ECONOMICS OF FARMING SYSTEMS IN SOLAPUR DISTRICT OF MAHARASHTRA

by

Miss. Patil Vidya Bharat
(Reg. No. 17/209)

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

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1. INTRODUCTION

1.1 General

Agriculture throughout the World is still, man's only most important activity. Despite all the advances of high technology, it is the reliable source of food and an important source of fibres and other products whose synthetic substitutes are not as good as the natural products, or more costly to produce. In many countries, agriculture is also the largest single employer. In many countries, it is the main or only source of livelihood for over 50 per cent of population.

1.2 Indian Agriculture

Agriculture constitutes one of the most crucial sectors of Indian economy by virtue of its being single largest contributor of gross domestic product covering around 17.30 per cent of the total income and provider of employment to nearly 60 per cent of total workforce. Growth in agriculture has therefore, a direct impact both on poverty alleviation as well as food and nutritional security. This apart, the shares of agricultural products vis-à-vis the total export earnings are also substantial relative to the perspective economic growth. Equally important is the kind and extent of support that, agriculture and allied sectors provides to agro-based food and non-food industrial growth since independence.

Indian agriculture is known for its multi-functionalities of providing employment, livelihood, food, nutrients and ecological securities. The income from cropping alone on small farms is hardly sufficient to sustain the farmer's family only with decline in farm size due to explosion of population and this situation is further weakened due to repeated failure of monsoons. Therefore, the farmer, to be assured of regular income for satisfactory living (above the poverty line), a judicious mix of any one or more of these enterprises with agronomic crops should complement the farm income. The selection of enterprises must be based on the cardinal principle of minimizing the competition and maximizing the complementarities between the enterprises.

One of the finest Indian success stories of post independent era has been the green revolution of sixties, which salvaged the country from being a chronic importer of food grains into an exporter. Since independence, the population has increased more than three times, from 361.1 million in 1950-51 to 1210.20 million by the year 2011 (Census, 2011), Whereas production has increased more than four times from 50.8 million tonnes to 235.90 million tonnes during same period.

1.3 Farming Systems

Traditional farming system used by farmers in India were based on centuries of experiences characterized by mixed farming involving crop production with one or more enterprises like dairy, poultry, sericulture, piggery, sheep, goat, fisheries, bee-keeping *etc*. Their main aims were to achieve stability of production, provide subsistence for the family and guard against weather aberration and other environmental stresses.

In the recent years, farming system approach gave scientific touch to the existing practices and found ways and means to make it sustainable in changing global scenario. "Farming system" is a resource management strategy to achieve economic and sustained agricultural production to meet diverse requirements of the farm household, while preserving the resource base for future generation and maintaining a high environmental quality. Thus, farming system is the result of interaction among several interdependent components.

Land being the most limited and scarce resource, particularly on small and marginal farms, the 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.

1.4 Agriculture in Maharashtra

The Maharashtra is second largest State in India both in terms of population and geographical area spread over 3.08 lakh sq.km. The state has population of around 11.23 crores (2011 census) which is 9.29 per cent of total population of India. While the agriculture and allied activities sector contributes just 13 per cent to the state income through about 55 per cent of the population dependent on agriculture and allied activities sector.

Since there is no further scope for horizontal expansion of land for cultivation of farm enterprise the emphasis should be on vertical expansion by increasing the productivity using the available resources properly choosing the best enterprise mix. The income from cropping alone is hardly sufficient to sustain the farmer's family. The farmer's family in case of small and marginal farmers, who constitute 80.3 per cent of agricultural population with only 36 per cent of area operated. With decline in farm size due to explosion of population, it would be increasingly difficult to produce enough for family by the end of 21st century. The farmers need to be assured of regular income for living at least above poverty line.

There are several farming systems *viz*; crop based, horticulture based, dairy based and their combinations the profitability of different crops and livestock combination varying from region to region also. In Solapur district many farming systems are followed namely**:** crops, crops + livestock and crops + livestock + horticulture.

There is a need to study socio-economic characters like education level, family size, size of land holding and asset structure of the farmers to understand the farming systems is also important.

So far, studies conducted on farming system in Solapur district are very few, and farming system approach in analysing the problems of agriculture is gaining lot of importance in recent years. Such a study, it is believed to throw light on the problems associated with different farming systems and enable the academicians and policy makers to formulate and implement appropriate policies for a balanced, integrated and overall agricultural development.

The farming systems is a whole farm approach, where in farm is studied in holistically. The farm situation changes with very little spatial change, therefore the location specific farming system should be identified, studied and the profitable farming system which are perfectly suited to a particulars location need to be suggested, because crop or any other enterprise cannot sustain the farmer in long run. The farming system approach provides a solution for sustainability of farm in long run. In view of this, study was carried out in Solapur district of Maharashtra state with the following objectives;

1.5 Objectives

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

1.6 Hypotheses

1. The resource use levels are varying under different farming systems.
2. The income from crop production is less than the other farming systems.
3. The farming systems in vogue are economically viable.

1.7 Scope of the Study

The findings of the present study will be useful for the farmers for selecting farming system and for getting more profit. These findings will also useful for extension workers for advising the farmers in selecting proper farming system for increasing production, income and employment. The study will be also useful for research scientists who are engaged in farming system research to know the existing practices followed by the farmers and to suggest improvements on the basis of research and evaluate them critically.

1.8 Limitations of the Study

The results of study based on data collected for one year. It is well known that agriculture production is a function of many variables and fluctuate from year to year. The primary data were collected by interviewing farmers on the basis of multistage sampling design. Farmers of the village do not maintain farm record so that responses of farmers regarding area

sown under different crops, quantity of seed used, manures and fertilizers used, output produced, price received and information on various kinds of expenses made and other related aspects of study were mainly based on memory. Due to limited resources and single person investigation the study was undertaken for only limited villages of Solapur district and sample size was of 90 farms (30 crop only farming system, 30 C + L farming system and 30 C + L + H farming system). Hence, the conclusions of the study may be considered as indicative and cannot be generalised.

2. REVIEW OF LITERATURE

Past literature forms an integral part of any systematic research work. Moreover, it becomes imperative on the part of a research worker to have knowledge of research work carried out by previous researchers in the research area of interest. This requires that the research findings of previous studies closely related to a particular field of his or her research work from various sources. The knowledge obtained through such review of literature efforts enables him or her to gain insight in respect of a manner in which a given research problem has been tackled, the nature of results obtained and the conclusions drown. Many a times, it may be true and previous research work might have been carried out under different set of conditions.

Nevertheless, such knowledge is always useful for improving efficiency and effectiveness of all acts relating to designing of research problem, adopting suitable methodology and interpreting research results. In recognition of the importance of review of literature in research work, this chapter is devoted to present and discuss the reviews collected from various sources. For convenience, the reviews have been grouped in major headings as follows.

2.1. Study socio-economic characteristics of farmers.

2.2. Resource use pattern of different farming systems.

2.3. Profitability of different farming systems.

2.4. Constraints in existing farming systems.

2.1. Socio-economic Characteristic

Narayanmurti (2000) studied farmer's education and productivity of crops. He analysed the role of the farmer's education in productivity of crops using two season data of two hundred farm households in Tamilnadu state. The study analysed the role of farmers education in the productivity of crops by estimating five alternative specifications of production function. The bivariate analysis indicated that the use of input in yield increasing inputs was significantly higher among the higher educated group of farmers when compared to the less educated group of farmers. The coefficient of education implies that one per cent increase in the education level of the farmers will have an effect of 0.038 per cent. In the productivity of paddy, the estimates of production function relating to samba paddy indicates that the coefficient of education was positive but not significant in influencing the productivity of paddy.

Sundar and Sharma (2000) examined the role of farmers education and knowledge for raising the agricultural productivity. Education plays a key role in the economy. Farmers education in rural area was considered to be central ingredients in a strategy to improve agricultural productivity. Farm productivity was increased on an per cost average by 7 per cent as result of farmers completing four additional year of schooling

Reddy and Sen (2004) conducted study on technical inefficiency in rice production and its relationship with farm specific socio-economic characteristics. The study was undertaken in the sone canal command area of Bihar. There were 270 farms, from that 207 marginal farms were selected through stratified random sampling method. Technical inefficiency in rice production decreased with increase in farm size. The average technical inefficiency was highest in marginal farm (27.28%). To study the effect of age, the farmers belonging to age group 40-50 years showed lowest technical inefficiency in production of rice followed by the farmers belonging to below 40 years age. It would be clear that technical inefficiency in level of farmers below 50 years of age was comparatively lower than that of farmers above 50 years. Technical inefficiency reduced significantly with the increase in level of education, lowest technical inefficiency reduced significantly with the increase in level of education. It was indicated that well educated farmers can understand production technology better.

Toor *et al*. (2006) studied income and employment pattern in Punjab. The distribution of landholding was very important as farm incomes along with the level of technological adoption depends on size of farm. It was revealed that 122760 holding falling in size group up to 1 hectare out of total holding comprising 12.31 per cent. The size of analysis indicated the contribution of crops below 1hectare area 33.97 per cent, dairying 36.09 per cent. Non-farm income 22.36 per cent and miscellaneous income 7.58 per cent. This showed that contribution of income from dairying and nonfarm was found to decline with increase in farm size except crops indicating an inverse relation. The pattern and magnitude of total human labour employment in crop production, family labour 51.22 man-days and hired human labour 24.67 man-days and in dairying only family labour was 193.75 man-days. This indicated that substantial share of family labour in the state. The income of farm families showed that crop followed by dairying in the state contributed the major share.

Jain and Chetan (2007) made an attempt to study marketing of major horticultural crops in Dharsiwa block of Raipur district of Chattishgarh. They have selected five vegetables *i.e.* brinjal, tomato, green chilies, cauliflower and okra and two fruit crop *i.e.* watermelon and muskmelon. They selected 62 respondent and 29 intermediaries for study. Study revealed that total cropped area was increasing with the increase in size of land holding. The cropping intensity on various farm size was estimated to be 178.92 per cent, 169.40 per cent and 152.03 per cent on small, medium and large farm respectively.

Sridhar (2008) studied contract farming in maize and revealed that the age of contract farmer was 43 years with a family size of six. The education levels concerned, hardly 21.66 per cent of the farmers had illiterate and remaining 78.33 per cent had literate in which 15.83 per cent, 42.50 per cent and 20.00 per cent studied upto primary, high school and college level, respectively. In case of non-contract farming, the average age of the farmers was 47 years with

an average family size of six. The annual income was 66.95 per family and educational level concerned, 23.34 per cent had illiterate and 76.66 per cent literate. Among the literate about 36.66 per cent, 31.66 per cent and 8.34 per cent of the farmers were studied up to primary, high school and college level, respectively.

Asmatoddin *et al*. (2009) studied the resource productivity of tomato in different seasons in Western Maharashtra. Sangmner tehsil from Ahmednagar district was selected purposively and ten villages were selected randomly. From each village three tomato grower were selected. The result revealed that an on average family size of *kharif, rabi* and summer tomato grower. Farmer was 5.97, 5.47 and 5.59 respectively. Education status of family members at overall level in *kharif, rabi* and summer season *i.e.* illiterate, primary, secondary, graduate farmers were 7.78, 24.44, 45.56 and 22.22 percentage, respectively. Livestock rearing at overall level by tomato growers in the three seasons was observed in which crossbreed occupied the highest place follower by sheep goat, bullock and buffaloes *i.e.* 37.00, 34.67, 17.34 and 10.97 per cent, respectively. Cropping intensity was highest in case of *rabi* tomato growers followed by *summer* and *kharif i.e.* 170.68, 169.33 and 152.85 per cent, respectively.

Malathesh *et al.* (2009) studied the factors contributing towards socio-economic performance among the farmers on selected farming system in Eastern dry zone of Karnataka. They observed that, the net income of the farmers per unit was high in case of crop + dairy + sericulture (₹ 51,284) followed by crop + sericulture (₹ 48,231) and very low net income was obtained in case of crop-based farming system (₹ 29,560). Hence the extension workers should popularize and encourage farmers to adopt diversified farming and also motivate them to take combinations of enterprises to realize more income per unit area.

Biradar *et al.* (2013) studied assessing contribution of livestock to the livelihood of farmers of farmers of Western Maharashtra and observed that, the per cent contribution of livestock to the household income ranged from 18.69 to 33.90 per cent. The livestock to the household income contributes 34.61 gm protein. 52.32 gm fat and 1690.5 mg calcium to the daily diet of the farm household. The average nutrients required to is 42.57 gm protein, 64.35 gm fat and 2079 mg calcium 12 per cent of the household used livestock for mitigating uncertainties of farming. About 63 per cent of respondents obtained the livestock farming is a symbol of higher social status. The study concludes that, livestock system contributes economically and socially to enhance sustainable livelihoods.

Hiware (2016) studied scenario of sericulture industry in Maharashtra State, India, in this paper mainly focused on socio-economic development, employment generation and sericulture sector activities in the state. Sericulture industry requires low investment and it helps to earn higher returns in short gestation period, due to this farmers getting attracted to this sector and it is a best tool to improve the rural economy as well as to improve their standards of living.

It is boon to the rural population associated with agriculture and helping them to avoid suicidal attempts by earning very good income throughout the year.

From the above study, it can be concluded that the farmers education is the central ingredient to increase agricultural productivity, technical efficiency and resource use productivity.

2.2. Resource Use Pattern of Farming Systems

Gupta and Rao (2004) have analysed the major livestock and crop production systems and the socio-economic conditions of the farmers in different agro climatic regions of Rajsthan and indicated that the interaction of crop and livestock sector is of significant importance to Rajsthan, which is highly prone to draught due to occasional failure of monsoon. Mixed farming system is the rule of the state rather than an exception resulting in an array of crop - livestock system. The interaction of the livestock-crop is more pertinent in view of the farming system approach and resource utilization.

Singh (2004) fitted the Cobb-Douglas production function to analyse the resource use efficiency in vegetable crops of Mahakoshal region in Madhya Pradesh and found that independent variables explain nearly 87 per cent to 98 per cent of the variation in the dependent variable. The elasticity of production of rental value of land was found to be more than one indicating increasing returns for tomato and onion. Remaining variables for okra, brinjal and potato vegetable crops were found less than one indicating decreasing returns to scale. The sum of regression coefficients of variables observed to be less than one for onion, okra and potato vegetable crops increase proportionally with an increase in the variable factors and vice-versa.

Singh *et al.* (2009) Results are presented of a study examining the resource use efficiency in agriculture in Ghazipur, Uttar Pradesh, India, during 2004-05, using the Cobb-Douglas production function. A set of 4 village was selected randomly and 30 cultivators from each village selected randomly. The major crops selected for the study were wheat, sugarcane, potato and paddy. The resource use efficiency was determined by comparing the estimated marginal value productivity of various inputs (seed, manure/fertilizer, irrigation, human labour, plant protection) with their respective factor costs. It appears that the cultivators have not been able to allocate their inputs efficiency and there seems to be considerable scope for augmenting profit by optimum use of inputs.

Mane *et al.* (2012) investigation was carried out during the year 2010-11. About 60 sericulture producers were randomly selected from ten villages of two tahsils of Usmanabad district of Maharashtra. Cross sectional data were collected from sericulture producers with the help of pretested schedule by personal interview method. The study was conducted to know the elasticity of production, resource productivity and resource use efficiency in cocoon production. Cobb-Douglas production function was fitted to the data. The results revealed that regression

coefficient of disease-free laying (0.042) and disinfecting material (0.229) were positive and significant. Regression coefficient with respect to batches under cocoon production was 0.048 followed by that of hired human labour (0.105), family human labour (0.170), mulberry leaves (0.257) and electricity (0.025) which were positive but non-significant. The sum of production elasticities was 0.876 which indicated decreasing return to scale.

Pawar and Vijaykumar (2012) Investigation was carried out during the year 2010-11. About 32 soybean growers were randomly selected from eight villages of Udagir tahsil of Latur district of Maharashtra. Cross sectional data were collected from soybean growers with the help of pretested schedule by personal interview method. Data were related to soybean output and inputs like area under soybean, hired human labour, bullock labour, machine labour, seed, manure and use of nitrogen, phosphorus, potash and family labour as resources. Cobb-Douglas production function was fitted to the data. The results revealed that, regression coefficient of human labour was (0.129) followed by machine labour (0.024) which was positive and highly significant at 1 per cent level. Regression coefficients of bullock labour (0.067) and plant protection (0.011) were positive and significant at 5 per cent level. Regression coefficients of seed, manure, nitrogen and phosphorus were also positive but non-significant. Marginal product of area under soybean was 10.803 q followed by machine labour (0.274 q), bullock labour (0.231 q) and so on. MVP to price ratio with respect to phosphorus was 3.01 followed by that of nitrogen (2.98). Hence, preference might be given to increase the use of phosphorus on priority basis in soybean production.

Karthick *et al.* (2013) The resource use efficiency and technical efficiency of turmeric production have been computed using primary data collected from 90 turmeric growers spread over three blocks in Dharmpuri district of Tamilnadu. The study has revealed that planting material, nitrogen, potash, harvesting and curing cost, machine hours and irrigation have a positive and significant influence on turmeric yield. Economic efficiency of these variables, except harvesting and curing cost, is more than one, indicating that these resources are being used at sub-optimum levels and there exists the possibility of enhancing the yield of turmeric by increasing their use. The technical efficiency of about 60 per cent of sample farmers has been found more than 80 per cent, which indicates the possibility of increasing the yield of turmeric by adopting better technology. The study has suggested some measures to increase productivity and income of farmers in the study area.

Takale (2013) This study examined the production elasticities, resource use efficiency and return to scale of sugarcane cultivation in Parbhani district, Maharshtra, India. Primary data for the year 2009-10 were collected from a sample of 100 farms. The study found diminishing return to sale in sugarcane cultivation for all farm sizes because of the excessive use of human labour, machine charges and insecticides. Analysis of resource use efficiency revealed that none

of the inputs was efficient allocated for all size groups of cultivators. The analysis of production elasticities in sugarcane cultivation, according to farm size, revealed that the coefficient of irrigation and seeds was positively significant except for large farms, while the production elasticities of machine charges, human labour and insecticides (except for small farms) were negative.

Jagtap *et al.* (2014) The study was conducted in Achalpur tahsil of Amravati district oh Maharashtra with a sample of 80 farmers selected randomly from four villages with twenty farmers from each village. Data used were pertaining to the period 2009-10. Production function analysis of data indicated that, among various resources selected, human labour, bullock labour and machine power in small farmers, seed, bullock labour, fertilizers and manures in medium farmers and the fertilizers and manures in large farmers were statistically significant. The ratio of marginal value product to its acquisition cost per unit was found to be greater than unity for the variables plant protection chemicals, fertilizers and manures in small farmers, variables human labour, fertilizers and manures in medium farmers and the variables seed, human labour, fertilizers and manures in large farmers. Also, economic analysis of data indicated that majority of farm produce was routed through two marketing channels, channel-I (Producer-commission agent-retailer-consumer) and channel-II (Producer-commission agent-wholesaler-retailer-consumer). Producer's share in consumer's rupee was found to be 56.31%, 40.50% and price spread was Rs. 655.35 and Rs. 891.00 for channel-I and channel-II, respectively.

Jawanjal *et al*. (2015) the functional analysis was carried out to know the contribution of independent variables in yield of sugarcane. From the estimated Cobb-Douglas production function, it was observed that, in sure sugarcane coefficient of determination was 0.9113 indicating 91 per cent of variation and in ratoon sugarcane coefficient of determination was 0.9334 indicating that, 93 per cent of the variation in the yield was explained by the identified input variables included in the function e.g. expenditure on manures, plant protection, potassium and nitrogen in suru sugarcane cultivation, and plant protection and manures to be curtailed considering their excess utilization in ratoon sugarcane cultivation. Whereas, MVP to FC ratios was more than unity for phosphorus and nitrogen, human labour, irrigation indicated under-utilization of these resources in sugarcane cultivation which underlines scope of expanding the use of these inputs.

Waghmode *et al.* (2015) This paper presents the results of field studies conducted in Maharashtra, India, to determine the resource productivity and resource use efficiency in sugarcane production in the area. It was shown that irrigation, nitrogen fertilizers, human labour and farmyard manure were the resources most important in increasing the sugarcane productivity in the study area.

To sum up, in above studies, research workers used the Cobb-Douglas production function to estimate resource use efficiency. The above reviews indicate that the farmers have not been able to allocate their inputs efficiently and there seems to be considerable scope for augmenting profit by optimum use of inputs.

2.3. Profitability of Farming Systems

Sharma and Sharma (2000) studied farm size productivity relationship. A two-stage random sampling procedure was followed to select the sample household. The 120-farm household were selected randomly in proportion to the number of households in each selected village. The selected households were stratified in to small, medium and large categories on the basis of their land holding using square root cumulative frequency method. The results showed that the productivity of wheat and barley was 18,058 and 26,010 on large farm. To examine the effect of farm size on productivity of different crops log-linear regression analysis was done. The result of regression analysis confirmed the negative effect of farm size on yield rate of wheat and paddy. The regression coefficient on large farm for wheat and paddy was -0.048 and -0.091 respectively. Results revealed that in wheat and paddy the small farm used significantly higher amounts of human labour (43.5) as compared to large farm (29.3) there was the inverse relationship between farm size and input use. The results showed that the small farm used higher amount of human labour and fertilisers as compared to large farm.

Naik *et al.* (2002) studied the economics of farming systems in South Konkan region of Maharashtra State. It was observed that in sole cropping, 100 per cent income was contributed by the crops. In mixed farming (crop + dairy), 34.40 per cent income was contributed by dairy enterprise and remaining by crops. Regarding crop + poultry, 16.17 per cent of income was contributed by poultry enterprise and remaining by crops. In crop + dairy + poultry farming system, 30.44 per cent income was contributed by dairy, 11.25 per cent by poultry enterprise and remaining 58.33 per cent income was contributed by crop production. It was also revealed that only crop provide 197.58 man-days employment, whereas crop + dairy farming system had provide 203.18 man-days employment and crop + dairy + poultry farming system provide total employment of 248.09 man-days.

Swami (2004) studied the economics of farming system in Ratnagiri district of Maharashtra state. Study revealed that the crops + dairy, crops + goat, crops + poultry enterprise was most profitable farming system giving farmer a net income at ₹ 41373, ₹ 37903. ₹ 37710, respectively which can provide supplementary income to the farmers.

Sindhu and Bhullar (2004) studied changing structure of the farm economy in Punjab. They tried to analyze the growing importance of the livestock economy in the agricultural sector of the Punjab and estimate its impact on the income and employment generation in the rural area. Cost accounting method 240 farm household classified in to different standard farm size

categories are selected from Punjab. The growth in dairy income was higher on marginal and semi-medium size farm than the medium and large farm. 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 mandays in 2000-2003. The decrease in labour demand for crops on medium and large farms was so large that even the increase in employment due to growth of dairy enterprise failed to offset it.

Murugan and Namasivayam (2005) analyzed and compare the cost and return from agriculture under different size of land holding *viz*. marginal, small, medium and large farmers in the irrigated, unirrigated and pooled farm in Cuddalore and Thanjavar district of Tamilnadu. Cost A includes the cost on human labour, bullock, fertilizer, pesticides, irrigation, mechanical power and seeds. Cost C include cost A, interest on working capital, rent on land and land revenue of less taxes and depreciation on farm machinery. Total operating cost accounts for 51.93 per cent, cost on working capital was 5.19 per cent. Total cost of production was ₹ 20384.22 and gross return was ₹ 31709. Total cost production was ₹ 20384.22 and gross return was ₹ 31709. net return over cost C was ₹ 11324.98. Input output ratio over operational cost was 4.43 and cost benefit ratio for large farm was 1.55 which is less than medium farm.

Ganesh Kumar and Rai (2006) studied economic status of poultry farming enterprise in Andaman and Nicobar Island. Study revealed that, at overall level out of total investment 45.18 per cent investment on land while 51.06 per cent was on building. Among the variable cost involved for maintenance of broiler poultry farm. The total variable cost constituted 95.85 per cent (₹ 90682). The net return per bird was ₹ 14.13 at overall level and benefit cost ratio was ranging from 1.13 to 1.24 among different size groups.

Rajkumar (2007) studied the economics of red gram-based cropping systems in Bihar district. The study has revealed that the ratio of MVP to MFC was greater than one for human labour, seed, nitrogen, potash and plant protection chemicals under different Cropping Systems, indicating further scope for using additional units of these inputs to increase gross income. With respect to employment generation, CS-II generated higher employment (55.87man days/ha) and CS-III (55.11man days/ha). Majority of farmers faced the problems of exogenous factors, high wages, scarcity own land, price fluctuation and lack of market information, which lead to uncertainty of income to the farmers.

Singh (2008) studied economics of sugarcane-based farming system in Western Uttar Pradesh. Sugarcane-livestock-cereals-fodder has been found the major system followed by a majority of farmers. It has been found that sugarcane farmer keeps in general two dairy animals, largely for household milk consumption. The major income source of farmers in the area has been found sugarcane (58 %), followed by livestock and cereal crops. The study has observed that a family worker earns ₹ 41,270 per year in the study area, which is much lower than that

Punjab (₹ 74,270/ year). The study has suggested that a combination of technology, policy and institutional innovations is needed for improvement in productivity and profitability of crops and livestock in the area.

Pokharkar *et al.* (2008) studied on farm business analysis of farms in Western Maharashtra, using family employment function, income function and expenditure function on irrigated and unirrigated farms separately. Results revealed in employment function that gross cropped area is highly significant at 1 per cent level for irrigated area and at 5 per cent level in unirrigated area. The livestock unit has positive and significant impact on total employment in case of irrigated and unirrigated area. Income function results revealed that total employment days had positive and highly significant relationship with family income. Expenditure function results revealed that crop production income showed positive and highly significant at 1 per cent level in the irrigated and unirrigated area.

Hadole and Tawade (2009) studied the economics of farming system in Ratnagiri district of Konkan region and observed that, there is wide variation in per hectare net and gross return in different crops irrigated crop found more profitable than rainfed crops. Perennial and seasonal horticulture crops were more profitable than cereals, pulses and oil seeds in both farming systems Production from crops were main source of income some farmers were found to combining dairy and poultry enterprises with crop production, Income and employment had increases by adding these enterprises with crop production. Among the different farming systems identified in rice based and horticulture-based farming systems area, crop + dairy + poultry was most beneficial having total returns of ₹ 10441.58 and ₹ 27354.59 respectively, followed by crops + dairy (₹ 9379.20 and ₹ 26423.96 each) crops + dairy (₹ 9379.20 and only crops (₹ 5814.53 and ₹ 23359.55).

Korikanthimath (2009) found that, integration of different agriculturally related enterprises with crop activity as base will provide ways to recycle produces and waste materials of one component as input through another linked component and reduce the cost of production which will finally enhance the total income of the farm. On rice-based IFS revealed that rice + brinjal + mushroom + poultry as best one in terms of rice equivalent yield (21.49 tonnes/ha), employment generation (392 man-days), energy efficiency and net return under irrigated agro-ecosystem of Eastern Uttar Pradesh.

Torane (2011) studied the farming systems diversification in North Konkan region of Maharashtra- An economic analysis. The location-specific existing farming systems have been studied for their profitability and extent of diversification in the North Konkan region of Maharashtra. The study area has been delineated into different clusters using hierarchical agglomerative method. The farming in North Konkan region has been found highly varied in nature. The farm economy has also depicted a while variation as per-farm income has been

found to range of ₹ 1135 to ₹ 2,18,015 across different farming systems. The most 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). The diversification has shown a positive co-relation with profitability which underlines the importance of combination of enterprises.

Sachin Kumar *et al.* (2012) studied the economics of farming systems in northern transitional zone of Karnataka and observed that, in peri-urban area of Dharwad, the net returns were highest in the system involving crops, dairy and plantation (₹ 57285.23). Whereas, in the case of Belgaum peri-urban area the net returns were highest in system involving crops, vegetables, dairy and poultry (₹11142.62). In rural area the farming systems consisting of crops, dairy, goat performed much better (₹ 31668.41). The dairy was found profitable in all the farming system in Dharwad area.

The above reviews clearly indicate that crop alone farming system was not profitable. The farmer may adopt farming system like crop with livestock, crop with poultry, crop with livestock and horticulture, crop with sericulture etc. to increase their income and profitability.

2.4. Constraints of Farming System

Wagh *et al.* (2002) studied the constraints in adoption of dairy technology on Sirpur taluka of Dhule district of Maharashtra. The study has revealed that the important economic constraint was non-availability loan (100 %), lack of capital (81 %). Among the constraints related to input supply, non-supply of improved breeds and feeds (100 per cent), lack of improved fodder and non-availability of veterinary aid centre (67.00 per cent).

Khot et al. (2002) studied the constraints faced by goat farmers in Satara district. The data were collected from 150 goat keepers by direct interview method. Considerable number of goat keepers reported that important constraints with respect to lack of grazing land, lack of veterinary aid facilities, non-availability and high cost of feed mixture, cheating middleman and low market price as expected.

Wadear (2003) pointed out the problems faced by the sample farmers in production of different crops in selected zones of northern Karnataka. He observed problems like non-availability of seeds in time, lack of storage facility, pest and disease incidence, price fluctuation were severe in many of the crop cultivation. In milk production problem on non-availability of credit, non- availability of pasture land, artificial insemination facility, improved breeds, lack of knowledge of scientific feeding; efficient market facility and cost of feed materials were severely confronted.

Ramesh and Konureddy (2003) studied the agricultural research prioritization for agro-climatic zones 1, 2 & 3 of northern Karnataka. He observed that among the socio-economic constraints, fluctuations in prices of output, non-availability of chemicals, non-availability of labour during peak season and unawareness of improved technology were most severe constraints faced by the farmers in the study area.

Nagaraju and Sankhala (2003) surveyed in West Godavari district of Andhra Pradesh to study constraints in adoption of improved dairy farming practices. There were serious constraints in adoption of improved dairy farming practices such as non-existence of milk co-operatives in the village, lack of sufficient knowledge in different areas of improved dairy farm practices, exploitation by middleman, distant location of artificial insemination centre or veterinary hospital and lack of good transportation facilities.

Rajeshwari (2004) in her attempt to study the problem and prospects of coconut-based farming systems in Tumkur district of Karnataka opined that major problems faced by the were might infestation in coconut garden (100%) lack of transportation and marketing facility, fragmentation and division of land, scarcity of funds. The other problems were less reliable market in the context of global scenario, low yield due to local seeds, non-availability of support prices etc.

Singh *et al.* (2009) studied the economics of farming systems in Uttar Pradesh. The study has indicated that cross breed breeding programme has not become popular due to low demand for milk of cross-breed cows. Credit has significant impact on farm income and credit requirement of about 86 per cent farmer is met by the institutional sources. Fragmentation and subdivision of landholdings, scarcity of labour, low yield of crops, less reliable markets, scarcity of owned-fund, depleting natural resources, non-availability of good quality of seeds and sheds for poultry, *etc*. have been identified as the major constraints to promote integrated farming system in this area.

Amarnath (2009) identified the diversification of agriculture for sustainability and its impact on farm income through the linear programming technique. The constraints specified in the model include minimum land for paddy and fodder crops. The optimal plan has suggested raising paddy I, fodder I, sorghum II, and maize II along with 50 per cent increased application of inputs from the prevent level. Also, raising of paddy I, fodder sorghum I and maize I along with dairy activity has been suggested. Thus, the farmers could adopt combination of crops along with increased application of inputs and carrying dairy activity for higher income and sustainability.

Biswas (2010) conducted a study on farming system approach to improve IUE, employment and income in eastern India reported that farm size is too small to employ family labour force year around if they grow mono crop. Therefore, they resort to integration of various types of farming systems namely cropping, livestock, fishery, goat keeping, horticulture (fruit, vegetables, flower, apiculture, plantation) *etc.* This results in higher use efficiency of inputs(IUE) including fertilizers, reduction of risk, and generation of employment opportunities in culminating higher farm income.

From the above review, it is conclude that the major constraints reported by the farmers were high cost of inputs (chemical fertilizers, seed *etc.*), high wage rates, unawareness of improved technology and unavailability of loan in time.

3. METHODOLOGY

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

3.1 Data Requirement

To study the 'Economics of farming systems in Solapur district of Maharashtra' the data on various aspects were required. The major aspects of data requirements were as under

i. General information of the sample farmer.

ii. Information regarding land use pattern and cropping pattern of sample farm.

iii. Detail information on annual employment, income and expenditure patternof sample farm.

v. Information of constraints faced by farmers.

3.2 Sources of Data

The primary sources of data were the selected sample farmers. The data for various aspects were obtained from the sample farmers in Solapur district.

3.3 Sampling Design

Since the study was aimed of Economics of farming systems in Solapur district of Maharashtra, the sample for the study necessarily involves multistage sampling design was adopted for selection of district, tahsils and villages.

3.3.1. Selection of the study area

The present study was undertaken in Solapur district. The Solapur district was selected purposively as Solapur district is one of the major district having different farming systems.

3.3.2 Selection of tahsils

There are total eleven tahsils in Solapur district. For the study two tahsils *viz;* Karmala and Madha were selected purposively.

3.3.3 Selection of villages:

Based on availability of samples, from each tahsil three villages were selected, randomly. In all, six villages were selected from two tahsil *viz;* Karmala and Madha.

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 + Livestock

3) Crop + Livestock + Horticulture

3.3.5 Selection of sample farmers

15 farmers from each village consisting of 5crop, 5crop+livestock and 5crop+ livestock+ horticulture farming system were selected. Thus, 90 farmers from 6 villages comprising of 30crop, 30crop+livestock and 30crop+livestock+ horticulture farming systems were selected for study.

Table 3.1 Selection of sample farmers

Sr. No.	Tahsil	Village	Crop	C + L	C + L + H	Total
1	Karmala	Shetphal	5	5	5	15
		Dahigaon	5	5	5	15
		Shelgaon	5	5	5	15
2	Madha	Shiral	5	5	5	15
		Surali	5	5	5	15
		Akole	5	5	5	15
		Total	**30**	**30**	**30**	**90**

3.4 Collection of Data

For the present study, the primary data was collected by survey method from the selected farmers with the help of specially designed questionnaire for the year 2017-18. The data was collected on different aspects such as the family size, land utilization, cropping pattern, capital assets, livestock position, cost and returns from crop, crop + livestock and crop + livestock + horticulture.

3.5 Analysis of Data

The data collected from cultivators was tabulated and analysed by using appropriate statistical tools. In order to accomplish the objectives of the study, the socio-economic indicators *viz*; family size and its composition, land use pattern, cropping pattern, assets, income, employment, expenditure *etc* was analysed on per farm basis as a farm business. Different Farming systems were compared on the basis of income received, expenditure obtained and employment pattern on per farm basis.

3.5.2 Functional analysis

Employment, income, and expenditure function were used for different farming system separately. The independent variables were different as per the farming system.

a) Employment function

Multiple linear production function was used 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 (₹)

a = Constant

X_1 = GCA (ha)

X_2 = GIA (ha)

X_3 = No. of Earners

X_4= No. of livestock

X_5= Area under Horticulture crops (ha)

bi's= Regression coefficient

Ut= Error term

b) Expenditure function

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 = No. of livestock

X_4 = No. of Earners

X_5= Area under Horticulture crops (ha)

bi's = Regression Coefficient

Ut = Error term

c) Income function

Multiple linear production function was used 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 = No. of Earners

X_4 = No. of livestock

X_5 = Area under Horticulture crops (ha)

bi's = Regression Coefficient

Ut = Error term

3.5.3 Specification of variables

A brief description of the inputs used as explanatory variables for the individual farming system in the present study has been explained in succeeding paragraphs.

i) Gross cropped area

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 indicates total irrigated area in a particular year out of total cropped area in a particular farm family. It was considered in hectare.

iii) Number of earners

This is one of the important variable which indicates the number of earner persons in the family out of family size. This variable was measured in numbers.

iv) Livestock number

It is number of livestock available in the particular farming family. This variable was also measured in numbers.

v) Area under horticultural crop

Area under fruits, vegetables etc. in operational holding of particular farm family is considered here. It was also considered in hectare.

v) Family size

Total members of family including children, young and aged or earners and non-earners were considered in this variable and unit for this variable is numbers.

vi) Output (Y)

The output has been used as a dependent variable for individual farming system. Here output in three different multiple linear regression function are gross family employment, gross family income and gross family expenditure.

3.5.4 Analysis of problems faced by farmers

To find the most significant factor which influences the respondents, Garrett's ranking technique was used. As per this method, respondent have been asked to assign the rank for all factors and the outcome of such ranking have been converted into score value with the help of following formula:

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 help of designed questionnaire were analyzed as per objectives by using different tools and techniques described in the methodology chapter. The results that emerged from analysis for achieving the set of objectives of the study are presented in this chapter under following subheads.

4.1. Socio-economic characteristics of farmers.

4.2. Resource pattern of different farming systems.

4.3. Profitability of different farming systems.

4.4. Constraints in existing farming systems.

4.1 Socio-economic Characteristics of Farmers

General information of the selected sample farmers for the present study helps to understand the background and socio-economic conditions of sample farmers under the following sub heads.

4.1.1 Family size and its composition

The information about the size and composition of a family gives an idea about the available labour force and also indirectly indicates the consumption needs of the family. The details about the size and composition of the selected farm families are presented in Table 4.1.

It can be seen from the Table that, at the overall level the average size of the family was 5.26 persons consisting of 31.17 per cent males, 29.27 per cent females and 39.35 per cent children. The average family size of the Crops only farming system was found to be 5.20 persons, consisting of 32.11 per cent males, 30.76 per cent females and 37.11 per cent children. The average family size of the C + L farming system was found to be 5.20 persons, consisting of 32.11 per cent males, 29.42 per cent females and 38.46 per cent children. The average number of persons in C + L + H farming system was highest with 5.37 persons, consisting of 29.79 per cent males, 29.23 per cent females and 40.96 per cent children.

Table 4.1 Family size and its composition

(No. / Farm)

Sr.No.	Particulars	Farming systems			
		C	C + L	C + L + H	Overall
1.	Male	1.67 (32.11)	1.67 (32.11)	1.60 (29.79)	1.64 (31.17)
2.	Female	1.60 (30.76)	1.53 (29.42)	1.57 (29.23)	1.54 (29.27)
3.	Children	1.93 (37.11)	2.00 (38.46)	2.20 (40.96)	2.07 (39.35)
4.	Earners	2.73 (52.5)	2.86 (55)	2.80 (52.14)	2.87 (54.56)
5.	Total	5.20 (100.00)	5.20 (100.00)	5.37 (100.00)	5.26 (100.00)

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

The average family size was maximum in C + L + H farming system and same size in Crops only farming system and C + L farming system.

4.1.2 Educational status of farmers

Education is another important factor influencing managerial ability and technical knowledge of the farmers. The information about the educational status of selected sample farmers is presented in Table 4.2. It was noticed that in Crop only farming system, 14.04 per cent family members were having education upto primary level, 40.38 per cent family members were having education upto secondary education, 31.92 per cent family members were having education upto college level, 3.85 per cent family members were having education upto post-graduation and 9.62 per cent family members were illiterate.

In C + L farming system, 10.96 per cent family members were having education upto primary level, 37.88 per cent family members were having education upto secondary education, 33.85 per cent family members were having education upto college level, 1.35 per cent family members were having education upto post-graduation and 15.96 per cent family members were illiterate.

Table 4.2 Educational status of farmers

(No. / Farm)

Sr. No.	Particulars	Farming systems			
		C	C + L	C + L + H	Overall
1.	Upto primary	0.73 (14.04)	0.57 (10.96)	0.67 (12.48)	0.60 (11.41)
2.	Secondary	2.10 (40.38)	1.97 (37.88)	2.33 (43.39)	2.09 (39.73)
3.	College	1.66 (31.92)	1.76 (33.85)	1.80 (33.52)	1.80 (34.22)
4.	P.G.	0.20 (3.85)	0.07 (1.35)	0.17 (3.17)	0.10 (1.90)
5.	Illiterate	0.50 (9.62)	0.83 (15.96)	0.33 (6.14)	0.67 (12.74)
6.	Total	5.20 (100.00)	5.20 (100.00)	5.37 (100.00)	5.26 (100.00)

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

In C + L + H farming system, 12.48 per cent family members were having education upto primary level, 43.99 per cent family members were having education upto secondary and education, 33.52 per cent family members were having education upto college level, 3.17 per cent family members were having education upto post-graduation and 6.14 per cent family members were illiterate. At the overall level, 11.41 per cent family members were having education upto primary level, 39.73 per cent family members were having education upto secondary education, 34.22 per cent family members were having education upto college level and 12.74 per cent family members were illiterate.

The percentage of illiterate family members were high (15.96 %) in C + L farming system. Whereas, the per centage of post-graduate education of family members was high in C + L + H farming system (0.17 %).

4.1.3 Land use pattern on sample farms

The land is one of the important capital assets for the farmers. The particulars regarding average holding size, cultivable land, and gross cropped area are given in the Table 4.3.

Table 4.3 Land use pattern

(ha / Farm)

Sr. No.	Particulars	Farming systems			
		C	**C + L**	**C + L + H**	**Overall**
1.	Total holding	2.42 (100.00)	2.39 (100.00)	4.09 (100.00)	2.96 (100.00)
2.	Permanent fallow	0.19 (7.85)	0.19 (7.95)	0.33 (8.06)	0.24 (8.11)
3.	Operational holding	2.21 (91.32)	2.19 (91.63)	3.75 (91.68)	2.72 (91.89)
4.	a. Irrigated	2.18 (90.08)	2.17 (90.79)	3.73 (91.20)	2.69 (90.87)
	b. Unirrigated	0.03 (1.23)	0.02 (0.83)	0.03 (0.73)	0.03 (1.01)
5.	NCA	2.14	2.19	3.75	2.72
6.	GCA	2.16	2.28	3.87	2.77
7.	Cropping intensity (%)	100.93	104.10	103.20	101.83

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

The average land holding was 2.42, 2.39 and 4.09 hectares in Crops only, C + L and C + L + H farming system of sample growers, respectively with an overall average holding of 2.96 hectares. The net sown are was 2.72 hectares at the overall level, the area under permanent fallow land was 0.24 per cent. The proportion of area under irrigation was 90.08, 90.79 and 91.20 per cent in case of Crops only, C + L and C + L + H farming systems, respectively.

At overall level, the proportion of area under irrigation was 90.87 per cent of total holding. The proportion of area under irrigation was high in case of C + L + H farming system and unirrigated was highest in crops only farming system.

Gross cropped area of overall was 2.77 ha with cropping intensity of 101.83 per cent. Among three farming systems highest cropping intensity was of C + L farming system which was 104.10 per cent followed by C + L + H farming system with 103.20 per cent and Crops only farming system with 100.93 per cent. In all the three farming systems cropping intensity was found very low, it was due to the higher area under annual and perennial crops.

4.1.4 Livestock composition on sample farms

Total numbers of livestock inventory for Crops only C + L and C + L + H farming system was shown in the Table 4.4.

It can be observed from the Table 4.4 that the average size of livestock per family was 4.15 at overall level. At the overall level, per farm availability of cow, buffalo, calf and heifer were 55.42, 16.38, 18.79, and 9.39 per cent, respectively.

In C + L farming system per farm availability of cow, buffalo, calf and heifer were, 62.58, 13.42, 15.60 and 8.38 per cent, respectively. In C + L + H per farm availability of cow, buffalo, calf and heifer were 48.99, 19.01, 21.63 and 6.47 per cent, respectively.

Table 4.4 Livestock composition on sample farm

(No. / Farm)

Sr. No.	Particulars	Farming systems			
		C	C + L	C + L + H	Overall
1.	Cow	0.00 (0.00)	3.73 (62.58)	3.17 (48.99)	2.30 (55.42)
2.	Buffalo	0.00 (0.00)	0.80 (13.42)	1.23 (19.01)	0.68 (16.38)
3.	Calf	0.00 (0.00)	0.93 (15.60)	1.40 (21.63)	0.78 (18.79)
4.	Heifer	0.00 (0.00)	0.50 (8.38)	0.67 (10.35)	0.39 (9.39)
5.	Total	0.00 (0.00)	5.96 (100.00)	6.47 (100.00)	4.15 (100.00)

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

4.1.5 Investment on irrigation structure

Total investment of irrigation structure for crops only, C + L and C + L + H farming systems were shown in the Table 4.5.

It can be observed from the Table 4.5 that the average investment on irrigation structure per family was ₹ 242602.39 at overall level. At the overall level, per farm expenses on Well, Pipeline, Bore well and Drip set were 2.84, 7.73, 2.16 and 87.27 per cent, respectively.

In Crops only farming system per farm expenses on Well, Pipeline, Bore well and Drip set were 1.51, 5.93, 3.05 and 89.73 per cent, respectively.

Table 4.5 Investment on irrigation structure

(₹ / Farm)

Sr.No.	Particulars	Farming systems			
		C	C + L	C + L + H	Overall
1.	Well	3236.30 (1.51)	7500.00 (3.53)	8843.33 (2.91)	6893.33 (2.84)
2.	Pipeline	12666.67 (5.93)	15400.00 (7.25)	24250.20 (7.97)	18772.22 (7.73)
3.	Bore well	6533.33 (3.05)	7033.33 (3.31)	8166.67 (2.68)	5244.44 (2.16)
4.	Drip set	191666.70 (89.73)	182225.50 (85.89)	262631.20 (86.42)	211742.40 (87.27)
	Total	213603.00 (100.00)	212158.83 (100.00)	303891.40 (100.00)	242602.39 (100.00)

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

In C + L farming system per farm investment on Well, Pipeline, Bore well and Drip set were 3.53, 7.25, 3.31 and 85.89 per cent, respectively.

In C + L + H farming system per farm investment on Well, Pipeline, Bore well and Drip set were 2.91, 7.97, 2.68 and 86.42 per cent, respectively.

The investment on irrigation structure was maximum in C + L + H farming system followed by crop only farming system and C + L farming system, respectively.

4.1.6 Investment on farm implements

Total Investment on farm implements for Crop only, C + L and C + L + H farming systems were shown in the Table 4.6.

It can be observed from the Table 4.6 that the average investment on farm implements per farm was ₹ 77243.04 at the overall level. At the overall level, per farm maximum investment per cent was on Tractor (88.24%) followed by Tractor accessories (9.36%) and Spray pump (1.80%).

In Crops only farming system per farm investment per cent was maximum on Tractor (75.05%) followed by Tractor accessories (22.17%) and Spray pump (2.17%).

The same trend was observed in C + L and C + L + H farming system.

Table 4.6 Investment on farm implements

(₹ / farm)

Sr. No.	Particul-ars	C		C + L		C + L +H		Overall	
		No.	₹/ farm	No.	₹/ farm	No.	₹/ farm	No.	₹/farm
1.	Plough	0.3	113.33 (0.39)	0.2	82 (0.08)	0.23	97.33 (0.09)	0.24	97.55 (0.12)
2.	Seed Drill	0.13	37.33 (0.12)	0.17	48.67 (0.04)	0.16	51.33 (0.05)	0.15	45.77 (0.05)
3.	Bullock cart	0.03	13.33 (0.04)	0.03	16.67 (0.01)	0.07	35.00 (0.03)	0.04	21.67 (0.02)
4.	Tractor	0.1	21666.66 (75.05)	0.23	95833.33 (94.82)	0.37	87000.00 (85.64)	0.23	68166.67 (88.24)
5.	Tractor Accesso-ries	0.27	6400 (22.17)	0.27	4366.67 (4.32)	0.77	10933.33 (10.76)	0.43	7233.33 (9.36)
6.	Spray pump	0.83	627 (2.17)	0.73	439.67 (0.43)	1.23	3119.00 (3.07)	0.93	1395.33 (1.80)
7.	Hand Tools	7.06	122.5 (0.42)	14.66	273.33 (0.27)	16.8	345.33 (0.33)	13.21	282.72 (0.36)
8.	Total	8.42	28866.82 (100.00)	16.29	101060.34 (100.00)	19.6	101581.32 (100.00)	15.23	77243.04 (100.00)

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

4.1.7 Cropping pattern on sample farms

In cropping pattern individual crops were grouped into *kharif*, *rabi*, annual and perennial crops with their areas were presented in Table 4.7. The results revealed that gross cropped area for overall was 2.77 hectares, in which the highest proportionate area was 68.23 per cent under sugarcane followed by perennial crop with 15.52 per cent, fodder crop with 9.47 per cent, *kharif*with5.35 per cent and *rabi with* 5.14 per cent.

It is revealed from the Table 5.7 that, Onion contributed 1.44 per cent as the highest share of area in cropping pattern of *kharif* season for overall group. Other crops in *kharif* season include Tur, Maize and Fodder crops contributing 3.91 per cent.

While in *rabi* season, *rabi* jowar contributed 1.84 per cent as the highest share of area followed by Wheat 1.44 per cent. Other crops in *rabi* season includes Groundnut, Gram and Fodder crops contributing 1.86 per cent. It inferred that in farming business farmer were giving more importance to cash crops like sugarcane and banana.

Table 4.7 Cropping pattern

Sr. No.	Particulars	Farming systems			
		C	**C + L**	**C + L +H**	**Overall**
1.	***Kharif* crops**				
	a. Fodder maize	0.00 (0.00)	0.12 (5.26)	0.11 (2.84)	0.078 (2.81)
	b. Fodder jowar	0.00 (0.00)	0.01 (0.44)	0.01 (0.26)	0.006 (0.21)
	c. Onion	0.04 (1.85)	0.00 (0.00)	0.08 (2.06)	0.040 (1.44)
	d. Tur	0.027 (1.20)	0.00 (0.00)	0.00 (0.00)	0.009 (0.32)
	e. Maize	0.0067 (0.31)	0.027 (1.18)	0.01 (0.26)	0.016 (0.57)
	Total	0.07 (3.36)	0.15 (6.88)	0.21 (5.42)	0.14 (5.35)
2.	***Rabi* crops**				
	a. *Rabi* jowar	0.07 (3.24)	0.027 (1.18)	0.06 (1.55)	0.05 (1.84)
	b. Wheat	0.03 (1.38)	0.04 (1.75)	0.05 (1.29)	0.04 (1.44)
	c. Fodder jowar	0.00 (0.00)	0.02 (0.88)	0.00 (0.00)	0.007 (0.25)
	d. Fodder maize	0.00 (0.00)	0.02 (1.00)	0.02 (0.51)	0.01 (0.50)
	e. Groundnut	0.04 (1.85)	0.00 (0.00)	0.04 (1.03)	0.02 (0.97)
	f. Gram	0.01 (0.46)	0.00 (0.00)	0.00 (0.00)	0.004 (0.14)
	Total	0.15 (6.93)	0.10 (4.81)	0.17 (4.38)	0.13 (5.14)
3.	**Annual crops**				
	a. Sugarcane	1.94 (89.81)	1.77 (77.63)	1.95 (50.38)	1.89 (68.23)
	b. Lucerne grass	0.00 (0.00)	0.20 (8.77)	0.17 (4.39)	0.12 (4.33)
	c. Napier grass	0.00 (0.00)	0.04 (1.75)	0.07 (1.80)	0.03 (1.37)
	Total	1.94 (89.81)	2.01 (88.15)	2.19 (56.14)	2.04 (73.93)
4.	**Perennial crops**				
	a. Banana	0.00 (0.00)	0.00 (0.00)	1.29 (33.33)	0.43 (15.52)
5.	**GCA**	2.16 (100.00)	2.28 (100.00)	3.87 (100.00)	2.77 (100.00)

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

Recently, the area under sugarcane and banana has increased due to availability of irrigation and good price.

4.2 Resource Use Pattern of Different Farming Systems

The resource use pattern of any production activity indicates composition of the expenditures incurred on various inputs. It is useful to locate the strength and weaknesses in the production system so as to increase the efficiency.

4.2.1. Per farm resource use pattern

The average per farm expenditure made on input utilization is given in Table 4.8.

It is seen from the Table 4.8, that the average per farm cash expenditure was ₹ 4,65,865.10 at the overall level. The major portion in the total expenditure was livestock maintenance, which shared 40.06 per cent, followed by fertilizers (20.50 %), seed (11.53 %), labour charges (8.92 %), tractor (8.79 %), manure (0.94 %) and plant protection charges (0.29 %).

While the average per farm cash expenditure in Crops only farming system was ₹ 1,42,538.99. Fertilizers constituted major portion of the total expenditure, which shared 44.40 per cent, followed by machine charges (21.58 %), seed (18.73 %), labour charges (14.48 %) and plant protection charges (0.79 %).

The average per farm cash expenditure in C + L farming system was ₹ 4,28,694.30. Livestock maintenance constituted major portion of total expenditure, which shared 56.07 per cent, followed by fertilizers (14.07 %), seed (8.44 %), tractor (7.36 %), labour charges (6.35 %), manure (1.15 %) and plant protection charges (0.24 %).

The average per farm cash expenditure in C + L + H was ₹ 6,93,671.48. The major portion of total expenditure was livestock maintenance, which shared 35.67 per cent, followed by fertilizers (23.51 %), seed (14.20 %), tractor (8.70 %), labour charges (8.22 %), manure (1.18 %) and plant protection charges (0.29 %).

Table 4.8 Resource use pattern

(₹/ farm)

Sr. No	Particulars	C		C + L		C + L + H		Overall	
		q.	₹ / farm	q.	₹ / farm	q.	₹ / farm	q.	₹ / farm
1.	Hired labour (Man-days)	39.27	8620.00 (6.04)	34.56	7553.33 (1.76)	93.79	20563.33 (2.96)	55.78	18804.44 (4.04)
2.	Family labour (Man-days)	48.24	12026.67 (8.44)	77.30	19670 (4.58)	147.72	36510.00 (5.26)	91.36	22735.55 (4.88)
3.	Total labour (Man-days)	87.51	20646.67 (14.48)	111.86	27233.33 (6.35)	241.51	57033.33 (8.22)	147.14	41539.99 (8.92)
4.	Tractor (Hrs.)	76.8	30766.66 (21.58)	67.06	31553.33 (7.36)	133.89	60385.99 (8.70)	92.58	40935.55 (8.79)
5.	Seed (Kg.)	8461.33	26703.33 (18.73)	7701.46	36177.33 (8.44)	8052.52	98537.5 (14.20)	8161.30	53696.05 (11.53)
6.	Manure (Qt.)	0.00	0.00 (0.00)	19.60	4916.66 (1.15)	32.30	8166.66 (1.18)	17.3	4361.11 (0.94)
7.	Fertilizers (Kg.) N P K	871.35 581.43 589.50	63289 (44.40)	878.56 545.53 601.03	60328.33 (14.07)	1712.56 1531.03 1538.16	163055.00 (23.51)	1220.84 888.22 909.56	95557.74 (20.50)
8.	Plant protection		1133.33 (0.79)		1022.00 (0.24)		1963.00 (0.28))		1338.72 (0.29)
9.	Livestock maintenance		0.00 (0.00)		240250.00 (56.04)		247456.67 (35.67)		186623.00 (40.06)
10.	Total		142538.99 (100.00)		428694.31 (100.00)		693671.48 (100.00)		465865.15 (100.00)

(Rs. / farm)

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

4.2.2 Per hectare resource use pattern

The average per farm expenditure made on input utilization is given in Table 4.8.

It is seen from the Table 4.8, that the average per farm cash expenditure was ₹ 4,65,865.10 at the overall level. The major portion in the total expenditure was livestock maintenance, which shared 40.06 per cent, followed by fertilizers (20.50 %), seed (11.53 %), labour charges (8.92 %), tractor (8.79 %), manure (0.94 %) and plant protection charges (0.29 %).

While the average per farm cash expenditure in Crops only farming system was ₹ 1,42,538.99. Fertilizers constituted major portion of the total expenditure, which shared 44.40 per cent, followed by machine charges (21.58 %), seed (18.73 %), labour charges (14.48 %) and plant protection charges (0.79 %).

The average per farm cash expenditure in C + L farming system was ₹ 4,28,694.30. Livestock maintenance constituted major portion of total expenditure, which shared 56.07 per cent, followed by fertilizers (14.07 %), seed (8.44 %), tractor (7.36 %), labour charges (6.35 %), manure (1.15 %) and plant protection charges (0.24 %).

The average per farm cash expenditure in C + L + H was ₹ 6,93,671.48. The major portion of total expenditure was livestock maintenance, which shared 35.67 per cent, followed by fertilizers (23.51 %), seed (14.20 %), tractor (8.70 %), labour charges (8.22 %), manure (1.18 %) and plant protection charges (0.29 %).

Table 4.9 Resource use pattern

(₹/ ha)

Sr. No	Particulars	C		C + L		C + L + H		Overall	
		q.	₹ / ha	q.	₹ / ha	q.	₹ / ha	q.	₹ / ha
1.	Hired labour (Man-days)	18.20	3996.90 (6.01)	15.02	3284.05 (1.88)	24.18	5318.10 (3.23)	20.10	4413.69 (3.11)
2.	Family labour (Man-days)	22.36	5576.50 (8.39)	33.68	8552.17 (4.72)	38.37	9442.24 5.74)	32.93	8194.63 (5.78)
3.	Total labour (Man-days)	40.56	9573.40 (14.40)	48.70	11836.22 (6.77)	62.55	14760.34 (8.97)	53.03	12608.32 (8.89)
4.	Tractor (Hrs.)	35.61	14265.84 (21.47)	26.26	13718.84 (7.85)	34.62	15556.89 (9.45)	33.37	14754.50 (10.40)
5.	Seed (Kg.)	3923.43	12381.76 (18.63)	3348.43	15703.18 (8.99)	2082.52	25414.00 (15.45)	2909.34	19353.80 (13.65)
6.	Manure (Qt.)	0.00	0.00 (0.00)	0.91	2279.75 (1.30)	0.83	2112.06 (1.28)	0.62	1571.08 (1.10)
7.	Fertilizers (Kg.) N	404.02	29345.74 (44.16)	381.98	26229.71 (15.01)	442.91	42169.39 (25.63)	416.00	34442.01 (24.28)
	P	269.59		237.18		395.95		319.34	
	K	273.33		261.31		397.80		327.83	
8.	Plant protection		516.22 (0.78)		444.34 (0.25)		486.42 (0.29)		482.51 (0.34)
9.	Livestock maintenance		0.00 (0.00)		104456.52 (59.80)		63997.41 (38.90)		58595.11 (41.32)
10.	Total		66442.96 (100.00)		174667.20 (100.00)		164496.51 (100.00)		141807.33 (100.00)

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

4.3 Employment Pattern on Farming Systems

The per family annual employment of male and female is depicted in Table 4.10. The per farm employment at overall level was 309.69 man-days out of which male contributed 153.92 man-days and female contributed 155.77 man-days during a year. At the overall level the livestock maintenance was major (40.03 %) source of employment and followed by crop production (36.20 %) and off farm (12.38 %).

Out of three farming systems, C + L + H farming system have more working man-days (469.45 man-days / farm) as compare to C + L farming system (333.40 man-days / farm) and Crops only farming system (123.57 man-days / farm). Proportion of employment by crop production is maximum in Crops only farming system (64.93%).

From the foregoing discussion, it is concluded that the livestock maintenance activity was the major source of employment in C + L and C + L + H farming system in all the three farming systems. However, off farm wages was another source of employment in the three farming systems.

Table 4.10 Employment patterns of farmers

(Man-days / farm)

Sr. No.	Particulars	C			C + L			C + L + H			Overall		
		M	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**
1.	Crop	31.67	48.57	80.24 (64.93)	47.50	64.52	112.02 (33.60)	57.62	84.33	141.65 (30.17)	43.49	68.63	112.12 (36.20)
2.	Livestock	0.00	0.00	0.00 (0.00)	103.83	75.33	179.16 (53.73)	98.16	75.83	173.99 (37.06)	67.33	50.38	125.71 (40.03)
3.	Horti. Crop	0.00	0.00	0.00 (0.00)	0.00	0.00	0.00 (0.00)	36.16	72.19	108.35 (23.08)	11.04	24.26	35.30 (11.39)
4.	Off farm	26.14	17.19	43.33 (35.06)	27.00	15.22	42.22 (12.66)	40.06	5.10	45.16 (9.62)	32.06	12.50	44.56 (12.38))
5.	Total	57.81	65.76	123.57 (100.00)	178.33	155.07	333.40 (100.00)	232.00	237.45	469.45 (100.00)	153.92	155.77	309.69 (100.00)

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

4.3.1 Employment function

Table 4.11 Estimated employment function of different farming systems

Sr. No.	Particulars	Parameters	Farming systems		
			C	C + L	C + L + H
1.	Sample size (N)		30	30	30
2.	Intercept (a)		10.28 (12.23)	45.01 (17.72)	31.94 (26.91)
3.	Gross Cropped Area (ha)	X_1	(41.09)*** (8.21)	18.22 (13.37)	77.56*** (14.42)
4.	Gross Irrigated Area (ha)	X_2	10.10 (9.63)	50.87*** (16.97)	60.60*** (1.67)
5.	Earners (No.)	X_3	4.03 (3.67)	1.70 (3.02)	6.91* (4.00)
6.	Livestock (No.)	X_4	- 	2.87 (1.57)	2.40 (1.74)
7.	Area under horticultural crop (ha)	X_5	-	-	5.58** (12.86)
8.	R^2		0.79	0.58	0.75
9.	DF		29	29	29

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

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

In order to establish the functional relationship between total family employment and the factors like gross cropped area, gross irrigated area, number of earners in the family, number of livestock and area under horticultural crop, the multiple linear regression linear model was estimated and the result are presented in Table 4.11

1. Crops only farming system

It can be revealed from the Table 4.11 that the three independent variables have jointly explained the 79 per cent of total variation in Crops only farming system. Coefficient of gross cropped area (X1) is found to be highly significant at 1 per cent level in Crops only farming system indicating that, if gross cropped area is increased by 1 ha the total employment will increase by 41.09 days. Number of earners in family and gross irrigated area has found positive impact but non-significant.

2. C + L

Table reveals that the four independent variables have jointly explained the 58 per cent of total variation in medium C + L farming system. Coefficient of gross irrigated area (X2) is found to be highly significant at 1 per cent level in C + L farming system indicating that, if gross irrigated area is increased by 1 ha the total employment will increase by 50.87 days. Gross cropped area, number of earners and number of livestock has positive but non-significant impact on gross family employment.

3. C + L + H

It is revealed from the Table that the five independent variables have jointly explained the 75 per cent of total variation in C + L + H farming system. Coefficient of gross cropped area (X1) is found to be highly significant at 1 per cent level in C + L + H farming system indicating that, if gross cropped area is increased by 1 ha the total employment will increase by 77.56 days. Coefficient of gross irrigated area (X2) is found to be highly significant at 1 per cent level in C + L + H farming system indicating that, if gross irrigated area increased by 1 ha the total employment will increase by 60.60 days. Whereas the number of earners in family and area under horticultural crop were found to be significant at 10 per cent and 5 per cent level respectively and number of livestock has positive but non-significant relation with gross family employment of C + L + H farming system.

4.4 Income Pattern of Different Farming Systems

The average per farm annual gross income of different farming systems from various sources is given in Table 4.12

At overall level, the average gross per farm income was ₹ 14,62,275.61per annum. The maximum share of 56.46 per cent income was gained from crop production followed by horticultural crop, income from livestock, service and off farm.

The average per farm annual gross income for Crops only farming system worked out to₹ 7,62,346.67 while for C + L farming system and C + L + H farming system, it was ₹13,42,315.00 and ₹22,82,165.17. The largest share in total income of all three categories of farming system *i.e.* Crops only, C + L and C + L + H was income from crop production. Another major source of total income was income from livestock and it was tune of 28.84, and 16.64 per cent, respectively in C + L and C + L + H farming system, respectively. From the above discussion it is noted that the crop production was the major source of income to the farmers in all the three farming systems and was followed by income from livestock and horticultural crop in C + L and C + L + H farming system, respectively.

Table 4.12 Income pattern of different farming systems

(₹ / Farm)

Sr. No.	Particulars	Farming systems			
		C	C + L	C + L + H	Overall
1.	Crop	684180.00 (89.73)	838963.33 (62.50)	953973.33 (41.80)	825705.56 (56.46)
2.	Livestock	0.00 (0.00)	387185.00 (28.84)	379891.83 (16.64)	255692.28 (17.48)
3.	Horticultural crop	0.00 (0.00)	0.00 (0.00)	871900.00 (38.20)	290633.33 (19.87)
4.	Service	34000.00 (4.45)	70000.00 (5.21)	50400.00 (2.20)	51466.67 (3.51)
5.	Off farm	44166.67 (5.79)	46166.67 (3.43)	26000.00 (1.13)	38777.78 (2.65)
6.	Total	762346.67 (100.00)	1342315.00 (100.00)	2282165.17 (100.00)	1462275.61 (100.00)

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

4.4.1 Family income function

In order to establish the functional relationship between total family income and the factors like gross cropped area, gross irrigated area, number of earners, number of livestock, area under horticultural crop the multiple linear regression model was estimated and the result are presented in Table 4.13

1. Crops only farming system

It can be revealed from the Table 4.13 that the three independent variables have jointly explained the 76 per cent of total variation in crops only farming system. Coefficient of gross irrigated area (X2) was found to be significant at 10 per cent significant level in crops only farming system indicating that, if gross irrigated area is increased by 1 ha the total income will increase by ₹ 16,266.93. Gross cropped area and number of earners has positive but non-significant relation with gross family income.

2. C + L

It is revealed from the Table 4.13 that the four independent variables have jointly explained the 68 per cent of total variation in C + L farming system. Coefficient of gross irrigated area (X2) and number of livestock (X4) is found to be significant at 10 per cent level in C + L farming system indicating that, if gross irrigated area is increased by 1 ha the total income will increase by ₹ 101207.40 and if the number of livestock increased by one the total income will increase by ₹ 141992.10. Whereas, gross cropped area and number of earners has positive but non-significant impact on dependent variable.

3. C + L + H

It is revealed from the Table 4.13 that the five independent variables have jointly explained the 56 per cent of total variation in C + L + H farming system. Coefficient of gross

irrigated area is found to be highly significant at 1 per cent level in C + L + H farming system indicating that, if gross irrigated area increased by 1 ha the total income will increase by ₹ 5,39,365.30. Number of livestock and area under horticultural crop is found to be significant at 10 per cent level in C + L + H farming system indicating that, increase in 1 number of livestock will lead to ₹ 40,574.02 increase in gross income of family and increase in 1 ha area under horticultural crop will lead to ₹ 314872.20 increase in gross income of family. Other variables like gross cropped area and number of earners shown positive but non-significant impact on gross family income.

Table 4.13 Estimated income function of different farming systems

Sr. No.	Particulars	Parame-ters	Farming systems		
			C	**C + L**	**C + L + H**
1.	Sample size (N)		30	30	30
2.	Intercept (a)		573983.90 (893878.10)	712889 (1622658.00)	389997.70 (395242.40)
3.	Gross Cropped Area (ha)	X_1	341651.50 (580327.90)	803599.80 (1224864.00)	262100.70 (211867.90)
4.	Gross Irrigated Area (ha)	X_2	16266.93* (8211.91)	101207.40* (54718.68)	539365.30*** (194891.50)
5.	Earners (No.)	X_3	104906.90 (192877.10)	78131.74 (276817.20)	39939.52 (58835.64)
6.	Livestock (No.)	X_4	-	141992.10* (83880.36)	40574.02* (25622.05)
7.	Area under horticultural crop (ha)	X_5	-	-	314872.20* (158929.60)
8.	R^2		0.76	0.68	0.56
9.	DF		29	29	29

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

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

4.5 Expenditure Pattern of Different Farming Systems

The details of average per farm annual expenditure incurred by different farming systems on items of expenditure is indicated in Table 4.14

At overall level, the average total annual family expenditure was ₹ 5,01,791.35 per farm and the major share of expenditure is estimated on livestock maintenance (37.22%) followed by crop production (31.74%) and horticultural crop production (15.51),grocery (7.65 %), education (3.68%), cloths (1.28%) , medical (1.16%), food (1.14%) and other (0.58%).

The average annual family expenditure by Crops only farming system is found to be ₹ 2,16,479 While, it was ₹ 5,12,931.00 and ₹ 7,75,964.06 for C + L and C + L + H farming system, respectively. The largest share in total expenditure of crops only farming system was expenditure on crop production and the largest share in total expenditure of C + L and C + L + H farming system was expenditure on livestock maintenance. Another major source of expenditure was on grocery, education and cloths and it was tune of 15.95, 10.22 and 2.75 per cent, respectively in Crops only farming system. In C + L farming system major source of total expenditure was expenditure on crop production, grocery, education, cloths and it was tune of 31.31, 3.26 and 1.17 per cent, respectively. In C + L + H farming system major source of total expenditure was on crop production, horticultural crop production, grocery, education and it was tune of 22.58, 30.09, 5.51, and 2.13 per cent, respectively.

Table 4.14 Expenditure pattern of different farming systems

(₹ / Farm)

Sr. No.	Particulars	Farming systems			
		C	C + L	C + L + H	Overall
1.	Crop Production	141922.33 (65.55)	160612.33 (31.31)	175287.33 (22.58)	159274.00 (31.74)
2.	Livestock Maintenance	0.00 (0.00)	277216.66 (54.04)	283156.66 (36.49)	186791.11 (37.22)
3.	Horti. Crop Production	0.00 (0.00)	0.00 (0.00)	233522.40 (30.09)	77840.80 (15.51)
4.	Food	4810.00 (2.22)	5950.00 (1.16)	6463.00 (0.83)	5741.11 (1.14)
5.	Grocery	34550.00 (15.95)	37900.00 (7.38)	42766.66 (5.51	38405.55 (7.65)
6.	Cloths	5966.66 (2.75)	6026.66 (1.17)	7406.66 (0.95)	6466.66 (1.28)
7.	Medical	4823.33 (2.22)	5890.00 (1.14)	6866.66 (0.88)	5860.00 (1.16)
8.	Education	22133.33 (10.22)	16766.66 (3.26)	16566.66 (2.13)	18488.88 (3.68)
9.	Others (Festival etc.)	2273.33 (1.05)	2568.66 (0.50)	3927.66 (0.50)	2923.22 (0.58)
	Total	216479.00 (100.00)	512931.00 (100.00)	775964.06 (100.00)	501791.35 (100.00)

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

4.5.1 Expenditure function

In order to establish the functional relationship between total family expenditure and the factors like gross cropped area, gross irrigated area, family size, number of livestock and area under horticultural crop the multiple linear regression linear model was estimated and the result are presented in Table 4.15

1. Crops only farming system

It can be revealed from the Table 4.15 that the three independent variables have jointly explained the 67 per cent of total variation in Crops only farming system. Coefficient of gross cropped area (X1) is found to be highly significant at 5 per cent level indicating that, if gross cropped area increased by 1 ha the total expenditure will increase by ₹ 6,57,375.50. The variables like gross irrigated area and family size shown positive but non-significant impact on dependent variable *i.e.* gross family expenditure.

Table 4.15 Estimated expenditure function of different farming systems

Sr. No	Particulars	Parameters	Farming systems		
			C	**C + L**	**C + L + H**
1.	Sample size (N)		30	30	30
2.	Intercept (a)		365878.30 (472114.20)	35822.70 (65688.37)	6566.88 (96274.95)
3.	Gross Cropped Area (ha)	X_1	657375.50** (301943.60)	23123.33 (40988.58)	9351.20 (47789.86)
4.	Gross Irrigated Area (ha)	X_2	558260.90 (363829.00)	113741.60** (52595.31)	62696.86 (58102.14)
5.	Family size (No.)	X_3	34509.67 (73363.60)	16387.35* (9741.81)	17331.86* (8546.65)
6.	Livestock (No.)	X_4	-	33073.69*** (4887.34)	51032.64*** (5708.91)
7.	Area under horticultural crop (ha)	X_5	-	-	120194.70** (43980.84)
8.	R^2		0.67	0.78	0.82
9.	DF		29	29	29

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

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

2. C + L

It can be observed from the Table 4.15 that the four independent variables have jointly explained the 78 per cent of total variation in C + L farming system. In this group coefficients of number of livestock (X4) found to be highly significant at 1 per cent level indicating that if number of livestock increase by 1 will lead to increase in ₹ 33073.69 in family expenditure. Coefficient of gross irrigated area (X2) and number of family size (X3) found to be significant at 5 and 10 per cent level, respectively. Gross cropped area has shown positive relation with gross family expenditure.

3. C + L + H

It is revealed from the Table 4.15 that the five independent variables have jointly explained the 82 per cent of total variation in C + L + H farming system. In this group, coefficient of number of livestock (X4) found to be highly significant at 1 per cent level indicating that 1 number increase in livestock will lead to increase in ₹ 51032.64 in family expenditure. Family size and area under horticultural crop are also observed significant at 10 per cent level and 5 per cent level respectively. Gross cropped area and gross irrigated area has shown positive but non-significant impact on gross expenditure.

4.6 Profitability of different Farming Systems

Profitability of farming systems is important to examine the best farming system in the study area. The information on profitability of different farming system is presented in Table 4.16.

Table 4.16 Profitability of farms

Sr. No.	Particulars	Unit	Farming systems			
			C	C + L	C + L + H	Overall
1.	Income (₹)	Per / ha	357909.23	610143.20	624623.30	544721.88
		Per / farm	762346.67	1342315.00	2282156.17	1462275.61
2.	Expenditure (₹)	Per / ha	101633.30	233150.50	212379.50	186925.60
		Per / farm	216479.00	512931.00	775964.06	501791.35
3.	Income (₹)	Per / ha	256275.93	376992.70	412243.80	357796.28
		Per / farm	545867.67	829384.00	1506192.17	960484.26

It can be seen from the Table 4.16 that, In C + L + H farming system per hectare as well per farm profit was high as compared to Crops only and C + L farming system. Similarly, the per hectare and per farm profit in C + L farming system was higher than Crops only farming system. The per hectare and per farm income of C + L + H farming system over C + L and C + L over Crops only farming system was more.

To sum up, it can be noted that as farmer shifts from Crop only to C + L and C + L to C + L + H farming system, the income, expenditure and profit goes on increases. It indicates that the C + L + H farming system was economically most viable in Solapur district as compared to other farming systems.

Table 4.17 Analysis of farm income

(₹)

Sr. No.	**Particulars**	**Farming systems**			
		C	**C + L**	**C + L + H**	**Overall**
1.	Total income	22870400.00	40269450.00	68464955.00	131604805.00
a.	Per family income	762346.67	1342315.00	2282156.17	1462275.61
b.	Added per family income over farming systems	-	579968.33	939841.17	

The above Table 4.17 shows that the per family was highest in C + L + H farming system i.e. ₹ 22,82,156.17 and ₹ 4,24,9822.52, respectively over the C + L and Crops only farming system. Added income per family income of C + L over Crops only farming system and C + L + H farming system over C + L farming system was more.

Table 4.18 Analysis of farm expenditure

(₹)

Sr. No.	Particulars	C	C + L	C + L + H	Overall
1.	Total Expenditure	6494370.00	15387930.00	23278922.00	45161222.00
a.	Per family expenditure	216479.00	512931.00	775964.06	501791.55
b.	Added per family expenditure over crop cultivator's	-	296452.00	263033.06	-
Incremental Cost-Benefit Ratio (ICBR)		-	1.96	3.57	-

Table 4.18 indicates that, the per family was highest in C + L + H farming system *i.e*. ₹ 7,75,964.06 and ₹ 1,44,499.82, respectively over the C + L and Crops only farming system. Family expenditure was also increases as farmers shift from Crops to C + L and C + L + H farming systems. Incremental Cost-Benefit Ratio (ICBR) was economically viable in C + L and C + L + H farming systems.

Table 4.19 Analysis of farm employment

(Man-days)

Sr. No.	Particulars	Farming systems			Overall
		C	C + L	C + L + H	
1.	Total employment	2625	3361	7258	13244
a.	Per family employment	87.50	112.03	241.93	147.15
b.	Added per family employment over crop cultivator's	-	24.53	129.90	-

Table 4.1 depicts that, the per family as well as per capita employment was highest in C + L + H farming system i.e. 241.93 man-days and 45.08 man-days, respectively over the other farming systems. The per farm and per capita employment was also increasing as farmers shifts from Crops only to C + L and C + L + H.

4.7 Constraints Faced by Farmers

Garret ranking method was used to examine the priority in the constraints of different farming systems and presented in the Table 4.20 to 4.22. Table 4.20 indicates that the, low price for produce ranked by 65 respondents, second rank by 4 respondents and 1 respondent of them mentioned as last rank. Similarly, high cost of fertilizers ranked as first by 15 respondents and second rank by 60 respondents.

The Table 4.22 indicates problems ranked by farmers. Low price for produce got the first rank followed by High cost of fertilizers, Shortage of labour, High wage rate, Lengthy process of loan sanction by banks, High cost of improved breeds, Delay payment, No storage facility, Irregular supply of electricity and High cost of animal feed and fodder got II, III, IV, V. VI. VII. VIII. IX and X rank, respectively

Table 4.20 Problems faced by farmers

Sr. No.	Particulars	Rank									
		I	II	III	IV	V	VI	VII	VIII	IX	X
1	Shortage of labour	9	6	46	8	6	3	3	6	2	1
2	High wage rate	3	5	6	48	7	12	9	6	3	1
3	High cost of fertilizers	15	60	5	4	1	2	1	2	0	0
4	Irregular supply of electricity	12	8	4	8	16	6	8	2	3	23
5	High cost of improved breeds	9	12	6	3	14	6	33	2	3	2
6	High cost of animal feed and fodder	12	5	7	3	2	9	2	38	2	0
7	Low price for produce	65	4	3	7	4	2	1	1	2	1
8	No storage facility	12	9	8	6	5	6	14	2	25	3
9	Delay payment	2	4	7	12	35	3	12	6	5	4
10	Lengthy process of loan sanction by banks	4	6	12	15	7	32	6	6	2	0

Table 4.21 Per cent position and Garret value

Sr. No.	Formulae - (100*(Rij-0.5)/Nj)	Calculated value	Garret 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	57
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	37
9	100*(9-0.5)/10	85	30
10	100*(10-0.5)/10	95	18

Table 4.22 Calculation of Garret value and ranking of problems

Sr. No.	Particulars	Rank										Total	%	Rank
		I	II	III	IV	V	VI	VII	VIII	IX	X			
1	Shortage of labour	738	420	2898	456	312	144	126	222	60	18	5394	59.93	3
2	High wage rate	246	350	378	3726	364	576	378	222	90	18	5358	59.53	4
3	High cost of fertilizers	1230	4200	315	228	52	96	42	74	0	0	6237	69.30	2
4	Irregular supply of electricity	984	560	252	456	832	288	336	74	90	414	4284	47.60	9
5	High cost of improved breeds	738	840	378	171	728	288	1386	74	90	36	4729	52.54	6
6	High cost of animal feed and fodder	984	350	441	171	104	432	84	1406	60	0	4032	44.80	10
7	Low price for produce	5330	280	189	399	208	96	42	37	60	18	6659	73.98	1
8	No storage facility	984	630	504	342	260	288	588	74	750	54	4474	49.71	8
9	Delay payment	164	280	441	684	1820	144	504	222	150	72	4481	49.78	7
10	Lengthy process of sanction of loan by banks	328	420	756	855	364	1530	252	222	60	0	4793	53.25	5

5. SUMMARY AND CONCLUSIONS

In farming system approach, the farm is viewed in holistic manner. The farmers are confronted many socio-economic, biological, institutional, administrative and technological constraints. The farming system conceptuality is a set of elements or components, which are interrelated and interact among themselves. At the centre of interaction is the farmer himself, exercising control and choice regarding the type and results of interaction.

Recently research on farming system has been gaining momentum and the scientists and research scholars are developing tools and techniques to discover the more practicable methods to improve the farming. In a predominantly agricultural dependent country like India, economic development largely depends on growth in agricultural production. Since, the scope to bring additional land under cultivation is limited, significant increase in agricultural production is possible through raising productivities of different crops per unit of land, labour and capital.

The resources of the farmers being meager. It is difficult for him to sustain himself and his family on crop components only. The crop production and livestock raising combine with horticulture production, offers special advantages such as balanced farming providing more employment, income and covering risk of complete failure of farm business and finally the sustainability of the farming systems.

The profitability of different crop and livestock combination is varying from region to region and within the region also. Study of the Farming system with location specific outlook is worthwhile to know various socio-economic dimensions of farming systems. Hence, the present study *viz*. "Economics of Farming Systems in Solapur District of Maharashtra," was undertaken with following specific objectives.

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, crops with livestock enterprise and crops with livestock and horticulture enterprise are the widely adapted farming system in Solapur district. Therefore, these three farming systems were selected for the study.

The study was based on the data collected from 90 farmers by survey method for the year 2017-18. Two tahsils *viz*; Karmala and Madha were purposively selected. Three villages from each tahsils were selected randomly purposively and 15 farmers from each village were selected randomly.

The farmers selected from each village were further classified into crop only, crop with livestock and crop with livestock and horticulture farming system. The data was analysed in the tabular form with the help of means and averages. To work out per hectare and per farm resource use and profitability same procedure was followed. In order to know the factors influencing the employment, income and expenditure of farm families in the selected areas, the functional analysis was carried out by using multiple linear regression equation.

5.1 Summary

1. The overall size of family was 5.26 persons. The average size of family was 5.20 in Crops only farming system, 5.20 in C + L and 5.37 in C + L + H farming system.
2. At the overall level, 87.26 per cent family members were literate and 12.74 per cent family members were illiterate.
3. The average size of livestock per family was 4.15. The average size of livestock per family was 5.96 in C + L farming system and 6.47 in C + L + H farming system.
4. At the overall level, per farm investment on various irrigation structure by sample farmers was ₹242602.39. It was ₹213603.00, ₹212158.83 and ₹303891.40 for Crops only, C + L and C + L + H farming system, respectively.
5. At the overall level, per farm investment in various assets owned by sample farmers was ₹77243.04. It was found to be increasing as farming system shifts *i.e.* ₹28866.82, ₹101060.34 and ₹101581.32 for Crops only, C + L and C + L + H farming system, respectively.
6. The selected farmers adopted mainly sugarcane as a cash crop. In *kharif* seasons they were cultivating crops like onion, tur, fodder crops, maize. *Rabi* season was mainly occupied by crops like *Rabi* jowar, wheat, gram, groundnut and other minor crops. In horticultural crop banana was the main fruit crop. At the overall level, cropping intensity was 101.83 per cent. Cropping intensity was found highest on C + L farming system as compare to Crops only and C + L + H farming system.
7. The per family employment at overall level was 309.69 man-days out of which male contributed 153.92 man-days and female contributed 155.77 man-days during study year.
8. Out of three farming systems, C + L + H farming system have more working man-days (469.45 man-days) as compare to C + L farming system (333.40 man-days) and Crops only farming system (123.57 man-days).
9. Estimated employment function of sample farms shows that two variables viz., gross cropped area and number of livestock were highly significant at 1 per cent level. Number of earners and gross irrigated area were found to be significant at 10 per cent level at overall farms.

10. At overall level, the average gross family income was ₹1462275.61 per annum. The average per farm annual gross income for Crops only farming system was worked out to ₹762346.67 while for C + L farming system and C + L + H farming system it was ₹1342315.00 and ₹ 2282165.17.
11. Estimated income function of sample farms shows coefficient of gross irrigated area (X2), and number of livestock (X4) were found to be highly significant at 1 per cent level at overall farms. Other variables like gross cropped area was shown significance at 5 per cent level.
12. The average total annual family expenditure was ₹ 501791.35 at overall level. The average total annual family expenditure was high in C + L + H farming system i.e. ₹ 775964.06 followed by C + L farming system (₹ 512931.00) and Crops only farming system (₹ 216479.00).
13. At overall, in expenditure function the coefficients of gross cropped area (X1) and gross irrigated area (X2) were found to be significant at 5 per cent level.
14. C + L + H farming system have more per capita income and per family income *i..e* ₹ 424928.52 and ₹ 2282156.17, respectively.
15. C + L farming system have more per capita income and per family income than Crops only farming system *i.e.* ₹ 258137.50 and ₹ 1342315.00, respectively.
16. Crop only farming system have less per capita as well per family income. It was ₹ 146605.12 and ₹ 762346.67, 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 sample farmers with different farming systems in Solapur district. The foregoing discussion on various aspects of study led to draw the following conclusions.

1. The major share of gross family employment was livestock maintenance (40.03%) followed by crop production (36.20%), off farm (12.38%) and horticultural crop production (11.39%). Employment pattern indicates share of wage days in gross family employment increase as farmer shifts from Crop only to C + L and C + L to C+ L + H farming system.
2. The functional analysis of employment pattern indicates that the variables *viz.*, gross cropped area, gross irrigated area, livestock number and number of earners were significant variables for which output was responsive.

3. Income pattern of sample farmer shows that crop production was the major source of income followed by horticulture production, livestock, service and off farm.
4. The functional analysis of income pattern indicates that the variables *viz.*, gross irrigated area, number of earners, number of livestock and area under horticulture crop were significant variables indicating the importance of these variables for increasing the farm income.
5. The expenditure pattern depicts that livestock maintenance, crop production and horticultural crop production have major share in gross family expenditure.
6. The functional analysis of expenditure pattern indicates that the variables *viz.*, gross cropped area, gross irrigated area, family size, number of livestock were significant variables for which output was responsive.
7. Sugarcane is the dominating crop in all the three farming system having highest area under cultivation *viz*., in Crops only (89.81%), in C + L (88.15), and in C + L + H (56.14).
8. More use of machine, like tractor was observed in all the three farming systems.
9. In crops only farming system share of fertilizers and capital was maximum, while in C + L farming system, the share of milch animals and fertilizers was maximum. And in C + L + H farming system the expenditure on labour, land under horticultural crops, fertilizers and working capital were maximum.
10. C + L + H farming system generate more employment than other farming system.
11. In crops only farming system, expenditure on the crop production (65.55%), in C + L farming system, expenditure on livestock (54.04%) and in C + L + H farming system, expenditure on livestock (36.49%) was the major expenditure items in total annual expenditure, respectively
12. In Crops only and C + L farming system, major source of income was from crop production. It was 89.73 and 62.50 per cent, respectively. Whereas, in C + L + H farming system livestock and crops together contribute 58.44 per cent of total annual income.
13. C + L farming system over crop only farming system and C + L + H farming system over C + L farming system was more profitable.
14. Per family and per capita income in C + L + H farming system is more as compared to C + L and Crops only farming system.
15. The constraints faced by farmer ranked by Garret ranking, the obtained results show that low price for produce got first rank followed by high cost of fertilizer and high wage rate got second and third rank, respectively.

5.3 Policy Implications

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

1. Since, C+L+H Farming system is profitable farmers should be motivated to undertake horticultural crops and livestock with cash crops for enhancing their income and employment on farms.
2. The cropping intensity of all the three farming system is low (100.93%, 104.10% and 101.83% respectively.) hence, the farmer should be promoted to grow short durational crops, intercrops for increasing efficient use of irrigation facilities and cropping intensity.
3. Generation of employment and income is more in C + L + H farming system. Hence farmer may follow C + L + H farming system for increasing per family as well as per capita income.
4. As C + L + H is more profitable than C + L and Crops only farming system. So, farmers may adopt C + L + H farming system for sustainable income.

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7. VITAE

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MASTER OF SCIENCE (AGRICULTURE)

IN

AGRICULTURAL ECONOMICS

2019

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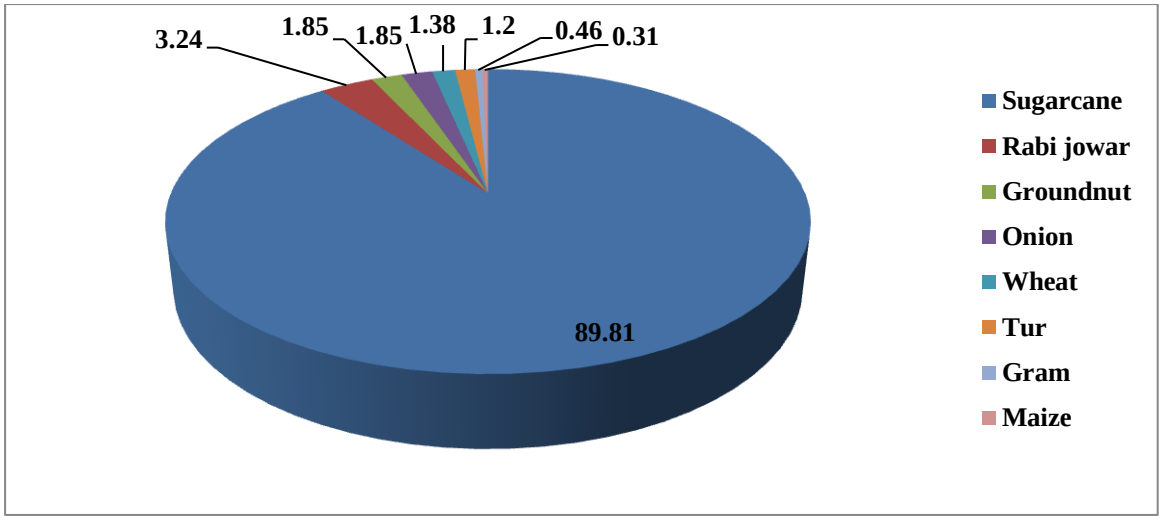


Fig.2 Cropping pattern of Crops only farming system

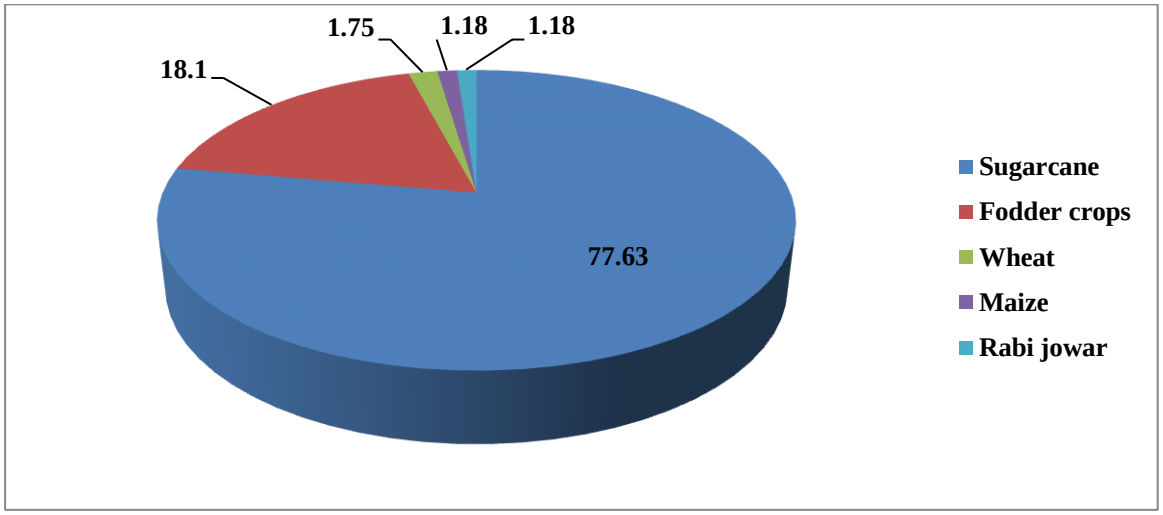


Fig.3 Cropping pattern of C + L farming system

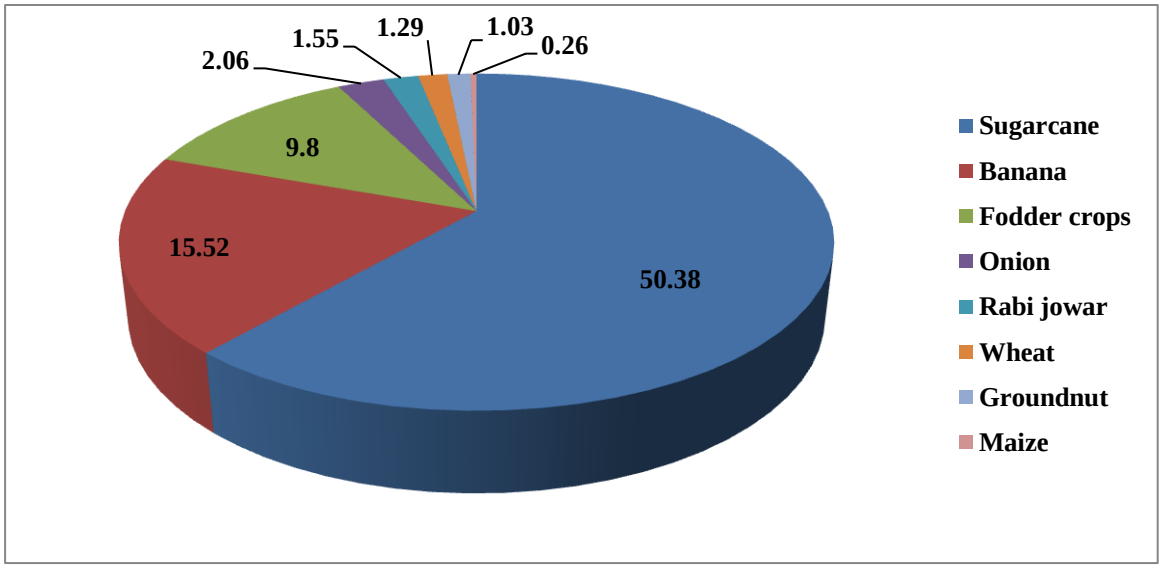


Fig.4 Cropping pattern of C + L + H farming system

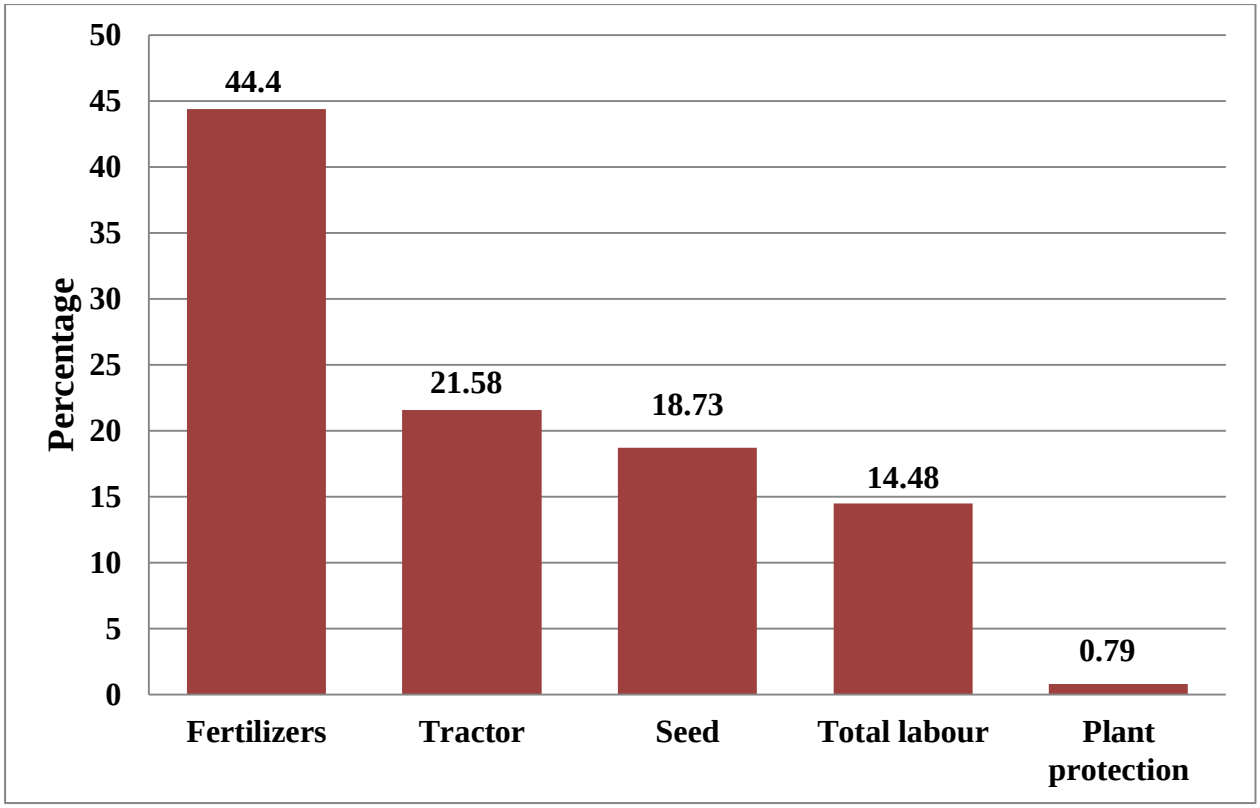


Fig.6 Resource use pattern of Crops only farming system

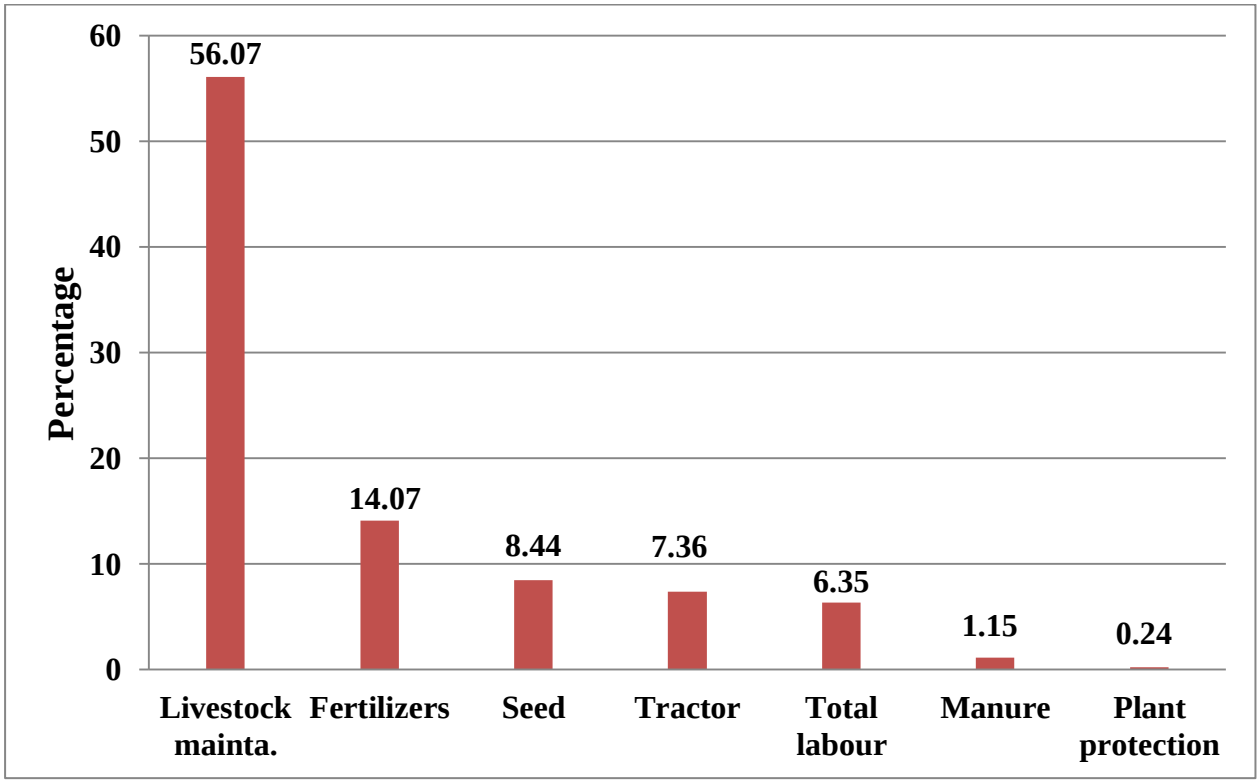


Fig.7 Resource use pattern of C + L farming system

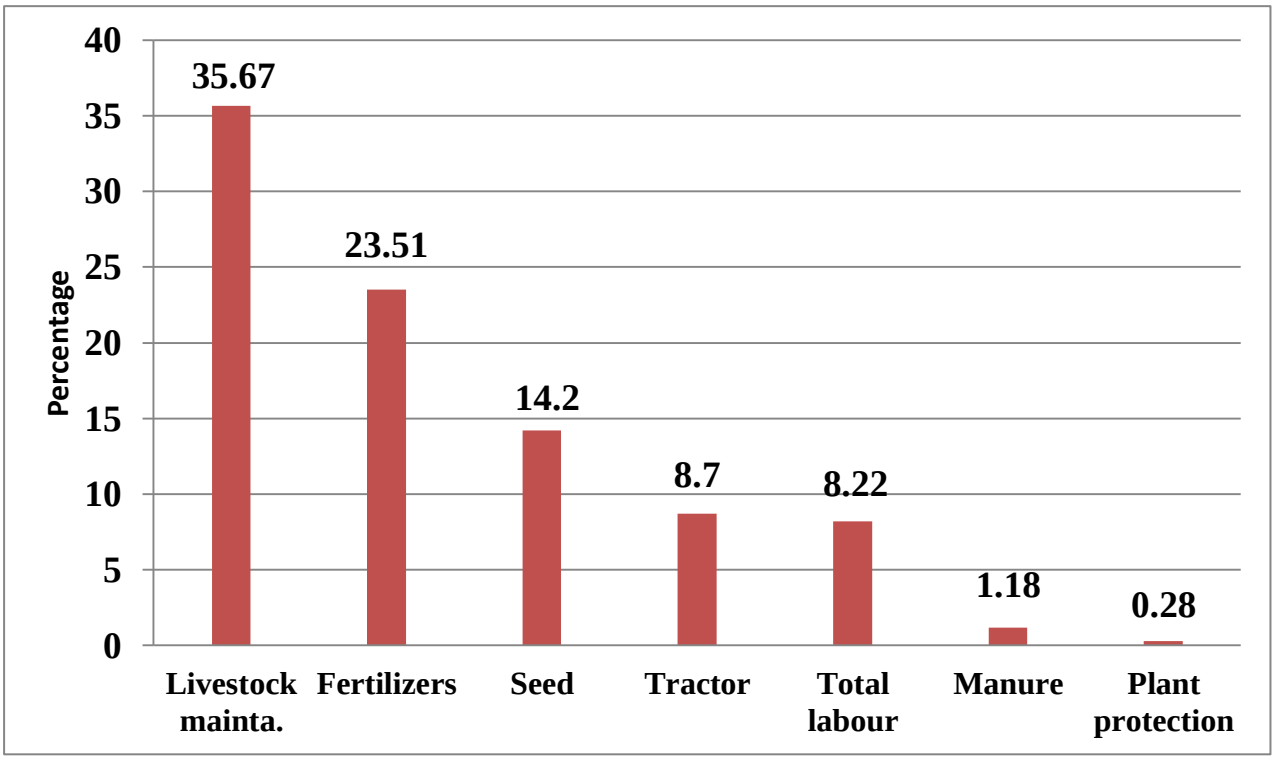


Fig.8 Resource use pattern in pattern in C + L + H farming system

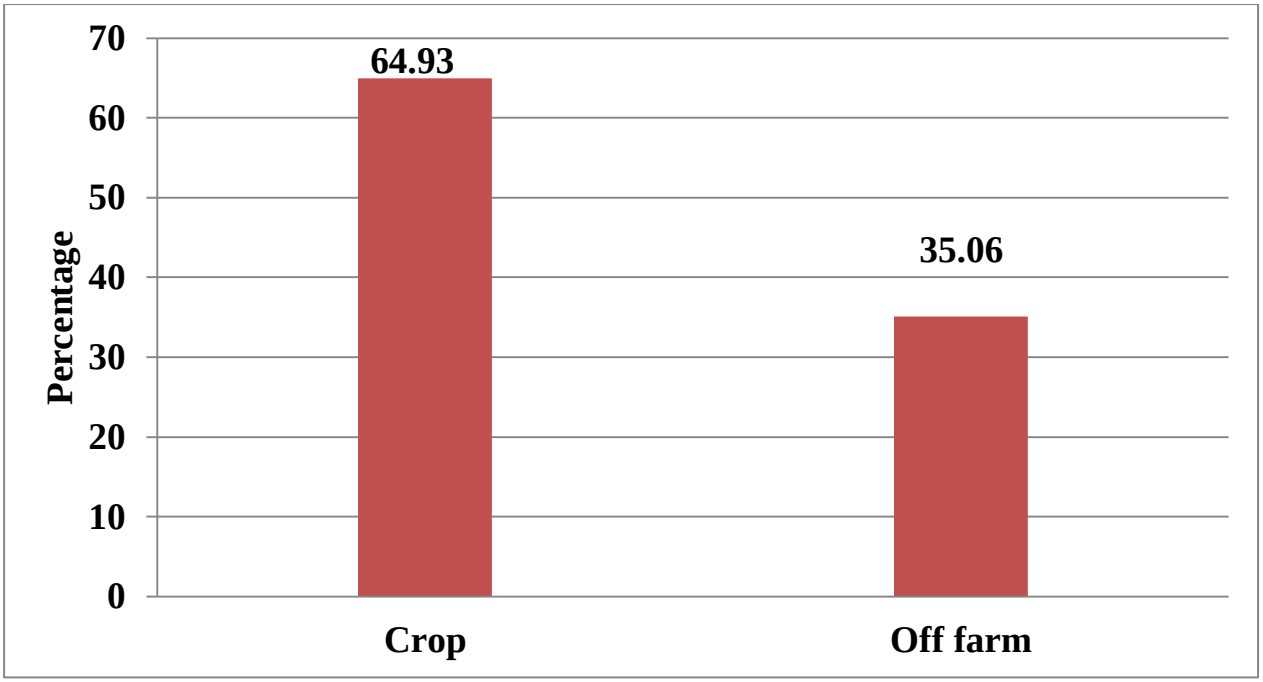


Fig.9 Employment pattern of Crops only farming system

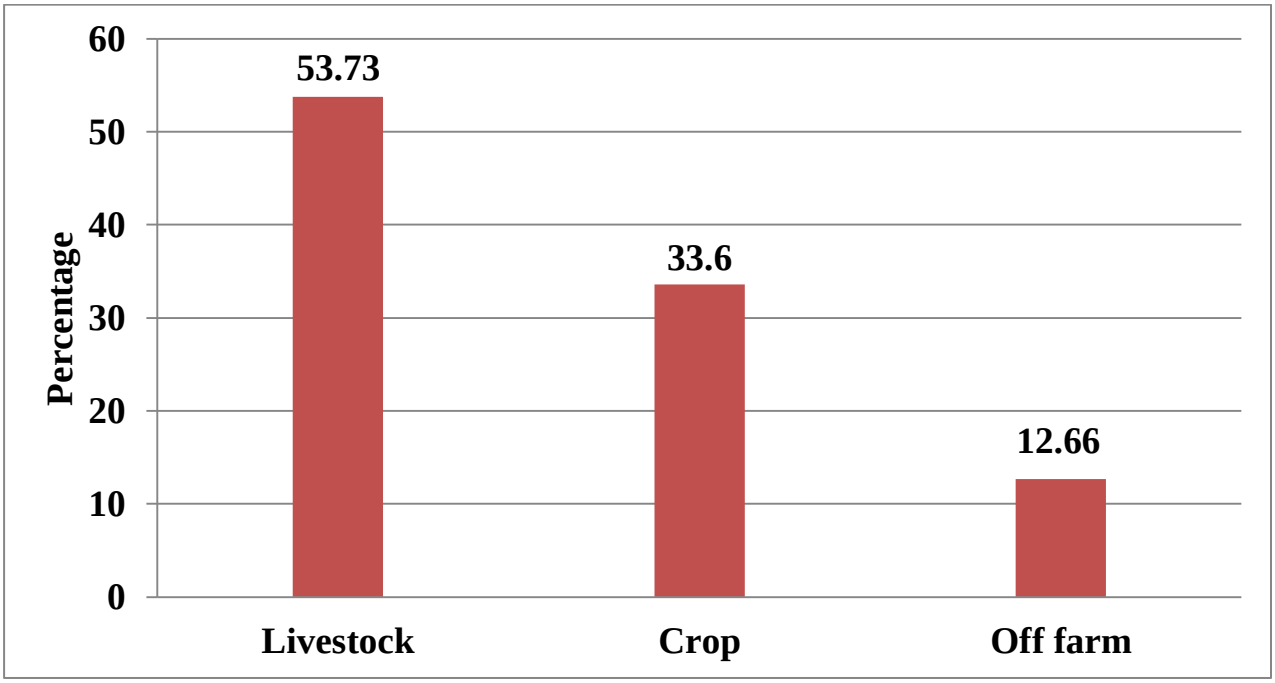


Fig.10 Employment pattern of C + L farming system

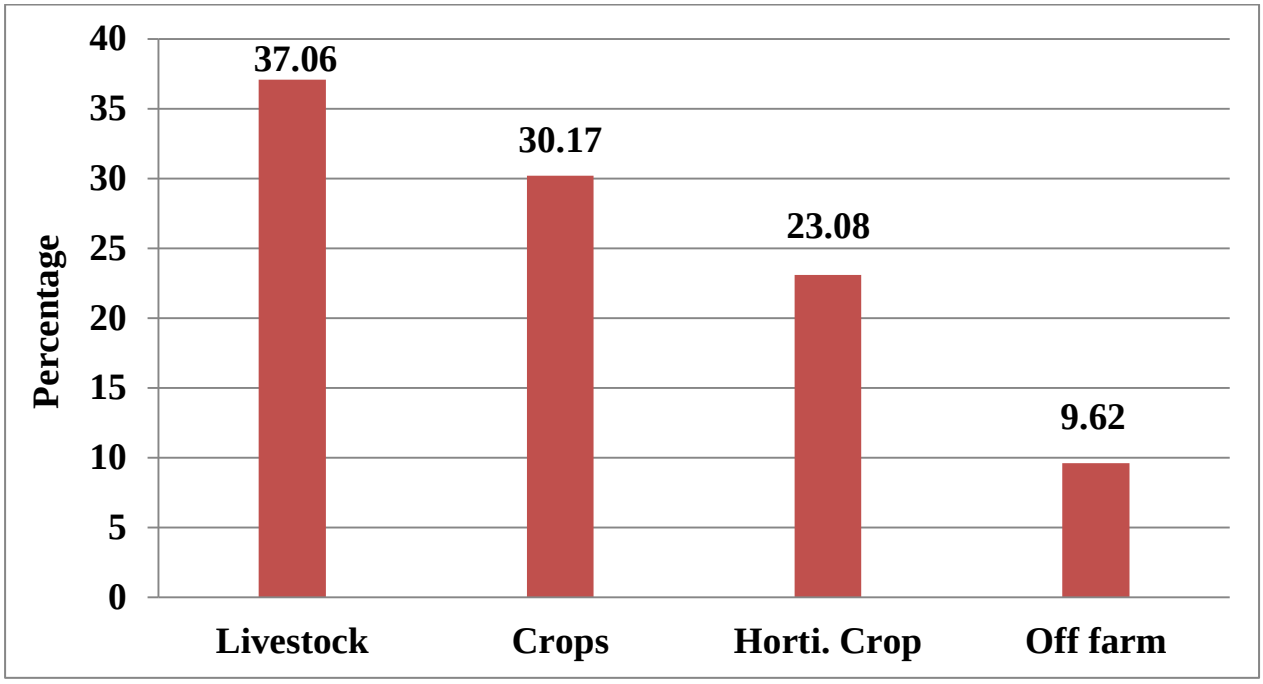


Fig.11 Employment pattern of C + L+ H farming system

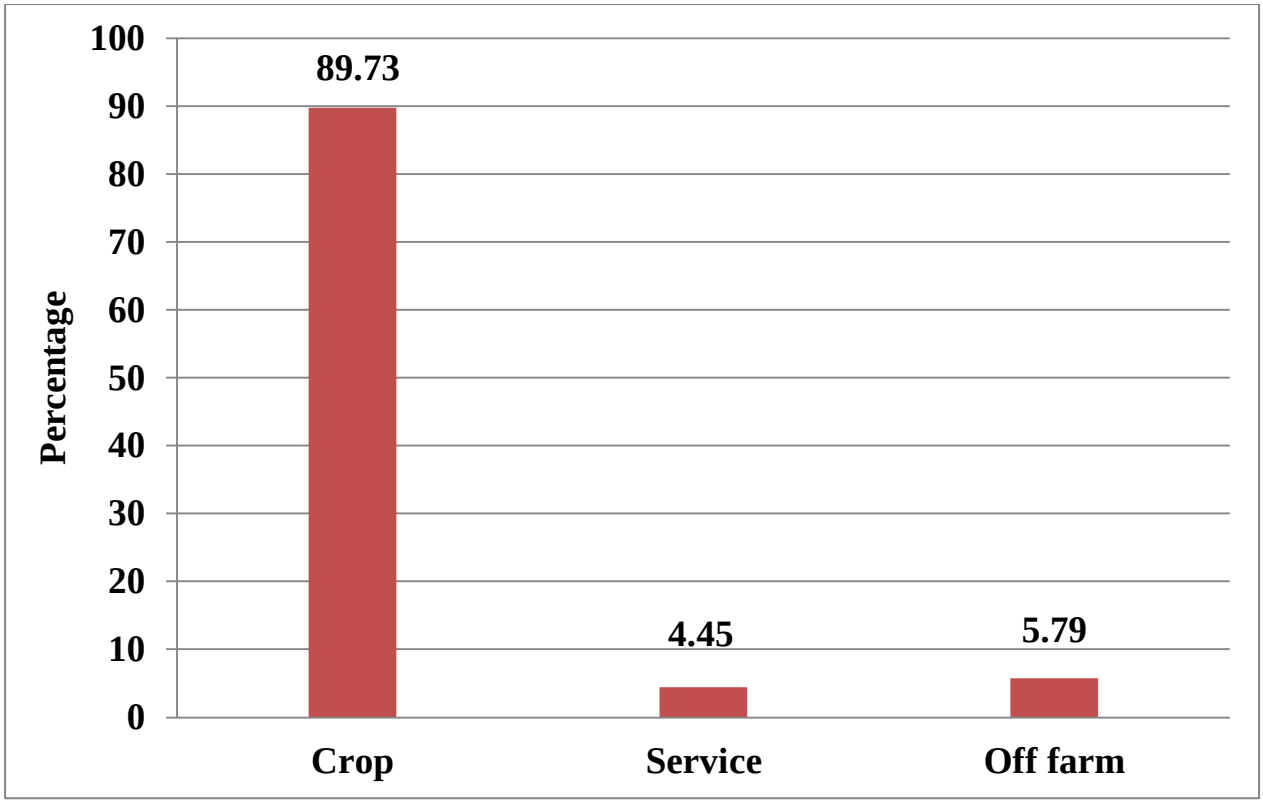


Fig.13 Income source of Crops only farming system

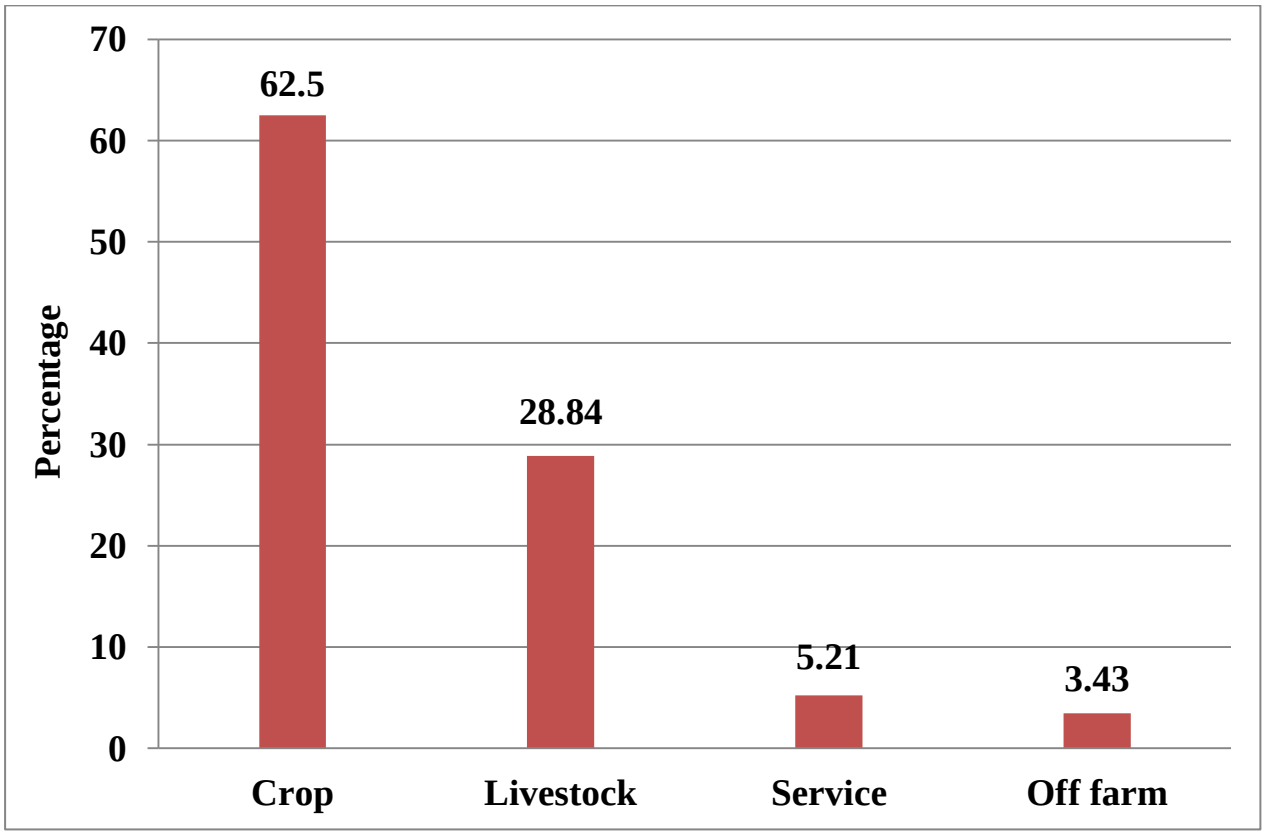


Fig.14 Income source of C + L farming system

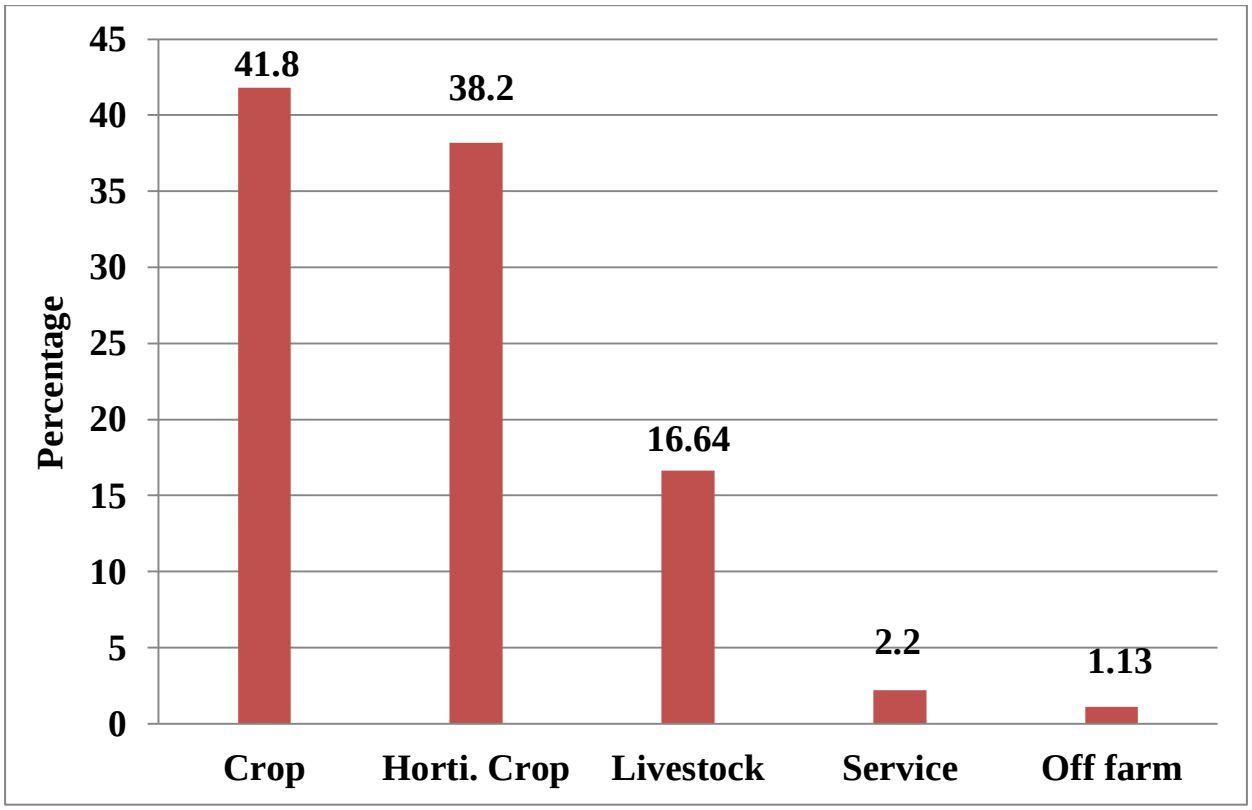


Fig.15 Income source of C + L + H farming system

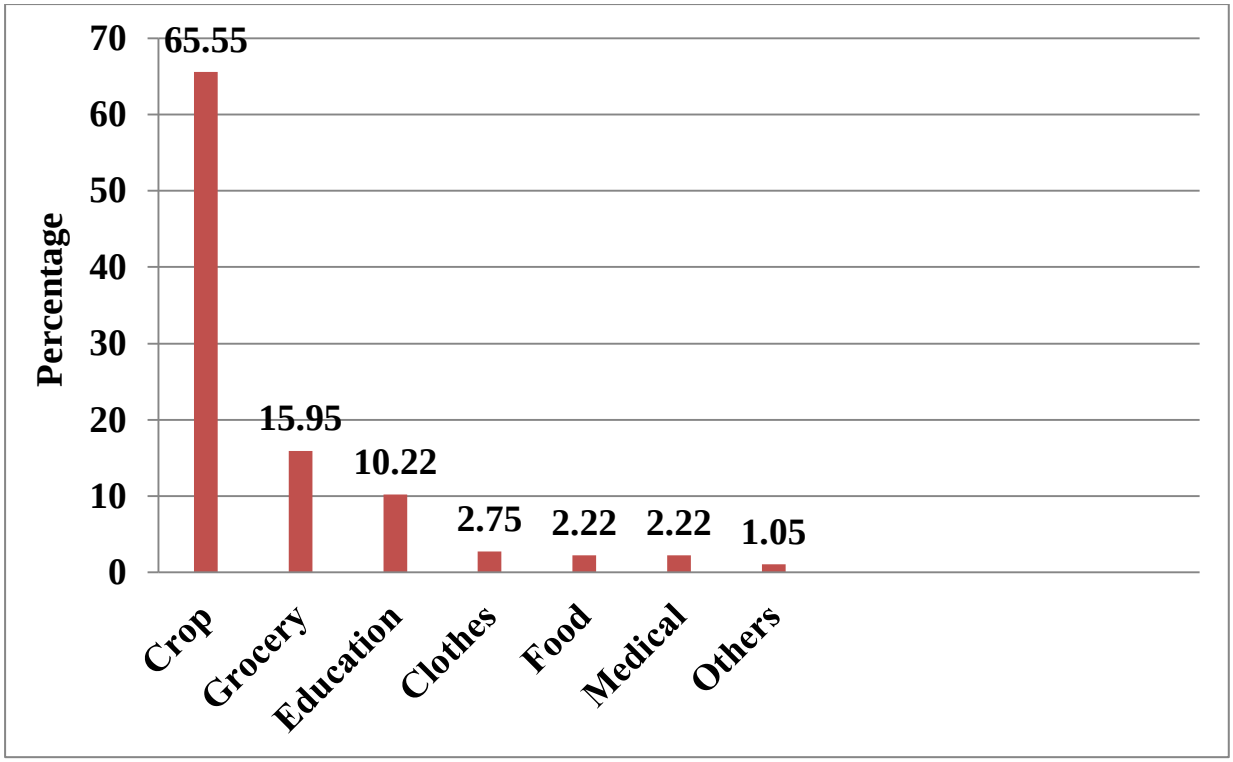


Fig.17 Expenditure pattern of Crops only farming system

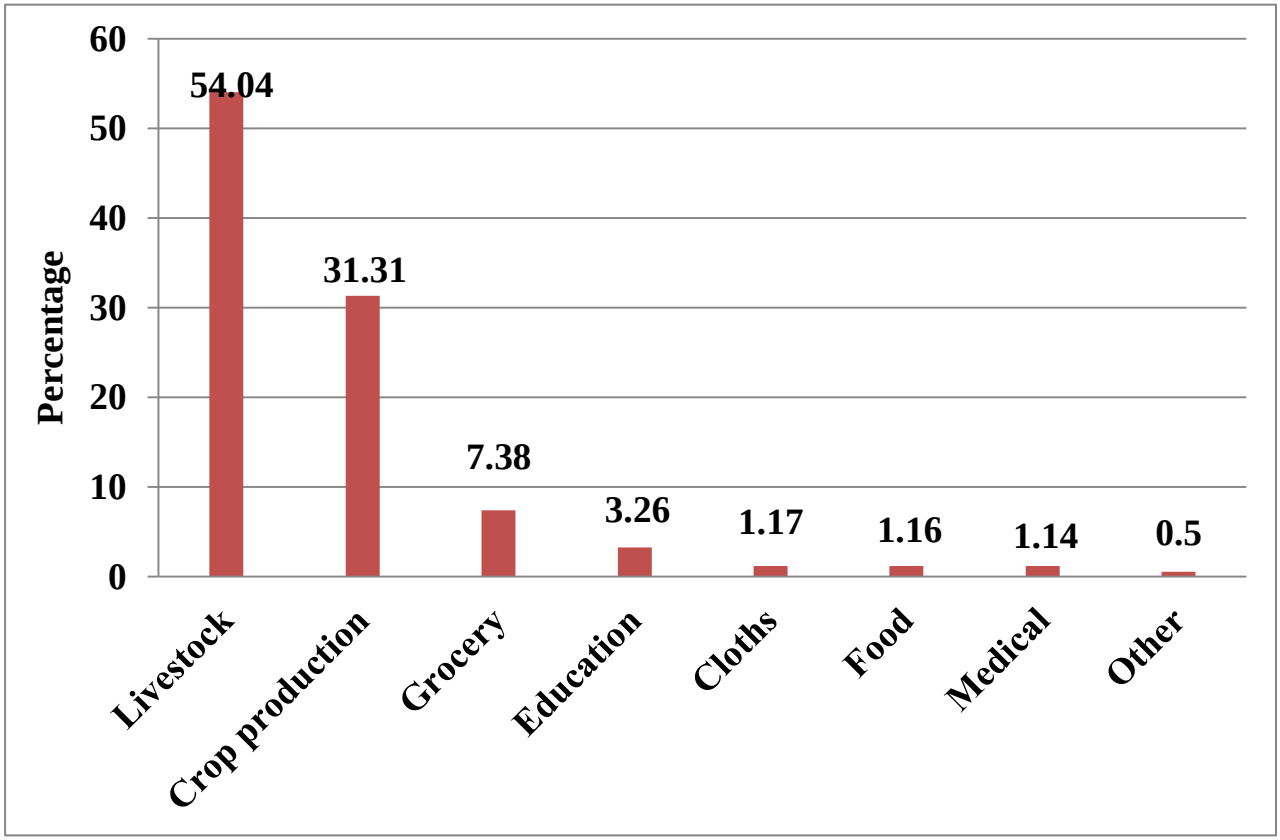


Fig.18 Expenditure pattern of C + L farming system

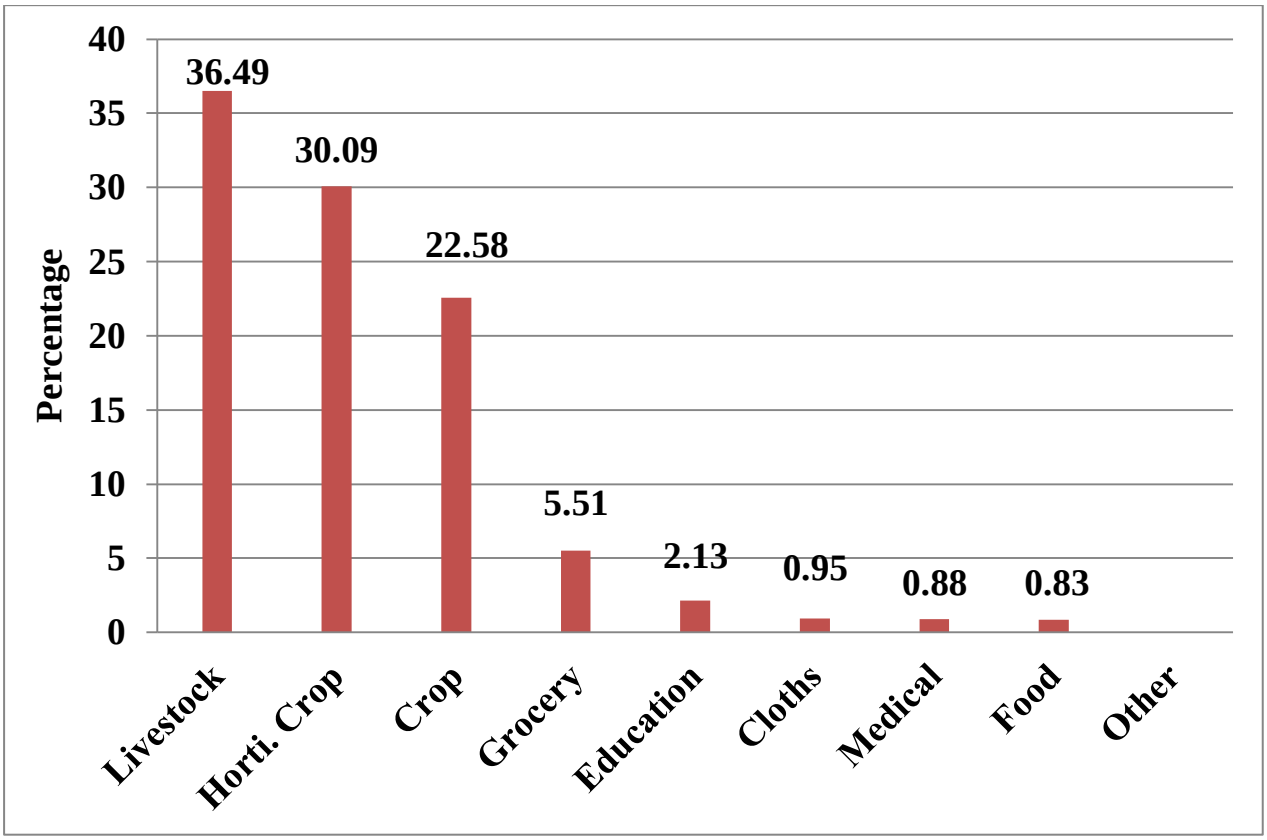


Fig.19 Expenditure pattern of C + L + H farming system

Sugarcane

G.nut **Maize**

Fig.5 Crops only Farming System, At / post Shetfal Tal – Karmala Dist – Solapur (2017-18)

Livestock

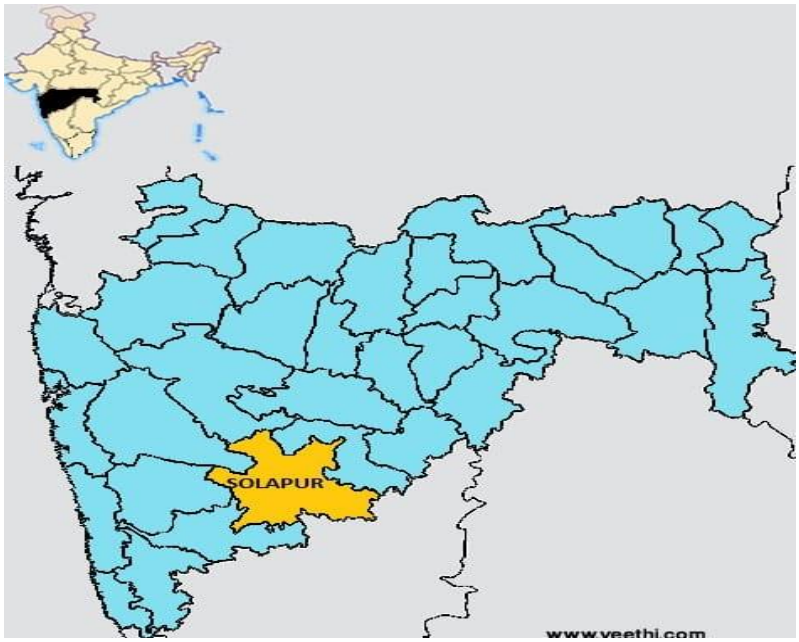
Lucern grass **Sugarcane**

Fig.12 Crop + Livestock Farming System, At / post Shiral Tal – Madha Dist - Solapur (2017-18)

Banana orchard

Sugarcane **Livestock**

Fig.16 Crop + Livestock + Horticulture Farming System, At / post Surali Tal – Madha Dist – Solapur (2017-18)



Map of Maharashtra

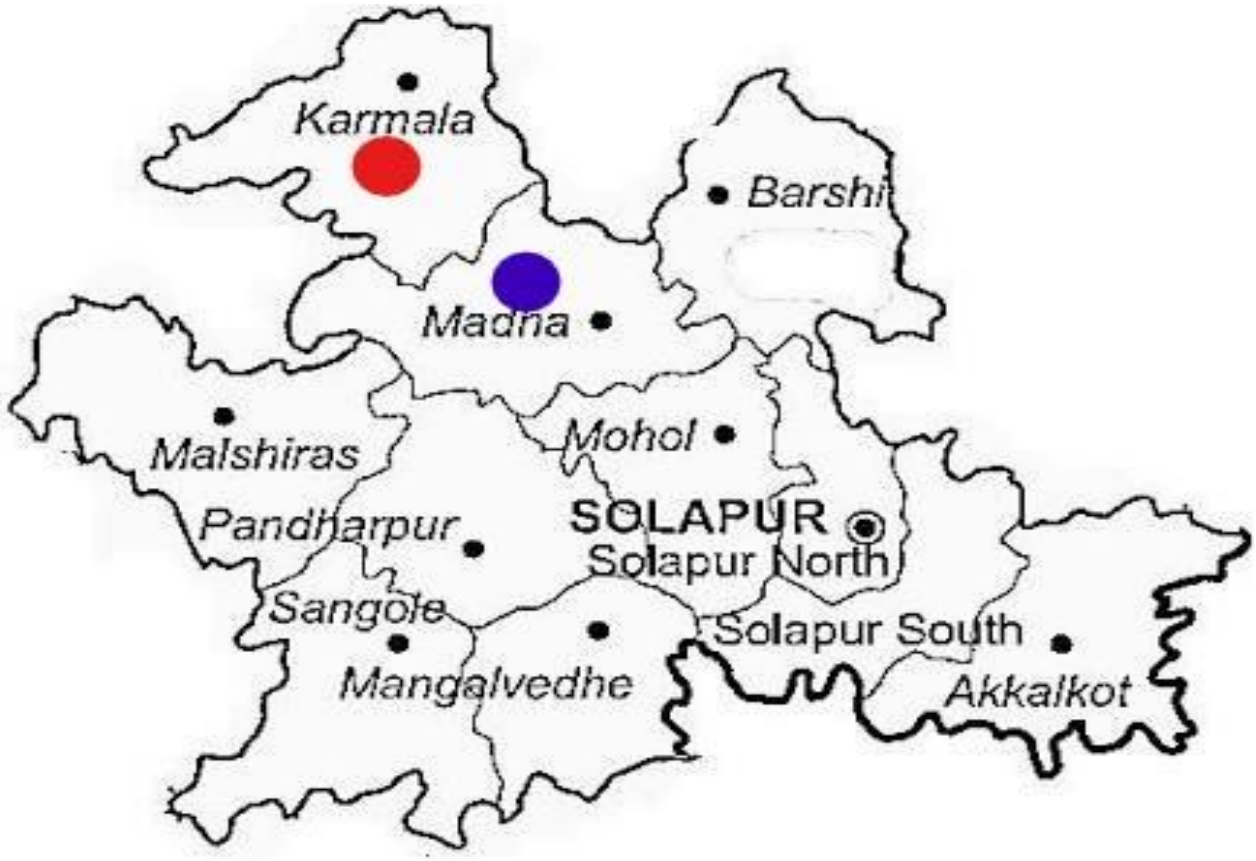


Fig. 1 Map of Solapur district

7. APPENDIX

QUESTIONNAIRE

"Economics of Farming System in Solapur District of Maharashtra"

Schedule for primary data collection from farmers

Date: / /20 Year: 2018-2019 Schedule No.

Farming system – Crop /Crop + Livestock / Crop + Livestock + Horticulture

1. General information of farmer

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

2. Family size and it's composition

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

3. Land use pattern (Area in acre)

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

4. Cropping pattern

Sr. No	Season	Survey No./ Plot No.	Crop	Variety	Area (acre)
1.	*Kharif*				
2.	*Rabi*				
3.	Summer				
4.	Annual				
5.	Perenn-ial				

5. Farm assets, machinery implements

A) Farm implements and machinery

Particulars	Numbers	Year of purchase	Present value (₹)	Repairs (₹)
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 accessori-es				
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 (acre)
1.	Well		
2.	Tube well		
3.	Farm pond		
4.	River		
5.	Other		

6. Livestock composition

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

10. Expenditure on livestock (Annual)

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

11. Details regarding production of livestock

Livestock type and Number	**Prod. Milk (lit)**	**Home consu mption**	**Sold (₹)**	**Rate (₹)**	**Eggs**			**Total Value (₹)**
					No.	**Rate (₹)**	**Value (₹)**	
Buffalo								
Cow								
Goat								
Poultry								

12.Annual expenditure of farmer

Sr. No.	**Particulars**	**Average annual expenditure (₹)**
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		

13.Total annual income

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

14. 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		

7. Input use and expenditure 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.																				

8. 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								

9. Operation wise Labour and maintenance of perennial 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 Protection chemicals a. b.											
5.	Giving irrigation											
6.	Harvesting1. 2.											
7.	Packing											
8.	Marketing											
9.	Any other operation											
10.	Total cost (Rs.)											

10. Input use and expenditure on inputs used for horticulture crop production (Annual)

Sr. No	Crop	Area (acre)	Seed/Planting material		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.																				