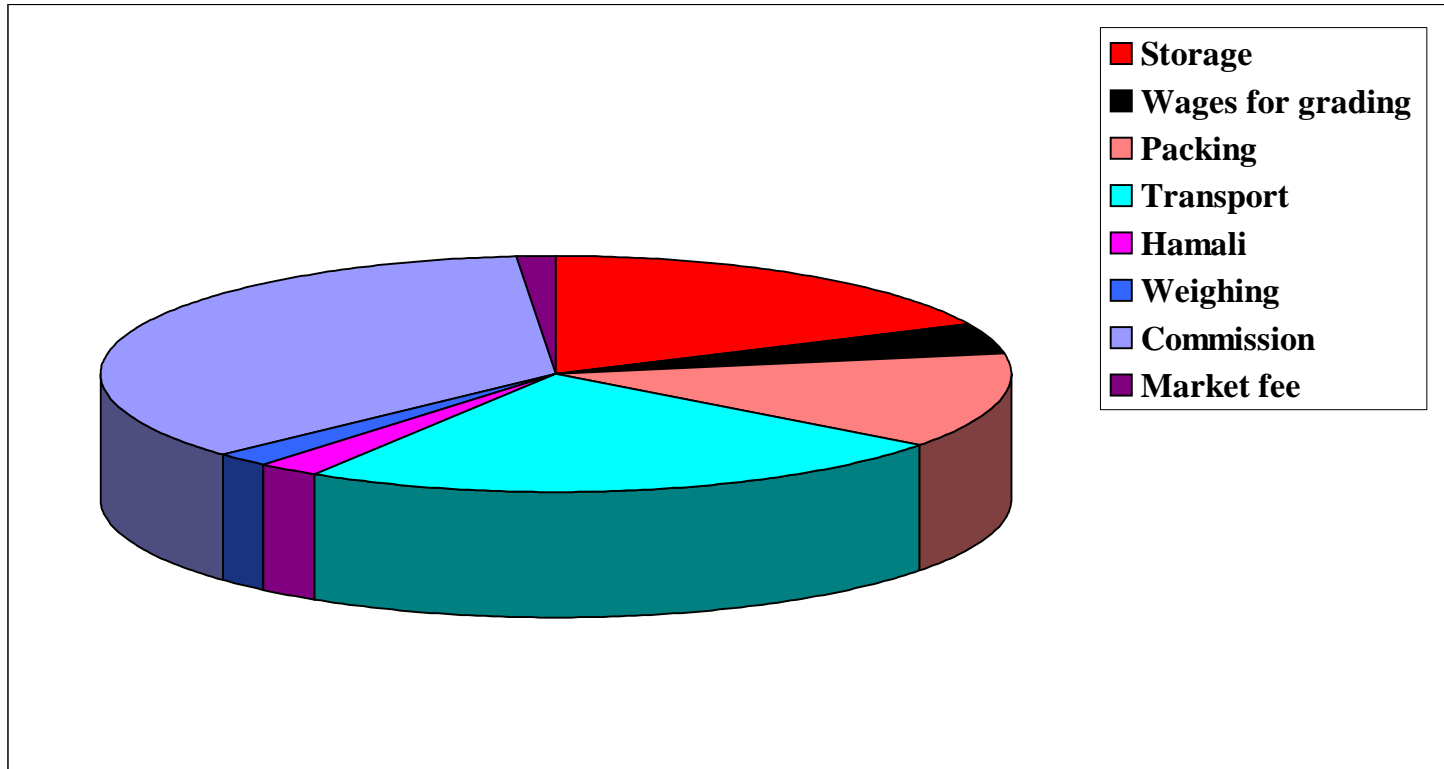
It is revealed that the per quintal storage cost of *rabi* potato was Rs. 20.83. The physical loss in monetary value and interest on value of stored potatoes were the major items of storage cost of *rabi* potato contributing 84.39 per cent of the total storage cost. Depreciation, interest on structure and filling and taking out charge were another items of storage cost contributing near about 15.60 per cent of the total storage cost of *rabi* potato. The findings of the study have been graphically presented by way of a pie chart in figure.

### 5.8.3 Marketing cost of stored potato

The item wise per quintal marketing cost of stored potato for different size groups of potato cultivators is presented in Table 5.8

**Table 5.8 Item wise per quintal marketing cost of stored potato for different size groups of potato cultivators**

Sr. No.	Particulars	Size small	Group of medium	Holding large	Overall
1.	Storage	20.65 (18.19)	20.74 (18.18)	21.10 (18.00)	20.83 (18.12)
2.	Wages for grading	4.55 (4.01)	4.67 (4.09)	4.85 (4.14)	4.69 (4.08)
3.	Packing	14.90 (13.12)	14.70 (12.89)	15.40 (13.13)	15.00 (13.05)
4.	Transport	26.90 (23.69)	26.30 (23.06)	27.80 (23.71)	27.00 (23.49)
5.	Hamali	2.50 (2.20)	2.81 (2.46)	2.85 (2.43)	2.72 (2.37)
6.	Weighing	2.20 (1.94)	2.20 (1.93)	2.20 (1.88)	2.20 (1.91)
7.	Commission	40.33 (35.52)	41.15 (36.07)	41.55 (35.44)	41.01 (35.68)
8.	Market fee	1.50 (1.32)	1.50 (1.31)	1.50 (1.28)	1.50 (1.30)
	Per quintal marketing cost of stored potato	113.53 (100.00)	114.07 (100.00)	117.25 (100.00)	114.95 (100.00)

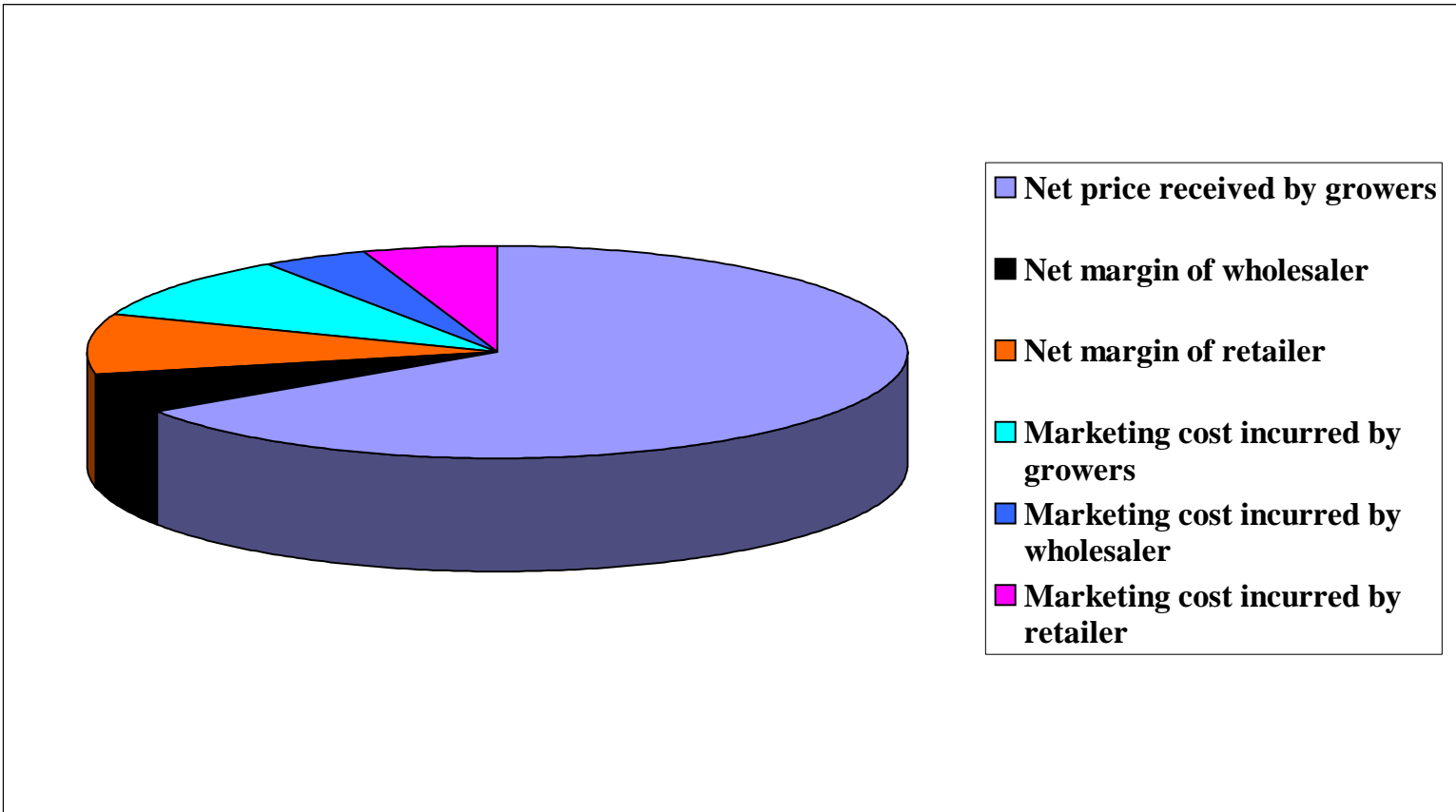


**Fig. 5** Item wise per quintal marketing cost of stored potato for different size groups of potato cultivators

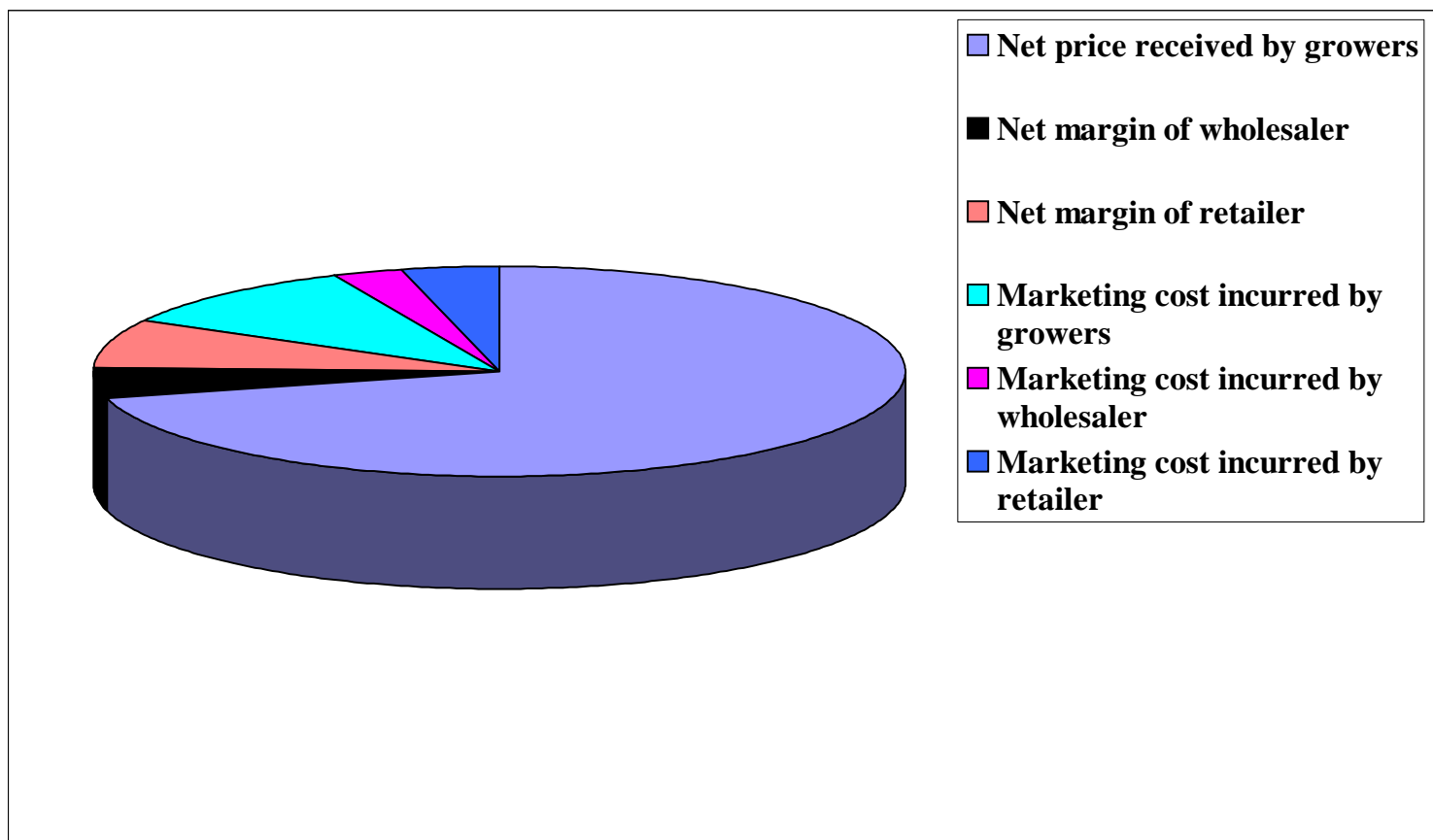
From the above table, it can be observed that, for stored potato the per quintal marketing cost was Rs. 114.95 at overall level. The major items of marketing of costs of unstored potato were commission, transport, storage and packing. They were 35.68 per cent, 23.49 per cent 18.12 per cent and 13.05 per cent respectively at the overall level. For small size group of holding, the commission, transport, storage and packing costs were 35.52 per cent, 23.69 per cent 18.19 per cent and 13.12 per cent, respectively. It was 36.07 per cent, 23.06 per cent, 18.18 per cent and 12.89 per cent respectively for medium size group of holding and for large size group of holding. They were 35.44 per cent, 23.71 per cent, 18.00 per cent and 13.13 per cent respectively. The other items like wages for grading, hamali, weighing and market fee were 4.08 per cent, 2.37 per cent, 1.91 per cent and 1.30 per cent respectively at overall level.

### **5.9 Market margins and price spread**

Price spread is the good indicator for determining the producers share in consumer rupee. Price spread refers to the difference between the price paid by the consumer and price received by the producer for an unit quantity of farm produce. Price spread consists of marketing costs and margins of the intermediaries which ultimately determine the overall efficiency of marketing system. The price spread is made up of various costs incurred and margins of intermediaries in the various marketing process such as assembling, transport, wholesaling, retailing etc. The average price spread per quintal of *rabi* potato sold in pre – storage and post – storage period is presented in Table 5.9.



**Fig. 6 Average price spread of rabi potato in prestorage**



**Fig. 7 Average price spread of rabi potato in poststorage**

**Table 5.9 Average price spread of *rabi* potato in prestorage and post storage periods**

<b>Sr. No.</b>	<b>Particulars</b>	<b>Pre - storage</b>	<b>Post-storage</b>
1	Net price received by growers	631.70 (74.32)	785.75 (77.03)
2	Net margin of wholesaler	60.42 (7.11)	52.24 (5.12)
3	Net margin of retailer	86.83 (10.21)	81.32 (7.97)
4	Total margin of wholesaler and retailer (A)	147.25 (17.32)	133.56 (13.09)
5	Marketing cost incurred by growers	95.00 (11.18)	114.95 (11.27)
6	Marketing cost incurred by wholesaler	38.60 (4.54)	29.20 (2.86)
7	Marketing cost incurred by retailer	51.51 (6.06)	44.53 (4.37)
8	Total marketing cost (B)	185.11 (21.78)	188.68 (18.50)
9	Total marketing cost and margin (A+B)	332.36 (39.10)	322.24 (31.59)
10	Price paid by consumer	850.00 (100.00)	1020.00 (100.00)
11	Producers share in consumer price (%)	74.32	77.03

(Figures in the parentheses indicate percentages to the price paid by consumers)

It is observed from the table that the producers share in pre-storage period was 74.32 per cent and in post storage period it was 77.03 per cent. The net price received by producer was more by Rs. 154.05 in post storage period than in the pre-storage period. The producers share in consumers' price was also more in post storage period. These results endorse the findings of Singh (1998) and Nikam (2003). Thus it is clear that post storage potatoes fetch better prices in the markets. The results have been graphically presented in figure 6 and 7.

### 5.10 Problems faced by potato growers in production and marketing of *rabi* potato

The potato crop is more sensitive to vagaries of weather and other diseases and infestation as compared to other field crops. This requires very careful upkeep of the crop. Potatoes are perishable in nature and therefore, require speedy and efficient marketing. Further, growers face various problems, in production and marketing of potatoes. These are summarized in table 5.10.

**Table 5.10 Problems faced by potato cultivator in production (Number)**

Sr. No.	Particulars	Size group on holding			
		Small	Medium	Large	Overall
1	Non availability of loan in time	28 (70.00)	21 (52.50)	16 (40.00)	65 (54.17)
2	Non availability of quality seed	32 (80.00)	30 (75.00)	25 (65.50)	87 (72.50)
3	Non availability of labour	16 (40.00)	14 (35.00)	11 (27.50)	41 (34.17)
4	Non availability of cheap packing material	19 (47.50)	17 (42.50)	10 (25.00)	46 (38.33)
5	Difficulty of getting bullock and implements on hire for different operations	15 (37.50)	13 (32.50)	8 (20.00)	36 (30.00)
6	Lack of technical knowledge about potato cultivation	19 (47.50)	14 (35.00)	9 (22.50)	42 (35.00)
7	New varieties are not available in time for plantation	21 (52.50)	16 (40.00)	14 (35.00)	51 (42.50)
8	High fertilizer cost	26 (65.00)	22 (55.00)	18 (45.00)	66 (55.00)
9	High seed cost	29 (72.50)	27 (67.50)	22 (55.00)	78 (65.00)
10	High wage rates	30 (75.00)	24 (60.00)	18 (45.00)	72 (60.00)
11	Non availability of insecticides at cheap rate	21 (52.50)	15 (37.50)	9 (22.50)	45 (37.50)
	Total number of farmers	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in the parentheses indicate percentages to the total)

From the table 5.10, it is seen that the non availability of loans at cheap rate at the time of sowing was the major problem as reported by 54.17 per cent of the farmers. Good crop output cannot be expected without sowing good quality seed. About 73.00 per cent of farmers complained that despite their best efforts they are not able to procure good quality seed. High seed price was also a common complaint reported by 65 per cent of farmers. Another major problem was high wage rates, about 60 per cent of farmers complained about it.

About 55 per cent of the farmers expressed the difficulty of high fertilizer cost. About 43 per cent of the farmers faced the problems of non availability of new varieties in time for plantation. The non availability of labour, cheap packing material and non availability of pesticides and insecticides at cheap rate was put forth by 34.17 per cent, 38.33 per cent and 37.50 per cent respectively.

About 30 per cent of farmers expressed the difficulty of getting bullock and implements on hire for different operations. Lack of technical knowledge about potato cultivation was also complained by 35 per cent farmers.

From the Table 5.11 it was observed that, the transportation was a major bottleneck in efficient marketing of potatoes. About 70 per cent farmers complained that transportation charges were high. The price variation emerged as an important problem as 66.37 per cent farmers complained about it. About 63.00 per cent farmers faced the problem of high commission charges. The farmers were not getting adequate information about market and intelligence and also it was available for limited number of markets. These combined with inadequate and misleading information was hampering the market of produce directly to various unexplored markets of Maharashtra. About 59.00 per cent farmers faced the problem of market intelligence.

**Table 5.11 Problems faced by potato cultivators in marketing  
(Number)**

Sr. No.	Particulars	Size group on holding			
		Small	Medium	Large	Overall
1	High commission charges	28 (70.00)	26 (65.00)	21 (52.50)	75 (62.50)
2	Faulty measures and weights	28 (70.00)	24 (60.00)	17 (42.50)	69 (57.50)
3	Problem of price variation in the market	29 (72.50)	27 (67.50)	24 (60.00)	80 (66.67)
4	Lack of market intelligence	27 (67.50)	23 (57.50)	21 (52.50)	71 (59.17)
5	High transport cost	30 (75.00)	28 (70.00)	26 (65.00)	84 (70.00)
6	Payments are not made quickly	28 (70.00)	22 (55.00)	20 (50.00)	70 (58.33)
7	Lack of cold storage facilities in the producing area	25 (62.50)	19 (47.50)	14 (35.00)	58 (48.33)
	Total number of farmers	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in the parentheses indicate percentages to the total)

About 58.00 per cent of the farmers had problems regarding faulty measures and weights. The farmers also had problems regarding proper storage facilities. About 48.00 per cent farmers complained about lack of cold storage facilities in the producing area.

The farmers showed their discontentment over procurement / support price policy of the central / state government. Low price, delay in announcing prices and making payment were the common complaints reported by the farmers. About 58.33 per cent of the farmers complained that payments were not made quickly.

## 6. SUMMARY AND CONCLUSIONS

Potato is a crop which has always been considered as the “Poor mans friend”. Potato having high nutritive value and superior quality protein has the potential of forming a viable subsidiary food crop in India and may remove the nutritional imbalances. On the other hand, from the point of view of the farm economy it would be very useful to grow potato as it is a cash crop and earns a considerable amount of net profit. This also may help in diversification of farming.

Potato crop has two economic characteristics *viz.*, it is an expensive crop to grow and once grown, it requires efficient marketing system for disposal. The marketing problems arise from fluctuating potato prices seasonal and perishable nature of the crop and the limited cold storage facilities in the producing area. In the peak marketing months after harvest, the supply is much more sensitive than the fresh market demand. This results in glut conditions and causes a crash in prices. This adversely affects the farmers’ income. Thus the present work has been undertaken to study the various aspects of production and marketing of potato. With this aim in view the problem *viz.*, “An Economic Analysis of Production and Marketing of *Rabi* Potato in Pune District” has been taken up with the following specific objectives.

1. To study resource use structure of potato production.
2. To estimate production cost, gross income and net returns of potato.
3. To examine the economics of different methods of storage.
4. To analyse cost of marketing, marketing margins and price spread of potato.

5. To study the problems faced by potato growers in production, storage and marketing.

Pune district is one of the major districts growing potatoes in Maharashtra. Ambegaon and Khed tahsils of pune district were selected purposively for this study because these tahsils have maximum area under potato crop. Two villages *viz.*, Avasari (Bk) and Pimpalgaon from Ambegaon tahsil and two villages *viz.*, Saygaon and Kadus from Khed tahsil were selected randomly. Thirty cultivators from each of the village were selected randomly.

For the purpose of analysis cultivators selected from these villages were grouped into three categories on the basis of their operational holdings *viz.*, small farmers (holding 0.01 to 2 hectares), medium farmers (2.01 to 4 hectares) and large farmers (4.01 ha and above). Thus a total sample of 120 potato growers was selected randomly for the present study comprising 40 small farmers, 40 medium farmers and 40 large farmers.

Most of the produce of this tract is marketed in Pune and Mumbai markets. The marketing information has been collected from these markets from commission agents and other intermediaries involved in marketing of potato. The data pertaining to complete agricultural year 2004 – 05 were collected by the personal interviews by the survey method with the help of a specially designed schedule. The data thus collected were analysed by tabular method for estimation of cost of production, marketing cost and margins. The functional analysis was also carried out within the framework of Cobb – Douglas type of production function and the significance of the parameters of the function was tested by using students 't' test. The appropriateness of estimated model and the variables incorporated in the model was tested by estimating  $R^2$  values. The important findings of the study are summarized below.

## 6.1 Summary

1. The overall size of family was 5.91 persons. The average size of family was 5.94 in small, 5.59 in medium and 6.19 in large size group. In all the size groups, the proportion of illiteracy was relatively high. At the overall level, 54.17 per cent of the farmers were working as agricultural labourers, 22.50 per cent were engaged in dairy enterprises, 10.00 per cent were carrying out business and 13.33 per cent were in service. The number of agricultural labourers was found to be large in small size groups (70.00 per cent).

2. At the overall level, the average size of holding was 4.16 hectares. It was 1.40 ha in small, 3.15 ha in medium and 7.92 ha in large size groups. The gross cropped area was 160.71 per cent, 143.17 per cent and 141.67 per cent in the case of small, medium and large size categories respectively. The percentage of irrigated area to total area was 55.71 per cent, 60.95 per cent and 59.47 per cent in the case of small, medium and large size group of holdings.

3. The overall area under potato was 1.55 ha. The area under potato was relatively more in large size group (2.80 ha). Potato was the main crop during *rabi* season. Sugarcane was the main annual cash crop. Other crops grown by cultivators were paddy, wheat, jowar, bajra, maize, soybean, gram etc.

4. The average per farm value of investment in various farm assets owned by the potato growers was Rs. 368629.25, Rs. 711644.97 and Rs. 2139900.99 in small, medium and large size categories respectively. The contribution of land was more in fixed farm investment in all the size groups. The total investment in asset was about six times more in large size group than that of small size group.

5a. The overall per hectare use of human labour was 110.10 man days comprising of 64.94 male labour and 67.41 female labour. It was

observed that use of human labour was more in small size group of holding.

5b. The per hectare bullock labour use at the overall level was 6.72 pair day. It increased with increase in size group of holding.

5c. The per hectare seed used by the cultivator was 1465.23 kg in small, 1473.19 kg in medium and 1506.24 kg in large size groups of holding. It was observed that use of seed and plant protection increased with increase in the size group of holding.

5d. At the overall level per hectare use of FYM was 10.69 cartloads. The use of manures was found to be more in large size group as compared to other groups.

5e. The per hectare use of fertilizers worked out to 144.17 kg N, 118.15 kg P<sub>2</sub>O<sub>5</sub> and 136.01 kg K<sub>2</sub>O in small, 150.12 kg N, 122.23 kg P<sub>2</sub>O<sub>5</sub> and 140.06 kg K<sub>2</sub>O in medium and 161.38 kg N, 125.12 kg P<sub>2</sub>O<sub>5</sub> and 146.28 kg K<sub>2</sub>O in large size categories.

6. The per hectare overall cost A and cost C worked out to Rs. 37097.98 and Rs. 56935.02 respectively. Amongst the major items of cost tuber seed accounted Rs. 10363.91 (18.20 per cent) followed by fertilizers Rs. 6052.64 (10.63 per cent), manures Rs. 3208.25 (5.63 per cent) and machine labour Rs. 3179.82 (5.58 per cent). In the case of items of imputed cost, the rental value of the land was predominant one and worked out to Rs. 14628.68 i.e. 25.69 per cent of cost C.

However, the total cost of cultivation in different size groups of holdings was Rs. 56649.53, Rs. 56632.38 and Rs. 57523.15 in small, medium and large size groups of holdings respectively. This shows that the per hectare cost of cultivation i.e. cost C was more in large size groups of holding followed by small and medium size group of holdings.

7. The per hectare yield was the highest in small size group of holdings (156.45 qtls) followed by medium (152.27 qtls) and large (148.82 qtls) size groups of holding respectively. At the overall level the per hectare yield was 152.51 qtls. At the overall level, gross income was Rs. 87772.08. The gross income received was Rs. 89489.68, Rs. 87440.70 and Rs. 86385.87 in small, medium and large size group of holdings respectively.

At the overall level, the net profit was Rs. 30837.06 while the net profit in small, medium and large size groups of holding was Rs. 32840.15, Rs. 30608.02 and Rs. 28862.72 in small, medium and large size groups of holding. Production and net income showed decreasing trend with the size group of holdings. The per hectare output – input ratio at the overall level was 1.54 which is greater than 1. It was 1.57, 1.54 and 1.50 in small, medium and large size group of holding respectively. This shows that potato cultivation is profitable proposition.

At the overall level per kilogram cost of production was Rs. 3.73 and average price received per kilogram was Rs. 5.75.

8. The values of co-efficients of multiple determination were estimated at 0.82, 0.87 and 0.85 in the case of small, medium and large size group of holdings respectively. It was 0.84 at the overall level. The regression coefficients of human labour ( $X_2$ ), bullock labour ( $X_3$ ) and plant protection ( $X_8$ ) were positive and significant at 5 per cent. The regression coefficients of land ( $X_1$ ), nitrogen ( $X_5$ ), phosphorus ( $X_6$ ) and potassium ( $X_7$ ) were positive and non-significant. The regression coefficient of manure ( $X_4$ ) was negative and non-significant. At the overall level production elasticities of land, human labours, bullock labour, manures, nitrogen, phosphorus and potassium and plant protection expenditure were 0.1470, 0.0618, 0.1494, 0.1242, 0.0862, 0.0869, 0.0256 and 0.1114 respectively.

The ratio for MVP/F for all remaining variable is less than one but more than zero showing efficient use of these resources, however the efficiency can be increased by minimizing use of these resources to increase the profitability.

9. The per quintal average marketing costs for unstored potato and stored potato were Rs. 95.00 and Rs. 114.95. The major item of marketing cost for stored potato was storage cost that is Rs. 20.83. The other major items of marketing cost for the unstored potato and stored potato were transportation (Rs.27.00), commission (Rs.40.00) and packing (Rs.15.00). Shares of wholesaler and retailer were 4.54 per cent and 6.06 per cent for unstored potato and 2.86 per cent and 4.36 per cent for stored potato.

10. The total storage cost may vary with the type of storage structure and capacity of storage structure. The per quintal storage cost of *rabi* potato was Rs. 20.83. The loss in monetary value and interest on value of store potatoes were the major items of storage cost of *rabi* potato contributing 84.39 per cent of the total storage cost. Depreciation, interest on structure and filling and taking out charges were other items of storage cost contributing 15.60 per cent of the total storage cost of *rabi* potato.

11. Price spread refers to the difference between the price paid by the consumer and price received by the producer for a unit quantity of farm produce. Per quintal producers share in consumers' rupee in pre storage period was 74.32 per cent and in post storage period it was 77.03 per cent. The net price received by producer was more by Rs. 154.05 in post storage period than in the pre-storage period. The producers share in consumers' price was also more in post storage period.

12. The major production problems faced by the cultivators were non availability of loan, quality seed, labour in time, high fertilizer cost, high seed cost, high wage rates, non availability of cheap packing material etc.

Other difficulties expressed by the farmers were difficulty of getting bullocks and implements on hire for different operations, lack of technical knowledge about potato cultivation, desired varieties are not available in time for plantation, non availability of pesticide and insecticides at cheap rate.

13. The major marketing problems expressed by the farmers were problem of price variation in the market, high commission charges, high transport cost and other difficulties expressed by the farmers were payment were not made quickly by commission agent, lack of market information, faulty measures and lack of cold storage facilities in the producing areas.

## **6.2 Conclusions**

The present investigation was intended to depict the picture of the *rabi* potato growing enterprise in Pune district, the prominent *rabi* potato growing district in Maharashtra State. The enterprise has assumed a pride place in the economy of the tract as it is an important vegetable crop of the tract. The foregoing discussion on various aspects of the study leads to draw the following conclusions.

### **A. Resource use structure**

The per hectare human labour requirement for *rabi* potato cultivation was found to be 110.10 man days. It was observed that the use of human labour decreased with the increase in size of holdings. It was also noticed that per hectare bullock labour, machine labour, tubers, plant protection were 6.72 pair days, 10.59 hours, 1480.55 kg and Rs. 2053.39 respectively. They all showed increasing trend in accordance with size groups of holdings. The per hectare manures and fertilizers used were 10.69 cartloads and 414.50 kg respectively which also showed increasing trend in accordance with size groups of holdings.

## **B. Cost of production**

At the overall level, the total cost of production was Rs. 56935.02 i.e. cost C while cost A was about 65.16 per cent and cost B was about 96.93 per cent. The major items of cost of cultivation were tubers, fertilizers and imputed rental value of land. Cost of production was highest in large sized farms followed by medium and small groups of holdings.

The profit at cost A, cost B and cost C was highest in small size group followed by medium and large size groups of holdings. Thus net profit decreased with increase in the size of holdings.

The output – input ratio at the overall level was 2.36 at cost A, 1.59 at cost B and 1.54 at cost C. It is greater than 1 therefore *rabi* potato is a profitable crop. The output input ratio at cost A, cost B and cost C was highest in small size group followed by medium and large size group of holdings. Output input ratio also showed decreasing trend with size group of holdings.

## **C. Production function analysis**

Use of human labour, bullock labour and plant protection turned out to be the most important factors for providing impetus to crop productivity in the state. The impact of land and fertilizers though positive in sign was statistically non-significant. It may be argued that in fact it has played a complementary or enabling role in the production process, raising the productivity of other inputs associated with the production process. The impact of manures was negative in sign and was statistically non significant. But farmers are using more manures than required.

## **D. Marketing cost**

Per quintal marketing cost for unstored and stored potato was Rs. 95.00 and Rs.114.95 respectively. The items such as commission, transport and packing were observed to be most important items of cost.

These costs can be minimized through certain measures like efficient transport facilities, cheap packaging material. It also further indicated for minimizing the market commission to be paid by the producers.

#### **E. Price spread and market margin**

In pre storage period the producers net share in consumers rupee was 74.32 per cent that of post storage period 77.03 per cent. Thus in post storage period producers share was more than pre storage period. Total margin of wholesaler and retailer was 17.32 per cent in pre storage period and that is 13.09 per cent in post storage period.

There was a gap between the price paid by the consumer and price received by the producers. A major part of it is swallowed by the middlemen operating in the potato trade. The middlemen share can be reduced by eliminating some of the intermediaries and bringing the consumer closer to producer. This would also raise the producers share in consumers' rupee.

The major constraints faced by the potato growers in production and marketing of *rabi* potato were non availability of quality seeds at cheap rates, high fertilizers and wage rates, non availability of loan facility in time and in marketing major difficulties expressed by farmers were price variation high commission rates, high transport cost etc.

#### **F. Economics of storage of *rabi* potato**

Potato being a semi perishable commodity needs proper storage not only for better prices but also for regular supply. Storage plays a very important role in marketing of potato. It helps in adjustment of supply of a particular commodity in relation to its demand in the market. The potatoes are sold at cheaper rate in the season and at higher rate in the off season.

The total storage costs may vary with the type of storage structure and capacity of storage structure. In 'Airani' method of storage the per

quintal storage cost of *rabi* potato was Rs. 20.83. The loss in monetary value and interest on value of stored potatoes were major items of storage cost of *rabi* potato contributing 84.39 per cent. Thus storage helps to eliminate and minimize price fluctuations to a larger extent.

### **6.3 Policy implication**

Cultivation of *rabi* potato is highly profitable proposition. This crop should, therefore be cultivated on large area. The following policy implications emerged from the present study which will help to increase the area and production of potato.

1. There should be adequate and timely supply of inputs like quality tubers, fertilizers, pesticides etc. at reasonable price, which requires stream lining of distribution channels. Provision may also be made for the supply of credit to purchase the above inputs.
2. The transport cost forms a major part of the marketing cost to the producer as well as the traders. Steps may be taken at the Government level to regularize the transport charges. For this purpose, the monopoly of the transport agencies will have to be broken and controlled rate should be applied.
3. It has been observed that there had been a very wide fluctuation in prices. In the month of November and December the prices were very high causing hardship to the consumers while in the months of January, February and March the prices were very low causing distress to the producers. In order to regulate the prices throughout the year to save the producers as well as consumer from the hardship, the Government should fix the support prices as well as ceiling prices at a level fair to both the producer as well as consumer. Since potato is a perishable

commodity, Government will have to enter into the market for the purchase of the commodity for onward supply to the deficit areas.

4. Market information with respect to the price in consuming markets should be made available to the farmers. Availability of information on prices will enable the farmers to adjust the harvesting of crop.
5. Payments from the wholesalers are received late which causes inconvenience to the potato growers. Marketing of potato should therefore be undertaken on co-operative basis.
6. The industrial use of potato should be encouraged and factories could be established in this area for the production of starch, vodka and potato flour etc.
7. There are limited cold storage facilities in the area which are not being offered to potato growers equitably. There were many problems of cold storages so far, which related to monopoly of storages in the matter of charges, compensation, quantity stored and reservation etc.

However, constant watch is needed to save the potato growers from the manipulation of cold storage owners.

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## 8. APPENDIX

### Questionnaire for study of economics of production and marketing of *rabi* potato in Pune district (Maharashtra)

#### 1. General information about the cultivator :

Name : Age :

Education : Village :

Taluka : Dist. :

Occupation : a) Main

b) Subsidiary

#### 2. Family Information

Sr. No.	Particulars	Male	Female	Children	Educated	Uneducated
1	Size of family					
2	No. of workers					
3	No. of Dependents					

#### 3. Land holding

Sr. No.	Gat. No. / Survey No.	Total land (ha.)	Soil type	Fallow land		Cultivable land		Value of land	Land revenue
				Permanent	Current	Irrigated	Dry		

- i. Total area
- ii. Permanent fallow land
- iii. Net sown area (NCA)
- iv. Area sown more than once (DCA)
- v. Gross cropped area (GCA)
- vi. Irrigated area

#### 4. Farm building

Sr. No.	Category	Year of construction	Construction type	Present value	Repairs	Remaining life
1	House					
a	In village					
b	On farm					
2	Byre					
3	Store house					
4	Engine house					
5	Well					
a	Dug well					
b	Tube well					
6	Others					
	Total					

#### 5. Implements and Machinery

Sr. No.	Category	Nos.	Original cost (Rs)	Year of purchase	Probable life	Repairing Cost (Rs)	Present value (Rs)
A.	Implements						
	i) Wooden plough						
	ii) Iron plough						
	iii) Seed drill						
	iv) Harrow						
	v) Hoe						
	vi) Clod crusher						
	vii) Others						
	a)						
	b)						
	c)						

Sr. No.	Category	Nos.	Original cost (Rs)	Year of purchase	Probable life	Repairing Cost (Rs)	Present value (Rs)
<b>B.</b>	Equipments						
	i) Bullock cart						
	ii) Duster						
	iii) Sprayer						
	iv) Others items						
	a)						
	b)						
	c)						
<b>C.</b>	Machinery						
	i) Oil engine						
	ii) Ele. Motor						
	iii) Tractor						
	iv) Pipe line						
	v) Power tiller						
	vi) Thresher						
	vii) Other						
	a)						
	b)						
	c)						
<b>D.</b>	Hand tools						
	i) Sickle						
	ii) Weeding hook						
	iii) Kudal						
	iv) Spade						
	v) Wooden basket						
	vi) Iron bucket						
	vii) Pickaxe						
	viii) Others						
	a)						
	b)						
	c)						

## 6. Livestock

Sr. No.	Category	Nos.	Breeds	Age	Purchase price (Rs)	Present value	Remark
1	Cows – a. In milk b. Dry						
2	Buffaloes - a. In milk b. Dry						
3	Bullocks						
4	Heifer buffaloes						
5	Heifer cows						
6	Sheeps						
7	Goats						
8	Poultry						
9	Other animals						
	Totals						

## 7. Cropping pattern (hectares)

Sr. No.	Season	Crop	Variety	Irrigated crops	Dry crops	Remark
<b>A.</b>	<b>Kharif</b>					
1						
2						
3						
<b>B.</b>	<b>Rabi</b>					
1						
2						
3						
<b>C.</b>	<b>Summer</b>					
1						
2						
3						
<b>D.</b>	<b>Annual / Perennial</b>					
1						
2						
3						
	<b>Total</b>					

## 9. Storage

### i. Storage type

Sr. No.	Type of storage	Storage capacity (qtls)	Area (Sq. ft.)	Expected life	Present value	Quantity stored during this year	Storage period (From – To)
1							
2							
3							

### ii. Details of storage

Sr. No.	Month of storage	Quantity stored	Quantity after storage	Losses during storage		Nature of damage
				In quintal	Value in Ps.	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						



**iii. Storage cost**

Sr. No.	Cost items	Cost (Rs.)
1	Transport	
2	Labours (For filling and taking out etc.)	
3	Chemicals	
4	Others	
a		
b		
c		
5	Storages charges	
	Total	

**10. General information about storage of *rabi* Potato**

1. Which variety of *rabi* potato can be stored for a long time?
2. In which season potato can be stored for a long time?
3. State reasons for storing the potato
  - a. To reap benefits of higher price
  - b. For home consumption
  - c. For preparation of seed
  - d. After harvest inadequate time to disposed off produce
  - e. Any other reason (Specify)
4. What is your past experience of storing potatoes?
  - a. Higher price realized
  - b. Same price prevailed in post harvest period
  - c. Decline in prices
5. Different types of storage structure known to you.
  - a.
  - b.
  - c.

6. Different type of losses faced by you during storage
  - a. Decaying due to rains
  - b. Discolouration
  - c. Sprouting
  - d. Infected due to pest diseases
  - e. Other
7. Which part of storage structure need frequent repairs?
8. Where you constructed the storage structure?
  - a. Near residence
  - b. In field
  - c. state reasons
    - a.
    - b.
9. What are the problems faced by you in storing potatoes?
  - a.
  - b.

### **11. General information about cultivation of *rabi* potato**

- 1) Do you think that crop is profitable Yes/No
- 2) Do you prepare seed at home Yes/No
- 3) a. Can you get a quality seed material in time? Yes/No  
 b. Can you get new varieties of seed in time? Yes/No
- 4) What do you think about price of seed? Costly/cheap/Optimum
- 5) Do you use sufficient quality of manures for the crop? Yes/No  
 If not, why?  
 It is costly /Not available sufficiently/Not available at all.
- 6) Do you use sufficient quality of fertilizers? Yes/No  
 If not, why?  
 It is costly /Not available sufficiently/Not available at all.
- 7) Pest and diseases if infection is More/less medium.
- 8) Whether the pesticide and insecticide are available in sufficient quantity. Yes/No

- 9) What do you think about prices of pesticides and insecticides?  
 Costly / Cheap / Optimum
- 10) Is there availability of loan in time? Yes/No
- 11) Whether labour supply is sufficient? Yes/No
- 12) Work on own farm is available through out year Yes/No
- 13) Whether hired labour is easily available? Yes/No
- What do you think about wages of labour? High / optimum
- 14) Whether labour work satisfactorily? Yes/No
- 15) Whether there is difficulty of getting bullocks and implements on hire for different operations? Yes/No
- 16) In which month do you plant this crop?
- 17) Do you recommend that research should be undertaken on this crop? Yes/No
- 18) If yes, then on what aspects varieties / pests/ diseases / cultivation practices.
- 19) Whether you get the technical knowledge about potato cultivation? Yes/No

## 12. General information about marketing of *rabi* potato

1. Whether there is assured market for the commodity? Yes/No
2. Which market you perfect?  
 Chakan/ Pune / Mumabi
3. Whether transport facilities are available in time? Yes/No
4. Means of transportation. Trunck/Tempo/Railway/Bullock cart.
5. Transport cost is reasonable or not?
6. Whether packing material is available easily?
7. What you think about the prices of paking material? High/optimum/chep.
8. In which month the prices are high?
9. Losses during transport? Yes/No
10. Whether there are cold storage facilities in the producing area. Yes/No
11. Whether there is presence of High Commission agents? Yes/No
12. Whether there is deduction in weight by commission agent? Yes/No

13. Whether there are faculty measures and weight in market? Yes/No
14. i. Is there problem of price variation in the market? Yes/No  
 ii. Market rates are satisfactory or not? Yes/No  
 iii. What is per quintal rate of potato in market?
15. You know about all information of market i.e. prices, commission of each middle etc? Yes/No
16. Can you made the payment of you produce quickly by the market? Yes/No
17. Any other problem about potato marketing?

**13. Schedule for commission agents – Hundekari (Transport agency), wholesaler, Export agent etc.**

- 1.Name-
- 2.Name of market-
- 3.Licence fees/year-
- 4.Wages of permanent/casual labour per year-
- 5.Hiring charges for marketing shops per year-
- 6.Hospitality charges per year-
- 7.Other expenses, if any –
- 8.Total quantity of potato handled in a season-
  - a. How much quantity handled of other vegetables?
  - b. Sale price flow in a season-
  - c. Commission received from potato grower-

**14. Schedule for retailer**

- 1.Name of retailer-
- 2.Name of purchasing market-
- 3.Name of marketing area –
- 4.Total quantity of potato sold in a year-
- 5.How much quantity of other vegetables sold in a year-
- 6.Purchase price of potato-
- 7.Expenses incurred –
  - a.Loading unloading charges
  - b.Transporting charges

- c. Market fees-
- d. Commission-
- e. Other expenses, if any-
- f. Losses in quantity spoiled-
- g. Selling price of potato-

**15. Schedule for consumer-**

- 1. Name of consumer-
- 2. Name of market-
- 3. Total quantity of potato purchased –
- 4. Purchase price of potato-

## 9. VITA

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### **AMOL TATYASAHEB PATIL**

A candidate for the degree of  
MASTER OF SCIENCE (AGRICULTURE)  
in  
AGRICULTURAL ECONOMICS

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**Title of thesis** : “AN ECONOMIC ANALYSIS OF  
PRODUCTION AND MARKETING OF  
*RABI* POTATO IN PUNE DISTRICT”

**Major Field** : Agricultural Economics

#### **Biographical information:**

**Personal** :

- Born at Miraj, Tal. Miraj, Dist. Sangli, on 27<sup>th</sup> February 1983, Son of Shri. Tatyasaheb Bhikaji Patil and Sau. Shakuntala Tatyasaheb Patil. I have only brother Dhananjay.

**Educational** :

- Attended primary school at Nutan Marathi Vidyaniketan, Tasgaon.
- Passed S.S.C. from Vidyaniketan Krishi Madhyamik Vidyalay, Tasgaon with first Class in 1998.

- Passed H.S.C. from Vidyaniketan Junior College, Tasgaon with first class in 2000.
- Received B.Sc. (Agri.) degree with first class in 2004 from the College of Agriculture, Kolhapur.

**Scholarship**

:

- Received College cum Merit Scholarship during B.Sc. (Agri.) degree from 2000 to 2004.
- Received University Merit scholarship during M.Sc. (Agri.) degree programme.

**Co-curricular activities :**

- Participation in National Service Scheme (240 hrs) during under graduation programme.

**Job selection**

:

- Selected as Assistant Manager (Rural Development) in Union Bank of India (A Government of India Undertaking)