“An Empirical Verification of Profitability in Potato Farming with special reference to Ambegaon and Khed Talukas of Pune District”

THESIS SUBMITTED TO

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SUBMITTED BY

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MARCH 2015

CERTIFICATE

This is to certify that the work incorporated in the thesis entitled **"An Empirical Verification of Profitability in Potato Farming with special reference to Ambegaon and Khed Talukas of Pune District"** for the degree of 'Doctor of Philosophy' in the subject of Economics under the faculty of Arts, Social Sciences and Commerce has been carried out by **Mr. Devadatta Vasant Shelake** in the department of Economics at Bharati Vidyapeeth Deemed University's 'Yashwantrao Mohite College, Erandawane, Pune 411038, Pune during the period from 2010 to 2015 under the guidance of Dr. Mrs. Madhura Joshi.

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Place: Pune **Prin. Dr. K. D. Jadhav**

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Place: Pune

Date: _____

Dr. Mrs. Madhura Joshi
Research Guide

DECLARATION

I, hereby declare that the thesis, entitled, **"An Empirical Verification of Profitability in Potato Farming with special reference to Ambegaon and Khed Talukas of Pune District"** submitted by me to the Bharati Vidyapeeth University, Pune (India) for the Degree of Doctor of Philosophy (Ph. D.) in Economics under the Arts, Social Sciences and Commerce, is original piece of work carried out by me under the supervision of Dr. Mrs. Madhura Joshi. I further declare that it has not been submitted to this or any other university or institution for the award of any degree or diploma.

I also confirm that all the material which I have borrowed from other sources and incorporated in this thesis is duly acknowledged. If any material is not duly acknowledged and found incorporated in this thesis, it is entirely my responsibility. I am fully aware of the implications of any such act which might have been committed by me advertently or inadvertently.

Place: Pune
Date: _____

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Devadatta Vasant Shelake

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ABBREVIATIONS USED

Abbreviation	Full Form
AEZs	Agri Export Zones
APEDA	Agricultural and Processed Food Products Export Development Authority
APMC	Agriculture Produce Marketing Committee
AICRP (PHT)	All India Coordinate Research Projects centers.
BPO	Business Process Outsourcing
DCCB	District Central Coop. Bank Ltd.
FYM	Farm Yard Manure
FAO	Food and Agriculture Organization
Ha	Hectare
MIDC	Maharashtra Industrial Development Corporation.
MPKV	Mahatma Phule Krishi Vidyapeeth, Rahuri
MARKFED	Marketing Federation Ltd. (Each state has such a Markfed)
M. T.	Matric Tonne
MNCs	Multi National Companies
NAPHED	National Agricultural Co-operative Marketing Federation of India Ltd
NABARD	National Bank for Agriculture and Rural Development
S.H.G.	Self Help Group
T.V.	Tele Vision
CIPRI	The Central Potato Research Institute, (Simla)
DMI	The Directorate of Marketing and Inspection
HAFED	The Harayana State Cooperative Supply & Marketing Federation Ltd.
U.T.	Union Territories
WTO	World Trade organization

CHAPTER – I
INTRODUCTION

1.1 INTRODUCTION

In Indian economy, agriculture plays a dominant role. India has a vast population base. As of 2011 census the Indian population was 1,210,193,422 (1.21 billion). There are number of basic commodities like wheat, rice, jawar, bajara, cereals, pulses, etc. produced in India. At present the dietary system is undergoing changes. The masses have number of options available in the Indian market. The demand for food is diversified and is increased to a great extent. India imports edible oils and pulses. In order to reduce the dependence on imports efforts are being made to diversify India's agricultural produce. At the same time India is aiming at ensuring sustainable development of agriculture. The prime objective of this is to increase the agricultural income of the agriculturists. Due to increase in the standard of living the demand for fruits and vegetables has also increased over the years.

Of the world's geographical area, India accounts for only about 2.4% area and has only 4% water resources. India's population is 17% of the world population and in addition it has 15% of world livestock which is dependent on this resource. Agricultural income forms a major portion of the Indian economy. It is 14% of the Gross Domestic Product. Agriculture exports account for about 11 per cent. Almost 50 percent of India's population is dependent upon agriculture income. The Indian industries get 75 per cent of its raw material requirement from agriculture sector.

During the financial year 2011-12 Indian agriculture sector recorded highest production at 23259.32 million of which the production in Kharif season was 131.27 million tonnes and in Rabbi season it was 128.5 million tonnes. Cereals production was 242.23 million tonnes while the pulses recorded production of 17.9 million tonnes.

1.2 ORIGIN OF POTATO

In the world consumption of food grains rice and wheat account for number 1 and 2 and potato ranks 3rd number. Over one billion consume potato as a food item. Over the years in India also there is a fast shift in the consumption of potato. Earlier it was used only as a vegetable but of late there are number products of potato that are used in the daily consumption of the Indian population. It is expected that the production of potato will continue to increase in India as the climate is suitable and it's cultivation fits in Indian cropping patterns.

Around 145 man days are required for the cultivation of potato as it is a labour intensive crop. Semi skilled labour is required in huge number for completing harvest operations like transportation, storage, processing, marketing etc. Thus potato achieves to provide utilization in the rural economy. Around 75% of labour required for potato cultivation is contributed only by woman. Therefore potato encourages giving equal treatment to men and woman in today agricultural labour market.

Potato an input intensive crop contributes sufficient importance in the overall economic development of the country by supporting other sectors of the economy like industry, finance and services. Overall potato as a crop supports the growth of different service sectors like agricultural marketing, technical consultancy etc.

As per the technological interventions made by Indian Council of Agricultural Research the potato productivity was 6.44 t/ha in the year 1949-50 that increased to 18.81 m.t/ha in the year 2008-09. In India Potato was introduced as a moderate crop and was first time restricted to highland areas. Indian Council of Agricultural Research which is a premier institution so far as Potato research has made a change in the temperate potato to a subtropical crop. Potato emerged as a principal component of the profitable maize-potato- wheat sequence in the vast North western plains, during the Green Revolution. In many areas of eastern Indo-Gangetic plains potato became a successful crop.

In India more than a dozen private enterprises have already entered into seed potato production. It is certain to happen that private sector has entered in the

participation due to huge demand of certified seeds. Instead of conventional practice of field multiplication the private enterprises prefer rapid multiplication.

Over the last decades, in India potato is consumed as a vegetable. There are heavy losses due to wastage of potato due to insects and sub-tropical conditions. Use of both fresh and processed potatoes is necessary to avoid excess supply and market variation. A special importance has to be given for development of innovative potato products for its consumption all over India. This process has already begun and multinational companies like Pepsi, ITC, etc. have already started their production of processed potatoes in a big way and it has been accepted by the Indian public.

1.3 USAGES OF POTATOES

Potatoes are also used in the production of pharmaceutical products like dextrin and glucose. For use of potatoes as a food product it is converted into potato chips, sliced and shredded potatoes. Potatoes are also used in the hotel industry in a big way. It is also used in the textile industry for production of starch and alcohol. Potato starch is used by the sizing units of textile industry.

Potato bread has 6 percent flour. It also has distinctive flavors, better keeping qualities than that of wheat flour bread. Potato flour is also used as thicker, flavouring agent as in gravies, sauces and baby foods. Potato flour is used in the manufacture of pastries, yeast doughnuts, cakes and cake mixes, greater bloom flavour intensification colour of crust, volume texture and flavour.

There are different interesting ways to consume potato. With the entry of McDonald, Pizza Hut, Papa John like multinational hotels in India number of products wherein potato is used as a food item have become very popular throughout the length and breadth of India.

Now days due to globalization of Indian economy there are several multinational malls all over the metro centres as well as lots of Star Hotels have been opened over the few years which have brought forward various western world products where potato is used. A few of these items are given below:

- ❖ Various types of parathas wherein potato is stuffed in various form. It is traditionally used as a breakfast item.
- ❖ In the rural areas all over India potato vada is very popular which is consumed with bread.
- ❖ Pav Bhaji is also a very popular dish in all the hotels and particularly kids prefer to have it. Potato is also used in various types of sandwiches which are sold on all the railway stations and is an item of mass consumption.

In all these varieties of food items potato is used in various forms like boiled, fried and is used as stuffing material in various dishes. A combination of potato with onion and garlic and ginger is used in these dishes. Along with these dishes tomato souses in general.

A number of multiple food preparations have been introduced in the Indian market where potato figures very commonly. Due to this there is heavy demand for potatoes and its powder from the hotel industry which is a flourishing industry today.

1.4 GLOBAL PERSPECTIVE

The commonly used vegetable in the country is Potato, with a production of 40-42 million tonnes, the third largest producer of the crop is India. Though India's agricultural levels are lower than the crop yield in Germany and Netherlands, and these are higher than China and Russia.

Table 1.1: Area, Production and yield of Potato in Major producing countries (2010-2011)

Rank	Country	Area in Thousand Ha.	Production in Mill. MT	Yield MT/Ha	(Col. %)	
					Area	**Production**
1	Poland	490.9	8.8	17.9	2.43	2.15
2	China	5077.5	74.8	14.7	27.25	18.29
3	India	1863.0	42.3	22.7	10.0	10.35
4	Russian Fed.	2109.1	21.1	10.0	11.32	5.17
5	Ukraine	1408.0	18.7	13.3	7.56	4.57
6	USA	406.6	18.0	44.3	2.18	4.41
7	Germany	255.2	10.2	40.3	1.37	2.49
8	Bangladesh	435.0	7.9	18.2	2.33	1.94
9	Belarus	366.08	7.8	21.4	1.97	1.91
10	Netherlands	157.0	6.8	43.6	0.84	1.67
11	Others	6061.2	113.5	18.7	32.53	27.75
	Total	**18630.2**	**408.09**	**17.7**	**100.00**	**100.00**

Source: National Horticulture Board.www.nhb.gov.in

1.5 HISTORY OF POTATO IN INDIA[1]

Amongst the newly introduced ideal crops the potato crop is the most ideal one. It has immediately caught the top most favourite food item in the world. The potato crop was first invented in the Southern Asia in the late sixteenth. It was introduced, it is believed, that Portuguese mariners introduced it. The scientific name of potato is Solanum Tubersoum L. At that time the Europeans were not confident about the wholesome nutrition value of potato. Potatoes inclusion as cargo on ships from Portugal.

History of potato is not clear. The term potato is derived from 'Batata'. Eighty years before potato the sweet potato was known in Asia. It was for the first time Edward Terry who was attached to the chapel of a royal court, to Shir Thomas Roe

[1] https://research.cip.cgiar.org/confluence/display/wpa/India

who was the British Ambassador in the Mughal Empire between 1615 to 1619 referred to Potato in the then northern area.. (Upadhya, cited in Pandey and Kaushik 2003, p. 22)

Warren Hastings the British Governor was pioneer in promoting potato cultivation during his regime from 1771 to 1785.

During the 19th century cultivation of potato crop was very well established in the hills and plains of India. It was then a local variety which was known as 'Phulwa', 'Gola' and 'Satha'. This variety was maturing within sixty days. (Pandey and Kaushik 2003, p. 23).

However it was cultivate as a garden vegetable i.e. on minor scale and usually it was grown as a summer crop at high altitudes where Britishers had colonized The varieties of potato introduced via Europe were not suitable to Indian conditions because of the hot climatic conditions prevailing in India. Initially the problem of storage of the potato production created problems during summers. It was mainly due to fast degeneration seed tubers. Only a few varieties could gather roots in the higher altitudes.

A working group was appointed for cultivation of potato in India under the chairman ship of Sir Herbert Steward. He was the then Agricultural Advisor to the Government of India. And as per this committee in the year 1949 i.e. within two years of India getting independence. The Central Potato Research Institute (CPRI) was established in Patna in Bihar. In the year 1956 the Institution was shifted to Shimla. CPRI was established to develop potato varieties and also to develop technologies appropriate to suit the Indian conditions.

By 1950, 32 cultivated varieties had been identified, 16 each of relatively recent European import and more locally adapted so- called Desi varieties (Pandey and Kaushik 2003, p. 23).

1.6 CULTIVATION OF POTATOES IN INDIA

Potato is cultivated in India in about 21.3 million hectares with a total production of 24.7 million tonnes. The areas where potato crop is prominently cultivated are: Uttar Pradesh, West Bengal, Bihar and Punjab. In India Uttar Pradesh is the area where potatoes are grown in a big way. Almost over 41% of the total production of potato is from Uttar Pradesh.

In India the potato crop is cultivated in two seasons i.e. Kharif and Rabi. During August to October, we get potato from Kharif season which is nearly 15 to 20%. The Rabi potato crop is harvested by middle of December to April and this is nearly 80 to 85% of the total potato production. Only the Rabi potato is stored in cold storages and later on it is brought to the market as per the demand and some part is also exported.

Climatic Requirements

We have already seen above that the potato is a cool season crop. The ideal conditions for the potato cultivation are where soil is fertile, there is sufficient moisture in the atmosphere and cool atmosphere. When the temperatures are between 170 to 180 C the growth of tubers is satisfactory. When the temperature goes higher than this it adversely affects the tuber formation and ultimately the yield is affected. At higher temperatures it consumes the carbohydrates rather than sorted in the tubers. So also it grows under long day conditions rather than short day conditions. If during the day there is sunshine and nights are cool there is less scope for attack of diseases.

Varieties of Potato

CPRI has invested number of high yielding varieties of potato which suit the Indian soils as well as climatic conditions. After due library tests these varieties are introduced in the market for cultivation of potato by the farmers.

Kufri Pukhraj, Kufri Jawahar, Kufri Ashoka, Kufri Lauvkar, Kufri Chandramukhi are the early duration varieties which are ready in about 70-90 days. Kufri Anand, Lalima, Kufri bahar, Kufri Badsahah are the mid duration varieties (90 – 100 days).

Field Preparation

For cultivation of potato crop the seed bed is required to be prepared which is properly crushed. Such a land is good for tuberization of the potato crop. Immediately after the Kharif crop the land is required to be ploughed once with 20-25 centimeter deep with soil turning plough. Thereafter harrowing operations are carried out to ensure that there is properly crushed land. The land is required to be prepared properly surfaced and leveled. At the time of sowing there should be adequate moisture so that germination takes properly.

Selection of Seed

The selection of potato seed is a skillful job. The seed should be sound in health and pure seed of high yielding varieties and it should be free from diseases and pests. Seeds with surface borne diseases should not be used for sowing. Needless to say that certified seeds should be used for better results.

Seed Treatment

Before sowing the seeds should be got washed in water and then dipped in 1% chlorocin solution. Afterwards it should be again rinsed in fresh water. Then washed tubers may be treated in 3% solution of boric acid for 30 minutes to control black scurf and common scable etc.

Planting Time

In order to obtain optimum yield it is essential that the planning of the potatoes should be right time. The right time is when the temperatures are from 300 to 320 C and 180 to 200 C respectively.

Seed Size, Seed Rate and Spacing

For obtaining highest yield the tuber size should be of 30 to 50 grams weight. For early crop the whole tubers should be planted. Because of high temperature and moisture in soil, the chances of tubers get rotted. For plantation of one hectare of potatoes normally 25 to 30 quintals of seeds are sufficient. Cut tubers can be planted for main crop.

This cutting of potato for planting should be carefully done and it should be ensured that at least two or three eyes are there on the cut potato and its weight should be at least 25 grams. There should be a minimum distance of 45 to 60 centimeter between two rows. Plant to plant distance should be of 15 to 20 centimeter.

Manures and Fertilizers

Feeding value of potato is quite high and therefore it needs sizable does of fertilizers for obtaining speedy growth and higher yield.

It has been observed that a good crop of potato where the yield is about 400 quintals takes away 170 to 180 Kgs of nitrogen from the soil, 25 Kg of Phosphorus and 250 Kg of Potash. Usually potash is available in abundance. In some soils phosphorous is also available. Therefore, these fertilizers i.e. potash and phosphorus should be used only after testing the soil.

Most important nutrient that affects the potato production is Nitrogen. In the soils classified as acidic soils of hills and lateritic soils of south and east India The Phosphorus fertilizer requirements are high. On the basis of the available phosphorus in the soil the application of phosphate is dependent. Therefore, testing of soil is necessary which indicates various ingredients in the soil and the cultivator can decided the dosage of fertilizers.

Water Requirement

In order to obtain good yield the potato crop requires good water management. Excess water is required to be removed promptly. It is required to be ensured that the soil should have adequate moisture and hard or highly wet soils should not be used for potato cultivation.

Insect Pests

Potato crop is highly susceptible for the insect pests as it adversely affects the soil to a great extent. The Agriculture Extensions Offices which are attached to the Block Development Office located at the Taluka / Block head quarter provide requisite guidance to the agriculturists.

Harvesting

When the haulms start yellowing and falling on the ground the harvesting should be done. Haulms should be removed at the ground level. There should be two weeks time after cutting the haulms for starting the harvesting. Where the area to be harvested is small the digging is done with the help of spades or Khurpi. For large size harvesting tractor of suitable capacity is use. These tractors are having potato diggers. At the time of harvesting maximum moisture should be there in the soil. After digging out the potatoes those are kept in shade for drying.

- In the state of Maharashtra normally potato crop becomes ready for harvesting in about 3 months after planning.

- For obtaining optimum yield the potatoes should be harvested at the right time when the leaves turn yellow and dry.

- In order to get market price if there is a good demand and the rates are favourable even slightly early harvesting is also advisable.

- For smooth harvesting it is advisable to have the soil dry therefore irrigation is withheld before harvesting.

- The plants should be cut at the ground level one week before the harvesting date. This is done with the help of Kudal or potato digger or by ploughng with deshi plough.

- Digging out the potato without injury is a skilful job. The exposed tubers be collected and cleaned off by removing soil, roots and stolons etc.

- The potatoes which are damaged or affected by any diseases should be sorted out and discarded.

- ❖ The potatoes which can be marketed should be graded according to their size and stored in a shade to avoid sun injury.

- ❖ It is advisable to collect disease free and medium size potatoes for seed purposes for sowing in the next season.

Yield

Any yield of about 30 to 40 tonnes per hectare can be obtained.

- ❖ The yield of potato varies from variety from variety season of planting and care taken during cultivation.

- ❖ Average yield of potato in Maharashtra is about 125 qt/ha.

- ❖ Average yield of potato in India is about 200 to 300 qt /ha.

Table 1.2 : State-wise Area for Potato in India during 2007-08 to2012-13

(Area (in '000 Hectare)

State/UTs	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Andhra Pradesh	6.60	6.60	7.20	-	4.92	5.07
Arunachal Pradesh	4.00	4.00	4.00	-	4.60	4.60
Assam	79.30	79.70	86.60	-	89.38	90.27
Bihar	315.50	310.30	313.60	-	315.17	315.40
Chhatisgarh	31.00	32.10	32.60	36.40	41.20	43.37
Daman and Diu	-	-	-	-	-	-
Delhi	1.40	1.50	1.50	-	0.71	0.15
Gujarat	65.20	57.00	60.10	-	80.70	80.70
Haryana	19.80	23.20	23.00	-	27.82	28.20
Himachal Pradesh	14.00	16.00	16.00	-	16.00	16.00
Jamu and Kashmir	5.60	6.50	2.00	-	6.91	6.91
Jharkhand	40.0	38.10	38.20	43.20	45.75	45.75
Karnataka	67.90	71.60	81.10	-	45.40	47.50

Kerala	0.00	0.30	0.30	-	0.32	0.32
Madhya Pradesh	50.0	66.20	60.80	62.00	87.98	96.77
Maharashtra	19.10	18.00	18.80	-	18.00	14.00
Manipur	1.70	1.70	1.70	-	17.84	-
State/UTs	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
Meghalaya	18.80	20.30	20.30	-	0.20	18.14
Mizoram	1.70	2.90	1.50	-	2.90	0.25
Nagaland	1.50	1.50	1.50	-	14.19	2.90
Odisha	12.90	13.30	12.90	-	-	14.14
Punjab	79.00	81.10	83.10	83.60	84.11	85.14
Rajasthan	11.30	9.10	8.50	-	11.86	11.86
Sikkim	7.80	8.10	9.20	-	9.77	10.23
Tamil Nadu	5.60	4.40	4.70	-	4.91	5.50
Tripura	5.90	-	-	-	6.90	6.95
Uttar Pradesh	504.90	527.30	540.80	556.60	567.66	579.02
Uttarkhand	23.70	25.10	25.10	-	25.03	25.03
West Bengal	400.80	400.80	370.00	406.30	376.75	376.75
And others	212.60	211.20	178.0	675.20	-	-

Source: National Horticulture Board (ON54), (ON 103),

Table 1.3 : State-wise yield of Potato in India during 2011-12 and 2012-13 Upto 24.09.2012

(Yield : Kilograpm'000/Hectare)

State/Union Territories	2011-12*	2012-13@
Andaman and Nicobar Islands	-	-
Andhra Pradesh	20.00	20.00
Arunachal Pradesh	8.70	8.70
Assam	8.76	8.85
Bihar	19.36	20.00
Chhatisgarh	14.06	13.90
Dadra and Nagar Haveli	-	-

Daman and Diu	-	-
Delhi	23.75	43.33
Goa	-	-
Gujarat	29.68	29.68
Haryana	22.24	20.67
State/Union Territories	**2011-12***	**2012-13@**
Himachal Pradesh	12.89	12.89
Jamu andKashmir	18.42	18.42
Jharkhand	14.27	14.27
Karnataka	10.64	10.61
Kerala	17.00	17.00
Lakshdweep	-	-
Madhya Pradesh	20.65	20.65
Maharashtra	20.00	23.00
Manipur	-	-
Meghalaya	9.24	9.53
Mizoram	12.60	12.61
Nagaland	6.96	6.96
Odisha	14.17	14.22
Punducherry	-	-
Punjab	25.01	25.01
Rajasthan	15.01	15.01
Sikkim	4.82	4.83
Tamil Nadu	21.36	22.89
Tripura	17.82	17.69
Uttar Pradesh	24.88	25.38
Uttarkhand	17.33	17.33
West Bengal	25.73	25.73

Note: * Final Estimates, @ Provisional

Source : National Horticultural Board, Govt. of India

Table 1.4: State-wise Area, production and Yield of Potato in Western India for the period 2007-08 to 2010-11

(Area in '000 Hectare, Production in '000 Tonne, Yield in '000 Kilogram/Hectare)

State/UTs		2007-08	2008-09	2009-10	2010-11
Maharashtra	Area	19.10	18.00	18.80	0.00
	Production	198.20	187.20	407.90	253.20
	Yield	0.00	0.00	0.00	0.00
Gujarat	Area	65.20	57.00	60.10	0.00
	Production	1493.90	1448.80	1657.00	1300.00
	Yield	22.9	25.04	27.60	0.00
Goa	Area	0.0	0.00	0.00	0.00
	Production	0.0	0.00	0.00	0.00
	Yield	0.0	0.00	0.00	0.00
Madhya Pradesh	Area	50.00	66.20	60.80	0.00
	Production	650.40	882.90	608.40	1067.40
	Yield	13.00	13.30	10.00	0.00
Daman & Diu	Area	0.00	0.00	0.00	0.00
	Production	0.00	0.00	0.00	0.00
	Yield	0.00	0.00	0.00	0.00
Western India	Area	134.30	141.20	139.70	0.00
	Production	2342.50	2518.90	2673.30	2620.60
	Yield	35.90	38.70	37.60	0.00
India	Area	1795.00	1828.30	1835.30	0.00
	Production	34658.30	34390.90	36409.50	38015.40
	Yield	19.31	18.81	19.84	0.00

Source: Compiled by datanet India from: National Horticulture Board, Ministry of Agriculture.

0- data not available

1.7 PRODUCTION REQUIREMENT

The history of potato is traced about 8000 years ago near Titicaca which is at the altitude of over 12500 ft above sea level in South America's Andes mountain range. It is surrounded by the borders between Bolivia and Peru. The first effort to domesticating the wild potato plants was begun about 7000 years ago by the hunter communities.

In America more than 200 species of potatoes are found. The farmers in Central Andes were successful in improving the select varieties of potato for domestic consumption. Potato is the only food crop next to cereals that supplement the need of the food of the country.

This is a crop which is harvested and the tubers can be consumed at any time after sixty days of planting. All over the world we find that the potato is a major food crop. It is a source of energy which is superior to cereals like rice and wheat. Potato contents carbohydrates with a high production potential.

Even in India potato is most widely consumed. So far as world production of potato is concerned India ranks second, contributing to 10 – 11% of the world production of potato. China ranks first in the world with 22% of the world production. Most of the potato produced in India is used for domestic consumption and only marginal potato is exported. About 90 per cent of the production of Indian potato takes place in the cold weather season and quite a significant portion is stored and consumed throughout the entire year.

1.8 PRODUCTION OF POTATO

The Cropping System of Potato

In India the potato crop is cultivated across the country in highly varied agro climatic conditions which ranges from sea level to snow fall area in high hills. In India in certain areas three crops are raised in a year. In the hilly areas it is grown under rain fed situation. Planting of potato is sometime in March and April and is harvested in September-October.

Potato is usually grown in autumn and spring seasons i.e. two crops in a year. In September – October winter crop is taken up which is harvested sometime in April-May.

Seed Sources and Varieties

Three Potato crops are taken throughout the year in the Southern Hills. Himachal Pradesh was the main source of seed supply and now the centre has been shifted to Punjab and the neighbouring states because of the development of the seed plot technique.

The Himalayan hills at about 2500 meters height above the sea level are most suited for raising healthy seed potatoes. These climatic conditions are rare and in order to meet the demand for the potato seeds there was need for finding alternative seed developing technique.

National Seed Corporation and State Departments of Agriculture, receive supply of about 1500 tons of breeders' seed from Central Potato research Institute (CIPRI) Simla. These agencies then multiply the breeders seed in their fields and supply it to the farmers – the end users. [2]

- **Kufri Chandramukhi:** White skin, early bulking habit with oval tubers with fleet eyes, resist PLRV and PVY, best suited to the plains.

- **Kufri Alankar:** white skin, maturing early, oval shaped tubers, field immune to late blight suited to the plains.

- **Kufri Jyoti:** this variety was developed at Shimla with the material of Dr. Black. White skin variety, maturity medium. Field resistant to late blight both on foliage and tubers, Wart immune. Best suited for hills and spring crops in plains, where late blight is a limiting factor.

[2] Bhardwaj, V. P. 1985, Report on Potato production in India. International Potato Course IAC, Wageningen.

- **Kufri Sheetman:** white skin, oval shape tuber, medium maturity, resistant to frost, suited for western plains where frost is a problem.

- **Kufri Shinduri:** red skin variety, tubers round, maturity medium late, moderately resistant to late blight, suited for cultivation in the plains.[3]

Production Practices

Initially it was very difficult for the Indian agriculturists to accommodate this crop in their cropping pattern. However, after the invention of short duration variety of potato it has been rightly adjusted in the Indian agriculturists cropping pattern.

We have already seen that the cultivation of potato also requires availability of moderate irrigation facility. This is also a crucial factor which puts limitations in the cultivation of potato. Taking up potato crop in the hill area in the summer it is very difficult to maintain the requisite moisture. In the plains potatoes are required to be grown as an irrigated crop.

We have also seen that the potato crop requires heavy doses of fertilizer inputs and cost wise it works out second only to seed. Experiments are already going on to get optimum potato production with least fertilizer inputs. In a recent revelation it has been observed that with the use of organic fertilizers the production of potato increases sizably.

Diseases and Pests

Potatoes are susceptible to all bacterial, viral and fungal diseases. Some are specific to a particular part of the country, e.g. late blight in hills, cyst forming nematodes in Nilgiris, wart in the Darjeeling hills, etc.

Viral Diseases

All types of viruses such as 3leaf roll, virus A, Virus X, Virus S and M, Virus Y etc. are found in India.

[3] Srivasta, B. N. 1980. Potato production and utilization in India. CIP.

Fungal Diseases

Amongst the fungal diseases Late blight is the most widely prevalent fungal disease.

Insects and Pests

In India there are several different kinds of insects and pests are found. To name a few: Aphis gossypii Glov, Aphis fabae Scop, and Macrosiphum enphorbiae. Leaf hopper (Empaasca spp.), cutworks (Agrotis spp.) and tuber moth (Phthorimaea spp.) are also found.[4]

Potato Production, Storage and Processing

Prior to the advent of cold storages the potatoes were used to be stored at the room temperature.

As a result of high temperature of about 35 degree C in summer there used to be adverse impact on the quality of the potatoes. Foreign varieties of potatoes therefore could not be cultivated as those could not withstand with this much of temperature.

It was in 1938 the first Cold storage for potatoes was started at Meerut. Gradually the number of cold storages increased to 7,486 with a capacity of 34.82 million tons by 2006. Even then today there is shortage of cold storages all over India. The government has introduced special scheme through National Bank for Agriculture and Rural Development (NABARD) for construction of cold storages at concessional rates of interest.

After adoption of the economic reforms and policy of globalization, liberalization and privatization there has been lots of changes in the Indian economy. Indian potato processing industry has now emerged the fastest growing industry. India has witnessed migration of the rural masses to the nearby urban centre to earn their livelihood as a result the urbanization is also growing rapidly. The domestic demand

[4] Dhingra, M.M.K. 1978.Report on Potato production in India. International Potato Course IAC, Wageningen.

for the processed potato products has considerably increased. This has paved the way for development of indigenous processing varieties. Potato processing industry mainly comprises 4 segments: potato chips, French fries, potato flakes/powder and other processed products. However, potato chips still continue to be the most popular processed product.

So far as the processing of potato products is concerned in the Western India the state of Gujarat is a leading State. The potatoes produced in Gujarat are most suitable or potato powder and flakes and this leads to value addition.

Product Application

The potato products like powder and flakes have considerable consumption s it is used in processing and snack food industries. It can be used in any food recipe which requires potato puree. Potato powder is used as a thickener or base for preparation of ready to eat vegetable gravies and soups.

Market & Growth Drivers

In the year 2005 the global potato production was around 322 million MT. As has been stated earlier China dominates the world production of potatoes. It contributed about 23 per cent, and Netherlands is the top most importer and exporter of the potato in the world. During 2004-05 it exported around 17 million MT of potato valued at US $ 498 million and imported about 16.5 million MT of potatoes valued at US $ 208 million. The other major exporters of potatoes are France, Germany and Egypt and USA. Germany, USA, Algeria and Brazil import sizable potato.

Table 1.5: Trade Statistics

Sr. No.	Particulars	Years ending 31st March					Total
		2003	2004	2005	2006	2007*	
1	Export (Q)	43.89	17.02	122.48	141.91	76.01	436.1
	(V)	15	2.58	20.57	72.46	20.85	141.87
2	Import (Q)	414.01	560.15	830.24	369.4	40.27	2450.13
	(V)	203.28	311.51	492.06	211.1	22.97	1362.27

Source: Department of Commerce, India. (Q) Quantity (V) Value in INR lacs. 2006-07* indicates data from April to June.

Distribution

The greatest hurdle in the expanding the potato production is the monopoly of wholesale and retail distribution which is in the hands of the private traders. These distributors manipulate the market conditions and cheat the producers. There is no price uniformity and many a times artificially glut and shortages are created. In this process the middlemen get more profit and exploit the producers. Currently there is some improvement as the producers cooperative societies are being formed to replace the middlemen in the marketing activity. These societies are also having their own cold storages and their attempt is to fetch better price to the producers.

Post-harvest Management and Value-addition

Post harvesting losses in potatoes vary from 10 to 40 per cent. It depends on the manner in which those are harvested and are handled and stored. These losses can be drastically reduced if the agriculturists use improved and efficient handling and storage of potatoes and maintain the quality of the potatoes. These losses can be brought down below 10 per cent. Low-cost, improved on- farm storage technologies can be quite useful in staggering market arrival and avoiding distress sale.

1.9 NUTRITION VALUE OF POTATO[5]

A medium size potato has 110 calories and is absolute fat, sodium and cholesterol free. The power of potato consists of :

Potato contains good amount of potassium even exceeding what is available in banana. The potato is among the top 20 frequently consumed raw vegetables having rich potassium. Potassium is a part of everybody cell. It helps in maintaining stable blood pressure. Potassium is very vital for transmitting nerve signals. Potassium helps in lowering blood pressure.

[5] http://www.potatogoodness.com/nutrition/nutritional-facts/

1.10 NATIONAL AGRICULTURAL MARKETING FRAMEWORK

The Indian agricultural marketing depends on the market forces of demand and supply. The trading is concentrated in the hands of private enterprises. The government intervenes only when there is exploitation in promoting organized marketing of agricultural committees.

The Directorate of Economics and Statistics, Ministry of Agriculture, every year publishes annual crop and production estimates and the market arrivals and prices. The National Agricultural Co-operative Marketing Federation of India Ltd. (NAFED) is the nodal agency which deals with procurement, distribution, import and export of the agricultural commodities in India.

So far as marketing of potatoes is concerned the commission agents and cooperative marketing societies play a dominant role in the marketing of potato in India. In Harayana, Uttar Pradesh, West Bengal, Bihar, Gujarat and Maharashtra cold storages owners associations have been formed. They also play key role in potato marketing. Number of potato processed products has now been introduced in India particularly in the Urban and Metropolitan area and therefore number of potato processing units have come up in the adjoining areas of the urban and metropolitan areas. Even the packaging of the processed product has been improved and has become healthy and handy too.

Storage and Transport

The storage and transportation of potatoes takes place mostly in the winter season between November and March. However, the potato is consumed throughout the year. Therefore, storage of potatoes to keep its quality, weight, assumes key importance. It is in this context the cold storages play important role. They provide desired temperature, and storage arrangements so that the quality of potato stored in the cold storage remains healthy and acceptable in the market. The Government of India has with a view to regulating and the development of cold storages all over India has issued Cold Storage Order in 1964 and the same was replaced by the order of 1980 under section 3 of Essential Commodities Act, of 1955.

For transporting the potatoes to the market different types of modes of transport are available. For long distance transport railways haul potatoes are used while in the nearby markets trucks are used.

The following factors adversely affect the price that is fetched by the producers:

1. In the rural areas transport facilities are poor.
2. There is no grading of potatoes.
3. Inadequacy of the storage facilities.
4. Middle men charge assembling charges.

The Malpractices in the Market Place

Over the years there is a tremendous development and now the potato is mainly stored in cold storages. National Bank for Agricultural & Rural Development (NABARD) has put in special efforts in this direction and has given boost to the establishment of cold storage in the areas where there is a need for proper storage for agricultural produce including the potatoes.

Over the years because of the improved cultivating practices as well as storage and marketing techniques adopted by the producers their produce is fetching higher price year after year. It is also due to export of potatoes as well as value addition in processing of potato.

The cost of cultivation and profit margin form the price spread. There is sharing of costs between the producers, middlemen and the retailers. The transport costs for bringing the produce the market are borne by the producers. The loading and unloading charges, packing charges, toll tax etc. are borne by the middlemen. The retailers take care of the cost of commissions, transport from the warehousing to the shop. In order to ensure that there is a steady potato prices and to avoid crash in potato prices there is a market intervention scheme which is operated by the NAFED.

1.11 BUSINESS OPPORTUNITIES

Over the years the business opportunities in the area of seed production, storage, processing has steeply increased in respect of the potato crop. Even today there is inadequate supply of the potato seeds. Because of the semi-perishable nature of potatoes it is necessary to store it in cold storages as a result of which there is great demand for cold storages in the potato producing areas.

So also there is demand for transport of potato from one end to the other and hence transport activity is also in demand for transport of potatoes to the cold storage and then to the market. Most of the MNCs who have now started their potato processing units in India have already established their marketing links with the potato growers. They enter into contract with the potato producers and buy their products according to their quality requirement from the farm sites itself. In such cases the farmers also save on the transportation costs as well as cold storage costs.

PepsiCo the leading American agricultural Company has now established its outfit in India. Since 1989 they are helping the farmers to improve the quality of the potatoes as well as yield also. They enter into contract with the farmers and provide them quality seed, technical knowhow, and also buy the entire product which is according to their specifications at a pre-determined rate which is quite attractive.

Now there are number of companies both MNCs as well as domestic who are entering into contract farming with the potato producers. This is why the production of potato, over the years, is showing increasing trend. This is certainly helping the agriculturists producing potato to improve their standard of living to a great extent.

1.12 CONTRACT FARMING[6]

The “Contract Farming” is a system in which the commodity is marketed by farmers under a pre-agreed buy-back contract with an agency engaged in trading or processing. In contract marketing, a producer will produce and deliver to the contractor, a quantum of required quality of produce, based upon anticipated yield and contracted acreage, at a pre-agreed price. In this agreement, agency contributes input

[6] Pepsi co website

supply and renders technical guidance. The company also bears the entire cost of transaction and marketing. By entering in to contract, farmer's risk of price reduces and the agency reduces the risk of non-availability of raw material. The inputs and extension services provided by the agency include improved seed, credit, fertilizers, pesticides, farm machinery, technical guidance, extension, marketing of produce etc. In present scenario, Contract marketing is one of the way by which producers, especially small farmers, participates in the production of good quality potato to get higher return.

Contract Farming enables producers to adopt new technologies to ensure maximum value addition and access to new global markets. It also ensures efficient post harvest handling and meeting specific needs of customers. In such arrangement, the purchaser, may be exporter or processing unit, generally provides inputs, technical know-how and financial support. Thus sharing the risk by both the, buyers and sellers. It is an approach that can contribute to increased income to farmers, avoidance of risk of adverse price fluctuation, and higher profitability to sponsors. Many companies have entered into contracts with farmers for production and marketing of agricultural produce including potato.

Today PepsiCo India's potato farming programme reaches out to more than 40000 farmer families across six states. The company provides with superior seeds, timely agricultural inputs and supply of agricultural implements free of charge. The company enters into contract with the potato cultivators and prefix the rate with the farmers and through this mechanism the cultivators are not exposed to market price fluctuations. The company has made tie up arrangements with banks like State Bank of India through which the farmers cultivating potatoes are getting speedy sanction of credit facilities at a lower rate of interest. The company has arranged weather insurance for farmers through its tie up with ICICI Lombard. The company has a retention ratio of over 90% which reveals the depth and success of their partnership. This remarkable growth has resulted in farmers receiving somewhere Rs.20 to 40 thousand as profit per acre as against about Rs. 10,000 in 2009.

PepsiCo pioneered contract farming in India in 1989 when in order to improve the performance of a tomato processing unit in Punjab it imported and tested high yielding varieties that thrived in India. Consequently yield improved by over 300% and the length of the tomato season more than doubled, resulting in substantial increase of farmer income. Today the success of contract farming has spread and PepsiCo engages with over 240 ,000 farmers across the country to grow a variety of crops. Through this partnership PepsiCo has transformed the lives of thousands of families by helping them refine their farming techniques and raise farm productivity.

In order to provide farmers the best quality potato seeds, PepsiCo collaborated with Thaper Institute of Technology to develop quality potato mini tubers. PepsiCo has also invested in a world class potato mini-tuber facility at Sahura in Punjab which helps getting robust and disease free seeds to the company's contract farmers. PepsiCo India has introduced world class, top quality high yielding potato varieties. High yielding potato seeds have allowed farmers to produce world class potatoes and obtain higher returns.

So far the company has been successful in contracting with over 4000 farmers spread over across Punjab, Uttar Pradesh, Karnataka, Bihar, West Bengal, Gujarat and Maharashtra for supply of potatoes of the specific varieties which are used for preparation of world class chip grade.

The company has also tied up with several banks for speedy soft loans for potato cultivators which reduce the cost of cultivation. Similar is the case with McDonald – a multinational company. This is evident from the news item in Business Line dated the 24th Sept. 2012 which states as follows:

McDonald's alone will increase its potato procurement in Gujarat from 30,000 farmers as a key ingredient for outlets across the country. Through its Canadian French fries and other products, Big Mac has provided the latest technologies variety, to potato growers, mainly contract farmers in Deesa (North Gujarat).

McCain, which set up its potato processing plant in Mehsana, Gujarat, since 2007, is now increasing acreage for the tuber's contract farming. It had begun potatoes. "Last year, we sourced 40,000 tonnes of processed quality potatoes. Director, McCain Foods India, told Business Line. Contract farming has increased 40-50 tonnes per hectare"

Now these multinational companies have also expanded their contract farming activities in the State of Maharashtra which has given rise for increase in area under potato cultivation. In Pune District in Ambegaon and Khed Blocks there is a steady growth of area under potato cultivation and number of farmers have entered into partnership with the PepsiCo India and McDonalds. In fact this partnership has resulted in the economic development of these farmers.

1.13 POTATO CULTIVATION IN MAHARASHTRA

In Maharashtra state, potato is cultivated in more than fifteen thousand ha area. The major potato growing districts of Maharashtra are Satara and Pune, which is in the jurisdiction of MPKV, Rahuri. The productivity of potato in the state is extremely low and need to improve by way of using required quantity of inorganic, organic and bio-fertilizers.

The plains of Maharashtra are well suited for potato cultivation. Hence, there is scope for increasing the area under potato crop. Potato is cultivated by traditionally hence yield is very low. The lower range of production of potatoes along with following problems has become a limiting factor in potato cultivation in tropics viz. Non availability of information on use of inorganic fertilizer, organic manure and bio-fertilizers, improved production technology for potato cultivation and good quality potato seed material at planting time. Use of organic manure, inorganic fertilizers and bio-fertilizers is the best approach.

In this approach various plant nutrients are supplied by the different sources such as organic manures and previous crop residues, bio-fertilizers and chemical fertilizers contain higher nutrients than organic manures are comparatively slow acting. However, they supply available nutrients on a long term period.

Therefore, integrating inorganic with farm yard manures and bio-fertilizers will go a long way in maintaining crop production and enhancing soil fertility through their complementary effects.

In Ambegaon Taluka of Pune District there is a peculiar location named as “Satgaon Pathar” which is most ideally suited for the cultivation of potatoes. Potato crop requires a particular temperature and climate in various stages of the growth of the crop. The same is described hereunder.

At the time of plantation 220 to 200 C.G. During the first 45 days at the time of growth of the crop the temperature requirement is 200 to 220. During the period of growth of potato tubers that is 45 to 60 days from the date of plantation the temperature should be 170 to 200. During the further growth of the tubers i.e. between 60 to 90 days the temperature should be between 200 to 250.

Humidity during the growth of the potato crop is required 65 to 80%

The potato crop requires sun light every day for a period of 10 hours.

Potato is originally a crop from cold weather. Therefore, the cold weather is useful for the nourishment of potato. The above area i.e. Satgaon Pathar (Plain) offers all these climate requirements and hence the production of potato is growing fast in this area. Currently this crop is taken round the year. During Kharif and Rabbi season mainly this crop is being cultivated. The production of potatoes is higher during the Rabbi season. However, the potato processing companies which have their procurement arrangements in Ambegaon and Khed Taluka procure potato production during Kharif season as they get the required quality of potatoes for further processing.

These potato processing companies have now making inroads in the state of Maharashtra for their procurement of Potatoes. Apart from Pune District these

agencies are also procuring potatoes in Kharif season under contract basis from Parner taluka of Ahmednagar District,

There are a few districts in the state of Maharashtra where the potato crop is grown. The below detailed table indicates the district wise production of potatoes over the years.

Table 1.6: District wise cultivation of Potatoes in Maharashtra

Area in Ha

Sr.No.	Name of the District	2008-09	2009-10	2010-11	2011-12
1	Ahmednagar	647	647	1517	1517
2	Akola	NA	71	78	89
3	Amaravati	NA	203	213	238
4	Aurangabad	NA	NA	41	43
5	Jalgaon	NA	10	12	15
6	Latur		577	678	611
7	Nagpur	NA	200	216	236
8	Nasik	NA	647	764	832
9	Parabhani	NA	203	213	236
10	Pune	909	7305	7171	7260
11	Satara	NA	5382	5690	6213

Source: Mahadesh.maharashtragovt.in

1.14 POTATO EXPORT FROM INDIA

Potatoes have a price advantage over European counterpart because of lower production cost and due to short crop duration and cheap labour. Indian potatoes have immense export potential. Potato known as king of vegetables, has the quality for its savory taste with exuberant varieties. Some of the best varieties of potatoes are available in our country with natural abode. Due to the potential emerge it is one of the largest supplier of seed potato.

The Indian table purpose potatoes account for 50 per cent of export, 28 per cent for frozen potatoes, 10 per cent seed potatoes, 8 percent for chip cried and about

3 per cent for frozen preparation. India also exports potato to various countries. Following table gives the export of potato from India.

Of late there is a gradual increase in potato export and trend indicates that it will continue this trend.

Table 1.7 : Export of Potato from India (Thousand MT).

Country	2008-09	2009-2010	2010-2011
Nepal	74.3	64.0	107.08
Sri Lanka	10.3	8.3	34.7
Russia	0.	0.0	15.3
Malaysia	0.8	1.1	8.1
Mauritius	2.6	2.6	4.9
Maldives	2.9	3.4	6.0
UAE	5.5	0.2	3.4
Singapore	1.5	0.5	1.7
Vietnam	0.0	0.1	0.4
Brunei	0.0	0.2	0.3
Others	87.0	13.7	1.5
Total	**185.0**	**94.1**	**184.3**

Source: APEDA, www.apeda.gov.in

1.15 STEPS TAKEN BY THE GOVT. OF INDIA FOR PROMOTION OF EXPORT OF POTATO

- Agri Export Zones (AEZs) are established in the states where potato production is on a large scale e.g. States of Uttar Pradesh, Punjab, Madhya Pradesh, West Bengalfor adopting superior practices for pre and post harvest and production and distribution of quality seeds to farmers and also for realizing better prices.

- ❖ Agricultural and Processed Food Products Export Development Authority (APEDA), the Government provides financial assistance to exporters under various schemes.

- ❖ The government organizes International Interactive workshops specially on potato during AAHAR International event.

- ❖ The principle potato export from India, the destinations are Bangladesh, Malaysia, Nepal, Sri Lanka, UAE etc.

- ❖ Central Potato Research Institute, Shimla is engaged in increasing productivity by evolving high yielding diseases resistant varieties of potatoes.

Potato Export in 2011-12

The product production during the period 2011-12 was expected to be around 43645 thousand metric tonnes which is certainly more than the previous year. By and large the potato prices are governed by the market forces.[7]

Table 1.8: All India -wise Area, production and Yield of Potato in Western India for the period 2007-08 to 2010-11

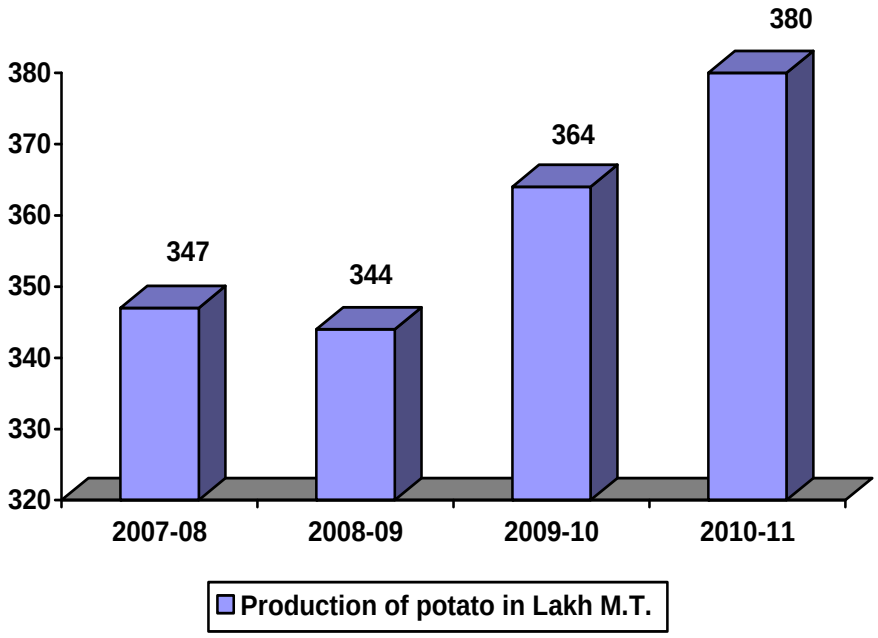
(Area in '000 Hectare, Production in lakhs Tonne, Yield in '000 Kilogram/Hectare)

	2007-08	2008-09	2009-10	2010-11
Area	1795.00	1828.30	1835.30	0.00
Production	347	344	364	380
Yield	19.31	18.81	19.84	0.00

Source: Compiled by datanet India from: National Horticulture Board, Ministry of Agriculture.
0- data not available

[7] Ministry of Agriculture, Govt. of India Press Release of 26th March 2012

Figure 1.1 : India's Production of Potato in Lakh M.T.



Potato has been established as an important food crop in Europe and the America. But in India, due to our traditional food habits, we continued to depend upon cereals. Primarily rice and wheat are our stable food. So failed in accepting potato as a stable article of food. The potato contains all major nutrients like Proteins, Vitamins, Calcium, and Phosphorus and is treasure house of carbohydrates which are essential for the body building.

Ministry of Agriculture, Govt. of India Press Release of 26th March 2012 Potato has been established as an important food crop in Europe and the America. But in India, due to our traditional food habits, we continued to depend upon cereals. Primarily rice and wheat are our stable food. So failed in accepting potato as a stable article of food. The potato contains all major nutrients like Proteins, Vitamins, Calcium, and Phosphorus and is treasure house of carbohydrates which are essential for the body building.

Potato is a wholesome food. Apart from carbohydrates, which are major constituents of potato, it provides essential body building substances such as proteins, vitamins and minerals. It contains practically all the essential dietary constituents

except fat and fat soluble nutrients. Potato is one of the richest sources of calories needed to maintain day to day output of human energy. Potato is valuable food for those who seek to lower their blood pressure.

1.16 PROCESSING INDUSTRIES IN PUNE DISTRICT

In Pune District there is one large scale potato processing unit of multinational company PepsiCo India at Ranjan Gaon Taluka Shirur. Besides this the other potato processing industries are of small and medium size. Consumption of potato in the Pune metropolitan area is also quite sizable. The potato is being mainly used by the hotel industry as well as Farsan manufacturers e.g. Hot Chips etc. who have a chain in and around Pune.

1.17 THE FUTURE OF POTATO PROCESSING INDUSTRY

The industry is growing fast among the other varieties French Fries show the highest growth at 20% while the potato chips grow at 17 per cent. Potato flakes and powder account for 15 per cent growth.

Taking into account the increased consumption of potato tubers by the Indian industry the production of potato during 2013-14 has been estimated to be around 1.54 m.t. showing an increase ofabout 4.25 per cent.

1.18 POTATO MARKETING IN INDIA

The market forces of demand and supply largely decide the market operations in the agricultural marketing. The private traders dominate the entire marketing of potato produce. The Government intervenes only when it smells that there is exploitation of the producers as well as consumers.

In India, Cooperative marketing societies play a dominant role in the marketing of potato along with the commission agents. In the state of Punjab, Haryana, Uttar Pradesh, West Bengal, Gujarat the cold storage owners have their associations and this network of cold storages influences the marketing of potato. Now there is awareness amongst the potato growers and they are now promoting value added ventures to get higher yield on their produce. In Delhi, Ludhiana new

potato processing plants have come up which has also given impetus in increasing the cultivation of potato crop in and around that area. Retailers market both fresh as well as potatoes stored in the cold storages.

Hence, cold storages have a key role in the creation of time and place utilities. In the early period before the emergence of cold storages the cultivators were using sand method, pit storage, machan storage and storage on bamboo chips or wooden planks.

In Pune District there are two Talukas namely Ambegaon and Khed (Rajgurunagar) where the potato crop is cultivated for over two decades. The area under potato crop is steadily increasing over the years. Number of new potato processing units has come up in this area. The Government of India has strengthened the hands of the leading potato processing industries like PepsoCo, Uniliver, Jain Irrigation etc. to increase the production of potato by using the special funds provided by the govt. Through these companies the government funds are channelized to the potato cultivators which increases their efficiency and production through which tangible gains are achieved.

In a recent investment summit Shri Sudhir Kumar Goel –Agriculture Secretary of the Govt. of Maharashtra stated that "The government has crores of rupees allocated under various schemes for the agriculture sector. But all these schemes do not result in end-to-end integration of the agricultural chain. In order to increase the effective use of these funds, the government will make these funds available to corporate if they work with farmers,".

In the same summit Shri Abasaheb Harla, Project coordinator of Maharashtra State Horticultural Board stated that "The companies help farmers by providing plant protection kits, training, subsidized seeds and technology support. The government makes funds available for drip irrigation, crates, spraying equipments, mulching etc under the Rashtriya Krishi Vikas Yojana and various schemes of National Horticulture Mission, National Food Security Mission, and National Programme on Micro-irrigation, etc."

Dr. D. N. Kulkarni, President (Agri. foods), Jain Irrigation Systems, informed in the same summit that the his company has signed MoU with the State Govt. for the onion project. He further stated that, "The farmers will get benefit from the PPP projects as all these schemes will be canalized properly. They will not have to visit multiple offices for getting benefits under these schemes. Farmers will also benefit from the professional guidance extended by the corporate,"

Similar efforts are being made by Hindustan Unilever with about 500 farmers in Nasik District in Dindori Taluka for grapes and wines.

Unilever and PepsiCo India have already taken initiative to enter into contract farming in the State of Maharashtra wherein they are trying to expand the potato cultivation over 3,000 acres in Satara and Sangli districts.

In adequate potato storage arrangements pose a major handicap in spreading the marketing period, regulating the flow of supply, preventing losses and ensuring stability of prices. Most cold storages are located in producing areas. Potatoes in India have to be moved from producing areas to distant consuming centres. Potatoes suffer from quick deterioration once taken out from cold storages, the storage of adequate arrangement for cold storage generally resulted in high losses. Most markets are unregulated with no control over the market practices. Since distribution trade is almost entirely in the hands of private traders, the chain of intermediaries between growers and consumers extracts heavy charges for their services. These factors lead to a considerable disparity between the price fetched for the growers and paid to the ultimate consumers.

New National Agricultural Policy Union Government has announced new National Agricultural Policy in the Parliament on July 28, 2000. This policy has been planned under the provisions of World Trade organization so as to face the challenges of agriculture on prompting agricultural exports after fulfilling domestic demand. The salient features of this policy are:

- 4% growth rate p.a. for the next two decades.

- Land reforms to provide land to poor farmers.
- Consolidation of holdings in all states of the nation.
- Promoting private investments in agriculture.
- To provide insurance umbrella for crops to farmers.
- To promote biotechnology Promoting research for developing new varieties and ensuring protection to the developed varieties.

New agriculture Policy has been described as "Rainbow Revolution" which includes the followings revolutions:

The Green (Food Grain Production)

- White (Milk)
- Yellow (Oil seeds)
- Blue (Fisheries)
- Red (Meat / Tomato)
- Golden (Fruits/Apple)
- Grey (Fertilizer)
- Black/Brown (Non-conventional Energy Sources)
- Silver (Eggs)
- Round (Potato)

Above Rainbow Revolution also includes "Food Chain Revolution" to put a check on destroying food grains, vegetables and fruits.

1.19 RECENT DEVELOPMENTS

Partnership with Farmers PepsiCo India is an agriculture company. It was established in India in the year 1989. Since then the company is working closely with farmers and is helping the farmers to improve their livelihood as their agricultural production. The company initially started with the high yielding variety of tomato, paddy, to increase their production Today the company has diversified into high yielding potato farming and has brought smile on the face of the agriculturist growing potato.[8] 9 Ministry of Agriculture, Govt. of India website

[8] Ministry of Agriculture, Govt. of India website

The company was pioneer in the offering contract farming arrangements for the potato growers. In the year 2012 the company had over 50000 connected farmers cultivating potatoes. The company is trying to establishing a sustainable farming practice and methods for contact farming. The company provides the farmers seeds of high yielding varieties of potato which are time tested and widely accepted at global level. The company provides a forward marketing linkage for the potato growers which are the company's raw material for manufacture of wafers and other products. Company has entered into collaboration with Thapar Institute of Technology for development of potato mini-tubers. The world accepted potato high yielding variety of potato has helped Indian farmers to achieve higher production and to earn higher profits. The company has also tied up with State Bank of India to provide soft loans to the potato growers who enter in the contract farming arrangements with the company. Thus it provides a forward recovery linkage to the Bank and in the process both the bank as well as the company stands to benefit. b) FAO's Guidelines for Sustainable Development of Potato Crop in Developing Countries The United Nation celebrated year 2008 as the International year of the Potato. It highlighted the importance of role played by potato in agriculture and the world food security. The objective of the celebration of International Year of the Potato was to world food security. The aim of the celebration of International Year of the Potato was will improve the well being of the potato consumers in the developing countries. Potato production is helping several developing companies to ensure socio economic development of the potato cultivators. Today at the global level production and consumption of potato is achieving newer heights. The food processing industry having potato as a raw material has developed newer products which have been widely accepted by the emerging market.

Food and Agricultural Organization(FAO) of the United Nations has brought out technical guidelines in a book form which cover Good Agriculture Practices relevant to potato production. It covers indicators and recommendations for certain key areas – conservation and utilization of potato biodiversity and improvements in seed systems, storage of the potato production, management of soil fertility, pest controls, water use etc. These guidelines for sustainable development of potato

farming are helping the governments of developing countries for framing policies for boosting the potato production.

State bid to boost potato production (Nov. 2014)[9]

The Government of Odisa has launched potato incentivization programme under Rashtriya Krishi Vikas Yojana, targeting to cover 5,000 hectare during current rabi season. Under the programme, farmers will be given potato seeds at subsidized rates.

[9] http://timesofindia.indiatimes.com/city/bhubaneswar/State-bid-to-boost-potato-production/ articles how /45065673.cms 2.7.2012

CHAPTER – II
REVIEW OF LITERATURE

2.1 INTRODUCTION

It has been seen that the potato crop is being cultivated in India since 16th Century. There is good amount of literature available both from foreign as well as Indian authors. Before taking up the actual research on the research topic the researcher has gone through various related books, journals, periodicals, news paper articles and new items to understand the research topic in right perspective. The researcher has given hereunder brief reviews of the literature that he has gone through which relevance to this research topic has. Indian potato is preferred worldwide for its taste and meets the international quality standards in terms of disease freeness, shape, size, skin colour, flesh and dry matter content. The Government of India has set up four Agri Export Zones (AEZs) in Punjab, West Bengal, Uttar Pradesh and Madhya Pradesh for significant development in this direction. These AEZs are making effort in strengthening and creating infrastructure for export of fresh and processed potato products, with the mandate for tackling the export of potato and it's products. The main objectives of the Agri Export Zones set up is to provide emphasis on partnership, convergence of different organizations, stakeholders with a focus on providing a package of facilities for export of potato. Here it is worthwhile to mention that the cultivation of potato in India has gathered momentum in the recent past. So far Indians were using potato as a vegetable in their food but it was rarely looked at as a snack. It is only after globalization of the Indian economy when multinational companies came to India and brought potato products like lays, kurkure, chips, food powder for curry etc. When the agriculturists from the area suitable for cultivation of potato crop realized that there is assured market, they started growing potato crop. Therefore, there is no much of research so far as financial aspects of this crop. There are number of research thesis and the papers which deal with the technical aspects of cultivation. Therefore this researcher had difficulty in getting related literature for its review.

2.2 IMPORTANCE OF POTATO

It has been revealed that, according to FAO, potato is consumed by more than one billion people the world over. It is a high quality vegetable cum food crop and used in preparing more than 100 types of recipes in India. The popular Indian recipes like Samosas and Aalu Paranthas are prepared from potato. The protein of potato has high biological value than proteins of cereals and even better than that of milk. The biological value of mixture of egg and potato is higher than the egg alone. Hence, potato can be supplement of meat and milk products for improving their taste, lowering energy intake and reducing food cost. Nutritional point of view, potato is a wholesome food and deserves to be promoted as a potential high quality vegetable cum food crop in the country

Here it is worthwhile to mention that the cultivation of potato in India has gathered momentum in the recent past. So far Indians were using potato as a vegetable in their food but it was rarely looked at as snack. It is only after globalization of the Indian economy when multinational companies came to India and brought potato products like lays, kurkure, chips, food power for curry etc. When the agriculturists form the area suitable for cultivation of potato crop realized that there is assured market, they started growing potato crop. Therefore, there is no much of research so far as financial aspects of this crop. There are number of research thesis and the papers which deal with the technical aspects of cultivation. Therefore this researcher had difficulty in getting related literature for its review. The only research study which has relevance to the current research topic was that of Dr. Sudhakar Jadhawar has been reviewed and the other researches which may indirect bearing on the cultivation of the potato have been covered in this chapter.

Prof. S. U. Jadhavar, (2002),[1] The researcher has discussed in greater details various aspects relating to the costing of potato crop, marketing of the potato crop. This researcher has also dealt with full details which are more or less on the same line as that of Prof. S. U. Jadhavar. There was no contract farming facility which has now been offered by the various potato processing multinational as well as domestic

[1] "Cost-Benefit Analysis of Potato Production and Marketing in Pune District", thesis approved by University of Pune. Since his research work was quite similar to that of this researcher it carries greater weightage.

companies like PepsiCo, ITC, Balaji Wafers, Samruddhi etc. These companies are now playing a positive role of providing the agriculturists specific variety of seed which is best suited for their products as well as providing technology, guidance and insecticides etc. These companies are also providing forward marketing linkage which resulted in the area under potato crops in Ambegaon and Khed talukas of Pune District. Dr. Jadhavar has arrived at the following conclusions:

Storage methods: it was found that there is general tendency to keep the produced potatoes either in their own houses or in rented godowns in Pune District. It was clear that the farmers for storage of potatoes did not prefer the rented godowns. This was the result of various difficulties encountered by them. Viz. The necessity to carry the produce from the farm to godowns, location of godowns, supervision charges of hired godowns for the period of storage. It is natural that these factors led rise in the costs. “Cost-Benefit Analysis of Potato Production and Marketing in Pune District”, thesis approved by University of Pune. Since his research work was quite similar to that of this researcher it carries greater weightage. incurred by the farmers on rented godowns as compared on storing potatoes in their own houses.

There is severe lack of cold storage facilities in rural areas. Most of the markets do not have facilities like pre-cooling chambers, ripening chambers, waxing and grading facilities, packaging units and vapour treatment plants.

It was observed that all the quantities produced were not stored by the farmers, further the quantity stored and the period of storage varied in different years. The main reason for this was variation in the price of potatoes in the market. Thus, the storing tendency is related to the price of produce. Therefore there is no rigidity in storing tendency.

The period of storage was also determined on the market situations. In some cases the potatoes were stored for minimum 30 days and the maximum period is 91 to 120 days. The highest proportion is stored for a period of 61-90 days. So far as transportation of potatoes to the market is concerned the major produce is transported by tractors and very small quantities are transported by the bullock carts.

So far as the net profit is concerned it was observed that the farmers obtained the price, which not only covered their total costs, but also left them some profit. So far this observation is concerned this research has revealed that because of the improved seeds and the use of technology and training to the farmers by the contracting companies the yield is better as well as the contracted rate is also fair. This results into quite a good profit for the potato growers.

Varsha Ajabrao Apotikar [2]

The researcher had set out the following objectives for her research study:

1. To study potato in relation to micro climate under different irrigation levels, planting dates and mulching.
2. To study interaction effects between irrigation levels planting dates and mulching.
3. To work out the economics

For economic evaluation of cultivation and benefit cost ratio (B.C.) of 2009-10, 2010-11 and pooled were computed treatment wise.

Gross monetary returns: The total monetary value of economic produce and by products obtained from the crops in the cropping pattern was calculated based on the current local market prices.

Net Monetary returns: Net monetary returns of each treatment were obtained by subtracting cost of cultivation of each treatment from respectively gross returns.

Rahuri Krishi Vidyapeeth, thesis submitted to (2012) titled, "Response of Potato (solum tub) in Relation to Micro climate studies under different irrigation levels, planting dates and mulching".

Benefit cost ratio: It is the ratio of gross monetary returns to the cost of cultivation. It can be also be expressed as returns per rupee invested.

[2] Thesis submitted to Rahuri Krishi Vidyapeeth, (2012) titled, "Response of Potato (solum tub) in Relation to Micro climate studies under different irrigation levels, planting dates and mulching".

Season 2009-10

The total rainfall received during rabi 2009-10 was 146.60 mm in 9 rainy days. The rainfall of 143.80 mm received during 45h (61.4 mm) and 46th mw (82.4 mm) coincided with tuber initiation stage of potato helped in better tuber growth and yield during the year.

The weekly maximum and minimum temperature in the year 2009-10 ranged between 33.7 and 27.10 C and 19.6 and 9.30 C respectively. The mean weekly morning relative humidity ranged between 60 and 87% and evening humidity ranged between 22 and 71%. The total pan evaporation in the year 2009-10 was 525.90 mm. The weekly maximum and minimum pan evaporation was 6.0- mm in 44th and 1.6 mm in 46th mw respectively.

Season 2010-11

The total rainfall received during rabi 2010-11 was 156.40 mm in 8 rainy days. The rainfall received in 42nd m.. (2 days), 45th mw 2 (days) 46th mw 3 days and 47th mw 1 day were 53.8. 10.6, 61.6 and 30.4 mm respectively during tuber initiation stage helped for better growth and yield .The weekly maximum and minimum temperatures in 2010-11 ranged between 32.1 and 24.9 and 22.8 and 6.20 respectively. The mean weekly morning relative humidity ranged between 20 and 61%. The total pan evaporation during first year and second year was 525.9 and 529.5 mm respectively.

The weekly maximum and minimum pan evaporation was 6.0 mm in 44th and 1.6 mm in 46th mw during 2009-10 and 5.1 in 44th mw 3.0 in 51st mw during 2010-11 respectively.

Effect of Mulching

The application of mulching recorded significantly higher values of growth parameters viz., plant height, and number of branches, plant, and spread, number of functional leaves, leaf area and total dry matter per plant than without mulching during both the years. Whereas, water stress condition impose due to without

mulching at recorded significantly less values of these characters as compared to mulching during both the season.

Effect of interaction of different treatments

There were no significant interactions between irrigation levels and planting dates and sub plot treatments for all the micro climatic parameters except Phytosynthetic rate,CO2 concentration and stomatal conductance at 56 and 84 DAP during both the years where as irrigation applied at 1.2 IW/CPE ratio with sugarcane trash mulching (I3M1) recorded higher photosynthetic rate, CO2 concentration and stomatal conductance than other treatment combination.

The interaction effect between main plot treatment (irrigation levels or planting dates) and sub plot treatment (mulching) were non significant for all the yield contributing characters and fresh tuber and haulm yield during first year but it was significant for large sized tuber yield and total tuber yield and haulm yield during second year and on pooled analysis also. With the application of irrigation at 1.2 IW/CPE ratio with sugarcane trash mulching (I3M1) or early planting on 44th MW with mulching (D2M1). Further, application of irrigation at 1.0 IW/CPE ratio with sugarcane trash mulching (I2M1) or early planting on 42nd MW with sugarcane trash mulching (D1M1) was followed the next in order of significant.

The interaction between main plot treatments (IxD) with sub plot treatment (M) i.e. (IxDxM) were significant for all the yield contributing characters viz. small, large size tuber, total tuber yield and haulm yield in which the irrigation applied at 1.2 IW/CPE ratio and early planting on 44h MW with sugarcane trash mulching (I3D2M1) recorded higher values for all the yield contributing characters.

S. S. Acharya,[3] The author has observed that the regional cropping patterns have increasingly changed according to the comparative advantage in growing various crops which helped in reducing to some extent the disparities between different regions and between irrigated and dry land farmers. However, there are several

[3] The Paper titled, “Markets and Role of Marketing Organizations”. Before discussing the key issues involved in marketing, the author has discussed the achievements of the Indian agriculture. (2005)

emerging policy issues which need attention. The issues arise from the imperative of growth need for diversification for reducing disparities in development and achievement of the objective of food security. The policy regime for agriculture in India has undergone considerable change, since 1991, when a programme of economic reforms was launched in the country. Though the reforms programme did not initially covered agriculture it was soon realized that sector specific policies cannot remain insulated from the rest. The Paper titled, "Markets and Role of Marketing Organizations". Before discussing the key issues involved in marketing, the author has discussed the achievements of the Indian agriculture. (2005) of the economy as otherwise these are bound to end up in a failure and harm not only that sector but turn the whole economy.

S. Chatterjee, M. Saha, M. K.Samanta and S. S. Mondal [4] The authors have stated that the potato is the second most important cash crop grown in the Rabi-season in West Bengal. Its coverage is mainly concentrated in the alluvium tract of the state. The crop covers 6.52% of net cropped area in West Bengal (on the basis of 2002-03 figure), which is well ahead of 5.20% of area coverage in 1997-98.

Dholakia and Dholakia, (1993) opined that technical progress as measured through total factor productivity growth (TFPG) has not been directly determined by capital, labour or capital per worker. After carrying out the research they have concluded that the importance of potato cultivation has increased day by day and the farmers have shifted from traditional rice-based cropping system to high value cash crops like potato in the rabi season. The area under potato has been found to be increasing and farmers are well acquainted with the adoption of new techniques and use of modern inputs for the cultivation of potato in the state of West Bengal.

Vinod Kumar, B. S. Vyakaranahal, N. Basavaraj, Birbal and S. D. Raikar,[5] They observed that potato is one of the important commercial crops of Karnataka grown in 3 agro-climatic zones, namely southern transitional zone, hilly

[4] Research paper titled, "An Economic Analysis of Total Factor Productivity (TFP) of Potato in West Bengal". (2007)
[5] Paper published titled, "Effect of intra-row spacing and nutrient level on growth and yield of potato". (2008)

zone and eastern dry zone. The productivity of potato in the region is far below the national average (11 tonnes/ha), because large area of cultivation is under rain fed condition coupled with non-availability of healthy 14 Research paper titled, "An Economic Analysis of Total Factor Productivity (TFP) of Potato in West Bengal". (2007) 15 Paper published titled, "Effect of intra -row spacing and nutrient level on growth and yield of potato". (2008) seed and inadequate knowledge on seed production practices. Hence, an experiment was conducted to investigate the growth and production of potato crop at different intra row spacing and fertility levels. Plant spacing has significant role to play in affecting the size of tuber and ensures desired plant population, which determine the yield. They observed that all the yardsticks of growth such as plant height, number of stems/hill, leaf and total dry matter production /plant. (leaves, stems and tubers) were significantly influenced by intra-row spacing. Potato seed crop grown by seed tuber at a spacing of 60 cm x 15 cm with application of 25% more fertilizers than the recommended dose (100:75:100 NPK kg/ha), followed by 60 cm x 20 cm with 100% RDF application under northern transitional tract of Dharwad region (Karnataka) has proved advantageous to obtain higher yield of seed size tuber as well as total tuber yield/ha during rainy (kharif) season.

Satyendra Kumar, Ram Asrey, G.Mandal and Rajbir Singh,[6] A study was conducted during 2003- 04 to compare micro-sprinkler, drip and furrow irrigation system for potato production at Central Institute of Post Harvest Engineering and Technology, Abohar, Punjab Each irrigation method was combined with 4 irrigation levels, i.e. IW: CPE ratio of 1.20, 1,00.0.80 and 0.60. Better crop performance was recorded under micro sprinkler regime. The highest potato yield (31.60 tonnes/ha) was obtained with micro sprinkler, followed by drip (29.83 tonnes/ha) and 16 Research paper titled, "Micro-sprinkler, drip and furrow irrigation for potato cultivation in a semi-arid environment".(2008) furrow (22.6 tonnes/ha) irrigation system when irrigation was scheduled at 1.20 IW:CPE, Irrespective of irrigation system, potato tuber yield increased with increasing irrigation level from 0.60 to 1.20 IW:CPE. However, highest water use efficiency (1.37 a/ha. mm.) was recorded with 0.80 IW: CPE under micro sprinkler irrigation. Water application of 257 and 261 mm

[6] Research paper titled, "Micro-sprinkler, drip and furrow irrigation for potato cultivation in a semi-arid environment".(2008)

was found optimal for attaining the maximum yield under micro sprinkler and drip irrigation system respectively. Fertilizer use efficiency was highest (71.kg/kg) in micro sprinkler, followed by drip (67 kg/kg) and furrow irrigation (48.kg/kg. Economic analysis revealed that using micro irrigation for potato production in semi-arid environment is a profitable alternative of existing irrigation method.

M. Nedunchezhiyan, K. Rajsekhara Rao, and B. S. Satpathy,[7] Intercropping is gaining importance because not only it provides biological insurance against risks under aberrant rainfall behaviour in dry land environment but also more labour employment. Field experiment was conducted during 2006-08 in Alfisols under rain fed conditions to investigate the productivity potential, biological efficiency and economics of sweet potato – based strip intercropping systems. Among the crops tested, sweet potato as a sole crop recorded higher yield (13.367 kg/ha) than other crops. Among strip intercropping, sweet potato tuber yield was higher (8.538 kg/ha) in sweet potato + pigeonpea. All the strip intercropping systems showed superiority over sole crops in terms of sweet potato tuber equivalent yield. Research paper titled, "Productivity potential, biological efficiency and economics of sweet potato based strip inter cropping systems in rain fed Alfisols".

Yashbir Singh Shivay, (2010)[8] Potato is an important food crop and presently being cultivated on an area of 1. 786 million ha and with a production of 34.46 million tonnes during 2007-08 in India. (FAI 2009). Potato being a short duration crop having sparse root system is highly responsive to applied nutrients. Studies have shown that its phosphorus requirement is almost double than that of the cereal crops. The high cost of phosphorus in India is because bulk of the phosphate rock for making phosphate fertilizers is imported. The field study experiments conducted during 2001-04 at New Delhi to study the effect of crop residue incorporation on the relative efficiency of diammonium phosphate and mussoorie rock phosphate at varying rate of application on growth, yield and economics of potato. Results showed phosphorus application significantly increased growth and

[7] Research paper titled, "Productivity potential, biological efficiency and economics of sweet potato based strip inter cropping systems in rain fed Alfisols".(2010)

[8] Research paper titled, "Effect of di-ammonium phosphate and Missouri rock phosphate on productivity and economics of potato".

yield parameters, yield (mean tuber yield 28.6, 27.5 and 26.6 tones /ha during 2001-02, 2002-03 and 2003-04 respectively) and gross and net returns (mean Rs./ha 42,278/-, 39,379 and 37,158 during 2001-02, 2002-03 and 2003- 04 respectively.

M. S. Brar and Navdeep Kaur-[9] In this paper the researcher has observed that the pooled data of soil application of N.K. and foliar application of KNO3 showed significant increase in the potato yield with the soil application of K at all levels. The effect was however, significant upto 90 Kg K2O / ha although increased the 18 Research paper titled, "Effect of di-ammonium phosphate and Missouri rock phosphate on productivity and economics of potato". 19 research paper titled, "Effect of soil and foliar applied potassium and nitrogen on yield of potato (Solanum tuberosum) in alluvial soils of Punjab India" yield but the increase was non-significant on the other hand non- significant effect of K application on the small size tubers. Application of 1 Kg of muriate of potash resulted in24 Kg additional potato yield over NP. Similarly over the soil application of NPK with foliar application of 1 Kg KNO3 about 205 additional yields was obtained. Thus soil application of K or foliar application of KNO3 may be beneficial to the growers.

S. K. Pandey and E. P. Venkatasalam,[10] The CPRI, Shimla, developed "Seed plot techniques" through which potato planting was pre-poned to October and the crop was harvested by 15th January before the insect vector population reaches the critical threshold level. Through this technology, it became possible to grow good quality seed in the plains so as to meet the bulk requirement of seed for ware Potato production in subtropical plains. The potato revolution in India is by far the most remarkable landmark achievement of potato research and development in India. It has transformed the potato from a subsistence vegetable crop to a food crop. The main features that triggered this success are development of fleet of disease and pest resistant indigenous varieties suitable for different agro-climatic zones, production and protection technology and a very sound scientific seed production network.

[9] Research paper titled, "Effect of soil and foliar applied potassium and nitrogen on yield of potato (Solanum tuberosum) in alluvial soils of Punjab India"

[10] Research paper titled, "Sustaining potato Revolution – Technology – driven production of seed potato", (2010)

Research paper titled, "Sustaining potato Revolution – Technology – driven production of seed potato", (2010) Hi-tech Seed Production: Of late scientists have fully explored the total potent nature of plant tissues in micro propagation. Potato has readily responded to this process and it has became easy to export / import disease. Free planting material without any risk of importation of deadly diseases and pests. Not only for the exchange of plant material the process of micro propagation has become much more important in case of vegetative propagated crop for the purpose of making diseases free plants from infected one. The load of viral disease is directly related with the age of the tissue indicating least disease load in the growing tips. Potato is very sensitive to the natural vagaries whether it is environment solid or disease and pests. Scientists have conquered the environmental constraints by adjusting the plantation time as per the needs of the crop, identified suitable soils for cultivation and higher production standardized agro techniques and identified suitable chemicals to control the disease and pests. However, viruses being of intermediate nature between living and non-living can be eliminated only through a particular culture. Factors influencing Hi-tech see potato production.

- ❖ All the varieties are not responding equally in vitro.
- ❖ Handling of large number of micro plants during last stage of multiplication cycle is difficult and it requires more trained manpower for a short period.
- ❖ Transportation of micro plants to far off places is difficult.
- ❖ Drainage of about 30-40% micro tubers during storage and less emergences of micro tubers (45-50%). Cross contamination with virus at any stage of culturing will lead to rejection of entire lot.

Requires big poly net houses for transporting and more care after planting.

Gavit Chandrakala Devram,[11] 2011 In her dissertation the researcher had set out the following objectives. The objective of the research were:

[11] M.Sc. (Agri) Dissertation titled, "Effect of organic Manures, inorganic fertilizers and bio-fertilizers on growth and yield of potato (Solanum tuberosum L.) was carried out during rabi season 2009-10 at Post Graduate Institute Farm of Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.).(2007)

1. To study the effect of organic manures and inorganic fertilizers on growth and yield of potato.
2. To study the performance of different bio-fertilizers on growth and yield of potato.
3. To study the economics.

The important findings of the investigation were as follows: Effects of treatments: The maximum plant height (59.20 cm), number of functional leaves (48.00 cm), plant spread (47.92 cm), leaf area (10.19 cm) and total dry matter of plant (84.30 g) were observed with application of recommended NPK through chemical fertilizer.

At harvest, the mean number of tubers per plant was highest (8.0) in recommended NPK through chemical fertilizers, followed by FYM @ 10t/ha + half NPK through fertilizer (7.0) where as lowest in control (3.25) treatment. The mean fresh weight of tuber per plant was maximum in treatment of recommended NPK through chemical fertilizer (294.45 g) whereas treatment FYM 10 t/Ha + half NPK through fertilizer (294.37 g) was next in order merit. Treatment control recorded least fresh weight of potato tubers (240.45g). 21 M.Sc. (Agri) Dissertation titled, “Effect of organic Manures, inorganic fertilizers and bio-fertilizers on growth and yield of potato (Solanum tuberosum L.) was carried out during rabi season 2009-10 at Post Graduate Institute Farm of Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.).(2007)

At harvest, maximum total dry matter per plant (84.30g) was showed in treatment recommended NPK through chemical fertilizers followed by treatment FYM 10 10/Ha + half NPK through fertilizer through fertilizers (79.35 g) where as minimum in treatment control (43.40 g).

Grade wise tuber yield such as small sized tubers (<25g) was highest in treatment of recommended NPK through chemical fertilizers (44.21 a/a) and lowest in control (31.48 q/ha) , medium sized tubers (25-75) was highest in treatment recommended NPK through chemical fertilizers (48.22 q/ha) and lowest in treatment control (30.98 q/ha), large sized tubers (>75 g) was highest in treatment recommended

NPK through chemical fertilizers (87.49 g) and lowest in treatment control (70.09 q/ha).

All treatments differed significantly in respect of total tuber yield and dry haulm yield per hectare. Application of recommended NPK through chemical fertilizer recorded maximum total tuber yield and haulm yield viz. 179.93 q/ha and 9.92 q./ha respectively followed by treatment FYM 10 t/Ha + half NPK through fertilizer through fertilizer (132.96 q/ha and 6.67 /ha).

Application of organic manures, inorganic fertilizers and bio –fertilizers significantly influenced the content of nitrogen, phosphorus and potassium in plant at harvest. The maximum values were exhibited by recommended NPK through fertilizer as nitrogen (9.75%) phosphorus (0.660%) and Potassium (9.21%).

The nitrogen, phosphorus and potassium uptake by plant was significantly affected. The maximum uptake of nitrogen (112.59 56kg/ha), phosphorus (15.47 kg /ha) and potassium (133.74 kg/ha) uptake were observed in recommended NPK through chemical fertilizer.

Treatment control recorded lowest cost of cultivation (Rs.68500 /ha) and highest by vermin compost @ 10 t/ha + bio fertilizes (Rs.98620/ha). The highest gross monetary returns (Rs.125951 / ha), net monetary returns (Rs. 55979 /ha) and benefit: cost ratio (1.80) was recorded in recommended NPK through chemical fertilizer.

Mahabal Ram[12] studied high yielding varieties of crops in India. He noted that potato crop is a heavy feeder, and hence needs heavy doses of fertilizers for its good growth. However, due to constraint of the availability of chemical fertilizers in the country, there is a great need to use organic sources of manures. Further he suggested that for better harvesting and threshing potatoes may be kept always in a ventilated room to prevent excess humidity and to introduce oxygen. The storage room should be dark for light causes greening and room temperature should vary between 38 and 40 degree frosting.

[12] Mahabal Ram , Research Paper titled, “High Yielding Varieties of Crops.” (1980)

Khalon and Randhava[13] in their research study on marketing of vegetables found commission charges and transportation costs as the major components of marketing costs. They suggested a reduction in the large number of intermediaries in marketing of vegetables so as to raise the producer's share in the 22 Mahabal Ram , Research Paper titled, "High Yielding Varieties of Crops." (1980) 23 Khalon and Randhava, Research paper titled, "Marketing of Vegetables" (1980) consumer's rupee. For this, cooperativization and regulation of markets were the only remedies.

S. S. Sangwan [14](1991) in his research study on Production and marketing of potato in India: A case study of Uttar Pradesh, is broadly divided into two parts.

The first part consists of three theoretical chapters relating to the statement of the problem, critical review of Nerlove's model for the supply of agricultural commodities and the specification of variables included in the supply function of potato. The second part comprises of four chapters about the empirical analysis of potato supply in India.

The author had used regression equations between potato acreage and its supply variable from 1958-59 to 1981-82. The author felt that there is need to improve the yield levels of potato in the various regions and sub-regions of the country which are agro- climatically suitable for the cultivation of this crop.

However, it was concluded that there has been less growth of post-harvest facilities like cold storage and transport as compared to the increase in the production of potato and there is need to develop more of these facilities within the production regions to bring their efficiency at part with the consumption centers.

Indian Society of Agricultural Marketing[15] has observed that the task of agricultural marketing is to supply farm products.

[13] Khalon and Randhava, Research paper titled, "Marketing of Vegetables" (1980)
[14] S. S. Sangwan, Research Paper Titled, "Production and Marketing of Potato in India" (1991)
[15] Indian Society of agricultural Marketing, Book titled, "Vistas in Agricultural Marketing"

S. S. Sangwan, Research Paper Titled, "Production and Marketing of Potato in India" (1991) in the right form, at the right place , at the right time and in the right quantity needed at prices which are fair to the producers and the consumers with the minimum of economic waste and reflect changes in demand and supply. According to National Commission on Agriculture (1976), agricultural marketing is a process which starts with a decision to produce a saleable farm commodity and it involves all aspects of market structure or system, both financial and institutional based on technical and academic considerations and includes pre and post harvest operations, assembly, grading storage, transportation and distribution.

Marketing plays an important role not only is stimulating production and consumption but also accelerating economic development. Of late, agricultural marketing has become a highly complex. It involves a large number of intermediaries and physical and facilitating service across the country in handling a large number of agricultural commodities which are seasonal bulky and some of them are highly perishable. The marketing process is further complicated as the majority of the farmers are small illiterate, unorganized, scattered all over the country and have very little time and knowledge for the marketing of their produce.

Hari Har Ram,[16] observed that Vegetable breeding and genetics in general has remained neglected particularly in Indian sub continent. India is the largest grower of number of vegetables and is the second largest producer of vegetables in the world. China ranks first. Department of Genetics and or plant breeding Indian Society of agricultural Marketing, Book titled, "Vistas in Agricultural Marketing"
Hari Har Ram, book titled, "Vegetable Breeding principles and practices" (2002) are well equipped in theoretical concepts of plant breeding have normally nothing to do with vegetable breeding.

David Colman and Trevor Young[17] The farmer's share of the retail price of food products is too small and that retail farm gate margins are excessive include

[16] Hari Har Ram, book titled, "Vegetable Breeding principles and practices" (2002)
[17] David Colomn and Trevor Young, book titled, "Principles of Agricultural Economics" – Markets and Prices in less developed countries. (2002)

elements of excess profit. A careful analysis of the profits of middlemen and processing firms show them to be commensurate with the business risks involved.

Prem Singh Arya & Sant Prakash,[18] book has been compiled by the authors keeping in view the increasing importance of vegetables in the country under varied agro-climatic conditions to meet the requirement ever increasing population. The book covers various aspects of vegetable production such as area under cultivation, production, productivity of vegetable, seed, off-season vegetables grown in each state and union territory of the country. The book turned out to be very useful in understanding the cultivation of the potato crop in various states.

Premjit Sharma,[19] The book has dealt with in depth improvement of marketing system for both farm produce and inputs in developing countries and the emerging economics. The author has observed that there is a need for a strong private sector backed up by appropriate policy frameworks and effective government support services such provision of market infrastructure, supply of market information and agricultural

David Colomn and Trevor Young, book titled, "Principles of Agricultural Economics" – Markets and Prices in less developed countries. (2002)
Prem Singh Arya & Sant Prakash book titled, "Vegetable growing in India" (2002)
Premjit Sharma, book titled, "Agricultural marketing Management", (2007) extension services to advise farmers on marketing. In addition government need to ensure that the legislative and regulatory environment is suitable for competition and efficient private sector marketing.

Mr. K. N. Ravikumar, K. Sree Lakshmi, T. V. Satyanarayana,[20] India is an active member of the WTO.WTO has over 150 member nations. Indian agricultural trade is significantly influenced by the multilateral trading regime. India has formulated several policies to revamp the agricultural sector; however, there is

[18] Prem Singh Arya & Sant Prakash book titled, "Vegetable growing in India" (2002)
[19] Premjit Sharma, book titled, "Agricultural marketing Management", (2007)
[20] Mr. K. N. Ravikumar, K. Sree Lakshmi, T. V. Satyanarayana, "World Trade Agreement and Indian Agriculture - Implementation experience" (2008)

still a long way to go. The authors have critically reviewed India's performance in agriculture sector during both pre and post – WTO regimes. The authors have also suggested the commodities / products which should be given more priority in the export trade, keeping in view the competitiveness and further identified the commodities that are to be given special thrust to improve their net trade position.

Mr. Chhidda Singh, Prem Singh, Rajbir Singh[21], In this book the author has described the modern management practices with regard to 38 major crops of the country comprising cereals, millets, pulses, oilseeds, fibre crops, forage and sugar crops. The various aspects of the crop cultivation relate to the origin and history, area and distribution of the crops in world and India , botanical description of crop plants, varieties, soil, climatic requirements, cropping systems, seed and sowing, manures and fertilizers, water management, weed control, diseases and pest control etc. Description of high yielding varieties of crops find important place in the chapters. Suitable varieties and hybrids for different agro-climatic zones have been mentioned along with their

Mr. K. N. Ravikumar, K. Sree Lakshmi, T. V. Satyanarayana, "World Trade Agreement and Indian Agriculture - Implementation experience" (2008) Mr. Chhidda Singh, Prem Singh, Rajbir Singh, book titled, "Modern Techniques of Raising Field Crops".(2008) main characteristics. All the latest research findings in various aspects of crop production have been incorporated in the book. The book contains the latest, authoritative and readily usable information on improved farming techniques for stepping up crop productivity.

Particularly on the back drop of the low crop productivity of the Indian agriculture the book is of very much importance as it provides latest techniques for increasing productivity. Now high yielding varieties, hybrids and composites of various crops have entered the scene of Indian agriculture. Valuable information is provided in this book which can be used by the agriculturists to improve their production. All the latest research findings in various aspects of crop production have

[21] Mr. Chhidda Singh, Prem Singh, Rajbir Singh, book titled, "Modern Techniques of Raising Field Crops".(2008)

been incorporated in this book which has added its practical utility. In the context of this research the book has very aptly described the potato crop which is assuming importance even on the export front.

Arun Bhargav[22]. India is an agrarian economy and it has an important place in the overall Indian economy. Of late its share has declined it contributes the highest percentage to the growth rate. The Indian rural market is a complex mosaic of mind-sets culture and lifestyles, while education employment income agricultural land ownership may still be the major deciding factors accounting for social differentiation.

Arun Bhargav, Book titled, "Rural Marketing & Agri Business in India"(2010) producers' surplus etc. The agricultural marketing is a link between the farm and the non-farm sectors. The author has drawn the following objectives of marketing:

1. To enable the primary producers to get the best possible returns.
2. To provide facilities for lifting all produce the farmers are willing to sell at an incentive price.
3. To reduce the price difference between the primary producer and ultimate consumer and
4. To make available all products of farm origin to consumers at a reasonable price without impairing in the quality of the produce.

Narendra Singh, Zakwan Ahmed (2010),[23] "Potato Production, Storage and Marketing". This book is the outcome of the research work that has been carried out in Leh-Ladakh region situated in the high hills lies in cold desert zone of north Western Himalayas. The harsh climatic conditions in the region offer only limited period i.e. 100-120 days for growing agricultural crops during summer season (May-September). Potato a short duration crop having highest dry matter production / area/ time can play a pivotal role in raising farm income of the people and meeting their food and nutrition security. Predominance of local varieties and age-old farm

[22] Arun Bhargav, Book titled, "Rural Marketing & Agri Business in India"(2010)

[23] Narendra Singh, Zakwan Ahmed , book titled, "Potato Production, Storage and Marketing". (2010)

practices are the major bottleneck for the low productivity in the region. Raising potato productivity under such difficult situation was a challenging task. The technology outlined in the book is likely to boost potato production in the region thereby providing round the year

Narendra Singh, Zakwan Ahmed , book titled, "Potato Production, Storage and Marketing". (2010) availability of ware and seed potato not only to the local population but also meeting the important demand of the defense personnel employed in this sector.

The book has been divided in 11 chapters which deal with all aspects of the potato cultivation, storage and marketing. The term agricultural marketing is composed of two words agricultural and marketing. Agricultural in the broadest sense means activities aimed at the use of natural resources of human welfare and marketing connotes a series of activities involved in moving the goods from the point of production to the point of consumption. Marketing functions include agencies, channels, efficiency and cost price spread and market integration high hills north western region. The book has been presented with statistics as well as pictures which explain the subject topic leading to better understanding.

Jagtar Singh,[24] The authors have carried out research with in the study area consists of an almost circular part of land within a radius of 25 kms having its centre at Jalandhar City, Kapurthala and Hoshiapur districts. The study area fall in the seven sub-divisions of Jalandhar I and II. This book covers the presentation of the said study.

According to Von Thuenen's thesis around a lone market city, in the middle of a featureless plain, the crops with high transportation costs and intensive uses of land would be produced near the market. Whether or not a farmer grows a particular crop depended on his or her distance from the market. Distance determined land value and transportation costs and therefore the margin of profit from a particular enterprise

[24] Jagtar Singh, book titled, "Agricultural Location and the Market (Revisiting von Thunen in Indian Context).(2009)

needed to be sufficient to pay these costs. As a result, agricultural production organized itself as “rings of lowering production intensity around central cities”.

The spatial organization of such agricultural commodities is therefore a topic in which John Heinrich Von Thunen’– a German economist and land owner, notions of centrality are still pertinent. His ideas have had a significant effect on marketing policy of commodities, such as milk products, fruits and vegetables.

The author has discussed in detail in a systematic way various facets that have relation with the distance from the city. E.g. Distance from the city and – the and use intensity, -cropping pattern, - irrigation intensity, - agricultural productivity, - degree of commercialization, - Dairy farming, and he has summarized his findings as under:

Land use intensity and cropping pattern: With the developed road network, fast and sophisticated means of transport, and the advances in storage facilities have now diluted the significance of distance, yet it plays a crucial role in shaping the land use and cropping pattern in the study region.

Irrigation intensity: Evidently, role of distance from the city in influencing intensity of irrigation had been diminishing over the period in the study region. In other words, factors other than distance of the city were getting stronger with passage of time to influence irrigation intensity in the study region.

Agricultural Productivity: Agricultural productivity and the distance from the city find positive rather than negative relation in the study region. The intensity of cultivation and irrigation, nature of the crops grown, network of roads, location of market centers, inherent fertility of the soil, pressure of population on agricultural land, supply of labour, mechanization of agriculture, general awareness and economic condition of the farmer were the other crucial factors.

Degree of Commercialization: The role of distance was the strongest in case vegetable and fruit crops followed by density of dairy cattle, density of poultry birds and irrigation intensity in sequential order

Dairy farming: Market facilities, distance, slaughtering house facilities, demand for meat, density of population, physical environment, availability of pastures, socio economic, religious and cultural habitats are the chief determinants of their spatial distribution.

R. T. Patil, Desh Beer Singh, R. K. Gupta,[25] Fresh vegetables and fruits are vital source of vitamins, minerals and dietary fibres. Both provide essential ingredients like vitamins, minerals, carbohydrates, dietary fiber and supply complex carbohydrates and protein. Green and yellow fruits and vegetables are rich source of vitamin A, thiamine, niacine, and folic acid which are required for normal functioning of human body are also present in significant quantity. Because fruits and vegetables are perishable products with high metabolic activity during post harvest period, proper post harvest handling plays an important role in increasing their availability.

Remarkable improvement has been made in post harvest handling of various fruits and vegetables and in controlling post harvest diseases and disorders. Improved storage facilities have been developed for various fruits and vegetables that maintain the quality intact and add to the common appeal. New chemicals and post harvest treatment techniques have been developed that are made effective in control of decay and attack of microbes. Information on all these aspects is available in many journals, research papers, reviews, books, bulletins but is in scattered form.

In chapter 42, the authors have dealt with Potato vegetable crop. Potato tubers are harvested as soon as they mature. However, time of harvest can be adjusted to suit market prices and demand. Manual harvesting is the common practice. In large coverage two row mechanical diggers or mechanical harvesters are used. They are placed in to containers, sacks or directly in to crates and loaded in to trucks and transported to the storage or packing shed. Losses of potato depend upon maturity stage and method of harvesting.

[25] R. T. Patil, Desh Beer Singh, R. K. Gupta , book titled, "Post harvest Management of Horticultural Produce – Recent Trends" (2009)

Before storage the potato tubers are thoroughly washed using vegetable and fruit washing machines developed at All India Coordinate Research Projects (AICRP) (PHT) centers.

Optimum Storage Conditions

Intended use	Temperature	% Relative Humidity
Table	7^0C	98
Frying	10 to 25^0 C	95
Chipping	15 to 20^0 C	96

Post harvest disorders, diseases and their control

Physiological Disorders: Black heart, Black Spot, Chilling Injury, Greening, Internal Brown Spot are the disorders witnessed in potato storage. Physical Injury: Packing and handling should be done with great care to prevent damage to the highly sensitive, think -skinned, affected tubers, crushing, pressure bursting, brown spot or shatter bruising are common defects and may lead to rapid water loss, shriveling and decay. Freezing Injury: Freezing injury will be initiated at– 0.80C. Symptoms of freezing injury include a water-soaked appearance, glossiness and tissue breakdown on thawing. Mild freezing may also result in chilling injury.

Pathological Disorder: Diseases are an important source of post harvest loss, particularly in combination, with rough handling and poor temperature control. Three major bacterial diseases and a greater number of fungal pathogens are responsible for, occasionally, serious post harvest losses. The major bacterial and fungal pathogens that cause post harvest losses in transit, storage and to the consumer are bacterial soft-rot.

Interestingly, the book has narrated only the various types of disorders, diseases are likely to be in post harvesting potato, but the book has not given solution as to how these can be prevented or minimized.

A. P. Srivastava, D.V.K. Samuel, Indra Mani[26] (2009), book titled, "Mechanization of Vegetable Production and Post- harvest Management". Vegetables play an important role in making our diet nutritionally balanced and improving the economic condition of vegetable growing farmers. The present per capita consumption of vegetable in India is 175 grams per day which is much les than the nutritional requirement of 285 grams per capita per day for a balanced diet. India is second largest producer of vegetables in the world. One of the constraints to increase production and productivity of vegetable crop is low level of mechanization.

India has made a substantial progress in vegetable production but contribution of farm mechanization and post harvest process in enhancing production and productivity of vegetable crops is yet to be observed. Mechanization facilitates faster agricultural growth through efficient utilization of non- engineering inputs like seed, fertilizers, insecticides and pesticides by ensuring timeliness in agricultural operations and reducing cost of operations. Efficient harvest and post harvest management practices reduce losses and add value to the produce more so in perishable crops like vegetables. Introduction of appropriate and modern farm equipment and post harvest technologies would facilitate enhanced production of quality vegetables, which will not only help in providing nutritionally rich diet to our population but also improve earnings of farmers.

In recent years, there has been rapid progress in development of equipment and practices for vegetable cultivation and post harvest management in many countries of the world. However, these machines are yet to be introduced on commercial scale on farms in India.

The book is a comprehensive collection of appropriate technologies and process on the subject, divided in nineteen chapters and encompassing basic and applied as well as researchable aspects.

[26] A. P. Srivastava, D.V.K. Samuel, Indra Mani book titled, "Mechanization of Vegetable Production and Post-harvest Management". (2009)

Apart from various other vegetables, the authors have covered potato crop in this book.

Varieties: The high yielding and improved verities play an important role in boosting up the vegetable production.

Varieties of potato crop: Up to date, Kufri Red, Kufri Chandramukhi, Kufri Alankar, Kufri Chamatkar, Kurfri Jyoti, Kufri Bahar, Kufri Badshah, Kufri Ashoka, Kufri Jawahar

Manures and fertilizers: Appropriate and timely does of manures and fertilizers results in high yield of vegetables. Therefore, balanced application of fertilizer is very important for successful vegetable production.

Weed control: In case of most of the vegetables, initially the growth rate is slow, as against the aggressive weeds. Infestation of weeds also increases insects, pests and diseases in vegetables. Therefore, weeds should be controlled upto a period of 30-35 days after sowing.

One of the major components of mechanization in vegetable cultivation is use of machines for planting and transplanting operations. The traditional methods are highly labour intensive and time consuming. In advanced countries for most of the vegetables, appropriate equipment and practices for seeding, planting and transplanting have been developed. However, in India, with the exception of few vegetables such as potato, the level of mechanization of seeding operation for most of the vegetables is low or almost negligible.

Potatoes are usually grown in light soils, such as loam, sandy loam or sandy clay loam. Seeds beds are well prepared and deep ridges and furrows are formed at 50-60 cm row spacing and the tubers are planted at the centre of the ridge. Traditionally, potatoes are planted manually in small plots using small hand tools, such as spades. Large scale farmers who grow potatoes on large areas are planting and harvesting machines.

There are semi- automatic potato planters and fully automatic potato planting machines.

Potato harvesting: Potato is grown on ridges or beds. The tuber lies buried underground while leaves and stem remains outside. The unit operations involve in potato harvesting are:

1) Cutting or destroying of the potato haulms before harvesting operations.
2) Breaking the soil-potato ridges and exposing the tubers with a view to collect them easily and efficiently. This can be done by suing animal drawn potato digger or tractor drawn potato digger. This may be done manually also.
3) Cutting, lifting and conveying of soil plus potato mass with an aim to separate the potato from soil and stem.
4) Collecting the tubers with minimum injuries.

Potato Combine harvester: A potato combine harvester dismantles the potato ridges, picks up the potato mass, shifts out the loose soil and places the material on slow moving sorting conveyer. In India, Jalandhar, is the main centre for manufacturing of potato machinery. These manufacturers are supported by Central Potato Research Station, Jalandhar and Punjab Agricultural University, Ludhiana. Potato harvesters are not manufactured commonly in India.

Nempal Singh, D. K. Singh, Y. K. Singh, Virendra Kumar,[27] Vegetables have played a vital role in enhancing the most return per unit area and also give nutritious food to the mankind. In India, vegetable production has been receiving considerable attention every year. Vegetable seed production and supply programme are playing an important role towards food sufficiency and the improvement of yield and farmers' income. Of all the agricultural inputs, the seed is very critical, critical and vital input for attending the sustained growth in production. The timely availability of not only quality seed but of adequate quantity at the farmers' door steps is absolutely necessary for increased production. The book provides enough

[27] Nempal Singh, D. K. Singh, Y. K. Singh, Virendra Kumar,[27] "Vegetable Seed Production Technology",(2006)

information about techniques of seed production, seed storage, field and seed standards.

The underground stem of potato is known as stolon. At the ends of the stolons are borne the tubers. The tuber arises as terminal enlargement of the stolon and usually enlarges after the stolon has ceased to grow. The bud-end of the tuber represents the growing point of the original stolon.

Successful cultivation of seed potato depends upon the availability of diseases free seed, soil moisture, plant protection measures, low temperature, short day conditions during tuberization phase resulting in rapid bulking rate. However, some varieties tuberiaze well under long day conditions also.

Potato plant is very sensitive to ecological factors such as temperature, rainfall and photo period. The author has discussed various varieties of potato, planting time, manure and fertilizers, seed size, spacing and seed rate, method of planting, intercultural operations, rouging, dehaulming, insect pest and their control, diseases and their control, field standards, seed standards, harvesting and storage, yield. All these vital aspects of potato cultivation have been discussed in detail and easy to understand language. The book also refers to alternate technology for potato seed production. However, in the area of this study potato is traditionally grown through vegetative seed tubers.

Alfred Steferud[28] : When the vegetable crops are suffering i.e. not developing and functioning in the way, it is expected i.e. called disease. The symptoms produced by a disease, the cause of the disease and injuries caused to the vegetable crop have been considered synonymous. However, they signify only the conditions of crops due to disease or cause of the disease.

Alfred Steferud, ((2012), book titled, “Diseases of Vegetable Crops” (2012) diseases as abnormal change sin physiological processes, this changes the ability of the vegetable crop.

[28] Alfred Steferud, ((2012), book titled, “Diseases of Vegetable Crops” (2012)

In the case of potato it is susceptible to many diseases. The fungi that might attack it range from the slime molds to the smuts and rusts. Serious diseases of potatoes such as late blight, ring rot and leaf roll can cause the total loss of crop. Most of the damage is caused by seven of them. Diseases that affect the growing crops reduce the yield and the proportion of choice size potatoes and cause disinfection and skin blemishes that reduce their stability. Those, that affect the potatoes in storage, in transit and at the market cause decay, shriveling and unattractive appearance.

Chapter 7 of the book titled Control of diseases of Potatoes is written by Eugene S. Schultz. It states that unless effective methods of control are practiced, serious diseases, such as late blight, ring rot, and leaf roll, can cause the total loss of a crop. The chapter has dealt with various diseases and the treatment to be given or care to be taken to avoid attack of diseases.

Problems in control involve devising and evaluating new fungicides and studies on antibiotics designed to find a product that is systemic and persists during the growing season.

A primary objective in disease resistance involves breeding verities that are immune from as many of the major potato diseases as possible and that posses other desirable characters such as quality, yield and adaptability.

The book has comprehensively covered all the vegetable crops and has discussed in greater detail the various diseases.

S. K. Gupta, T. S. Thind:[29] India is endowed with varied climatic conditions suitable for the production of various vegetables in different areas round the year. Vegetables occupy an important place in Indian economy and are grown on about 30 million ha area. Vegetables being a rich source of vitamins, minerals and the much needed fibre in our daily diet constitute a major component in balanced nutrition. Vegetables like other crop plants are affected by various diseases, which result in both qualitative and quantities losses. The introduction of hybrids and various high

[29] S. K. Gupta, T. S. Thind, (2006), “Disease Problems in Vegetable Production”.

yielding varieties of vegetables has resulted in epidemics of many diseases. Without proper knowledge of diseases, farmers are indiscriminately using agro chemicals to combat the ravages of insect-pests and diseases, which may lead to an increase in environmental pollution. It is necessary to use integrated disease management practices involving most effective and economical methods so that quality produce without pesticide residue is obtained.

The book has among other vegetable crops has discussed in detail the diseases of potato in its chapter 3. Potato is an important vegetable crop and is cultivated in an area of about one million hectares in India, with the total production of more than 1 .5 million tons. The chapter has discussed the fungal diseases like Late Blight, Early Blight, Black scurf, potato wart,83Bacterial diseases like Common Scab, Black Leg and soft rot, Bacterial wilt, Viral diseases. In each of the disease the author has explained geographical distribution, symptoms of the disease, the pathogen, disease cycle, epidemiology and disease forecasting, Management, sanitary measures, use of healthy seed, cultural practices, host resistances, chemical control. All these aspects give first hand information about the disease and the steps needed to contain the disease and the preventative measures to be taken.

While concluding the author has stressed that certified seed for planting potatoes is the foundation of maintaining and producing a healthy crop. Seed certification in potatoes is very important in maintaining purity of variety, yields of the crop and health standards over a period of time.

Shri Pisal A. A. (2010),[30] book titled, “A text book of Introductory Agriculture – Agronomy". Agriculture is the back-bone of the Indian economy. Indian farmers are cultivating their farms in traditional way, but now a day farmers are adopting new techniques and other’s experiences in their farm. The book has been divided into 11 chapters which provide basic knowledge about the agriculture. It has discussed definition of agriculture, basic elements of crop production and factors affecting it, history of agricultural development, agricultural growth, diversity in physiographic, soil groups, dry and irrigated agriculture, farming system approach,

[30] Shri Pisal A. A. book titled, “A text book of Introductory Agriculture – Agronomy". (2010)

value addition in field crops, requirements in New technology, women in agriculture, the nucleus of agricultural extension and training.

D. N. Singh, Vishal Nath[31], (2011), book titled, "Varieties and Hybrids of Vegetables". (2011) Research Institute. The chapter gives detail characteristics of potato varieties of different maturity groups which are being cultivated in India.
India is largely a vegetarian society, solely depending on vegetables for bulk of their nutritional requirement. Long life of vegetarians is not only due to the fact that vegetables provide much needed vitamins, minerals and other nutrients but also the green leafy vegetables, carrot, squash, melons and tomatoes act as antioxidant. Antioxidants are known to protect as by destroying the free radicals produced in our body.

For successful vegetable production, better seeds, improved varieties, improved cultural practices and better plant protection methods are necessary. Due to rapid expansion of research and development in the ICAR institute and other Agricultural Universities, private and public seed companies, number of varieties and hybrids have been released for commercial cultivation in the country. Production of hybrid vegetable is gaining momentum and it is apprehended that the next decade will be the decade of hybrids for sustainable development of horticulture as well as higher economic returns to the farmers and vegetable industry.

Chapter 4 of this book, titled 'Bulbs and Tuber Crops' refers to Potato cultivation. This chapter gives details of varieties and hybrids. There are many varieties of potatoes either introduced into or bred in India. Varieties of different maturity periods can escape easily from incidence of insect, pests' diseases and disorders up to some extent. Most of the varieties are developed by Central Potato Research Institute. The chapter gives detail characteristics of potato varieties of different maturity groups which are being cultivated in India.

[31] D. N. Singh, Vishal Nath, (2011), book titled, "Varieties and Hybrids of Vegetables". (2011)

2.3 NEWS PAPER ARTICLES

DNA Patna: March:[32] The following news item that appeared in DNA Patna issue has focused on the potential of the Indian farmers in the production of Potato crop.

A young farmer of Darveshpura village in his native Nalanda district has set what is claimed to be a world record in potato production through organic farming.

Three months ago, a group of farmers in the same village had created a "world record" producing 224 quintals of paddy per hectare using the SRI (System of Rice Intensification) method.

The potato farmer, Nitish Kumar, has harvested 72.9 tonnes of tuber per hectare. The world record so far was 45 tonnes per hectare held by farmers in the Netherlands, officials said.

Nalanda District Magistrate Sanjay Kumar Agrawal said that several officials and agricultural experts were present in the field at the harvest time to verify the claim and record it. "The world record is the result of hard labour and experiment with organic farming," Agrawal told IANS.

Kumar Kishore Nanda, a soil scientist, who helped Nitish in his farming, said success was a result of the organic method of farming. "Once again the organic method of farming proved superior to other methods of farming." Nanda said that the loam soil of the village is suitable for several crops, including the potato.

Rajesh Umath, a district horticulture officer, said the new record will certainly go a long way in removing doubts about low production associated with organic farming and encourage other farmers to adopt it.

[32] DNA Patna: March 14, 2012 news on page 4

Nalanda, the home district of Chief Minister Nitish Kumar, is already the leading potato producing district in Bihar with farmers growing the crop on over 27,000 hectares.

Bihar is the third largest potato producing state after Uttar Pradesh and West Bengal. Last year, five farmers of the village are said to have created a world record when they produced 224 quintals of paddy per hectare.

A young farmer, Sumant Kumar, produced 224 quintals of paddy per hectare beating the world record of Yuan Longping of China with 190 quintals of paddy produce per hectare. The Indian Council of Agricultural Research (ICAR) has certified Sumant Kumar's record.

Business Standard,[33] In India, more than 80% of the crop is raised in the rabi season under assured irrigation during short winter days from October to March whereas Kharif production takes place in Karnataka, Maharashtra, Himachal prades, Jammu & Kashmir and Uttaranchal. Utter Pradesh (32%) produces the highest quantity amount to 11. 51 million tones (from5.3lakh hectare followed by West Bengal (25%), Bihar (17%), Punjab (6%) and Gujarat (5%).

These five states contribute about 85% of production and Karnataka adds a small amount (1.28%). The estimated area under potato cultivation is around 15lakh hectare.

The Strategist[34]**,** TC Food's snack brand Bingo continues to tickle consumer taste buds with new variants. The latest to hit the shelves is Tangles, the fourth in its portfolio after bingo potato chips. Bingo Tedhe Medhe and Bingo Mad angles.Bingo which is expected to be worth Rs.650-700 crore, is expected to break even this year, say analysts. Since its launch in 2007, the brand has given stiff competition to market leader Pepsi. While Pepsi brands Lays and Kurkure lead by a huge margin, their

[33] Business Standard, dated 7th February 2011, news titled, "Low prices may cut Rabi Potato Acreage by 15-20%"
[34] The Strategist,[34] 24th October 2011: TC Food's snack brand Bingo continues to tickle consumer taste buds with new variants

shares have taken hit in recent months. According to Nilesen 2010 data, Lays potato wafers reported drop in share from 48 to 45 percent. And Kurkure witnessed a 3 per cent decline in market share between January- December 2009 to January-December 2010. On the other hand, Bingo's potato chips have notched a 1 per cent increase in share, where as its sub-brands in the bridge category like Tedhe Medhe and Mad Angles have seen a small rise in market share. Other players in the snack food arena are mostly Indian players such as Parle Products, Haldiram and Balaji Namkin, besides a host of local and consumption, with the bridge category still small.

Business Standard, dated 7th February 2011, news titled, "Low prices may cut Rabi Potato Acreage by 15- 20%" 44 The Strategist,44 24th October 2011: TC Food's snack brand Bingo continues to tickle consumer taste buds with new variants13next few years, we expect the numbers to reverse. (This shows that there is rapid steady growth of potato as a food complement). Economic Times,45 dated 23rd Nov. 2011, News Titled, "Potato Price Fall Cheers Chip Makers" – A bumper crop of processing varieties will reduce cost for Pepsico McCain Indian & Haldiram" A bumper crop of processing potato which finds its way into everything from potato crisps to starch flakes – is expected to reduce raw material costs for branded players like Pepsico India, Haldiram, Balaji Wafers and McCain India. The companies are expecting full capacity utilization in the coming days. Prices of processing varieties like Chipsona, Atlantic and Lady Rosetta are now stable at Rs.6-7 a kg. According to an industry estimate 1.5 million tonne of processing varieties are used across the country with organized players having a 15-20% market share. A huge market is still with the unorganized players who sell potato powder, chips and snacks. PepsiCo. India, having brands Lays and Kurkure, leads among the organized wafer players in the country. The company is processing 2 lakhs tonne potato annually across its three factories in India. "Good availability of the crop and demand from the industry have supported the price. We started procuring potato at Rs.12 a kg in Punjab in November and are now paying Rs.6 -7 a kg." PepsiCo India vice President (agronomy) Jaideep Bhatia said. To manufacture one kg of chips 4 kg of potato is needed. According to an industry analyst, increasing competition among the players and falling prices of the raw material could benefit consumers who may see an increase in quantity in the packs.

Economic Times,[35] dated 23rd Nov. 2011, News Titled, "Potato Price Fall Cheers Chip Makers" The Indian Express (Poona)46 12th Aug. 2012: For the last 12 years, nearly 5,000 farmers of Satgaon Pathar in Ambegaon taluka, about 60 km from Pune, have been engaged in cultivating the root vegetable. Most of them are contract farmers who grow potatoes for manufacturing wafers and sell them to companies such as ITC Foods Limited, PepsiCo Holdings Private Limited and Parle.

With 8,600 acres, ie about 90 per cent of the total cultivable land in Satgaon Pathar, under the crop, the area produced five to six tonnes of potatoes per acre every year. But things may change for one of the largest potato belts of Maharashtra this year. Experts have predicted at least 30 to 40 per cent drop in production due to delayed monsoon.

Anand Vitthal Naikawadi, sarpanch of Wakalwadi, sows seeds that bring out a harvest of about 600 to 700 bags every year. "Since the rain began only in the later half of July this year, I have sown seeds for only about 350 bags, with an investment of Rs 6 lakh. Unless it rains till August, there is no chance that the crop is saved since it is solely dependent on monsoon," he says.

Ram Todkar, another farmer who grows potatoes on his 20 acres every year, has decided to cultivate only 17 acres this year. "Every year, we start sowing after first monsoon showers in June and finish by the first week of August. This year, however, we have started only a week ago and will complete most of the sowing till August 5," he says.

"This crop requires 300 to 400 mm rainfall between June and September. It will be difficult to sustain the crop if it rains less. Excess rainfall might also be a problem for the crop," says Jaisingh

The Indian Express [36](Poona) 12th Aug. 2012: Maruti Erande, another farmer who has considerably reduced the area under potatoes and is aiming for only

[35] Economic Times, dated 23rd Nov. 2011, News Titled, "Potato Price Fall Cheers Chip Makers"
[36] The Indian Express (Poona)[36] 12th Aug. 2012:

150 bags this year — down from 450 bags Loksatta Pune Edition, PepsiCo India is the largest potato procuring company in India has encouraged the potato growers to adopt drip irrigation system for potato crop in the state of Maharashtra, Gujarat, Karnataka. Results of this encouragement are now being seen. Khatav sub-district of Satara Dist. which is a water scarcity area had only 200 acres of potato crop in the year 2009. However, after this encouragement the acreage under potato crop has increased to 1600 acres during 2013. Shri Rajiv Wakhale Sr. Director of PepsiCo India in charge of food division told that the company has entered into a partnership with State Bank of India for providing credit to the potato growers and that the company takes the responsibility of providing high quality seeds and other inputs. He further added that because of the drip irrigation system there is a saving of water for about 20 to 30% and that the production of potato has also recorded increase of about 20%. The saving in water enables the potato growers to bring in additional acreage under potato. The company also provides predetermined attractive guarantee price which encourages the potato growers. The company is also following similar policy in the other districts in the State of Maharashtra where there is potential for cultivation of potato crop.

2.4 RESEARCH GAP

Potato cultivation on mass scale is a recent development in Pune District. More particularly after globalization multinational companies like PepsiCo, ITC, and the domestic companies like Balaji, Mahindra, Siddhi Vinayak have entered into contract potato farming with the local agriculturists from the identified Khed and Ambegaon Taluka. Hence there has been no research on the profitability of the cultivation of the potato crop. Subsequent to this development there was no research on the cost benefit of the potato crop and hence this researcher felt that there is a research gap in this regard. As there is a steady growth of potato cultivation in Pune district as well as some adjoining districts like Satara, Nagar, Nasik etc. this researcher considered it appropriate to study the cost benefit of potato cultivation in the changed scenario.

CHAPTER III

RESEARCH METHODOLOGY

3.1. INTRODUCTION

Fresh Potato Potato is an important food source. It is one of the largest grown crops all around the globe. The fresh potatoes provided us are rich in taste, and high in nutritional value. These are cultivated under hygienic conditions and free from pesticides, chemicals and other extraneous substances. Further, proper and safe packaging of Fresh Potatoes helps us in ensuring its freshness.1Potato is used for fresh food, processed products for human consumption, starch and alcohol production, seed, and animal feed. In India, however, potato is exclusively used for human consumption.

3.2 SIGNIFICANCE OF THE RESEARCH TOPIC

Positive impact of globalization on Indian agriculturists needs to be understood in its right perspective. The most positive effect that globalization would have given to most Indian farmers with very small landholdings is to sell the land to fellow larger farmers or industrialists at a price that would be far more in value than his lifetime earnings from the land he currently owns and a better life as a non- farm worker after that. The farmers that got the exposure to global links of markets, technology and investment, benefited in terms of improving their yields, getting better prices and secured off take. In many areas of the country, tomatoes growers, potato farmers and fruit growers' farmers benefited from tie-up and collaborations with ketchup, potato chips, fruit juices, etc. Indian agricultural exports have grown where Indian farmers in selected pockets are competitive: these include spices made from agricultural produce, flowers, mangoes, other fruits rice, vegetables, pickles, papads, tobacco, etc.Globally India has tremendous opportunities of exporting farm produce and allied agro-products. The only negative effect of globalization on Indian farming is that the cropping pattern may change and higher scales of production and higher productivity will displace agricultural labour. The large proportion of population in India is still closely tied to the rural sector and is dependent on agriculture. This is the sector, where, the bulk of poverty in India is concentrated. Unless and until, the

cultivators get an opportunity to improve their economic status, India will not be able to change her status, from a backward economy to a developed economy. Taking into consideration, large and growing demand for potatoes in the Indian as well as in the world market, this crop may help the farmers to earn an assured income. Hence in the present study the researcher wanted to explore the present scenario of global output of this world popular crop, the present scenario in India, Maharashtra & Pune District.

The study has focused on the growth in output and trade of potatoes, in special context of impact of WTO since its inception. The study tried to investigate whether there is any opportunity for the Indian farmers to cultivate potatoes and export them to the rest of the world, to enable them to improve their standard of living. Over the past few years the potato cultivation in the state of Maharashtra in general and particularly in Pune district's Ambegaon and Khed talukas is growing fast because of the availability of adequate bank finance due to forward recovery linkage from various Multinational companies engaged in manufacture of various value added potato products, e.g. PepsiCo, MacDonald, and also newly established Indian manufacturers. It is in this context the researcher thought of studying the profitability of the cultivation of potato crop based on the field level study of Ambegaon and Khed Talukas of Pune District. The researcher is of the view that his study will focus light on the trend in profitability and prospects of the cultivation of potato crop and its positive impact on the farmers' surplus generation from this agricultural activity which will also raise his standard of living.

3.3 OBJECTIVES OF THE STUDY

Keeping in view the research problem, the researcher has framed the following objectives for this study:

1. To study the price and cost trends in Market of potatoes and the profitability in production of this crop.
2. To study what is the rationale behind these changes in profitability.
3. To study the growth and productivity of the potato crops in the selected Ambegaon and Khed Talukas of Pune District.

3.4 HYPOTHESES

Birds' eye view of the potato crop in Pune District was taken by the researcher which enabled him to draw certain hypotheses for the current research. Keeping in the view the broad observations during the said survey the researcher has formulated the following hypotheses:

H1 Over the years the production of potato in Khed and Ambegaon Taluka in Pune District has shown growing tendency.

H2 The banks are providing the requisite finance for cultivation of potato crop.

H3 The cost of cultivation has gone up due to added input costs.

H4 Per ha. surplus generation of potato crop as a result of forward marketing linkage has induced the farmers for potato cultivation.

3.5 RESEARCH UNIVERSE

In Pune District Ambegaon and Khed talukas are having ideally most suited and favourable conditions for cultivation of potato crops. Traditionally these talukas are growing potato. Although the area under cultivation of crop was not much in the past, because of the changed scenario of marketing after globalization, number of multi nationals like PepsiCo. MacDonolds, and a few large size domestic units engaged in manufacture various potato products, the agriculturists have been assured better market. This has prompted increase in the area under potato crop in these two talukas. Keeping this back ground in view the researcher has carved out Ambegaon and Khed (Rajgurunagar) talukas for this research.

a) Data Collection

The researcher has collected to base his research both on the primary data as well as the secondary data to have realistic findings. The data was collected through administration of a well formulated questionnaire. The data has also been collected from Agriculture Produce Marketing Committee – Chakan, Khed and Ambegaon, Manchar sub-centre as well as respective taluka headquarter brnches of the Pune District Central Cooperative Bank Ltd.

b) Primary Data

Primary data has been collected from the various potato cultivators from both the identified Khed and Ambegaon Talukas district. These talukas have been identified for the study because of the area under potato cultivation is relatively higher than the rest of the talukas of Pune district. For this purpose with the help of the banks engaged in financing of potato crops (mainly as Pune District Central Coop. Bank Ltd. is the major financing bank), the data of the various villages where major potato growing agriculturists' names have been obtained. Similarly the names of the agriculturists financed for cultivation of potato by other banks also have been obtained. These agriculturists have been then divided on the basis of their holding i.e. Small & marginal farmers (holding less than 2.5 Ha.), Medium scale farmers (holding land above 2.5 Ha and less than 5 Ha.) and large farmers (having land holding above 5 Ha.) Potato is grown in the Kharif and Rabbi seasons. Therefore, while selecting the sample the researcher has also accounted for both the seasons' potato cultivators. On compiling the data for each taluka, the position obtained was as follows: The researcher wanted to work out a sample survey of 10% of the potato cultivators; in the field it was very difficult to get the respondents from the villages. Even for identifying the villages for the study the same criterion of area under potato has been taken into account. Potato cultivators from Khed Taluka, 250 and Ambegaon Taluka 250 farmers are selected on the basis of the size of farm. The farmers are selected randomly, as shown in the following tables.

c) Secondary Data

The secondary data has been collected from the books, journals and periodicals, print media, reports, and the websites which deal with the potato crop. Review of this related reading undertaken by the researcher has been furnished in the Chapter III of this thesis.

d) Sample Size

On identifying the total taluka wise area under potato cultivation in the identified talukas the following sample has been finalized. While selecting the sample care has been taken to ensure that there is proper representation of the farmers from all categories and that the overall sample represents at least the 15% of the total

farmers to make the sample truly representative. The table given below focuses on the sample size of this research.

e) Interview Schedule

Bearing in mind the objective of the study and that the hypotheses to be proved through this research, meaningfully well drafted questionnaire was prepared. Before actually using the same it was tested on a few selected agriculturists and on marginally modifying the said questionnaire was finalized and through it the data collected from the identified potato cultivators.

f) Period of Research

The researcher has taken period from F.Y.2007 to F.Y.2012.

g) Statistical Tools used for Testing Hypothesis

The following statistical tools have been used:-

- **Percentage**- This is a special kind of ratio which has been used to compare variables. Percentages have been used to condense data and express in relation to 100.
- **Correlation**- This tool used to know the relationship between the variables. That is the effect of change in one variable on another variable.
- **Diagrams and Graphs**- The diagrams and graphs have been used as an aid in interpretation of data and drawing conclusions.
- **Averages-** This statistical method is often necessary to represent a set of data in terms of one single number that should neither represent the lower nor the highest value but a value in between the highest and the lowest value.

ANOVA Statistical Test: A brief note about this test is detailed hereunder: Analysis of Variance (ANOVA) is a collection of statistical models used to analyze the differences between group means and their associated procedures (such as "variation" among and between groups), developed by R.A. Fisher. In the ANOVA setting, the observed variance in a particular variable is partitioned into components attributable to different sources of variation. In its simplest form, ANOVA provides a

statistical test of whether or not the means of several groups are equal, and therefore generalizes the t-test to more than two groups. As doing multiple two-sample t-tests would result in an increased chance of committing a statistical type I error, ANOVAs are useful in comparing (testing) three or more means (groups or variables) for statistical significance. When the groups or variables are more than three and sample size are not less than 30. That time the researcher can use analysis of variance for data (ANOVA). Condition If there is variation in data of variable between the selected terms of year then we can say that process of potato cultivation and its production are affected by exogenous factor which are significantly impacting to the inputs like fertilizer, electricity, seeds, labours viz. so these inputs are varying from its common mean of data and so growth and development can happen. If there is no progress then inputs will not feel dynamical functions and so data will never varied and development will not happen.

Mathematical Function

Source of Variation	Degrees of Freedom	Mean of Squares	F-Ratio
Within Groups	n-k	$MS_w = \frac{\sum\sum (x_{ij} - \bar{x}_j)^2}{n-k}$	MS_b / MS_w
Between Groups	k-1	$MS_b = \frac{\sum n_j (\bar{x}_j - \bar{x})^2}{k-1}$	
Total	n-1	$MS_{tot} = \frac{\sum\sum (x_{ij} - \bar{x})^2}{n-1}$	

Table values must be less than calculated value

3.6 SCOPE

Over the past few years the Indian agricultural front is witnessing drastic changes. It may be due to globalization, introduction of new technologies, farm mechanization and the development of markets and value added production of agricultural produce etc. India's export of agricultural produce is also showing steady increase. Therefore, the scenario offers newer and newer areas for undertaking research in this vast field. Now contract farming has been receiving popularity. New types of forward marketing linkages are being available. The Indian agricultural canvas has been enlarged and this has led to vast scope for research. Particularly for

this research is concerned, number of components have undergone changes. Say the seed quality, prices, labour costs, storage costs, input costs etc. as well as corresponding agriculture proceeds from the crop have also increased substantially. It is in this context this research has ample scope to study the profitability of the potato cultivation particularly in the identified talukas of Pune district.

3.7 LIMITATIONS

The data has been collected from the potato cultivators spread in Ambegaon and Khed taluka of Pune District. It is a peculiar situation so far as Indian agriculturists are concerned that they do not maintain proper books of accounts to arrive at the correct cost of production. The information that they give is just on the basis of their memory. Hence the reliability of the data is doubtful. However, to ensure its correctness the researcher has on the basis of the data collected from Agricultural Produce Market Committees, financing banks, to refresh their memory and furnished various vital inputs to these agriculturists and to that extent reliability of the data has been improved.

3.8 CHAPTER SCHEME

In First chapter the researcher has covered the origin of the potato crop, usages of potato, global perspective of potato, history of potato in India, cultivation of potato in India, post harvest management of potato, nutrition value of potato, vitamins in potato, national agricultural marketing frame work, storage and transport of potatoes, business opportunities for potato growers, contract farming, potato cultivation of Maharashtra, potato export from India, steps taken by Govt. of India to promote potato exports, history of Central Potato Research Institute (CPRI), potato processing industries in and around Pune, the future of potato, potato marketing in India.

In Second chapter the researcher has brought out the reviews of the related literature that he has gone through. The researcher has referred various books, periodicals, journals, research work already gone into (through earlier thesis on similar topics) and the web sites.

Chapter Third is devoted to significance of the research topic, objectives of the study, hypotheses, research universe, data collection, primary data, secondary data, sample size, questionnaire, analytical tools used, scope and limitation and chapter scheme of the thesis.

Chapter Four deals with the perspective of the research universe, the researcher has given a brief profile of Ambegaon and Khed talukas of Pune District.

The Fifth chapter deals with the presentation of the data collected, and its analysis, and interpretation of it.

The Sixth chapter summarizes the researcher's observations based on the findings from the analysis of the data collected, as well as the suggestions that the researchers thought it appropriate for adoption / implementation.

This chapter also covers validation of the hypotheses, scope for future research and the conclusion of the thesis.

CHAPTER – IV

PROFILE OF PUNE DISTRICT AND AMBEGAON AND KHED TALUKA

4.1 PROFILE PUNE DISTRICT

The following figure is the map of Pune district along with its location in the map of the State of Maharashtra.

Map of Pune District

Pune District is situated in Maharashtra state of India. Pune city is the district headquarters. In the last census on 2001, the total population of the district was 7,232,555, making it the fourth most populous district in India (out of 640)

1. Urban population comprises 58.08% of the total population.
2. The current population of Pune urban agglomerate is over 4 million. Area Population 15,642 km2 (6,039 sq mi) 99,24,224 (2001)

Pune District is situated in Maharashtra state of India. Pune city is the district headquarters. In the last census on 2001, the total population of the district was 7,232,555, making it the fourth most populous district in India (out of 640)[1]. Urban population comprises 58.08% of the total population.[2] The current population of Pune urban agglomerate is over 4 million.

Area	15,642 km^2 (6,039 sq mi)
Population	99,24,224 (2001)

According to the **2011 census** Pune District has a population of 9,426,959, roughly equal to the nation of Benin or the US state of North Carolina. This gives it a ranking of 4th in India (out of a total of 640). The district has a population density of 603 inhabitants per square kilometre (1,560 /sq mi) . Its population growth rate over the decade 2001-2011 was 30.34 %. Pune has a sex ratio of 910 females for every 1000 males, and a literacy rate of 87.19 %.

As of the census of 2001, there were 7,232,555 people and 1,517,041 households. The population density was 462 people per /km². In the district the population was spread out with 6,85,022 under the age of 4; 1,491,352 from 5 to 15; 4,466,901 from 15 to 59 and 5,89,280 60 years of age or older. For every 1000 males age 6 and older, there were 919 females.

Population density	461.85 /km^2 (1,196.2 /sq mi)	
Literacy	80.78%	
Sex ratio	919	
Thesils	1. Pune City tehsil,	2. Daund tehsil,
	3. Baramati tehsil,	4. Bhor tehsil,
	5. Indapur tehsil,	6. Velhe tehsil,
	7. Purandar tehsil,	8. Shirur tehsil,
	9. Ambegaon tehsil,	10. Khed tehsil,
	11. Junnar tehsil,	12. Maval tehsil,
	13. Mulshi tehsil,	14. Haveli tehsil

Rivers, Lakes and Dams

Major rivers of the district are: Pushpavati, Krushnavati, Kukadi, Meena, Ghod, Bhima, Bhama, Andhra, Indryani, Pavna, Mula, Mutha, Ambi, Mose, Shivganga, Kanandi, Gunjavni, Velvandi, Neera, Karha etc.

Some major dams are Yedgaon (Kukadi), Pimpalgaon (Pushpavati), Manikdoh, Meena (Meena), Dimbe (Ghod), Chas-Kaman and Ujani (Bhima), Andhra (Andhra), Valvhan (Indrayani), Pavna (Pavna), Mulshi (Mula), Temghar, Khadakwasla (Mutha), Varasgaon (Ambi), Panshet (Mose), Chapet (Kanandi), Bhatgar (Velvandi), Devghar, Veer (Neera) Lonavla region (Wadgaon-Maval Taluka) can be called as lake district of Maharashtra due to numerous lakes in this area viz, Bhushi, The Lonavla lake, INS Shivaji, Pavna, Valvhan, Tungarli, Andhra, Shirawta lake. However the Sahyadris and its branches offer lot of opportunity for damming the streams leading to large number of lakes in Pune district.

Table 4.2 : Irrigation Coverage (Ha) in Pune District

Total Area Available for Irrigation (NIA + allow)	1172952
Irrigation Potential created	NA
Net Irrigated Area (Total area irrigated at least once)	269901
Area irrigated by canals / channels	124358
Area irrigated by wells	145543
Area irrigated by tanks	NA

Area irrigated by other sources	NA
Irrigation potential utilized (Gross Irrigated Area)	319995

Source: Annual Credit Plan 2013-14 under Lead Bank Scheme

4.1.1 Agriculture and Cropping Pattern

Agriculture is the main land use in all tahsils except Pune where the area not available for cultivation constitutes the major land use category covering about 60% of the total area. The western tahsils of Velhe, Mulshi and Mawal have more forest cover than the other tahsils.

Cereals dominate the crops in all tahsils except Bhor, Velhe, Mulshi and Mawal.

The eastern part of Pune district has more area under cultivation than the western part. Large patches under Kharif crops have been delineated in Baramati, Shirur and Junner tahsils. Availability of good irrigation facilities in the area has enabled widespread practice of double cropping along the Nira River forming the Southern boundary of the district, as well as along the Bhima, Mula and Indrayani rivers.

The bovine population is highest in Khed (1,17,782) followed by Junner (95,547) and is lowest in Pune (12,859). The cattle population is highest in Baramati tahsil with 1,93,844 cattle, closely followed by Indapur, with 1,90,891 cattle and is lowest in Pune with only 24,353 heads of cattle.

4.1.2 Major Crops in Pune District

The following table shows the major crops and cash crops that are cultivated in Pune District.

Table 4.3 Statement showing Major crops in Pune district.

Types	Names	Cropping Period in Months	Market (District, State, Export)
Major Crops (Irrigated)	Ground nut, Tur, Soya, Corn Wheat, gram	June-July	District and State
Major Crops (Non - Irrigated)	Kharif--Bajra, Tur, Mug, Udid, Sunflower Rabi----Jowar	June -July Sept- Oct	District and State
Major Cash Crops	Sugarcane	June-July Sept-Oct. Jan-Feb	District(sugar factories)
Major Plantations	Mango, Chickoo, Pomegranate, Anjir, citrus fruits Rose flowers, shevanti etc.	June- July Throughout the year	District, State and Exports

4.1.3 Economy of Pune City

Pune is the district head quarter and the metropolitan city. The brief economy of is covered here. Pune has a booming economy. There are two industrial estates in the outskirts of Pune developed by the Maharashtra Industrial Development Corporation (MIDC). This is besides the already bustling industrial hub of Pimpri-Chinchwad. A large number of Indian industry majors and MNC's have set up base in Pune and its suburbs. These include companies like Bajaj Auto, TELCO, Philips India, Kirloskar Cummins, Kalyani Sharp, Bharat Forge, Mahindra And Mahindra, Hindustan Antibiotics, Mercedes Benz India Ltd, Weikfield India, Serum India, Duro Shocks, Kinetic Honda, Whirlpool, LG, Frito Lay, Coca Cola etc. Suburbs of Pune like Baramati, Khed, Mundhwa, Loni, Yerwada, Talegaon, Alandi, Warje, Wadgaon etc. account for a majority of Pune's agricultural produce, though Pune is not an agricultural city. Pune has also emerged as a software industry hub. Many of the leading Indian software companies have their presence in Pune. These include companies like Infosys, Tech Mahindra, Wipro, Patni, Satyam, Persistent Systems, Geometric Software Solutions Private Limited and others besides many global

players. The BPO industry is also booming with many leading Indian names and MNC's registering their presence in Pune.

Table 4.4 : Branches of Commercial Banks in Pune District

(Rs. In Lakhs)

Sr. No.	Name of the Bank	No. of Service Area Villages	Branch Net work					Deposits	Advances	C/D Ratio
			R	SU	U	M	Total			
01.	Allahabad Bank	1	1	0	0	4	5	25232	10452	41.42
02.	Andhra Bank	0	0	1	3	2	6	58263	45888	76.86
03.	AXIS Bank	0	0	4	0	13	17	324574	294565	90.75
04.	Bank of Baroda	94	13	7	0	39	59	667321	226070	33.88
05.	Bank of India	138	16	13	0	35	64	966958	544969	56.36
06.	Bank of Maharashtra	846	60	26	3	90	180	1747743	973021	55.67
07.	Canara Bank	67	8	12	0	30	50	422909	201679	47.69
08.	Central Bank of India	93	11	4	3	32	50	380622	227876	59.87
09.	Corporation Bank	3	3	6	0	21	30	399700	531724	133.03
10.	Dena Bank	21	5	3	0	14	22	103353	50178	48.55
11.	Federal Bank	0	0	0	0	2	2	12465	10835	86.92
12.	HEFC Bank	5	10	7	3	33	53	975556	919592	94.26
13.	ICICI Bank	22	3	9	0	26	38	824294	712785	86.47
14.	IDBI Bank	32	6	4	1	22	33	515131	311190	60.41
15.	Indian Bank	5	1	1	0	12	14	168865	82152	48.65
16.	Indian Oversea Bank	1	1	0	0	10	11	154622	79845	51.64
17.	Karnataka Bank Ltd.	0	0	0	0	1	1	4652	3424	73.60
18.	Karur Vysya Bank Ltd.	0	0	0	0	2	2	6852	2795	40.79
19.	Maharashtra Gramin Bank	1	2	2	0	0	4	2425	1075	44.33
20.	Oriental Bank of Commerce	20	4	6	1	24	35	260262	138864	53.36
21.	PDCC Bank	0	174	27	20	27	248	605093	403723	66.72
22	Punjab National Bank	32	3	4	2	13	22	255752	186352	72.86
23.	Ratnakar Bank	0	2	0	0	4	6	4362	989	22.67
24	State Bank of Bikaner & Jaipur	0	0	0	0	2	2	21456	29557	137.76
25	State Bank of Hyuderabad	0	0	0	0	2	2	9845	6895	70.04
26	State Bank of India	240	13	23	0	64	100	2849300	2013700	70.67
27	State Bank of Patiala	1	0	1	0	2	3	60507	12256	2026
28	Syndicate Bank	45	5	3	0	14	22	162815	85309	52.40
29	UCO Bank	45	7	1	0	14	22	198524	84565	42.60
30	Union Bank of India	81	17	4	1	32	54	491291	160563	32.68
31	Vijaya Bank	2	0	1	0	5	6	65245	34254	52.50
	Total	**1795**	**365**	**169**	**37**	**592**	**1163**	**12746089**	**8387142**	**65.80**

Source: Annual Credit Plan 2013-14 under Lead Bank Scheme

Deposit Resources

Deposits represent one of the resources for lending to various sectors of econmey and hence the following table showing the deposits outstanding in the various types of banking institutions.

Table 4.5: Deposit Resources of the banking institutions in Pune District

(Rs. In Lakhs)

Agency	**31.3.2010**	**31.3.2011**	**31.3.2012**	**31.3.2013**
Commercial Banks	5160302	6435051	8820828	12128726
Regional Rural Bank	NA	835	1862	2425
Cooperative Banks	491174	510289	544992	605093
All Agencies	**56511476**	**6946175**	**9367682**	**12736244**

Source: Annual Credit Plan 2013-14 under Lead Bank Scheme

Advances Outstanding

Table 4.6: Total Advances of all categories of banks in Pune Dist.

(Rs. In Lakhs)

Agency	**31.3.2010**	**31.3.2011**	**31.3.2012**	**31.3.2013**
Commercial Banks	3170605	4151262	5364558	7975449
Regional Rural Bank	NA	115	914	1075
Cooperative Banks	230320	285214	337558	403723
All Agencies	**3400925**	**4436591**	**5703030**	**8380247**

Source: Annual Credit Plan 2013-14 under Lead Bank Scheme

Pune is considered as the Oxford of India with it many educational and research institutions apart form other institutions for sports, yoga, ayurveda, culture and social services. In Balewadi of Pune city a big stadium is built up for Asian Games (Shri Chhatrapati Stadium).

Pune is also famous for :

- **Ganesh Festival :** This is the most popular event in the City when Lord Ganesha arrives for ten days when various cultural programmes are celebrated and the process of emersion of the lord Ganesha is top most event when thousands of devotees participate in the processon.

- **Osho Ashram:** This is the famous institute of Rajneesh, the guru of Meditation. The institute is located at Koregaon Park and spread over a huge area.
- **Shaniwar Wada:** The historic palace built by Bajirao Peshwa.
- **Shinde Chhatri**: An architectural excellence, this is a memorial built and dedicated to Mahadji Shinde. It is located at a small distance from the racecourse in Pune.
- **Pataleshwar Cave Temples**: This cave is carved out of a single stone. It is located in the heart of the city. The following is the map of Pune district along with its location in the map of the State of Maharashtra.

4.2 PROFILE OF AMBEGAON TALUKA

In Pune district Khed and Ambegaon talukas are having major potato cultivation. Therefore, the researcher has identified these two talukas for this research.

Figure 4.2 : Location of Ambegaon Taluka in Pune District Map

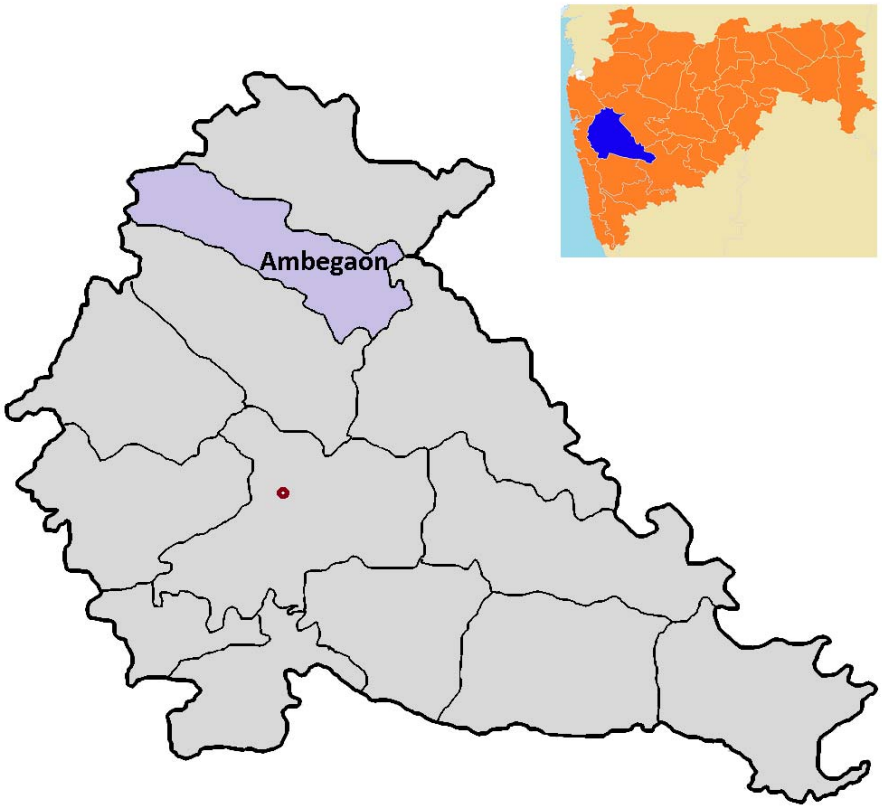


Table 4.7: Block Profile of Ambegaon where potato crop is grown

Particulars	**Ambegaon**
No. of Villages	143
No. of Grampanchayat	Group: 28 Independent: 75
No. of Towns	1
No. of families	42000
Total Population	214000
Rural	200000
Urban	14000
Males	108000
Females	106000
Literacy %	74
Geographical area (sq. k.m.)	1043
No. of PACs.	49
Functioning Dairy Societies	138
Area Under Major Crops (Ha.)	
Paddy	5130
Bajara	14545
Wheat	2230
Other Cereals	54804
Pulses	7989
Vegetables	5139
Sugarcane	1750
Mango Grapes & Other Fruits	711
Total Cropped Area (Ha)	104275
Forest Area	24300
Follow Land	6706
Cultivate land	77904
Well Irrigated land	8459
Total Irrigation	17867
No. of Wells	8075

Well with Oil Engines	669
No. of BPL Survey as per 2006-07 survey	8333
Average Rain fall (m.m.)	828
Rain fall in 2010 (m.m.)	823
No. of Vet. Centers	19
No. of A. I. Centres	19
No. of Poultry Birds	275603
No. of Goats	40991
No. of Buffaloes	7336
No. of local /C.B. Cows	74762
No. of bullocks	3033

Source: Census Hand Book Pune District 2011

Table 4.8: Major Cropping Pattern in Ambegaon taluka

Cropping Pattern			
Kharif	**Rabi**	**Summer**	**Perennial**
Groundnut, Bajra, Paddy, Jowar, Soybean, Tomato, Maize, Cauliflower, Finger Millet, Tur, Green gram, Black gram etc.	Gram, Wheat, Onion, **Potato,** Tomato etc.	Bajra, Groundnut, Okra, Onion, Tomato etc.	Sugarcane, Grape, Pomegranate, Custard Apple, Banana, Mango etc.

Source: Website of Krishi Vigyan Kendra, Narayangaon

Table 4.9: Rainfall status of Ambegaon Taluka

Year	Taluka
	Ambegaon(mm)
2005-06	1355.5
2006-07	877.3
2007-08	426.6
2008-09	476.6
2009-10	896

Source: Website of Krishi Vigyan Kendra, Narayangaon

Table 4.10: Agro ecological situations of Ambegaon Taluka

Sr. No	Agro ecological situation	Distribution	Characteristics
1	AES I	Ambegaon (East)	Low rainfall, low humidity, Light soils, No irrigation.
2	AES II	Ambegaon (East)	Low rainfall, low humidity, Medium soils, No irrigation
3	AES III	Ambegaon (East),	Low rainfall, low humidity, Heavy soils, No irrigation
4	AES IV	Ambegaon (East-North)	Low rainfall, low humidity, Light soils with irrigation,
5	AES V	Ambegaon (East-North)	Low rainfall, low humidity, Medium soils with irrigation
6	AES VI	Ambegaon(East-North)	Low rainfall, low humidity, Heavy soils with irrigation
7	AES VII	Ambegaon,	High Rainfall 1250 mm Light Sloppy soils
8	AES VIII	Ambegaon (central),	Medium Rainfall 750mm-1250 mm, Light sloppy soils(8-15 % slope)
9	AES IX	Ambegaon (central),	Medium Rainfall 750mm-1250 mm, Medium sloppy soils(8-15 % slope)
10	AES X	Ambegaon (central),	Medium Rainfall 750mm-1250 mm, Heavy sloppy soils(8-15 % slope)

Source: Website of Krishi Vigyan Kendra, Narayangaon

4.3 LOCATION OF RAJGURUNAGAR (KHED) TALUKA IN PUNE DISTRICT MAP

The following map presents location map of Pune district in the map of the Maharashtra state and the other map shows location of the Khed (Rajgurunagar Taluka) in Pune district.

Table 4.11: Block Profile of Khed (Rajgurunagar) TALUKA

Particulars	**Khed**
No. of Villages	188
No. of Grampanchayat	Group : 25 Independent: 138
No. of Towns	3
No. of families	68000
Total Population	343000
Rural	286000
Urban	57000
Males	178000
Females	165000
Literacy %	72
Geographical area (sq. k.m.)	1400
No. of PACs.	98
Functioning Dairy Societies	178

Area Under Major Crops (Ha.)	
Paddy	6420
Bajara	16450
Wheat	4420
Other Cereals	73453
Pulses	14248
Vegetables	8624
Sugarcane	60
Mango Grapes & Other Fruits	540
Total Cropped Area (Ha)	137354
Forest Area	20079
Follow Land	9530
Cultivate land	105152
Well Irrigated land	9845
Total Irrigation	26754
No. of Wells	9561
Well with Oil Engines	3010
No. of BPL Survey as per 2006-07 survey	11940
Average Rain fall (m.m.)	607.3
Rain fall in 2010 (m.m.)	971.0
No. of Vet. Centers	32
No. of A. I. Centres	32
No. of Poultry Birds	554120
No. of Goats	49361
No. of Buffaloes	17819
No. of local /C.B. Cows	74859
No. of bullocks	3179

Source: Annual Credit Plan 2013-14 under Lead Bank Scheme

Table 4.12 : Cropping Pattern of Khed (Rajgurunagar) taluka

Cropping Pattern			
Kharif	**Rabi**	**Summer**	**Perennial**
Paddy, Jowar, Bajra, Maize, Tur, Green gram, Black Gram, Ground nut, Soybean, Niger, Sun flower , Potato	Tomato, Onion, Potato, Wheat, Gram, Garlic, Maize, Lentil etc.	Maize, Groundnut, Bajra etc.	Sugarcane, Pomegranate, Banana, Mango etc.

Source: Website of Krishi Vigyan Kendra, Narayangaon

Table 4.13 : Rainfall status of Khed (Rajgurunagar) taluka

Year	Tahsil
	Khed(mm)
2005-06	N.A.
2006-07	N.A.
2007-08	N.A.
2008-09	N.A.
2009-10	752.2

Source: Website of Krishi Vigyan Kendra, Narayangaon

Table 4.14 : Agro ecological situations of Khed (Rajgurunagar) Taluka

Sr. No	Agro ecological situation	Distribution	Characteristics
1	AES VII	Khed (West)	High Rainfall 1250 mm Light Sloppy soils
2	AES VIII	Khed (Central)	Medium Rainfall 750mm-1250 mm, Light sloppy soils(8-15 % slope)
3	AES IX	Khed (Central)	Medium Rainfall 750mm-1250 mm, Medium sloppy soils(8-15 % slope)
4	AES X	Khed (Central)	Medium Rainfall 750mm-1250 mm, Heavy sloppy soils(8-15 % slope)

Source: Website of Krishi Vigyan Kendra, Narayangaon

CHAPTER – V

PROFITABILITY OF POTATO CROP IN KHED AND AMBEGAON TALUKAS

5.1 INTRODUCTION

The researcher has carried out empirical verification of the profitability in potato farming in Khed and Ambegaon Talukas of Pune District. As a consequence to it the researcher has to study the cost of cultivation of the potato crop in these two talukas.

5.2 FIELD SURVEY DATA PRESENTATION

The land holding of the identified potato growers is also of vital importance or the purpose of the study. Hence the identified data has been classified according to their land holding which has been shown in the following table. The following table shows classification as Marginal, Small, Marginal and Large farmers. However, for the purposes of this study Marginal and Small holders are clubbed as the number of marginal farmers cultivating potato crop was meager. So also although the study targeted to obtain data from 250 respondents from each of the Talukas under study, in actual working marginally less number of respondents could provide the data and hence the researcher has also included the targeted and actual respondents.

Table 5.1: Land holding wise classification of the identified potato cultivators in Ambegaon Taluka

Sr. No.	**Category**	**No. of potato cultivators**
1	Small Farmers	100
2	Marginal Farmers	100
3	Large farmers	50
	Total	**250**

Source: Field survey data

Figure 5.1

Land holding wise classified of identified potato cultivators in Ambegaon Taluka

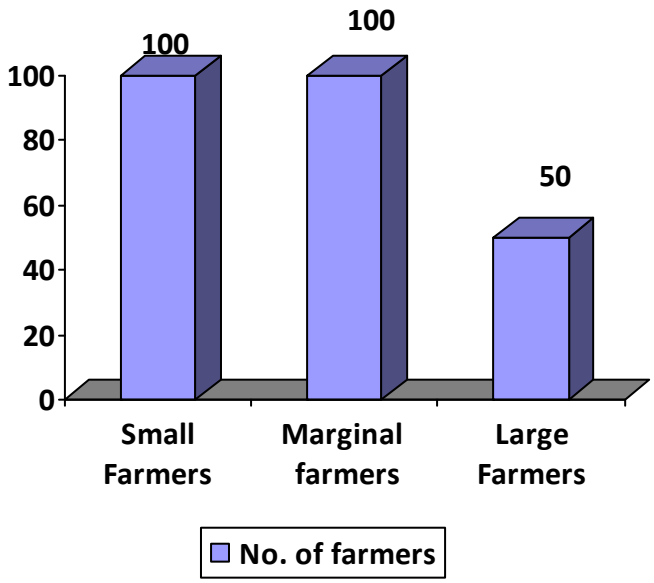


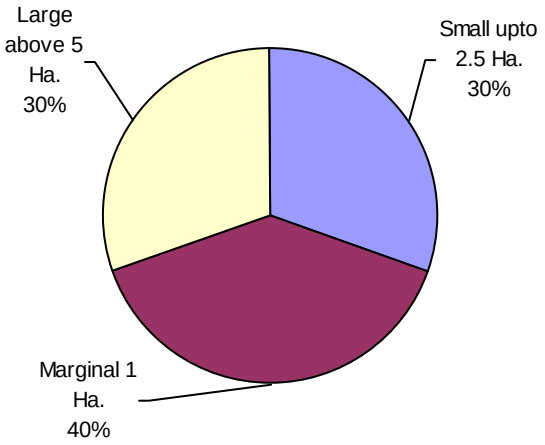
Table 5.2: Area under potato crop of the identified potato growers in terms of percentage of their total holding in Ambegaon taluka

	Small Upto 2.5 Ha.	**Marginal 1 Ha**	**Large Above 5 Ha.**	**Total**
Targeted	100	100	50	250
Actual respondents	100	100	50	250
Average % of cultivation of potato	30.43	39.14	30.43	

Source: Field Survey Data

Figure 5.2

Area under potato crop of the identified potato growers in terms of percentage of their total holding in Ambegaon taluka



Land holding

Usually the agriculturists do not use his total land for one crop. He takes multiple crop per his needs and keeping in view various other factors such availability of water, know how, climatic conditions etc. Hence the land holding of the agriculturists has been considered here. The data on the agriculture holding reveals the following.

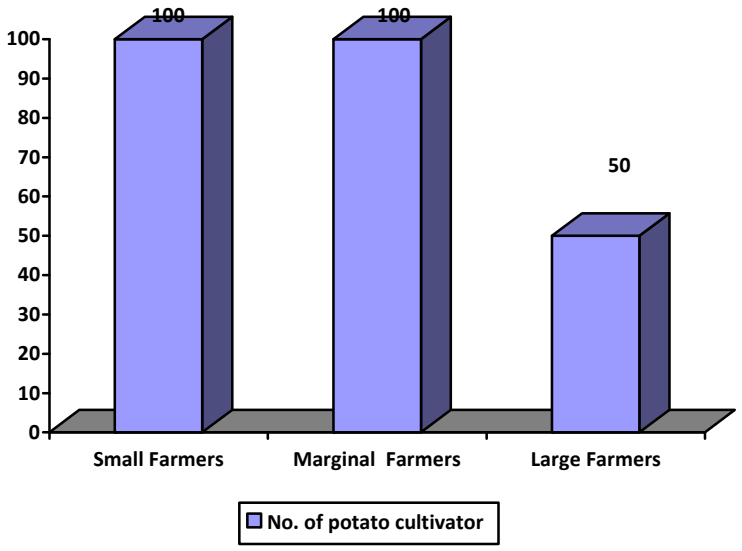
Table 5.3: Land holding wise classification of the identified potato cultivators in Khed Taluka

Sr. No.	**Category**	**No. of potato cultivators**
1	Marginal Farmers	100
2	Small Farmers	100
3	Large Farmers	50
	Total	**250**

Source: Field survey data

Figure 5.3

Land holding wise classification of identified potato cultivators in Khed Taluka



It can be seen from the above table that in the normal course of the total land holding the small farmers on an average have brought 38% of their holding under potato crop. The same percentage in respect of marginal farmers is 55.30% and for large farmers it is 64.19%. During the course of interaction with the respondents it was transpired that there are number of factors which determine the coverage of potato crop. The first and foremost is the availability of bank finance and the other is dependability on water resource. For obtaining bank finance the marginal and large farmers do not find difficulty while the small farmers have their limitations in raising the finance.

It can be seen from the above table that even in Khed taluka the same pattern of average coverage under potato crop is seen. It is marginally higher.

Education wise classification of the respondents

Education has a bearing on the cultivation practices followed by the cultivator hence the researcher felt that this data will also be useful in understanding the cultivation practices followed by the cultivators.

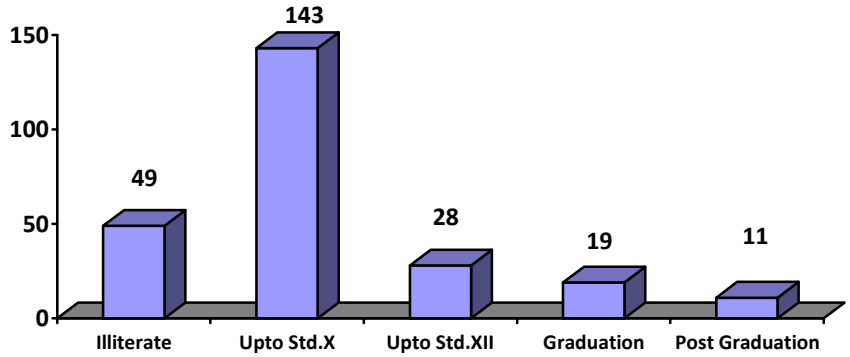
Table 5.4: Education wise classification of the respondents from Ambegaon Taluka as on 31.3.2012

Sr. No.	Parameter	No. of Respondents	% to Total respondents
1	Illiterate	49	19.60
2	Upto Std. X	143	57.20
3	Upto XII	28	11.20
4	Graduation	19	7.60
5	Post graduation	11	4.40

Source: Field survey data

Figure 5.4

Education wise classification of the respondents from Ambegaon Taluka



From the above table it can be observed that majority of the respondents i.e. 57.20% have studied upto std. X and 11.20 % have studied above Std. XII. There are only 7.60% graduates and only 4.40% are post graduates.

Table 5.5 : Education wise classification of the respondents from Khed Taluka as on 31.3.2012

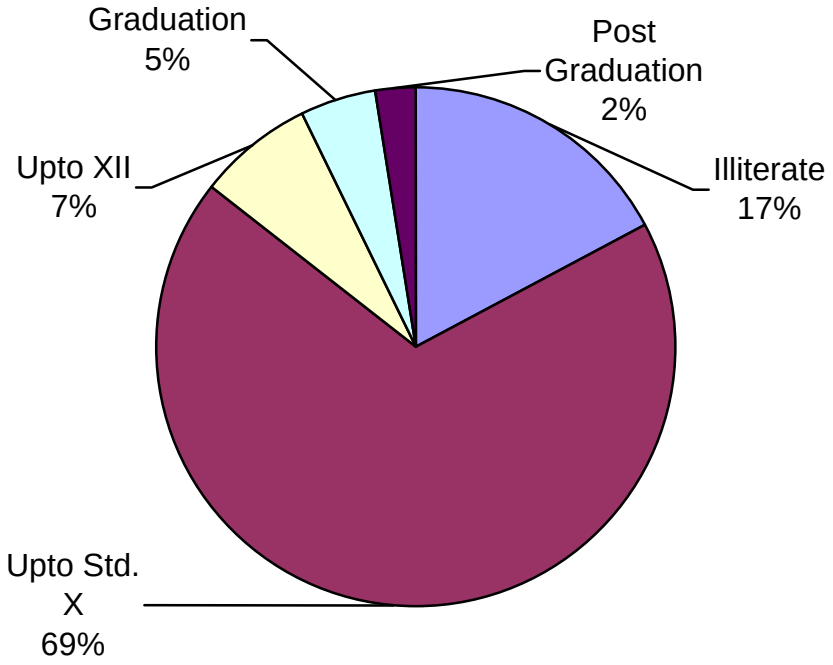
Sr. No.	Parameter	No. of Respondents	% to Total respondents
1	Illiterate	43	17.20
2	Upto Std. X	171	68.40
3	Upto XII	18	7.20
4	Graduation	12	4.80
5	Post graduation	6	2.40
	Total	**250**	**100**

Source: Field survey data

From the above table it can be observed that majority of the respondents i.e. 68.4% have studied upto std. X and 16% have studied above Std. XII. There are only 5% graduates and only 3% are post graduates. The percentage has been worked out for 230 respondents. The total has not been arrived at there will be respondents falling under multiple heads.

Figure 5.5

Education wise classification of the respondents from Khed Taluka



DATA ANALYSIS

Introduction

In the following tables various statistics for Ambegaon and Khed Talukas for the each of the operation have been clubbed. Expenditure on each of the following operation has been analyzed using statistical tools which include Mean, Median, Mode, Standard Deviation, Variance, Skewness, Standard error of skewness and sum.

For Kharif season

v1 Represents Purchasing the new farm.
v2 Pre tillage expenditure
v3 Scond part of Pre tillage
v4 Expenditure on compost fertilizer
v5 Expenditure on fertilizers
v6 Expenditure on Pesticides
v7 Expenditure on Crop vaccination
v8 Expenditure on Fencing (compound)
v9 Expenditure on Irrigation, piping, sprinkler and watering
v10 Expenditure Agricultural instrucments and others
v11 Investment with loan / individual
v12 Loan from Pune District Central Coop. Bank Ltd.
v13 Loan from Commercial Banks
v14 Loan from Regional Rural Banks
v15 Loan from Contracting Companies
v16 Loan from Individuals
v17 Details of individual investments
v18 Individual investment in percentage term
v19 Availability of seeds
v20 For second year pre tillage
v21 Expenditure on Fencing (campound)
v22 Expenditure on Compost /fertilizer
v23 Expenditure on Seeds
v24 Expenditure on Electricity, diesel etc.

v25 Weighing machine, packing and marketing expenses

v26 Repairs and maintenance

v27 Expenditure on Crop safety/pesticides/crop vaccination etc.

v28 Expenditure on Watering

v29 Labour charges

v30 Storage expenses

v31 Transport expenditure

v32 Purchasing of machinery

v33 Animal hunsbandary and its expenses

v34 Farm and water taxes

v35 Yearly Income

v36 Sales medium

v37 Impact of steps taken for increasing potato production

v38 Increase in production in last 10 years

Consolidated position of various operations detailed herein above -

Frequencies

Statistics

		v1	v2	v3	v4	v5	v6
N	Valid	3	3	3	3	3	3
	Missing	0	0	0	0	0	0
Mean		33.33	33.33	32.00	32.00	33.00	32.67
Median		42.00	14.00	31.00	27.00	26.00	22.00
Mode		11[a]	3[a]	11[a]	6[a]	8[a]	8[a]
Std. Deviation		19.502	43.363	21.517	28.827	29.138	31.390
Variance		380.333	1880.333	463.000	831.000	849.000	985.333
Skewness		-1.605	1.608	.209	.757	1.019	1.353
Std. Error of Skewness		1.225	1.225	1.225	1.225	1.225	1.225
Sum		100	100	96	96	99	98

a. Multiple modes exist. The smallest value is shown

Consolidated position of various operations detailed herein above - …. contd

Statistics							
		v7	v8	v9	v10	v11	v12
N	Valid	3	3	3	3	3	3
	Missing	0	0	0	0	0	0
Mean		33.33	31.33	33.33	33.00	27.00	32.67
Median		23.00	21.00	6.00	38.00	33.00	29.00
Mode		9[a]	5[a]	2[a]	12[a]	12[a]	15[a]
Std. Deviation		30.827	32.747	50.846	19.000	13.077	19.757
Variance		950.333	1072.333	2585.333	361.000	171.000	390.333
Skewness		1.339	1.279	1.720	-1.102	-1.630	.806
Std. Error of Skewness		1.225	1.225	1.225	1.225	1.225	1.225
Sum		100	94	100	99	81	98
a. Multiple modes exist. The smallest value is shown							

Consolidated position of various operations detailed herein above - …. contd

Statistics							
		v13	v14	v15	v16	v17	v18
N	Valid	3	3	3	3	3	3
	Missing	0	0	0	0	0	0
Mean		31.67	32.00	33.00	32.67	32.67	32.0000
Median		41.00	23.00	26.00	16.00	44.00	32.0000
Mode		4[a]	3[a]	0[a]	5[a]	4[a]	7.00[a]
Std. Deviation		24.379	34.395	37.000	38.786	25.007	25.00000
Variance		594.333	1183.000	1369.000	1504.333	625.333	625.000
Skewness		-1.470	1.097	.821	1.577	-1.621	.000
Std. Error of Skewness		1.225	1.225	1.225	1.225	1.225	1.225
Sum		95	96	99	98	98	96.00
a. Multiple modes exist. The smallest value is shown							

Consolidated position of various operations detailed herein above - …. contd

Statistics							
		v19	v20	v21	v22	v23	v24
N	Valid	3	3	3	3	3	3
	Missing	0	0	0	0	0	0
Mean		33.33	33.33	32.67	33.33	30.67	32.00
Median		2.00	43.00	41.00	3.00	34.00	26.00
Mode		1[a]	2[a]	14[a]	0[a]	14[a]	22[a]
Std. Deviation		55.139	27.791	16.197	55.157	15.275	14.000
Variance		3040.333	772.333	262.333	3042.333	233.333	196.000
Skewness		1.731	-1.376	-1.702	1.726	-.935	1.574
Std. Error of Skewness		1.225	1.225	1.225	1.225	1.225	1.225
Sum		100	100	98	100	92	96
a. Multiple modes exist. The smallest value is shown							

Consolidated position of various operations detailed herein above - …. contd

Statistics						
		v25	v26	v27	v28	v29
N	Valid	3	3	3	3	3
	Missing	0	0	0	0	0
Mean		31.33	32.33	33.33	33.00	33.00
Median		29.00	26.00	7.00	19.00	22.00
Mode		0[a]	3[a]	1[a]	5[a]	4[a]
Std. Deviation		32.563	32.960	50.895	37.041	35.791
Variance		1060.333	1086.333	2590.333	1372.000	1281.000
Skewness		.321	.833	1.705	1.458	1.252
Std. Error of Skewness		1.225	1.225	1.225	1.225	1.225
Sum		94	97	100	99	99
a. Multiple modes exist. The smallest value is shown						

Consolidated position of various operations detailed herein above - …. contd

Statistics							
		v30	v31	v32	v33	v34	v35
N	Valid	3	3	3	3	3	3
	Missing	0	0	0	0	0	0
Mean		33.00	33.33	33.00	33.00	33.33	30.67
Median		8.00	42.00	1.00	29.00	47.00	30.00
Mode		0[a]	3[a]	0[a]	8[a]	5[a]	2[a]
Std. Deviation		50.388	27.062	56.294	27.221	24.542	29.006
Variance		2539.000	732.333	3169.000	741.000	602.333	841.333
Skewness		1.683	-1.293	1.731	.647	-1.729	.103
Std. Error of Skewness		1.225	1.225	1.225	1.225	1.225	1.225
Sum		99	100	99	99	100	92
a. Multiple modes exist. The smallest value is shown							

Consolidated position of various operations detailed herein above - …. contd

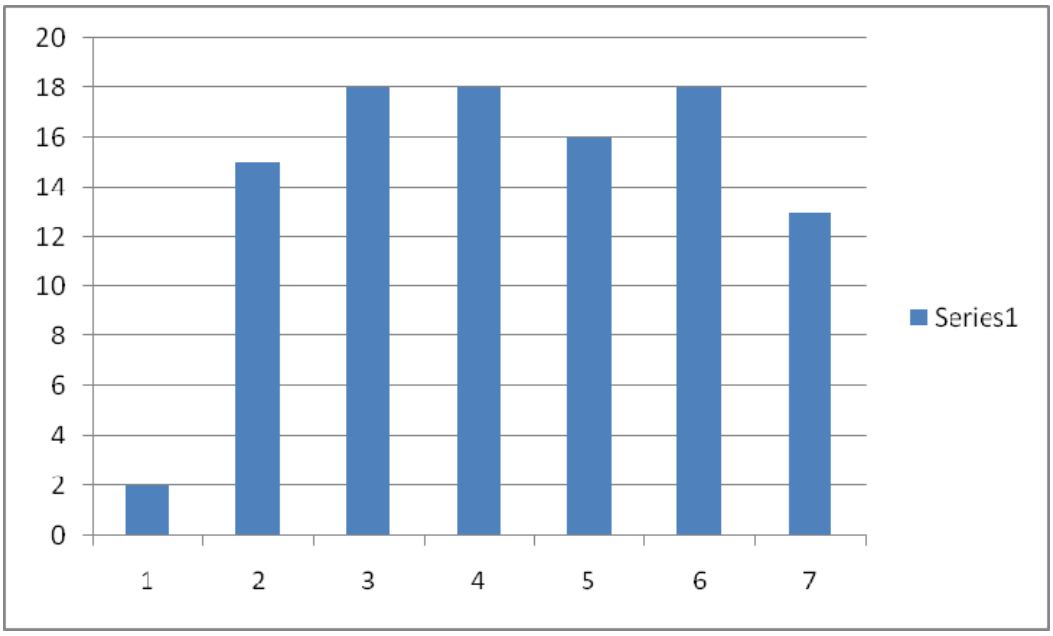
Statistics				
		v36	v37	v38
N	Valid	3	2	3
	Missing	0	1	0
Mean		26.00	50.0000	33.3333
Median		25.00	50.0000	17.0000
Mode		16[a]	10.00[a]	3.00[a]
Std. Deviation		10.536	56.56854	41.01626
Variance		111.000	3200.000	1682.333
Skewness		.423		1.508
Std. Error of Skewness		1.225		1.225
Sum		78	100.00	100.00
a. Multiple modes exist. The smallest value is shown				

Analysis of the data collected through the questionnaire administered

Frequency Table

1. Farmers started taking potatoes crop.

Year	Number of farmer
2006	10
2007	75
2008	90
2009	90
2010	80
2011	90
2012	65



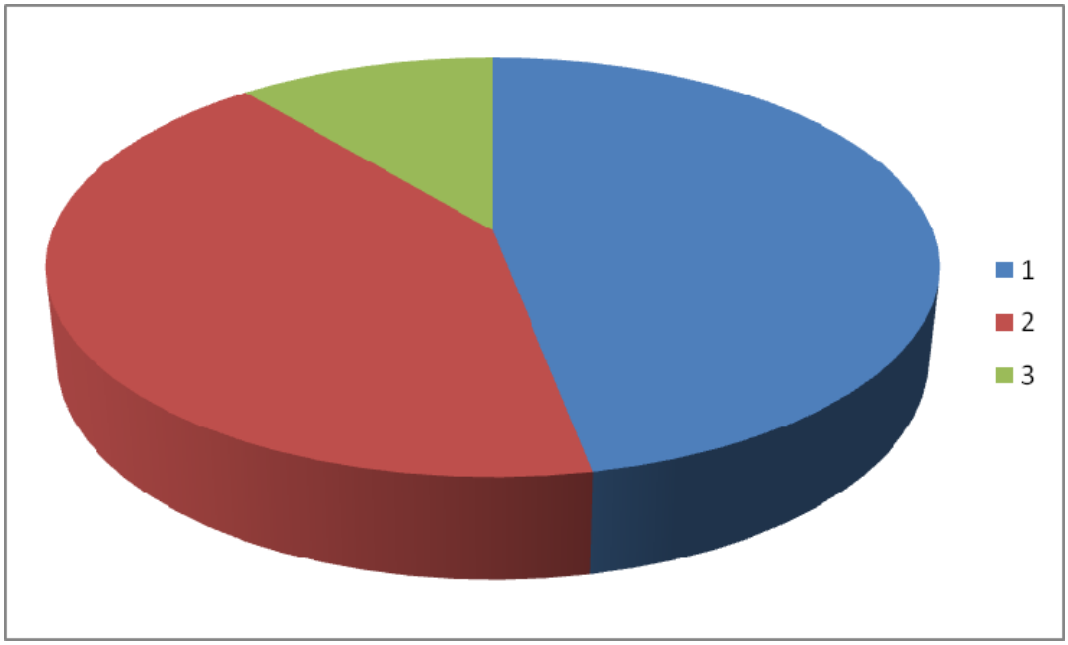
From the survey, researcher found that year wise number of farmers is taking interested for the potatoes as main crop.

1. Purchasing the new farm for Khed Taluka

v1- (Khed Taluka)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<20000	235	47	47	47
	Between 20000 and 30000	210	42	42	89
	>30000	55	11	11	100
	Total	500	100.0	100.0	

Figure 5.6

Purchasing the new farm for Khed Taluka

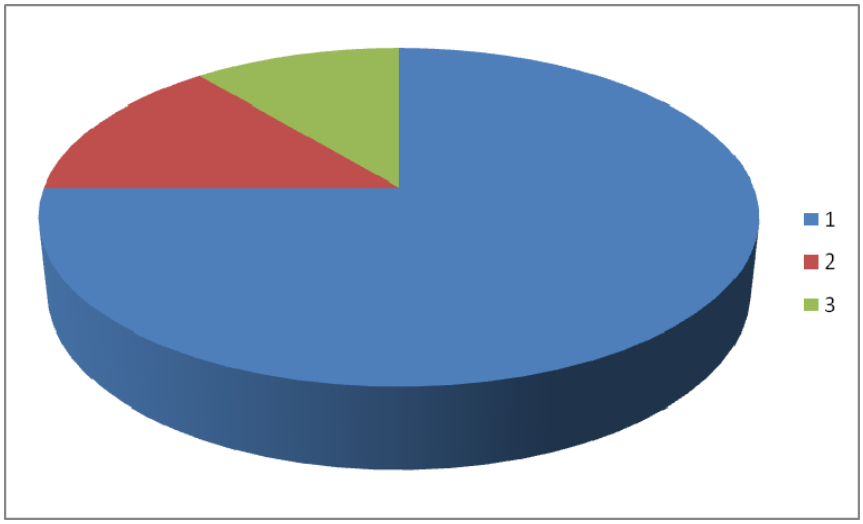


Purchasing the new farm for Ambegaon Taluka

v1 – Ambegaon Taluka					
		Farmer	Percent	Valid Percent	Cumulative Percent
Valid	<20000	375	75	75	75
	Between 20000 and 30000	70	14	14	89
	>30000	55	11	11	100
	Total	500	100.0	100.0	

Figure 5.7

Purchasing the new farm for Ambegaon Taluka



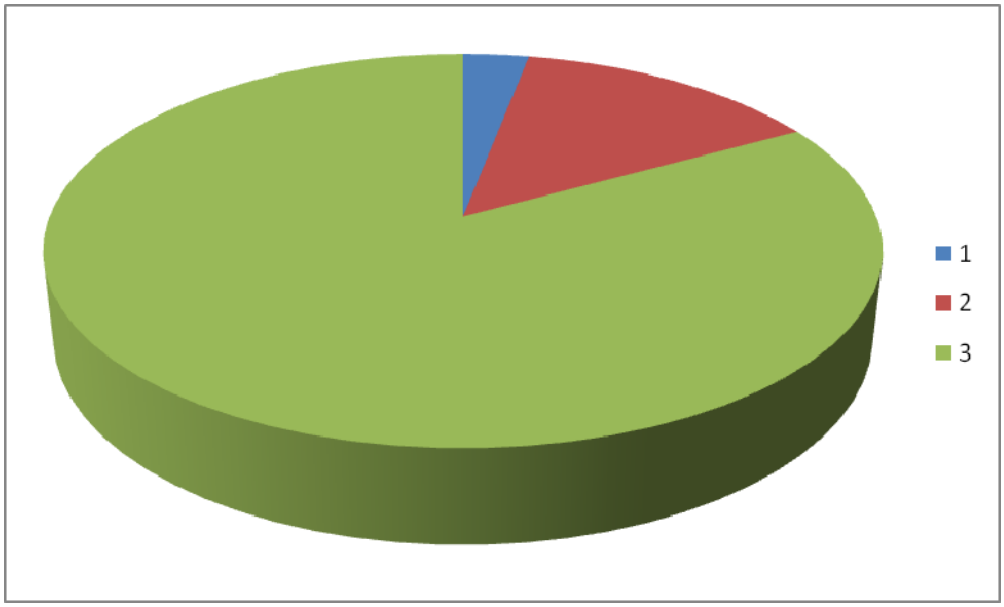
From the survey of Khed and Ambegaon taluka, among total the respondents, 47% respondents are using fund for pre-tillage amount less than 20000, 42% of respondents using between 20000 to 30000 and 11% of respondents using more than 30000 while in Ambegaon taluka 75% respondents are using fund for pre-tillage amount less than 20000, 14% of respondents using between 20000 to 30000 and 11% of respondents using more than 30000.

2. Pre-tillage Expenditure

v2 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	15	3	3	3
	Between 5000 and 7000	70	14	14	17
	>7000	415	83	83	100
	Total	500	100.0	100.0	

Figure 5.8

Pre-tillage Expenditure Khed Taluka

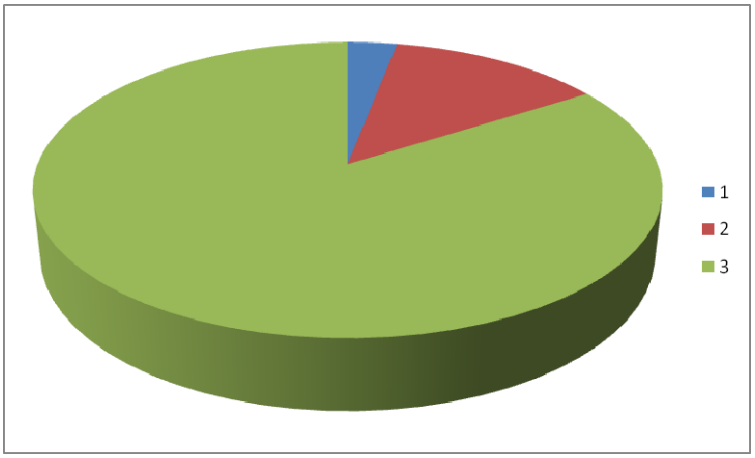


Pre-tillage Expenditure Ambegaon Taluka

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<5000	15	3	3	3
	Between 5000 and 7000	65	13	13	16
	>7000	420	84	84	100
	Total	500	100.0	100.0	

Figure 5.9

Pre-tillage Expenditure Ambegaon Taluka



From the survey of Khed and Ambegaon taluka, among total the respondents, 3% respondents are using fund for pre-tillage amount less than 5000 , 14% of respondents using between 5000 to 7000 and 83% of respondents using more than 7000 while in Ambegaon taluka 3% respondents are using fund for pre-tillage amount less than 5000 , 14% of respondents using between 5000 to 7000 and 84% of respondents using more than 7000.

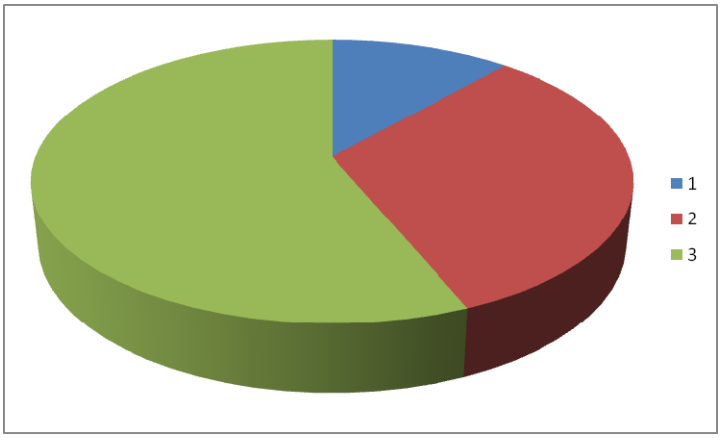
3. Second part of pre-tillage

Pre tillage expenditure for Rabbi season for Khed Taluka

v3 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	55	11	11	11
	Between 5000 and 7000	155	31	31	42
	>7000	290	58	58	100
	Total	500	100.0	100.0	

Figure 5.10

Pre tillage expenditure for Rabbi season for Khed Taluka



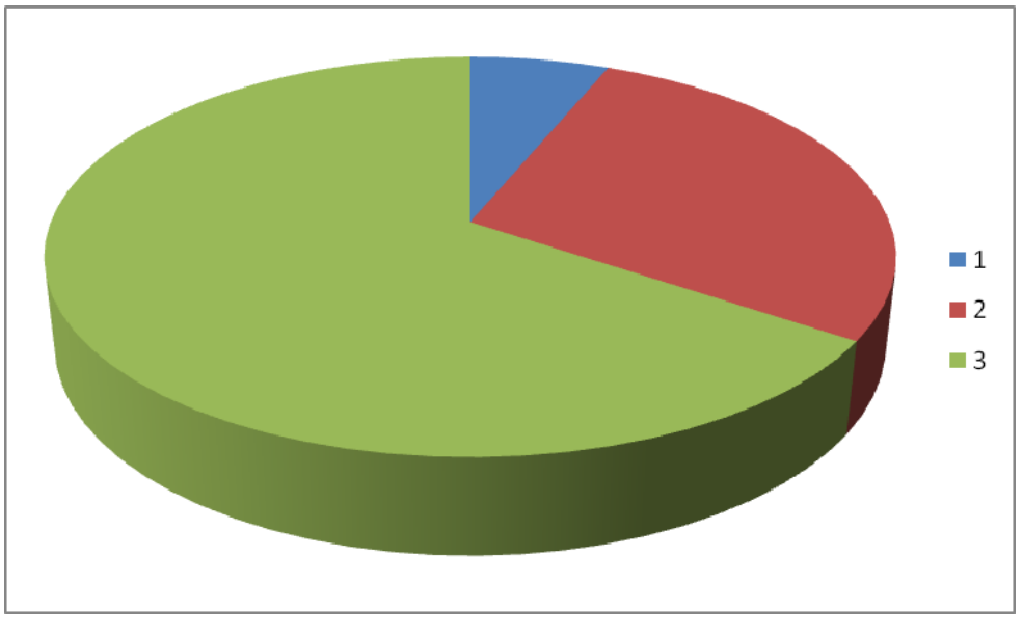
From the survey of Khed and Ambegaon taluka, among total the respondents, 11% respondents are using fund for second part of pre-tillage amount less than 5000 , 31% of respondents using between 5000 to 7000 and 54% of respondents using more than 7000 while in Ambegaon taluka 10% respondents are using fund for second part of pre-tillage amount less than 5000, 31% of respondents using between 5000 to 7000 and 59% of respondents using more than 7000.

4. Expenditure on compost fertilizer

v4 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	30	6	6	6
	Between 5000 and 7000	135	27	27	33
	>7000	335	67	67	100
	Total	500	100.0	100.0	

Figure 5.11

Expenditure on compost fertilizer (Khed Taluka)

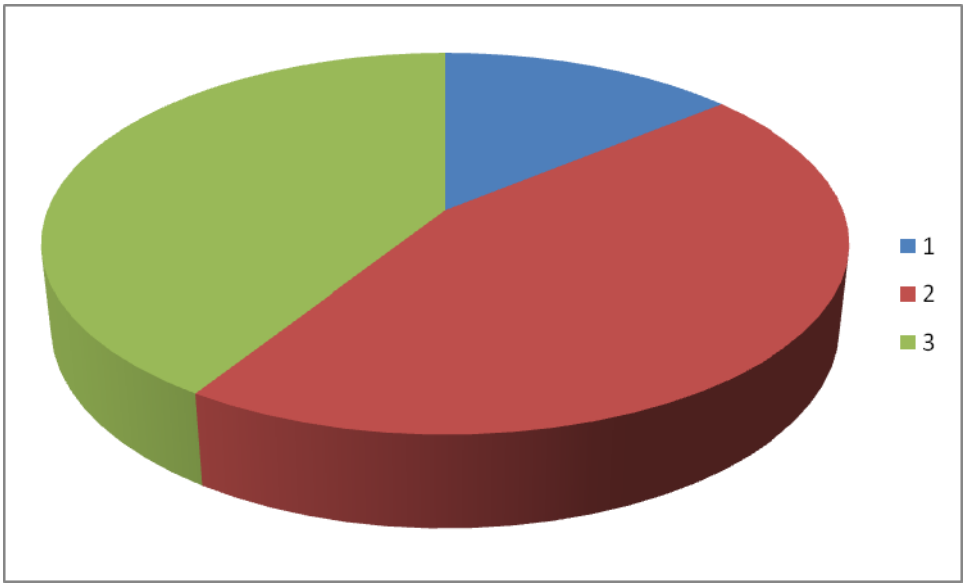


V-4 Expenditure on compost fertilizer Ambegaon Taluka

		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	70	14	14	14
	Between 5000 and 7000	225	45	45	59
	>7000	205	41	41	100
	Total	500	100.0	100.0	

Figure 5.12

Expenditure on compost fertilizer Ambegaon Taluka



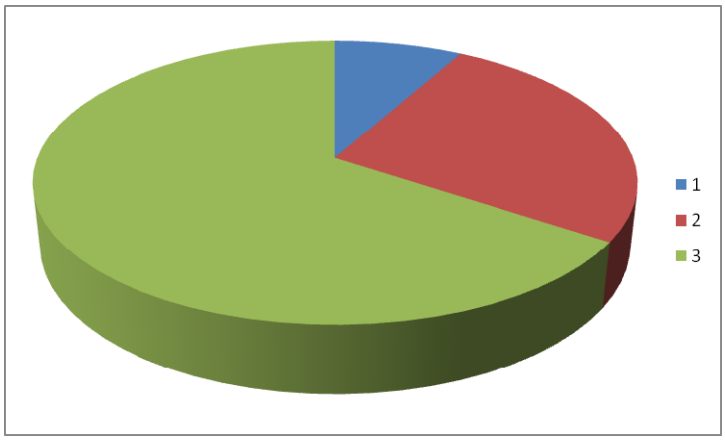
5. Expenditure on Fertilizers

Expenditure on fertilizers

v5 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	40	8	8	8
	Between 5000 and 7000	130	26	26	34
	>7000	330	66	66	100
	Total	500	100.0	100.0	

Figure 5.13

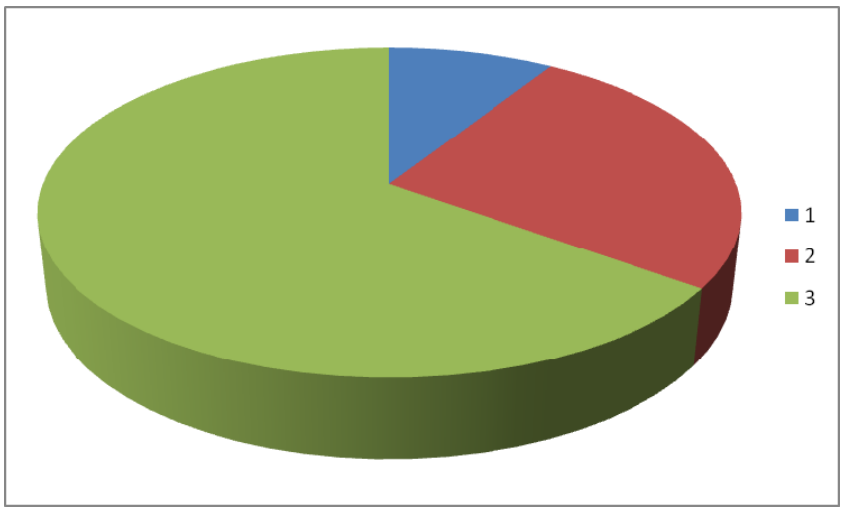
Expenditure on fertilizers Khed Taluka



v5 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	45	9	9	9
	Between 5000 and 7000	130	26	26	35
	>7000	325	65	65	100
	Total	500	100.0	100.0	

Figure 5.14

Expenditure on fertilizers Ambegaon Taluka



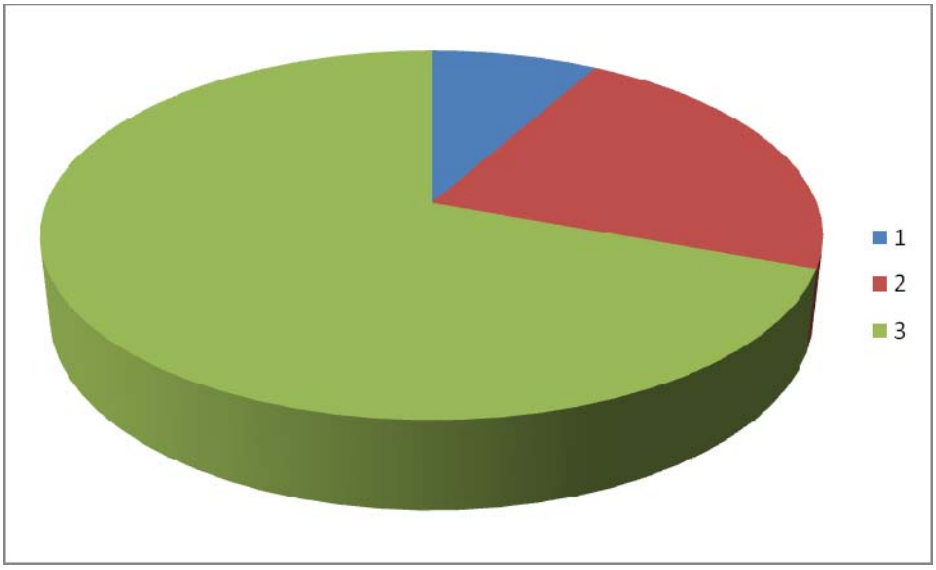
From the survey of Khed and Ambegaon taluka, among total the respondents, 8% respondents are using fund for purchase of fertilizer amount less than 5000 , 26% of respondents using between 5000 to 7000 and 66% of respondents using more than 7000 while in Ambegaon taluka 9% respondents are using fund for purchase of fertilizers amount less than 5000 , 26% of respondents using between 5000 to 7000 and 65% of respondents using more than 7000.

6. Expenditure on Pesticide

v6 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	40	8	8	8
	Between 5000 and 7000	110	22	22	30
	>7000	350	70	70	100
	Total	500	100.0	100.0	

Figure 5.15

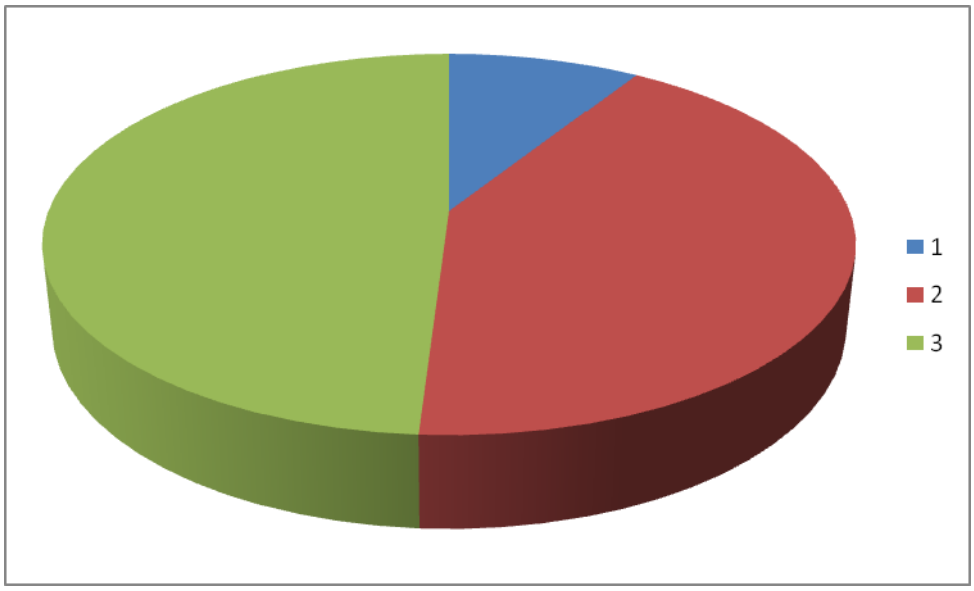
Expenditure on Pesticide Khed Taluka



v6 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	45	9	9	9
	Between 5000 and 7000	210	42	42	51
	>7000	245	49	49	100
	Total	500	100.0	100.0	

Figure 5.16

Expenditure on Pesticide Ambegaon Taluka



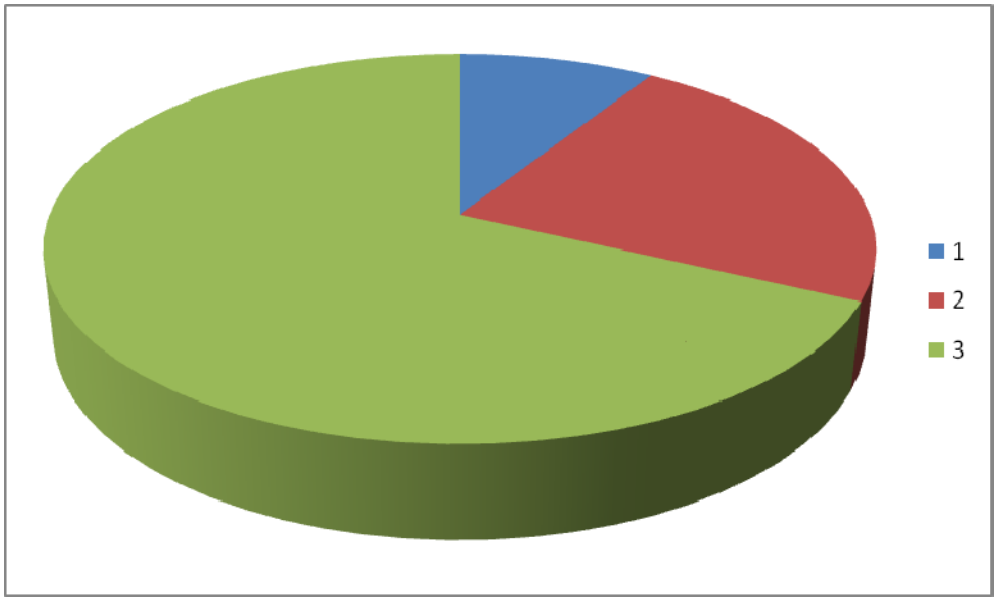
From the survey of Khed and Ambegaon taluka, among total the respondents, 9% respondents are using fund for purchase of Pesticide amount less than 5000 , 22% of respondents using between 5000 to 7000 and 68% of respondents using more than 7000 while in Ambegaon taluka 9% respondents are using fund for purchase of Pesticide amount less than 5000 , 42% of respondents using between 5000 to 7000 and 49% of respondents using more than 7000.

7. Crop vaccination Expenditure

v7 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	45	9	9	9
	Between 5000 and 7000	115	23	23	32
	>7000	340	68	68	100
	Total	500	100.0	100.0	

Figure 5.17

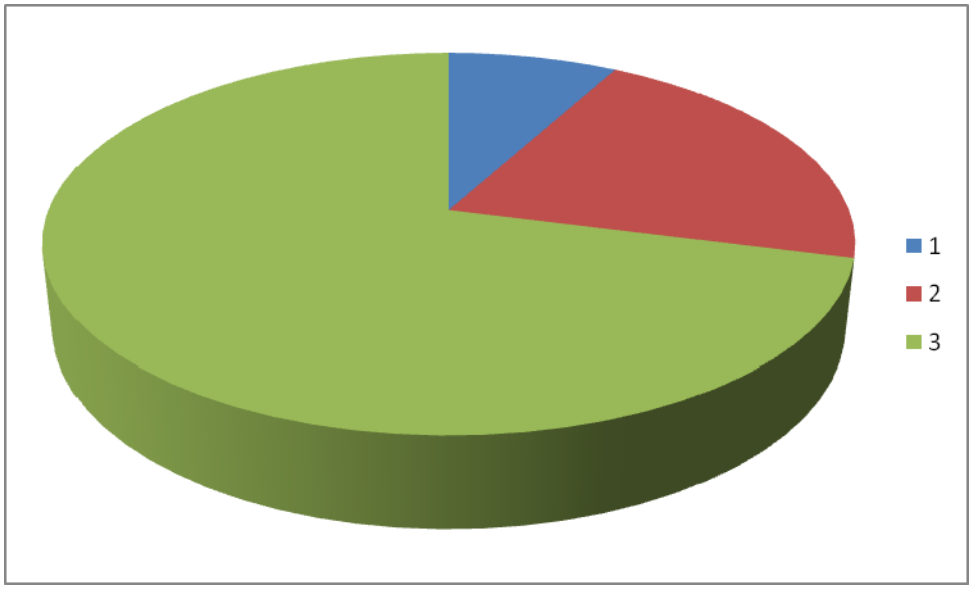
Crop vaccination Expenditure Khed Taluka



v7 Ambegaon					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	40	8	8	8
	Between 5000 and 7000	105	21	21	29
	>7000	355	71	71	100
	Total	500	100.0	100.0	

Figure 5.18

Crop vaccination Expenditure Ambegaon Taluka



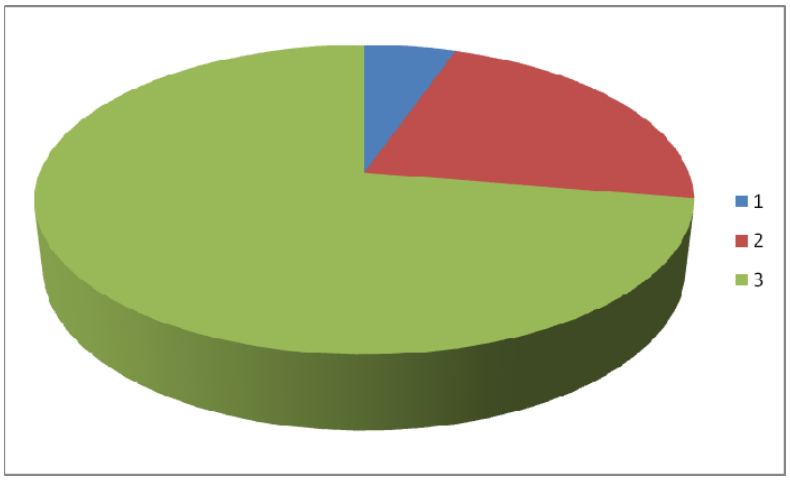
From the survey of Khed and Ambegaon taluka, among total the respondents, 9% respondents are using fund for purchase of crop vaccination amount less than 5000, 23% of respondents using between 5000 to 7000 and 68% of respondents using more than 7000 while in Ambegaon taluka 8% respondents are using fund for purchase of crop vaccination amount less than 5000, 21% of respondents using between 5000 to 7000 and71% of respondents using more than 7000.

8. Fencing Expenses (Compound)

v8 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	25	5	5	5
	Between 5000 and 7000	105	21	21	26
	>7000	370	74	74	100
	Total	500	100.0	100.0	

Figure 5.19

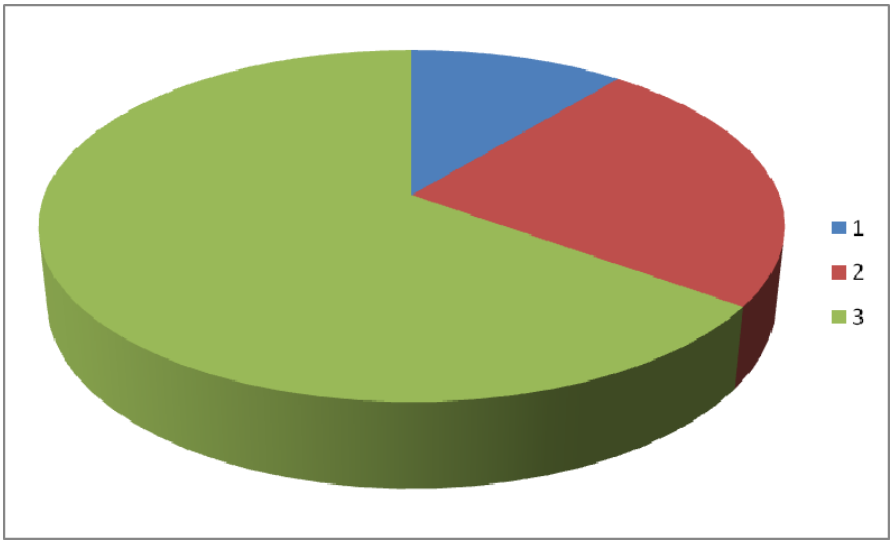
Fencing Expenses (Compound) Khed Taluka



v8 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	55	11	11	11
	Between 5000 and 7000	120	24	24	35
	>7000	325	65	65	100
	Total	500	100.0	100.0	

Figure 5.20

Fencing Expenses (Compound) Ambegaon Taluka



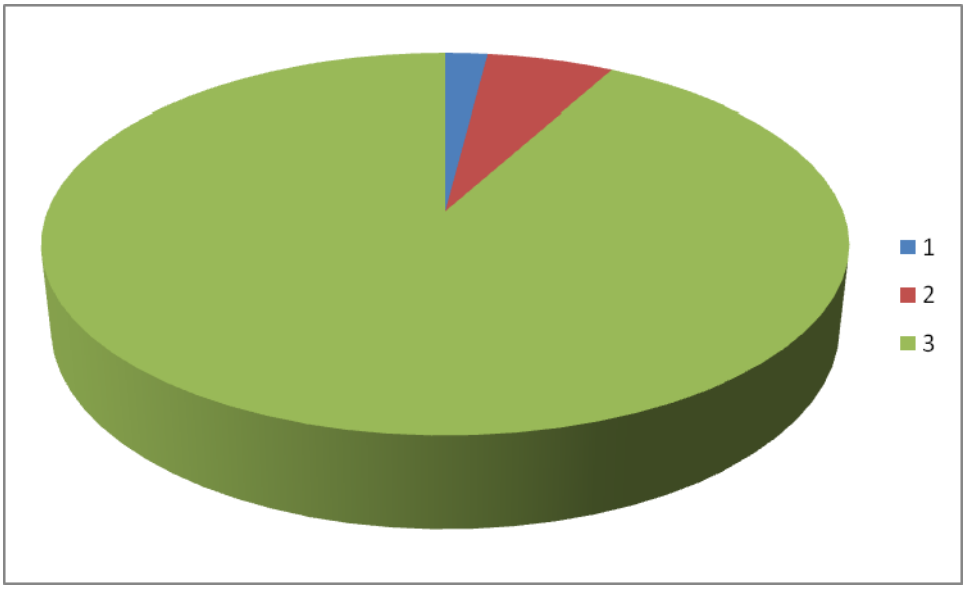
From the survey of Khed and Ambegaon taluka, among total the respondents, 5% respondents are using fund for purchase of fencing amount less than 5000 , 21% of respondents using between 5000 to 7000 and 68% of respondents using more than 7000 while in Ambegaon taluka 11 respondents are using fund for purchase of fencing amount less than 5000 , 24% of respondents using between 5000 to 7000 and 65% of respondents using more than 7000.

9. Expenditure on irrigation, piping, sprinkler and watering

v9 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	10	2	2	2
	Between 5000 and 7000	30	6	6	8
	>7000	460	92	92	100
	Total	500	100.0	100.0	

Figure 5.21

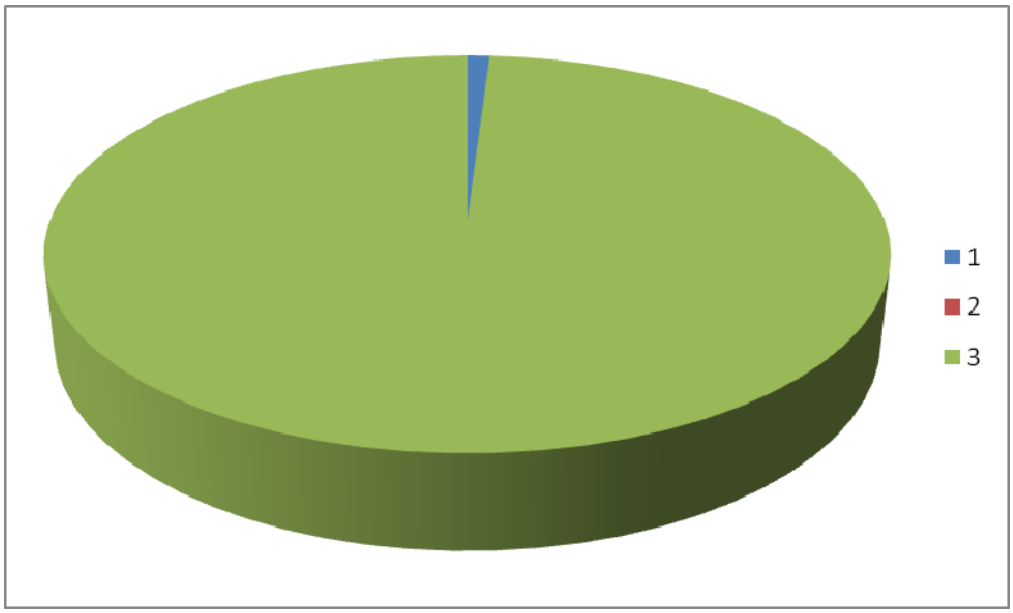
Expenditure on irrigation, piping, sprinkler and watering Khed Taluka



v9 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	5	1	1	1
	Between 5000 and 7000	0	0	0	1
	>7000	495	99	99	100
	Total	500	100.0	100.0	

Figure 5.22

Expenditure on irrigation, piping, sprinkler and watering Ambegaon Taluka



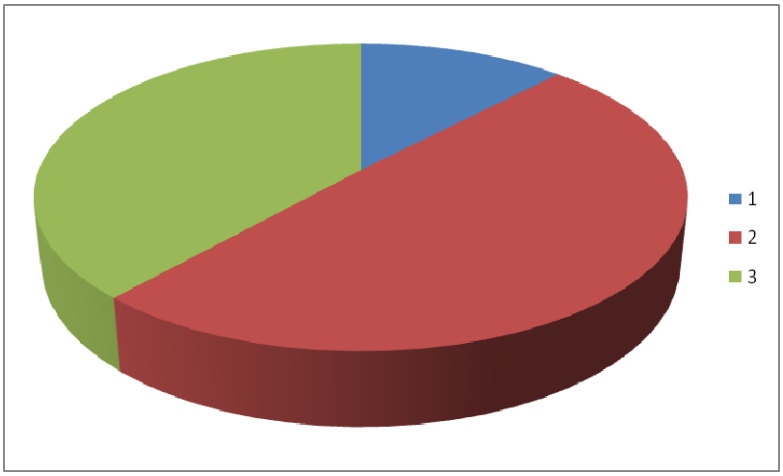
From the survey of Khed and Ambegaon taluka, among total the respondents, 2% respondents are using fund for irrigation, piping , sprinkler and watering amount less than 5000 , 6% of respondents using between 5000 to 7000 and 92% of respondents using more than 7000 while in Ambegaon taluka 1%respondents are using fund for irrigation, piping , sprinkler and watering amount less than 5000 , no one of respondents using between 5000 to 7000 and 99% of respondents using more than 7000.

10. Expenditure on agriculture instruments and others

v10 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	60	12	12	12
	Between 5000 and 7000	250	50	50	62
	>7000	190	38	38	100
	Total	500	100.0	100.0	

Figure 5.23

Expenditure on agriculture instruments and others Khed Taluka

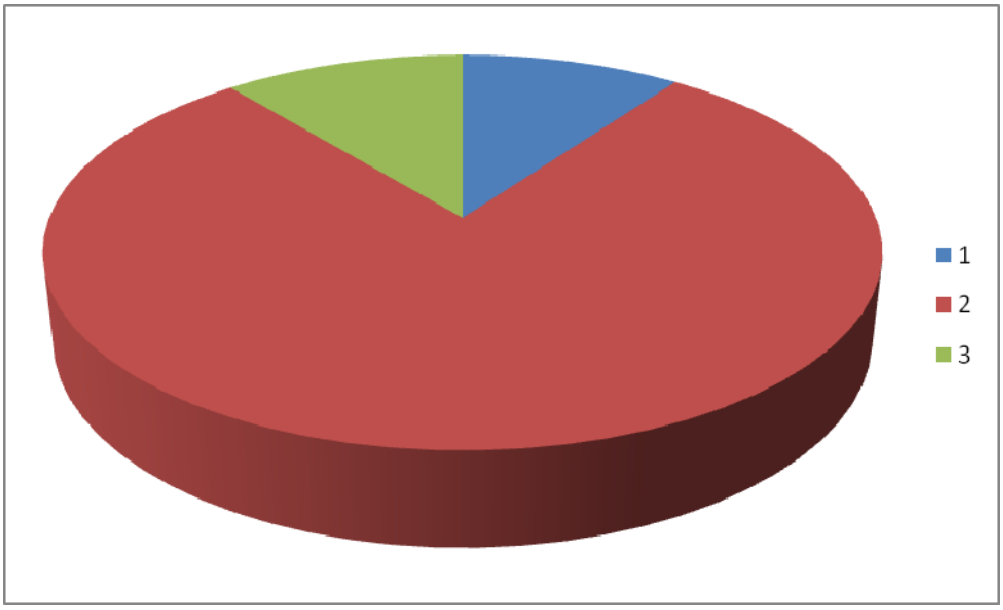


v10 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	50	10	10	10
	Between 5000 and 7000	395	79	79	89
	>7000	55	11	11	100

v10 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	50	10	10	10
	Between 5000 and 7000	395	79	79	89
	>7000	55	11	11	100
	Total	500	100.0	100.0	

Figure 5.24

Expenditure on agriculture instruments and others Ambegaon Taluka



From the survey of Khed and Ambegaon taluka, among total the respondents, 12% respondents are using fund for irrigation, piping , sprinkler and watering amount less than 5000 , 49% of respondents using between 5000 to 7000 and 38% of respondents using more than 7000 while in Ambegaon taluka 10%respondents are using fund for irrigation, piping , sprinkler and watering amount less than 5000 , 79% respondents using between 5000 to 7000 and 11% of respondents using more than 7000.

The Cost data collected for five years period from 2007 top 2012 is given below

Data for the year 2007

	Kharif 2007				Rabi 2007			
	Small	**Marginal**	**Large**	**Total average**	**Small**	**Marginal**	**Large**	**Total average**
Production	1951.13	1710.13	5943.80	3201.69	2008.33	1684.21	3345.69	2346.08
Total Income	19511.33	17082.35	59437.97	32010.55	10443.30	8757.89	17397.61	12199.60
Rate per kg	10.00	9.99	10.00	10.00	5.20	5.20	5.20	5.20
Pre-tillage	598.12 (6.39)	556.06 (7.29)	1917.57 (6.89)	1023.92 (6.85)	485.79 (8.56)	524.72 (10.22)	1050.39 (9.99)	686.97 (9.66)
Fertilizer	1790.79 (19.13)	1484.7 (19.47)	5476.36 (19.67)	2917.28 (19.52)	1257.36 (22.14)	1277.14 (24.87)	2572.92 (24.48)	1702.47 (23.95)
Seed	4498.12 (48.06)	3626.1 (47.56)	12733.91 (45.74)	6952.71 (46.53)	2214.74 (39.01)	1932.97 (37.64)	3820.67 (36.35)	2656.13 (37.37)
Pesticide	1242.96 (13.28)	862.55 (11.31)	3032.01 (10.89)	1712.5 (11.46)	703.08 (12.38)	618.86 (12.05)	1210.94 (11.52)	844.29 (11.88)
Labour	677.56 (7.24)	510.47 (6.69)	1958.31 (7.03)	1048.78 (7.02)	490.38 (8.64)	465.95 (9.07)	936.63 (8.91)	630.99 (8.88)
Electricity	124.7 (1.33)	103.49 (1.36)	1370.91 (4.92)	533.03 (3.57)	118.29 (2.08)	74.12 (1.44)	310.02 (2.95)	167.48 (2.36)
Transport	261.51 (2.79)	313.22 (4.11)	728.18 (2.62)	434.3 (2.91)	259.19 (4.56)	158.49 (3.09)	326.88 (3.11)	248.19 (3.49)
Marketing	165.89 (1.77)	168.31 (2.21)	622.18 (2.23)	318.79 (2.13)	149.16 (2.63)	83.47 (1.63)	283.01 (2.69)	171.88 (2.42)
Total Cost	9359.63 (100)	7624.89 (100)	27839.42 (100)	14941.31 (100)	5678 (100)	5135.73 (100)	10511.45 (100)	7108.39 (100)
Absolute income (percentage compare to total income)	10151.7 (52.03)	9457.46 (55.36)	31598.55 (53.16)	17069.24 (53.32)	4765.3 (45.63)	3622.16 (41.36)	6886.16 (39.58)	5091.21 (41.73)

The Cost data collected for five years period from 2007 top 2012 contd.

Data for the year 2008

	Kharif 2008				Rabi 2008			
	Small	**Marginal**	**Large**	**Total average**	**Small**	**Marginal**	**Large**	**Total average**
Production	**1709.47**	**1775.82**	**4681.41**	**2722.23**	**2253.49**	**1662.47**	**3647.01**	**2520.99**
Total Income	**15385.20**	**15982.41**	**42132.67**	**24500.09**	**11320.06**	**8312.66**	**18235.07**	**12622.60**
Rate per kg	**9.00**	**9.00**	**9.00**	**9.00**	**5.02**	**5.00**	**5.00**	**5.01**
Pre tillage	347.85 (3.77)	283.06 (2.81)	474.42 (1.9)	368.44 (2.49)	503.51 (8.32)	289.27 (6.64)	577.4 (7.41)	456.73 (7.53)
Fertilizer	1823.26 (19.77)	1925.45 (19.11)	5378.32 (21.51)	3042.35 (20.6)	1480.9 (24.48)	1064.21 (24.44)	1918.73 (24.62)	1487.95 (24.53)
Seed	4991.72 (54.11)	5530.15 (54.9)	13089.55 (52.35)	7870.48 (53.29)	2202.03 (36.4)	1620.66 (37.22)	3022.75 (38.79)	2281.81 (37.62)
Pesticide	1005.4 (10.9)	1165.41 (11.57)	3126.93 (12.5)	1765.92 (11.96)	816.81 (13.5)	621.8 (14.28)	1017.45 (13.06)	818.69 (13.5)
Labour	630.16 (6.83)	734.07 (7.29)	1962.12 (7.85)	1108.78 (7.51)	608.96 (10.06)	445.86 (10.24)	742.81 (9.53)	599.21 (9.88)
Electricity	102.81 (1.11)	114.76 (1.14)	266.69 (1.07)	161.42 (1.09)	142.6 (2.36)	99.53 (2.29)	175.43 (2.25)	139.19 (2.29)
Transport	152.59 (1.65)	163.43 (1.62)	374.02 (1.5)	230.01 (1.56)	145.24 (2.4)	109.44 (2.51)	169.43 (2.17)	141.37 (2.33)
Marketing	170.82 (1.85)	156.82 (1.56)	333.87 (1.34)	220.5 (1.49)	150.29 (2.48)	103.02 (2.37)	168.18 (2.16)	140.5 (2.32)
Total Cost	**9224.61 (100)**	**10073.16 (100)**	**25005.93 (100)**	**14767.9 (100)**	**6050.34 (100)**	**4353.78 (100)**	**7792.18 (100)**	**6065.43 (100)**
Absolute income (percentage compare to total income)	**6160.59 (40.04)**	**5909.26 (36.97)**	**17126.75 (40.65)**	**9732.2 (39.72)**	**5269.72 (46.55)**	**3958.87 (47.62)**	**10442.89 (57.27)**	**6557.16 (51.95)**

The Cost data collected for five years period from 2007 top 2012 contd.

Data for the year 2009

	Kharif 2009				Rabi 2009			
	Small	**Marginal**	**Large**	**Total average**	**Small**	**Marginal**	**Large**	**Total average**
Production	**1592.98**	**1804.97**	**4109.87**	**2502.60**	**2138.27**	**1729.13**	**2358.12**	**2075.17**
Total Income	**22301.66**	**25269.58**	**57538.11**	**35036.45**	**23029.15**	**18622.77**	**25396.91**	**22349.61**
Rate per kg	**14.00**	**14.00**	**14.00**	**14.00**	**10.77**	**10.77**	**10.77**	**10.77**
Pre tillage	347.85 (3.3)	283.06 (2.59)	474.42 (1.85)	368.44 (2.35)	512.45 (6.03)	299.27 (5.35)	453.17 (4.65)	421.63 (5.31)
Fertilizer	1984.2 (18.81)	2198.05 (20.08)	5027.92 (19.65)	3070.06 (19.56)	1768.56 (20.83)	1152.27 (20.59)	1921.07 (19.7)	1613.97 (20.31)
Seed	5345.67 (50.68)	5765.65 (52.68)	13878.53 (54.24)	8329.95 (53.08)	4028.6 (47.44)	2793.18 (49.9)	4942.32 (50.68)	3921.37 (49.34)
Pesticide	1106.7 (10.49)	1225.68 (11.2)	2860.06 (11.18)	1730.81 (11.03)	740.67 (8.72)	449.35 (8.03)	925.95 (9.5)	705.32 (8.88)
Labour	753.95 (7.15)	835.25 (7.63)	1953.89 (7.64)	1181.03 (7.53)	675.16 (7.95)	460.78 (8.23)	796.63 (8.17)	644.19 (8.11)
Electricity	330.19 (3.13)	210.78 (1.93)	473.83 (1.85)	338.27 (2.16)	274.71 (3.23)	157.07 (2.81)	241.91 (2.48)	224.56 (2.83)
Transport	336.01 (3.19)	211 (1.93)	469.09 (1.83)	338.7 (2.16)	275.21 (3.24)	163.48 (2.92)	295.78 (3.03)	244.82 (3.08)
Marketing	342.89 (3.25)	215.06 (1.97)	450.82 (1.76)	336.26 (2.14)	216.54 (2.55)	122.07 (2.18)	174.81 (1.79)	171.14 (2.15)
Total Cost	**10547.46 (100)**	**10944.53 (100)**	**25588.57 (100)**	**15693.52 (100)**	**8491.91 (100)**	**5597.48 (100)**	**9751.63 (100)**	**7947 (100)**
Absolute income (percentage compare to total income)	**11754.2 (52.71)**	**14325.05 (56.69)**	**31949.55 (55.53)**	**19342.93 (55.21)**	**14537.24 (63.13)**	**13025.3 (69.94)**	**15645.28 (61.6)**	**14402.6 (64.44)**

The Cost data collected for five years period from 2007 top 2012 contd.

Data for the year 2010

	Kharif 2010				Rabi 2010			
	Small	**Marginal**	**Large**	**Total average**	**Small**	**Marginal**	**Large**	**Total average**
Production	**2778.01**	**1861.69**	**4047.75**	**2895.82**	**2490.16**	**1857.38**	**5194.11**	**3180.55**
Total Income	**34725.11**	**23271.16**	**50596.86**	**36197.71**	**18078.58**	**13484.57**	**37709.25**	**23090.80**
Rate per kg	**12.50**	**12.50**	**12.50**	**12.50**	**7.26**	**7.26**	**7.26**	**7.26**
Pre tillage	259.15 (2.38)	277.52 (2.22)	695.57 (2.37)	410.75 (2.34)	516.58 (6.05)	298.78 (5.36)	691.6 (6.91)	502.32 (6.24)
Fertilizer	2145.75 (19.73)	2478.04 (19.82)	5757.04 (19.6)	3460.28 (19.68)	1961.52 (22.96)	1192.67 (21.38)	2086.75 (20.85)	1746.98 (21.72)
Seed	5740.27 (52.77)	6757.6 (54.05)	15463.15 (52.65)	9320.34 (53.01)	3118.13 (36.49)	2135.37 (38.27)	4004.38 (40.01)	3085.96 (38.36)
Pesticide	1298.38 (11.94)	1477.53 (11.82)	3501.92 (11.92)	2092.61 (11.9)	1424.92 (16.68)	899.07 (16.11)	1378.53 (13.77)	1234.17 (15.34)
Labour	824.77 (7.58)	946.6 (7.57)	2339.02 (7.96)	1370.13 (7.79)	772.04 (9.04)	555.36 (9.95)	1064.81 (10.64)	797.4 (9.91)
Electricity	197.56 (1.82)	216.52 (1.73)	798.75 (2.72)	404.27 (2.3)	241.08 (2.82)	186.89 (3.35)	231.66 (2.31)	219.88 (2.73)
Transport	200.54 (1.84)	188.39 (1.51)	450.47 (1.53)	279.8 (1.59)	254.36 (2.98)	161.72 (2.9)	275.55 (2.75)	230.54 (2.87)
Marketing	211.28 (1.94)	160.05 (1.28)	361.61 (1.23)	244.31 (1.39)	255.4 (2.99)	149.61 (2.68)	275.23 (2.75)	226.75 (2.82)
Total Cost	**10877.7 (100)**	**12502.24 (100)**	**29367.53 (100)**	**17582.49 (100)**	**8544.03 (100)**	**5579.46 (100)**	**10008.51 (100)**	**8044 (100)**
Absolute income (percentage compare to total income)	**23847.41 (68.67)**	**10768.92 (46.28)**	**21229.34 (41.96)**	**18615.22 (51.43)**	**9534.55 (52.74)**	**7905.11 (58.62)**	**27700.74 (73.46)**	**15046.8 (65.16)**

The Cost data collected for five years period from 2007 top 2012 contd.

Data for the year 2011

	Kharif 2011				Rabi 2011			
	Small	**Marginal**	**Large**	**Total average**	**Small**	**Marginal**	**Large**	**Total average**
Production	**2308.60**	**1904.80**	**4247.77**	**2820.39**	**2527.91**	**1981.82**	**5277.05**	**3262.26**
Total Income	**30011.77**	**24762.42**	**55221.02**	**36665.07**	**17897.59**	**14031.30**	**37361.53**	**23096.81**
Rate per kg	**13.00**	**13.00**	**13.00**	**13.00**	**7.08**	**7.08**	**7.08**	**7.08**
Pre tillage	337.15 (2.87)	290.59 (2.22)	505.64 (1.87)	377.79 (2.19)	319.61 (3.83)	195.93 (3.53)	721.09 (4.03)	412.21 (3.89)
Fertilizer	2238.31 (19.06)	2583.96 (19.72)	5108.46 (18.92)	3310.24 (19.16)	2181.75 (26.14)	1449.01 (26.1)	4532.36 (25.35)	2721.04 (25.69)
Seed	6222.81 (52.98)	7155.97 (54.61)	14267.47 (52.85)	9215.42 (53.33)	2969.85 (35.59)	2112.16 (38.04)	6432.01 (35.97)	3838.01 (36.23)
Pesticide	1351.46 (11.51)	1548.16 (11.82)	4165.71 (15.43)	2355.11 (13.63)	1273.23 (15.26)	814.81 (14.67)	2692.08 (15.06)	1593.37 (15.04)
Labour	934.91 (7.96)	1078.47 (8.23)	2149.31 (7.96)	1387.56 (8.03)	876.96 (10.51)	543.26 (9.78)	2100.26 (11.75)	1173.49 (11.08)
Electricity	220.67 (1.88)	144.99 (1.11)	256.43 (0.95)	207.36 (1.2)	251.62 (3.02)	147.69 (2.66)	445.05 (2.49)	281.45 (2.66)
Transport	215.14 (1.83)	149.12 (1.14)	265.27 (0.98)	209.85 (1.21)	235.13 (2.82)	141.64 (2.55)	471.82 (2.64)	282.86 (2.67)
Marketing	224.89 (1.91)	152.01 (1.16)	276.27 (1.02)	217.72 (1.26)	236.95 (2.84)	147.98 (2.67)	486.62 (2.72)	290.52 (2.74)
Total Cost	**11745.33 (100)**	**13103.26 (100)**	**26994.56 (100)**	**17281.05 (100)**	**8345.1 (100)**	**5552.48 (100)**	**17881.3 (100)**	**10592.96 (100)**
Absolute income (percentage compare to total income)	**18266.44 (60.86)**	**11659.17 (47.08)**	**28226.47 (51.12)**	**19384.02 (52.87)**	**9552.48 (53.37)**	**8478.81 (60.43)**	**19480.23 (52.14)**	**12503.84 (54.14)**

The Cost data collected for five years period from 2007 top 2012 contd.

Data for the year 2012

	Kharif 2012				Rabi 2012			
	Small	**Marginal**	**Large**	**Total average**	**Small**	**Marginal**	**Large**	**Total average**
Production	**1845.23**	**2008.27**	**3721.59**	**2525.03**	**1996.45**	**1448.78**	**6623.32**	**3356.18**
Total Income	**25371.90**	**27613.74**	**51171.90**	**34719.18**	**24696.09**	**17921.40**	**81930.49**	**41515.99**
Rate per kg	**13.75**	**13.75**	**13.75**	**13.75**	**12.37**	**12.37**	**12.37**	**12.37**
Pre tillage	392.62 (2.85)	265.4 (1.83)	457.88 (1.71)	371.97 (2.03)	350.99 (3.76)	334.93 (4.7)	425.76 (1.71)	370.56 (2.68)
Fertilizer	2666.16 (19.38)	2903.15 (20.06)	5354.44 (19.99)	3641.25 (19.86)	2002.63 (21.47)	1525.38 (21.4)	5708.93 (22.86)	3078.98 (22.3)
Seed	7109.77 (51.67)	7741.72 (53.5)	14274.46 (53.3)	9708.65 (52.94)	4298.41 (46.07)	3300.62 (46.3)	12049.43 (48.26)	6549.49 (47.43)
Pesticide	1731.54 (12.58)	1910.23 (13.2)	3504.44 (13.08)	2382.07 (12.99)	1109.03 (11.89)	899.58 (12.62)	3157.6 (12.65)	1722.07 (12.47)
Labour	1137.59 (8.27)	1194.29 (8.25)	2225.18 (8.31)	1519.02 (8.28)	952.54 (10.21)	622.19 (8.73)	2334.38 (9.35)	1303.04 (9.44)
Electricity	232.39 (1.69)	153.22 (1.06)	312.87 (1.17)	232.83 (1.27)	185.06 (1.98)	131.98 (1.85)	409.94 (1.64)	242.33 (1.75)
Transport	236.03 (1.72)	153.79 (1.06)	318.5 (1.19)	236.1 (1.29)	209.37 (2.24)	157.15 (2.2)	434.99 (1.74)	267.17 (1.93)
Marketing	252.67 (1.84)	149.57 (1.03)	334.72 (1.25)	245.66 (1.34)	221.56 (2.37)	156.51 (2.2)	448.16 (1.79)	275.41 (1.99)
Total Cost	**13758.77 (100)**	**14471.37 (100)**	**26782.51 (100)**	**18337.55 (100)**	**9329.59 (100)**	**7128.34 (100)**	**24969.19 (100)**	**13809.04 (100)**
Absolute income (percentage compare to total income)	**11613.13 (45.77)**	**13142.36 (47.59)**	**24389.39 (47.66)**	**16381.63 (47.18)**	**15366.49 (62.22)**	**10793.05 (60.22)**	**56961.3 (69.52)**	**27706.95 (66.74)**

It can be seen from the above data that in the total costs, the seed cost is much higher. This is because the potato growers are dependent on the seeds from MNCs of specific variety. This they have to use it as per the contract. For the rest of the items of expenditure the potato growers have lea way for some cost cutting. Despite these costs the graph shows that all the types of potato growers irrespective of their size of holding they have earned good absolute income. The small holders have received marginally less absolute income which can be understood because of the other low input.

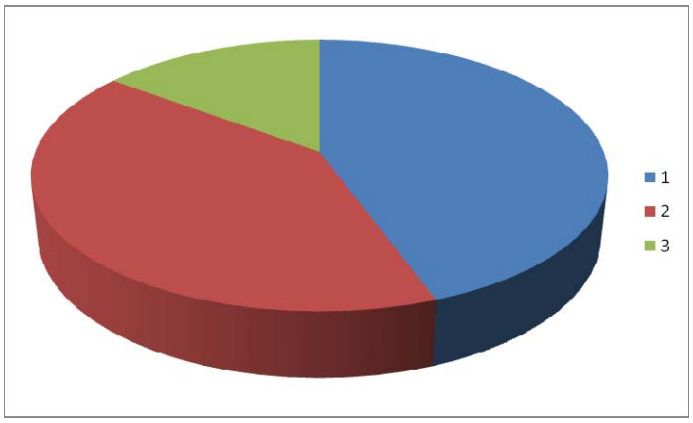
11 Investment with loan/individual

1. Loan

v11 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	225	45	45	45
	Between 5000 and 7000	215	43	43	88
	>7000	60	12	12	100
	Total	500	100.0	100.0	

Figure 5.25

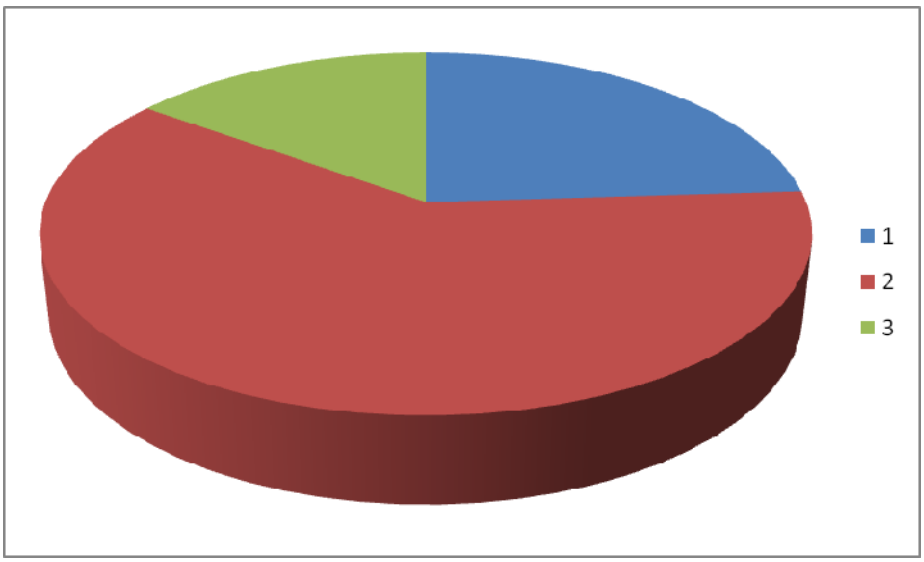
Investment with loan/individual Khed Taluka



v11 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	120	24	24	24
	Between 5000 and 7000	305	61	61	85
	>7000	75	15	15	100
	Total	500	100.0	100.0	

Figure 5.26

Investment with loan/individual Ambegaon Taluka



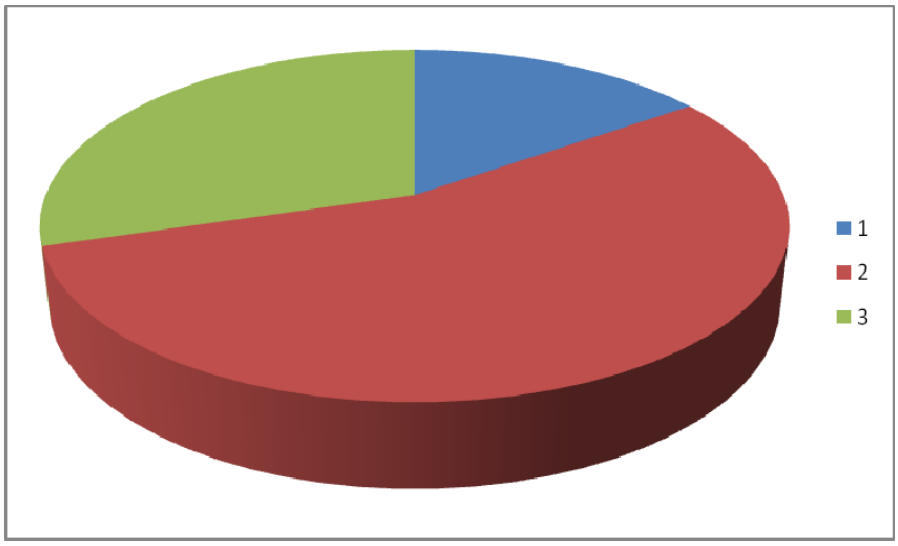
From the survey of Khed and Ambegaon taluka, among total the respondents, 36% respondents are taken loan amount less than 5000 , 33% of respondents using between 5000 to 7000 and 12% of respondents using more than 7000 while in Ambegaon taluka 24%respondents are taken loan amount less than 5000 , 61% respondents using between 5000 to 7000 and 15% of respondents using more than 7000.

12. Loans from Pune District Central Coop. Bank Ltd.

v12 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	75	15	15	15
	Between 5000 and 7000	270	54	54	69
	>7000	155	31	31	100
	Total	500	100.0	100.0	

Figure 5.27

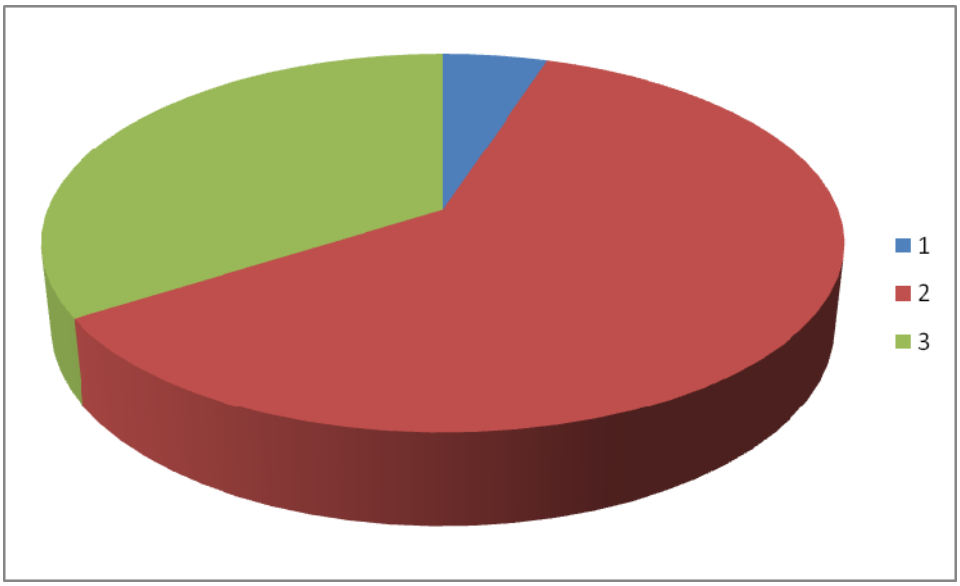
Loans from Pune District Central Coop. Bank Ltd. Khed Taluka



v12 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	25	5	5	5
	Between 5000 and 7000	305	61	61	66
	>7000	170	34	34	100
	Total	500	100.0	100.0	

Figure 5.28

Loans from Pune District Central Coop. Bank Ltd. Ambegaon Taluka



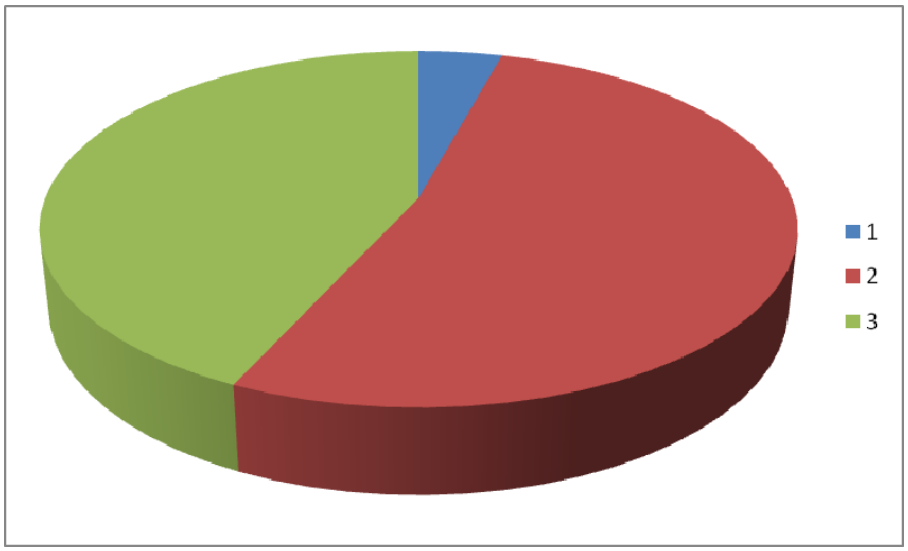
From the survey of Khed and Ambegaon taluka, among total the respondents, 15% respondents are taken loan from PDCS amount less than 5000 , 54% of respondents using between 5000 to 7000 and 29% of respondents using more than 7000 while in Ambegaon taluka 5%respondents are taken loan from PDCS amount less than 5000 , 61% respondents using between 5000 to 7000 and 34% of respondents using more than 7000.

13. Loans from Commercial Banks

v13 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	45	9	9	9
	Between 5000 and 7000	250	50	50	59
	>7000	205	41	41	100
	Total	500	100.0	100.0	

Figure 5.29

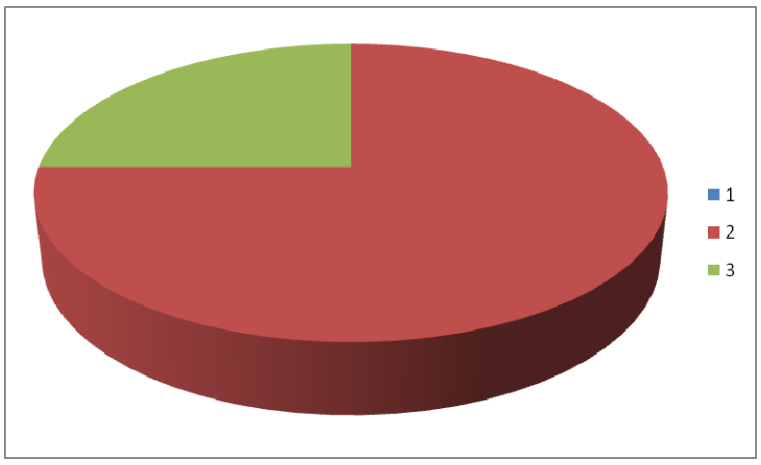
Loans from Commercial Banks Khed Taluka



v13 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	0	0	0	0
	Between 5000 and 7000	375	75	75	75
	>7000	125	25	25	100
	Total	500	100.0	100.0	

Figure 5.30

Loans from Commercial Banks Ambegaon Taluka



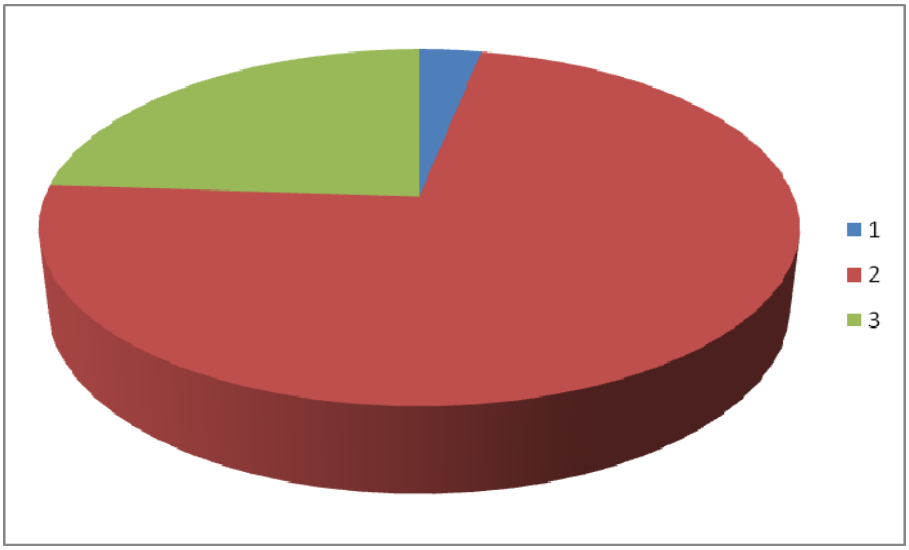
From the survey of Khed and Ambegaon taluka, among total the respondents, 9% respondents are taken loan from commercial banks amount less than 5000 , 50% of respondents using between 5000 to 7000 and 41% of respondents using more than 7000 while in Ambegaon taluka no one respondents have taken loan from commerical banks amount less than 5000 , 75% respondents using between 5000 to 7000 and 25% of respondents using more than 7000.

14. Loans from Regional Rural Banks

v14 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	15	3	3	3
	Between 5000 and 7000	350	70	70	73
	>7000	135	27	27	100
	Total	500	100.0	100.0	

Figure 5.31

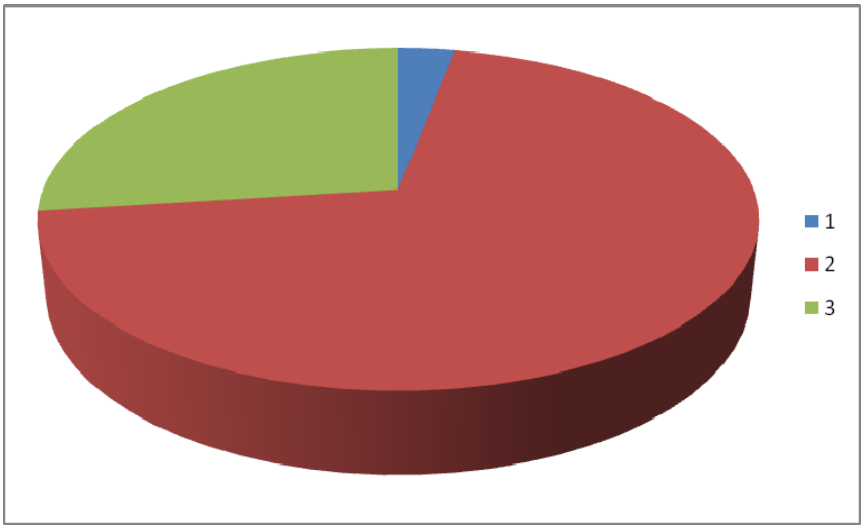
Loans from Regional Rural Banks Khed Taluka



v14 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	15	3	3	3
	Between 5000 and 7000	350	70	70	73
	>7000	135	27	27	100
	Total	500	100.0	100.0	

Figure 5.32

Loans from Regional Rural Banks Ambegaon Taluka



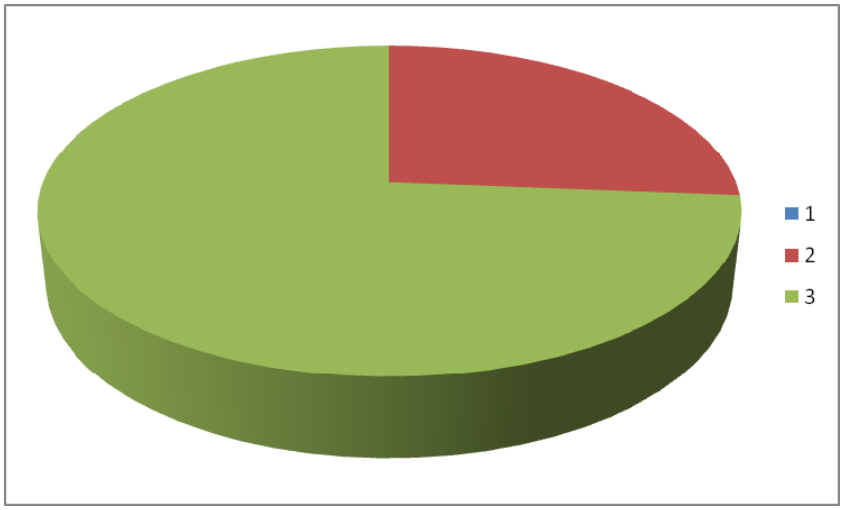
From the survey of Khed and Ambegaon taluka, among total the respondents, 3% respondents are taken loan from commerical banks amount less than 5000 , 70% of respondents using between 5000 to 7000 and 27% of respondents using more than 7000 while in Ambegaon taluka 3% respondents have taken loan from commerical banks amount less than 5000 , 70% respondents using between 5000 to 7000 and 27% of respondents using more than 7000.

15. Loans from Contracting Companies (Pepsi, Siddhivinayak etc.)

v15 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	0	0	0	0
	Between 5000 and 7000	135	27	27	27
	>7000	365	73	73	100
	Total	500	100.0	100.0	

Figure 5.33

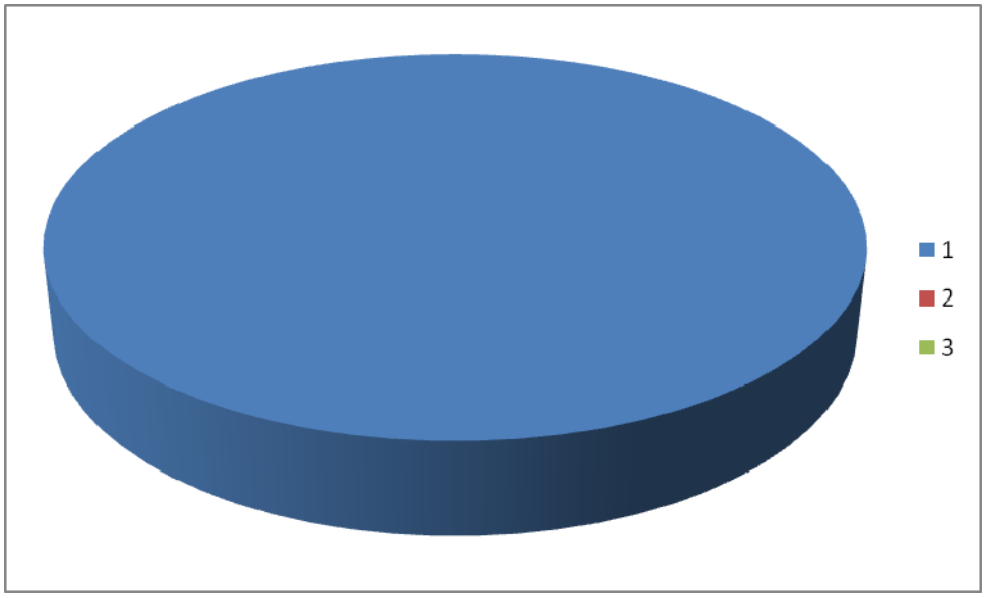
Loans from Contracting Companies (Pepsi, Siddhivinayak etc.) Khed Taluka



v15 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	500	100	100	100
	Between 5000 and 7000	0	0	0	100
	>7000	0	0	0	100
	Total	500	100.0	100.0	

Figure 5.34

Loans from Contracting Companies (Pepsi, Siddhivinayak etc.) Ambegaon Taluka



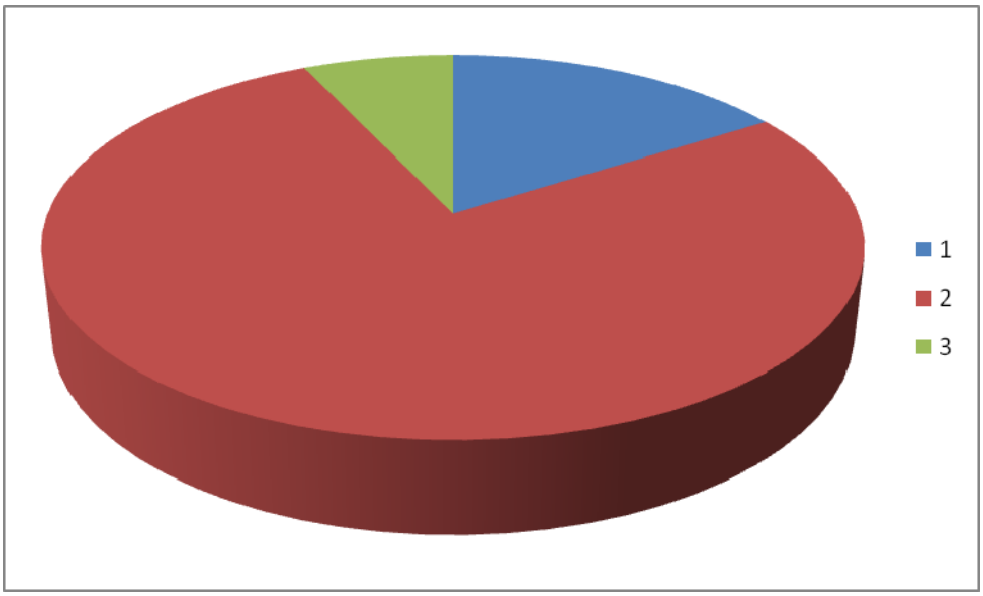
From the survey of Khed and Ambegaon taluka, among total the respondents, no one respondents are taken loan from PepsiCo amount less than 5000 , 26% of respondents using between 5000 to 7000 and 70% of respondents using more than 7000 while in Ambegaon taluka 100% respondents have taken loan from PepsiCo amount less than 5000 , while no one respondents taken loan between 5000 to 7000 and more than 7000.

16. Individual loans

v16 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<15000	80	16	16	16
	Between 15000 and 25000	385	77	77	93
	>25000	35	7	7	100
	Total	500	100.0	100.0	

Figure 5.35

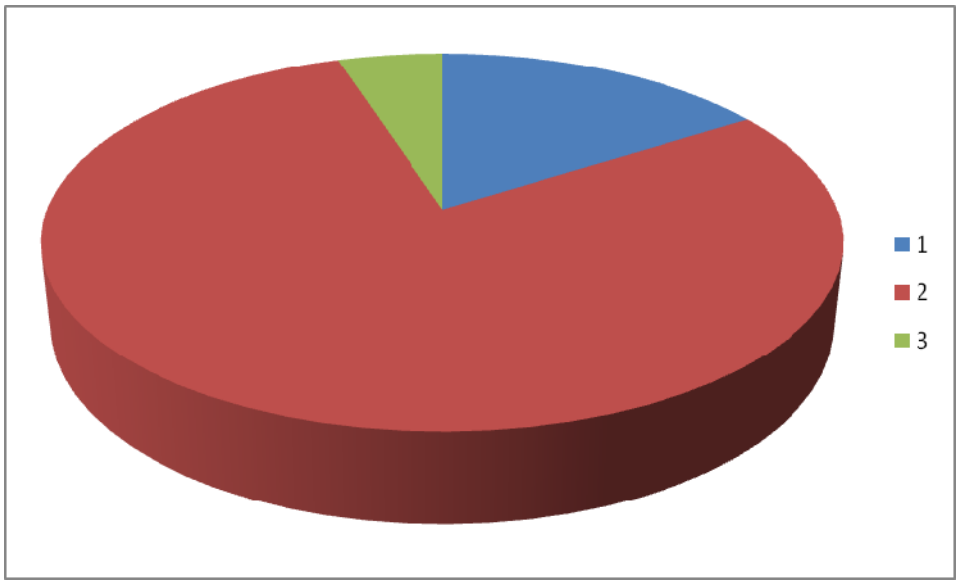
Individual loans Khed Taluka



v16 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<15000	80	16	16	16
	Between 15000 and 25000	395	79	79	95
	>25000	25	5	5	100
	Total	500	100.0	100.0	

Figure 5.35 a

Individual loans Ambegaon Taluka



From the survey of Khed and Ambegaon taluka, among total the respondents, 16% respondents are taken individual loan amount less than 15000 , 77% of respondents have taken loan between 15000 to 25000 and 7% of respondents taken loan more than 25000 while in Ambegaon taluka 16% respondents are taken individual loan amount less than 15000 , 79% of respondents have taken loan between 15000 to 25000 and 5% of respondents taken loan more than 25000

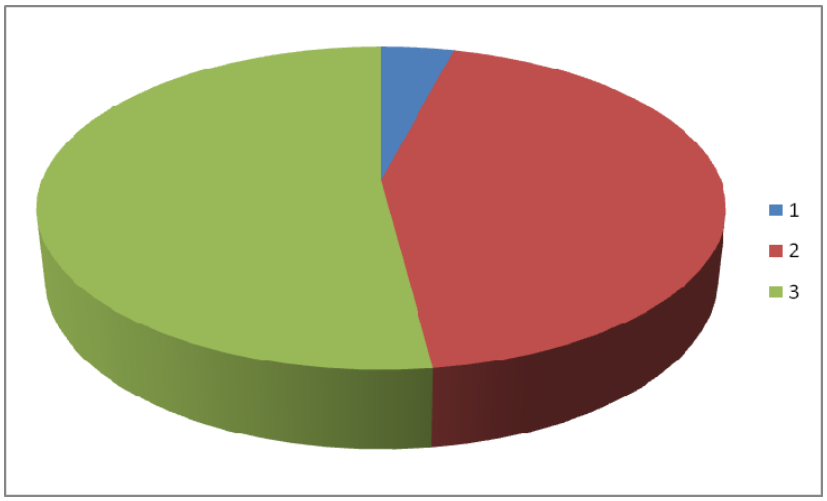
17. Details of individual investment

1. Amount of percentage of available working capital amount – In this particular no one respondent made any kind of investment details.
2. Part of bank loan

v17 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	20	4	4	4
	Between 5000 and 7000	220	44	44	48
	>7000	260	52	52	100
	Total	500	100.0	100.0	

Figure 5.36

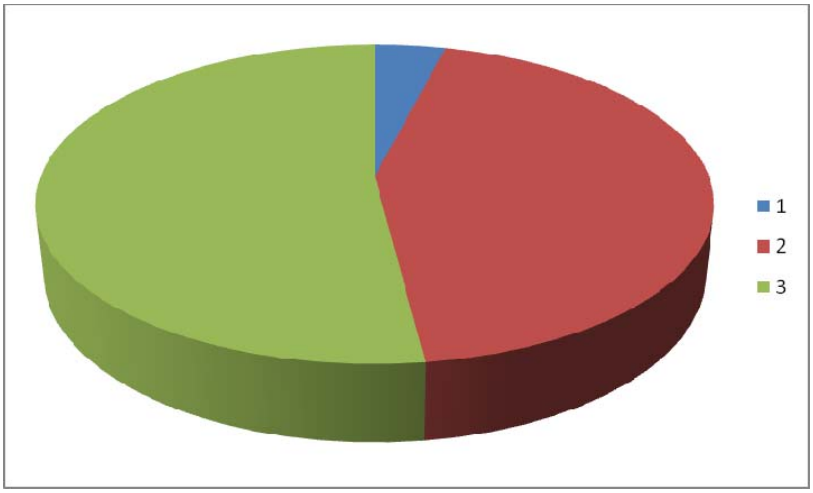
Details of individual investment Khed Taluka



v17 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	20	4	4	4
	Between 5000 and 7000	220	44	44	48
	>7000	260	52	52	100
	Total	500	100.0	100.0	

Figure 5.37

Details of individual investment Ambegaon Taluka



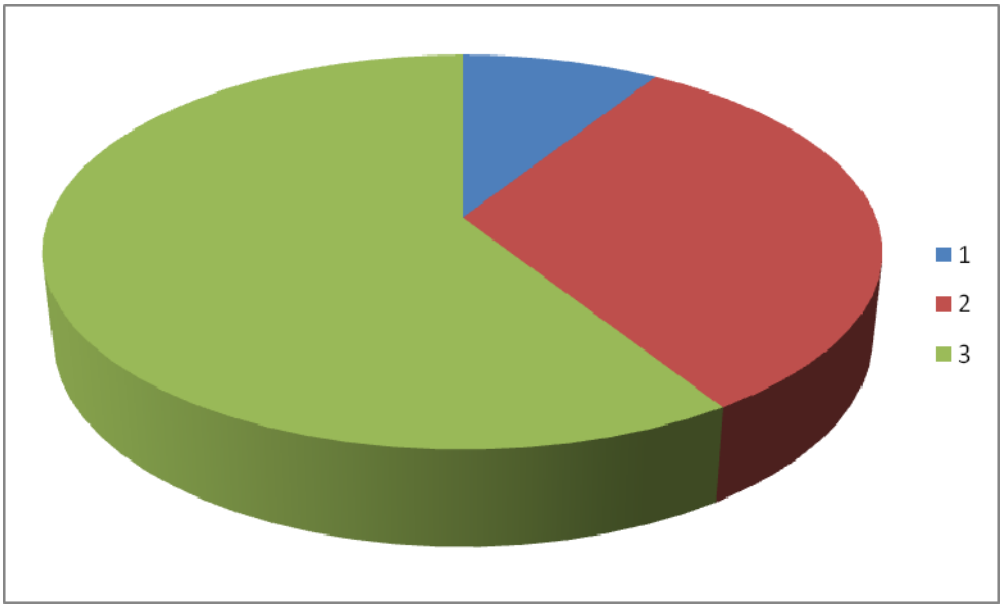
In both the talukas, same number of respondents made their investment for crop out of investment it is as , 4% respondents are taken individual loan amount less than 5000 , 44% of respondents have taken loan between 5000 to 7000 and 52% of respondents taken loan more than 7000.

18. Individual investment percentage

V18 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	45	9	9	9
	Between 5000 and 7000	160	32	32	41
	>7000	295	59	59	100
	Total	500	100.0	100.0	

Figure 5.38

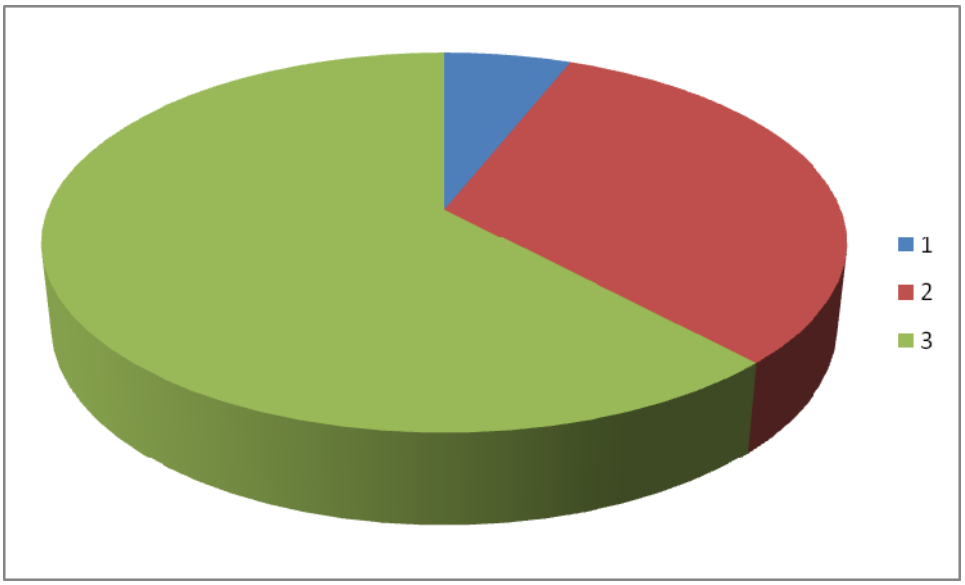
Individual investment percentage Khed Taluka



v18 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	30	6	6	6
	Between 5000 and 7000	160	32	32	38
	>7000	310	62	62	100
	Total	500	100.0	100.0	

Figure 5.39

Individual investment percentage Ambegaon Taluka



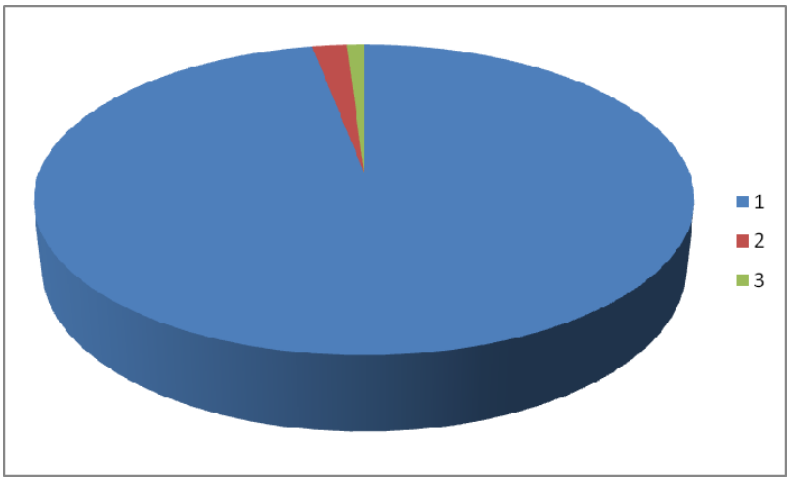
Among the respondents from both districts, 9% of respondents have made their investments amount less than 5000, 32% of respondents using between 5000 to 7000 and 59% of respondents using more than 7000 while in Ambegaon taluka , 7% of respondents have made their investments amount less than 5000 , 32% of respondents using between 5000 to 7000 and 62% of respondents using more than 7000.

19. Availabilityu of Seeds

v19 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Private	485	97	97	97
	Co-op	10	2	2	99
	Govt.	5	1	1	100
	Total	500	100.0	100.0	

Figure 5.40

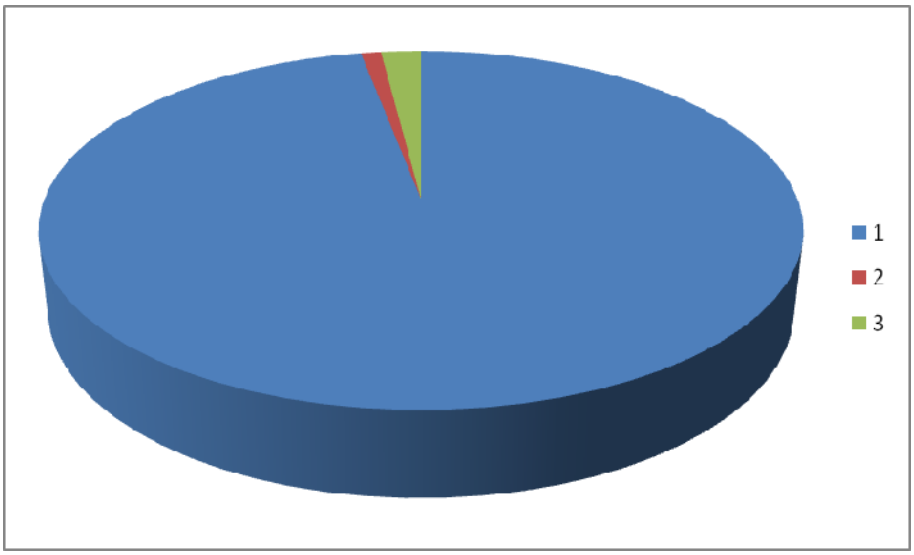
Availabilityu of Seeds Khed Taluka



v19 Ambegaon Taluka					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Private	485	97	97	97
	Govt.	5	1	1	98
	Co-op	10	2	2	100
	Total	500	100.0	100.0	

Figure 5.41

Availabilityu of Seeds Ambegaon Taluka



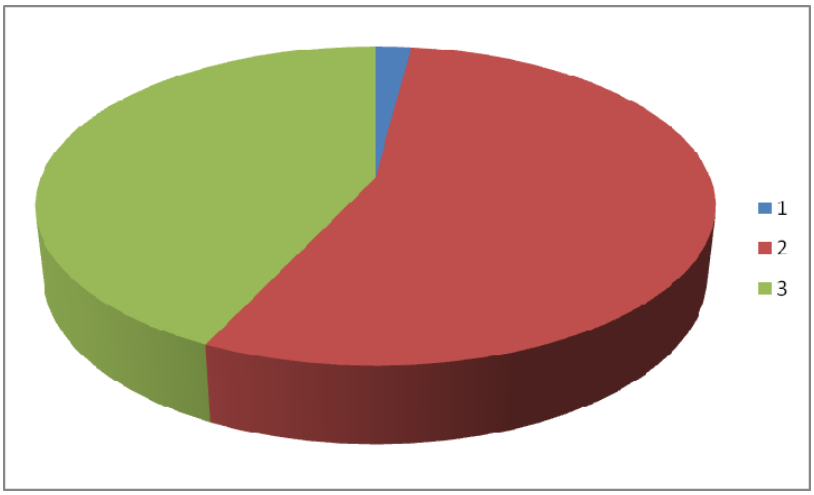
For both the talukas, 97% of respondents made available their required seed privately, 2% of respondents made available their required seeds from co-operative society while only 1% of respondents take their required seeds from government authorities.

20. For second year pre-tillage

v20 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<15000	10	2	2	2
	Between 15000 and 25000	275	55	55	57
	<25000	215	43	43	100
	Total	500	100.0	100.0	

Figure 5.42

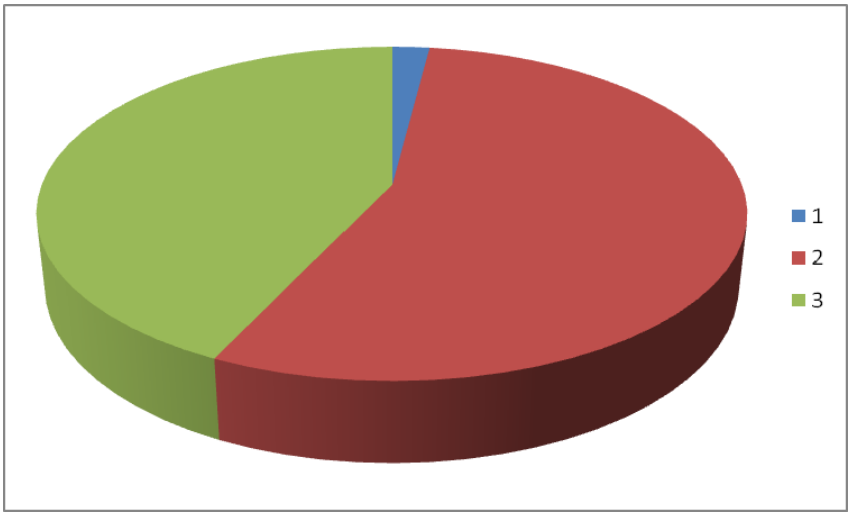
For second year pre-tillage Khed Taluka



v20 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<15000	10	2	2	2
	Between 15000 and 25000	275	55	55	57
	<25000	215	43	43	100
	Total	500	100.0	100.0	

Figure 5.43

For second year pre-tillage Ambegaon Taluka



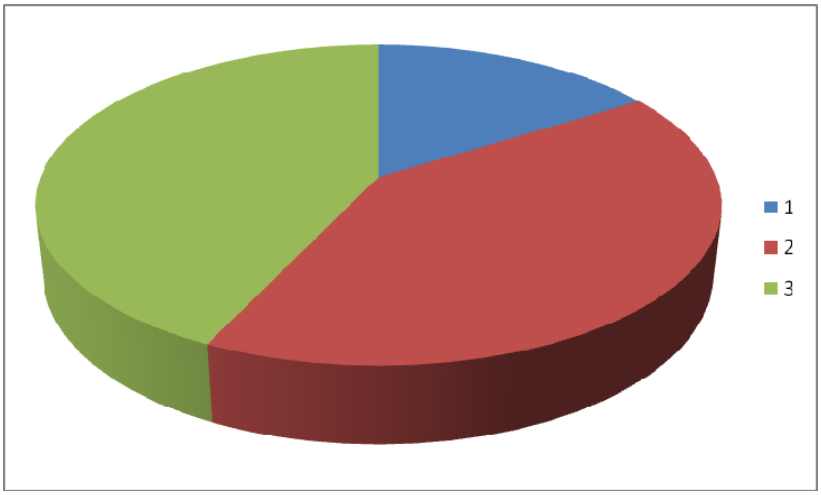
For the second year of crop, expenses will have to from individual 1. For second year pre-tillage From both the talukas, same percentage of respondents made investment in pre-tillage expenses as 2% of respondents made their investment upto 15000, 55% of respondents between 15000 to 25000 and 43% of respondents made expenses more than 25000.

21. Expenditure on fencing and compound

v21 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	80	16	16	16
	Between 5000 to 7000	205	41	41	57
	> 7000	215	43	43	100
	Total	500	100.0	100.0	

Figure 5.44

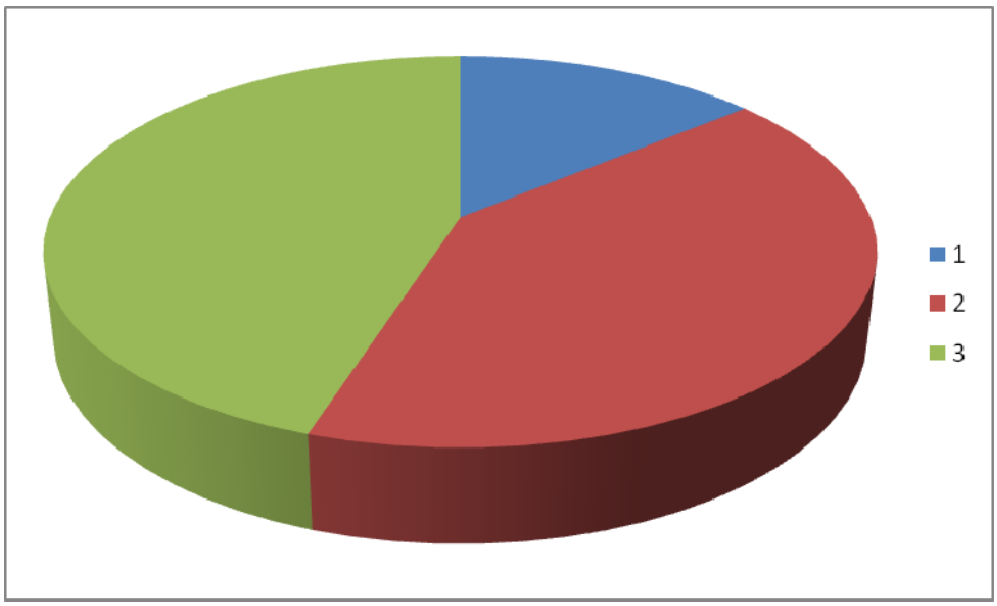
Expenditure on fencing and compound Khed Taluka



v21 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	70	14	14	14
	Between 5000 to 7000	205	41	41	55
	> 7000	225	45	45	100
	Total	500	100.0	100.0	

Figure 5.45

Expenditure on fencing and compound Ambegaon Taluka



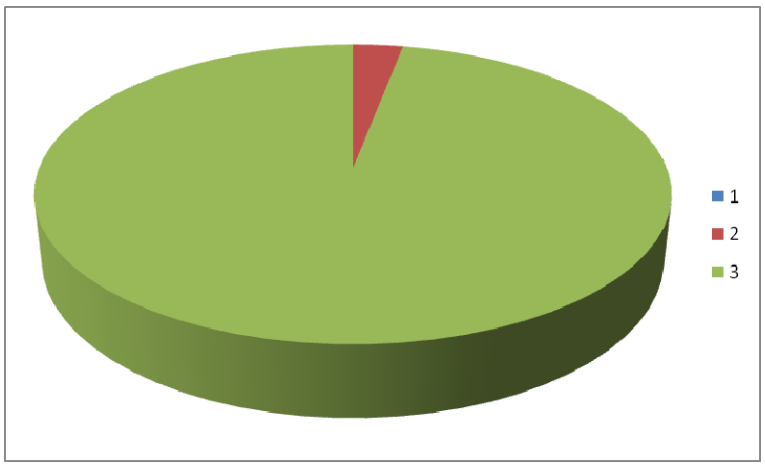
Among the respondents from both Khed and Ambegaon taluka, 16% of respondents are making investment in fencing below 5000, 41% of respondents are investing between 5000 to 7000 while 43% of respondents are investing more than 7000, in case of Ambegaon taluka, 14% of respondents are making investment in fencing below 5000, 41% of respondents are investing between 5000 to 7000 while 45% of respondents are investing more than 7000.

22. Expenditure on Compost fertilizer

v22 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	0	0	0	0
	Between 5000 to 7000	15	3	3	3
	> 7000	485	97	97	100
	Total	500	100.0	100.0	

Figure 5.46

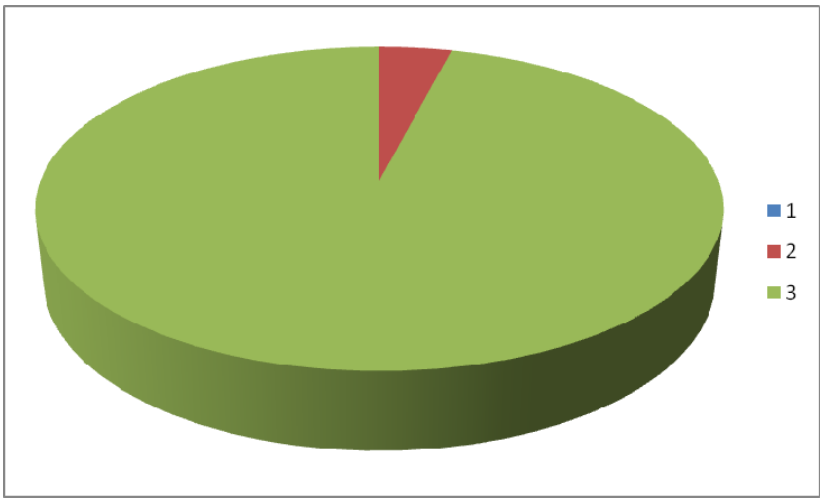
Expenditure on Compost fertilizer Khed Taluka



v22 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<5000	0	0	0	0
	Between 5000 to 7000	20	4	4	4
	> 7000	480	96	96	100
	Total	500	100.0	100.0	

Figure 5.47

Expenditure on Compost fertilizer Ambegaon Taluka



Among the respondents from both Khed and Ambegaon taluka, no one of respondents are making investment in compose fertilizer below 5000, 3% of respondents are investing between 5000 to 7000 while 97% of respondents are investing more than 7000, in case of Ambegaon taluka, no one of respondents are making investment in compose fertilizer below 5000, 4% of respondents are investing between 5000 to 7000 while 96% of respondents are investing more than 7000.

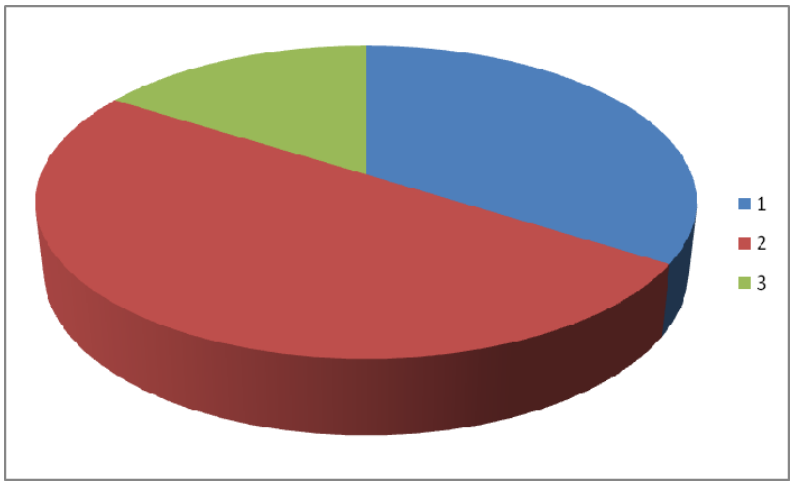
23. Expenditure on Seeds

v23 Khed Taluka

		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<80000	170	34	34	34
	Between 80000 to 90000	250	50	50	84
	> 90000	80	16	16	100
	Total	500	100.0	100.0	

Figure 5.48

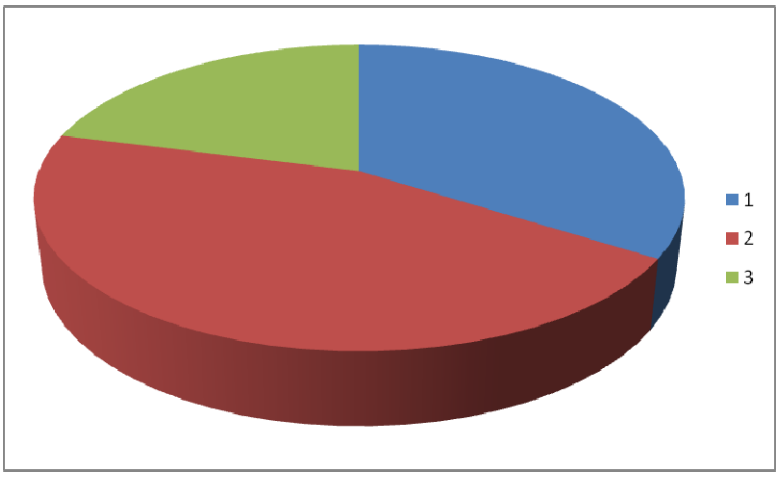
Expenditure on Seeds Khed Taluka



v23 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	<80000	170	34	34	34
	Between 80000 to 90000	225	45	45	79
	> 90000	105	21	21	100
	Total	500	100.0	100.0	

Figure 5.49

Expenditure on Seeds Ambegaon Taluka



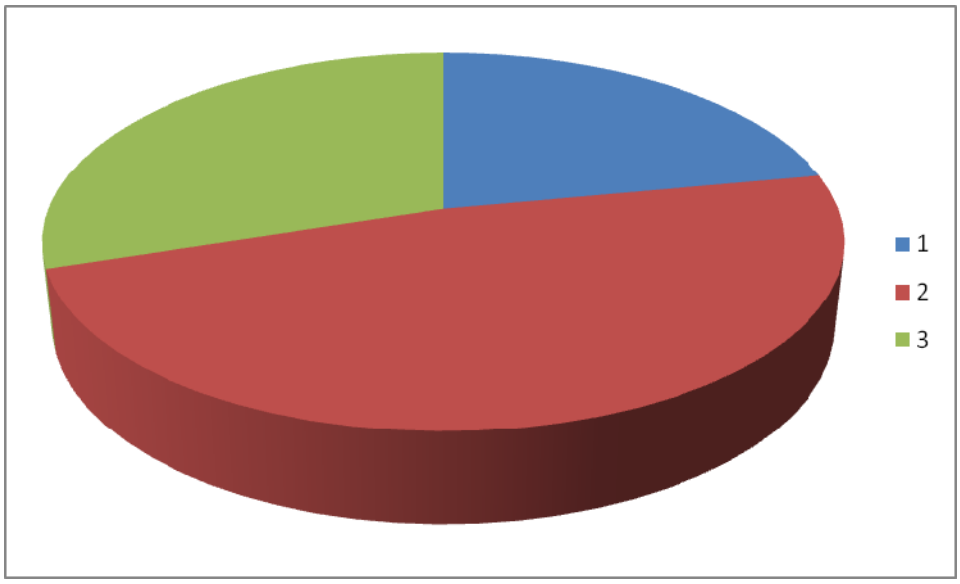
Among the respondents from both Khed and Ambegaon taluka, 34% of respondents are making investment in seeds below 80000, 50% of respondents are investing between 80000 to 90000 while 16% of respondents are investing more than 90000, in case of Ambegaon taluka, 34% of respondents are making investment in seeds below 80000, 54% of respondents are investing between 80000 to 90000 while 21% of respondents are investing more than 90000.

24. Expenditure on Electricity, diesel etc.

v24 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	110	22	22	22
	Between 5000 to 7000	240	48	48	70
	>7000	150	30	30	100
	Total	500	100.0	100.0	

Figure 5.50

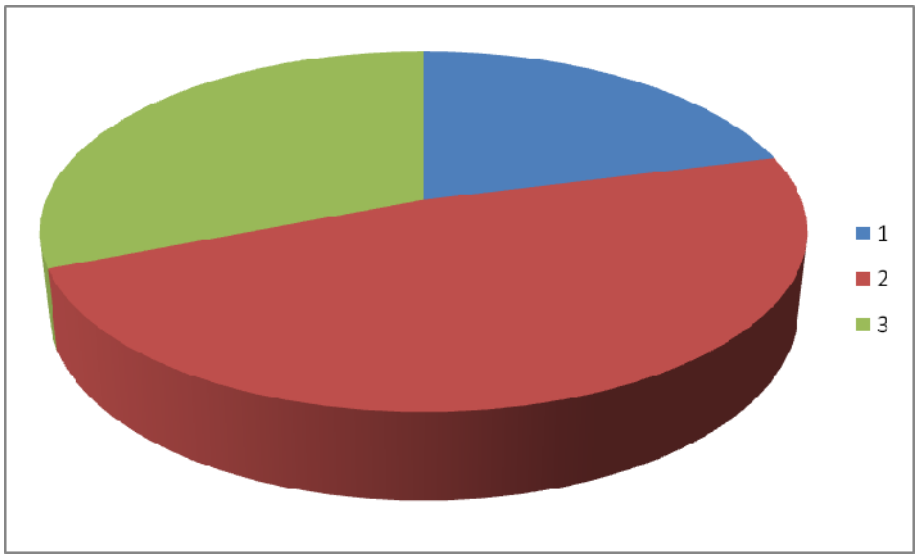
Expenditure on Electricity, diesel etc. Khed Taluka



v24 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	105	21	21	21
	Between 5000 to 7000	240	48	48	69
	>7000	155	31	31	100
	Total	500	100.0	100.0	

Figure 5.51

Expenditure on Electricity, diesel etc. Ambegaon Taluka



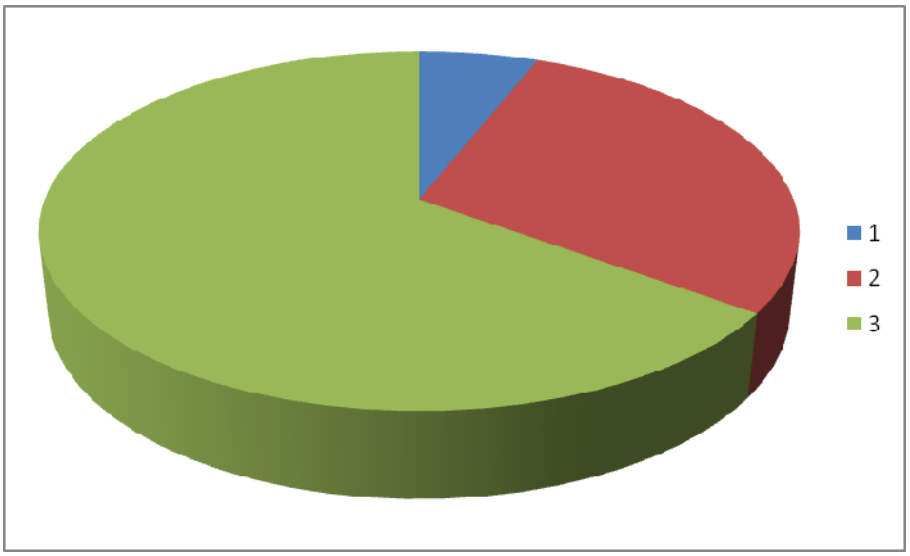
Among the respondents from both Khed and Ambegaon taluka, 22% of respondents are making investment in electricity, diesel and other fuel below 5000, 48% of respondents are investing between 5000 to 7000 while 30% of respondents are investing more than 7000, in case of Ambegaon taluka, 21% of respondents are making investment in electricity, diesel and other fuel below 5000, 48% of respondents are investing between 5000 to 7000 while 31% of respondents are investing more than 7000.

25. Weighing machine, packing and marketing expenses

v25 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	30	6	6	6
	Between 5000 to 7000	145	29	29	35
	>7000	325	65	65	100
	Total	500	100.0	100.0	

Figure 5.52

Weighing machine, packing and marketing expenses Khed Taluka

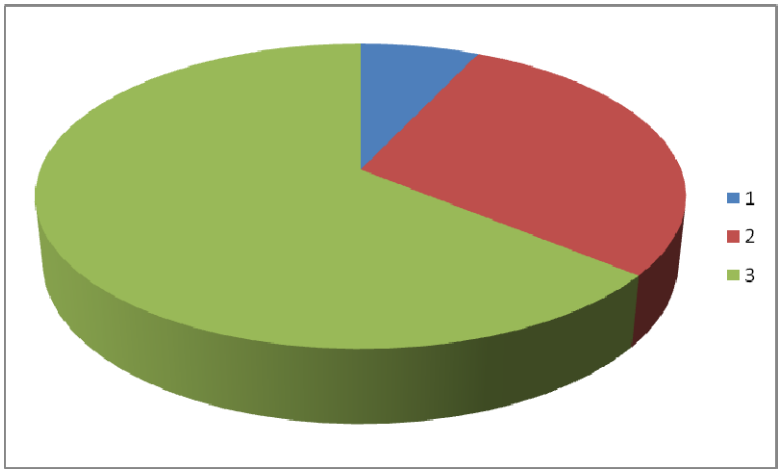


V25 Ambegaon Taluka

		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	35	7	7	7
	Between 5000 to 7000	145	29	29	36
	>7000	320	64	64	100
	Total	500	100.0	100.0	

Figure 5.53

Weighing machine, packing and marketing expenses Ambegaon Taluka



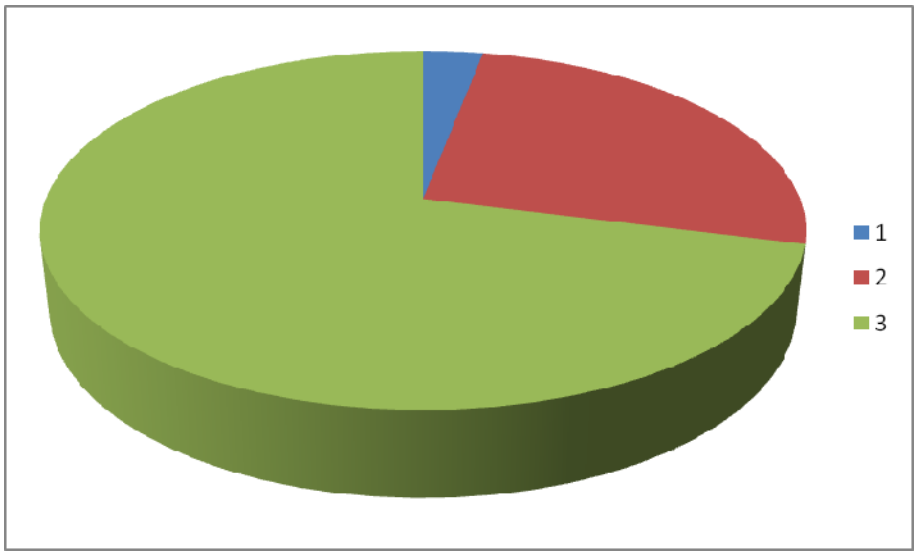
Weighing machine, packing and market expenses Among the respondents from both Khed and Ambegaon taluka, 6% of respondents are making investment in Weighing machine, packing and market expenses below 5000, 29% of respondents are investing between 5000 to 7000 while 65% of respondents are investing more than 7000, in case of Ambegaon taluka, 7% of respondents are making investment in Weighing machine, packing and market expenses below 5000, 29% of respondents are investing between 5000 to 7000 while 64% of respondents are investing more than 7000.

26. Repairs & Maintenance expenses

v26 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	15	3	3	3
	Between 5000 to 7000	130	26	26	29
	>7000	355	71	71	100
	Total	500	100.0	100.0	

Figure 5.54

Repairs & Maintenance expenses Khed Taluka

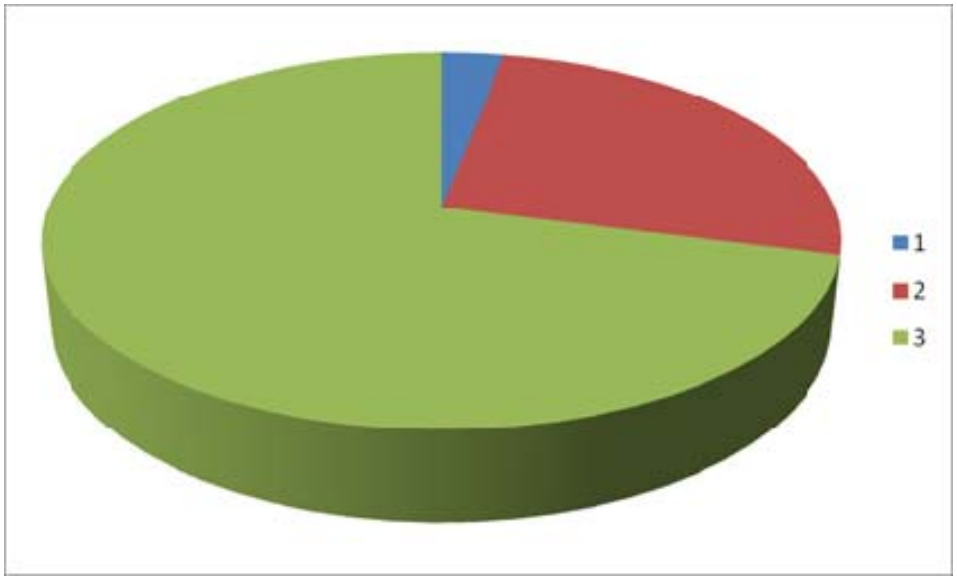


Repairs & Maintenance expenses

v26 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	15	3	3	3
	Between 5000 to 7000	130	26	26	29
	>7000	355	71	71	100
	Total	500	100.0	100.0	

Figure 5.55

Repairs & Maintenance expenses Ambegaon Taluka



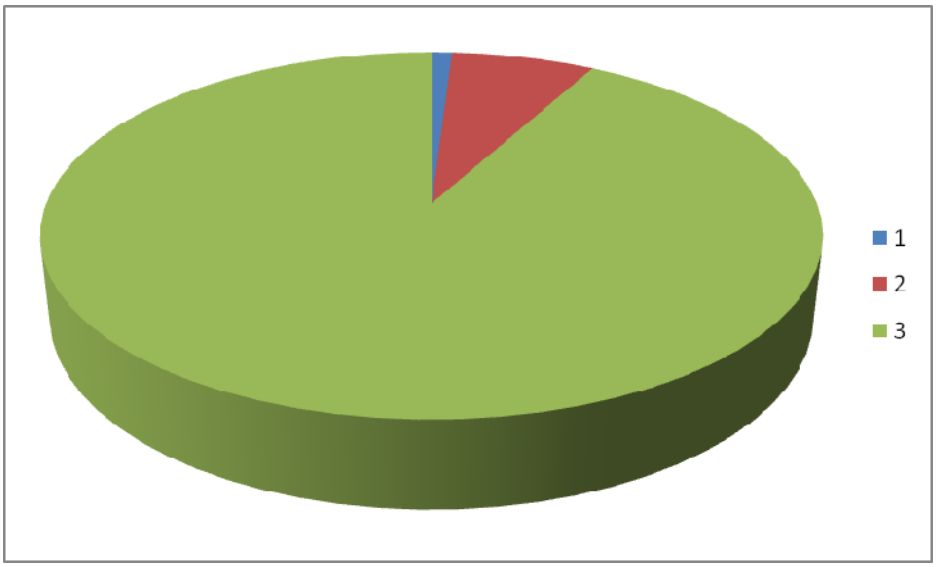
Among the respondents from both Khed and Ambegaon taluka, 3% of respondents are making investment in inner maintenance below 5000, 26% of respondents are investing between 5000 to 7000 while 71% of respondents are investing more than 7000, 8. Crop safety- pesticides, crop vaccine and others .

27. Expenditure on Crop safety- pesticides, crop vaccine etc.

v27 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	5	1	1	1
	Between 5000 to 7000	35	7	7	8
	>7000	460	92	92	100
	Total	500	100.0	100.0	

Figure 5.56

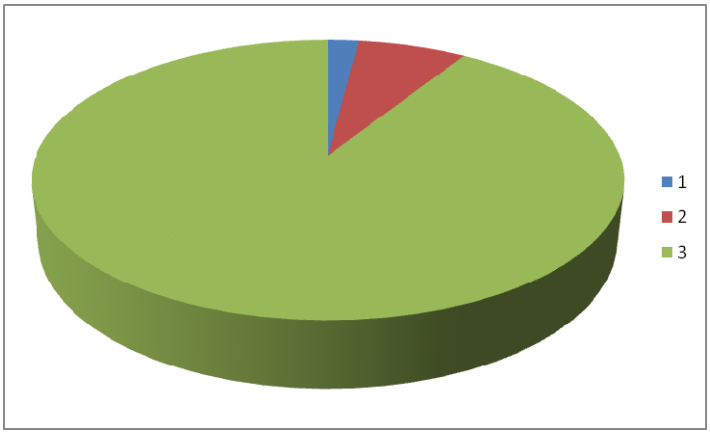
Expenditure on Crop safety- pesticides, crop vaccine etc. Khed Taluka



v27 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	10	2	2	2
	Between 5000 to 7000	35	7	7	9
	>7000	455	91	91	100
	Total	500	100.0	100.0	

Figure 5.57

Expenditure on Crop safety- pesticides, crop vaccine etc. Ambegaon Taluka



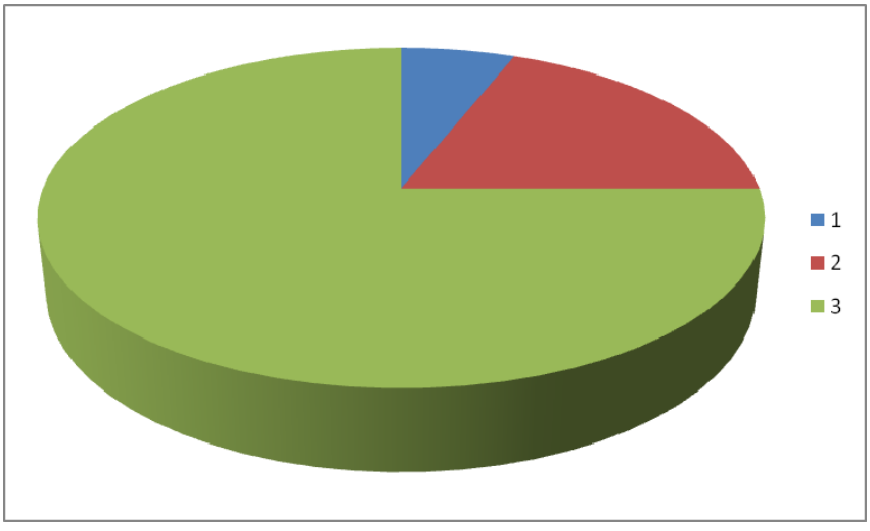
Among the respondents from both Khed and Ambegaon taluka, 1% of respondents are making investment in Crop safety- pesticides, crop vaccine and others expenses below 5000, 7% of respondents are investing between 5000 to 7000 while 92% of respondents are investing more than 7000, in case of Ambegaon taluka, 2% of respondents are making investment in Crop safety- pesticides, crop vaccine and others expenses below 5000, 7% of respondents are investing between 5000 to 7000 while 91% of respondents are investing more than 7000.

28 Expenditure Watering

v28 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	30	6	6	6
	Between 5000 to 7000	95	19	19	25
	>7000	375	75	75	100
	Total	500	100.0	100.0	

Figure 5.58

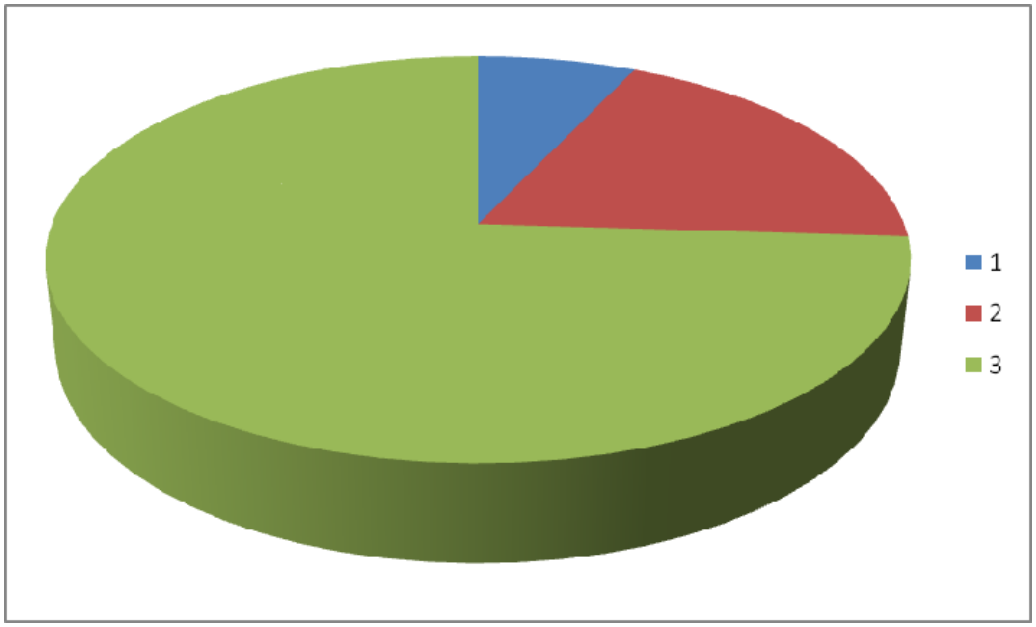
Expenditure Watering Khed Taluka



v28 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	35	7	7	7
	Between 5000 to 7000	95	19	19	26
	>7000	370	74	74	100
	Total	500	100.0	100.0	

Figure 5.59

Expenditure Watering Ambegaon Taluka



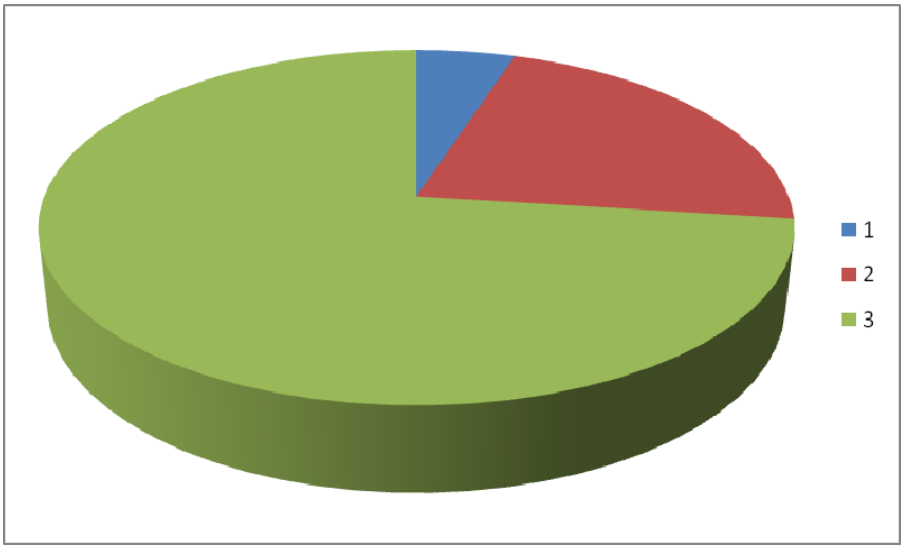
Among the respondents from both Khed and Ambegaon taluka, 6% of respondents are making investment in watering process expenses below 5000, 19% of respondents are investing between 5000 to 7000 while 75% of respondents are investing more than 7000, in case of Ambegaon taluka, 7% of respondents are making investment in watering process expenses below 5000, 19% of respondents are investing between 5000 to 7000 while 74% of respondents are investing more than 7000.

29 Labour charges

v29 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	25	5	5	5
	Between 5000 to 7000	110	22	22	27
	>7000	365	73	73	100
	Total	500	100.0	100.0	

Figure 5.60

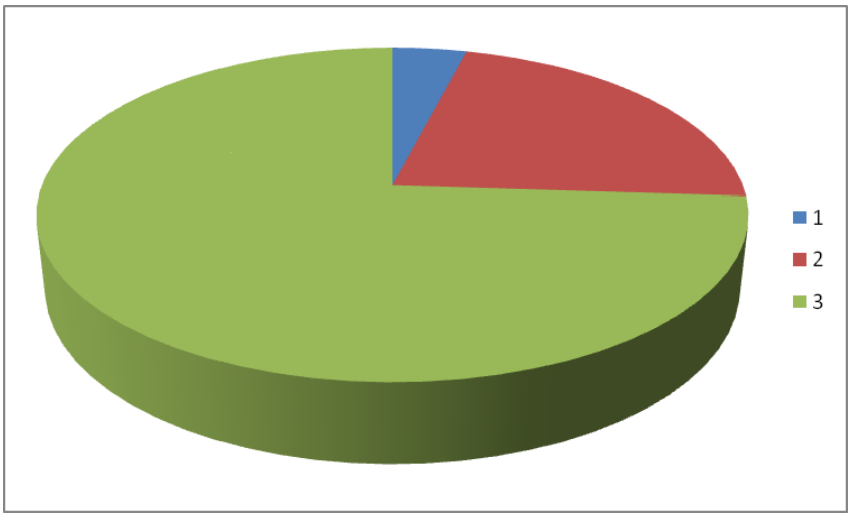
Labour charges Khed Taluka



v29 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	20	4	4	4
	Between 5000 to 7000	110	22	22	26
	>7000	370	74	74	100
	Total	500	100.0	100.0	

Figure 5.61

Labour charges Ambegaon Taluka



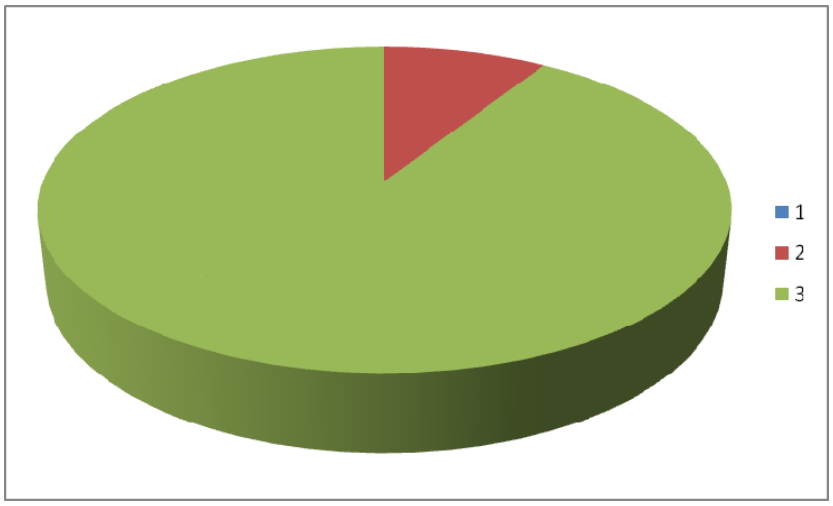
Labour charges Among the respondents from both Khed and Ambegaon taluka, 5% of respondents are making investment in labour expenses below 5000, 22% of respondents are investing between 5000 to 7000 while 73% of respondents are investing more than 7000, in case of Ambegaon taluka, 4% of respondents are making investment in labour expenses below 5000, 22% of respondents are investing between 5000 to 7000 while 74% of respondents are investing more than 7000.

30. Storage expenses

v30 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	0	0	0	0
	Between 5000 to 7000	45	9	9	9
	>7000	455	91	91	100
	Total	500	100.0	100.0	

Figure 5.62

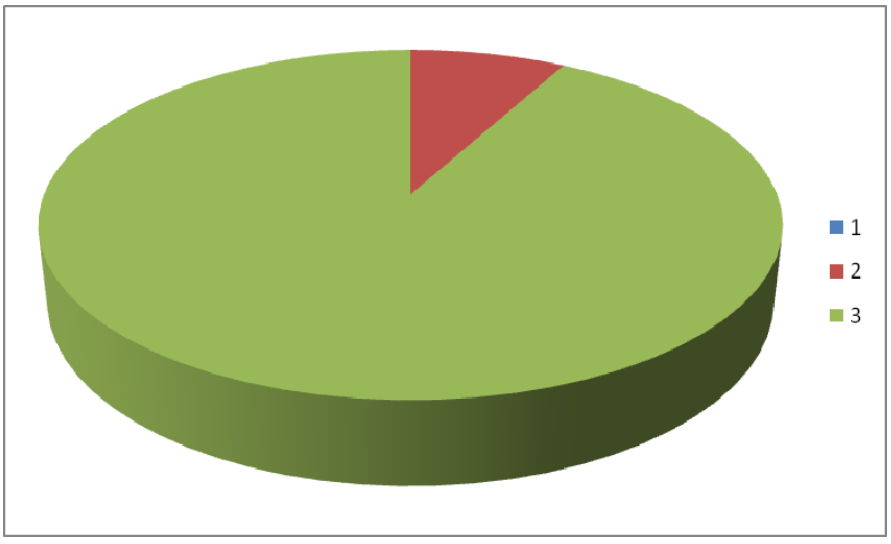
Storage expenses Khed Taluka



v30 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	0	0	0	0
	Between 5000 to 7000	40	8	8	8
	>7000	460	92	92	100

Figure 5.63

Storage expenses Ambegaon Taluka



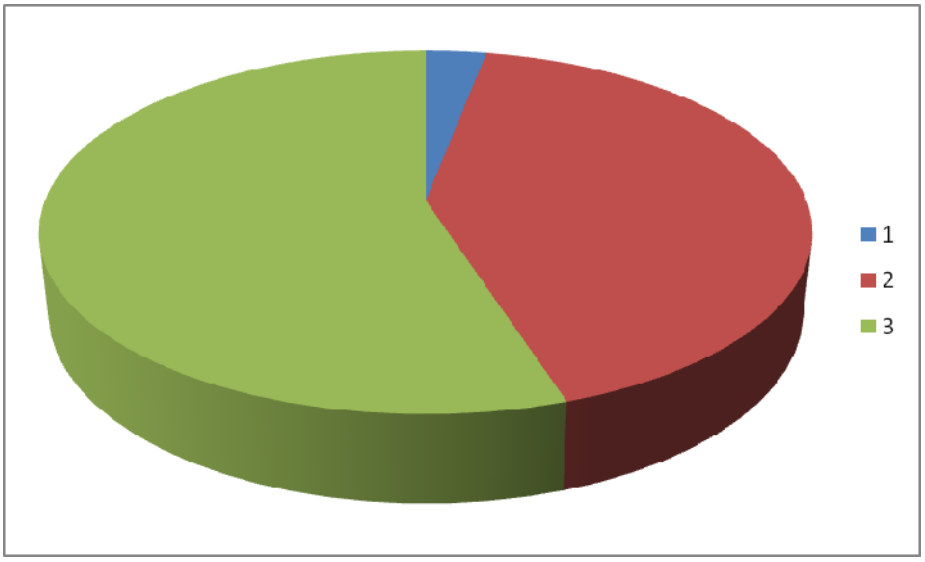
Storage expenses Among the respondents from both Khed and Ambegaon taluka, no one of respondents are making investment in storage expenses below 5000, 8% of respondents are investing between 5000 to 7000 while 91% of respondents are investing more than 7000, in case of Ambegaon taluka, no one of respondents are making investment in labour expenses below 5000, 8% of respondents are investing between 5000 to 7000 while 92% of respondents are investing more than 7000.

31 Transport Expenditure

v31 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	15	3	3	3
	Between 5000 to 7000	210	42	42	45
	>7000	275	55	55	100
	Total	500	100.0	100.0	

Figure 5.64

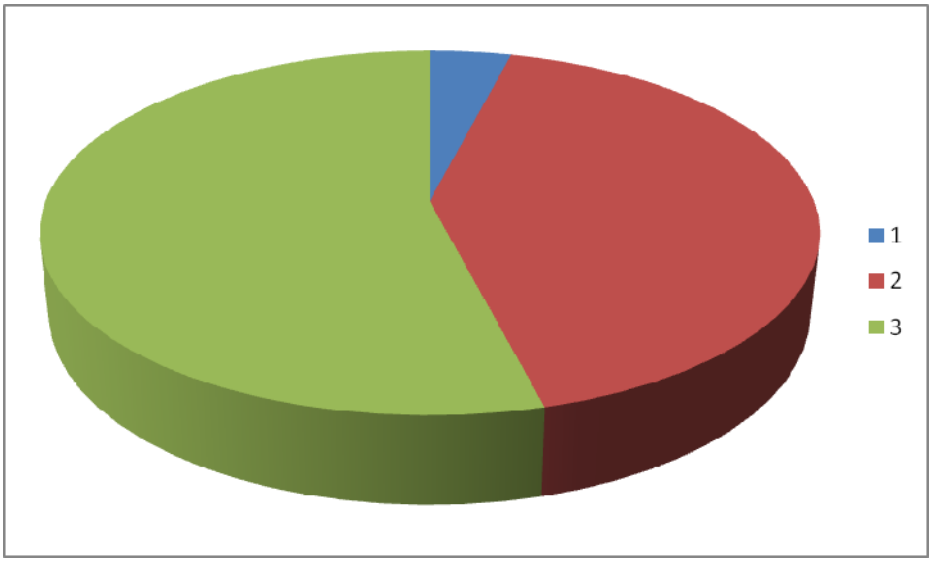
Transport Expenditure Khed Taluka



v31 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	20	4	4	4
	Between 5000 to 7000	210	42	42	46
	>7000	270	54	54	96
	Total	500	100.0	100.0	

Figure 5.65

Transport Expenditure Ambegaon Taluka



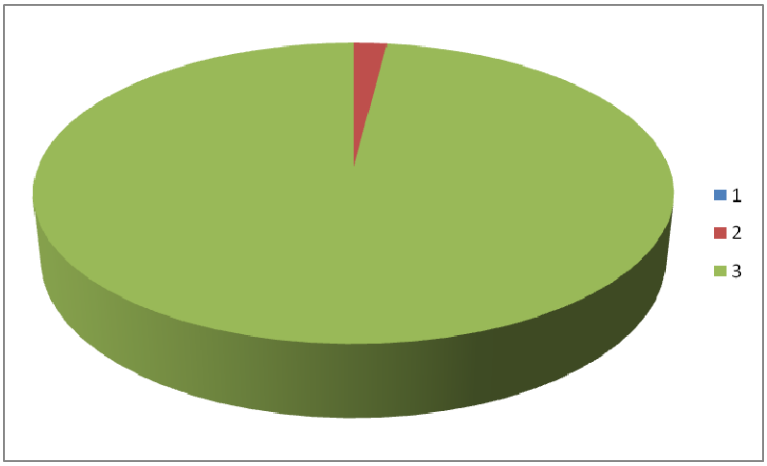
Among the respondents from both Khed and Ambegaon taluka, 3% of respondents are making investment in transport expenses below 5000, 42% of respondents are investing between 5000 to 7000 while 55% of respondents are investing more than 7000, in case of Ambegaon taluka, 4% of respondents are making investment in transport expenses below 5000, 42% of respondents are investing between 5000 to 7000 while 54% of respondents are investing more than 7000.

32. Purchasing of machinery

v32 Khed Taluka					
		Farmers	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	*Below 5000*	*0*	*0*	*0*	*0*
	Between 5000 to 7000	*10*	*2*	*2*	*2*
	>7000	*490*	*98*	*98*	*100*
	Total	*500*	*100.0*	*100.0*	

Figure 5.66

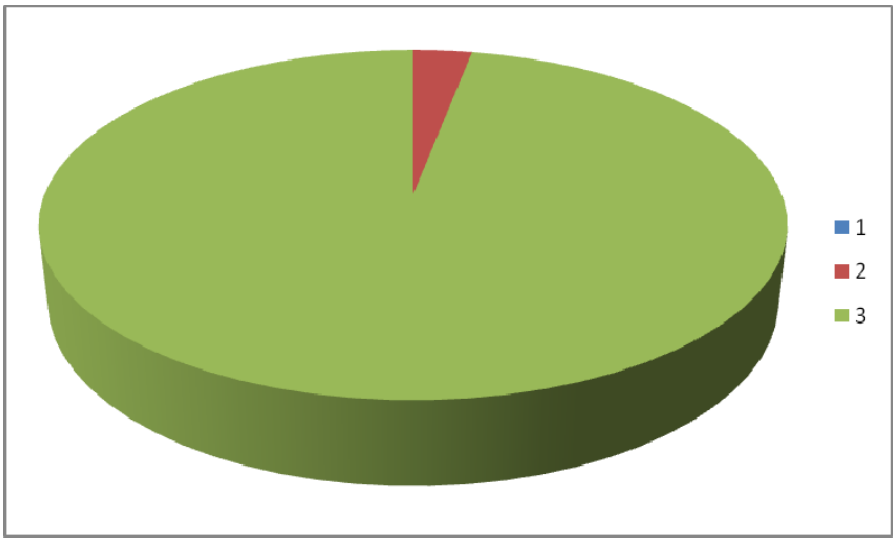
Purchasing of machinery Khed Taluka



v32 Ambegaon Taluka					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	0	0	0	0
	Between 5000 to 7000	15	3	3	3
	>7000	485	97	97	100
	Total	500	100.0	100.0	

Figure 5.67

Purchasing of machinery Ambegaon Taluka



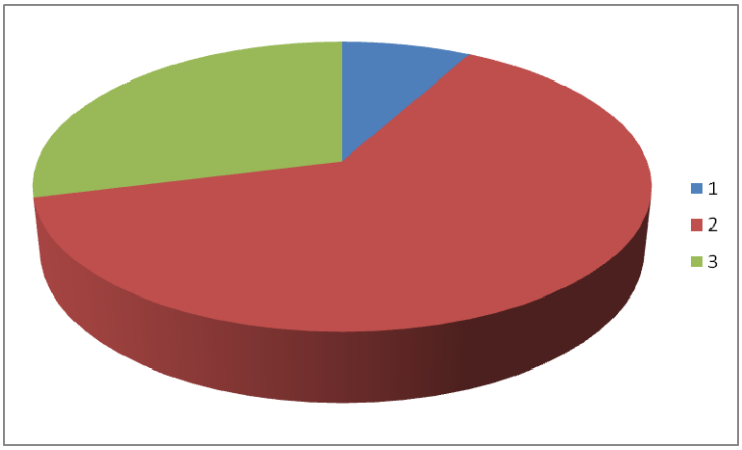
Among the respondents from both Khed and Ambegaon taluka, no one of respondents are making investment in Purchasing of machinery and its maintenance expenses below 5000, 2% of respondents are investing between 5000 to 7000 while 98% of respondents are investing more than 7000, in case of Ambegaon taluka, no one of respondents are making investment in Purchasing of machinery and its maintenance expenses below 5000, 3% of respondents are investing between 5000 to 7000 while 97% of respondents are investing more than 7000.

33. Animal husbandry and its expenses

v33 Khed Taluka					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 500	40	8	8	8
	Between 500 to 700	315	63	63	71
	>700	145	29	29	100
	Total	500	100.0	100.0	

Figure 5.68

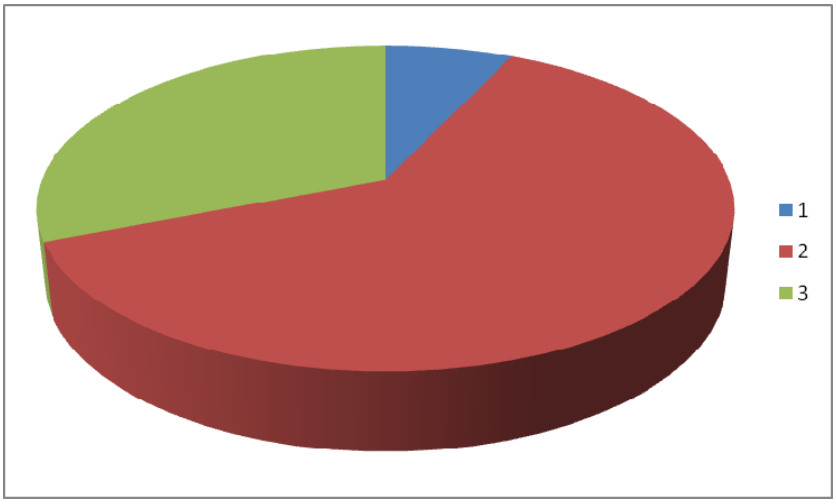
Animal husbandry and its expenses Khed Taluka



v33 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 500	35	7	7	7
	Between 500 to 700	310	62	62	69
	>700	155	31	31	100
	Total	500	100.0	100.0	

Figure 5.69

Animal husbandry and its expenses Ambegaon Taluka



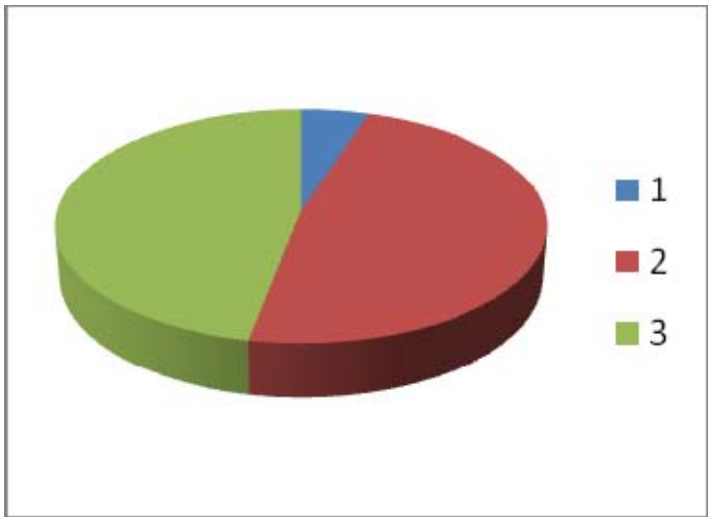
Among the respondents from both Khed and Ambegaon taluka, 8% of respondents are making investment in Animal husbandary and its expenses below 5000, 63% of respondents are investing between 5000 to 7000 while 29% of respondents are investing more than 7000, in case of Ambegaon taluka, 7% of respondents are making investment in Animal husbandry and its expenses below 5000, 62% of respondents are investing between 5000 to 7000 while 31% of respondents are investing more than 7000.

34. Farm and water taxes

v34 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	25	5	5	5
	Between 5000 to 7000	240	48	48	53
	>7000	235	47	47	100
	Total	500	100.0	100.0	

Figure 5.70

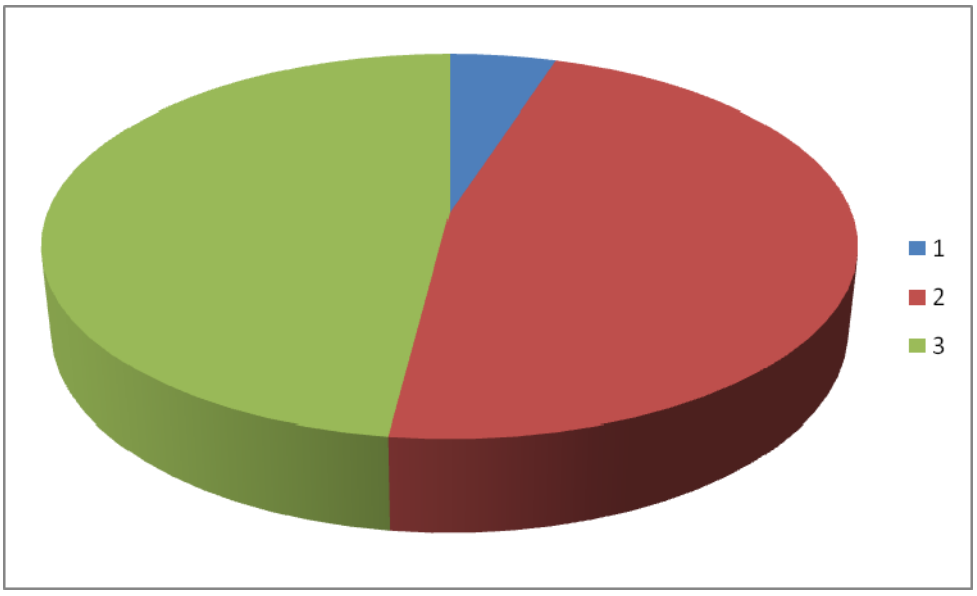
Farm and water taxes Khed Taluka



v34 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	25	5	5	5
	Between 5000 to 7000	240	48	48	53
	>7000	235	47	47	100
	Total	500	100.0	100.0	

Figure 5.71

Farm and water taxes Ambegaon Taluka



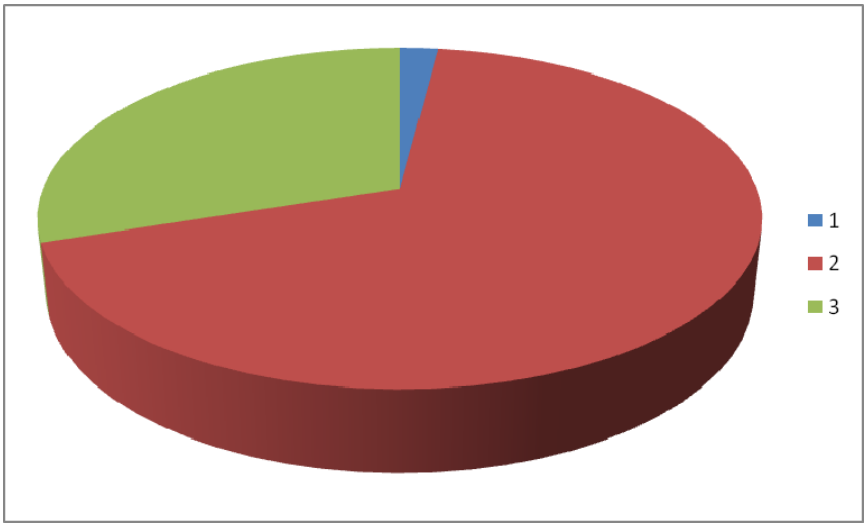
Among the respondents from both Khed and Ambegaon taluka, 5% of respondents are making investment in farm and water taxes expenses below 5000, 48% of respondents are investing between 5000 to 7000 while 47% of respondents are investing more than 7000, in case of Ambegaon taluka, 5% of respondents are making investment in farm and water taxes expenses below 5000, 48% of respondents are investing between 5000 to 7000 while 47% of respondents are investing more than 7000.

35 Yearly income

v35 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	10	2	2	2
	Between 5000 to 7000	340	68	68	70
	>7000	150	30	30	100
	Total	500	100.0	100.0	

Figure 5.72

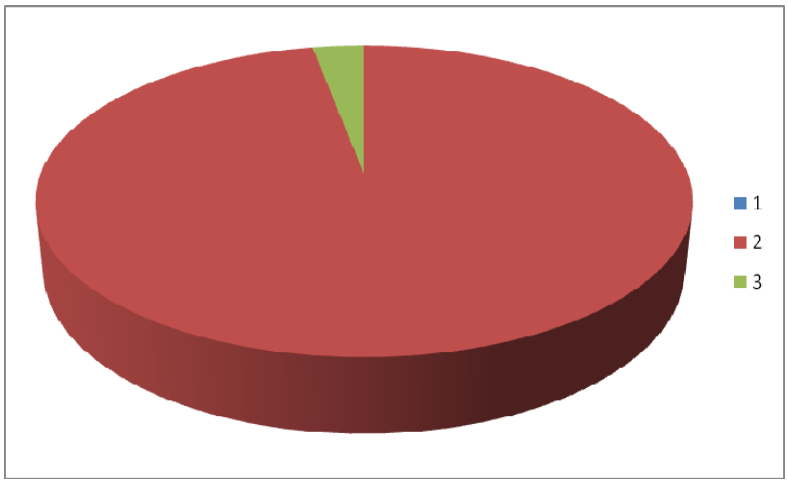
Yearly income Khed Taluka



v35 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5000	0	0	0	0
	Between 5000 to 7000	485	97	97	97
	>7000	15	3	3	100
	Total	500	100.0	100.0	

Figure 5.73

Yearly income Ambegaon Taluka



36 Sales Medium

v 36 Khed Taluka

	Farmers	Percent	Valid Percent	Cumulative Percent
Agent	185	37	37	37
Pepsico	125	25	25	62
SV3	80	16	516	78
Samrudhi	20	4	4	82
Balaji	90	18	18	100

v36 Ambegaon Taluka

		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Agent	490	98	98	98
	other	10	2	2	
					100
	Total	500	100.0	100.0	

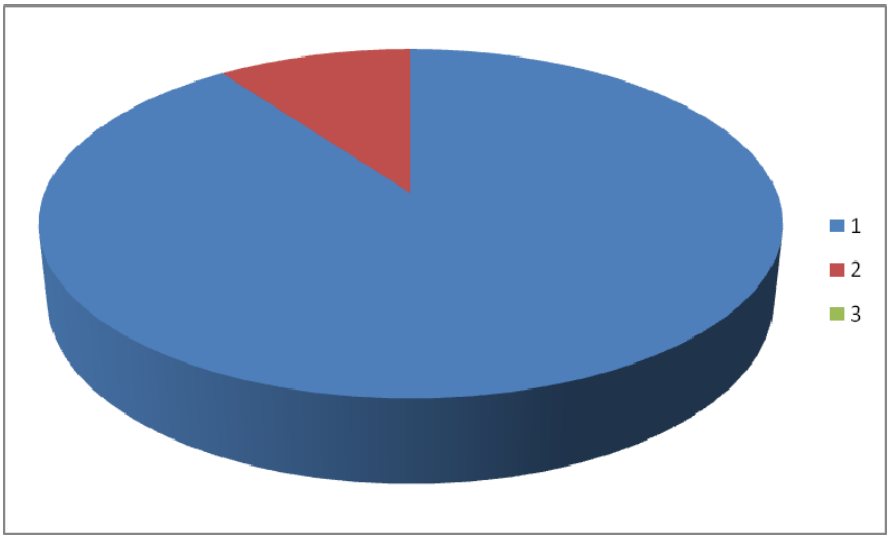
From Khed taluka, 37% of respondents are selling their product through the agent, 25% of respondents are selling through PepSico company, 16% of respondents are selling through SV3 company, 4% of respondents are selling through Samrudhi Agency and other are selling from Balaji Agency while from Ambegaon taluka, 98% respondents are selling through agent and 2% of respondents are selling thought others.

37 Impact of steps taken for increasing potato production

v37 Khed Taluka					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	450	90	90	90
	No	50	10	10	100
					100
Total		500	100.0		

Figure 5.74

Impact of steps taken for increasing potato production Khed Taluka



V37 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Yes	450	90	90	90
	No	50	10	10	
	Total	500			100

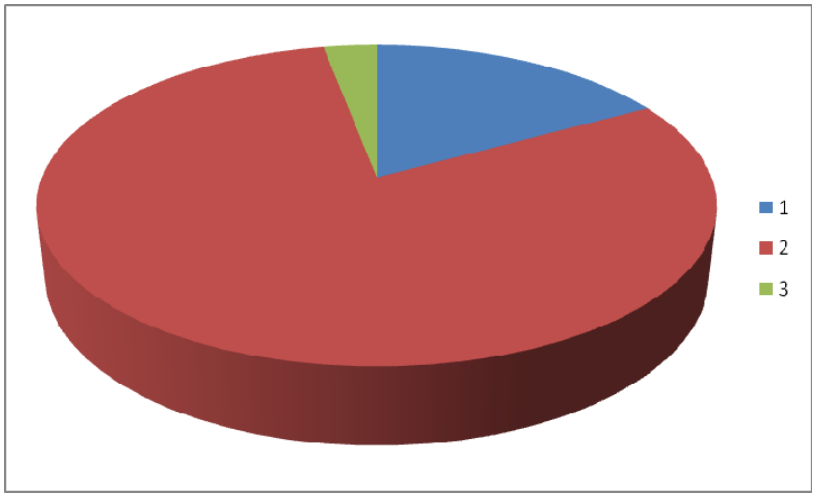
From both these taluka, respondents have made necessary changes and they are getting benefits of that.

38. Increase in production since last 10 years

v38 Khed Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5%	85	17	17	17
	Between 5% to 8%	400	80	80	97
	>8%	15	3	3	100
	Total	500	100.0	100.0	

Figure 5.74

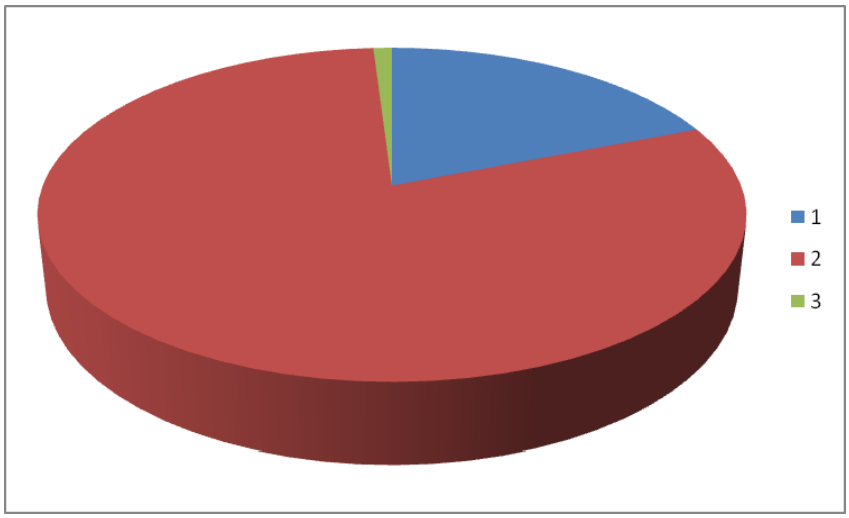
Increase in production since last 10 years Khed Taluka



v38 Ambegaon Taluka					
		Farmers	Percent	Valid Percent	Cumulative Percent
Valid	Below 5%	95	19	19	19
	Between 5% to 8%	400	80	80	99
	>8%	5	1	1	100
	Total	500	100.0	100.0	

Figure 5.75

Increase in production since last 10 years Ambegaon Taluka



From both these taluka, 17% and 19% respondents have below 5% increases in production, 80% respectively between 5% to 8% while 3% and 1% respondents have got more than 8% increase in production.

5.3 COST OF CULTIVATION OF POTATO CROP IN AMBEGAON & KHED TALUKA

5.3.1 Procedure for deciding the Scale of Finance (i.e. cost of cultivation) for the Banks Operating in the District .

Every year before the fresh sowing season starts the District Central Coop. Bank of the district convene a meeting to decide the crop loan policy of the bank for

the district. This meeting is attended to by the Lead Bank Manager of the district, District Agriculture Officer, Representative of Rural Planning and Credit Department of the Reserve Bank of India, Representative of National Agricultural Bank for Rural Development, DCC Bank's Agri. Officers, Representative of the Agriculture University in the region, Representative Agri. Officers of the various operating in the districts who have major role in financing the agriculture sector, and finally a few prominent representatives of the Agriculturists from various fields. This committee discusses the cost of cultivation of each crop that is being grown in the district and decides the costs of cultivation. All input costs are accounted at current market rates. The agriculturists family labour that is put in, is considered as his margin contribution and the financing limits of each crop per Ha are decided which are normally binding on the financing banks in the district. At times there is a small deviation depending upon each case, say a progressive farmer who is using all the new technologies and sincerely cultivates the crop and his yield is, for over the past few years, is much higher than the other counter parts, such a farmer is given slightly higher scale of finance as his input requirements are more. Of course this is being done selectively applying certain parameters.

The cost of cultivation is also showing similar increasing trend which can also be said to be a marginal increase. The major increase is in the cost of seeds and that is because the agriculturists have entered into contract farming with the various wafers and agro food products manufacturers namely PepsiCo, Siddhivinayak, ITC, Balaji, Parle etc. PepsiCo and Siddhivinayak companies provide specific quality seeds e.g. ATL 1533, SV 3, Super Jyoti etc. which is specially procured from Himachal and Simla, Punjab sources and is slightly costlier than the other varieties which were hither to be used by the agriculturists. These special varieties give marginally higher production but the quality of the potato is as required by the company with which the agriculturists have entered into contract. These companies are in competition with each other and hence the real profit per acre came from the high rates of potato fetched by these agriculturists form the contracted companies. And this has resulted into increasing number of agriculturists turning to the contract farming and cultivating potato. This has certainly increased the socio economic performance of the area and has also resulted into improved life style of these agriculturists.

Table 5.6: Scale of finance for potato crop for the study period for the entire Pune District

Rs. in thousand only

Ending 31.3 every year →	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Scale of finance for potato per Ha.	35000	35000	40000	40000	62500	62500	62500	62500
Per acre	14000	14000	16000	16000	26000	26000	26000	26000

Source: PDCC Bank's Agri. Finance Policy Booklet of respective years.

5.3.2 Financial Assistance extended by the Pune DCC Bank in Ambegaon Taluka

On the same lines of Khed taluka the information regarding financial assistance extended by the Pune D.C.C. Bank in Ambegaon taluka has been collected and the same has been presented in the following table.

Table 5.7 : Financial assistance extended by the Pune DCC Bank in Ambegaon Taluka.

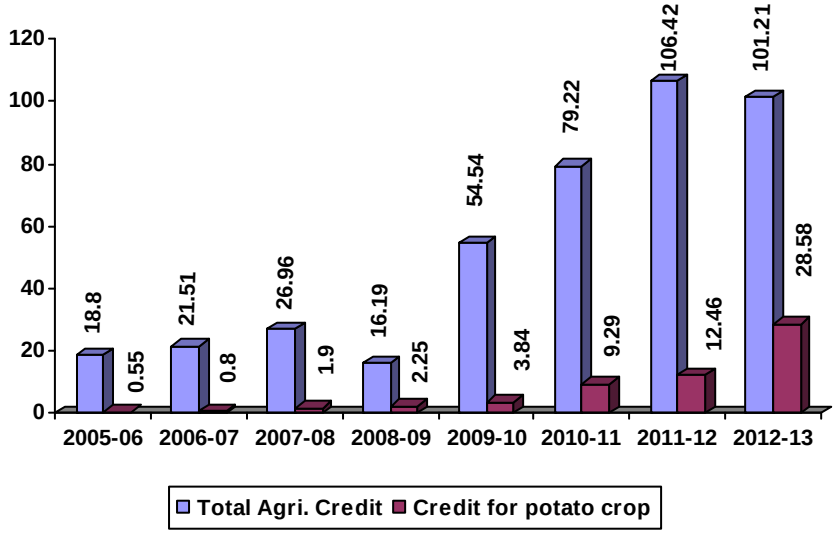
Rs. in crores

Ending 31.3 every year →	2005	2006	2007	2008	2009	2010	2011	2012
Total Agri. Credit	18.80	21.51	26.96	16.19	54.54	79.22	106.42	101.21.
Of which for cultivation of Potato	0.55	0.80	1.90	2.25	3.84	9.29	12.46	28.58

Source: Field Survey Data

Figure 5.76 a

Total Agri Credit and Credit for Potato Crop in Ambegaon Taluka during the study period



It can be seen from the above data that during the study period the finance for cultivation of potato crop has been marginally increased. It is due to two factors: the area under cultivation has shown increase as well as the scale of finance which is based on the cost of inputs has increased over the years. For the year 2010-11 onwards there is a steady growth in the area under potato cultivation. During the year 2012-13 there was over 100% growth in the area.

Ambegaon Taluka (Anova Table)

Growth of Potato crop during the study period

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Groups	38298246903260.60	2.00	19149123451630.30	**36.82**	0.00	**3.09**
Variables	138555577700554.00	61.00	2271402913123.83	**4.47**	0.00	**1.57**
Error	63792557311955.90	122.00	522889814032.43			
Total	**240646381915770.00**	**185.00**				

SS =Sum of Squares, MS = Mean of Squares, Df = Degree of Freedom,

F= Calculated values, P Value = Probability value,

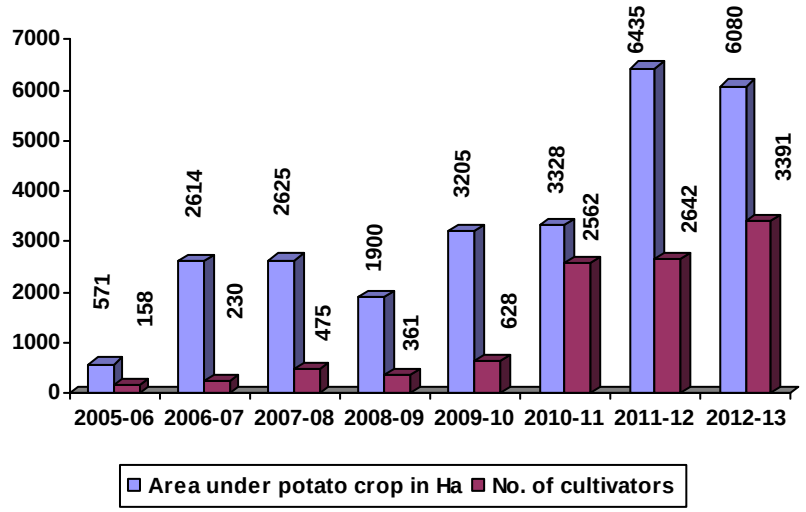
F Crit= Fishers Critical value of Table value

Observation

It is found in Ambegaon taluka that f table value 1.57 is less than the calculated value 4.47 hence our alternative hypnosis is proved that Growth and development are happening during the study period for potato crop.

Figure 5.77

Area under Potato Crop and the Number of Cultivators in Ambegaon Taluka during study period



It can be seen from the above data that during the study period, the area under cultivation of potato crop as well as the number of cultivators has gradually increased. During the year 2012-13 the area under potato crop is marginally decreased however the number of cultivators has increased substantially. This is due to coverage of small farmers cultivating potato crop is increased. This is also due to the fact that there were drought conditions and water shortage was there. This has reduced the area under potato cultivation by the big farmers. This means the cultivators of this area have now realized the potential earning from this crop. This is also due to forward marketing linkage with the Pepsico, Balaji Wafers etc.

Table 5.8: Area under potato crop and the number of cultivators in Ambegaon taluka during the study period

Ending 31.3 every year →	2008	2009	2010	2011	2012
Area under potato Ha.	2625	1900	3205	3328	6435
No. of farmers cultivating potato crop	475	361	628	2562	2642

Source: Field survey: Information given by PDCC financing branches

5.3.3 Financial Assistance extended by the Pune DCC Bank in Khed Taluka

The data relating to the financial extended by the Pune D.C.C. Bank in Khed Taluka has been collected and the same has been presented in the following table.

Table 5.9 : Financial assistance extended by the Pune DCC Bank in Khed Taluka.

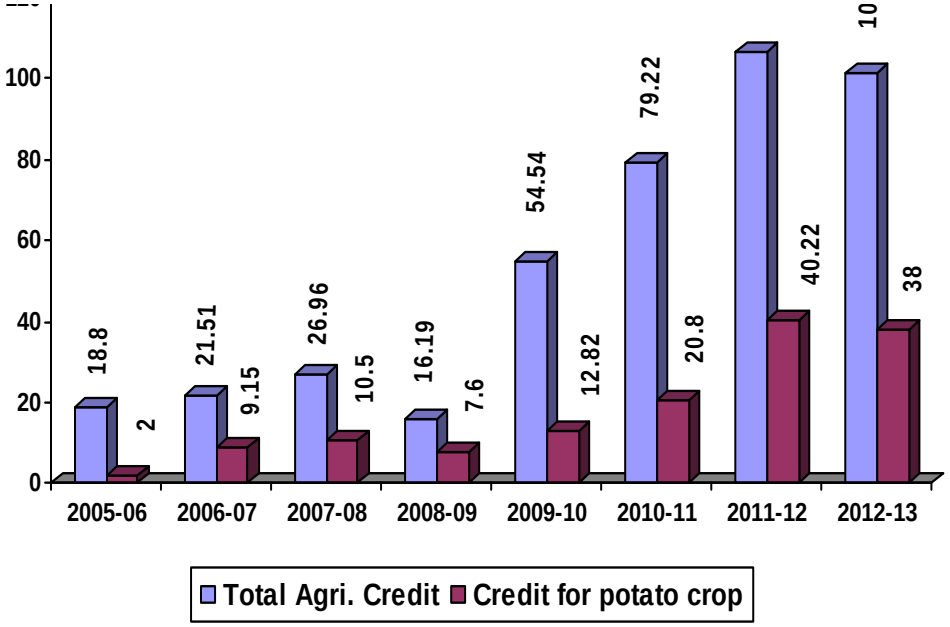
Rs. in crores

Ending 31.3 every year →	2006	2007	2008	2009	2010	2011	2012	2013
Total Agri. Credit	18.80	21.51	26.96	16.19	54.54	79.22	106.42	101.21
Of which for cultivation of Potato	2.00	9.15	10.50	7.60	12.82	20.80	40.22	38.00
Per acre actual credit to potato farmers	1428.57	6535.71	6562.50	4750.00	4930.77	8000.00	15469.23	14615.38
Percentage of potato finance in total agriculture finance	10.64%	42.54%	38.95%	46.94 %	23.51%	26.26%	37.79%	37.55%

Source: Field Survey Data

Figure 5.78

Total Agri Credit and Credit for Potato Crop in Khed (Rajgurunagar) Taluka during study period



It can be seen from the above data that during the study period the finance for cultivation of potato crop has been increased. It is due to two factors: the area under cultivation has shown increase as well as the scale of finance which is based on the cost of inputs has increased over the years. During the period under study there were variations in the percentage share of credit for potato cultivation to total agriculture credit. Subsequent to this period till today the share of potato financing in the total agriculture finance has grown phenomenally because of the increase in the area under potato cultivation and the scale of finance.

Table 5.10 : Area under potato crop and the number of cultivators in Khed (Rajgurunagar) taluka during the study period

Ending 31.3 every year →	2005	2006	2007	2008	2009	2010	2011	2012
Area under potato Ha.	157	228	475	562	960	1486	1993	4573
No. of farmers cultivating potato crop	158	230	475	361	628	2562	2642	3391

Source: Field survey: Information given by PDCC financing branches.

KhedTaluka (Anova Table)

Growth of Potato crop during the study period

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Groups	45337431870170.80	2.00	22668715935085.40	**44.61**	0.00	**3.07**
Variables	139722897380848.00	61.00	2290539301325.37	**4.35**	0.00	**1.57**
Error	64970383118586.70	122.00	532544123922.84			
Total	250030712369605.00	185.00				

SS =Sum of Squares, MS = Mean of Squares, Df = Degree of Freedom,

F= Calculated values, P Value = Probability value,

F Crit= Fishers Critical value of Table value

Observation

About to the Khed taluka we found that the table value are 1.57 which is less than calculated value of 4.35 are indicating that the alternative hypothesis are proven like Ambegaon taluka in Khed also.

Conclusion

It is found that the alternative hypothesis is **"Growth and development is happening during the selected term of study for potato crop"** which are sharply proven by the test of anova. Within the both talukas calculated values exceed to the table value are indicating that the mean of the data within the column and within the rows are varied. It is indicating that the inputs and the income as well as expenditure also showing positive dynamical function which is a remarkable symbol of growth and development.

Storage of Potato

It has been revealed during the field study that at present the potato growers in both the talukas do not require cold storage facility as during the Kharif season the entire production of the contracted farmers is immediately on harvesting lifted by the contracted company who have their own cold storage arrangements.

The seeds for Kharif season are supplied by the contracted companies who have their own cold storage arrangements for safe storage of the seeds. So far as Rabbi season is concerned the potato growers purchase their seed requirement from Manchar Market which has the facility of cold storage for safe preserving the potato seeds. The following table shows the current availability of the cold storages in Pune District. Only handful of the potato growers make use of these cold storages for preserving their potato crop during Rabbi season. However, during the field survey it was transpired that these cold storages are not maintaining commodity wise data and hence the information on stocking of potato in cold storage could not be obtained.

However, considering the fact that there is variation in the potato sale prices every month on proper study of the market for the past few years, one can definitely take advantage of better prices in Rabbi crop for which they may require the use of cold storage for their potato crop.This will certainly add to their income from potato crop.

In Pune district as of 2013 there are 27 cold storages owned by different types of owner say: Govt. / Coop. and Private entrepreneurs.

Table 5.11: Cold Storage facilities in Pune District.

Sr. No.	Name of the Cold storage with location	Capacity In M.T.	Purpose
1	Aura Ice and Cold Storage, Bhosari, Pune	542	Multipurpose
2	Dairy Tops (Div. of Quality Frozen Foods) Pvt. Ltd. Bhosari Pune	214	Dairy products
3	Govt. Milk Supply Scheme Pune	305	Dairy Products
4	Mafco Cold Storage, New Market Yard, Gultekadi Pune	2674	Multi purpose
5	Mafco Factory, Gokhalenagar, Pune	426	Meat storage
6	Maharashtra Krishi Sheet Grihas, Manchar	2220	Multi purposes

Sr. No.	Name of the Cold storage with location	Capacity In M.T.	Purpose
7	Poona Dist. Coop. Milk Producers Federation, Katria Pune	350	Dairy products
8	Shivsantosh Dugdhalay, Pune	40	Dairy products
9	Sunrise Cold Storage, Bhosari Pune	2991	Multi purposes
10	Pune Grape Growers Coop. Soc. Pune	203	Grapes purpose
11	Kavare Ice ream Pune	16	Dairy products
12	Hande Farm Products Pvt. Ltd. Vadgaon Anand Tal. Junner Pune	192	Grapes
13	Riverdates Foods Ltd. Ozarde, Talegaon Dabhade Pune	322	Meat purpose
14	Abhinav Grape Growers Coop. Soc. Narayangaon Pune	85	Grapes
15	Vighnhar Grape Growers Ltd. Narayangaon Pune	42	Grapes
16	Jayashri Cold Storage, Pune Nashik Road, Pune	1480	Multi purposes

Source: Field Survey Data

There are few other 11 cold storages in Pune District but those are far away from the potato growing area. Of the 16 cold storages detailed herein above only 5 cold storages are multipurpose cold storages where potato can also be stored. The field survey revealed that these agriculturists from potato growing area also planning to have their own cooperative cold storage in the nearby area for keeping potato in cold storages and to obtain the benefit of higher price in times to come.

5.3.4 Arrival of the Potato in tonnes at Chakan Sub Centre of Khed Agricultural Produce Market Committee

The potato produced in Ambegaon and Khed talukas is marketed through Pune District's Agricultural Produce Market Committee's sub centre located at Chakan. Hence the researcher has also collected the data about the arrival of potato in

Chakan Sub Centre of Khed Agriculture Produce Market Committee. and the same has been presented hereunder monthwise for the study period.

Table 5.12 : Data relating to Arrival of the Potato in tonnes at Chakan Sub Centre of Khed. Agricultural Produce Market Committee

Sr. No.	Month	2008	2009	2010	2011	2012
1	Apr.	5815	4860	5565	8726	5974
2	May	5260	7395	7775	9278	9696
3	June	8985	5960	9090	10000	10480
4	July	7250	6495	9295	10700	10093
5	Aug.	8140	5715	8220	11308	11635
6	Sept.	7170	6685	10750	11535	11423
7	Oct.	9165	5870	14095	16788	14693
8	Nov.	5910	5625	5855	12704	10070
9	Dec.	7875	7410	6785	11171	14403
10	Rabbi –	27665	20290	21830	21390	18554
11	Feb.	21495	17090	25025	28396	28597
12	Mar.	5975	13275	30918	9709	13738
	Total	120705	106670	155203	161705	159356

Source: Field level data collected from A.P.M.C.

Observation

The data shown herein above also comprises the arrival of potato from other than Khed Taluka sources say: Talegaon, Himachal Pradesh, Jullunder, West Bengal, Uttar Pradesh etc. However, majority of the local potato producers are having potato supply contracts with the PepsiCo, Balaji Wafers, Haldiram, ITC, Siddhi Vinayak, Parle etc. This data is separately shown. It can be seen from the above table that during the months of January, February and March the arrival of potato in the market is sizable. It is because of the harvesting period. In respect of the period the stocks are held in the storage. Currently there is no cold storage facility available at Chakan market. Here it is also required to be mentioned that the potato which is not according to the specified size by the contracting agency is rejected and then it comes to the

local market and it is sold either in Chakan or in Pune A.P.M.C. It has been revealed that normal there is insignificant difference in the average rate of potato in Chakan and Pune Market. However, the price ranges as to when the produce is harvested. This can be seen from the following table which shows month wise variations in the rates.

5.3.5 Average rate per quintal of the Potato in Chakan Sub Centre of Khed. Agricultural Produce Market Committee

As stated in the earlier paragraph the potato produced in the identified Ambegaon and Khed taluka are mainly marketed through Chakan Sub Centre of Khed A.P.M.C. In order to find out the yield of potato in monetary terms it was considered appropriate to collect the data relating the price fetched by potato during the study period month wise. Hence the data on the market rate fetched at the said market has been collected and presented in the following table.

Table 5.13: Data relating to Average rate per quintal of the Potato in Chakan Sub Centre of Khed. Agricultural Produce Market Committee

Rupees per quintal

Sr. No.	Month	2008	2009	2010	2011	2012
Range of Rate →		300-600	600-1515	600--900	500-900	800-1550
1	Apr.	435	860	730	**900**	1200
2	May	490	970	710	850	1250
3	June	482	1105	685	800	1250
4	July	555	1215	635	750	**1550**
5	Aug.	521	1240	590	750	1500
6	Sept.	552	1415	725	750	1400
7	Oct.	541	**1440**	751	600	1200
8	Nov.	520	1515	895	600	1200
9	Dec.	450	1260	**905**	500	1200
10	Jan.	420	651	670	500	1200
11	Feb.	435	651	675	600	800
12	Mar.	**601**	605	750	900	1100
Average		**500**	1077	726	708	1237

Source: Field level data collected from A.P.M.C.

Observation

It can be observed from the above table that over the study period the rate of potato has moved from 300-900 to 500 – 1250. The average rate increased by 147.4% during the study period. The increase can be attributed to increased cost of input, labour and the profit margin.

Table 5.14: Data relating to Sale of Potato in rupees at Chakan Sub Centre of Khed. Agriculrural Produce Market Committee

Rupees in lakhs

Sr. No.	Month	2008	2009	2010	2011	2012
1	Apr.	25.26	41.76	40.63	78.53	20.75
2	May	25.66	71.68	55.01	74.87	13.41
3	June	43.27	65.68	62.16	78.25	13.27
4	July	40.18	78.86	58.84	80.37	14.36
5	Aug.	42.42	70.87	48.41	84.06	17.45
6	Sept.	39.56	94.51	77.78	89.58	16.29
7	Oct.	49.51	84.47	**105.81**	95.72	16.88
8	Nov.	30.64	85.05	52.43	73.75	12.43
9	Dec.	35.27	93.28	61.36	58.85	18.12
10	Jan.	**115.73**	132	14.57	**103.76**	19.27
11	Feb.	92.89	**111.17**	16.87	16.75	**25.49**
12	Mar.	35.93	80.15	17.76	74.41	13.26
	Total	**576.32**	**1009.48**	**611.63**	**908.9**	**200.98**
Sale of potatoes in M. Tonnes		1152.64	937.31	842.47	1283.76	162.47

Source: Field Survey Data from A.P.M.C.

Observation

The above data reveals that there is a good turnover of potato in Chakan market during the study period. There are ups and downs in the turnover of the potato in Chakan market. The F.Y. 2009-10 recorded highest turnover while the lowest turnover was in the F.Y. 2012-13. The low turnover can be attributed to the low production of potato because of the scanty rainy season during the year.

5.3.6 Procurement of the Potato in tones by the potato products manufacturing companies under purchase contracts in the study area i.e. Ambegaon & Khed Talukas.

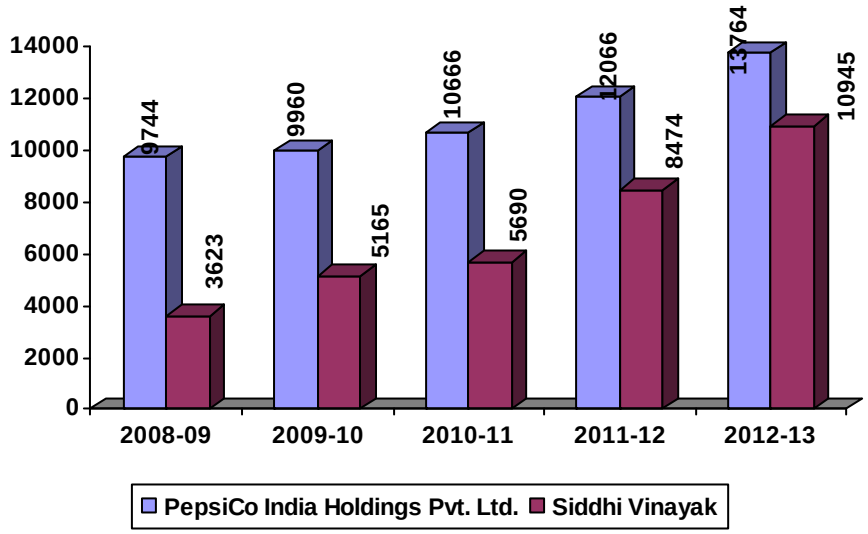
It has been already stated that majority of the production of potato in Ambegaon and Khed talukas is under contract farming which has a direct marketing linkage with the potato processing few multinational companies as well as few domestic companies. Since this potato crop does not come to the Chakan sub centre of Khed A.P.M.C. it was essential to collect the data on the purchases effected by the potato processors from the study area. Hence this data has been presented in the following table.

Table 5.15: Data relating to procurement of the Potato in tones by the potato products manufacturing companies under purchase contracts in the study area i.e. Ambegaon & Khed Talukas

Sr. No.	Name of the company contracting potato purchase	During the period covered by the study years				
		2008	**2009**	**2010**	**2011**	**2012**
1	PepsiCo India Holdings Pvt. Ltd.	9744	9960	10666	12066	13764
2	Siddhi Vinayak	3623	5165	5690	8474	10945
	Total	13367	15125	16356	20540	24709

Source: Field Survey Data obtained from contract farming companies.

Figure 5.79
Procurement of Potato under contract agreement by the Agri. Processing Companies from Ambegaon & Khed Talukas



Observation

It can be seen from the above table that there is a continuous growth in the procurement of potato by these companies under contract system. This entire production is from both the talukas i.e. Khed and Ambegaon.

The following agri. processing companies which are using Potato as a principle raw material and which are of good repute are not directly procuring potato from Khed and Ambegaon Talukas but apart from own requirement Siddhi Vinayak organization also supplies potato to these companies. The following table shows the procurement of potato by these companies which are purchasing it through Siddhi Vinayak.

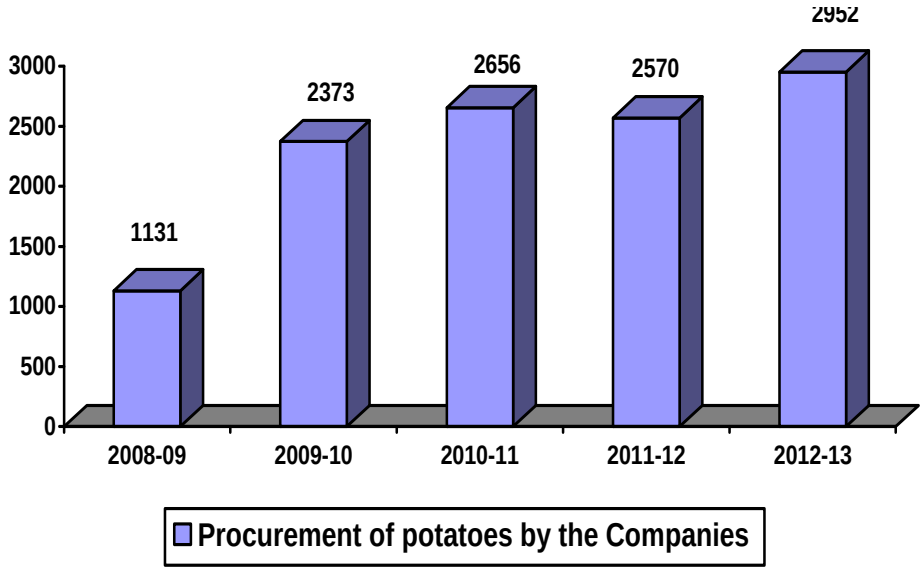
Table 5.16: Data relating to procurement of the Potato in tones by the potato products manufacturing companies through Siddhi Vinayak from Ambegaon & Khed Talukas (Quantity in M.T.)

Sr. No.	Month	F.Y. 2008	F.Y. 2009	F.Y. 2010	F.Y. 2011	F.Y. 2012
1	Balaji	360	789	857	932	1000
2	Indian Tobacco Co. Agri food Division.	321	853	931	850	931
3	Parle Products Agri food division.	450	731	868	788	1021
	Total	**1131**	**2373**	**2656**	**2570**	**2952**

Source: Field level data collected from the respective contract farming companies.

Figure 5.80

Procurement of potatoes by Potatoes Processing Companies during the study period from Ambegaon & Khed Talukas



Observation

It can be seen from the above table that over the study period there is a consistent growth in the procurement of potatoes by the potato food processing companies. From 1131 M.T. in the F.Y.2008-09 it shoot up to 2952 MT in 2012-13 means a rise of 161% increase which is quite sizable. Credit for this goes to the potato processing companies as they provide good quality seeds, technology and training input to the farmers as also provide forward linkage for marketing of the potatoes produced. The trend has continued further.

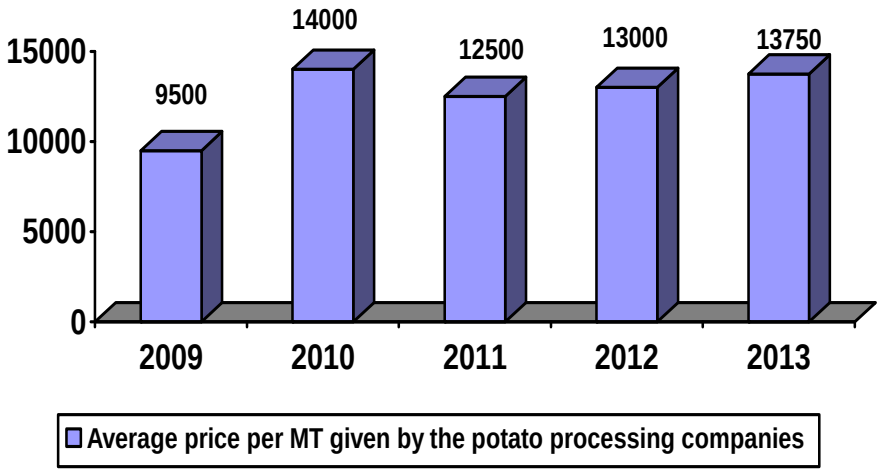
Table 5.17: Data relating to average prices Rs. per tone, offered by the following companies for the Potato procured

Sr. No.	Month	F.Y. 2008	F.Y. 2009	F.Y. 2010	F.Y. 2011	F.Y. 2012
1	Pepsi Co	9000	13500	12000	12000	13500
2	Siddhi Vinayak	10000	14500	13000	14000	14000
	Total	19000	28000	25000	26000	27500
	Average price p/MT	**9500**	**14000**	**12500**	**13000**	**13750**

Source: Field level data collected from the contracting companies

Figure 5.81

Average price per MT given by the Potato Processing Companies during the study period



Observation

From the above table and the graph there under it can be seen that the average potato prices are showing a rising trend barring exception of the year 2011 when there was a marginal fall in the rates. These companies enter into contract with the potato growers and they offer better rates than the market rates which is an incentive to the potato growers.

5.4 COSTING OF POTATO CROP

Although the official measurement of the agricultural land is in terms of Hectare and Are, the agriculturists are using the measurement in Acres. Since they are comfortable in using this measurement we have in order to have dependable data used per acre cost calculation. So also both the Talukas under study namely Ambegaon and Khed are adjacent to each other it has been observed that there is no variation in the cost of cultivation as well as market prices . At Manchar market potato seeds dominate while the Rabbi potato is marketed either at Chakan, Pune or Navi Mumbai. At Manchar there is a provision of Cold storage for storage of potato seeds and hence for both Kharif and Rabbi Season potato seeds are purchased from Manchar.

Usually most of the agriculturists do not maintain written accounts and further they do not preserve it properly, they have during the course of administering the

questionnaire they were relying on their memory for giving the data. Since majority of the agriculturists had with them bills for seeds/fertilizers/pesticides and were remembering it for the latest season the researcher has for the purpose of better accuracy worked out the detailed costing exercise for the period 2011-12. For the earlier period the data base of few agriculturists who were educated and maintaining accounts and preserving those, have been taken as a base and then after averaging these costs have been arrived. Same is the principle applied for working out the potato production. So far as the market rates are concerned the rates records maintained by the contracting companies as well as Agricultural Produce Market Committees have been taken for working out the sale proceeds. These rates also change month to month and hence the twelve months average rate has been taken for calculating the sale of potatoes. Incidence of interest is 0% as 3% State Subsidy and 3% Central Subsidy is available to the farmers who are repaying within the prescribed period.

5.5 STAGES IN BRIEF INVOLVED IN THE POTATO CULTIVATION PRE TILLAGE OPERATIONS

The tillage operation that is done after the harvest of crop to bring the land under cultivation is known as primary tillage. Ploughing is the opening of the compact soil with the help of different ploughs. Primary tillage is done mainly to open the hard soil and to separate the top soil from lower layers and to uprooting of weeds also. Potato is a crop whose growing season is short and whose planting time is restricted. A speedy agricultural operation is a basic need to ensure success. There are various implements used for primary tillage which include country plough, (traditional plough), mould board plough, Disc plough, tractor, power tiller etc.

Now a day the power tiller is generally used for ploughing, harrowing, paddling and pumping of water. It makes the soil pulverized very well and buried the weeds completely.

Secondary tillage

Secondary tillage is taken up only when the primary tillage is complete. It includes lighter or finer operation which is done to clean the soil, break the clods and

incorporate the manures and fertilizers. Harrowing is used mainly for making the soil lose and friable.

Cultivator

It is one of the most useful implement used for secondary tillage of potato field. It may also be used for primary tillage, cultivation and weeding purposes soon after the emergence of the plant.

Besides this, spade, Khurpi, Nirani etc. are also used for secondary.

After tillage operation

This is also known as inter cultivation. It includes harrowing, hoeing, weeding, earthing up, drilling or side dressing of fertilizer etc.

Selection of seeds

Seeds is the base on which the foundation of potato farming has to be laid. Compared to all other agricultural crops the importance of good seed is of the highest importance in the cultivation of potatoes.

Potato is an asexually propagated crop and it is propagated from tubers which are commonly spoken of as seed. Pure and healthy seed is the basic requirement for the crop. Seed is one of the major inputs in potato production. Preservation of the potato seeds is also required specific conditions like cold storage. In the study area major portion of the seed is being supplied by the companies which have entered into the tie up arrangements.

Potato tubers are living entities which high rate of metabolism and they do not keep well under prolonged storage unless special precautions are taken. Potatoes are susceptible to three main types of deterioration in storage: shrinkage, rot and sprouting.

The cultivators use the whole or cut seed tuber under varying situation of culture. The whole tubers are preferable too cut tubers for early planting as the cut seeds potatoes are liable to rot easily due to high temperature and high soil moisture.

Seed Treatment

Seed potatoes act as a marginal for transmission of some disease. Tubers showing any surface borne diseases like scabs, wart, nematode infection or effect of rot caused by fungi and bacteria should be sorted out and destroyed. The seed rate varies from 15-20 quintals per hectare.

The seed rate depends on the size of seed and method of planting i.e inter and intra-row spacing.

Manuring

Manuring substances are in the nature of organic nature and they supply plant nutrients in available forms. Organic manures act as efficient soil amenders and are of vital importance for the underground tuber growth. Organic manures improves the physical condition of soil. Farm yard Manure(F.Y.M.) is a mixture of solid and liquid excreta of farm animals along with litter and left over materials from roughages or fodder fed to the cattle.

Fertilizers

Fertilizers are inorganic materials which can supply plant nutrients in available from having the high analytical value and having a definite composition and mostly are industrial products.

Potato crop is a heavy feeder and hence potato requires heavy manuring. In addition to compost or F.Y.M. potato needs large amount of nitrogen, phosphorus and potassium for its good growth. The soil type, soil fertility, crop rotation, variety and soil moisture are to be taken into account while fixing the optimum doses of fertilizers.

Intercultural Operations

The main object of the intercultural is to destroy weeds, keep the soil loose and cover the tubers with soil. Hoeing is done for breaking the hard soil crust which is formed due to rains or irrigation after planting but before germination is completed. Weeding or earthing up help in checking the weeds. Potato is heavily infested with weeds because of liberal application of fertilizers and wider spacing which encourages the luxuriant growth of weeds.

Irrigation

Potato is cultivated as a rain fed as well as irrigated crop. Water forms nearly 80 percent of the potato tubers. Potato is a short duration crop which produces large foliage and bulks up rapidly. The potato has a sparse and shallow root system. Nearly 70 per cent of total water is used by the crop from the upper 30 cm. soil layer and deeper soil layers contribute less and less to water supply.

Plant Protection

The potato is prone to various diseases and pests. The proper plant protection measures need to be undertaken. These measures are required to be taken to maintain healthy growth of the crop. Spraying of insecticide and fungicides should be combined to save time as well as cost on spraying. While spraying it should be ensured that all parts of the plant including the lower surface of the foliage are completely covered with spray solution.

Actual average cost of cultivation per Ha. arrived at after the field study of both Ambegaon and Khed Taluka is as under

Although the agriculturists are using in their day to day working acre as a measurement of land, in the government records it is used in the form of decimal measurements i.e. in terms of Hectare and Are. The Pune District Central Coop Bank’s Agriculture Finance Policy Book let also refers to Ha as a measurement hence the costing data obtained from the agriculturists has been appropriately converted into Ha.

Table 5.18: Cost of cultivation of Potato for Kharif Season for 2011-12

Sr. No.	Name of the operation #	Date when it is to be performed	No. of man days required for 1 acre cultivation	Expenditure in Rs.
1	Pre tillage operation: Ploughing Ploughing Labour Harrowing Sari bandhane Bullock pair Spreading of F.M.Y.	During May –early June	 1 1 2 1 x 600 1 3 L x 200	 1300 600 500 600
2	Plantation 5 female		**5 x 100**	**500**
3	Spread of Chemical fertilizers		**2 x 100**	**200**
4	Four times Spraying of pesticides		3 L x 200	600
5	Weeding operation. 3 L x days x 2 times		6 x 100	600
6	Harvesting 4 L x 1.5 day Bullock pair		 4 x 150 1 day	 600 500
7	Labour for storage of produce 2 L x 2 days		2 x 100	200
8	Packing baggage Gunny bags 80 bags		80 bags x 20 /b	1600
9	Seeds		16000	16000
10	FYM & Chemical Fertilizers		6000	6000
11	Pesticides		3500	3500
12	Transportation to the market		80 x 10	800
	Total			**34100**
	Average production of potato per acre 5040 Kg.	Average rate Rs.13.15/kg.		**66276**
	Surplus remained per acre			**32176**

Source: Field survey data

(Each Agri operation – harrowing, weeding, watering, harvesting/ packing etc./ seeds/water charges/ fertilizers, Manures, FYM, Packing material

Incidence of interest as a cost has not been accounted as the farmers get interest @ 0%.

The above working includes the total labour cost of Rs.3000. Of this partial labour contribution (usually accounting 75% i.e. for Rs.2250 is made by the potato grower's family. In addition to this because of the residual effect of the fertilizers applied the subsequent jawar / wheat crop cultivated on the same land does not require fertilizer input and to that extent there is saving on this score. This can be safely assumed a saving of Rs. 2000/-. Thus the average net earnings per acre of Kharif potato crop works out as follows:

Sale proceeds of potato:	Rs. 32176
Saving on account of captive labour used	Rs. 2250
Rs. Residual effect of fertilizers	Rs. 2000
	_____
	Rs. 36426
	=========

Table 5.19 : Consolidated position of the profitability per acre of potato crop in Kharif season in the identified study area during the study period

Sr. No.	Year	Production of potato in MT.	Price /Rate for potato in Rs. per Kg.	Cost of cultivation in Rs.	Profit Surplus Rs.
1	2007	5.00	10.00	23070	26930
2	2008	5.12	9.00	24800	21280
3	2009	5.12	14.00	26350	45330
4	2010	4.96	12.50	28150	33850
5	2011	5.04	13.00	29150	36370
6	2012	5.20	13.75	32500	39000

Source: Field survey data

Table 5.20: Comparative cost of cultivation of potato during the study period during Kharif season

(Combined for Khed & Ambegaon Taluka) In Rs.

Sr. No.	**Operation**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
1	Pre tillage	1520	1700	1750	1850	2150	2400
2	Labour cost	1550	1700	1900	2000	2300	2500
3	Seed cost	12000	12800	13600	14400	14800	16000
4	Fertilizers	4400	4700	5000	5300	5300	6000
5	Pesticides	2500	2700	2800	3200	3200	4000
6	Packing & forwarding	1100	1200	1300	1400	1400	1600
	Total	**23070**	**24800**	**26350**	**28150**	**29150**	**32500**
7	Scale of finance p.a.	16000	16000	26000	26000	26000	26000
8	Production of potato per acre in MT	5.00	5.12	5.12	4.96	5.04	5.20
9	Average price fetched per Kg. *	10.00	9.00	14.00	12.50	13.00	13.75
10	**Sale proceeds of potato**	**50000**	**46080**	**71680**	**62000**	**65520**	**71500**
	Surplus p.a.	**26930**	**21280**	**45330**	**33850**	**36370****	**39000**

Source: Field Survey Data

Figure 5.82

Comparative cost of cultivation of Potato in Kharif season during the study period

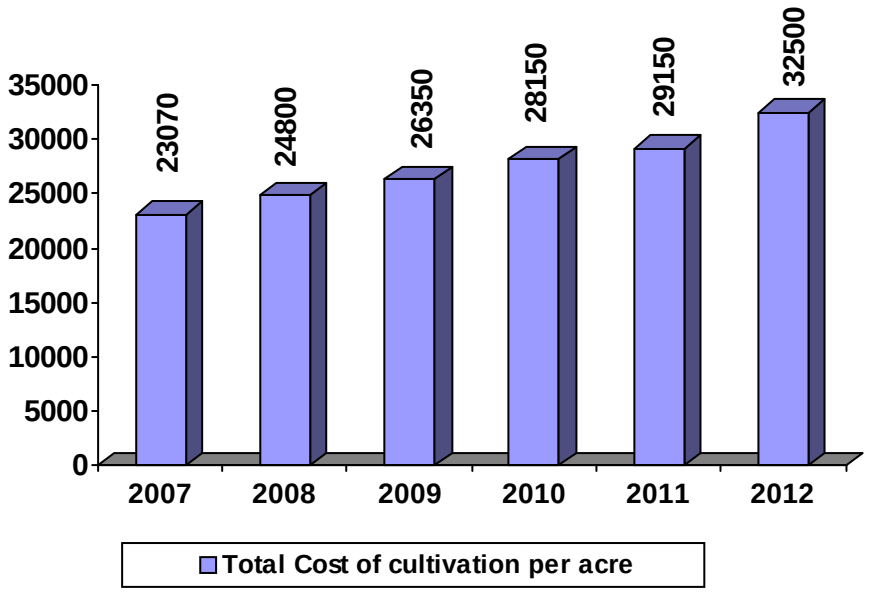


Table 5.21: Cost of cultivation of Potato for Kharif Season

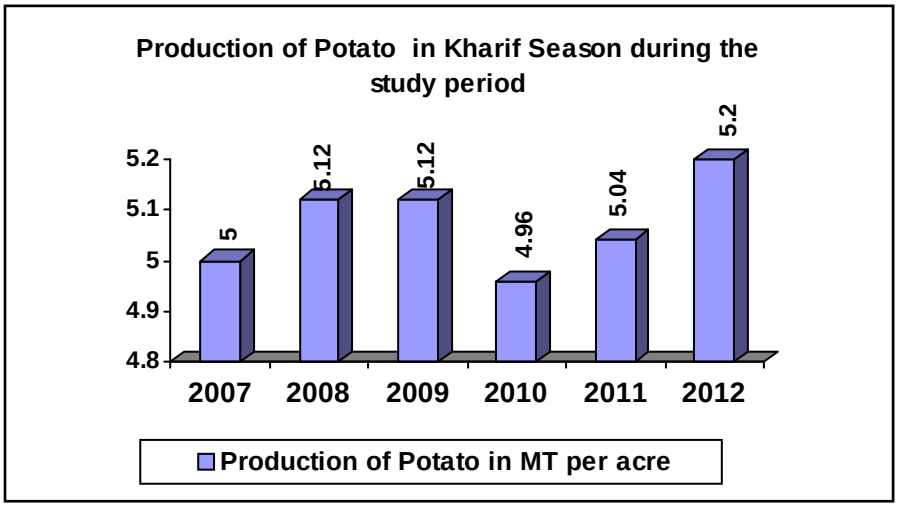
Sr. No.	Operation	2007	% to total cost	2012	% to total cost	Variation in % over 2007
1	Pre tillage	1520	6.58	2400	7.38	+ 0.8
2	Labour cost	1550	6.68	2500	7.69	+ 1.01
3	Seed cost	12000	52.01	16000	49.24	- 2.77
4	Fertilizers	4400	19.09	6000	18.47	- 0.62
5	Pesticides	2500	10.86	4000	12.30	+ 1.44
6	Packing & forwarding	1100	4.78	1600	4.92	- 0.14
	Total Cost	**23070**	**100.00**	**32500**	**100.00**	

Source: field survey data

There is marginal variation in the cost items during the study period.

It can be observed from the above table and the graph that there is a marginal annual increase in the cost of cultivation during the study period.

Figure 5.83



It can be observed from the captioned graph that there is a variation in the production of potato during the study period. During the year 2010 because of scanty monsoon there was adverse impact on the production of potatoes.

Table 5.22: Cost of cultivation of Potato for Rabbi Season for 2011-12

Sr. No.	Name of the operation #	No. of man days required for 1 acre cultivation	Expenditure in Rs.
1	Pre tillage operation: (During May –early June) Ploughing Ploughing Labour Harrowing Sari bandhane Bullock pair Spreading of F.M.Y.	 1 1 2 1 x 500 1 3 L x 200	 1300 500 500 600
2	Plantation	**5 x 100**	**500**
3	Spread of Chemical fertilizers	**2 x 100**	**200**
4	Four times Spraying of pesticides	4 x 150	600
5	Weeding operation. 3 L x 1 day x 2 times	**6 x 100**	**600**
6	Harvesting 4 L x 1.5 day Bullock pair	 4 x 150 1 day	 600 500
7	Labour for storage of produce 1 L x 2 days	2 x 100	200

Sr. No.	Name of the operation #	No. of man days required for 1 acre cultivation	Expenditure in Rs.
8	Packing baggage Gunny bags 80 bags	82 bags x 19.52 /b	1600
9	Seeds		12800
10	FYM & Chemical Fertilizers	6000	6000
11	Pesticides	3500	3500
12	Transportation to the market	80 bags x 10	800
	Total		**34000**
	Average production of potato per acre 5200 Kg.	Average rate Rs.12 p/KG	**62400**
	Surplus remained per acre		**28400**

Source: Field survey data

(Each Agri operation – harrowing, weeding, watering, harvesting/ packing etc. / seeds/water charges/ fertilizers, Manures, FYM, Packing material

Incidence of interest as a cost has not been accounted as the farmers get interest @ 0%.

The above working includes the total labour cost of Rs.7700. Of this partial labour contribution (usually accounting 75% i.e. for Rs.5775 is made by the potato grower's family. Thus the average net earnings per acre of Kharif potato crop works out as follows:

Sale proceeds of potato:	Rs.	28400
Saving on account of captive labour used	Rs.	3000*
Net surplus available from potato crop	**Rs.**	**31400**

***** Accounted partial use of capital labour

The research has on the basis of the field survey data which was cross checked with the data obtained from Agricultural Produce Market Committee, the major financing bank i.e. Pune District Central Coop. Bank Ltd. worked out the cost statement of the broad items of expenditure as well as the yield in MT and the production of the potatoes per acre. This helps in identifying as to how the profitability of cultivation of potato has fared during the study period.

Table 5.23 : Consolidated position of the profitability per acre of potato crop in Rabbi season in the identified study area during the study period

Sr. No.	Year	Production of potato in MT.	Price /Rate for potato in Rs. per Kg.	Cost of cultivation in Rs.	Profit Surplus Rs.
1	2007	5.04	5.20	15070	11138
2	2008	5.20	5.00	15760	10000
3	2009	5.30	10.77	21450	35631
4	2010	5.44	7.26	19250	20244
5	2011	5.36	7.08	20250	17698
6	2012	5.20	12.37	27100	37224

Source: Field survey data

Table 5.24: Comparative cost of cultivation of potato during the study period during Rabbi Season (In Rs.)
(combined for Khed & Ambegaon Taluka)

Sr. No.	**Operation**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
1	Pre tillage	1520	1700	1750	1850	2150	2400
2	Labour cost	1350	1500	1700	1800	2100	2300
3	Seed cost	5600	5760	10400	7200	7200	12000
4	Fertilizers	3700	3600	4100	4400	4600	5600
5	Pesticides	1800	2000	2200	2600	2800	3200
6	Packing & forwarding	1100	1200	1300	1400	1400	1600
	Total Cost	**15070**	**15760**	**21450**	**19250**	**20250**	**27100**
7	Scale of finance p.a.	16000	16000	26000	26000	26000	26000
8	Production of potato per acre in M.T.	5.04	5.20	5.30	5.44	5.36	5.20
9	Average price fetched per Kg. *	5.20	5.00	10.77	7.26	7.08	12.37
10	**Sale proceeds of potato**	**26208**	**26000**	**57081**	**39494**	**37948**	**64324**
11	**Surplus p.a.**	**11138**	**10000**	**35631**	**20244**	**17698**	**37224**

Source: Field Survey Data

@ As the cost of cultivation were more or less the same both are combined in this chart.

- The rate per Kg. has been arrived at as average price for the entire year fetched in Chakan market. Usually the Contracting Companies do not procure potato in Rabbi Season and hence the rates are relatively low.

Figure 5.84
Production of Potato in MT Rabi Season during the study period

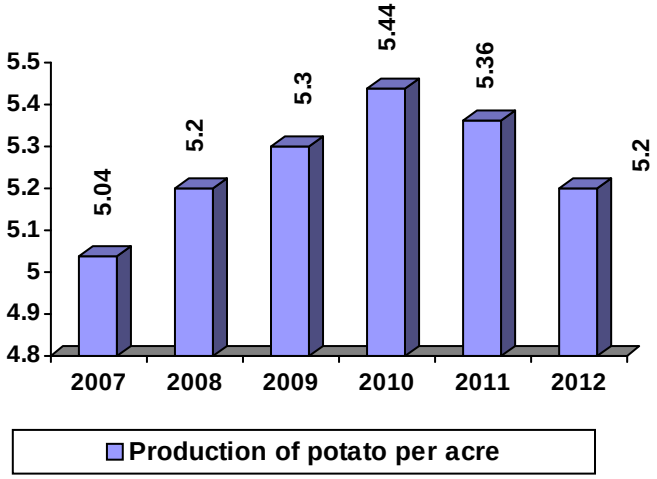
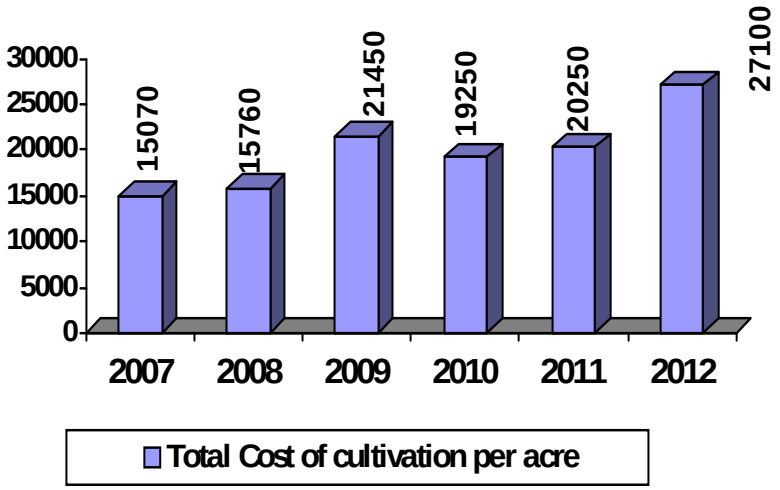


Figure 5.85
Comparative cost of cultivation of Potato in rabi season during the study period



The above working includes the total labour cost of Rs.7700. Of this partial labour contribution (usually accounting 75% i.e. for Rs.5775 is made by the potato grower's family. Thus the average net earnings per acre of Kharif potato crop works out as follows:

Sale proceeds of potato:	Rs.	28400
Saving on account of captive labour used	Rs.	3000*
Net surplus available from potato crop	**Rs.**	**31400**

***** Accounted partial use of capital labour

It can be seen from the above table and the graphs which show the comparison of the cost of cultivation of the potato crop in Rabbi season that compared to the cost of cultivation of Kharif crop the cost of cultivation in Rabbi crop is marginally less mainly on three counts: seeds costs, fertilizers cost and cost of labour. Due to change in weather the Kharif seeds (PepsiCo1533, ATL, SV3 etc.) which are provided by the contracting companies is not suitable for the Rabbi season. This variety of potato is specifically used for Wafers, French Fries, Lays, and Kurkure etc. (which are the products of these Potato Processing Companies). Therefore, the potato growers in Rabbi season have to shift to other seeds which are purely for domestic vegetable purposes. Since the contracting companies do not procure potato during Rabbi season the potato growers use different seeds like Super Jyoti, Khufri Sadabahar, Pushkaraj, Khufri Badshah, Khufri Chandramukhi, etc. which are relatively cheaper than the seeds provided by the contracting companies. So also because of the climatic change weeding operation is reduced resulting in saving in labour costs, even fertilizer doses are also reduced.

The Rabbi production is usually sold in the local Chakan market and is used for domestic consumption for vegetables. The rates are also varying but are usually lower than the contracted rates that are available to the growers from the contracted companies. Production of potato per acre is slightly higher compared to Kharif season. In view of this situation even the area under potato crop is also reduced during Rabbi Season.

Table 5.25: Percentage increase in the cost of cultivation between 2007 to 2012 (Rabbi Season)

Sr. No.	Operation	2007	% to total cost	2012	% to total cost	Variation in % over 2007
1	Pre tillage	1520	10.08	2400	8.86	- 1.22
2	Labour cost	1350	8.96	2300	8.49	- 0.47
3	Seed cost	5600	37.16	12000	44.28	+ 7.12
4	Fertilizers	3700	24.55	5600	20.66	- 3.89
5	Pesticides	1800	11.94	3200	11.80	- 0.14
6	Packing & forwarding	1100	7.31	1600	5.91	- 1.4
	Total Cost	**15070**	**100.00**	**27100**	**100.00**	

Source: Field survey data

Although apparently it is observed that the rate of return on potato crop is less, it is not correct. In fact the labour cost which has been accounted in the costing exercise is from the captive labour available in the family. This availability of assured labour opportunity is also need to be taken into account. Further the fertilizer cost is also met through the captive farm yard manure available in the family which also adds to the rate of return.

In order to get higher return now a days the farmers who are cultivating potato are selecting best quality potato produced in their land and are using it as seed thereby reducing the cost of seeds. Of course for this also they get guidance from the potato products manufacturing companies.

Apart from the above consideration, one has to pay attention to the fact that with the cultivation of the potato crop which is of only 90 days duration, the cultivator can take multiple crops on the same land. Usually after the Kharif harvesting of potato the cultivator takes wheat crop and after Rabbi harvesting the cultivator takes bajara or maize.

There is one more consideration to which the farmer gives weightage is that there is forward assured marketing linkage available through the potato processing companies which are on increase in the vicinity of potato growing area. More over unlike the sugar cane crop where the sugarcane grower has to wait for months together for getting the proceeds of the sugarcane, the potato grower gets the proceeds within week’s time.

It can be observed that during the study period from the year 2007 to 2012 there was substantial increase of 7.12% in respect of the seeds prices while the rest of the items of expenditure have shown marginally decrease. In regard to the cost of fertilizers is concerned upon inquiry it was transpired that the potato growers have now started using more Farm Yard Manure (F.Y.M.)

Correlation Analysis for Khed and Ambegaon Taluka For Khed Taluka

	Purchasing the new farm	Pre-tillage	Second part of pre-tillage	fund utilization for compose	Purchase of fertilizer	Pesticide	Crop vaccination	Fencing	For irrigation, piping ,	Agricu
Purchasing	1									
Pre-tillage	0.123163	1								
Second par	0.176546	0.719991	1							
fund utiliza	0.154166	0.645642	0.703052	1						
Purchase o	0.134725	0.455375	0.583126	0.656912	1					
Pesticide	0.113393	0.463955	0.499853	0.596866	0.597071	1				
Crop vaccir	0.035183	0.448505	0.457995	0.534538	0.443323	0.603401	1			
Fencing	0.046634	0.511131	0.601883	0.586875	0.599737	0.612199	0.601693	1		
For irrigatic	-0.04421	-0.33951	-0.28712	-0.25646	-0.29347	-0.31384	-0.13866	-0.35658	1	
Agriculture	-0.0144	0.38311	0.30094	0.355722	0.420898	0.380246	0.323363	0.487184	-0.22026	1

From Ambegaon Taluka

	Purchasing the new farm	Pre-tillage	Second part of pre-tillage	fund utilization for compose	Purchase of fertilizer	pesticide	Crop vaccination	Fencing	For irrigation, piping , s	Agricu
Purchasing	1									
Pre-tillage	0.096775	1								
Second par	0.147876	0.577131	1							
fund utiliza	0.137805	0.349123	0.542558	1						
Purchase o	0.069091	0.571455	0.583126	0.40491	1					
Pesticide	-0.0533	0.420085	0.377369	0.310184	0.499958	1				
Crop vaccir	0.161951	0.51146	0.49173	0.357361	0.461682	0.376134	1			
Fencing	0.09146	0.600717	0.612104	0.382088	0.612067	0.493341	0.612088	1		
For irrigatic	-0.13956	-0.29554	-0.34733	-0.24241	-0.31428	-0.30838	-0.35289	-0.42083	1	
Agriculture	-0.10335	0.379671	0.298799	0.192111	0.408713	0.401919	0.234059	0.522911	-0.10199	1

From the correlation analysis, it observed that purchasing the land, pre-tillage, pesticide and fencing are correlated to each other while others are not.

5.6 COST BENEFIT RATIO

From the above data the cost benefit ratio in terms of percentage for the year 2007 works out to 16.77% and for the year 2012 it is 20%. Now the question will

come as to how the farmer operates at such a low rate of return. The answer lies in the fact that for pre-tillage operations, for weeding operations and the other labour input that has been shown in the cost table comes from the captive source. Now a day the farmers are shifting to the use of farm yard manure which is captively available with them. So also the cultivation of potato provides assured labour opportunity to the farmer and hence he cultivates potato. The overall monetary gain is quite adequate. Moreover after this potato farming the farmer can take multiple crops i.e. for Kharif season the farmer can take wheat crop after harvesting the potato crop and in the Rabbi season the farmer takes Bajara / Maize etc. on the same land.

5.7 HYPOTHESIS TESTING

1) **Introduction**

In formal hypothesis testing, it customary to produce two hypotheses, called H0 (known as the "null hypothesis") and H1 (known as the "alternative hypothesis"). In fact, these two are always given as opposites to each other. The two hypotheses might be stated as:

Null Hypothesis (H0) : Over the years the production of potato in Pune District has no shown growing tendency.

Alternative Hypothesis (H1) : Over the years the production of potato in Pune District has shown growing tendency.

The testing aims to ensure that what is recognized is only what is contained in the data collection. When we test the hypotheses, we can never be 100% certain of our conclusions. We can only be confident to a certain level - hopefully a high one. Typically we construct our test so that we will be 95% certain that the conclusion we draw is a correct one. This is called a 95% confidence level, or a 5% significance level. If the hypothesized value for the effect (e.g. zero) lies outside the 95% confidence interval than we believe the hypothesized value is implausible and would reject H0. The study tests the following hypothesis:

Hypothesis # 1

Null Hypothesis (H0) : Over the years the production of potato in Pune District has not shown growing tendency.

Alternative Hypothesis (H1) : Over the years the production of potato in Pune District has shown growing tendency.

From the field level data collected and showed in data analysis part, it has been established that over the years the production of potato in Pune district has been increased. In the year 2008 in Kharif season the area under potato cultivation in the study area was 7967 acres which rose to 11627 acres in the year 2010. The trend is further continued as there is more demand from the potato processing companies both multinationals as well as domestic companies. Over the years the status of potato has been raised from mere vegetable to commonly used food in different forms. This has created higher demand for the potatoes and it will continue to increase. Naturally it will have its impact on the increase in the coverage of acreage of potato crop.

ANOVAs Test for growth of potato crops during 5 years

ANOVAs: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	90	1076922	11965.8	44183052		
Column 2	90	745336	8281.511111	7379318		
Column 3	90	911052	10122.8	20939954		
Column 4	90	736365	8181.833333	10938189		
Column 5	90	840943	9343.811111	12702867		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Between Groups	871505864.1	4	217876466	11.33081	9.15248E-09	2.391982
Within Groups	8556760898	445	19228676.17			
Total	9428266762	449				

If F > F critical, we reject the null hypothesis. This is the case, 11.33081 > 2.391982. Therefore, we reject the null hypothesis. The means of the five year data presentations are not all equal. At least one of the means is different. However, the ANOVA does not tell you where the difference lies.

Thus the hypothesis No. 1 has been fully substantiated.

Hypothesis # 2:

Null Hypothesis (H0) : The banks are not providing the requisite finance for cultivation of potato crop.

Alternative Hypothesis (H1): The banks are providing the requisite finance for cultivation of potato crop.

During the field study carried out in the identified talukas it was revealed that the potato crop cultivation financing is undertaken principally by the Pune District Central Cooperative Bank which has its net work in the identified area. This bank is providing adequate bank finance for raising the potato crop. Every year the scale of financing is being studied and revised at the District level by a committee which has representation of NABARD, RBI- Rural Planning and Credit Dept., Agriculture Officers from various financing banks, Agri. University Representative, State Govt.'s District Agriculture Officer and the representatives of agriculturists who are raising various crops to be financed in the district. It has been observed that during the study period Pune District Central Cooperative Bank has appropriately increased the scale of finance adequately. These year wise scales are given in the chapter V.

The other public sector as well as private sector banks which are operating in the identified area is slightly shy of financing for potato crop but they are not averse of financing it. Their stake is slightly less.

These banks also follow the same scale of finance that is decided by the Pune District Central Coop. Bank.

ANOVAs: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
0	99	559289	5649.384	4508416		
7500	99	632296	6386.828	1688551		
7000	99	690634	6976.101	1423202		
10000	99	884178	8931.091	10726587		
17000	98	1481107	15113.34	30063100		
18000	99	2070738	20916.55	3.78E+08		

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Between Groups	1.83E+10	5	3.66E+09	51.38565	3.43E-44	2.229374
Within Groups	4.18E+10	587	71190070			
Total	6.01E+10	592				

If F > F critical, we reject the null hypothesis. This is the case, 51.38565 > 2.229374. Therefore, we reject the null hypothesis. The means of the five year data presentations are not all equal. At least one of the means is different. However, the ANOVA does not tell you where the difference lies.

Thus it is crystal clear that there is no credit gap so far as financing of potato crop and that the Hypothesis No.2 i.e. the banks are providing finance for potato crop stands fully validated

Hypothesis # 3

Null Hypothesis (H0) : The cost of cultivation has not gone up due to added input costs such as seeds, fertilizers etc.

Alternative Hypothesis (H1): The cost of cultivation has gone up due to added input costs such as seeds, fertilizers etc.

The data presented in the Chapter V on Analysis and Interpretation of the data clearly indicates that there is a phenomenal increase in the cost of production of potato crop during the study period for the Kharif and Rabbi seasons. During the first year of the study the cost of production of potato in Kharif and Rabbi seasons was Rs. 23070 per acre which increased to Rs.32500 during the last year. This is mainly due to increase in the input costs like seed cost, fertilizer costs, cost of transport etc. Similar is the position that the cost of cultivation in the Rabbi season has also been increased during the study period.

ANOVAs: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	90	2234245	24824.94	2.03E+08		
Column 2	90	847792	9419.911	10959299		
Column 3	90	2561211	28457.9	1.41E+08		
Column 4	90	673773	7486.367	7847672		
Column 5	90	3111430	34571.44	2.49E+08		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Between Groups	5.14E+10	4	1.29E+10	104.9331	6.94E-63	2.391982
Within Groups	5.45E+10	445	1.22E+08			
Total	1.06E+11	449				

If F > F critical, we reject the null hypothesis. This is the case, 104.9331 > 2.391982. Therefore, we reject the null hypothesis. The means of the five year data presentations are not all equal. At least one of the means is different. However, the ANOVA does not tell you where the difference lies.

Thus it is proved that during the study period that the cost of cultivation of potato crop has been increased due to the cost of input, has been proved fully.

Hypothesis # 4

Null Hypothesis (H0): Per Ha Surplus generation of potato crop as a result of forward marketing linkage has not induced the farmers for potato cultivation.

Alternative Hypothesis (H1): Per Ha. Surplus generation of potato crop as a result of forward marketing various crops to be financed in the district. It has been observed that during the study period Pune District Central Cooperative Bank has appropriately increased the scale of finance adequately. These year wise scales are given in the chapter V.

The other public sector as well as private sector banks which are operating in the identified area is slightly shy of financing for potato crop but they are not averse of financing it. Their stake is slightly less. These banks also follow the same scale of finance that is decided by the Pune District Central Coop. Bank.

ANOVAs: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	90	107380	1193.111	462987		
Column 2	90	54056	600.6222	48942.26		
Column 3	90	72236	802.6222	67217.27		
Column 4	90	29592	328.8	15450.61		
Column 5	90	106859	1187.322	186633.4		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Between Groups	50743117	4	12685779	81.19101	1.0536E-51	2.391982
Within Groups	69529521	445	156246.1			
Total	1.2E+08	449				

If F > F critical, we reject the null hypothesis. This is the case, 81.19101 > 2.391982. Therefore, we reject the null hypothesis. The means of the five year data presentations are not all equal. At least one of the means is different. However, the ANOVA does not tell you where the difference lies.

Thus it can safely be concluded that the Hypothesis No.4 stands fully substantiated.

We have already seen that the potato crop is cultivate in both Kharif and Rabbi seasons. In the identified talukas also this potato crop is taken in both the seasons. The area under cultivation, the yield as well as the prices varies from season to season (Kharif and Rabi) the researcher considered it appropriate to obtain the data on the area under potato crop on the basis of the seasons. This data was available for the Pune district as a whole and as the Ambegaon and Khed taluksa are the leading potato cultivators the data is indicative of the season wise cultivation.

Interaction with the progressive agriculturists from both the Talukas i.e. Ambegaon and Khed it has been revealed that over the years the area under potato crop is increasing. Particularly the major increase is in Kharif potato crop. It has been stated by these agriculturists that those agriculturists who own Mal ran (baron land / padik ran) are now bringing it under Kharif potato cultivation as there is assured forward recovery linkage.

This increase in area under Kharif crop is also increasing due to the encouragement given by the Potato products manufacturers (PepsiCo / ITC/Balaji Siddhi Vinayak etc.) for cultivation of Kharif crop. Interaction with these company's purchase officers has revealed that when these companies started procurement for the first time, the area under was below 100 acres and not over a period of time the area under Kharif crop has now reached about 3000 acres details of which have been provided in this chapter separately.

CHAPTER – VI
OBSERVATIONS, SUGGESTIONS AND CONCLUSION

6.1 INTRODUCTION

The researcher has dealt in greater details the costing of the potato crop for both the Kharif and rabbi seasons for the identified study area. Every year there are changes in the costs of cultivation because of the changes in the prices of the inputs such as seeds, manures, fertilizers, insecticides and pesticides, transport charges so and so forth. This is mainly due to inflationary tendency of the economy. Therefore, even the banks while deciding the scale of finance for various crops the District Central Bank of the district in consultation with other banks who are having major role in the financing of agriculture sector, as well as other agencies which are involved in the growth of agriculture sector decide the Scales of Finance for various crops as well as other activities covered by the agriculture. This is followed by all the banks in the concerned district. While deciding the scale of finance this committee at the district level take into account the average yield of each crop and the current level of the prices of the various input.

Based on the actual survey of the identified study area the researcher has presented the data with the help of tables and using statistical tools like ratios, graphs etc. The researcher has also recorded in brief interpretation of the data in the said chapter No. V.

In order to enumerate in detail the researcher has brought out hereunder his observations in detail which will be helpful in deciding the cropping pattern in the study area.

On carefully analyzing the data the researcher has drawn various inferences which have been brought out hereunder in a summarized form.

6.2 OBSERVATIONS

1) It has been seen from the statistical data that the farmers in the identified Ambegaon and Khed talukas are gradually increasing their area under potato crop. This is because of the support and the assured price offered by the multinational and domestic companies engaged in the manufacture of wafers, chipps, kurkure, layers etc. and other potato products like potato powder under various brand names which is used in vegetable food production.

2) It has been observed that during the monsoon as there is no proper drainage in the black cotton soil the area under the potato crop is relatively less. Excessive water is not tolerable in potato as it starts sprouting. During the winter season the climate is conducive for cultivation of potato crop. The yield is also relatively more than the Kharif yield. During the winter season there is less attack of pests and insects. So also the rate fetched by the potato during the winter season is higher as has been seen from the relative table given in the Chapter V. During the winter season the harvesting of potato crop is bit easier as there is dry climate and there is no obstruction due to rain in harvesting work. Therefore, the area under potato crop is larger in the Rabbi Season than in the Kharif season.

3) As stated in the Chapter V, the potato crop also requires adequate water for its growth. The area under study has number of dug wells and so also the area has been bestowed with canal and lift irrigations. Therefore the area under potato cultivation is increasing fast. It is a cash crop with a small period of about 3 to 4 months within which it is harvested. Even the agriculturists also go in for multiple cropping of the potato crop.

4) During the Kharif season the agriculturists grow potato crop under contract farming arrangements provided by the end users potato

processing multinationals as well as domestic companies. These companies give them required seeds which suit their requirement, they provide technology as well as guidance for cultivation of potato crop and also provide forward marketing linkage and purchase the production which is according to their specified size and quality at predetermined attractive prices.

5) The production of potato crop per acre during the Kharif season relatively low than the production in the Rabbi season. This is mainly because of the availability of cold weather which is conducive for the growth of the potato crop.

6) It has been observed that the cost of production of potato per acre in Kharif season is on higher side compared to the Rabbi season. This is mainly due to labour costs as well as fertilizer cost. However, the profitability per acre is higher in Kharif season compared to Rabbi Season. This is due to the fact that the rates are higher and that the fertilizers used for cultivation of potatoes are partly retained in the field which reduces the requirement of fertilizers for the subsequent crop that is being taken on the same plot of land.

7) The cost of cultivation of potatoes in Rabbi season is less mainly due to reduction in the requirement of labour, and fertilizers as well as irrigation costs. Because of the cold climate which adds to the growth of the size of the potatoes the production is more.

8) The market forces decide the rates of potato crop. Law of demand and supply also applies in respect of this crop. There are wide price fluctuations of the potatoes which can be seen from the relevant table incorporated in Chapter V. During the rabbi season the yield of the potato is good and as the market is flooded with the potato naturally it affects its price adversely. In order to avail the benefit of better prices the agriculturists are now taking the advantage of storage of potato in

cold storages and bring the potato in the market when the prices improve in their favour.

9) In the areas identified for the study currently the agriculturists do not require cold storage or warehousing facility as the seeds which require storage in the cold storage are supplied by the companies which are having this facility of their own. So also when the potatoes are harvested all the selected produce is lifted by the companies in many cases at the harvesting site itself which results in reduction of transport costs.

10) However, in the Rabbi season these contracting companies do not procure the potatoes and hence the potato growers purchase seeds from Manchar A.P.M.C. where there is cold room for storage of the seeds is available. However, in the absence of cold storage facility for the potato storage these potato growers are not able to avail the benefit of higher prices and accordingly suggestion has been also made by the researcher.

A few observations that came to surface during the study:

National Level

1) **Wide Price Fluctuations:** The major potato growing states should arrange advance forecasting of area under potato and plan to divert the potatoes to the deficient areas or by export to avoid glut situations and price crashes in the markets.

2) **Bottlenecks in Storage Facilities:** About 90 per cent of total cold storages in the country used for potato storage and most of them are situated in big towns and markets. Hence it is needed to have new cold storage units in deficient areas particularly rural areas.

3) **Lack of Long term Indian Potato Export Policy:** The significant step has been taken in this direction by Govt. of India by establishing Agri

Export Zones (AEZs). Adequate infrastructure paucities like movement of potatoes from producing areas to exporting countries are required for further improvement.

4) **Lack of avenues of utilization of Potato:** There is a need to utilize larger quantities of potatoes in the processing industries to improve and enhance the efficiency of processing and to reduce the cost of processing and processed products. Developed technologies for dehydrated potatoes will not only ensure proper return to the farmers but also boost the processing industry.

6.3 SUBGGESTIONS

From the observations made out above as well as from the data that was available during the course of administration of the questionnaire following suggestions have emerged which if implemented will add to the profitability of the potato growers.

1. **Cultivation Practices :** It has been observed that the level of education of the potato growers is poor. They are adopting the traditional cultivation practices as well as the equipment like wooden plough, harrowing etc. which ultimately adversely affects the cost of cultivation as it is labour intensive. Now the new farm machinery has arrived in the market which is useful for labour cost saving as well as it helps in carrying out timely operations. Therefore, the need of the hour is to see that these agriculturists absorb new technology which the potato contracting companies are providing and take the benefit of cost saving devices.

2. **Establishment of Coop. Farming Societies :** Since 1957, policy was adopted to have ‘Multipurpose Co-operative Societies” undertaking both functions of supply of credit as well as marketing of agricultural produce. The co-operative marketing societies can link credit, farming, marketing and processing to the best advantage of the farmers. It can have its own storage and warehousing facilities. The most important advantage of the cooperative marketing is that it

can eliminate many of the middlemen and their profits margins so that the farmers exploitation can be avoided. The cooperative marketing societies can link credit, farming, marketing and processing to the best advantage of the farmers. It can have its own storage and warehousing facilities.

3. **Farm Mechanization:** Due to fragmentation of land the average land holding has become uneconomic. In order to make use of newly developed farm machinery for labour saving it is essential that the farmers come together and establish farming societies so as to enable them to take benefit of the labour saving devices as also for reaping the marketing benefit. These societies can also take initiative in providing storage facilities in their area operation so that they can bring their produce in the market when the rates are favourable to them. For this purpose the government of Maharashtra should take initiative and encourage these farmers for formation of their societies. Due to advancement of technology and the introduction of newer machinery useful for the agricultural operations e.g. cultivators which perform multiple operations, small tractors, etc. the agriculturists are finding it useful to meet out their labour problems which are in short supply due to migration to the nearby urban centres.

4. **Joint Efforts for spreading the Coverage of Potato crop:** Potato is a cash crop which ultimately will help the agriculturist to improve his standard of living. The efforts taken by the multinational companies like PepsiCo, ITC, and the domestic companies like Siddhi Vinayak, Balaji etc. which are engaged in processing the potato crop for manufacture of wafers, French fries, potato powder which is in demand from the Hotel industry world over, should come together and make joint efforts for enlarging the coverage of potato crop on larger area more particularly in the area like Ambegaon and Khed taluka. This will give boost to the rural economy.

5. **Self Help Groups:** There is good value addition if the potato which is of vegetable variety produced in Rabbi Season is processed through the media of the Self Help Groups. The process is not much complicated and it can be

produced in small quantities in a tiny / small scale industry. It is will be a regular activity for the SHGs and will help the men/women beneficiaries to raise their standard of living on a continual basis. Rural market offer vast potential for these products provided the production is taken in clean environment and properly packed and competitively priced. Similarly through various government sponsored programs where self employment activity is encouraged the government should high light/focus on the potato processing activity as it does not involve major capital requirement.

6. **Group purchases of input:** If the farmers' societies are formed it is well and good. But if it is taking some time, the farmers may come together and buy the inputs, seeds, fertilizers, pesticides etc. and procure it on the wholesale basis it will be cheaper and will fetch better profit.

7. **Practicing Organic Farming:** Of late in Maharashtra organic farming is getting momentum. There is greater awareness of the benefits of the organic farm produce amongst the educated class of customers. More particularly in the metros. The price these products are fetching is fabulous. The use of F.Y.M. in the cultivation of potato has proved to be very economic compared to the chemical fertilizers. The production is also increases along with the quality of the product. Therefore, there should be encouragement and spread of message from the govt. agencies to educate these farmers to resort to organic farming.

8. **Judicious use of water:** The potato crop though a cash crop requires water in minimum quantity which can be fetched from Gaon Tali / dug well / percolation tanks etc. Water is a scarce resource and needs to be judiciously and at the same time improves agriculturist's economic conditions. The farmer cultivating potato crop may also be encouraged to use sprinkler water system for economic use of water.

9. **Export Promotion Incentives:** The government of Maharashtra should educate the agriculturists growing potato crop about the export potential

offered by the potato crop. The crop is of short duration and there is adequate area which can be brought under potato cultivation. To begin with if some export incentives are provided to these agriculturists it will be helpful to the agriculturists to get better price as well as precious foreign exchange to the nation.

10. **Use of modern technology:** The present age is the age of information technology. Therefore, it is suggested that to overcome with the problems associated with marketing information, government, traders, and cultivators should coordinate to establish/improve centres for agricultural information to provide timely information to cultivators, traders and public in the various villages, sub districts. The modern communication facilities like T.V. newspaper, market bulletin, Internet, fax, and telephone etc. should be provided at in the centre.

11. **Govt. support:** The government should adopt long term policies about price, export and purchase of potatoes. It is suggested that support prices should be announced well in advance of the sowing season every year.

12. **Grading of the potatoes:** The government as well as the market committees should intensify propaganda activity so as to encourage farmers to get their produce graded prior to sale so that they can better price for higher grade potatoes.

13. **Guidance to the agriculturists:** The government of Maharashtra through their agriculture extension officers placed at the block level should provide technical guidance about use of quality seeds, fertilizers, pesticides, irrigation rotation etc. this will increase the area under potato as well as the productivity of the agriculturists.

6.4 SCOPE FOR FURTHER RESEARCH

As has been stated earlier that the cultivation of potato crop on mass scale is of recent origin in Pune district. Apart from costing and profitability aspects, there are

various other aspects such as marketing of potatoes, impact of farm mechanization in cultivation of the potato crop, storage facilities for potatoes, value addition from the potato crop and its bi-products etc., are the areas which need further research study. The researcher is of the view that there is a good potential for further research in this area.

6.5 FUTURE FOR THE POTATO CROP

It has been observed that day by day the demand for potato as a food item has been increasing fast. Numbers of newer products are available in the market. Particularly in under developed countries the consumption of potato as a food item is increasing rapidly. The research organizations are introducing newer varieties of potato crops with added advantages and that is why the area under potato cultivation is also growing. The trend indicates that there is a great potential is offing for the potato crop not only in India but all over the world.

6.6 CONCLUSION

On going through this research work it has been amply clear that there is vast potential available for cultivation of potato crop in Pune district. Particularly in Ambegaon and Khed talukas because of the availability forward marketing linkage the farmers can go in for this cash crop of very short duration and take multiple crops and increase their income and consequently can improve upon their lifestyle. The government of Mahrashtra should also take up a campaign for this identified area and may create awareness about potato cultivation. Potato is such a crop of which demand is constantly increase and will continue to grow in future. In fact this will be a boon for the potato cultivators. Even this potato cultivation may also provide impetus for value addition industry in and around the identified area. Thus the researcher is of the considered view that there is a bright potential for potato farming not only in the identified area of Pune district but also in India at large.

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2	Satyendra Kumar, Ram Asrey, G.Mandal and Rajbir Singh, (22.06.2008), paper titled, "Micro-sprinkler, drip and furrow irrigation for potato cultivation in a semi-arid environment", Indian Journal of Agricultural Sciences 79 (3): 165-9, March 2009.
3	Raj Kumar, R. S. Marwadha, J. Gopal and S. K. Pandey, (6.05.2009), "Relationship between chip colour and compositional characters in potato", paper published in Indian Journal of Agricultural Sciences 79 (9): 679-83, September 2009.
4	M. Nedunchezhiyan, K. Rajsekhara Rao, and B. S. Satpathy, (April 2010), "Productivity potential, biological efficiency and economics of sweet potato based strip inter cropping systems in rain fed Alfisols. , Indian Journal of Agricultural Sciences 80 (4): 321-4, April 2010.

5	Yashbir Singh Shivay,(2010), "Effect of diammonium phosphate and mussoorie rock phosphate on productivity and economics of potato", Indian Journal of Agricultural Sciences 80(4):329-2,April 2010
6	M. I. Mogahed, (2003), "Indian Journal of Agri Science 73(10) 546-49, October 2003.
7	A Basu and Srikanta Das, (2003), "Integrated Management of Potato (Solanum Tubeosum) disease in Hooghly area of West Bengal., Indian Journal of Agri. Science 73(12) 649-51 Dec.2003.

JOURNALS / PERIODICALS

Sr. No.	Particulars
1	Indian Journal of Agricultural Science, Dec. 2006, 76 (12): pp: 740-43
2	Indian Journal of Agricultural Science (January 2006), 76(1) p.p.26-28
3	Indian Horticulture, (bi-monthly) March-April 2010,Vol. 55, No.1

NEWS PAPERS

Sr. No.	Particulars
1	Business Standard, 7th February 2011.
2	The Strategist, 24th October 2011.
3	Economic Times, Mumbai, Page 16. 7th July 2012.
4	The Indian Express (Poona) 12th Aug. 2012
5	Loksatta Daily, Pune Edition dated 9th October 2013, Page 5

WEBSITES

Sr. No.	Particulars
1	Agricultureinformation.com
2	http://www.dnaindia.com/india/1662231/report-bihar-farmer-sets-world-record-in-potato-production
3	http://www.cipotato.org/library/pdfdocs/WP45383.pdf
4	ftp://ftp.fao.org/docrep/fao/012/i1127e/i1127e.pdf

Annexure - I
Questionnaire for the potato growers
(Please put ✓ (tick mark) wherever options are provided)

Name of the Agriculturist: _____
Name of the village,_____ Taluka Ambegaon / Khed (Rajgurunagar)
Age (completed as on 13.3.2012) _____ years.
Education:

Illiterate	Studied upto X	Studied upto XII	Graduate	Post graduate

Caste wise Classification (1) Scheduled Caste ( ) (2) General ( )

Details of agriculture land holding with source of water:

Sr. No.		Hectare	Ares	Source of irrigation				Remarks
				Own lift	Community lift	Dug well	Bore well	
1	Irrigated							
2	Dry Land			X	X	X	X	
	Total land holding							

Details of normal cropping pattern:

Sr. No.	Name of the season	Name of the crop	Area under the crop	
	Kharif		Hectare	Ares
1	Potato			
2	Bajari / Onion			
3				
	Rabbi			
1	Potato			
2	Wheat			
3	Gram			
	Perennial			
1	Sugarcane			
2	Vegetables			

Do you have any of the following agricultural machinery / equipment/ auto vehicle?

Tractor	Power tiller	Duster	Harvester	Thresher	Sprayer	Jeep	Two wheeler

Do you have any activity allied to agriculture such as Dairy / Poultry/ sheep rearing: Yes ( ) No. ( )

If your answer is yes name the activity:

_____

From where do you the agricultural inputs?
(like seeds / fertilizers / pesticides etc.)

Available locally	Supplied by the contracted vendor	Available from the Market Committee outlet	Use own seeds /fertilizers etc.

Do you find any difficulty in getting the required agri. Labour: Yes( ) No. ( )

What are the current gender wise rates for the daily labour for full day work?
Male Rs._____/- Female Rs._____/-

Do you avail of Cold Storage facility for storing the potato crop? Yes / No.
If yes, which is the nearby cold storage you have?

_____

If not, how do you store the potato crop when harvested?

(a) Immediately take to the market. ( )
(b) Contract Co. lifts it immediately. ( )
(c) By traditional rack method ( )

Where do you market the agricultural produce?

In local market	Supplied to the contracted vendor	At the taluka level Branch of APMC	APMC at Pune

What was the average yield of potato per acre in quintals ?

Season	2008	2009	2010	2011	2012
Kharif					
Rabbi					

What was the average rate per quintal in Rs. fetched by the potato in the following years at the market committee/s?

Season	2008	2009	2010	2011	2012
Kharif					
Rabbi					

What was the average rate per quintal in Rs. fetched by the potato in the following years by the contracted companies?

Season	2008	2009	2010	2011	2012
Kharif					
Rabbi					

Is there availability of any contract farming facility available nearby? Yes ( ) No. ( )

If yes, tick names the service provider:

PepsiCo	Siddhi Vinayak	Balaji	ITC	Parle Agro	Any other

From whom do you get counseling in potato farming?

Locally available expert: ( )

Govt. Agri. Extension officer ( )

Expert from Contracting Co. ( )

What is your experience about the cost escalation in the input prices each year?

About 5% ( ) 5 to 10% ( ) Over 10% ( )

Do you have any difficulty in obtaining from PDCC Bank crop loan for potato crop? Yes ( ) No ( )

In your view the scale of crop loan for potato decided by the PDCC Bank is adequate? Yes ( ) No. ( )

Please fill up the following form for indication of activity wise cost of expenses incurred during Kharif season for cultivation of potato crop during 2012.

Sr. No.	Name of the operation #	Date when it is to be performed	No. of man days required for 1 acre cultivation	Expenditure in Rs.
1	Pre tillage operation: Ploughing Ploughing Labour Harrowing Sari bandhane Bullock pair Spreading of F.M.Y.	During May –early June		
2	Plantation 5 female			
3	Spread of Chemical fertilizers			
4	Four times Spraying of pesticides			
5	Weeding operation. 3 L x days x 2 times			
6	Harvesting 4 L x 1.5 day Bullock pair			
7	Labour for storage of produce 2 L x 2 days			
8	Packing baggage Gunny bags 80 bags			
9	Seeds			
10	FYM & Chemical Fertilizers			
11	Pesticides			
12	Transportation to the market			
	Total			
	Average production of potato per acre 4200 Kg.	Average rate Rs._____ /kg.		
	Surplus remained per acre			

Please fill up the following form for indication of activity wise cost of expenses incurred during Rabbi season for cultivation of potato crop during 2012.

Sr. No.	Name of the operation #	Date when it is to be performed	No. of man days required for 1 acre cultivation	Expenditure in Rs.
1	Pre tillage operation: Ploughing Ploughing Labour Harrowing Sari bandhane Bullock pair Spreading of F.M.Y.	During May –early June		
2	Plantation 5 female			
3	Spread of Chemical fertilizers			
4	Four times Spraying of pesticides			
5	Weeding operation. 3 L x days x 2 times			
6	Harvesting 4 L x 1.5 day Bullock pair			
7	Labour for storage of produce 2 L x 2 days			
8	Packing baggage Gunny bags 80 bags			
9	Seeds			
10	FYM & Chemical Fertilizers			
11	Pesticides			
12	Transportation to the market			
	Total			
	Average production of potato per acre 4200 Kg.	Average rate Rs._____ /kg.		
	Surplus remained per acre			