ECONOMICS OF INTEGRATED FARMING SYSTEM IN AHMEDNGAR DISTRICT OF MAHARASHTRA

by

Shinde Swapnil Baban
(Reg. No. 019/212)

A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI- 413 722, DIST- AHMEDNAGAR,
MAHARASHTRA, INDIA

In partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

AGRICULTURAL ECONOMICS

DEPARTMENT OF AGRICULTURAL ECONOMICS

POST GRADUATE INSTITUTE

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APPROVED BY

Dr. R. B. Hile
(Chairman and Research Guide)

Dr. S. S. SADAPHAL	**Dr. V. G. POKHARKAR**	**Dr. V. S. WANI**
(Committee Member)	(Committee Member)	(Committee Member)

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MAHARASHTRA STATE (INDIA)

2021

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part
there of has not been submitted
by me or other person to any
other University or Institute
for a Degree or
Diploma

Place : MPKV, Rahuri
Date : / /2021

(Mr. Shinde S. B.)

Dr. R. B. Hile
Associate Professor,
Department of Agricultural Economics,
MPKV, Rahuri.
Maharashtra State (India)

CERTIFICATE

This is to certify that the thesis entitled. **"ECONOMICS OF INTEGRATED FARMING SYSTEMS IN AHMEDNAGAR DISTRICT OF MAHARASHTRA"**submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of the degree of**MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS**, embodies the result of a piece of bonafide research work carried out by **Mr. SHINDE SWAPNIL BABAN**under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

Place : MPKV, Rahuri (Dr. R. B. Hile)
Date : / /2021

Dr. D. B. Yadav
Head,
Department of Agricultural Economics,
Mahatma PhuleKrishiVidyapeeth,
Rahuri-413722, Dist. Ahmednagar,
Maharashtra State (India)

CERTIFICATE

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Place : MPKV, Rahuri

Date : / /2021 (Dr. D. B. Yadav)

Dr. P. N. Rasal
Associate Dean,
Post Graduate Institute,
Mahatma PhuleKrishiVidyapeeth,
Rahuri-413722, Dist. Ahmednagar,
Maharashtra State (India)

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Place : MPKV, Rahuri.

Date : / /2021 **(Dr. P. N. Rasal)**

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Needless to say, all omissions and errors are mine.

Place:*MPKV,Rahuri* ***(Shinde S. B.)***

Date: */ / 2021*

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LIST OF ABBREVIATIONS

M. P.K.V.	**: Mahatma Phule Krishi Vidyapeeth**
etal.	: **Et alli (and others)**
Fig.	**:Figure**
GDP	**: Gross DomesticProduct**
i.e.	**: Thatis**
kg	**:Kilograms**
q	**:Quantity**
qt	**: Quintals**
No.	**:Number**
Viz	**: Videlicet(Namely)**
%	**: Percent**
₹	**: Rupees**
C	**:Crops**
D	**:Dairy**
H	**:Horticulture**
C	**: Crops only farmingsystems**
C + D	**: Crop with dairy farming system**
C + D+ H	**: Crop with dairy and horticulture farmingsystem**
ha	**: Hectare**
kg	**: Kilogram**

ABSTRACT

ECONOMICS OF INTEGRATED FARMING SYSTEMS IN AHMEDNAGAR DISTRICT OF MAHARASHTRA

by

Shinde Swapnil Baban

Master of Science

(Agriculture)

in

Agricultural Economics

Mahatma Phule Krishi Vidyapeeth, Rahuri,

Dist – Ahmednagar (Maharashtra)

2021

Research Guide	:	**Dr. R. B. Hile**
Department	:	**Agricultural Economics**

The current study, titled "Economic Analysis of Farming Systems in Ahmednagar District of Maharashtra," was undertaken with specific objectives in mind, including examining the socio-economic characteristics of farmers, examining the resource use pattern of various farming systems, examining profitability of various farming systems, and examining the constraints in existing farming systems. Primary data for 96 farmers was obtained using a personal interview method and a newly designed questionnaire for the 2020-21 year.

During the research year, per household employment at overall level was 308.66 man-days, with males contributing 140.99 man-days and females contributing 167.68 man-days. Out of three farming systems, C + D + H farming system has more working man-days (477.44 man-days) as compare to C + D farming system (305.97 man-days) and Crop only farming system (142.59 man-days).

At overall level, the average gross family income was ₹ 1293892.14 during study year and maximum share of 55.04 per cent income was gained from crop production.

The average per farm annual gross income for Crop only farming system worked out to ₹ 651304.72 while for C + D and C + D + H farming systems it were ₹ 1231284.01 and ₹ 1999087.

At overall level, the average total annual family expenditure was ₹ 493611.33 during study year and the major share of expenditure was estimated on Crop (40.02%). The average annual family expenditure by Crop only farming system was found to be ₹ 231242.50. While, it was ₹ 476544.00 and ₹ 773047.48 for C + D and C + D + H farming system, respectively.

In the proposed farming system, in employment function three variables *viz*; no. of earners, no. of livestock and gross cropped area were highly significant. In expenditure function three variables *viz*; earners and no. of livestock's and area under horticulture crop were highly significant. In income function four variables *viz*; no. of earners, livestock number, gross cropped area and area under horticulture crop were positive and highly significant. It indicates that these are the important variables for which the employment, expenditure and income was responsive, respectively.

For the study area, three major farming systems were evaluated *viz*; 1) Crops only 2) Crop + dairy 3) Crop + dairy + Horticulture. It was observed that, the per farm expenditure was maximum in C + D + H farming system, while it was minimum in Crops only farming system. Per farm total income was maximum in C + D + H farming system followed by C + D farming system and Crops only farming system, which indicated higher returns in farming system in which livestock and horticultural crop were undertaken. Per farm profit was maximum in C + D + H farming system followed by C + D farming system and Crop only farming systems.

It was observed that, per hectare expenditure was also maximum in C + D + H farming system (₹ 307005.84) while it was minimum in Crops only farming system (₹ 174571.79). Per hectare total income was also maximum in C + D + H farming system (₹ 642937.84) followed by C + D farming system (₹ 507994.29) and Crops only farming system (₹ 373652.67). The per hectare net profit was also highest in C + D + H farming system followed by C + D and Crops only farming system.

The study revealed that among all the three farming systems, C + D + H farming system was found to be economically viable farming system than Crops only and C + D farming systems.

Abstract contd. **Mr. Swapnil Shinde**

Farmers in this study area faced problems such as a labour shortage, a high wage rate, a high cost of fertilizers, an irregular supply of electricity, a high cost of improved breeds, a high cost of animal feed and fodder, a low price for produce, delay payment, unavailability of storage facility and lengthy loan process by a bank, and so on.

The livestock is important to the profitability of farming systems. This emphasizes the significance of focusing on these enterprises in order to make the farming system more profitable. As a result, the right balance between livestock and crop enterprises must be encouraged in order to make the remaining farming systems more viable. According to the study, farmers should choose a crop + dairy + horticulture farming system in order to be sustainable and profitable.

It can be concluded that internal cost adjustment was more in Crop + Dairy +Horticulture among all the farming systems in all the seasons in the district while the return per rupee investment was more in Crop + Dairy +Horticulture farming system in all condition among the other farming systems in the district. The system is more feasible and sustainable when there is more utilization of resources within the system than the other system.

Thus, the study suggested that implementation of Crop + Dairy +Horticulture integration farming system could increase the use family labor, reduced the use of inorganic fertilizers, reduced production costs, and can increase cattle farming income and horticulture business income. Then, also could improve land fertility, water and air quality and creates harmony between the socio-cultural environment of the local community, and be solution to climate change mitigation.

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1. INTRODUCTION

1.1 General

Agriculture is the result of human efforts directed at using land resources in order to meet one of man's most basic necessities, food. Despite Maharashtra's strong growth in industry and the service sector, agriculture remains a major economic activity, employing 41.29 percent of total workers in 2020.

1.2 Indian Agriculture

Agriculture in India is noted for its multi-functionality in terms of employment, livelihood, food, nutrition, and environmental security. Cropping income alone on small farms is hardly enough to support a farmer's family, especially as farm sizes shrink due to population growth, moreover; periodic monsoon failures aggravate the situation. As a result, a smart mix of any one or more of these enterprises with agronomic crops should complement the farm income in order for the farmer to be assured of regular income for a satisfactory living (above the poverty line). The selection of enterprises must be based on the cardinal principle of minimizing the competition and maximizing the complementarities between the enterprises.

The increasing population, natural resource degradation, greater input costs, and concerns about climate change, Indian agriculture is currently facing lots of new issues. Agriculture is the most important sectors of the Indian economy, accounting nearly 19 per cent of total income and employing nearly 41.49 per cent of the workforce in 2020-21. As a result, agricultural growth has a direct impact on not only poverty reduction but also food and nutritional security. Apart from that, agricultural products have a good share in total export revenues in relation to economic growth. Since independence, agriculture and associated sectors have provided agro-based food and non-food industrial growth with varying degrees of assistance (Source: www.statista.com).

Small holder agriculture dominates Indian agriculture, with small holders cultivating 42 per cent of the land and accounting for 83 per cent of overall landholding (Source: www.census2011.co.in). However, the majority of these farms produce many commodities and are generally run by farm families. A number of factors related to household goals influence the commodities that are produced. Physical assets and markets should be formed. A farming system refers to a combination of enterprise involving crop and livestock production. The farming system method is seen as a possible means of increasing and stabilizing rainfed agriculture output and profitability. Different components of the farming system are organically linked in such a way that material flows from one component of the farming system to the other component as an input. As a result, the farming system integrates several enterprises. In the context of a farming system. The component is very closely tied to the farm family. Farming systems are comprehensive in nature, taking into account ecological, economic, and demographic factors. The green revolution of the 1960, which turned India from a chronic importer of food grains to an exporter, is one of the best success stories of the post-independence era in India. Since independence, the population has grown by more than threefold, from 361.1 million in 1950-51 to 1210.20 million in 2011 (Census, 2011). Meanwhile, production is increasing by more than fourfold, from 50.8 million tonnes to 235.90 million tonnes.

1.3 The Concept Integrated Farming System (IFS)

IFS cope with the changes farm level, in a manner that balances food production, profitability, safety, animal welfare, social responsibility and environmental care. The Integrated farming system has been used for integrated resource management which may not include either livestock or fish components. Its focus is the integration of livestock, horticulture and fish, often within a larger farming or livelihood system. IFS is a farming system that combines a variety of crop and livestock, horticulture and the application of various techniques to create suitable conditions to protect the environment, maintain land productivity and increase farmer income. This farming system occurs between the input-output relationship of commodities, linkages between production activities with pre-production and post-production, as well as between agriculture and manufacturing activities and services. IFS is part of the agro-eco technology system consisting of various interrelated components include non-farm business components, biophysical nature, and socio-economic, political and cultural. The Integrated farming system is a systematic approach to the use of low external input between crops with livestock and horticulture.

IFS is a system consisting of a combination of plants and animals, where waste from one component can be used for other components. The advantages of integrated agriculture and mixed farming are more in terms of economic benefits than monocultures. Food demand is increasing day by day as food production is declining; the ongoing conversion of land to residential land and also drastic reduction of working farmers. IFS is able to provide diverse benefits to smallholder systems, both social, economic and environmental benefits. This can support small farmers in farming, reduce their vulnerability, ensure food security, employment, increase biodiversity, carbon stocks in agriculture and improve agricultural energy efficiency. The Public extension should see

IFS as a flexible socio-ecological intervention, not a technology with the desired socio-economic and ecological outcomes. IFS is one of the agricultural systems that can be used as one of the solutions for climate change mitigation. Agricultural systems are setting the stabilized farming, unique and feasible are managed based on the practice match with physical environmental, biological and socio-economic according to objectives, preferences and household resources. The farming can be as cultivation or livestock raising. The feasible farming is productive and efficient that have productivity, or production per unit of high land.

IFS is one of the diversified activities of commodities that can be done to offset the demand for agricultural products (mainly food crop) are constantly increasing through the utilization of a synergistic relationship between commodity endeavored, without damaging the environment and high labor absorption. Implementation of the integrated farming system is the right choice toincrease farmers' income and at once to utilize optimally agricultural resources. Integrated farming is defined as biologically Integrated farming system which integrates natural resources and regulation mechanisms into farming activities to achieve maximum replacement of off-farm inputs, secures sustainable production high quality food and other products through ecologically preferred technologies, sustain farm income, eliminates or reduces sources of present environment pollutions generated by agriculture and sustains the multiple function of agriculture.

Based on some of the above concepts, it can be concluded that the integrated farming system is a farming system that combines two or more fields of agriculture, which is based on the recycling biological concept, and linked of input-output between the mutually commodities which approach of low-external-input utilization, which is done on the land, through the utilization of crop waste, animal manure, fish waste for the purpose of increasing the production and productivity so as to increase farmer income and can create condition that are environmentally friendly farming. Then it should consider several aspects, namely, sustainability that environmental friendly (environmentally tolerable), is socially accepted by society (socially acceptable), are economically viable (economically feasible) and politically acceptable (politically desirable).

1.4 The Importance of Integrated Farming System Development

The advantages of IFS are productivity, profitability, sustainability, balanced food, environmental safety, recycling of waste, saving energy, adoption of new technology, money around the year, availability of fodder, fuel, and timber, employment round the year, agro industries, increases input efficiency, standard of living and avoid degradation of forest. IFS is very important to be develop because could become a solution to the problems in the regional development. This includes a) physical environment damage; b) biotic environmental damage such as the decline of biological resources, illegal logging, damage to coastal ecosystems, rivers, and lakes; c) damage to natural resources; d) natural disasters; e) lack of development of local potential. The multifunctional of IFS is a concept that focuses on the policy of transitioning food and fiber production to multifunctional agricultural production comprehensively. This requires reconsideration of the role of small family farms, especially to improve food security, facilities, and landscaping, and protect the environment. Sustainable agriculture in developing countries emphasizes food security, sustainability of small farmers' livelihoods, and convenience for consumers and protection for the environment in developed countries. There are six benefits of multifunctional IFS, namely: one economy (income), two social (food and gender security) and three environments (carbon storage, biodiversity, and energy efficiency).

The objectives of the IFS are multiple: to enhance food production for the household, to maintain the natural resource base that contributes to food security and the well-being of the rural people, to contribute to income generation, and to be accepted by local communities.

1.5 Indian Farming Systems

Farmers in India used a traditional farming method based on decades of experience that combined crop production with one or more enterprises such as dairy, poultry, sericulture, piggery, sheep, goat, fishery, beekeeping, and so on. Their main goals were to create production consistency, provide food for the family, and protect against weather anomalies and other environmental pressures.

In recent years, the farming system approach has given a scientific spin to current methods and discovered ways to make them more sustainable in the face of changing global conditions. The term "farming system" refers to a resource management approach for achieving economic and sustainable agricultural production in order to meet the different needs of farm households while preserving the resource base for future generations and maintaining good environmental quality. As a result, the farming system is the product of multiple interdependent components interacting.

Land being the most limited and scarce resource, particularly on small and marginal farms, there is scope to increase farm income and employment through crop production alone is too bright. Therefore, one has to look for alternatives in order to get assured increase in the employment of the weaker sections. In this regard integrated farming system is the answer in which dairy, sericulture, poultry, sheep and goat rearing, mushroom cultivation and other allied activities are regarded as important components.

1.6 Agriculture in Maharashtra

Maharashtra is India's second largest population and area state with 3.08 lakh kilometres square area. The state's population, according to the 2011 census, is 11.23 crores, accounting for 9.29 percent of India's total population. Agriculture and related sectors employ roughly 55 percent of the population, while contributing 13 percent of the state's income (Source: www.statista.com).

There is no additional land available for agriculture, the focus should be on vertical expansion by increasing productivity with existing resources while carefully choosing the right enterprise mix. The crop earnings are not enough to support the own families of farmer. Small and marginal farmers, who make up 80.3 per cent of the agricultural population yet own just 36 percent of the land, are particularly vulnerable. Owing to a decline in farmland due to population increase, providing enough food for a family by the twenty-first century would become extremely problematic.

The crop-based, horticulture-based, and dairy-based farming systems, as well as their mixtures, exist. The profitability of different crops and livestock combinations varies from region to region. Many farming systems are practised in Ahmednagar district, including crops, crops + dairy, and crops + dairy + horticulture.

To understand farming systems, socio-economic characteristics such as education level, family size, land holding size, and asset structure of farmers must be studied. So far, there have been few researches on farming systems in Ahmednagar district, and the farming system method to analysing agricultural problems has gained a lot of traction in recent years. It is expected that such type study will shed light on the subject associated with various farming methods, allowing academics and policymakers to draught and execute appropriate policies for a balanced, integrated, and overall agricultural development.

1.7 General Description of Ahmednagar District

The Ahmednagar district was the largest district in the state of Maharashtra. The district of Ahmednagar is located in the western part of Maharashtra and total geographical area of the Ahmednagar district was 17048 sq.km. Which is about 5.66 percent of the state's geographical area. The Ahmednagar district comprises 14 tehsils namely Ahmednagar, Kopargaon, Akole, Sangamner, Rahata, Shrirampur, Parner, Rahuri, Nevasa, Shrigonda, Pathardi, Shevgaon, Karjat, Jamkhed. There are various landforms in Ahmednagar district and there are hilly offshoots of the Sahyadris in the western part of the district. They are called Kalsubai, Adula, Baleshwar and Harishchandragad hill ranges. The Mahatma Phule Agriculture University, Rahuri is located in Ahmednagar and it is the premier Agriculture University in Maharashtra that renders service to the farmers through education, Research and Extension Education. Ahmednagar district is divided into three agro-climatic zones *viz.*, scarcity zone, plain (Transition) zone, ghat zone. The selected study area i.e. Karjat and Rahuri tehsils are come in the scarcity zone (Source: http://ahmednagar.nic.in).

1.8 Cropping Pattern

The maximum area of Ahmednagar district is categorised in a scarcity zone and farming of agriculture is dependent mainly on monsoon. In *kharif* season, the *kharif* crops like pearl millet, black gram, red gram, and soybean crop are the dominate cropping pattern. The sugarcane and cotton are major dominating cash crops in Ahmednagar district. The area under vegetableand fruitcropswere also increasing. Wheat and chickpea (gram) are dominating crop in *rabi* season. Groundnut are major oilseed crop in Ahmednagar district.

The integrated farming system approach provides a solution for sustainability of farm in long run. In view of this, present study was undertaken in Ahmednagar district of Maharashtra state with the following objectives;

1.9 Objectives of the Study

1. To study the socio-economic characteristics of farmers.
2. To examine resource use pattern of different farming systems.
3. To examine the profitability of different farming systems.
4. To study the constraints in existing farming systems.

1.10 Hypotheses of the Study

The following hypothesis will be set forth for testing

A. **Null H_0** The resource use levels are constant under different farming systems.

Null H_1 The resource use levels are vary under different farming systems.

B. **Null H_0** The income from crop farming system alone is sufficient to cover the expenditure as compared to other farming systems.

Null H_1 The income from crop farming system alone is not enough to cover the expenditure as compared to other farming system.

1.11 Scope of the Study

Farmers will be able to use the findings of this study to help them choose a farming method and increase their profits. Extension personnel will be able to use these findings to help farmers choose the best farming system for boosting productivity, income, and employment. The study will also be valuable for research scientists those are working on farming system research to understand the current techniques used by farmers and to offer improvements based on research and critical evaluation.

1.12 Limitations of the Study

The study's findings are based on a year's worth of data. Agriculture production is well recognised to be a function of numerous variables and to vary from year to year. On the basis of a multistage sampling methodology, primary data were acquired by interviewing farmers. Farmers in the village do not keep farm records, so farmers' responses to questions about the area sown under various crops, the quantity of seed used, the manures and fertilizers used, the output produced, the price received, and information on various types of expenses made, among other things, were mostly based on memory. Due to the lack of resources and a one-person inquiry, the study was limited to a few villages in Ahmednagar district, with a sample size of 96 farms (32 crop alone farming systems, 32 C + D farming systems, and 32 C + D + H farming systems). As a result, the study's findings should be regarded as indicative rather than general.

2. REVIEW OF LITERATURE

Any systematic research project must include a review of previous literature. Furthermore, prior knowledge of research work done by previous researchers in the research area of interest becomes essential for a research worker. This requires that he or she get study data from many sources that are directly applicable to a specific topic of his or her research work. The knowledge gained through such evaluation of literature efforts allows him or her to acquire insight into how a specific study challenge was approached, the attributed of the data obtained, and the results obtained.

Nonetheless, such knowledge is always important for enhancing the efficiency and efficacy of all actions connected to the design of a research challenge, the selection of appropriate methodology, and the interpretation of research findings. This chapter is dedicated to presenting and discussing reviews of literature obtained from various sources, in acknowledgement of their value in research activity. The reviews have been organized into major headings for convenience.

2.1. Study socio-economic characteristics of farmers.

2.2. Resource use pattern of different farming system.

2.3. Profitability of different farming system.

2.4. Constraints in existing farming systems.

2.1 Socio-Economic Characteristic

Narayanmurti (2000) investigated farmer education and crop productivity. He looked studied the influence of farmer education in agricultural productivity using data from 200 farm households in Tamilnadu over two seasons. The study looked at the impact of farmer education on agricultural productivity by evaluating five different production function parameters. The use of yield-increasing inputs was significantly higher among the higher educated farmers as compared to the lower educated farmers, according to the bivariate analysis. According to the coefficient of education was1per cent increase in the level of education among farmers has a 0.038 per cent effect. The coefficient of education was positive and non-significant in impacting the productivity of paddy, according to the estimations of production function pertaining to samba paddy.

Sundar and Sharma (2000) investigated at how farmers' education and knowledge might help them increase their agricultural productivity. In today's economy, education is crucial. Farmer’s education in rural areas was considered to be one of the major important components of a strategy to boost agricultural productivity. Farmers completed four more years of study, which enhanced agricultural production by 7 per cent on average per cost.

Reddy and Sen (2004) investigated technical inefficiency in rice production and its association with farm-specific socio-economic factors, and research was carried out in Bihar's Sone Canal Command Area. There were 270 farms in total, with 207 marginal farms chosen via stratified random sampling. With increased farm size, technical inefficiency in rice production decreased. In marginal farms, the average technical inefficiency was highest (27.28 %). To investigate the influence of age, farmers between the ages of 40 to 50 years had the lowest technical inefficiency in rice production, followed by farmers under the age of 40 year. It is accessible that the level of technical inefficiency among farmers under the age of 50 years was lower than that of farmers beyond the age of 50 years. Technical inefficiency decreased dramatically as education level increased. It has been suggested that well-educated farmers have a superior understanding of production technology.

Toor *et al.* (2006) examined the income and employment pattern in Punjab. The distribution of landholding was critical because farm revenue and the extent of technological adoption are both affected by farm size. It was discovered that 122760 holdings in the size category up to 1 hectare account for 12.31 percent of all holdings. According to the scale of the analysis, crops under 1 hectare in area contributed 33.97 per cent, while dairying contributed 36.09 per cent. Non-farm income accounts for 22.36 per cent, while miscellaneous income accounts for 7.58 per cent. These resultsrevealed that the contribution of income from dairying and nonfarm was decrease with increasing farm size, with the exception of crops, demonstrating an inverse relationship. In grain production, family labour accounted for 51.22 man-days and paid human labour accounted for 24.67 man-days, but in dairy only family labour was accounted for 193.75 man-days. This indicated that substantial share of family labour in the state. The revenue of farm households revealed that agricultural production followed by dairying, generated the majority of the state's income.

Jain and Chetan (2007) examined the selling of main horticulture crops in the Dharsiwa block of Chattishgarh Raipur district. They've chosen five vegetables: brinjal, tomato, green chilies, cauliflower, and okra, as well as two fruit crops: watermelon and muskmelon. For the study, they chose 62 respondents and 29 intermediaries. According to the study, total cropped area increased as land holding size increased. Cropping intensity on various farm sizes was calculated to be 178.92 per cent, 169.40 per cent, and 152.03 per cent on small, medium, and large farms, respectively.

Sridhar (2008) studied contract farming in maize and discovered that, the average contract farmers were 43 years old and had a family size of six. In terms of education, just 21.66 per cent of farmers were illiterate, while the rest 78.33 per cent were educated, with 15.83 per cent, 42.50 per cent, and 20.00 per cent studying up to primary, high school, and college levels, respectively. In the non-contract farming, the average farmer was 47 years old, with a family size of six. The yearly income per family was 66.95, and in terms of educational level, 23.34 per cent were illiterate and 76.66 per cent were literate.

Asmatoddin *et al*. (2009) investigated tomato resource productivity in different seasons in Western Maharashtra. Sangmner tehsil in Ahmednagar district was chosen on purpose, and ten villages were selected at random. Three tomato growers were chosen from each village. The results revealed that *kharif, rabi* and *summer* tomato growers have an average family size. Farmer's scores were 5.97, 5.47, and 5.59, respectively. The *kharif, rabi* and *summer* seasons, the percentage of family members who were illiterate, primary, secondary, or graduate farmers was 7.78, 24.44, 45.56, and 22.22, respectively. Livestock rearing at the general level by tomato cultivators was observed in three seasons, with crossbreed occupying the highest rank followed by sheep goat, bullock, and buffaloes, i.e. 37.00, 34.67, 17.34, and 10.97 per cent, respectively. Cropping intensity was highest for *rabi* tomato growers followed by *summer* and *kharif* growers, with 170.68, 169.33, and 152.85 per cent, respectively.

Biradar *et al*. (2013) underlined the role of livestock to the livelihood of farmers in Western Maharashtra.The results revealed that the percentage contribution of livestock to family income ranged from 18.69 to 33.90 per cent. The cattle contribute 34.61 gm. protein to the family income. The farm household's daily diet includes 52.32 gm. fat and 1690.5 mg calcium. The average nutrient need is 42.57 gm. protein, 64.35 gm. fat, and 2079 mg calcium. 12 per cent of households used animals to mitigate farming uncertainties. Approximately 63 per cent of respondents said that cattle rising was a symbol of better social standing. The study indicates that the livestock system helps to improve both economically and socially sustainable livelihoods.

Khan *et al*. (2015) studied the integrated farming system is a viable approach that represents an appropriate combination of farm enterprises, such as crop production, horticulture, livestock, fishery, forestry, poultry and goatry, among others, in a specific farming situation to address the problems of sustainable economic growth in Indian farming communities.

Prakash *et al*. (2015) researched the farming system with a focus on the interdependencies between components under the control of the household and how these components interacted with physical, biological, and socio-economic factors of the household that were not under the control. Farm households were the basic unit of the farming system and interdependent farming enterprises carried out on the farm.

Hiware (2016) probed the scenario of the sericulture industry in Maharashtra State, India, with a focus on socio-economic development, job creation, and sericulture sector activities in the state. Sericulture requires little investment and yields high returns in a short period of time; as a result, farmers are drawn to this industry, and it is an excellent tool for improving the rural economy and raising peoples for the living standards. It is a godsend to the rural population involved with agriculture, allowing them to avoid suicidal attempts by generating a very decent income all year.

Rao *et al*. (2017) revealed the farming system is a collection of operations that include crop and livestock production. The farming system was as a potentially effective method of increasing and stabilising production and profitability levels in rainfed agriculture.

Gupta *et al.* (2020) looked into the different integrated farming system. The findings demonstrated that integrated farming systems (IFS) are an eco-friendly technique in which waste from one firm becomes input for another, allowing for more effective use of farm resources. IFSimprove soil health, controls weeds and pests; increases water efficiency, and maintain water quality. The use of toxic fertilizer, weed killers, and pesticides should be limited in integrated agricultural systems, while simultaneously protecting the environment from the negative consequences. It indicated that he integrated farming system improves the economic status of small and marginal farmers, which enhances education, health, and social obligations, as well as overall livelihood security. The use of chemicals (fertilizers and pesticides) can be reduced using the IFS strategy in order to supply chemical-free healthy food to society.

Many researchers have studied the socio-economic characteristics of different crops on farming basis. An attempt therefore, will be made, in the present investigation to study whether there is an increase farmers' education is the most important factor in increasing agricultural productivity, technical efficiency, and resource use productivity.

2.2 Resource Use Productivity of Farming Systems

Singh (2004) examined resource use efficiency in vegetable crops in the Mahakoshal region of Madhya Pradesh and discovered that independent variables explain about 87 to 98 per cent of the variation in the dependent variables. The elasticity of production of rental value of land was determined to be more than one, indicating that tomato and onion returns are increasing. The remaining variables for the vegetable crops okra, brinjal and potato were found to be less than one, showing diminishing returns to scale. For onion, okra, and potato vegetable crops, the total of regression coefficients seen to be less than one increases proportionally with an increase in the variable components, and vice versa.

Malathesh *et al*. (2009) determined that the influencing socio-economic farmers in identified farming system in eastern dry zone of Karnataka. They discovered that,the per unit of net income of farmers was higher in the crop + dairy + sericulture system (₹51,284) followed by crop + sericulture (₹48,231) and it was lowest in the crop-based farming system (₹29,560). As a result, extension staff should publicise and encourage farmers to practise diverse farming, as well as encourage them to combine enterprises to maximise income per unit area.

Singh *et al*. (2009) examined resource use efficiency in agriculture in Ghazipur, Uttar Pradesh, India, during 2004-05. A set of four villages was chosen at random, and 30 cultivators from each village were chosen at random. Wheat, sugarcane, potato, and paddy were the key crops used for the study. The resource use efficiency was calculated by comparing the predicted marginal value productivity of different inputs (seed, manure/fertilizer, irrigation, human labour, and plant protection) to their factor costs. It appears that cultivators had not been able to arrange their resources efficiently, and there looks to be significant room for profit enhancement through optimal input utilisation.

Rana *et al*. (2010) conducted research on the production potential, sustainability and economic viability of rice-based crop sequences in Himachal Pradesh's hills. Results from six years (2000-01 and 2005-06) demonstrated that, 'rice-radish-potato' sequence had obtained the maximum equivalent yield (26,102 kg/ha.) and net returns (90815/ha./year). Benefit-cost ratio, production efficiency (88.20kg/ha./day and 307 kg/ha./day), sustainable yield (0.640kg/ha.) and value index (0.481) 'Rice-Linseed-Sunhemp' gave the highest lands half of their land resources to some other use.

Srivastava *et al*. (2010) investigated the diagnostic of India's pulse performance. The result revealed that, the increase rate of area and production of pulses was very low, and it was wide variation in their yield across the country. The study investigated the rise and dynamics of major pulse production and consumption in several Indian states, as well as a comparative evaluation of important economic factors influencing their production pulses presented a bleak picture in their production performance were both spatially and temporally. Pulses were discovered to be favoured over coarse grains. Furthermore, a structural shift in the performance of pulse-producing states not only supports the lack of spatial and temporal stability in their production performance, but also focuses on the possible potential of minor states in pulse production for long-term pulse sustainability.

Pawar and Vijaykumar (2012) examined resource use efficiency and resource use productivity in Udagirtahsil of Latur district. The results revealed that, the production function the analysis indicate that the regression coefficient for human labour was (0.129) followed by the regression coefficient for machine labour (0.024) were positive and highly significant at the 1 per cent level. Bullock labour (0.067) and plant protection (0.011) regression coefficients were both positive and significant at the 5 per cent level. Seed, manure, nitrogen, and phosphorus regression coefficients were similarly positive but non-significant. The marginal product of soybean area was 10.803 q followed by machine labour (0.274 q), bullock labour (0.231 q) and so on. The marginal value of product to price ratio for phosphorus was 3.01 followed by nitrogen (2.98). Hence, preference might be given to increase the use of phosphorus on priority basis due to increases in soybean production.

Karthick *et al*. (2013) estimated resource usage efficiency and technical efficiency of turmeric production were calculated using primary data. According to the findings, planting material, nitrogen, potash, harvesting and curing costs, machine hours, and irrigation all have a positive and significant impact on turmeric yield. Except for harvesting and curing costs, the economic efficiency of these variables was greater than one, indicating that these resources are used at sub-optimal levels and that there is the possibility of improving turmeric yield by increasing their use. The technical efficiency of almost 60 per cent of sample farmers was found greater than 80 per cent, indicating the possibility of improving turmeric yield by adopting improved technology. The study proposed various ways to boost farmer production and profit in the study area.

Jagtap *et al.* (2014) examined the resource use efficiency and economic of marketing.The research was conducted in the Achalpur tahsil in Amravati district of Maharashtra for the year 2009-2010. The variables of human labour, bullock labour, fertiliser and manures in small farmers, seed, bullock labour, fertiliser and manures in medium farmers, and fertilizer and manures in large farmers were statistically significant among the various resources considered. The ratio of marginal value product to acquisition cost per unit was found to be greater than the unity for the variables plant protection chemicals, fertilizer, and manures in small farmers, human labour, fertilizers, and manures in medium farmers, and seed, human labour, fertilizers, and manures in large farmers.

Jawanjal *et al*. (2015) used functional analysis to determine the influence of independent variables to sugarcane yield. According to the estimated Cobb-Douglas production function, the coefficient of determination for suru sugarcane was 0.91, indicating that 91 per cent variation in the yield with jointly explained by the input variables included in the function.The coefficient of determination for ratoon sugarcane was 0.93, indicating that 93 per cent of the variation in the yield. Whereas, the MVP to FC ratios for phosphorus and nitrogen were greater than one.The human labour and irrigation suggested under-utilization of these resources in sugarcane agriculture, highlighting the potential to expand the usage of these inputs.

Waghmode *et al*. (2015) estimated resource productivity and resource usage efficiency in sugarcane cultivation.The variables of irrigation, nitrogen fertilizer, human labour, and farmyard manure were shown to be the most essential resources in enhancing sugarcane yield in the research area.

Patil (2018) did research on the economics of farming techniques in the Solapur district of Maharashtra. She collected data from 90 farmers, 30 of whom engaged in Crop only farming, 30 of whom engaged crop with livestock as a subsidiary, and 30 of whom engaged crop, livestock, and horticulture as a farming system. The study was carried out with a specific goal in mind: to analyse the resource usage patterns of various farming systems. Farmers consumed more resources as their farming systems transitioned from crop-only to crop-and-livestock, and crop-and-livestock to horticulture. The average per farm expenditure in Crop + Livestock + Horticulture was ₹ 693671.48, compared to ₹ 428694.30 and ₹ 142538.99 in crop and crop + livestock agricultural systems, respectively, indicating that farmers employed more resources in C+ L+ H farming system.

Sabu *et al*. (2020) studied the economic analysis of farming systems in Kerala. The results revealed, the rice + fish and Coconut + Banana+ Dairy cow + Poultry+ Goat were the most profitable farming systems with a benefit cost ratio of 2.63 and 2.86, respectively. The resource allocation in the existing plan was sub-optimal. The optimisation of resource use led to maximization of net returns, indicating the potential for realising greater income. The net returns of rice + fish increased from ₹ 181724 to ₹ 220010 in the optimal plan. The study also suggests the extent to which net returns can be increased with additional units of constraint resources *viz*., land/labour. The net returns in FS IV can be increased by ₹286177.9 per additional acreage of land allotted. Thus, the farmers in Kuttanad can increase their income by optimal resource allocation and by deploying additional units of land or labour.

To summarise, both the researchers were employed Cobb-Douglas production function to measure resource use efficiency. According to the assessments above, farmers have not been able to allocate their inputs efficiently, and there appears to be significant room for profit increase through optimal input usage.

2.3 Cost and Returns of Farming Systems

Naik *et al*. (2002) studied the economics of farming systems in South Konkan region of Maharashtra. It was discovered that with solo cropping, the crops provided 100 per cent of the income. In mixed farming (crop + dairy), the dairy enterprise contributed 34.40 per cent of income, while crops contributed the rest. In the crop + poultry farming system, the poultry enterprise contributed 16.17 per cent of income, while crops contributed the rest. In the crop + dairy + poultry farming system, dairy contributed 30.44 per cent of income, poultry contributed 11.25 per cent, and crop produce contributed the remaining 58.33 per cent

Swami (2004) examined the economics of the farming system in Ratnagiri district of Maharashtra. The Crops + dairy, crops + goat, and crops + poultry farming systems were shown most profitable agricultural systems, with net incomes of ₹ 41373, ₹ 37903, and ₹ 37710, respectively, which can help farmers supplements their income.

Sindhu and Bhullar (2004) estimated the changing structure of Punjab's farm economy. They attempted to evaluate the expanding importance of the livestock economy in the Punjabi agricultural sector, as well as its impact on rural income and employment generation. The cost accounting method was used to choose 240 farm households from Punjab, who were divided into four standard farm size categories. Dairy income increased faster on marginal and semi-sized farms than on medium and large farms. The demand for labour in the crop sector decreased continuously by 23 per cent from 385 man-days per farm in 1987-1989 to 297 man-days in 2000-2003. The decline in agricultural labour demand on medium and large farms, were significant that even the gain in employment due to expansion of the dairy industry was insufficient to compensate.

Murugan and Namasivayam (2005) evaluated and compared the cost and return from agriculture in Cuddalore and Thanjavar districts of Tamilnadu for marginal, small, medium, and large farmers in irrigated, unirrigated, and pooled farms. Human labour, bullock, fertilizer, pesticides, irrigation, mechanical power, and seeds are all included in Cost A. Cost C includes cost A, working capital interest, land rent and land revenue less taxes, as well as depreciation on farm machinery. The total operating cost is 51.93 per cent, and the cost of working capital is 5.19 per cent. The total production cost was. ₹20384.22, with a gross profit of ₹ 31709. ₹11324.98 were the net return over cost C. The input output ratio over operating costs was 4.43, and the B: C ratio for a large farm was 1.55, which was lower than the cost benefit ratio for a medium farm.

Rajkumar (2007) analyzed the economics of red gram-based farming systems in Bihar. The study found that MVP to MFC ratio was greater than one for human labour, seed, nitrogen, potash, and plant protection chemicals. It was indicated that the more units of these inputs may be used to boost gross income. The employment generation of CS-II (55.87man-days/ha) and CS-III (55.11man-days/ha) were produced more. Exogenous variables, such as high wages, lack of own land, price variation, and a lack of market information, which lead to uncertainty of income to the farmers.

Pokharkar *et al.* (2008) examined agricultural business analysis in Western Maharashtra, using family employment, income, and expenditure functions on irrigated and non-irrigated farms individually. Gross cropped area is highly significant at 1 percent level for irrigated area and at 5 per cent level for unirrigated land, according to the employment function. In both irrigated and non-irrigated areas, the livestock unit has a positive and strong impact on total employment. Total employment days had a positive and highly significant link with family income, according to the results of the income function. The findings of the expenditure function showed that crop production earnings were positive and very significant at the 1percent level in both irrigated and non-irrigated areas income.

Hadole and Tawade (2009) economized of farming system in the Ratnagiri district of the Konkanregion. The results of the finding that, per hectare net and gross returns vary significantly among crops, with irrigated crops being more profitable than rainfed crops. In both farming systems, perennial and seasonal horticulture crops were more profitable than cereals, pulses, and oil seeds. Although agricultural production was the primary source of income, several farmers discovered that by merging dairy and poultry enterprises with crop production, their income and employment were increased. The crop + dairy + poultry was the most profitable agricultural system in the rice and horticulture-based farming systems area, with total returns of ₹ 10441.58 and ₹ 27354.59, respectively, followed by crops +

dairy (₹ 9379.20 and ₹ 26423.96 each), crops + dairy (₹ 9379.20), and solely crops (₹ 5814.53 and ₹ 23359.55).

Korikanthimath (2009) studied integrating various agriculturally related enterprises with crop activity as a base will provide ways to recycle products and waste materials from one component as inputs through another linked component, decreasing production costs and, as a result, increasing the farm's total income. Rice + brinjal + mushroom + poultry was shown to be the greatest combination in terms of rice equivalent yield (21.49 tonnes/ha), employment generation (392 man-days), energy efficiency, and net return in the Eastern Uttar Pradesh irrigated agro-ecosystem.

Dorge (2010) conducted a study in Western Maharashtra on the economic analysis of sustainable farm earnings through farming systems. For this study, three widely used agricultural systems were chosen: Crop only (FS I), crop+ livestock (FS II), and crop+ livestock+ horticulture (FS III) (FS III). The study area was further divided into two types: rainfed and irrigated. The study revealed that, the output-input ratio of farming system III (C+ L+ H) was more profitable (B:C ratio1.75) followed by 1.39 in FS II and 1.19 in FS I. The result showed that farming system III (C+ L+ H) was highly profitable than rainfed region due to income of horticulture crop. As a result, the FS III (C+ L+ H) was found to be the most satisfying due to the variety of activities and irrigation assurance.

Torane (2011) analysed the diversification of farming methods in North Konkan region of Maharashtra. The profitability and extent of diversification of existing farming systems in the North Konkan region of Maharashtra have been investigated. Using the hierarchical agglomerative approach, the study area was divided into different clusters. The type of farming in the North Konkan region has been discovered to be extremely diverse. The agricultural economy has also shown considerable variety, with per-farm income ranging from ₹ 1135 to ₹ 218,015 across various farming systems. The most economical profitable farming system in study area are: (i) Paddy + Irrigated plantation + betel vines (B:C ratio, 2.02), (ii) Paddy + Pulses + Dairy + poultry (B:C ratio, 1.74), (iii) Paddy + Vegetables + Dairy (B:C ratio, 1.62), (iv) Paddy + Irrigated plantations + Dairy (B:C ratio, 1.57), (v) Irrigated plantations + Dairy (B:C ratio, 1.42. Diversification has a favourable relationship with profitability, highlighting the benefits of combining enterprises.

Sachinkumar *et al.* (2012) examined the economics of farming systems in northern transitional zone of Karnataka. He concluded that, net returns were best in the system involving crops, dairy, and plantation (₹57285.23) in Dharwad's peri-urban area. The net returns in the Belgaum peri-urban area were highest in a system that included crops, vegetables, dairy, and poultry (₹11142.62). Crop, dairy, and goat farming systems did suitable and substantially better in rural areas (₹31668.41). Dairy has shown to be lucrative in all farming systems in the Dharwad region.

Singh *et al.* (2012) conducted farming systems from 2000-01 to 2002-03. The maize-potato–*summer* groundnut +1 graded buffalo farming system, the yield of different components harvested 27.40 q/ha. 264.60 q/ha. maize, 27.00 q/ha. *summer* ground nut, and 8.001 q/ha. milk per buffalo every day. Similarly, in the maize-field pea-watermelon +1 graded buffalo farming system, which yielded 26.30 q/ha. of maize, 27 q/ha. of field pea, and 212 q/ha. of watermelon, the potential to increase Return Over Variable Cost(ROVC) over the previous plan was highest in farming system –(FS)-IV(Livestock), followed by FS-I (Crop+Livestock) and FS –I (Crop). In contrast, the possibility for increasing revenue in FS-III (Crop+Livestock+Orchard) was only 0.27 percent. The study's main policy suggested that the study area's orchard and livestock farming, as well as potato production, be given more attention.

Raghav and Srivastava (2015) examined the farming system –(FS)-IV(Livestock) had the greatest returns over variable Cost(ROVC) over the exiting plan followed by FS-I(Crop+Livestock) and FS –II(Crop+Livestock) (Crop). In contrast, the possibility to improve earnings in FS-III (Crop+Livestock+Orchard) was only 0.27 percent. The study's main policy recommendation is to focus more attention on improving orchard and livestock rearing, as well as potato production, in the study area.

Singh and Burak (2016) studied the: FS-I (Crops+Vegetables) and FS-II (Crop+Dairy), FS-III (Crop+Dairy+Goat), and FS-IV (Crop+Goat+Poultry+Orchard). The most profitable farming system under the rainfed environment was FS-III (Crop+Dairy+Goat) with ₹57601 per farm on the basis of net return per household. FS-I (Crops+Vegetables) was the most profitable farming system on net return (₹147287/farm) in an irrigated situation.

Mukhils *et al.* (2018) examined IFS of crop and livestock: rice and cattle integration. He studied that integrated farming systems has combined two or more fields of agriculture, which is based on the recycling biological concept, and linked of input-output between the mutually commodities were low external input utilization, which is done on the land, through the utilization of crop waste, animal manure, fish waste for the purpose of increasing the production and productivity so as to increase farmers income and can create condition that are environmentally friendly farming. The development of the integrated farming system is very important, because the integrated farming system has many usages and advantages and benefits in line with the objectives of the regional development that to improve the social welfare. It can be a solution for the various problems that arise in the regional development.

The reviews clearly show that a crop-only farming method is not profitable. To boost their income above profitability, farmers can use farming systems such as crop with livestock, crop with poultry, crop with livestock and horticulture, crop with sericulture, and so on.

2.4 Constraints of Farming System

Wagh *et al.* (2002) reported the barriers to dairy technology adoption in the Sirpur taluka of Maharashtra's Dhule district. The study found that the most significant economic constraint was the non-availability of loans (100 %), as well as a shortage of capital (81 %). Non-provision of improved breeds and feeds (100%), absence of improved fodder, and non-availability of veterinary help centre are among the input supply restrictions (67.00 %).

Wadear (2003) highlighted the difficulties faced by the sample farmers in producing various crops in various zones of northern Karnataka. In several of the crop cultivations, he found serious problems such as non-availability of seeds on time, lack of storage facilities, pest and disease incidence, and price fluctuation. The lack of financing, grazing area availability, artificial insemination facility, improved breeds, lack of understanding of scientific feeding, efficient market facility, and cost of feeds were all major issues in milk production.

Nagaraju and Sankhala (2003) reported constraints in improved dairy farming practises of Andhra Pradesh's West Godavari area. He suggested that significant barriers to the adoption of improved dairy farming practises *viz.,* including the lack of milk cooperatives in the village, a lack of sufficient knowledge in various areas of improved dairy farming practises, middleman exploitation, a remote location of an artificial insemination centre or veterinary hospital, and poor transportation.

Rajeshwari (2004) studied the problem and prospects of coconut-based farming systems in Tunkur district of Karnataka. He estimated that the major issues faced by the farmers were might infestation in coconut gardens (100 %), lack of transportation and marketing facilities, land fragmentation and division and a lack of funds. Other issues included a less reliable market in the global context, low yield due to local seeds and the lack of support pricing.

Singh *et al.* (2009) examined the economics of Uttar Pradesh's farming systems. According to the study, cross breed breeding has not become popular due to limited demand for cross-breed cow milk. Loan has a considerable impact on farm earnings, with institutional sources meeting around 86 percent of farmer credit needs. The major constraints to promoting integrated farming systems in this area have been identified as fragmentation and subdivision of landholdings, scarcity of labour, low crop yields, less reliable markets, scarcity of owned-fund, depleting natural resources, non-availability of good quality seeds and poultry sheds, and so on.

Biswas (2010) carried out a study on agricultural system approaches to improve IUE, employment and income in eastern India, farm size is too small to employ family labour for the year around in monocropping practised. As a result, they combine various farming systems such as agriculture, livestock, fisheries, goat keeping, horticulture (fruit, vegetables, flowers, apiculture, plantation), and so on. This leads to increased input use efficiency (IUE), including fertilizers use efficiency, risk reduction, and job creation, all of which lead to increased farm income.

Ponnusamy and Devi (2017) observed that farmers had a regular interaction with extension functionaries of the department of agriculture, animal husbandry, horticulture and KVK, both farmers and extension functionaries opined almost similarly in Haryana. He reported that, lack of remunerative returns for the products of different components from the same farm followed by heavy investment in the last years of IFS and non-availability of labours were the major constraints.

Sharma *et al.* (2017) reported constraints of farming system issues. The highly productive agricultural areas have been redirected to infrastructural development, urbanisation, and other associated activities in FS.

The key restrictions cited by the farmers were high input costs (chemical fertilizer, seed, etc.), high wage rates, lack of awareness of improved technology, and unavailability of loan on time, according to the above review.

From the above review it is summarized that the major problems faced by farmers were high cost of inputs, high wage rates and lack of awareness of improved technology.

3. METHODOLOGY

The goal of any specific inquiry is to reach helpful conclusions in light of the study's aims. It is critical for the investigators to use suitable methods and procedures in order to reach their conclusions. Keeping this in mind, this chapter has been dedicated to explaining the methods used to achieve the objectives under consideration. It discusses the sample selection strategy, data gathering methods, and analytical procedures utilised to obtain results that meet the study's objectives.

3.1 Data Requirement

Data on many elements were sought to research the 'Economics of integrated farming system in Ahmednagar district of Maharashtra. The following are the primary aspects of data requirements:

i. The sample farmer's information.
ii. Information about the sample farm's land usage and cropping patterns.
iii. Detailed information about the sample farm's annual employment, income, and expenditure patterns.
iv. Information about the limits that farmers face.

3.2 Sources of Data

The primary data were collected from the sample farmers. The data on several elements were gathered from a sample of farmers in the Ahmednagar district.

3.3 Sampling Design

The multistage sampling design was used to select the district, tahsils, and villages. These sampling designs were used to examine the economics of integrated farming systems in the Ahmednagar district of Maharashtra.

3.3.1 Selection of the Study Area

The present study was undertaken in Ahmednagar district. The Ahmednagar district was selected purposively because Ahmednagar district is one of the largest and most populardistricts having different farming systems in Maharashtra.

3.3.2 Selection of Tahsils

There are total fourteen tahsils in Ahmednagar district. For the study two tahsils *viz.,* Rahuri and Karjat were selected purposively.

3.3.3 Selection of Villages

Based on availability of samples, from each tahsil two villages were selected, randomly. In all, four villages were selected from two tahsils *viz.,* Rahuri and Karjat.

3.3.4 Selection of Different Farming Systems

The farming systems, which were taken into consideration for present study, were as follows

1) Crops only

2) Crop + Dairy

3) Crop + Dairy + Horticulture

3.3.5 Selection of Sample Farmers

Farmers from each village consisting of 8 crop, 8 crop + dairy and 8 crop+ dairy + horticulture farming system were selected. Thus, 96 farmers from 4 villages comprising of 32 crop, 32 crop + dairy and 32 crop + dairy + horticulture farming systems were selected for study.

Table 3.1 Selection of sample farmers

Sr. No.	Tahsil	Village	Crop	C + D	C + D + H	Total
1	Karjat	Belwandi	8	8	8	24
		Talwadi	8	8	8	24
2	Rahuri	Tambhere	8	8	8	24
		Kangar	8	8	8	24
		Total	**32**	**32**	**32**	**96**

3.4 Method of Data Collection

For the present study, the primary data was obtained by survey method from the selected farmers with the aid of specially designed questionnaire for the year 2020-21. The data was collected on many elements such as the family size, land use, cropping pattern, capital assets, livestock position, cost and returns from Crop only, crop + dairy and crop + dairy + horticulture.

3.5 Analysis of Data

Using proper statistical methods, the data collected from cultivators were tabulated and analysed. The socio-economic factors, such as family size and composition, land use pattern, cropping pattern, assets, income, employment, expenditure, and so on, were examined on a per farm basis in order to meet the study's objectives. On per farm basis, different farming systems were compared in terms of income received, expenditure incurred and employment patterns.

3.5.1 Functional Analysis

For each farming system, the employment, income, and expenditure functions were used individually. The independent variables differ based on the farming system.

a) Employment function

The multiple linear production function was fitted for estimating the factors affecting on employment.

$$Y= a +b_1X+b_2X_2+b_3X_3+b_4X_4+b_5X_5+Ut$$

Where,

Y = Employment (man-days)

a = Constant

X_1 = GCA (ha)

X_2 = GIA (ha)

X_3 = Earners (no.)

X_4= livestock (no.)

X_5= Area under Horticulture crops (ha)

bi's= Regression coefficient

Ut= Error term

b) Expenditure function

The multiple linear production function was used for estimating the factors affecting on expenditure.

$$Y= a +b_1X_1 +b_2X_2+b_3X_3+b_4X_4+b_5X_5+Ut$$

Where,

Y = Expenditure (₹)

a = Constant

X_1 = GCA (ha)

X_2 = GIA (ha)

X_3 = livestock (no.)

X_4 = Family Size (no.)

X_5= Area under Horticulture crops (ha)

bi's = Regression Coefficient

Ut = Error term

c) Income function

Multiple linear production function was fitted for estimating the factors affecting on income.

$$Y = a + b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+ Ut$$

Where,

Y = Income (₹)

a = Constant

X_1 = GCA (ha)

X_2 = GIA (ha)

X_3 = Earners (no.)

X_4 = livestock (no.)

X_5 = Area under Horticulture crops (ha)

bi's = Regression Coefficient

Ut = Error term

3.5.2 Specification of Variables

i) Gross cropped area

The gross cropped area (GCA) is the total area sown in a particular year. Gross cropped area includes Net Cropped Area (NCA) + Double cropped area. This input has been expressed in terms of hectare.

ii) Gross irrigated area

This variable represents the total irrigated area in a given year as a percentage of total cultivated area in a given farm family. It was measured in hectares.

iii) Number of earners

Out of the family size, this is one of the major variables that shows the number of earning members in the household. This variable was defined in terms of numbers.

iv) Livestock number

It is the number of livestock accessible in a specific farming family. This variable was also measured numerically.

v) Area under horticultural crop

The area under fruits, vegetables, and plantation crops, among other things, under the operational holding of a specific farm family is taken into account here. It was also assessed in terms of hectares.

v) Family size

This variable took into account all family members, including children, young and old, as well as earners and non-earners, and the unit for this variable is numbers.

vi) Output (Y)

Individual farming systems were employed to the output as a dependent variable. Gross family employment, gross family income, and gross family expenditure are the outputs of three separate multiple linear regression functions.

3.5.3 Analysis of Problems Faced by Farmers

The garrett's ranking technique was utilised to determine the most significant factor influencing the responders. According to this method, respondents were asked to rank all elements, and the results of such ranking were turned into score value using the following formula:

$$\text{Per cent position: } 100-(Rij-0.5)/Nj$$

Where, Rij = Rank given for the i^{th} variable by j^{th} respondents.

Nj = No. of variables ranked by j^{th} respondents.

4. RESULTS AND DISCUSSION

The data collected from the selected farmers with the use of a prepared questionnaire was evaluated according to the objectives using the methodologies and procedures specified in the methodology chapter. In this chapter, the results of the analysis for achieving the study's set of objectives are listed under the headings below,

4.1 Farmers socio-economic characteristics

4.2 Resource use pattern of different farming systems

4.3 The profitability of various farming systems

4.4 Study the constraints in existing farming system

4.1 Farmers Socio-Economic Characteristics

The general information on the selected sample farmers for the current study is provided under the following subheads to aid in understanding their backgrounds and socio-economic conditions.

4.1.1 The Size and Composition of a Family

The size and structure of a family exposes the available labour force as well as the family's consumption demands in an indirect manner. The size and composition of the selected farmer's families are shown in Table 4.1.

It is observed from the table, that the average family size was 5.49 peoples, with 34.61 per cent of men, 31.51 per cent of females and 33.88 per cent of children. The crops alone farming system's average family size was found to be 4.76 people, with 34.87 per cent men, 34.25 per cent females and 30.88 per cent children. The C + D farming system's average family size was determined to be 5.41 people, with 32.90 per cent males, 31.24 per cent females and 35.86 per cent children. The average number of people in the C + D + H agricultural system was 6.32, out of which 35.60 per cent males, 29.75 per cent females and 34.65 per cent children.

Table 4.1 Family size and its composition

(No. / farm)

Sr. No.	Particulars	Farming systems			Overall
		C	C + D	C + D + H	
1.	Male	1.66 (34.87)	1.78 (32.90)	2.25 (35.60)	1.90 (34.61)
2.	Female	1.63 (34.25)	1.69 (31.24)	1.88 (29.75)	1.73 (31.51)
3.	Children	1.47 (30.88)	1.94 (35.86)	2.19 (34.65)	1.86 (33.88)
4.	**Total**	**4.76 (100)**	**5.41 (100)**	**6.32 (100)**	**5.49 (100)**

(Figures in the parentheses are the percentages to the respective total)

The average family size was highest in the C + D + H farming system followed bymoderate in the C + D farming system andCrops only farming system. The size farming component increase with the increases of family size farming systems.

4.1.2 Educational Status of Farmers

Another key aspect determining a farmer's managerial competence and technical understanding is education. Table 4.2 contains the information on the educational position of selected sample farmers. At the overall, 11.66 per cent of family members had completed primary school, 34.97 per cent had completed secondary school, 32.79 per cent had completed college, 9.47 per cent had completed post-secondary education and 11.11 per cent family member were illiterate. Among, the different farming systems, in the Crop only farming system, 14.50 per cent of family members had received primary education, 34.24 per cent had received secondary education, 30.88 per cent had received college education, 3.36 per cent had received post-graduate education and 17.02 per cent of family members were illiterate.

In the C + D farming system, 10.91 per cent of family members had received primary education, 36.41 per cent had received secondary school, 35.12 per cent had received college education, 4.25 per cent had received post-graduate education and 13.31 per cent of family members were illiterate.

Table 4.2 Educational status of farmers

(No. / farm)

Sr. No.	Particulars	Farming systems			Overall
		C	C + D	C + D + H	
1.	Primary	0.69 (14.50)	0.59 (10.91)	0.63 (9.97)	0.64 (11.66)
2.	Secondary	1.63 (34.24)	1.97 (36.41)	2.16 (34.18)	1.92 (34.97)
3.	College	1.47 (30.88)	1.90 (35.12)	2.03 (32.12)	1.80 (32.79)
4.	P.G.	0.16 (3.36)	0.23 (4.25)	1.19 (18.83)	0.52 (9.47)
5.	Illiterate	0.81 (17.02)	0.72 (13.31)	0.31 (4.90)	0.61 (11.11)
6.	**Total**	**4.76 (100)**	**5.41 (100)**	**6.32 (100)**	**5.49 (100)**

(Figure in the parentheses are the percentages to the respective total)

In the C + D + H farming system, 9.97 per cent of family members had received primary education, 34.18 per cent had received secondary education, 32.12 per cent had received college education, 18.83 per cent had received post-graduate education and 4.90 per cent of family members were illiterate.

In the Crop only farming system, the percentage of illiterate family members was highest among the different farming system (17.02%). In the C + D + H farming system, however, the ratio of family members with a post-graduate education was more (18.83 %) than other farming system.

4.1.3 Land Use Pattern on Sample Farms

Land is one of their most valuable assets of farmers. The information on average holding size, cultivable land, net cropped area and gross cropped area is showed in Table 4.3.

Table 4.3 Land use pattern

(ha. / farm)

Sr. No.	Particulars	Farming systems			
		C	C+D	C+D+H	Overall
1.	Total holding	1.88 (100)	2.38 (100)	3.47 (100)	2.58 (100)
2.	Permanent fallow	0.10 (5.32)	0.13 (5.46)	0.26 (7.49)	0.16 (6.20)
3.	Operational holding	1.78 (94.68)	2.25 (94.54)	3.21 (92.51)	2.42 (93.80)
	a. Irrigated	1.74 (92.55)	2.20 (92.44)	3.17 (91.36)	2.38 (92.25)
	b. Unirrigated	0.04 (2.13)	0.05 (2.10)	0.04 (1.15)	0.04 (1.55)
5	Current fallow	0.05 (2.66)	0.06 (2.52)	0.09 (2.60)	0.07 (2.71)
4.	NCA	1.73 (92.02)	2.19 (92.02)	3.12 (89.91)	2.35 (91.09)
6.	GCA	2.27	2.92	4.20	3.14
7.	Cropping intensity (%)	131.21	133.33	134.62	133.62

(Figure in the parentheses are the percentages to the total land holding and operational land holding)

In the Crops only, C + D, and C + D + H farming systems of sample growers, the average land holding was 1.88, 2.38, and 3.47 hectors, respectively, with an overall average holding of 2.58 hectors. At the overall level, the net sown area was 2.35 hectors, while the area under permanent fallow land was 6.20 per cent. In the case of Crops only, C + D, and C + D + H farming systems, the area under irrigation was 1.74, 2.20, and 3.17 hectors, respectively.

The proportion of irrigated land at overall level was 92.25 per cent of the total holding i.e. 2.38 hectors. The area under irrigation was highest in the C + D + H farming system.

At the overall level, cropping intensity was 133.62 per cent with a gross cropped area of 3.14 ha. The C + D + H farming system had the highest cropping intensity of

134.62 per centfollowed by the C + D farming system with 133.33 per cent and the Crops only farming system with 131.21 per cent. Cropping intensity was found to be considerably good in all three agricultural systems.

4.1.4 Livestock Composition on Sample Farms

The information regarding the livestock composition of sample farms is represented in Table 4.4.

Table 4.4 Livestock composition of sample farm

(No. /farm)

Sr. No.	Particulars	Farming systems			
		C	C + D	C + D+ H	Overall
1.	Bullock	0.00 (00)	0.41 (6.40)	0.18 (2.43)	0.20 (4.34)
2.	Cow	0.00 (00)	3.84 (59.91)	4.22 (56.95)	2.69 (58.35)
3.	Buffalo	0.00 (00)	0.72 (11.23)	0.88 (11.88)	0.53 (11.50)
4.	Calf	0.00 (00)	0.97 (15.13)	1.44 (19.43)	0.80 (17.35)
5.	Heifer	0.00 (00)	0.47 (7.33)	0.69 (9.31)	0.39 (8.46)
6.	Total	0.00 (00)	6.41 (100)	7.41 (100)	4.61 (100)

(Figure in the parentheses are the percentages to the respective total)

It may be noted from the table, the average size of livestock composition per family was 4.61 at overall level while per farm availability of bullock, cow, buffalo, calf and heifer were 4.34, 58.35, 11.50, 17.35 and 8.46 per cent, respectively.

The bullock, cow, buffalo, calf, and heifer availability per farm under the C + D farming system were 6.40, 59.91, 11.23, 15.13 and 7.33 per cent, respectively. The bullock, cow, buffalo, calf and heifer availability per farm in C + D + H were 2.43, 56.95, 11.88, 19.43 and 9.31 per cent, respectively.

4.1.5 Investment on Farm Implements

Table 4.6 shows the total investment in farm implements for the Crop only, C + D, and C + D + H farming systems.

At overall level, the average investment in farm tools per farm was ₹ 79199.70. The highest per farm investment percentage at overall level was on tractor (86.30%) followed by tractor accessories (8.91%) and electric motor (3.39%). Among the farming systems, the crops-only farming systems had the highest per-farm investment percentage observed on tractor (75.66%) followed by tractor accessories (16.15%) and electric motor (6.37%). The similar trends were observed in the C + D and C + D + H farming systems, with more per farm investment in the tractor followed by tractor accessories and electric motor.

Table 4.5 Investment on farm implements

(₹ / farm)

Sr. No.	Particulars	Farming systems							
		C		C+ D		C+D+H		Overall	
		No.	₹/farm	No.	₹/farm	No.	₹/farm	No.	₹/farm
1.	Plough	0.22 (2.14)	103.13 (0.30)	0.37 (2.42)	175 (0.22)	0.41 (2.04)	198.13 (0.16)	0.33 (2.17)	158.75 (0.2)
2.	Seed drill	0.19 (1.84)	35.94 (0.11)	0.28 (1.83)	56.25 (0.07)	0.31 (1.55)	70 (0.06)	0.26 (1.71)	54.06 (0.07)
3.	Bullock Cart	0.12 (1.17)	26.56 (0.08)	0.16 (1.05)	34.53 (0.04)	0.13 (0.65)	31 (0.03)	0.13 (0.86)	30.70 (0.04)
4.	Tractor	0.19 (1.85)	25625 (75.66)	0.34 (2.23)	71875 (88.76)	0.75 (3.73)	107546.88 (87.61)	0.43 (2.76)	68348.96 (86.30)
5.	Tractor accessories	0.41 (3.98)	5468.75 (16.15)	0.50 (3.27)	5875 (7.26)	0.81 (4.03)	9825.00 (8.0)	0.57 (3.75)	7056.25 (8.91)
6.	Spray pump	0.75 (7.29)	273.44 (0.81)	1.03 (6.75)	302.50 (0.37)	1.28 (6.37)	1378.13 (1.12)	1.02 (6.71)	651.37 (0.82)
7	Electric motor	1.16 (11.27)	2159.06 (6.37)	1.75 (11.46)	2453.13 (3.03)	2.56 (12.74)	3442.19 (2.80)	1.82 (11.97)	2684.79 (3.39)
8.	Hand Tools	7.25 (70.46)	175.94 (0.52)	10.84 (70.99)	202 (0.25)	13.84 (68.89)	266.53 (0.22)	10.64 (70.07)	214.82 (0.27)
9.	**Total**	**10.29 (100)**	**33867.82 (100)**	**15.27 (100)**	**80973.41 (100)**	**20.09 (100)**	**122757.86 (100)**	**15.2 (100)**	**79199.70 (100)**

(Figure in the parentheses are the percentages to the respective total)

4.1.6 Cropping Pattern on Sample Farms

The individual crops were categorised into *kharif, rabi*, annual and horticultural crops in the cropping patternand their areas were mentioned in Table 4.6. The total gross cropped area at overall was 3.14 hectors, with sugarcane accounting for 33.76 per cent to the total followed by black gram accounting for 8.28 per cent and *kharif* total accounting for 32.16 per cent and *rabi* total accounting for 22.29 per cent.The black gram contributed largest share of land in cropping pattern of *kharif* season for overall group at 8.28 per cent. Other crops grown during the *kharif* season include soybean, maize, and fodder maize, which were contributed 6.69, 3.82 and 3.18 per cent, respectively. While in *rabi* season, *rabi* jowar and wheat contributed same as 14.02 per cent as the highest share of area followed by chickpea and fodder Jowar. It implied that in the farming business farmer were given more priority to income crops like sugarcane.

In C + D + H farming system, horticulture crop of pomegranate was the most important fruit crop in the Karjat and Rahuri tahsils of the Ahmednagar district.

Table 4.6 Cropping pattern

(ha. / farm)

Sr. No.	Particulars	Farming Systems			
		C	C+D	C+D+H	Overall
1.	***Kharif* crops**				
	a. Soybean	0.21 (9.25)	0.22 (7.53)	0.20 (4.76)	0.21 (6.69)
	b. Maize	0.14 (6.17)	0.10 (3.42)	0.13 (3.10)	0.12 (3.82)
	c. Fodder Maize	0.00 (00)	0.18 (6.16)	0.13 (3.10)	0.10 (3.18)
	d. Onion	0.13 (5.73)	0.16 (5.48)	0.17 (4.05)	0.15 (4.78)
	e. Tur	0.18 (7.93)	0.12 (4.12)	0.20 (4.76)	0.17 (5.41)
	f. Black Gram	0.27 (11.89)	0.25 (8.56)	0.24 (5.71)	0.26 (8.28)
	Total	0.93 (40.97)	1.03 (35.27)	1.07 (25.48)	1.01 (32.16)
2.	***Rabi* crops**				
	a. *Rabi* jowar	0.17 (7.49)	0.19 (6.51)	0.29 (6.90)	0.22 (7.01)
	b. Wheat	0.18 (7.93)	0.23 (7.88)	0.26 (6.19)	0.22 (7.01)
	c. Fodder jowar	0.00 (00)	0.09 (3.08)	0.20 (4.76)	0.10 (3.18)
	d. Chick pea	0.12 (5.28)	0.14 (4.79)	0.21 (5.00)	0.16 (5.09)
	Total	0.47 (20.70)	0.65 (22.26)	0.96 (22.85)	0.70 (22.29)
3.	***Summer***				
	Groundnut	0.07 (3.09)	0.08 (2.74)	0.12 (2.86)	0.09 (2.88)
	Total	0.07 (3.09)	0.08 (2.74)	0.12 (2.86)	0.09 (2.88)
4.	**Annual crops**				
	a.Sugarcane	0.80 (35.24)	1.07 (36.65)	1.30 (30.95)	1.06 (33.76)
	b. Napier grass	0.00 (00)	0.09 (3.08)	0.05 (1.19)	0.05 (1.59)
	Total	0.80 (35.24)	1.16 (39.73)	1.35 (32.14)	1.11 (35.35)
4.	**Horticulture crop**				
A.	Pomegranate	00 (00)	0.00 (00)	0.70 (16.67)	0.23 (7.32)
	Total	0.00 (00)	0.00 (00)	0.70 (16.67)	0.23 (7.32)
	GCA	2.27 (100)	2.92 (100)	4.20 (100)	3.14 (100)

(Figure in parentheses are the percentages to the total of gross cropped area)

4.2 Resource Use Pattern of Different Farming Systems

Any production activity's resource use pattern reflects the composition of the expenditures incurred on different inputs. It is beneficial to identify the strengths and weaknesses in the production system in order to improve efficiency.

4.2.1 Per Farm Resource Use Pattern

The information for the per hectare utilization of different inputs are presented in Table 4.7.

It is revealed from the table, the average per farm expenditure was ₹ 376576.77 at the overall level. The expenditure on livestock management accounted for 35.90 per cent of total spending followed by fertilizer (20.05 %), tractor (15.84 %), labour charges (10.92 %), seed (8.66 %), plant protection (6.54 %) and manure (2.09 %).

Among the different farming system, in case of Crops only farming system average per-farm expenditure was ₹ 166918, out of which fertilizers accounted for 37.29 per cent of total expenditures followed by tractor (27.59 %), labour charges (17.10 %), seed (14.29 %) and manure (2.56 %).In the C + D farming system average expenditure was ₹387196.72, among which livestock maintenance accounted for 51.15 per cent of total expense followed by fertilizer (16.65 %), tractor (12.31 %), seed (8.92 %), labour charges (8.83 %), manure (1.58 %) and plant protection charges (0.56 %).In C + D + H, the average expenditure per farm was ₹ 682015.02. Out of which Livestock management accounted for 36.06 per cent of total expense followed by fertilizer (17.33 %), tractor (14.80 %), plant protection charges (12.11 %), labour charges (10.54 %), seed (6.86 %) and manure (2.30 %). The per farm resources use of inputs were more use in C+D+H farming systems than the C+D and Crop only farming systems, because C + D + H farming system was required more resource use as compared to other farming systems.

4.2.2 Per Hectare Resource Use Pattern

The information of per hectare resource is presented in Table 4.8. According to table, at the overall level average cash expenditure per hectare was ₹ 160245.43 in total, out of which livestock maintenance accounted for 35.90 per cent of total spending followed by fertilizer (20.05 %), tractors (15.84 %), labour charges (10.92 %), seed (8.66 %), plant protection (6.54 %), and manure (2.09 %). In case of Crops only farming system the average cost per hectareresource was ₹ 96484.39. The highest cost accounted for fertilizer was 37.29 per cent of total expense followed by tractor (27.59 %), labour charges (17.10 %), seed (14.29 %) and manure (2.56 %).

Table 4.7 Per farm resource use pattern

(₹)

Sr. No	Particulars	Farming systems							
		C		C + D		C + D + H		Overall	
		q	₹/Farm	Q	₹ /Farm	q	₹/Farm	q	₹/Farm
1.	Hired labour(A) (Man-days)	38.78 (0.50)	10914.06 (6.54)	40.28 (0.45)	11383 (2.94)	71.69 (0.65)	20022 (3.48)	50.25 (0.54)	14106.35 (3.74)
2.	Family labour(B) (Man-days)	53.88 (0.69)	17621.88 (10.56)	69.94 (0.78)	22819 (5.89)	127.56 (1.15)	40652 (7.06)	83.79 (0.90)	27030.96 (7.18)
3.	**Total labour(A+B) (Man-days)**	**92.66 (1.19)**	**28535.94 (17.10)**	**110.22 (1.23)**	**34202 (8.83)**	**199.25 (1.80)**	**60674 (10.54)**	**134.04 (1.44)**	**41137.31 (10.92)**
4.	Tractor (hrs.)	76.75 (0.98)	46050 (27.59)	79.41 (0.89)	47644 (12.31)	116.19 (1.05)	85222 (14.80)	90.78 (0.98)	59638.67 (15.84)
5.	Seed (kg.)	5543 (71.07)	23855.63 (14.29)	6596.09 (73.57)	34530 (8.92)	7774.7 (70.25)	39409 (6.86)	6637.93 (71.55)	32598.21 (8.66)
6.	Manure (q.)	17.12 (0.22)	4281.25 (2.56)	24.5 (0.27)	6125 (1.58)	53.06 (0.48)	13265.62 (2.30)	31.56 (0.34)	7890.62 (2.09)
7.	Fertilizers (kg) N P K	 869.84 (11.15) 582.25 (7.47) 617.5 (7.92)	62244.56 (37.29)	 905.94 (10.11) 612.03 (6.83) 637.06 (7.10)	64475 (16.65)	 1120.3 (10.12) 896.38 (8.1) 907.38 (8.2)	99768 (17.33)	 965.36 (10.41) 696.89 (7.51) 720.65 (7.77)	75495.85 (20.05)
8.	Plant protection (₹)	-	1950.62 (1.17)	-	2180.1 (0.56)	-	69720 (12.11)	-	24616.91 (6.54)
9.	Livestock maintenance	-	-	-	198040.62 (51.15)	-	207557 (36.06)	-	135199.2 (35.90)
10.	Total	7799.12 (100)	166918 (100)	8965.25 (100)	387196.72 (100)	11067.26 (100)	575615.62 (100)	9277.21 (100)	376576.77 (100)

Table 4.8 Per hector resource use pattern (₹)

Sr. No.	Particulars	Farming systems							
		C		C + D		C + D + H		Overall	
		q.	₹ /ha	q.	₹ /ha	q.	₹/ ha	q.	₹/ ha
1.	Hired labour(A) (Man-days)	22.42 (0.50)	6308.71 (6.54)	18.39 (0.45)	5197.72 (2.94)	22.98 (0.65)	6417.31 (3.48)	21.38 (0.54)	6002.7 (3.74)
2.	Family labour(B) (Man-days)	31.14 (0.69)	10186.06 (10.56)	31.94 (0.78)	10419.63 (5.89)	40.88 (1.15)	13029.49 (7.06)	35.66 (0.90)	11502.54 (7.18)
3.	**Total labour(A+B) (Man-days)**	**53.56 (1.19)**	**16464.77 (17.10)**	**50.33 (1.23)**	**15617.35 (8.83)**	**63.86 (1.80)**	**19446.80 (10.54)**	**57.04 (1.44)**	**17505.24 (10.92)**
4.	Tractor (hrs.)	44.36 (0.98)	26618.5 (27.59)	36.26 (0.79)	21755.25 (12.31)	37.24 (1.05)	27314.74 (14.80)	38.63 (0.98)	25378.16 (15.84)
5.	Seed (kg.)	3204.05 (71.07)	13789.38 (14.29)	3011.91 (73.57)	15767.12 (8.92)	2491.89 (70.25)	12631.09 (6.86)	2824.65 (71.55)	13871.58 (8.66)
6.	Manure (q.)	9.90 (0.22)	2474.71 (2.56)	11.19 (0.27)	2796.80 (1.58)	17.01 (0.48)	4251.80 (2.30)	13.43 (0.34)	3357.71 (2.09)
7.	Fertilizers (kg.) N P K	502.80 (11.15) 336.56 (7.47) 356.93 (7.92)	35979.51 (37.29)	413.67 (10.11) 279.47 (6.83) 290.89 (7.10)	29440.64 (16.65)	359.07 (10.12) 287.30 (8.1) 290.83 (8.2)	31976.92 (17.33)	410.79 (10.41) 296.55 (7.51) 306.66 (7.77)	32125.89 (20.05)
8.	Plant protection (₹)	-	1127.53 (1.17)	-	995.48 (0.56)	-	22346.15 (12.11)	-	10475.28 (6.54)
9.	Livestock maintenance	-	-	-	90429.51 (51.15)	-	66524.68 (36.06)	-	57531.57 (35.90)
10.	Total	4508.16 (100)	96484.39 (100)	4093.72 (100)	176802.15 (100)	3547.20 (100)	184492.18 (100)	3947.75 (100)	160245.43 (100)

(Figure in the parentheses are percentage to the respective total)

In the C + D farming system the average expenditure was ₹ 176802.15. Livestock management accounted for 51.15 per cent of total expense followed by fertilizers (16.65 %), tractor (12.31 %), seed (8.92 %), labour charges (8.83 %), manure (1.58 %) and plant protection charges (0.56 %).

In the C + D + H farming system, the average expenditure of per hectare was accounted ₹184492.18. The livestock management accounted for 36.06 per cent of total cost followed by fertilizer (17.33 %), tractor (14.80 %), plant protection charges (12.11 %), labour charges (10.54 %), seed (6.86 %) and manure (2.30 %).The per hectare resource uses were increased with increases the components in farming systems.

These findings were confirmed by the results of Rana *et al*. (2010), Srivastava*et al*. (2010), and Patil *et al*. (2010).

The use of resources, such as seeds, fertilizer and machinery, in the proposed farming system is in varying proportions, indicating that the proposed alternative hypothesis i.e., resource use levels arevarying under different farming systems, has been proved.

4.3 Employment Pattern on Farming Systems

In the production of any good, four inputs are necessary, known as factors of production. Those are land, labour, capital, and enterprise. Human labour is one of the most important inputs in any manufacturing processes. The skilled and unskilled labour are needed in the hydroponics unit to perform various tasks, such as filling cups with planting crop, transplanting seedlings, cleaning, thinning, spraying, harvesting, packaging of vegetables and fruit, animal rearing and dairying of animal very were major labor-intensive.

The annual employment generated through farming systems are estimated and depicted in Table 4.9. At overall level, per farm employment were 308.66 man-days, out of which males contributing 140.99 man-days and females contributing 167.68 man-days over the year. Crop production was the most important source of employment at overall level (43.43 %) followed by livestock maintenance (34.44 %) and off-farm work (12.96 %). The C + D + H farming system has highest working man-days (477.44 man-days/farm) than C + D farming system (305.97 man-days/farm) and Crops only farming system (142.59 man-days/farm). The crop production accounts for the greatest proportion of employment in crop farming system.

Based on the previous discussion, it was concluded that livestock management was the primary source of employment in the C + D farming systems. Off-farm earnings, on the other hand, were another source of income in the three farming systems. Wages, enterprises, services and other related activities are all examples of off-farm employment (Appendix-1)

Table 4.9 Employment patterns of different farming systems

(Man-days / Farm)

Sr. No.	Particulars	Farming systems											
		C			C + D			C + D + H			Overall		
		M	F	Total	M	F	Total	M	F	Total	M	F	Total
1.	Crop	35.81 (57.19)	56.84 (71.08)	92.65 (64.98)	44.31 (30.79)	65.91 (40.67)	110.22 (36.02)	72.41 (33.45)	126.84 (48.60)	199.25 (41.73)	50.84 (30.06)	83.20 (49.62)	134.04 (43.43)
2.	Live stock	0.00 (00)	0.00 (00)	0.00 (00)	77.81 (54.07)	76.25 (47.05)	154.06 (50.35)	86.41 (39.92)	78.44 (30.05)	164.85 (34.53)	54.74 (38.82)	51.56 (30.75)	106.30 (34.44)
3.	Horti. Crop	0.00 (00)	0.00 (00)	0.00 (00)	0.00 (00)	0.00 (00)	0.00 (00)	40.5 (18.71)	44.5 (17.05)	85 (17.80)	13.5 (9.58)	14.83 (8.84)	28.33 (9.18)
4.	Off farm	26.81 (42.81)	23.13 (28.92)	49.94 (35.02)	21.78 (15.14)	19.91 (12.28)	41.69 (13.63)	17.12 (7.91)	11.22 (4.30)	28.34 (5.94)	21.90 (15.54)	18.09 (10.79)	39.99 (12.96)
5.	Total	62.62 (100)	79.97 (100)	142.59 (100)	143.9 (100)	162.07 (100)	305.97 (100)	216.44 (100)	261 (100)	477.44 (100)	140.99 (100)	167.68 (100)	308.66 (100)

(Figure in the parentheses are the percentages to the respective total)

4.3.1 Employment Function

The multiple linear regression linear model was estimated in order to establish the functional relationship between total family employment and factors such as gross cropped area, gross irrigated area, number of earners in the family, number of livestock and area under horticultural crop, and the results are presented in Table 4.10.

Table 4.10 Estimated employment function of different farming systems

Sr. No.	Particulars	Parameters	Farming systems		
			C	**C+D**	**C+D+H**
1.	Sample size (N)		32	32	32
2.	Intercept (a)		34.11 (5.54)	71.11 (3.93)	133.15 (9.22)
3.	Gross Cropped Area (ha)	X_1	25.59* (14.86)	9.74* (4.87)	5.79 (6.39)
4.	Gross Irrigated Area (ha)	X_2	-4.27 (14.75)	-0.43 (4.56)	2.82 (6.06)
5.	Earners (No.)	X_3	5.18** (2.01)	0.92 (0.89)	-2.15* (1.14)
6.	Livestock (No.)	X_4	-	1.55*** (0.54)	4.46*** (1.31)
7.	Area under horticultural crop (ha)	X_5	-	-	7.49 (8.82)
8.	R^2		0.85	0.85	0.89

(Figures in the parentheses are standard errors of respective regression coefficients)
***, **, * indicates 1, 5 and 10 per cent level of significance respectively.

1. Crops only farming system

It is revealed from the table, the three independent variables were explained 85 per cent of the total variation in the Crops only farming system. The coefficient of GCA (X_1) is determined to be significant at the 10 per cent level in the Crops alone farming system, showing that increasing GCA by one unit (i.e., 1 ha) total employment increases by 25.59 man-days. The coefficient of earners alsopositiveat 5 per cent level, indicating that one unit of earner increases employment by 5.18 man-days.

2. C + D

According to the table, the four independent variables were explained 85 per cent of the total variation in the medium C + D farming system. In the C + D farming system, the coefficient of number of livestock (X_4) was shown to be highly positive and significant at 1 per cent level, indicating that increasing the number of animals by one unit increases total employment by 1.55 days. The coefficient of gross cropped area (X_1) was determined to be positively significant at the 10 per cent level of significance, indicating that increasing gross cropped area by 1 ha. increases employment by 9.74 days. The numbers of earners have a favourable but little impact on gross family employment.

3. C + D + H

It is seen from table; the five independent variables were jointly explained 89 per cent of the total variation in the C + D + H farming system. In the C + D + H farming system, the coefficient of number of livestock (X_4) was shown to be very significant at 1 per cent, meaning that increasing one unit of livestock increases total employment by 4.46 man-days. In the C + D + H farming system, the gross cultivated area, gross irrigated area and area under horticulture were positive and non-significant. The number ofearners (X_3) were negatively significant, indicating that there is no scope for increasing the variables.

4.4 Income Pattern of Different Farming Systems

The income pattern has great importance to various accounting users or different farming systems unit. The income statement, balance sheets and other financial data provides information about expenses and sources of the income, profit or loss and also helps in assessing the financial position of farming business. Analysis of financial statement helps the finance farm manager in assessing the operational efficiency and managerial effectiveness of the different farming systems. The financial analysis is used to evaluate economic trends, set financial policy, build long term plans for business activities and identify unit for investment.

4.4.1 Per Farm Income Pattern of Different Farming Systems

The information regarding income of different farming system is presented in the Table 4.11(A).

At overall level, the average gross per farm income was ₹12,93,892 per year. The crop production was produced the highest income (55.04%) followed by horticultural crops, livestock income and off-farm income.

The average per farm yearly gross income for Crops only,C + D and C + D + H farming system was ₹ 6,51,304.72, ₹ 12,31,284.01 and ₹ 19,99,087.69, respectively. Among which, the crop production contributed the major item in total income of all three agricultural system types (Crops only, C + D, and C + D + H). Another significant source of total revenue was livestock income and it was accounted for 30.53 and 20.47 per cent of total income in the C + D and C + D + H farming systems, respectively.

Table 4.11(A) Per farm income pattern of different farming systems

(₹)

Sr. No.	**Particulars**	**Farming systems**			
		C	**C+D**	**C+D+H**	**Overall**
1.	Crop	578023.47 (88.75)	760180.88 (61.74)	798370.00 (39.94)	712191.45 (55.04)
2.	Livestock	0.00 (00)	375931.25 (30.53)	409323.94 (20.47)	261751.73 (20.23)
3.	Horticultural crop	0.00 (00)	0.00 (00)	729393.75 (36.49)	243131.25 (18.79)
4.	Off farm	73281.25 (11.25)	95171.88 (7.73)	62000.00 (3.10)	76817.71 (5.94)
5.	Total	651304.72 (100)	1231284.01 (100)	1999087.69 (100)	1293892.14 (100)

(Figure in the parentheses are the percentages to the respective total)

According to the preceding discussion, crop production was the primary source of income for farmers in all three farming systems followed by income from livestock and horticultural crops in the C + D and C + D + H farming systems, respectively.

Table 4.11(B) Per hector income pattern of different farming system

(₹)

Sr. No.	**Particulars**	**Farming systems**			
		C	**C+D**	**C+D+H**	**Overall**
1	Crop	334117.61 (88.75)	347114.56 (61.74)	255887.82 (39.94)	303060.19 (55.04)
2	Livestock	0.00 (0.00)	171658.10 (30.53)	131193.57 (20.47)	111383.71 (20.23)
3	Horticulture	0.00 (0.00)	0.00 (0.00)	233780.05 (36.49)	103460.11 (18.79)
4	Off Farm	42359.10 (11.25)	43457.48 (7.73)	19871.79 (3.10)	32688.39 (5.94)
5	Total	376476.71 (100)	562230.14 (100)	640733.23 (100)	550592.40 (100)

(Figure in the parentheses are the percentage to the respective total)

4.4.2 Per Hector Income Pattern of Different Farming System

The per hectare income pattern of different farming systems are depicted in Table 4.11(B).

At overall level the per hectare gross income was ₹ 5,50,592.40 per year on an annual basis. The crop production generated maximum share in income (55.04%) followed by livestock, horticulture and off-farm activities. The average annual gross income per hectare for Crops only, C + D and C + D + H farming system were₹ 3,76,476.71, seen the₹ 5,62,230.14 and ₹ 6,40,733.23, respectively. In all farming systems, the crop production was highest contribution in total income.In the C + D + H farming system significant source of income was cattle income in the C + D farming system, which was accounted by 30.53 per cent and horticulture income, which was contributed 36.49 per cent. Thecrop production was the primary source of income for farmers in all three farming systems followed by income from livestock and horticultural crops in the C + D and C + D + H farming systems, respectively.

It was concluded that, all the farming systems were economically profitable in the study area.

4.4.3 Family Income Function

The multiple linear regression models was estimated in order to establish the functional relationship between total family income and factors such as gross cropped area, gross irrigated area, number of earners, number of livestock, area under horticultural crop and the results are presented in Table 4.12.

1. Crops only farming system

From the table, the three independent variables were jointly explained 73 per cent of the total variation in the crops only farming system. The coefficient of number of earners (X_3) was found to be positively significant at a 1 per cent significant level in the crops only farming system. That means if you increasing the number of earners by one unit increases total income by ₹ 1,79,985.5. The gross cropped area was showed positive but non-significant relation with family income and gross irrigated areawas contributednegatively but non-significant relation with family income.

2. C + D

The value of coefficient of multiple determination R^2 was found to be 0.73 per cent that means 73 per cent variation in income was jointly explained by the four independent resource variables under consideration. The C + D farming system, the coefficient of number of livestock (X_4) is shown to be significant at 5 per cent. If the number of livestock was increased by one-unit, total revenue will be increases by ₹ 45,473. The coefficient of gross cultivated area (X_1) found to be highly significant at 5 per cent level indicating that if GCA increases by one-unit total income will increase by ₹ 3,57,378. The number of earners has a positive but non-significant impact on the variable and there was no scope for increasing the variable.

Table 4.12 Estimated income function of different farming systems

Sr. No.	Particulars	Parameters	Farming systems		
			C	C+D	C+D+H
1.	Sample size (N)		32	32	32
2.	Intercept (a)		-297666.63 (142623.87)	334577.9 (130985)	80471212.6 (242437.3)
3.	Gross Cropped Area (ha)	X_1	483985.87 (382545.66)	357378** (162356.6)	-124827 (168013.8)
4.	Gross Irrigated Area (ha)	X_2	-283075.29 (379630.98)	-193918 (152183.5)	324427.5* (159411.7)
5.	Earners (No.)	X_3	179985.54*** (51806.41)	28341.25 (29881.41)	42466.56 (30049.74)
6.	Livestock (No.)	X_4	-	45473.09** (18093.89)	-19220.5 (34616.79)
7.	Area under horticultural crop (ha)	X_5	-	-	732658.4*** (231996.5)
8.	R^2		0.73	0.73	0.76

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

***, **, * indicates 1, 5 and 10 per cent level of significance.

3. C + D + H

The value of coefficient of multiple determination R^2 was found to be 0.76 per cent that means 76 per cent variation in income was jointly explained by the five independent resource variables under consideration in C+D+H farming system. The coefficient of area under horticulture crop (X_5) was determined to be positively significant at the 1 per cent level, indicating that if 1 ha. of horticulture crop was increased, income will increase by ₹ 732658.40. The coefficient of gross irrigated area (X_2) was determined to be significant at 10 per cent level, indicating that increase in GIA by 1 ha. to total income will increase by ₹ 324427.50. On the other variables, such as gross cropped area and number of livestock had a negative and non-significant relation with family income. The number of earners had positive but non-significant relation with family income.

4.5 Expenditure Pattern of Different Farming Systems

The expenditure patterns are examined in a annual expenditure on items of cost incurred by different farming systems. It consistent income group differences exist in expenditure patterns across study area. Hence, the expenditure analysis involves to all farming activities related data in order to learn from it and thereby improve operations. It should be carried out investment strategy in farming systems.

4.5.1 Per Farm Expenditure Pattern of Different Farming Systems

The information on per farm annual expenditure on items of cost incurred by different farming systems is presented in Table 4.13(A).

At overall level, the average total annual family expenditure was ₹ 493611.33 per farm. Out of which crop productions were accounting for highest (45.15%) expenditure followed by livestock maintenance (29.31 %), horticultural crop production (8.98 %), grocery (7.75 %), education (4.51 %), cloths (1.34 %), medical (1.19 %), food (1.18 %) and other expenditures (0.59 %).

Table 4.13(A) Per farm expenditure pattern of different farming systems

(₹)

Sr. No.	Particulars	Farming systems			
		C	C + D	C + D + H	Overall
1.	Crop Production	158986.25 (68.75)	191509.69 (40.19)	318045.31 (41.14)	222847.08 (45.15)
2.	Livestock Maintenance	0.00 (00)	206807.44 (43.40)	227187.5 (29.39)	144664.98 (29.31)
3.	Horti. Crop Production	0.0 (00)	0.0 (00)	133039.98 (17.21)	44346.66 (8.98)
4.	Food	4931.25 (2.13)	5921.88 (1.24)	6592.81 (0.86)	5815.30 (1.18)
5.	Grocery	35203.12 (15.22)	37406.25 (7.85)	42218.75 (5.46)	38276.04 (7.75)
6.	Cloths	6093.75 (2.64)	6356.25 (1.33)	7337.51 (0.95)	6595.84 (1.34)
7.	Medical	4865.63 (2.11)	5865.62 (1.23)	6843.75 (0.89)	5858.34 (1.19)
8.	Education	18875 (8.16)	20109.37 (4.22)	27865.31 (3.61)	22283.23 (4.51)
9.	Others (Festival etc.)	2287.5 (0.99)	2567.50 (0.54)	3916.56 (0.51)	2923.86 (0.59)
	Total	231242.50 (100)	476544.00 (100)	773047.48 (100)	493611.33 (100)

(Figure in parentheses are the percentages to the respective total)

Among the expenditure pattern of different farming systems, the average annual family expense of Crops only farming system was ₹ 2,31,242.50, whereas C + D and C + D + H farming systems were average annual family expenditures ₹ 4,76,544.00 and ₹ 7,73,047.48, respectively. The crop production accounted for 68.75 per cent of total spending in the Crops only farming system, whereas livestock maintenance and horticultural crop expenditure accounted for the majority of total expenditure in the C + D and C + D + H farming systems. Another main source of expenditure was on groceries, education, and clothing, which accounted for 15.22, 8.16, and 2.64 per cent of total expenditure in the crops only farming system, respectively. In the C + D farming system livestock, crop production, groceries, education and clothing accounted for 43.19, 40.19, 7.85, 4.22 and 1.33 per cent of total expenditure, respectively. In the C + D + H farming system crop production,livestock, horticultural crop production, grocery and education accounted for 41.14, 29.39, 17.21, 5.46, and 3.61 per cent of total spending, respectively.

4.5.2 Per Hector Expenditure Pattern of Different Farming Systems

It is observed from the Table 4.13(B) the average annual spending per hectare incurred by various farming systems on various types of expenditure.

At overall level, the average total annual family expenditures per hectare was ₹ 210047.37, with crop production accounting for the largest share of expenditure (45.15 %) followed by livestock maintenance (29.31 %) and horticultural crop production (8.98 %), grocery (7.75 %), education (4.51 %), cloths (1.34 %), medical (1.19 %), food (1.18 %) and other (0.59 %).

Table 4.13(B) Per hector expenditure pattern of different farming systems

(₹)

Sr. No.	Particulars	Farming systems			
		Crop only	C+D	C+D+H	Overall
1	Crop Production	91899.57 (68.75)	87447.35 (40.19)	101937.60 (41.14)	94828.55 (45.15)
2	Livestock Maintenance	0.00 (00)	94432.62 (43.40)	72816.51 (29.39)	61559.57 (29.31)
3	Horticulture Production	0.00 (00)	0.0 (00)	42641.02 (17.21)	18870.92 (8.98)
4	Food	2850.43 (2.13)	2704.05 (1.24)	2113.08 (0.85)	2474.6 (1.18)
5	Grocery	20348.63 (15.22)	17080.48 (7.85)	13531.65 (5.46)	16287.68 (7.75)
6	Cloth	3522.40 (2.64)	2902.40 (1.33)	2351.76 (0.95)	2806.74 (1.34)
7	Medical	2812.50 (2.11)	2678.37 (1.23)	2193.51 (0.89)	2492.91 (1.19)
8	Education	10910.40 (8.16)	9182.37 (4.22)	8931.19 (3.61)	9482.22 (4.51)
9	Others (Festival etc.)	1322.25 (0.99)	1172.37 (0.54)	1255.31 (0.51)	1244.19 (0.59)
10	Total	133666.18 (100)	217600.00 (100)	247771.63 (100)	210047.37 (100)

(Figure in the parentheses are percentage to the respective total)

Among the different farming system, the average annual per hectare family expenditure for the Crop's only farming system was found to be ₹ 1,33,666.18, while it was ₹ 2,17,600.00 and ₹ 2,47,771.63 for the C + D and C + D + H farming systems, respectively. The crop production accounted for 68.75 per cent of total expenditure in the crops only farming system. In Crop only farming system the crop production was contributed the highest per hectare expenditure 68.75 per cent followed by grocery (15.22%), education (8.16%), cloth (2.64%), food (2.13%), medical (2.11%).

In case of C +D farming system the maximum per hectare expenditure contribution was observed in livestock maintenance (43.40%) followed by crop production (40.19%), grocery (7.85%), education (4.22%), cloth (1.33%), food (1.24%), medical (1.23%) and other (0.54%).

The highest source of total spending in the C + D + H farming system was crop production and livestock maintenance, horticulture crop, grocery and education, with figures of 41.14, 29.39, 17.21, 5.46 and 3.61 per cent, respectively. Thus, the per hectare farming systems component increases with increasing farm expenditure.

4.5.3 Expenditure Function

The expenditure function is a mathematical tool used to analyze the cost of living of a consumer. This function indicates how much it costs in rupees, to reach a certain standard of living. The expenditure function, then, measures the cost, in rupees, of getting some level of utility. In microeconomics, the expenditure function gives the minimum amount of money an individual needs to spend to achieve some level of utility, given a utility.

The multiple linear regression model was estimated in order to establish the functional relationship between total family expenditure and factors such as gross cropped area, gross irrigated area, family size, number of livestock, and area under horticultural crop, and the results are presented in Table 4.14.

1. Crops only farming system

It is revealed from table, the three independent variables were jointly explained 75 per cent of the total expenditure variation in the Crops only farming system. The family size coefficient (X_3) is determined to be highly positively significant at the 1 per cent level. If family size increases by one unit, the total expenditure will be increases by 44812 units. The gross cropped area and gross irrigated area had a positive and negative but non-significant impact on family expenditure.

2. C + D

The value of coefficient of multiple determination R^2 was found to be 0.76 per cent that means 76 per cent variation in expenditure was jointly explained by the four independent resource variables under consideration. The coefficients of number of livestock (X_4) were positive and highly significant at the 1 per cent level, indicating that increasing the number of animals by one unit will result in an increase in family expenditure of ₹ 22789.61. The variable of earners (X_3) was negatively non-significant. The gross cropped area (X_1) and gross irrigated area (X_2) were non-significant but positive relationship with gross family expenditure

Table 4.14 Estimated expenditure function of different farming systems

Sr. No	Particulars	Parameters	Farming systems		
			C	C + D	C + D + H
1.	Sample size (N)		32	32	32
2.	Intercept (a)		37575.77 (28758.25)	235364.10 (39070.62)	382641.8 (72679.69)
3.	Gross Cropped Area (ha)	X_1	115750.24 (77135.38)	22183.57 (48428.24)	65943.48 (50368.44)
4.	Gross Irrigated Area (ha)	X_2	-87949.31 (76547.67)	12351.31 (45393.76)	-24327.7 (47789.64)
5.	Earners (No.)	X_3	44812.27*** (10446.09)	-1194.51 (8913.12)	18804.29** (9008.53)
6.	Livestock (No.)	X_4	-	22789.61*** (5397.10)	7080.06 (10377.68)
7.	Area under horticultural crop (ha)	X_5	-	-	149601.9** (69549.65)
8.	R^2		0.75	0.76	0.78

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

***, **, and * indicates 1, 5 and 10 per cent level of significance.

3. C + D + H

The value of coefficient of multiple determination R^2 was found to be 0.78 per cent that means 78 per cent variation in expenditure was jointly explained by the five independent resource variables under C+D+H farming system. The coefficient of number of earners (X_3) was determined to be positive but significant at the 5 per cent level, indicating that increasing the number of earners by one unit will result in an increase in family expenditure of ₹ 18804.29. The coefficient of area under horticulture crop (X_5) was determined to be positively significant at 5 per cent level, indicating that increase in 1 ha.

area under horticulture crop results in increase in total expenditure by ₹ 149601.90. The gross cropped area and number of livestock had a positive but non-significant effect on gross expenditure, means there is no scope for increasing the variables.

4.6 Profitability of Different Farming Systems

The profitability of farming systems is essential when choosing the optimum farming system in the studied area. The information on profitability of selected farming systems is represented in Table 4.15.

Table 4.15 Profitability of farms

(₹)

Sr. No.	Particulars	Unit	Farming systems			
			C	C+D	C+D+H	Overall
1.	Income (₹)	Per / ha	376476.71	562230.14	640733.23	550592.40
		Per / farm	651304.72	1231284.01	1999087.69	1293892.14
2.	Expenditure (₹)	Per / ha	133666.18	217600.00	247771.63	210047.37
		Per / farm	231242.50	476544.00	773047.48	493611.33
3.	Profit (₹)	Per / ha	242810.53	344630.14	392961.6	340545.03
		Per / farm	420062.22	754740.01	1226040.21	800280.81

The per hectare and per farm profit in the C + D + H farming systems were higher than the Crops only and C + D farming systems. To summarise, as farmers transition from Crop only to C + D and C + D to C + D + H. It shows that the C + D + H farming system were the most economically viable in Ahmednagar district when compared to other farming systems.

These findings, that Crop+ Dairy + horticulture farming system is more profitable than other proposed farming systems. Similar results were supported by the findings of Dorge (2010), Raghav and Srivastava (2015) and Singh and Burak (2016).

Farmers in Crop-only farming systems have relied on other income streams such as services, labour, business, etc. This demonstrated that the proposed alternative hypothesis, state that income from cropping systems alone is insufficient to pay expenditure when compared to the other recommended farming system, has been proved.

4.7 Income, Expenditure and IBCR of Different Farming Systems

According to Table 4.16, the per farm and per hectare income was highest in the C + D + H farming system, i.e.,₹ 1999087.69 and ₹ 640733.23, respectively, as compared to the C + D and Crops only farming systems. The added per farm and per hectare income of the C + D farming system over the Crops only farming system and the C + D + H farming system over the C + D farming system was greater.

The C + D + H farming system had the largest per farm and per hectare expenditures, i.e., ₹ 773047.48 and ₹ 247771.63, respectively, as compared to the C + D and Crops only farming systems. Farmers' family expenditure increased as they transitioned from Crops to C + D and C + D + H farming systems. In C + D and C + D + H farming systems, the incremental benefit-cost ratio (IBCR) proved economically viable i.e., 2.21 and 2.60, respectively.

The highest IBCR obtained from C+D+H farming system i.e., 2.60 was indicated that the C+D+H farming system has been proved economically profitable. The study suggested that, Crop + Dairy + Horticulture farming systems was more profitable in the study area.

Table 4.16 Income, expenditure and IBCR of different farming systems

Sr. No.	Particulars	Farming Systems					
		C		C+D		C+D+H	
		Income	Expenditure	Income	Expenditure	Income	Expenditure
1	Total	20841751	7399760	39401088	15249408	63970806	24737519.38
2	Per farm	651304.72	231242.50	1231284.01	476544.00	1999087.69	773047.48
3	Per hector	376476.71	133666.18	562230.14	217600	640733.23	247771.63
4	Added per farm	-	-	579979.29	245301.5	767803.68	296503
5	Added per hector	-	-	185753.43	83933.82	78503.9	30171.63
6	Incremental Benefit-Cost Ratio (IBCR)	-		2.21		2.60	

4.8 Constraints Faced by Farmers

In order to study the problems faced by farming systems growers by using the Garret ranking technique, preference and rank given by sample farmers of integrated farming system for ten identified problems *viz.,*labour shortage, high wage rate, high cost of fertilizers, irregular supply of electricity, high cost of improved breeds, high cost of animal feed and fodder, low price for produce, delay payment, unavailability of storage facility and lengthy loan process by a bank and other, per cent position of the problem and its calculated and Garret value and ranking of problem based on its Garret value is depicted in Table 4.17 (Appendix-II and III), respectively.

It is observed that low price for produce had given first rank by 59 out of 96 respondents, second rank by 13 respondents and third rank by 6 respondents and likewise. The per cent position of the each problem along with its calculated and Garret value was estimated by using per cent position formula as indicated in methodology and the severity of the problem in sample farm of integrated faming system was decided by assigning the rank based on their percentage.

The problems faced by the integrated farming systems of sample farm growers in Ahmednagar district were ranked in descending order of their rank as low price for produce, high cost of fertilizers, high wage rate shortage of labour, high cost of improved breed, delay payment, high cost of animal feed and fodder, lengthy process of sanction of loan, irregular supply of electricity, no storage facility, and other.

Similar results were found by Sharma *et al.* (2017) in different areas during various periods.

Table 4.17. Calculation of Garret value and ranking of problems

Sr. No.	Particulars	Rank												
		I	II	III	IV	V	VI	VII	VIII	IX	X	Total	Average	Rank
1	Shortage of labour	574	350	2835	174	520	192	252	114	0	54	5065	**56.27**	**4**
2	High wage rate	656	770	378	1624	936	720	168	114	0	54	5420	**60.22**	**3**
3	High cost of fertilizers	1148	2520	819	1450	260	48	84	0	0	0	6329	**70.32**	**2**
4	Irregular supply of electricity	82	0	0	174	572	96	420	342	406	846	2938	**32.64**	**9**
5	High cost of improved breeds	0	700	567	174	1352	1584	420	76	87	0	4960	**55.11**	**5**
6	High cost of animal feed and fodder	492	140	252	174	468	624	756	1330	29	90	4355	**48.39**	**7**
7	Low price for produce	4838	910	378	464	104	192	126	38	0	0	7050	**78.33**	**1**
8	No storage facility	82	0	63	57	52	48	84	190	1769	414	2759	**30.65**	**10**
9	Delay payment	0	1050	378	464	364	336	1428	266	174	108	4568	**50.75**	**6**
10	Lengthy process of sanction of loan by banks	0	280	378	232	364	768	336	1178	319	162	4017	**44.63**	**8**

5. SUMMARY AND CONCLUSIONS

The farm is viewed holistically in the farming system approach. Farmers face a slew of socio-economic, biological, institutional, administrative, and technical challenges. The concept of a farming system is a collection of pieces or components that are interconnected and interact with one another. The farmer himself is at the centre of interaction, exercising control and choice over the nature and result of interaction.

Recently, farming system study has gained momentum, and scientists and research scholars are developing tools and strategies to identify more feasible methods to improve farming. Economic development in a mostly agriculturally dependent country like India is highly reliant on agricultural production growth. Because the opportunity to cultivate additional land is limited, a considerable rise in agricultural production is feasible through increasing crop productivities per unit of land, labour, and capital.

The farmers' resources are limited. It is tough for him to support himself and his family just on crop components. Crop production and livestock rearing combined with horticulture production provides particular benefits such as balanced farming, which provides more employment, income, and covers the risk of farm business failure, and lastly the sustainability of farming systems.

The profitability of various crop and livestock combinations varies from region to region and even within a region. It is worthwhile to study the agricultural system with a location-specific perspective in order to understand the numerous socio-economic characteristics of farming systems. As a result, the current study, titled "Economic Analysis of Integrated Farming System in Ahmednagar District of Maharashtra," was done with the following precise goals in mind.

1. To study the socio-economic characteristics of farmers.
2. To examine the resource use pattern of different farming systems.
3. To examine the profitability of different farming systems.
4. To study the constraints in existing farming systems.

The crops-only enterprise, crops-with-dairy enterprise, and crops-with-dairy-and-horticulture enterprise are the most extensively used farming systems in Ahmednagar district. As a result, these three agricultural techniques were chosen for the study.

The analysis was based on survey data received from 96 farmers for the 2020-21 financial year. Two tahsils, Karjat and Rahuri, were chosen on purpose. Two villages from each tahsil were chosen at random, and 24 farmers from each village were chosen at random.

Farmers from each community were divided into three groups: Crop only, crop with dairy, and crop with dairy and horticulture farming systems. Means and averages were used to analyse the data in tabular form. The same approach was used to calculate resource utilisation and profitability per hectare and per farm. The functional analysis was performed using multiple linear regression equations to determine the factors influencing the employment, income, and expenditure of farm families in the selected areas.

5.1 Summary

1. The overall number of people in the family was 5.49. The average family size in the Crops Only farming system was 4.76, 5.41 in the C + D farming system, and 6.32 in the C + D + H farming system.
2. At overall level, 89.89 per cent of family members were literate, whereas 11.11 Per cent of family members were illiterate.
3. At the overall level, total land holding of farmer 2.58 ha. i.e. 1.88 ha. In Crop only, 2.38 ha. in C+D, 3.47 ha. in C + D + H farming system.
4. The average number of dairy animals per family was 4.61 at overall level. The average number of animals per family in the C + D farming system was 6.41, whereas it was 7.41 in the C + D + H farming system.
5. The overall average farm investment in various assets possessed by sample farmers was ₹79199.70. It was discovered to increase as the farming system shifts, i.e. ₹33867.82, ₹80973.41 and ₹122757.86 for Crops only, C + D, and C + D + H farming systems, respectively.
6. The selected farmers primarily cultivated sugarcane as a commercial crop. During the *kharif* season, they cultivated crops such as black gram, soybean, onion, tur, fodder crops and maize. *Rabi* season was dominated by crops such as *Rabi* jowar followed by wheat, gram, fodder crops, and other minor crops. C + D + H farmers cultivated Pomegranate as a horticulture crop. At overall level cropping intensity was 133.62 per cent. The cropping intensity was determined to be greatest in the C + D + H farming system when compared to Crops only and C + D farming systems.
7. During the research year, the overall average per-family employment was 308.66 man-days, with males contributing 140.99 man-days and females contributing 167.68 man-days.

8. When on-farm employment is included, the C + D + H farming system has more working man-days (199.25 man-days) than the C + D farming system (110.22 man-days) and the Crops only farming system (92.66 man-days).
9. In employment function analysis of sample farms coefficient of gross cropped area (X_1) were found to be positively significant at 10 per cent level, both in Crop only and C + D farming system and coefficient of livestock (X_4) were found to be positively significant at 1 per cent level in C+D and C+D+H farming system.
10. Overall level, the average gross farm income was ₹ 1293892.14 per annum. The average per farm annual gross income for Crops only farming system was worked out to ₹651304.72, while for C + D farming system and C + D + H farming system it was ₹1231284 and ₹ 1999087.69.
11. Estimated income function of sample farms shows coefficient of no. of earners (X_4) were found to be highly significant at 1 per cent level in Crop only farming system. Coefficient of number of livestock (X_4) and gross cropped area (X_1) were found to be highly significant at 5 per cent level in C+D farming system. Other variables like area under horticulture crop (X_5) were positive and significance at 1 per cent level in C+D+H farming system.
12. The average total annual per farm expenditure was ₹ 493611.33 at overall level. The average total annual family expenditure was high in C + D + H farming system i.e.₹ 773047.48 followed by C + D farming system ₹ 476544.00 and Crops only farming system ₹ 231242.50.
13. In Crop only and C+D farming system the coefficients of family size (X_3) and no. of livestock (X_4) of estimated expenditure function were found to be positively significant at 1 per cent level of significance. Coefficient of area under horticulture crop (X_5) and earners (X_3) were found to be positively significant at 5 per cent level.
14. The C+D+H farming system have more per hectare income and per farm income i.e.₹ 640733.23 and ₹ 1999087.69, respectively.
15. The C+D farming system have more per hectare income and per farm income than Crops only farming system i.e. ₹ 562230.14 and ₹ 1231284.01, respectively.
16. Crop only farming system have less per hectare as well per farm income. It was ₹ 376476.71 and ₹ 651304.72, respectively.

17. As per the Garret ranking, the constraints *viz.,* low price for produce got first rank followed by high cost of fertilizer and high wage rate got second and third rank, respectively.

5.2 Conclusions

The present investigation was intended to depict the picture of integrated farming system of sample farm in Ahmednagar district. The integrated farming system assumed an important place in economical study. The previous discussion on various aspects of research resulted in the following conclusions.

1. The study revealed that, in all farming system the crop productions (43.43 %) obtained highest share of gross family employment followed by livestock maintenance (34.44 %), off farm (12.96%) and horticultural crop production (9.18 %). The employment pattern shows that the share of pay days in gross agricultural employment increases as farmers transition from Crop only, crop + dairy and crop + dairy to crop + dairy + horticulture farming systems. The results of functional analysis of the employment pattern, the variables number of earners, gross irrigated area, animal number, and area under horticulture crop were significant factors for which production was responsive.The C + D + H system is more feasible and sustainable when there is more utilization of resources within the system than the other system.
2. The crop production was the most important source of revenue for the sample farmer followed by horticultural production, livestock, and off-farm income. The results of functional analysis of the income pattern, the variables number of earners, number of livestock, and area under horticulture crop were significant factors, showing the relevance of these variables in raising farm revenue.
3. For the crops only farming system, expenditure on the crop production (68.75%), in C + D farming system, expenditure on livestock (43.40%) and in C + D + H farming system, expenditure on horticulture (17.21%) was the major expenditure items in total annual expenditure, respectively. According to the expenditure pattern, crop production, animal maintenance, and horticulture crop production account for the majority of gross family expenditure. The result of functional analysis of the expenditure pattern, the variables of family size and quantity of animals were significant factors for which output was accessible.
4. Study as whole, Crop + Dairy and Crop + Dairy + Horticulture were the most profitable farming systems in the study area, with a benefit-cost ratio of 2.21 and

2.2.60, respectively. The allied activities practiced by the farmers like crop, vegetable, fruit and dairy enterprises appeared to complement the crop activities in the study area. The farm resources in the existing plan were not optimally allocated. The optimization of farm plans led to an increase in net returns and effective utilization of available resources. The net returns can be increased with additional units of land/labour, as land and labour were the common resource constraint in all farming systems. Farmers in Ahmednagar district can attempt to increase the area under cultivation and deploy more labour in order to utilize the excess resources and to realize higher income. Integrated farming systems are viable option to address the distress faced by small and marginal farmers.

5. The study revealed that integrated farming system is a farming system that combines two or more fields of agriculture, which is based on the recycling biological concept, and linked of input-output between the mutually commodities which approach of low-external-input utilization, which is done on the land, through the utilization of crop waste, animal manure, friut waste for the purpose of increasing the production and productivity so as to increase farmer income and can create condition that are environmentally friendly farming. Then, it should consider several aspects, namely: Sustainability that environmental friendly, is socially accepted by society, are economically viable and politically acceptable.
6. The major problem faced by sample farmers were ranked by Garret ranking, the results show that low price for produce got first rank followed by high cost of fertilizer, high wage rate, shortage of labour and high cost of improved breeds, respectively.

5.3 Suggestion

From the present study the following policy implications could be emerged.

1. The income from C + D + H farming system is highest than C + D and Crop only farming systems; therefore, farmer may adopt the C + D + H farming system in order to sustain their income.
2. The C + D + H farming system generate more employment than C + D and Crops only farming system. As a result, farmers may adopt for the C + D + H farming system in order to generate more employment.

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7. APPENDICES

Appendix – I: Employment analysis

Sr. No.	Particulars	Farming systems		
		C	C+D	C+D+H
1.	Total employment	2965	3526	6376
a	Per family employment	92.66	110.19	199.25
b	Added per family employment over crop cultivator's	-	17.53	89.06

Appendix – II: Problems faced by farmers

Sr. No.	Particulars	Rank									
		I	II	III	IV	V	VI	VII	VIII	IX	X
1	Shortage of labour	7	5	45	13	10	4	6	3	0	3
2	High wage rate	8	11	6	28	18	15	4	3	0	3
3	High cost of fertilizers	14	36	13	25	5	1	2	0	0	0
4	Irregular supply of electricity	1	0	0	3	11	2	9	9	14	47
5	High cost of improved breeds	0	10	9	3	26	33	10	2	3	0
6	High cost of animal feed and fodder	6	2	4	3	9	13	18	35	1	5
7	Low price for produce	59	13	6	8	2	4	3	1	0	0
8	No storage facility	1	0	1	1	1	1	2	5	61	23
9	Delay payment	0	15	6	8	7	7	34	7	6	6
10	Lengthy process of loan sanction by banks	0	4	6	4	7	16	8	31	11	9

Appendix –III: Per cent position and Garret value

Sr. No.	Formula--(100*(Rij-0.5)/Nj)	Calculated value	Garett value
1	100*(1-0.5)/10	5	82
2	100*(2-0.5)/10	15	70
3	100*(3-0.5)/10	25	63
4	100*(4-0.5)/10	35	58
5	100*(5-0.5)/10	45	52
6	100*(6-0.5)/10	55	48
7	100*(7-0.5)/10	65	42
8	100*(8-0.5)/10	75	38
9	100*(9-0.5)/10	85	29
10	100*(10-0.5)/10	95	18

Appendix –IV: QUESTIONNAIRE

"Economics of Integrated Farming System in Ahmednagar District of Maharashtra"

Schedule for primary data collection from farmers

Date: / /20 Year: 2020-2021

Schedule No.

Farming system – Crop /Crop + Dairy / Crop + Dairy +Horticulture

4. General information offarmer

1.	Name:
2.	Age:
3.	Education:
4.	Village: Taluka:
5.	District:
6.	Occupation:1)Main- 2)Subsidiary-
7.	Social participation:
8.	Contact No:

5. Family size and its composition

Sr. No.	Name	Sex	Relation	Age	Education	Occupation
1.						
2.						
3.						
4.						
5.						
6.						
7.						

6. Land use pattern (Area in hectare)

Total holding	Permanent fallow	Operational holding		Present value (lakh Rs.)	
		Irrigated	Unirrigated	Irrigated	Unirrigated

7. Cropping pattern

Sr. No.	Season	Survey No./ Plot No.	Crop	Variety	Area (ha)
1.	*Kharif*				
2.	*Rabi*				
3.	*Summer*				
4.	Annual				
5.	Horticulture crops				

8. Farm assets and machinery

A) Farm implements andmachinery

Particulars	Numbers	Year of purchase	Present value (Rs.)	Repairs (Rs.)
Bullock drawn implements				
1. Wooden Plough				
2. Iron plough				
3.Harrow				
4. Seed drill				
5.Hoes				
6. Bullock cart				
Machinery				
1.Tractor				
2.Tractor drawn accessories				
3. Oil engine				
4. Ele. Motor				
5.Sprayer				
6.Other				
Hand tools				
1.pick axe				
2.Spade				
3.Sickles				
4.Khurpi				
5. Others				

B) Sources of irrigation

Sr. No.	Type	Number	Area irrigated (ha.)
1.	Well		
2.	Tube well		
3.	Farm pond		
4.	River		
5.	Other		

C) Livestock composition

Sr. No	Type	Breed	Number	Year of purchase/Born	Present value (Rs.)
1.	Bullock				
2.	Milch animals a) Cow b)Buffalo				
3.	Heifer				
4.	Calf				
5.	Goat				
6.	Sheep				
7.	Poultry				
6.	Others				

9. Expenditure on livestock (Annual)

Animals	Labour		Green fodder		Dry fodder		Concentrate		Veter-inary Charg-es	Total Expen-diture (Rs.)
	M	F	q	Value	Q	value	q	Value		
1.Bullock										
2.Cows										
3.Buffalo										
4.Calves										
5.Goat										
6.Poultry										
Total										

10. Details regarding production of livestock

Livestock type and Number	Prod. Milk (lit)	Home consumption	Sold (Rs.)	Rate (Rs.)	Eggs			Total Value (Rs.)
					No.	Rate (Rs.)	Value (Rs.)	
Buffalo								
Cow								
Goat								
Poultry								

11. Details regarding expenditure

Sr. No.	Particulars	Average annual expenditure (Rs.)
1.	Crop production	
2.	Livestock maintenance	
3.	Horti. Crop production	
4.	Food	
5.	Grocery	
6.	Cloths	
7.	Medical	
8.	Education	
9.	Others (Festival etc.)	
Total		

12. Details regarding income

Sr. No.	Particulars		Production	Rate (Rs.)	Value (Rs.)
1.	Agri. Produce				
	Crop				
2.	Horticulture				
3.	Dairy				
4.	Goat/ Sheep				
5.	Poultry				
6.	Service				
7.	Other				
	Total				

13. Problems faced by the farmers in different farming systems

Sr. No	Problems	Yes	No
A.	**Production**		
1.	Shortage of labour		
2.	High wage rate		
3.	Non availability of inputs in time		
4.	Non availability of inputs in village itself		
5.	High cost of fertilizers		
6.	Shortage of water in *summer*		
7.	Irregular supply of electricity/electricity failure		
8.	Lack of technical assistance		
9.	Fragmentation and subdivision of land		
B.	**Livestock**		
1.	Unavailability and high cost of improved breeds		
2.	High cost of animal feed and fodder		
3.	Costly medical treatment		
C.	**Marketing**		
a)	**Crop**		
1.	Low price for produce		
2.	High marketing cost		
3.	High price fluctuations		
b)	**Livestock**		
1.	Low milk rate by co-operative society		
2.	No storage facility		
3.	Irregular payment by co-operative society		
4.	Inadequate transport facility		
c)	**Financial**		
1.	Scarcity of own funds		
2.	Lengthy process of loan sanction in banks		
3.	No easy access for credit		

14. Investment on inputs used for crop production (Annual)

Sr. No	Crop	Area (acre)	Seed		Labour required						Labour cost (Rs.)	FYM		Fertilizer		Pesticides		Hired impl. and mach. charges	Irri. Charges(Fuel/ Ele.Rs.)	Total Cost (Rs.)
			Qty (Kg)	Cost (Rs.)	Family			Hired				Qty (Qt)	Cost (Rs.)	Qty	Cost	Qty	Cost			
					M	F	B	M	F	B										
1.																				
2.																				
3.																				
4.																				
5.																				
6.																				
7.																				
8.																				

15. Operation wise cost involved in establishment of perennial crop

i) Name of crop- ii) Area-

iii) Variety - iv) Spacing–

Sr. No.	Operation Quantity/Labour	1st Year		2nd Year		3rd Year		4th Year	
		Quantity	Rate	Quantity	Rate	Quantity	Rate	Quantity	Rate
1.	Digging of pit (Labour Days)								
2.	Planting material								
3.	F.Y.M								
4.	F.Y.M application								
5.	Planting (Labour Days)								
6.	Gap filling material								
7.	Gap filling (Labour Days)								
8.	Fertilizers								
9.	Fertilizer application								
10.	Pesticides								
11.	Pesticide application								
12.	Irrigation charges								
13.	Other operation								
14.	Total cost								

16. Operation wise Labour and maintenance cost of Horticulture crop (Annual)

i) Name of crop- ii) Area-

iii) Variety - iv) Spacing

Sr. No	Operation	Required labour (Days)							Machinery Charges (Rs.)	Material		
		Family			Hired					Name	Qty/ No	Rate (Rs.)
		M	F	B	M	F	B					
1.	Cleaning of orchard											
2.	Fertilizers											
3.	F.Y.M											
4.	Application of plant Protectionchemicals a. b.											
5.	Giving irrigation											
6.	Harvesting 1. 2.											
7.	Packing											
8.	Marketing											
9.	Any other operation											
10.	Total cost (Rs.)											

8. VITAE

Mr. Shinde Swapnil Baban

MASTER OF SCIENCE (AGRICULTURE)

IN

AGRICULTURAL ECONOMICS

2021

Title of thesis		:	Economics of Integrated Farming System In Ahmednagar District of Maharashtra
Major field		:	Agricultural Economics
Biographical information			
Personal	**Date of Birth**	:	12 May,1997
	Place of Birth	:	At.post Belwandi, Tal Karjat, Dist.- Ahmednagar
	Father's Name	:	Baban Dattatray Shinde
	Mother's Name	:	Nirmala Baban Shinde
Educational	**Bachelor Degree Obtained**	:	R. C. S. M College of Agriculture, Kolhapur.
	Class	:	First class
	Name of University	:	Mahatma Phule Krishi Vidyapeeth Rahuri, Maharashtra, (India)
Address		:	At. Post Belwandi, Tal Karjat, Dist.-Ahmednagar Pincode- 414403
	E mail –id	:	shindeswapnil727452@gmail.com
	Contact Number	:	8600074899

Fig. 2 Cropping Pattern of Crop only Farming System

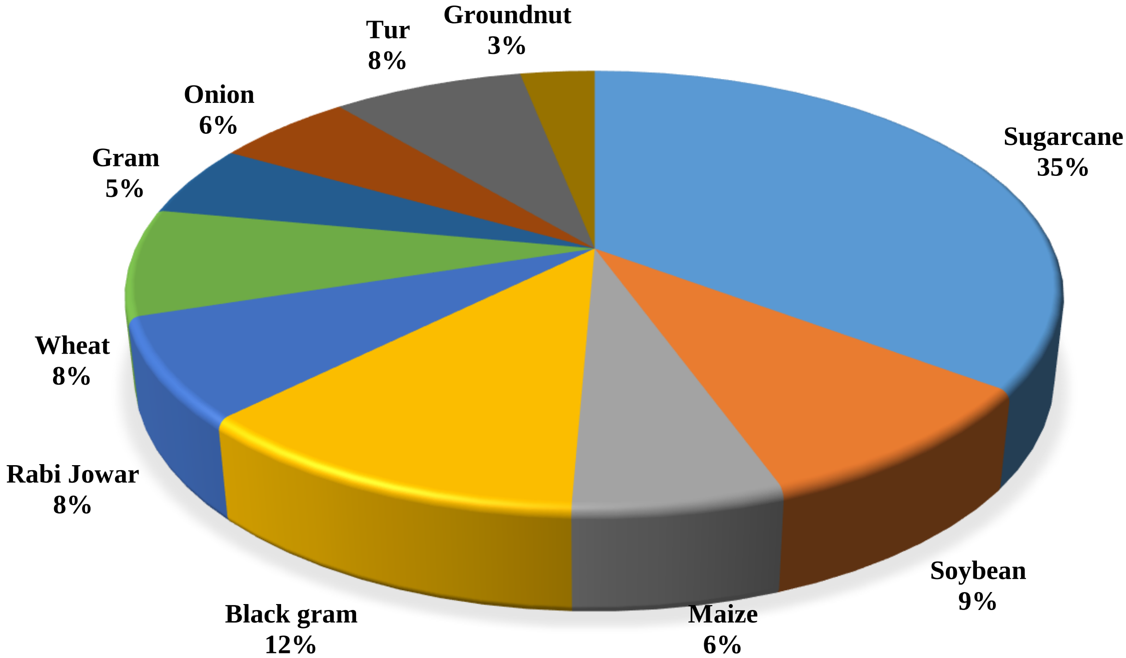
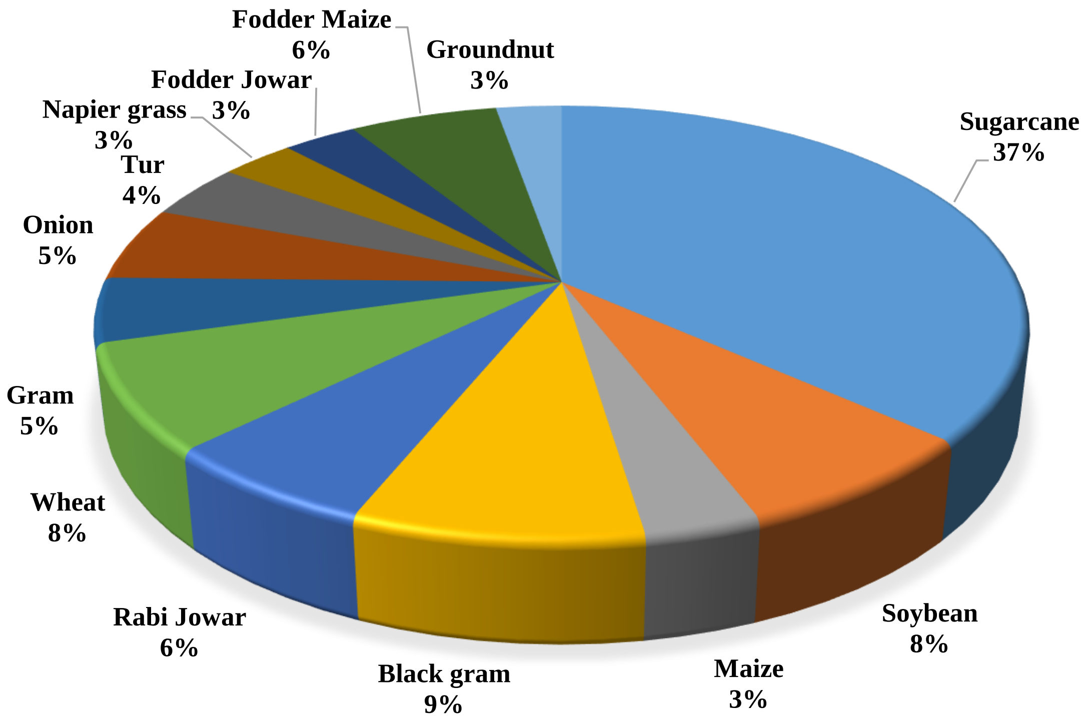


Fig. 3 CROPPING PATTERN OF CROP+ DAIRY FARMING SYSTEM



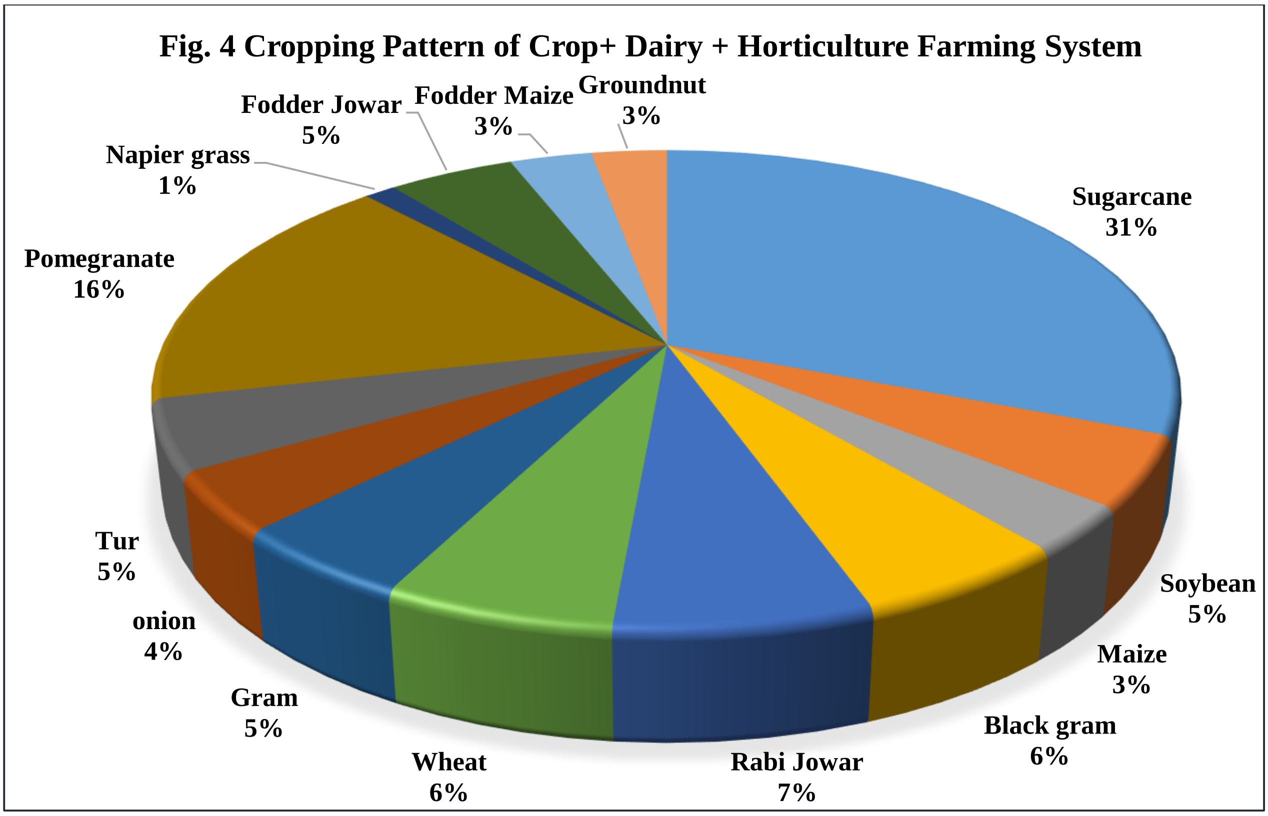


Fig. 4 Cropping Pattern of Crop+ Dairy + Horticulture Farming System
Fodder Jowar 5%
Fodder Maize 3%
Groundnut 3%
Napier grass 1%
Sugarcane 31%
Pomegranate 16%
Tur 5%
Soybean 5%
onion 4%
Maize 3%
Gram 5%
Black gram 6%
Wheat 6%
Rabi Jowar 7%

Fig. 5 Resource use pattern of Crop only farming system

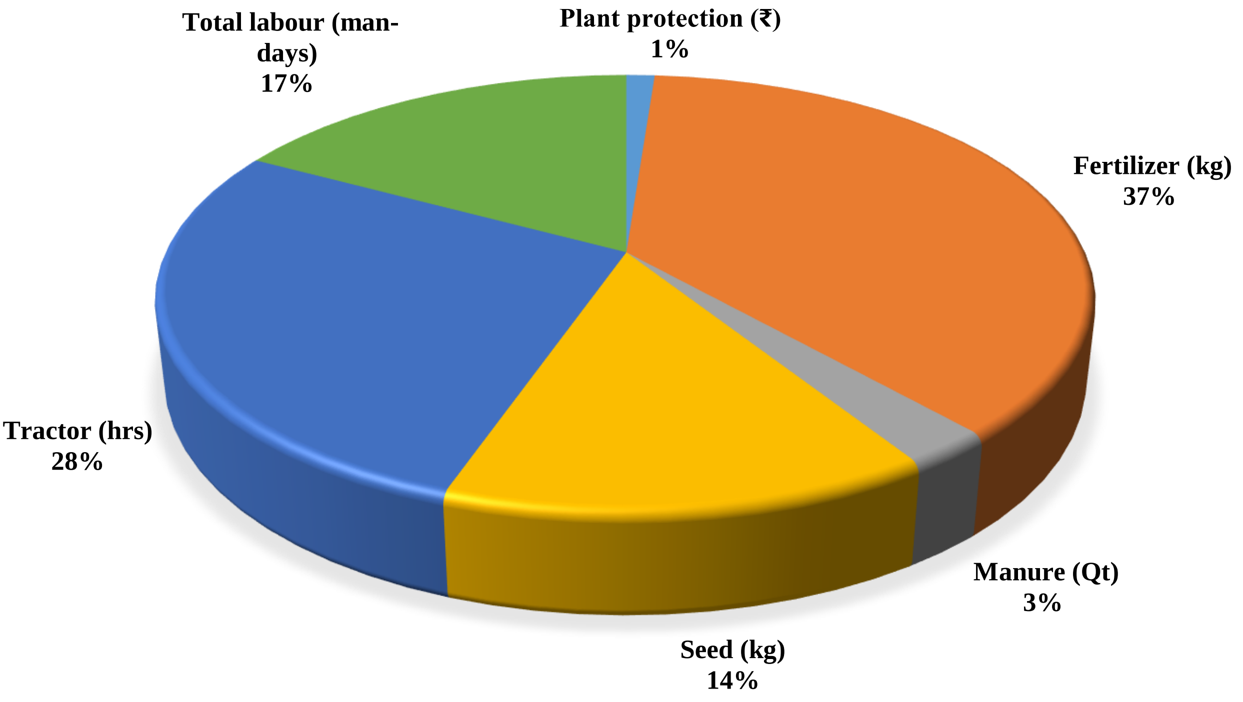
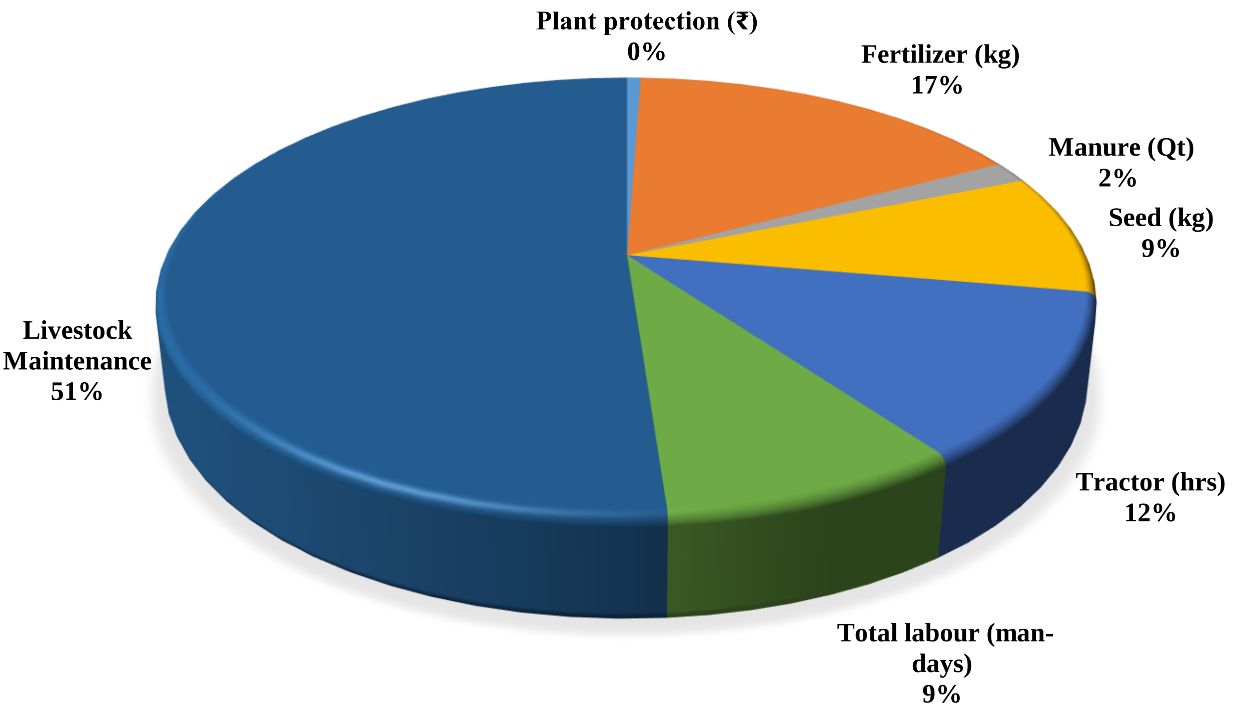


Fig. 6 Resource use pattern of Crop + Dairy farming system



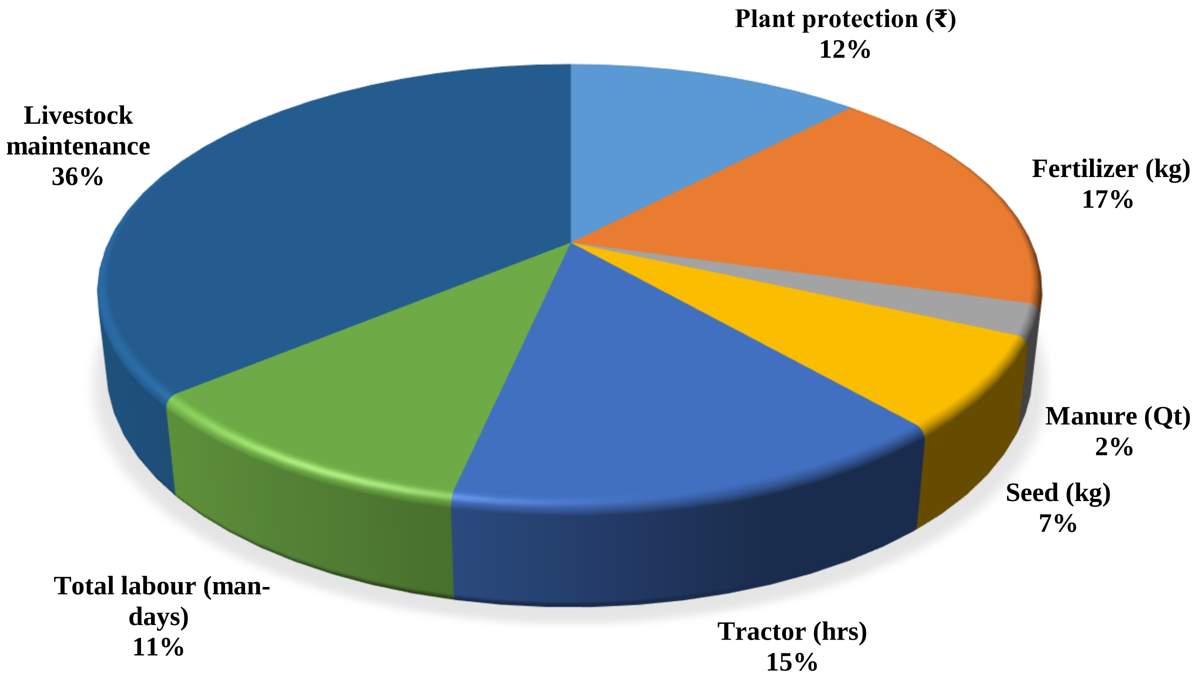


Fig. 7 Resource use pattern of Crop + Dairy + Horticulture farming system

Fig. 8 Employment Pattern (%) of Crop only farming System

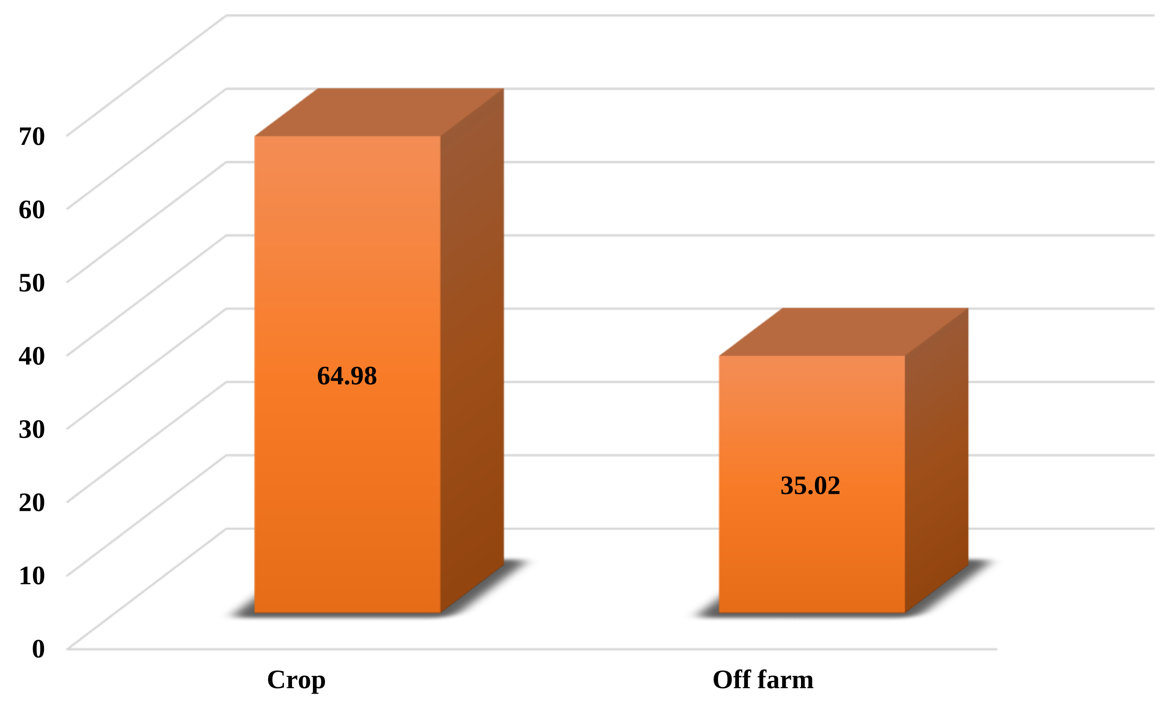


Fig. 9 Employment pattern (%) of Crop + Dairy farming System

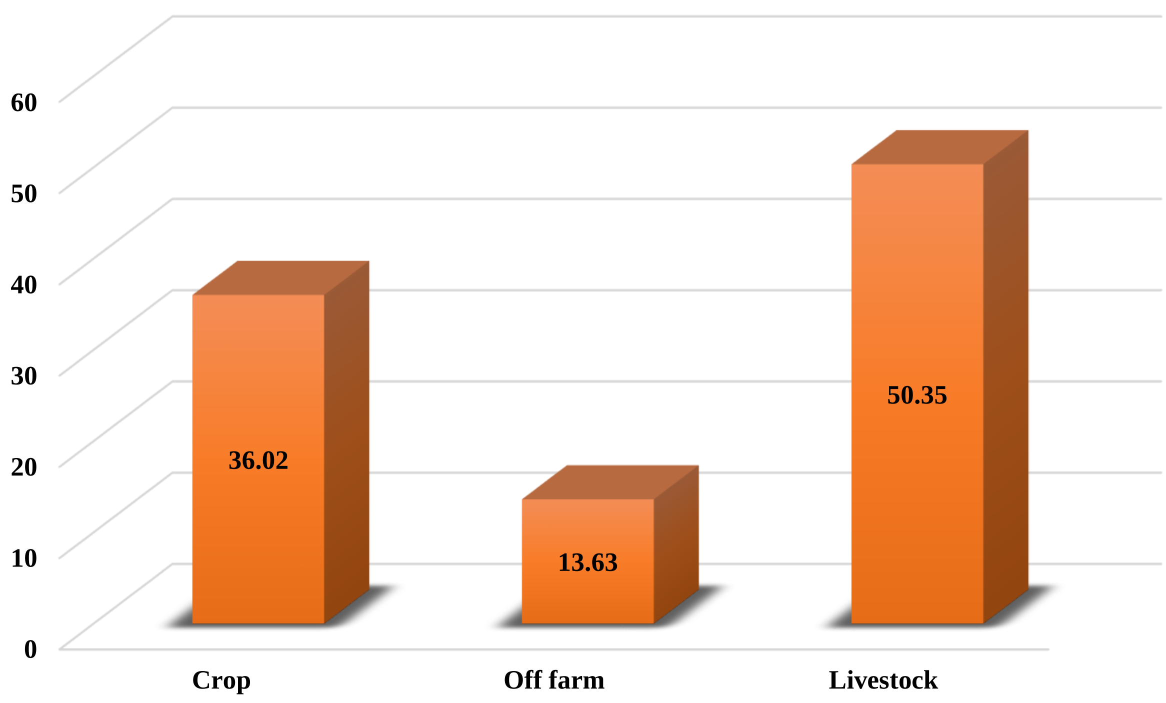


Fig. 10 Employment pattern (%) of Crop + Dairy + Horticulture farming System

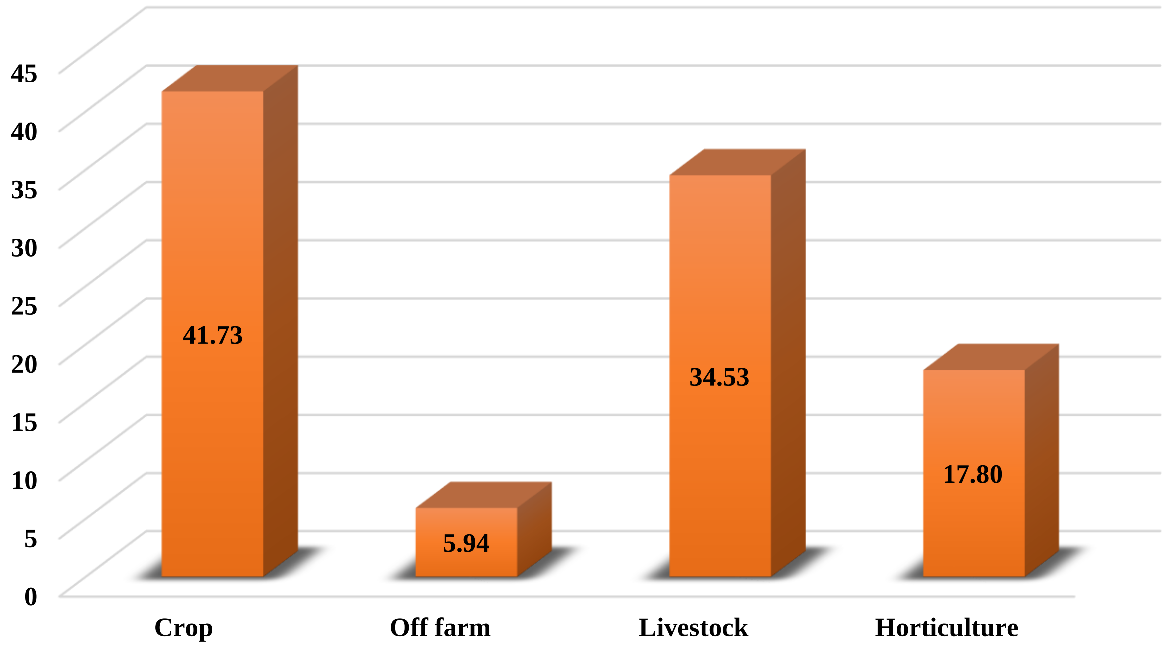


Fig. 11 Income Source (%) in Crop only Farming System

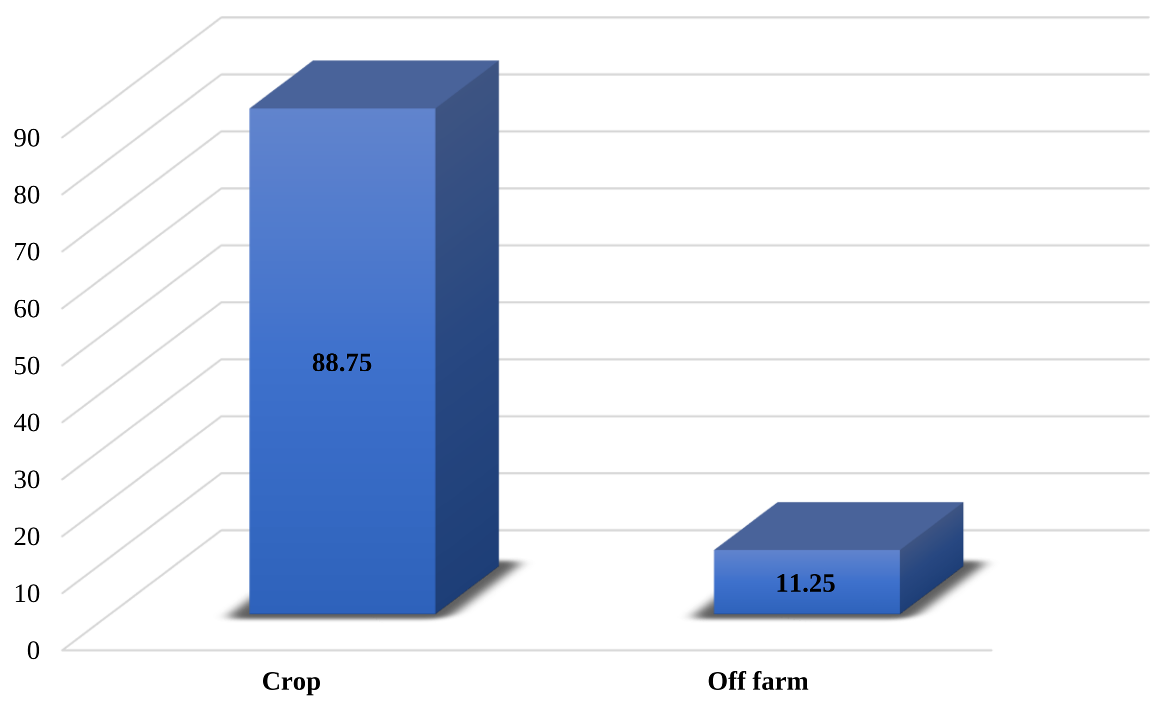
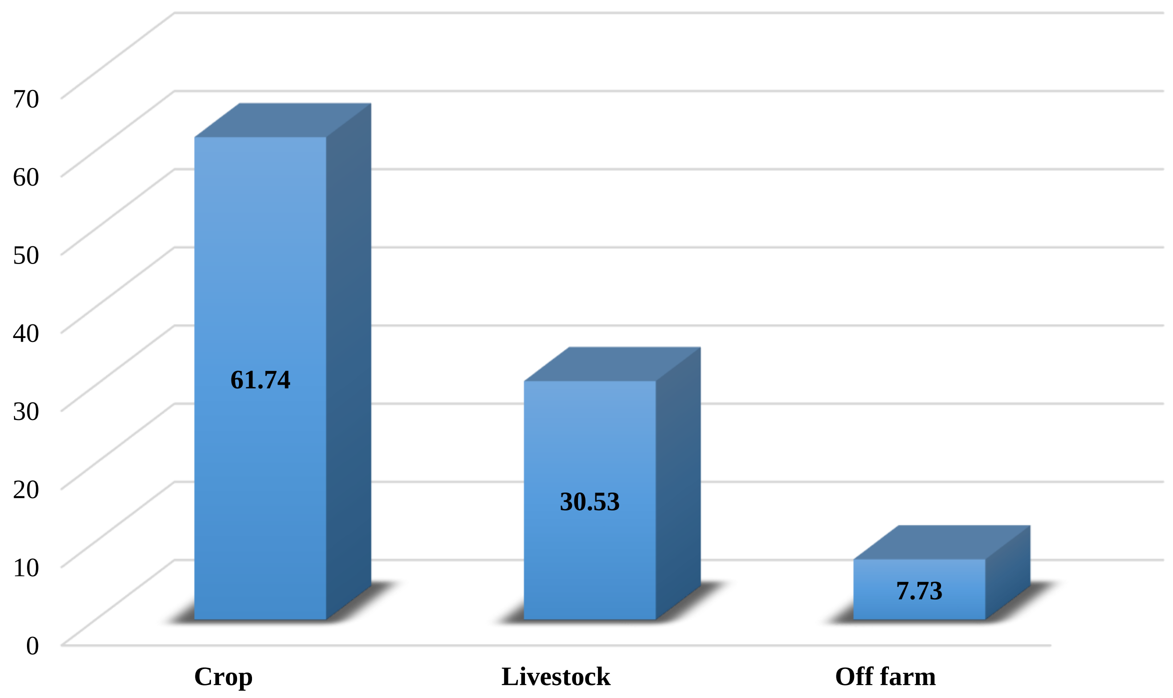


Fig. 12 Income Source (%) in Crop + Dairy Farmnig System



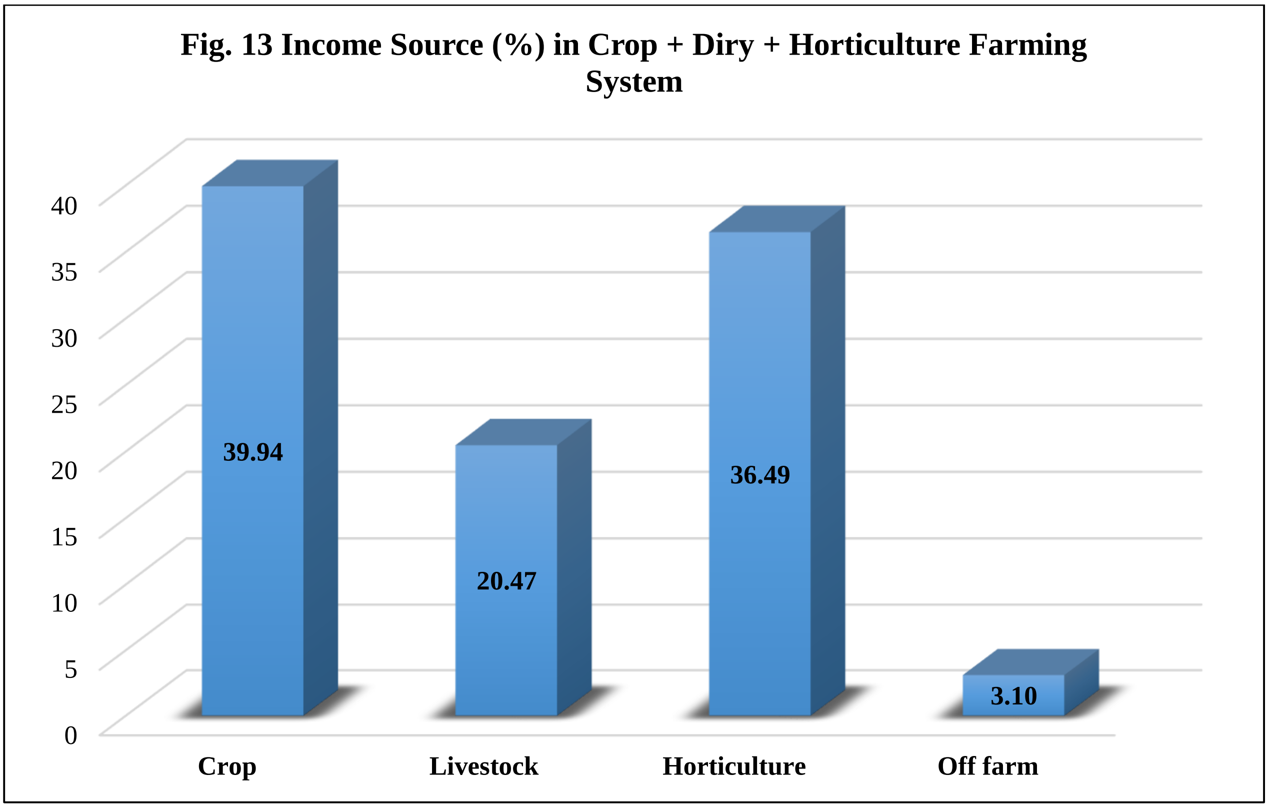


Fig. 13 Income Source (%) in Crop + Diry + Horticulture Farming System
40
35
30
25
20
15
10
5
0
39.94
20.47
36.49
3.10
Crop
Livestock
Horticulture
Off farm

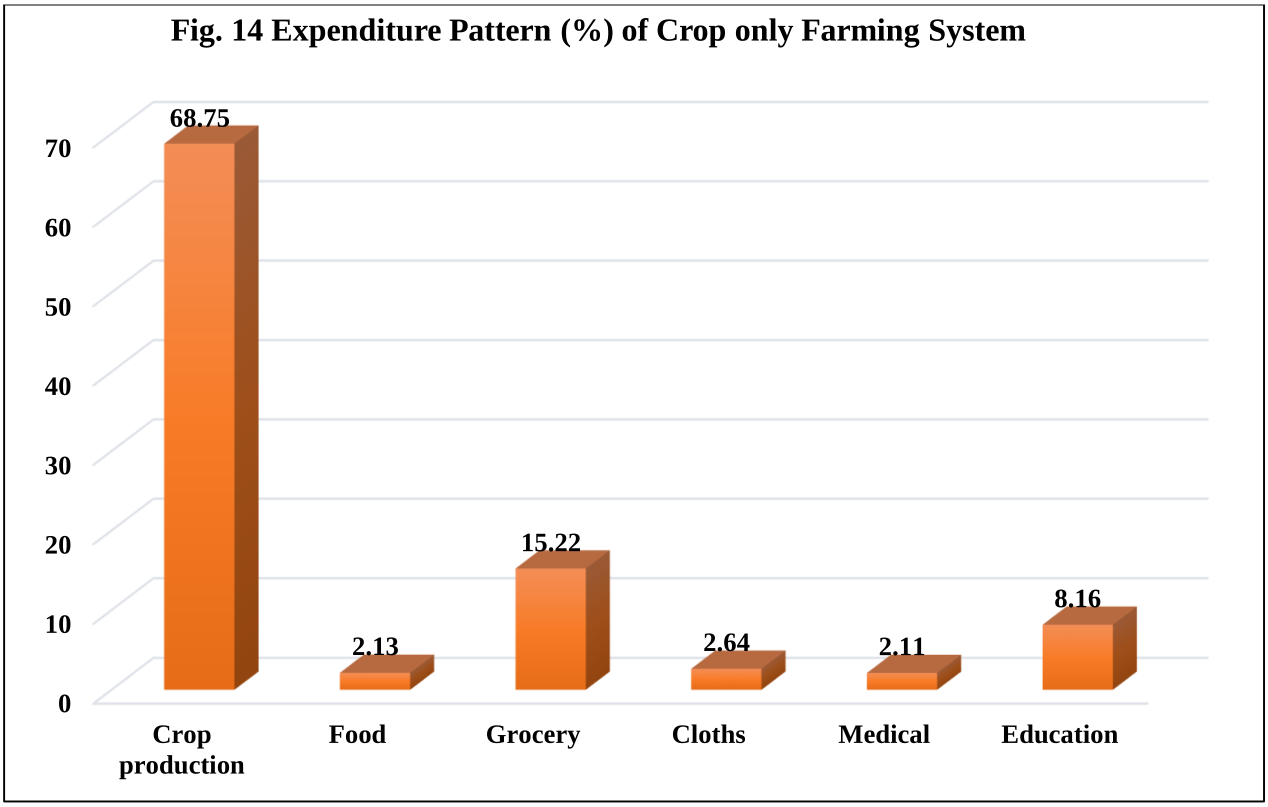


Fig. 14 Expenditure Pattern (%) of Crop only Farming System
70
60
50
40
30
20
10
0
68.75
2.13
15.22
2.64
2.11
8.16
Crop production
Food
Grocery
Cloths
Medical
Education

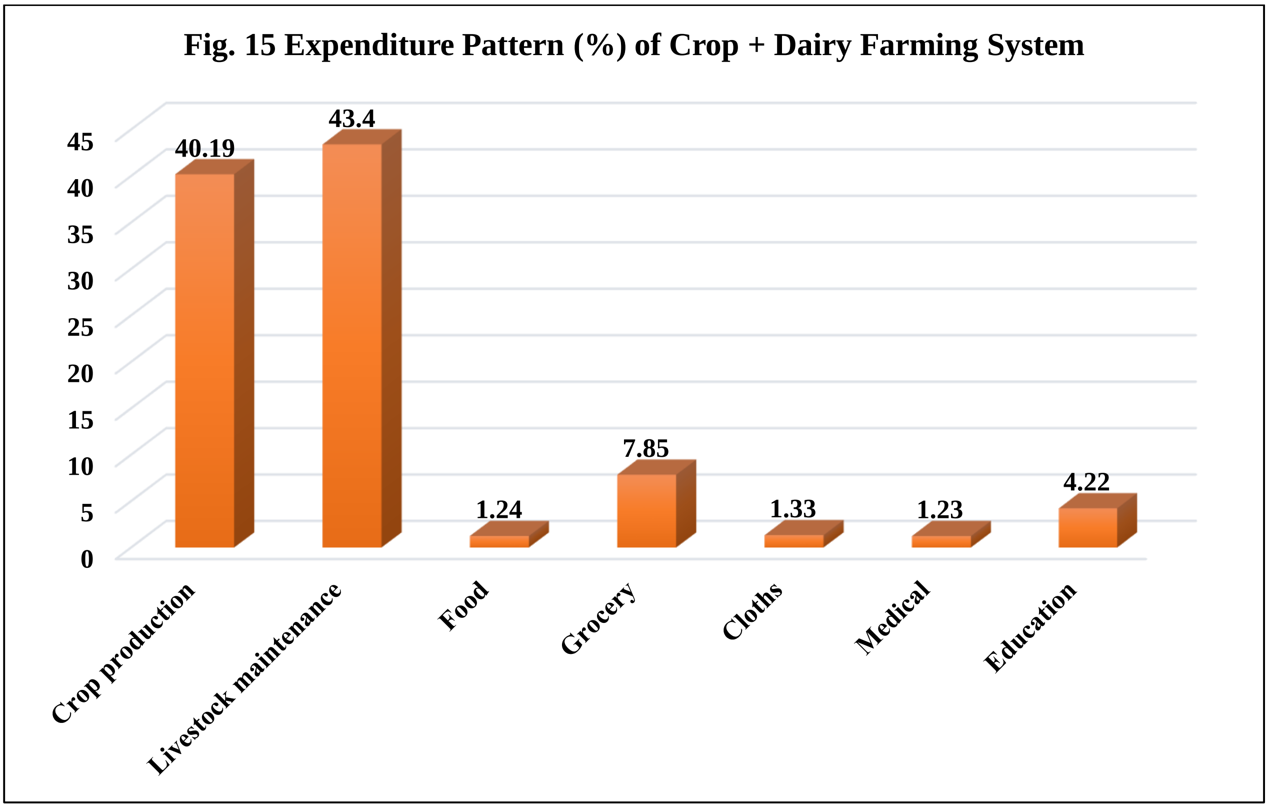
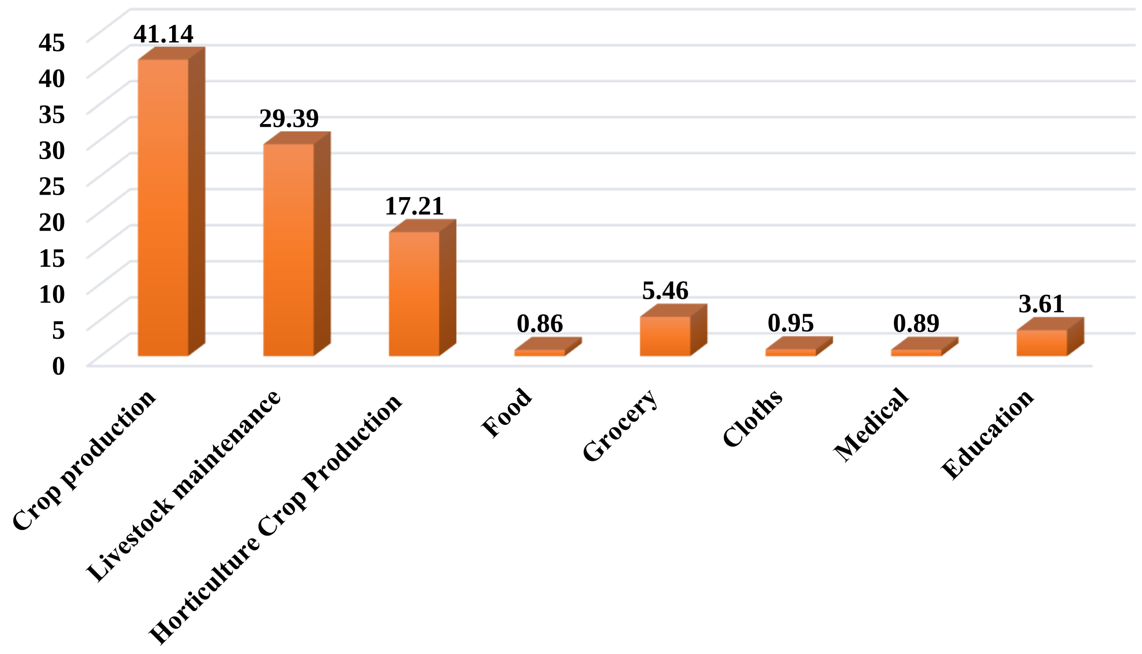


Fig. 15 Expenditure Pattern (%) of Crop + Dairy Farming System
45
40
35
30
25
20
15
10
5
0
40.19
43.4
1.24
7.85
1.33
1.23
4.22
Crop production
Livestock maintenance
Food
Grocery
Cloths
Medical
Education

Fig. 16 Expenditure Pattern (%) of Crop + Dairy + Horticulture Farming System



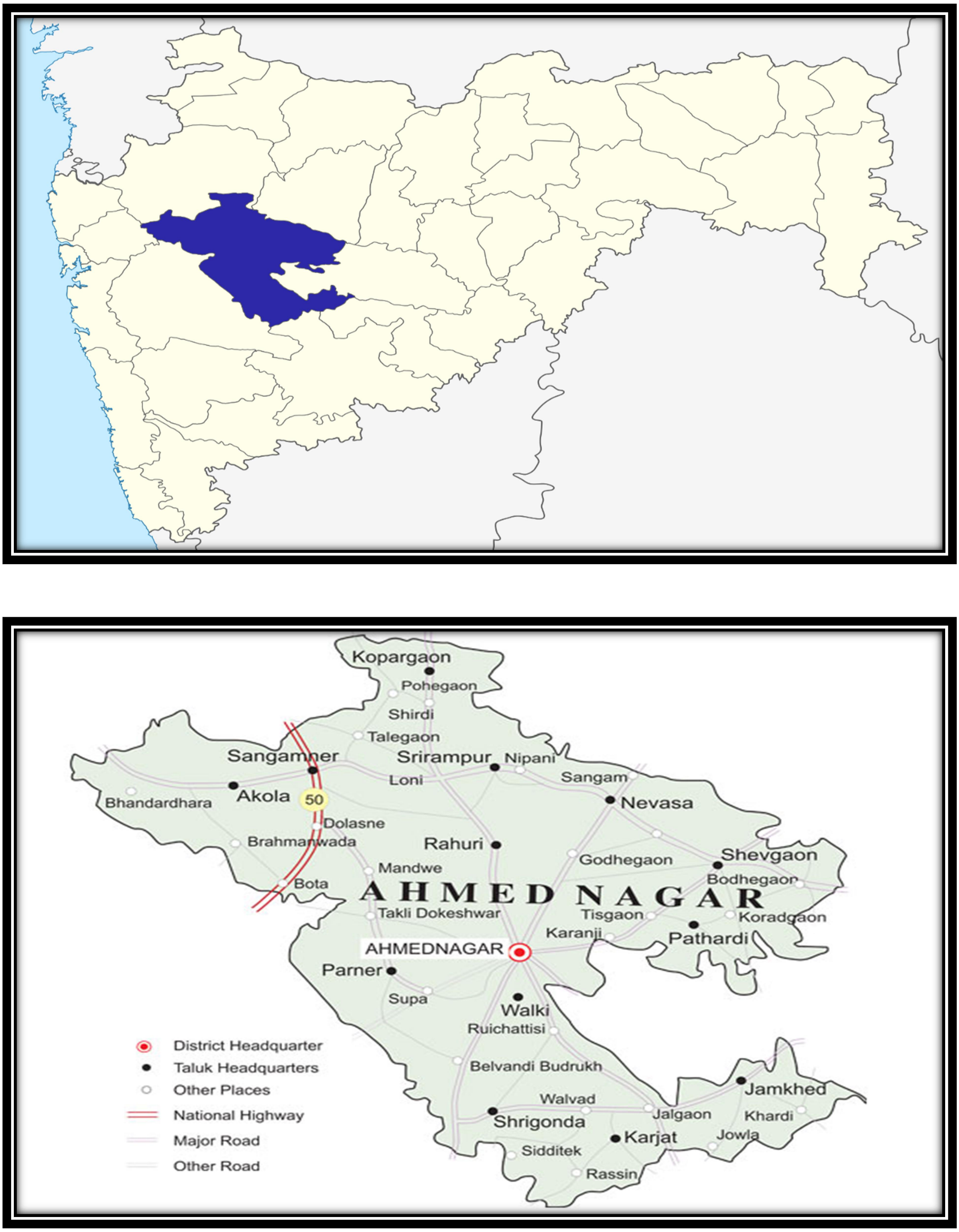


Fig. 1 Map of Ahmednagar District of Maharashtra