ECONOMICS OF VEGETABLE BASED CROPPING SYSTEM IN KHARGONE DISTRICT OF MADHYA PRADESH

THESIS

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Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya

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by

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CERTIFICATE-I

This is to certify that the thesis entitled **"ECONOMICS OF VEGETABLE BASED CROPPING SYSTEM IN KHARGONE DISTRICT OF M.P."** submitted in partial fulfilment of the requirements for the Degree of **MASTER OF SCIENCE**/DOCTOR OF PHILOSOPHY in **Agriculture Economics & Farm Management** of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior is a record of the bona-side research work carried out by **Mr.Narendra Rawal** under my guidance and supervision. The subject of the thesis has been approved by the student's Advisory Committee and the Director of Instruction.

No part of the thesis has been submitted for any other degree or diploma or has been published. All the assistance and help received during the course of this investigation has been acknowledged by scholar.

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CERTIFICATE-II

This is to certify that thesis entitled **"ECONOMICS OF VEGETABLE BASED CROPPING SYSTEM IN KHARGONE DISTRICT OF M.P."** submitted by **Mr.Narendra Rawal** to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior in partial fulfilment of the requirements for the degree of Master of Science in **Agriculture** in the Department of **Agriculture Economics & Farm Management** has been accepted after evaluation by the External Examiner and approved by the Student's Advisory Committee after an Oral examination on the same.

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CHAPTER – I

INTRODUCTION

The horticulture sector encompasses a wide range of crops e.g., fruit crops, vegetables crops, potato and tuber crops, ornamental crops, medicinal and aromatic crops, spices and plantation crops. While the first few Five Year Plans assigned priority to achieving self sufficiency in food grain production, over the years, horticulture has emerged as an indispensable part of agriculture, offering a wide range of choices to the farmers for crop diversification. It also provides ample opportunities for sustaining large number of agro-industries which generate substantial employment opportunities. The horticulture sector contributes about 24.5% of the GDP from about 8% of the area. Various studies depicted that horticulture crops realized higher net profitability over grain crops cultivation.

Traditionally, horticulture involves four areas of study namely, Pomology (fruit culture), Olericulture (vegetable culture) Floriculture (culture of ornamental crops), and Post Harvest Technology (management of produce after harvest). However, over the years the scope of the above field has been expanded to include other crops like mushroom, bamboo, plantation crops. In view of the above developments Horticulture can now be redefined as the 'Science of growing and management of fruits, vegetables including tubers, ornamental, medicinal and aromatic crops, spices, plantation crops their processing, value addition and marketing'.

In horticulture, vegetables cultivation is an important component. India is the second largest vegetable producer after China with 11% production share in the world vegetable production. It is also the largest producer of okra (ladyfinger) and second largest producer of most of the other important vegetable crops at global level, namely brinjal, cabbage, cauliflower, pea, onion and tomato and third largest producer of potato in the world. However, it falls behind in productivity in most of the crops except for tomato where India is ranked at number 1. In okra, it is at par with world productivity and in cauliflower it is quite close to the average world productivity.

Total vegetable production in India before independence was about 15 million metric tonnes and since independence for decades the growth rate was stabilized around 0.5%. The impetus on vegetable research and policy intervention to promote

vegetable crops witnessed a sudden spurt in growth rate of 2.5%, a hike of five times during the last decade. The potential technological interventions with improved gene pool and precise management can very well take growth rate to nearby 6% per annum. The area under vegetables increased from 5.59 million ha in 1991-92 to more than 7.00 million hectare during 2013-14. The production in this period increased from 58.53 to about 105 million metric tonnes. During the same period, productivity of vegetables increased from 10.5 metric tonnes per hectare to 15.0 metric tonnes per hectare.

During 21st century, which is an era of food and nutritional security, vegetables including tuber crops are the only alternative crops capable of providing both food and nutritional security owing to their high yield, energy, nutrient/health building substances and high yield potential/ unit land, time and water. Besides, based on their micronutrients, vitamins, antioxidants and medicinal properties, enhancing their consumption can go a long way in alleviating poverty, dietary deficiency ailments, and hunger. Vegetables including spices have significant role in export, corporate, contract, organic, cluster and periurban vegetable farming. These crops not only have great potential in improving health of our countrymen, but also are capable of economically empowering them and raising country's GDP.

Keeping the high nutrient status of vegetable crops, high bio-availability of nutrients compared to cereals, public awareness/ literacy mission focused on dietary knowledge empowerment of rural poor during XI five year plan need to be initiated nationally to appraise masses about balanced diet and advising making their diet vegetable based so as to shed load from cereals by increasing vegetable consumption. In response to important of vegetable cultivation, now farmers of adopting vegetable based cropping system at their farms.

Technological advancement causing in enhancing the productivity of vegetable and with the management practices vegetable cultivation finds to be profitable. This phenomenon attracted the general farmers for diversification towards vegetable cultivation. The invent of modern farm technology at the time of green revolution in India contributed to significant production gains and induced changes in cropping pattern in favours of improved inputs and other yield attributing factors using crops and to grow more commercial crops like vegetable cultivation on their farm. It is practical view that

adequate and improved technology has been generated to increase the productivity and production of crops but there level of profitability is lower than vegetable production. Due to variation in agro climatic condition and other socio-economic factors in different places the productivity and production of crops also found to variation in place to place. These differences in productivity may cause the returns from various crop productions. Hence, there is need to generate improved cropping pattern and make replacement of existing cropping pattern to get the benefit of improved technology over modern and economic cropping pattern in specific area. It was observed that vegetable based cropping system found to more beneficial in irrigated and semi irrigated condition.

Cropping system refers to the principle and practices of cropping and interaction with farm resources, environment, regional or national needs and production strategies. It is one of the very important tools to augment the agricultural production. The approach involves sequential as well as intercropping and mixed cropping system aimed at efficient utilization of natural and man made resources of production. This holistic approach is vital to boost crop productivity on sustained basis without impairing the ecological and environmental balance.

As the scope of extensive cultivation is found to meager due to scarcity of irrigation facilities and in rainfed area, the research on the multiple cropping sequences gains importance. The intensity and nature of crop components in the vegetable crops' sequences influence the productivity and economic returns. An indepth study of different vegetable crops and their relative economic significance with reference to time sequences would enable identification of the most efficient vegetable crops in a region. The impact of different vegetable based cropping systems on cost, returns and profit from farmers in a region would through light on and enable the farmer to plan for the right cropping system.

Cropping pattern speaks about the intensity of land resource use on various crop growth under different level of technology. A conjugal response of so many factors association, changes in land utilization pattern is a global phenomena and subjective change in technology, degree of market perfection and economic status of the producers and consumers. All these factors of the region do change with the pace of the time. The recent advances in farm technology in terms of new crop varieties, irrigation

facilities and other non conventional inputs are well known to the farmers at different levels and thereby they plan their production accordingly. The technological advancement in agriculture resulting into higher productivity have been established by effective substitute for land to its economic use.

Various study depicted that technological change and variation in other agro climatic and socio economic factors, the crop acreages have been found to be changing through out the country. The changes are revealed in terms of absolute increases for particular crop or decrease for specific crop in a time period. A large number of studies have been conducted by economists in recent years on the subject of relation between variations in acreage or change in cropping systems with their respective prices. From the same studies it has come out that the immediate response of the farmers to price variation is somewhat limited. The farmer was influenced chiefly by the ruling level of prices over a series of years and was not anxious to change his cropping pattern as well as cropping system merely because of a casual annual fluctuation. But what is chiefly important is that what the individual farmers dose on particular fields. Obviously the problem of the applied scientist in trying to improve agricultural practices is first to understand what the individual farmer is doing at present and why he is doing this, and those in what manner the result if increased knowledge based on research can be so communicated to the farmer as to make his practices, in the scientist's term, more rational and more scientific. In this context, indeed the scientist has to take into account the existing level of knowledge as well as the available resources of common farmer. The scientist has to start from the assumption that traditional farming incorporates the result of past experience and is reasonably adjusted to a given environment and to the ideal situation of the farmer. This dose not means that there is no scope for change. It only means that one has to understand the rationale of the present situation in order to chalk out his programme of brining about change.

Cropping system is an important component of a farming system. It represents cropping patterns used in a farm and their interaction with farm resources, other farm enterprises and available technology which determine their make up. Cropping system specially intercropping and mixed cropping receiving greater emphasis in Indian agriculture now, because stabilized yield advantage, especially under adverse weather

condition, mixed and intercropping systems have built mechanism of risk bearing against environmental hazards. Proper and well adopted cropping system increase supply of balanced food, feed and cash needs of marginal farmers, without extra expense. Experimental evidences have also proved that yield stability and monetary return is greater with intercropping and mixed cropping than single crop.

The recently, huge gap between existing cropping systems and improved cropping systems, improved cropping systems are capable to increase the farmers land use efficiency, productivity and economic return in respect to farmers land use efficiency; productivity and economic return in respect to existing cropping systems. So this study is chosen for calculating economies of production of vegetable based cropping systems which is improved cropping system in irrigated as well as semi irrigated areas because irrigation is must for vegetable cultivation particularly in rabi season and or at the time of long dry spell. The specific objectives of study were as below:

Objectives:

1. To analyze the cost structure of vegetable based cropping system.
2. To determine the profitability of vegetable based cropping system.
3. To study the constraints related to existing cropping system
4. To suggest ways and means for increasing production level of vegetable based cropping system.

Need for research in vegetable based cropping system:

Despite the importance of vegetable cultivation in general and cropping system in particular under existing conditions, scant attention has been paid to devise suitable cropping systems on scientific basis with vegetable production. There is an utter lack of data on costs and returns and the resulting incomes with high nutritive vegetable production. Even the agricultural statistics fail to provide the required details in this response. As a result of this indifference on the part of research workers, the fate of vegetable cultivation has remained almost unchanged. Unless the focus of research is shifted from sole crops to multiple as sequence crops and from irrigated crops to rainfed crops, no worthwhile breakthrough in agriculture can be anticipated. It is for this reason that the present study has been undertaken. The primary motive is to identify

constraints in vegetable based cropping system and to provide the basis for its reorientation and reconstruction during the next few years. Hence, the focus of this study is to evaluate and compare economics of major vegetable based cropping systems adopted by the farmers in the study area. It may serve as a basis for advocating appropriate changes in the prescribed cropping pattern and to suggest rational cropping patterns.

The importance of study:

The main objective of this study is to evaluate the economics of vegetable based cropping system among the prevailing cropping system, in respect of available production resources and resource utilization pattern in the production of different cropping system. The present investigation thus, may be helpful to the individual farmers in increasing farm profit by using the finding of this study. The foremost important of its lies the determination of optimum use of resources for different cropping system so that farmers get maximum profit with available input.

Limitations:

The most important limitation of this study is that it pertains to the data collected for only vegetable crops growing in different seasons (kharif and rabi, one year cropping system) in the agricultural year 2015-16. Moreover, the farmers do not keep records of their farm enterprise and provided the data on recall memory. Thus, there is possibility of certain bayous to enter in the present study. Lastly, its coverage is very limited i.e. the study covers one block and in this block only limited respondents.

CHAPTER - II

REVIEW OF LITERATURE

Scanning of relevant literature is helpful in formulating the framework of research problem undertaken. The researcher would be able to make an improvement over the existing studies and also expend the horizon of investigation on the subject matter. The review could also help in refracting the concept and statement, which were made in the earlier studies as well as for supporting of the present study. The attempt of new research worker is to study the literature related to the problem undertaken. Therefore, it forms an integral part of any systematic research work. Hence, an effort was made in this chapter to review the selected references as keeping in view of objectives of the study as under.

1. Vegetable based cropping system.
2. Profitability of vegetable based cropping system.
3. Constraints and suggestion related to existing cropping system.

2.1 Vegetable based cropping system:

Deshmukh (1980) observed the economics of cropping pattern in Madhya Pradesh. He studied that in order to assess the progress of multiple cropping programme over years in different areas, it is necessary to ensure that the same definition is adopted in all the different districts. To acquire a correct picture, either crop reporting surveys should be conducted by each at the seasonal planning period or an attempt should be made to find out the areas planted in each of multiple cropping rotations. The most important of the measures which multiple cropping programme are (i) Emphasis should be given on economic aspects trough the extension basis. (ii)Co-ordination of the marketing and prices policies with the programme of multiple cropping should be followed. Lastly it is concluded that marginal productivity of land increased at the increasing rate as the unit area of land increased under the irrigated conditions, while un-irrigated condition, it increase their farm income through the increasing of their farm size only.

Shaxson and Tauer (1992) the diversity of cropping system on small hold farms in southern Malawi was analysed using a frame work that explicitly incorporates the extent of intercropping of each crop in the overall cropping system. Six indices of

diversity were constructed for 208 farms and used in model of welfare. Study reported that maximizing farm household to example the reason for diversity in cropping system. Multiple regression technique was used to determine the effect of different household characteristics on diversity. The result suggests that on increase in labour availability over the production period is associated with more divers cropping system. Land holding size also influence diversity, which rises to a maximum and than falls as the area cultivated per capital increases. Farmers who grow non-food case crop (Tobacco) have more diverse cropping system than these who do not. As diversity increase, farmers use intercopping system that are more substitutive than additive.

Kumar *et al.* (1996) the cropping pattern during the pre- and post- green revolution period in different agro- climatic zones of plateau region of Bihar, India is examine. The growth rate in area, production and productivity during the same period is measured and the average productivity under the two periods is studied. Data represented from variety at sources. The study period is divided in to four: pre-green revolution period (1959-68) as period I, post green revolution period as period II (1969-70 to 1979-80), period III (1980-81 to 1990-91) and period IV (1969-70 to 1990-91). There was a shift in cropping pattern in favor of wheat and potato crops after introduction of the green revolution in all zones of the plateau region. The yield of paddy per hectare found to increase during the green revolution.

Karurasena (1997) conducted a study to evaluate the productivity of cropping pattern of command areas two village tanks (VTS) in Sri Lanks in relation to resource utilization. The VTS selected were Ambalegoda (North dry zone; cropping intensity 1.36) The Ambalegoda scheme had a higher ratio at catchments area; command area (16.7) and capacity: tank bed area (1.44) when compared to Elapathwewa (2.1 and 1.27 respectively) indicating that Ambalegoda scheme has hydrological potential to grow other field crops (OFCS) or rice/OFC mixtures. With proper land selection, a rice-chilli cropping pattern was established and evaluated in Maha 1996-97 in the command area of Ambalegoda VT. In this VT 24% of farmers decided to cultivate both rice and chilli while 76% opted for rice only. Chilli was selected based on high net returns and low water requirement. The command area of Elapathwewa was left fallow because of low rainfall and low tanks storage. Chilli recorded higher net return than rice per unit land

area, capital, water and material cost indicating the feasibility of cultivating OFCS in Ambalegoda VT. The probability of having a Maha season the need in this VT to utilize the water resources more efficiently for production in dry seasons.

Saleth (1999) the study assesses the nature and direction of cropping pattern change both at in all India and a states level and explains their cause and consequences. The study reveals that the economic and non-price factors affect cropping pattern change at macro and micro level, consequently the farm employment reduced and cost imbalances weakened the traditional inter-sectoral linkages between crop and livestock sectors and environment degradation. The area has shifted from cereal to non cereal crops by 3.36%. Pulses and food grains was declined by 1.57% and 4.92% respectively. In cereals crops and oilseeds have gained up by 4.08% especially in the rainfed parts of central and western India. The technology mission on vegetable production helped in raising the yields and productivity specially in Madhya Pradesh (8.3%), Rajasthan (7.4%), Andhra Pradesh, Haryana and Karnataka all below 2%.

Jha (2003) stated that an agricultural system is a synthetic system, embedded in the natural and social systems it is defined as an assemblage of components which are united by some farm of interaction and interdependence. A hierarchical classification of agricultural systems is starting from the simplest relationship at the base to the regional, national or even global profile of the area. When we intervene at any level or order through technology, institutions, investment, prices, the final effects on the farmers and the system is mediated through several interactions.

Bala and Sharma (2005) reported that the spectacular shift in the cropping system during 1990-91 to 2002-03 in the Kullu district. The traditional cereal crops have been almost completely replaced by the vegetable crops. The dominance of relatively short duration vegetable crops in the cropping system has raised the cropping intensity. The vegetable crops being highly labour-intensive have generated more employment in the villages. The overall labour employment has increased by about 49 percent. The agriculture income per farm has increased by 332 percent over the period. Consequently, the general standard of living of the farming community has been perceived to be uplifted.

Garg *et al.* (2006) reported that the rice-wheat cropping system has been the fastest growing cropping system in North Eastern Haryana. Study showed that this predominant cropping system have high potential area, hence, agricultural scientist should make effort to diversification through value addition and demand driven technology generation as vegetable based cropping system.

Joshi *et al.* (2006) reported that viability of small farms can be improved through diversification of agriculture into higher value crops like fruits and vegetables. They have assessed the impact of diversification of agriculture towards vegetables on farm income and employment using household level in formation from the Indian state of Uttar Pradesh.

2.2 Profitability of vegetable based cropping system:

Singh and Grover (1992) in their study worked out the economics of wheat crop which followed rice, maize, potato and cotton by collecting data from farmers selected from different agro-c1imatic areas of Punjab State. Variable cost of wheat per acre worked out to Rs.2503, Rs.1887, Rs.2002 and Rs.2027 when the crop was followed by potato, maize, cotton and rice, respectively. The returns over variable cost were the highest (Rs.2023 /acre) for wheat or maize farms, followed by Rs.1823 on weed farms, Rs.1248 on cotton farms and Rs.857 on potato farms.

Chand (1996) study the effect of agricultural diversification (fruit and vegetable production) and other relevant socioeconomic factors on farm and off-farm employment. The nature of the relationship between the off-farm employment and the level of agricultural progress was made diversification in Himachal Pradesh. Data were collected from 225 households of Solan block, Solan district, Himachal Pradesh. Data from the 1981 and 1991 census and other official sources are also used. Agricultural growth initially might have resulted in faster growth in employment in farm activities compared to off-farm activities, but as growth spreads and becomes broader based; it results in the faster growth of off-farm employment. It is concluded from the study that agricultural diversification through fruit and vegetable production in hill regions is a very effective to promote off-farm and on-farm employment.

Arjun Prasad and Sam (1990) conducted cropping systems studies during 1978-81 at Central Soil and Water Conservation Research and Training Institute, Bellary.

Among the different cropping systems tried, both triple cropping sequences of bajra-cowpea-jowar and bajra-coriander-jowar gave higher combined net returns of Rs.18,850 and Rs.17,981 per hectare and cost of cultivation were Rs.5406 and Rs.5447 per hectare, respectively. The net returns in these systems were 55 and 47 per cent more than that of maize-safflower cropping system.

Ashok *et al.* (2002) studied on profitability, risk and impact of diversification and suggest that vegetables, pulses, dairy was the most appropriate choice for the farmers of the study area there by they could increase their farm income as much as 47.76 per cent over the existing farm income. However the pure vegetable farming was found to be more risky and less remunerative. The coarse cereals, pulses and oilseed having low profitability did not enter into programming. However the area under cereals for subsistence level was kept as a constraint to have area under them in optimum cropping system. Therefore the study suggests that if we have to retain these eco friendly crops to promote human health the productivity and profitability have to be further enhanced through research efforts. The study clearly indicated the fact that risk could be notably decrease if the farmers diversify their cropping system. The study has further evaluated different plans showing different level of risk and income associated with them. Therefore the farmers have an option to choose different plans, suggested by the model as per their income risk criterion.

Gupta *et al.* (2003) A field experiment was conducted during winter 2000-01 under the Dryland Project at Kuthulia Farm, Rewa (Madhya Pradesh, India) to evaluate the most profitable high-value rabi crops among wheat cv. C-306, barley cv. RD-2503, chickpea cv. JG-322, lentil cv. JLS-1, mustard cv. Varuna, linseed cv. J-23-10, methi [Trigonella foenum-graecum] cv. Panipat and coriander [Coriandrum sativum] cv. Gaurav, grown after vegetable crops under pre-sowing irrigation from the water-harvest tank. Wheat recorded the highest grain yield (19.23 q/ha), net return (10 422/ha) and benefit:cost ratio (2.60). Although barley was the second best after wheat in terms of grain yield, lentil was the second best in terms of net return. Chickpea was the third best, providing yield of 6.27 q/ha and net return of 54.05/ha, with benefit: cost ratio of 1.35. Barley, linseed and mustard recorded almost equal net returns.

Singh (2004) in his study on economics of efficiency in vegetable business

system reported that cost of cultivation for tomato, onion, arvi, okra, brinjal and potato was estimated at Rs.12,599.00, Rs.13,338.10, Rs.9,742.10, Rs.10,046.40, Rs.11,274.60 and Rs.13,480.20 per hectare, respectively. Further, it also showed that about 95 per cent of the cost of cultivation of these vegetables constituted human labour and working capital cost. The cost on bullock labour for these vegetables ranged from 4 to 5 per cent. The per hectare net profit of vegetable growers for tomato, onion, arvi, okra, brinjal and potato were estimated to be Rs.31470.25, Rs.2644.34, Rs.22015.90 and Rs.31353.60, Rs.29205.40 and Rs.25328.25, respectively.

Joshi *et al.* (2004) study on economic viability of different farming systems and reported that the maximum profit per hectare was obtained from onion and sugarcane i.e. Rs.59031 and Rs.50012 respectively. Study showed that the rainfed crops like urad, sorghum and chickpea were realized next profitable crops after onion.

Suresha (2007) observed in chilli based intercropping systems were carried out using six intercrops at Department of Horticulture, College of Agriculture, Raichur of University of Agricultural Sciences, Dharwad. The study was conducted to know the effect of different intercrops viz., radish, carrot, onion, garlic, cluster bean and dolichos bean on chilli. Significantly the highest (75.16 q/ha) yields were obtained in sole chilli. Yield of chilli varied with different intercropping systems. Radish + chilli intercropping system results in realization of significantly the highest (72.05 q/ha) yield in chilli followed by chilli + carrot (70.77 q/ha). On the contrary 'chilli + cluster bean' resulted in lower yield of 64.43 q/ha. Further, economic analysis was also carried out. The highest net returns (Rs. 59,261/ha) and B:C ratio (1.75) were obtained in chilli, which was intercroped with garlic. On the contrary, the lowest net returns (Rs. 12744 and B:C ratio (1.01) were obtained in sole chilli. This obviously reflected the importance of intercropping to increase the productivity per unit area. Further, it also offer insurance against crop failure.

Hari Om *et al.* (2008) reported that the highest wheat equivalent yield (233.5 q/ha/year) was obtained in rice (short duration)-potato-onion sequence closely followed by rice (short duration)-potato-bittergourd (230.6 q). The lowest wheat equivalent yield (123.6 q) was recorded with the prevailing rice-wheat system. All the rotations provided higher wheat equivalent yield than rice-wheat system. The highest net return of

Rs.63,850 per ha was recorded with rice (short-duration)-tomato-cucurbits sequence followed by rice (short-duration)-potato-onion (Rs. 63,812), rice (short duration)-potato-bittergourd (Rs. 62,187), rice (short duration)-pea-onion (Rs. 57,000) and rice (short duration)-cauliflower-chillies (Rs. 55,162) sequences. Rice-wheat system proved to be the least remunerative (Rs. 32,438/ha) out of the 10 sequences evaluated. Benefit: cost ratio in rice-wheat system was 1.45. All the cropping systems under study registered either higher or at par benefit: cost ratio with the existing rice-wheat system.

Singh *et al.* (2008) reported that Field experiment was conducted during 2000-2003 on diversified rice-wheat cropping systems involving potato, vegetable peas and groundnut, and water management treatments in rice to increase the production, economics and water use efficiency. Inclusion of potato, vegetable peas and groundnut in rice-wheat cropping system increased the production, economics and land use efficiency on an average by 95, 75 and 11 percent, respectively. Rice equivalent yield (REY) was maximum in rice/ groundnut/rice(R/G/R)-potato-wheat (24.60 t/ha/yr), which was at par with rice-potato-wheat (24.27 t/ha/yr) followed by rice vegetable peas-wheat (19.02 t/ha/yr) as against traditional rice-wheat (11.63 t/ha/yr) system. Net returns was the highest in rice-vegetable peas-wheat (Rs.67540/ha/yr) system, which was at par with R/G/R-potato-wheat (Rs.67424/ha/yr) and rice-potato-wheat (Rs.64906/ha/yr) as against rice-wheat (Rs.38159/ha/yr) system. Irrigation to rice crop at hairline cracks (HC) in soil saved about 20 percent of total water use on an average in different cropping systems compared to traditional system of irrigating rice at disappearance of ponded water (DP). Decline in available soil K ranging from 4.0 to 12.0 percent and build up of available soil P from 41.7 to 62.5 percent was recorded from initial soil test values after 3 years in different cropping systems. The apparent soil nutrient balance (gain/loss) was negative for K (243-440 kg/ha) and positive for P (57.6-151.1 kg/ha) with varying degrees in different cropping systems.

Chauhan (2008) observed that the per hectare gross return from soybean-wheat cropping system was found to highest (Rs.47998 per hectare) followed by cotton crop (Rs.43894 per hectare) soybean-gram cropping system (Rs.43679 per hectare) maize+moong-gram cropping system (Rs.40605 per hectare) and cultivation of chilli as vegetable crop (Rs.38169 per hectare) respectively. The minimum gross return was

obtained from tur mixed cropping i.e. (Rs.18354) per hectare from tur+urad and (Rs.15091 per hectare) from tur+jowar cropping systems respectively.

Kumar *et al.* (2008) reported among the systems, rice - fenugreek -okra realized the highest net returns (Rs.96286/ha) followed by rice-onion-cowpea (Rs.84511 /ha). Inclusion of vegetable crops like fenugreek, okra, onion and cowpea in these cropping systems besides, increasing the system productivity, fetched higher market price thereby, increasing the net returns.

Walia *et al.* (2010) reported that maize-potato-onion cropping system gave the highest rice equivalent yield (22.5 tonnes/ha/annum), followed by summer grountnut-potato-peralmillet (fodder) (15.8 tonnes/ha/annum) and maize-potato-summer moongbean (15.8 tonnes/ha/annum). The highest net returns of Rs.48617 per hectare per year were realized from maize-potato-onion cropping system.

Jat *et al.* (2011) reported that inclusion of vegetable crops in rice- based crop sequences improved the net returns. Growing vegetable crops during summer in areas with assured irrigation facilities is economically remunerative as supply of vegetables from rainfed areas is drastically reduced during summer and vegetable prices soar up. Therefore, excess of vegetables produced can be transported in areas of high demand. However, rice-wheat-greengram and rice- sorghum-greengram, rice-wheat- greengram and rice-mustard-greengram, rice- sorghum-greengram and rice-chickpea -cowpea; and rice-sorghum-groundnut and rice-chickpea –cowpea remained at par in terms of net returns. Lowest net return (Rs.20448/ha) was obtained with rice-wheat -fallow cropping system. Returns per rupee invested was highest for Rice - fenugreek -okra (Rs.2.84) followed by rice-mustard-greengram (Rs.2.19). This was due to high gross returns of these systems.

2.3 Constraints and suggestion related to existing cropping system:

Chand (1996) study the effect of agricultural diversification (fruit and vegetable production) and other relevant socioeconomic factors on farm and off-farm employment. The nature of the relationship between the off-farm employment and the level of agricultural progress was made diversification in Himachal Pradesh. Data were collected from 225 households of Solan block, Solan district, Himachal Pradesh. Data from the 1981 and 1991 census and other official sources are also used. Agricultural

growth initially might have resulted in faster growth in employment in farm activities compared to off-farm activities, but as growth spreads and becomes broader based; it results in the faster growth of off-farm employment. It is suggested on the basis of result of the study that agricultural diversification through fruit and vegetable production is a very effective to promote off-farm and on-farm employment, hence, in cropping pattern vegetable production should be taken care.

Ashok *et al.* (2002) studied on profitability, risk and impact of diversification and suggest that vegetables, pulses, dairy was the most appropriate choice for the farmers of the study area there by they could increase their farm income as much as 47.76 per cent over the existing farm income. However the pure vegetable farming was found to be more risky and less remunerative. The coarse cereals, pulses and oilseed having low profitability did not enter into programming. However the area under cereals for subsistence level was kept as a constraint to have area under them in optimum cropping system. Therefore the study suggests that if we have to retain these eco friendly crops to promote human health the productivity and profitability have to be further enhanced through research efforts. The study clearly indicated the fact that risk could be notably decrease if the farmers diversify their cropping system. The study has further evaluated different plans showing different level of risk and income associated with them. Therefore the farmers have an option to choose different plans, suggested by the model as per their income risk criterion.

Rajkumar and Hari Singh (2002) studied problems in vegetable production. The problems reported were, poor quality seeds (42.2%), insufficient availability of seed (40%), high cost of seed (31%) and non-availability of seed at appropriate time (12.2%). The other problems noticed were high cost of fertilizer, poor state of fertilizer and plant protection delivery system in the district. High wages and shortage of labour was also one of the constraints.

Bala and Sharma (2005) reported that the spectacular shift in the cropping system during 1990-91 to 2002-03 in the Kullu district. The traditional cereal crops have been almost completely replaced by the vegetable crops. The dominance of relatively short duration vegetable crops in the cropping system has raised the cropping intensity.

The vegetable crops being highly labour-intensive have generated more employment in the villages. The overall labour employment has increased by about 49 percent. The agriculture income per farm has increased by 332 percent over the period. Consequently, the general standard of living of the farming community has been perceived to be uplifted hence, suggested for vegetable base cropping system.

Choudhari (2012) reported that the production portfolio of the sample farmers (cropping system) is a mix of cereals, pulses, oilseeds, vegetables and other commercial crops. The data in study revealed that entire cropped area is found to be dominated by cereal crops with an average 2.90 hectare per farm in current year and that of 3.56 hectare in before diversification. This showed the decrease in area about 0.66 hectares per farm in current cereal area over before diversification. The study also reported that the problems confronted by respondents are divided into five parts and each part having their own importance. The most important constraints were found to economic cause (rank Ist) followed by natural causes responses (rank IInd), technological cause responses (rank IIIrd), social cause responses (rank IVth) and institutional infrastructure cause responses (rank Vth) respectively.

CHAPTER - III

MATERIAL AND METHODS

Every research carried out on scientific line should have a research design to be applied as per the stated problems. For this, in present study a design has been drawn for classification of research method adopted. The present study is concern with economic importance of vegetable based cropping system prevailing in area which may be caused various economic problems. Solving these problems often without being conscious of the fact that while doing so researcher are engaged in scientific research is thus, nothing but a scientific method which, obviously, means a systematic approach to a problem under consideration. Each time researcher do research and become wiser, our behaviour changes. The distortion of observed facts because of our biases makes us difficult to be truly scientific. Once researcher follows the scientific method they have to discard their biases.

A scientific research is a systematic method of discovering new facts or verifying old facts through sequences, interrelationship, causal application and through the natural laws which cover them. When the research is in social science it involves the analysis of human behaviour or trend of social phenomenon to formulate broad principles of scientific concepts. The research than becomes a careful or diligent scientific or scholarly enquiry and a special study or experimental aimed at the discovery, interpretation or application of new facts to formulate a theory or law.

In the process of research a basic concept regarding theory and its application in present investigation is must for perfect and accurate finding of cause and effect relationship, therefore, it is important to follow the methods prescribed for empirical research. Since the empirical research has the immediate social usefulness one must take the method follow-up by work of others and must learn through the trial and error method. Empirical research is based on inductive logic so in empirical research factual and material evidences and census data are used to develop the descriptions, measurements comparison and test the hypothesized relationship that are themselves part of speculative side of scientific work. Research methodology also involves to built

ability to raise significant questions and to formulate fruitful hypotheses which demands appropriate technical methods which are helpful in selection of sample, method of enquiry and statistical tools used to conserves knowledge and the dynamic approaches which are interrelated with objectives through the process of analysis and verification for which scientific reasoning and logic is employed thus achieving rationality in the conclusion drawn. The research methodology and design are the main feet for waking, thus making the research move ahead. This chapter involves various steps applied to the study of the problem. The material and methods are described in the following sub heads:

I. The study area.
II. Sampling procedure.
III. Nature of data and its method of collection.
IV. Period of study.
V. Analytical procedure etc.
VI. Concept of cropping system.

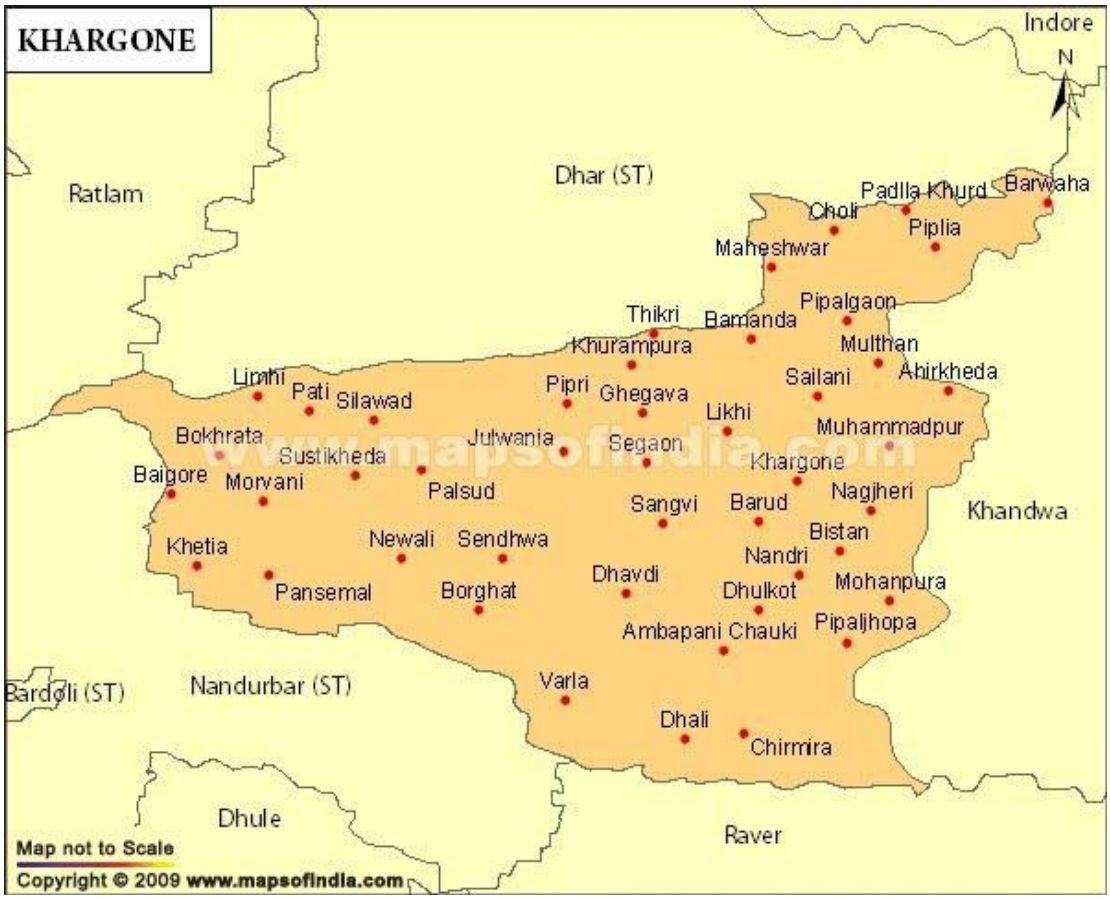
3.1 The study area:

The description about background information of study area is essential, so that researchers can correlate the finding with the prevailing conditions under study.

Location:

Khargone district formerly known as West Nimar district and lies between 21°22' and 22°35' North latitude and 74°25' and 76°14' East longitude. The district is surrounded by Dhar, Indore and Dewas in the north side, state of Maharashtra state in the south side, Khandwa, Burhanpur in the east side and Barwani in the West side. Khargone district covers the 8030 km2 area. Area of the district is 8030 km² and According to the 2011 census Khargone District has a population of 1,872,413. The district is divided into 5 sub-divisions, which are further divided into 8 tehsils. Barwaha sub-division has only one tehsil, Barwaha with the town bigger than Barwaha name *Sanawad*. Bhikangaon sub-division has two tehsils, Bhikangaon and Jhiranya. Kasrawad sub-division has only Kasrawad tehsil while Khargone sub-division has three tehsils, Khargone, Bhagwanpura and Segaon. Mandaleshwar sub-division has one tehsil, Maheshwar. Khargone town is the administrative headquarters of the district.

Other towns are Maheshwar, Kasrawad, Segaon, Bhagwanpura, Jhiranya, Bhikangaon and Barwah. Maheshwar is a place of tourist attraction as the former capital of the Haihayas and the Holkars of Indore. The Khargone district is presented in following map.



Climate:

Khargone has a tropical wet and dry climate and a humid subtropical climate. Summer is extremely hot and dry and it lasts from the mid of March till mid of June with the temperature above 40 C during April May, during these months the dry and hot wind blows in this area widely affects the local ecology. The temperature also remains quite high during the night. The monsoon season arrives in late June, with temperatures around 29 C. Rainfall of about 36 in, the rainy season is humid and experiences considerable rainfall. Local people are often affected by the floodof River Kunda which in the outskirts of the city. Dry, mild and sunny winter enters in mid-November the average temperatures is about 4-15 C, but often falls to freezing point during the night.

Land:

Sandy loam and black loam soil is generally found in the area. This soil is quite suitable for growing cotton, jowar, maize, soybean, arhar, moong, groundnut, wheat, lentil etc.

Main crops:

The major crops of the district are soybean, cotton jowar, arhar, maize and groundnut in kharif and wheat, gram and lentil in rabi season. Vegetable cultivation is also popular is Khargone district.

Horticulture progress in the district:

Horticulture looks after various fruits and vegetables. The department oversees production of Red chillies in the district – the second largest producers in the country, with an annual production of 60,000 tones. The department promoted various new technologies such as Drip irrigation and worked upon new technologies in various institutes such as ICAR in the country. The major technique used in this department was 'Grafting' – where the stem from a mature plant of the fruit was tied to the sapling of a young plant, so that it could absorb more minerals. The average time of the plant to be able to bear the fruit is thus reduced from six years to three years. the main horticultural crops in respect to production and productivity in Khargone district is presented as below.

Production and productivity of horticultural crops

Sl.No.	Fruits	Production ('000 tonnes)	Total Productivity (kg/ha)
1	Mango	6.00	30000
2	Guava	7.25	20000
3	Banana	23310	90000
Vegetables			
1	Potato	2.530	22000
2	Onion	7.875	25000
3	Tomato	4.040	20000
4	Chilly	43.957	2500
5.	Coriander	0.607	1200
6	Ginger	2.400	15000

Source (National Horticulture Mission Department of Agriculture and Cooperation (DAC) Krishi Bhawan, New Delhi [2012])

The above data regarding vegetable production depicted that potato, onion and tomato are the main vegetable crops in the district. Chilli is the main crops growing in the district it may be also considered under vegetable crops. Hence, following vegetable based cropping system is prevailing in the area.

1. Cropping system-I Chilli - Chickpea
2. Cropping system-II Jowar - Tomato
3. Cropping system-III Maize - Onion
4. Cropping system-IV Mong/Urad - Potato

3.2 Sampling Procedure:

Khargone district was selected for present study due to higher changing cropping system in irrigated area where double cropping system in a sequence is found to more prospects. The diversification towards vegetable in crop rotation found to popular. On the other hand, the Khargone district is one of the districts in the State where maximum farmers are having small to medium holding in which they are mostly cultivating cotton, chilli and vegetables in their cropping system to reaping maximum income and employment. Vegetable based cropping system is newly practices by farmers, hence, attempt was made for economic analysis.

Multi stage sampling technique was used for drawing a sample for the present study.

Selection of block:

The district Khargone is comprises of 9 blocks. At first stage, Khargone block in Khargone district was selected purposively due to higher area under vegetable based cropping system.

Selection of villages:

At second stage of selection, a list of all the villages in the selected block was prepared where vegetable based farming practices are common prevailing by farmers. Among these villages, top 5 villages having maximum area under vegetable based cropping system was further selected purposively for the study.

Selection of respondents:

At the third stage of sampling, a list of all the farmers of these selected villages was prepared who are the major adopters of vegetable based cropping system. Among,

this list 75 farmers was selected on random basis. Thus, 75 vegetable growers were selected for study by sample random sampling method.

Allocation of farmers:

All the selected vegetable growers were divided as per adoption of vegetable based cropping system and the following allocation of farmers have been found.

S.No.	Cropping system	Crops	Numbers of farmers
1	Cropping system-I	Chilli - Chickpea	20
2	Cropping system-II	Jowar - Tomato	18
3	Cropping system-III	Maize - Onion	20
4	Cropping system-IV	Mong/Urad - Potato	17
Total			75

3.3 Nature of data and its method of collection:

In present study, both primary and secondary data were used to find out the findings of study.

Primary data:

Primary data was collected from sample farmers regarding general information of the respondents and its family members, farm resource structure and cropping pattern etc. The specific and detail information was recorded on cost incurred and returns obtained from cultivation of vegetable based cropping system existing in real farm situation. The working or operational costs was taken into two parts i.e., operational (labour) and material used. The other required information was also collected from respondents as per the stated objectives.

Secondary data:

The required secondary data was collected from department of agriculture, horticulture and published record of Statistics Department.

Method of data collection:

The data were collected using survey method. The data on different aspects of cost and returns from cultivation of different cropping pattern was collected through pre-

tested interview schedule. Each of the selected sample farmers was approached personally for recording relevant data (Appendix-1).

3.4 Period of the study:

The period of the study was related to the agriculture year 2014-2015.


माध्य. विद्यालय


पं कार्यालय ग्राम पंचायत केदवाँ


उपस्वास्थ्यकेन्द्र भवन शकरगाँव

3.5 Analytical procedure:

The data was tabulated in light of objectives of the study and analyzed by using mean, percentages etc. The costs and returns were worked out using different costs and return concepts.

(a) Cost concepts:

The cost of cultivation classified as recommended by, “Special expert committee on cost estimates, GOI, New Delhi”, was used in this study. The cost concepts are given below:

Cost A_1: It includes: -

i. Value of hired human labour,
ii. Value of hired and owned bullock labour,
iii. Value of hired and owned machinery labour,
iv. Value of owned and purchased seed,
v. Value of fertilizers, manures and chemical,
vi. Value of insecticide and pesticides,
vii. Expenditure on irrigation,
viii. Land revenue and taxes,
ix. Interest paid on crop loan if taken,
x. Depreciation on farm assets excluding land,
xi. Interest on working capital,
xii. Miscellaneous expenses.

Cost A_2: It includes-

Cost A_1 + rent paid for leased in land

Cost B_1: It includes-

Cost A_2 + interest on value of owned fixed capital assets. (Excluding land)

Cost B_2: It includes-

Cost B_1 + rental value of owned land

Cost C_1: It includes-

Cost B_1+ imputed value of family labour

Cost C_2: It includes-

Cost B_2 +imputed value of family labour

Cost C_3: Cost C_2 + 10 percent of cost C_2 to account for managerial input of the farmer.

Evaluation of farm inputs:

Methods followed in evaluating different farm input for the present study are described in the following paragraphs.

i. Hired human labour:

The farmers normally engage permanent farm labour on the basis of yearly wages and casual labour on daily wage basis for performing farm operations. The casual labour was evaluated on the basis of actual wages prevailed in the locality. The wages of male and female labour included payment given both in cash or kind. The value of kind components given to the labour was calculated at their prevailing market prices.

ii. Family labour:

The family labour cost was evaluated at the rate of prevailing wage rates in the locality for casual hired labour at various stages of operations.

iii. Bullock and machinery labour:

Estimation of bullock and machine labour charges on actual wages prevailed in the locality were considered.

For estimation of depreciation, interest on working capital, interest on fixed capital and rental value of owned land, following standard norms were used.

iv. Depreciation on farm assets:

The straight-line method is used for calculating rate of depreciation @ 10 per cent of assets value excluding land on per unit area basis.

v. Interest on working capital:

It is worked out @ 12.50 percent for half of the duration of the crop.

vi. Interest on fixed capital:

Interest is charged @ 10 percent per annum on the value of implements, machineries, farm building, and irrigation structure and draft animals. It excludes interest on land input, because rental value of owned land is calculated separately.

vii. Rental value of owned land:

It is calculated on the basis of 25 per cent (1/4) of the gross income or prevalent rate in the area for the same.

(b) Return concepts:

Value of farm produce:

This includes the value of main product and the by product of the crop. The harvest price of the crop was considered for calculating the value of main produce. The value of by product was calculated at the prevailing price in the locality.

Profitability:

For the estimation of profitability from cultivation of crops, the following efficiency measures were used in this study:

(i) Gross income,

(ii) Net farm income,

(iii) Family labour income,

(iv) Farm business income,

(v) Input- output ratio,

These are defined as under: -

(i) Gross income: It is defined as: total value of main product +by product.

(ii) Net farm income: It is defined as: gross income – cost 'C_3'

(iii) Family labour income: it is defined as: gross income- cost 'B_2'

(iv) Farm business income: It is the gross value of output at farm harvest prices (Main product +by product) – cost 'A_1'

(v) Input – output ratio

$$\text{Input- output ratio} = \frac{\text{Gross income}}{\text{Cost of cultivation}}$$

3.6 Concept of cropping system:

A cropping system refers to the principles and practices of cropping and their interaction with farm resources, technology, aerial and edaphic environment to suit the regional or national or global needs and production strategy. It is an important component of farming system.

CHAPTER - IV

RESULT AND DISCUSSIONS

In this chapter the result of the study is presented after tabulation, analysis and interpretation of data. The result is presented in the light of stated objectives of the problem. It can be say that the matter presented in this chapter is concerned with the analytical results as per the stated objectives. The chapter also focused on detail discussion of the result found in the study. The study was conducted to assess the profitability of different vegetable based cropping system in a region. It is well known fact that the cropping systems, by and large, are affected by the national food need and the strategies planned to boost agricultural productivity. Cropping systems are the resultant product of principle and practices of cropping, resources, environment and available package of technology (production & management). Due to change in production technology (capital intensive) and marketing risk (marketing price) the farmers look upon the financial gain from the prevailing cropping system in the area.

It is well known fact that due to economic profit motive in general, the farmers are making decision regarding changes on their own farm. Profitability is thus the major criterion of adoption of an enterprise or practice. Farm as a business enterprise, farmers considers all possible aspects of an enterprise for the farm as a unit. It does not concern with merely one profitable enterprise, but with most profitable enterprise combinations to obtain maximum income from the farm as a whole, on continues basis, exploiting the advantages of complementarily and supplementary in the farm enterprises. That is reason shifting from subsistent farming to commercial farming to some extent, it implies shifting from low value food/non food crops to high value food/ non food crops and switching over from local to high yielding varieties with the integration of animal husbandry, fisheries, horticulture etc. It was observed that in Khargone district, farmers are growing higher area under vegetable due to its higher profitability. This attributed to change the cropping system and vegetable given more importance in the cropping system as existed before. The study was considered "Economics of vegetable based cropping system" to find out economic importance of vegetable in the area. The present study was investigation with following subheads:

1. Vegetable based cropping system.

2. Socio economic characteristics of respondents.
3. Cost structure of vegetable based cropping system.
4. Profitability of vegetable based cropping system.
5. Constraints related to existing cropping system.
6. Suggestions for increasing production level of vegetable based cropping system.

4.1 Vegetable based cropping system:

The kind and sequence of crops grown on an area of land over a period of one year was considered as cropping system. During the study it was observed that ingeneral following vegetable based cropping system is prevailing in study area. The whole study was considered only of this commonly prevailing cropping system.

1. Cropping system-I Green chilli - Chickpea

2. Cropping system-II Jowar - Tomato

3. Cropping system-III Maize - Onion

4. Cropping system-IV Moong/Urad - Potato

4.2 Socio economic characteristics of respondents:

Socio-economic characteristics of respondents in study area considerably influence various economic activities right from production, distribution, and exchange to final consumption of product which is directly related with economy of farmers. Thus, the social believes and personal characteristics influence the techniques of production particularly the use of improved technology and practices in production process. The social factors such as the size of family, literacy, sex-ratio, social disparities, socio-economic status, caste rigidities, social mobility etc, either retard or promote the process of economic growth by influencing the efficiency in production process. It is therefore, necessary to conduct a micro level study related with socio-economic aspects of respondents. An attempt in this direction is made in present part of chapter as cross section data collected form selected respondents and have been analyzed and presented in different parts.

Family structure:

Family structure is one of the production factors because most of the farmers are using family labour in production process. The family structure is determined as socio

economic characteristics of farm family. Keeping the importance of farm family this part of study is primarily concerned with micro level analyses of general socio economic information of sample farmers. Since, socio economic characteristics of farmers and their family reflect the efficiency of farm, level of resource use and decision making process. Hence, it is very important to study these characteristics of the sample farmers. These characteristics mainly concerned with age, education level of farmers and size of family, work force availability in individual family. The data on distribution of sample farmers according to their age and education level is presented in table 4.2.1 as per different prevailing cropping system.

a) Age and education level:

Table: 4.2.1 Distribution of farmers according to their age and education as per different prevailing cropping system. **(n=75)**

S.No.	Description	Cropping system				
		I	II	III	IV	Total
A.	Average age (year)	44	45	43	45	44
B.	Education level					
1.	Illiterate and functionally educated	8 (40.00)	7 (38.89)	7 (35.00)	8 (47.06)	30 (40.00)
2.	Primary and middle education	7 (35.00)	7 (38.89)	7 (35.00)	5 (29.41)	26 (34.67)
3.	High school and above	5 (25.00)	4 (22.22)	6 (30.00)	4 (23.53)	19 (25.33)
4.	Total	20 (100.00)	18 (100.00)	20 (100.00)	17 (100.00)	75 (100.00)

Figure in parentheses show the percentage of total.

The data shows that the average sample farmers found to about 44 years of age. The average age of sample farmers varied from minimum 43 year in cropping system III (Maize - Onion) and maximum 45 years in the cropping system II (Jowar - Tomato) and cropping system IV (Moong / Urad - Potato).

Regarding literacy position, the illiterate and functionally literate farmers found to be on an average (40.00 per cent) of total farmers. The result shows that the maximum farmers (60.00 per cent) were found to be literate. Among the literate, it was obvious that maximum number of farmers were found to be passed out primary and middle school level (34.67 per cent) followed by high school and above (25.33 per cent) respectively.

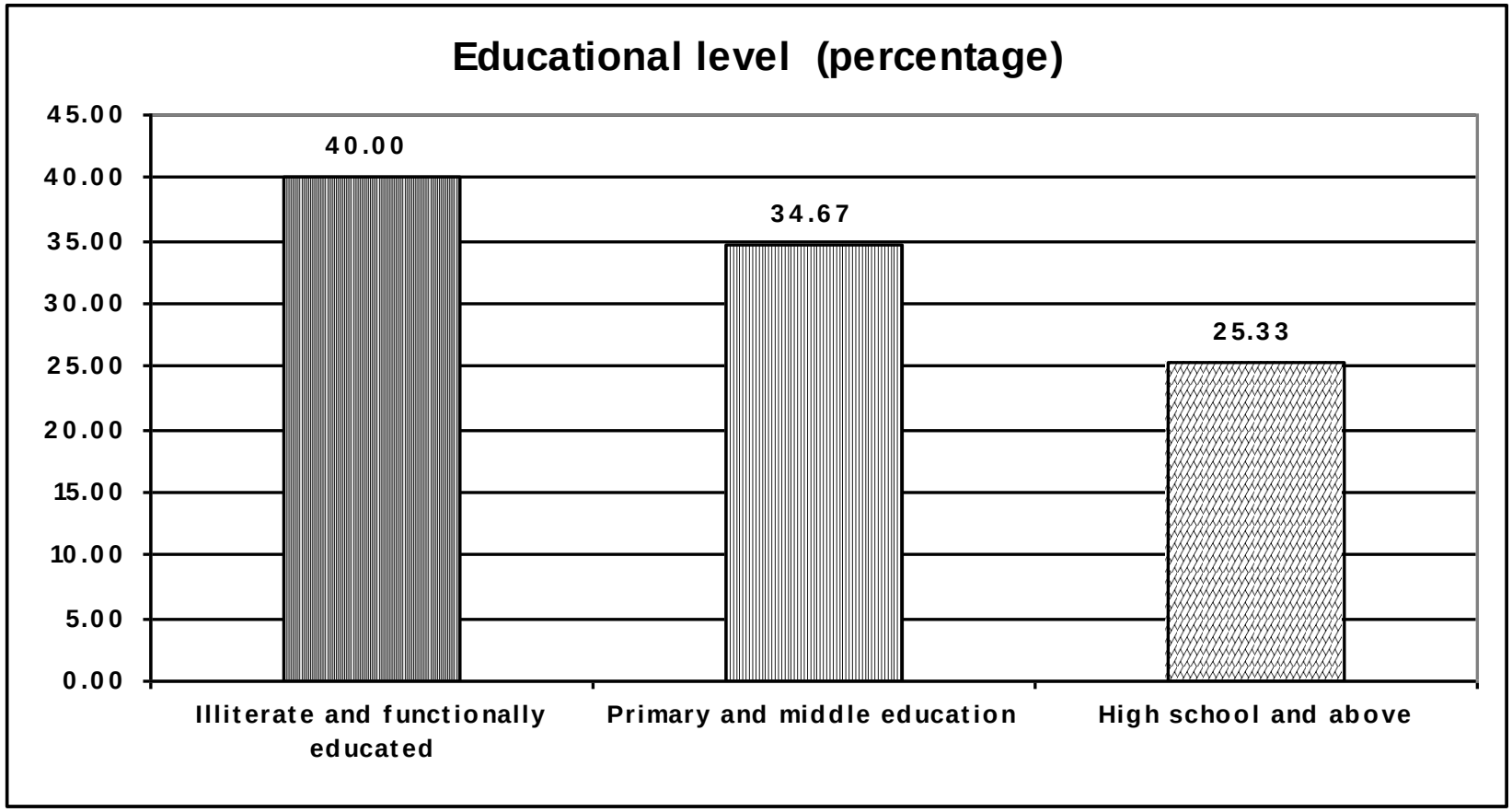


Fig. 1 Distribution of farmers according to their education.

The literacy position is also presented in Fig.1.

It is concluded that the maximum farmers were literate and among them they were educated to medium level.

The study also concluded that the minimum illiterate and functional literate farmers (35.00%) were found in cropping system III (Maize - Onion). On the other hand the maximum illiterate and functional literate farmers (47.06%) were found in cropping system IV (Moong/Urad - Potato).

b) Size of family and work force:

Size of family and work force determines and provides family labour for earning of family income through their activities. Table 4.2.2 presents the detail of size of family and work force available in a family as per different prevailing cropping system.

Table: 4.2.2 Distribution of farmers according to size of family and work force as per different prevailing cropping system.

(Average number of person per farm) (n=75)

S.No.	Family description	Cropping system				
		I	II	III	IV	Average
A	Strength					
1.	Male	1.85	1.56	2.15	1.94	1.88
2.	Female	1.70	1.50	1.65	1.53	1.60
3.	Children	3.05	3.11	3.35	3.00	3.13
4.	Total	6.60	6.17	7.15	6.47	6.60
B	Work force					
1.	Male	1.60	1.44	1.60	1.59	1.56
2.	Female	1.30	1.22	1.20	1.18	1.23
3.	Total	2.90	2.66	2.80	2.77	2.78

Table 4.2.2 shows the distribution of farm family as strength and work force in a family. The data revealed that on an average 6.60 persons were found in a family, this number is representative of strength of family. Among the total strength of family, the male persons were found to be on an average 1.88 person followed by female 1.60 and children 3.13 respectively. This indicated that male persons are higher than female in a family. **The strength of the family is also depicted in Fig. 2.**

The study also depicted that the strength of family members was found to maximum in the farmers family of adopting cropping system III (7.15 persons) and the minimum strength of family was found in the farmers family of adopting cropping system II (6.17 persons) per family.

Work force in a family is important parameter for family income. The data revealed that on average 2.78 persons in a family found as active members and determine as work force. Among the total workforce 1.56 persons were male workers followed by 1.23 was female workers per family. These family workers are performing so many activities including farming

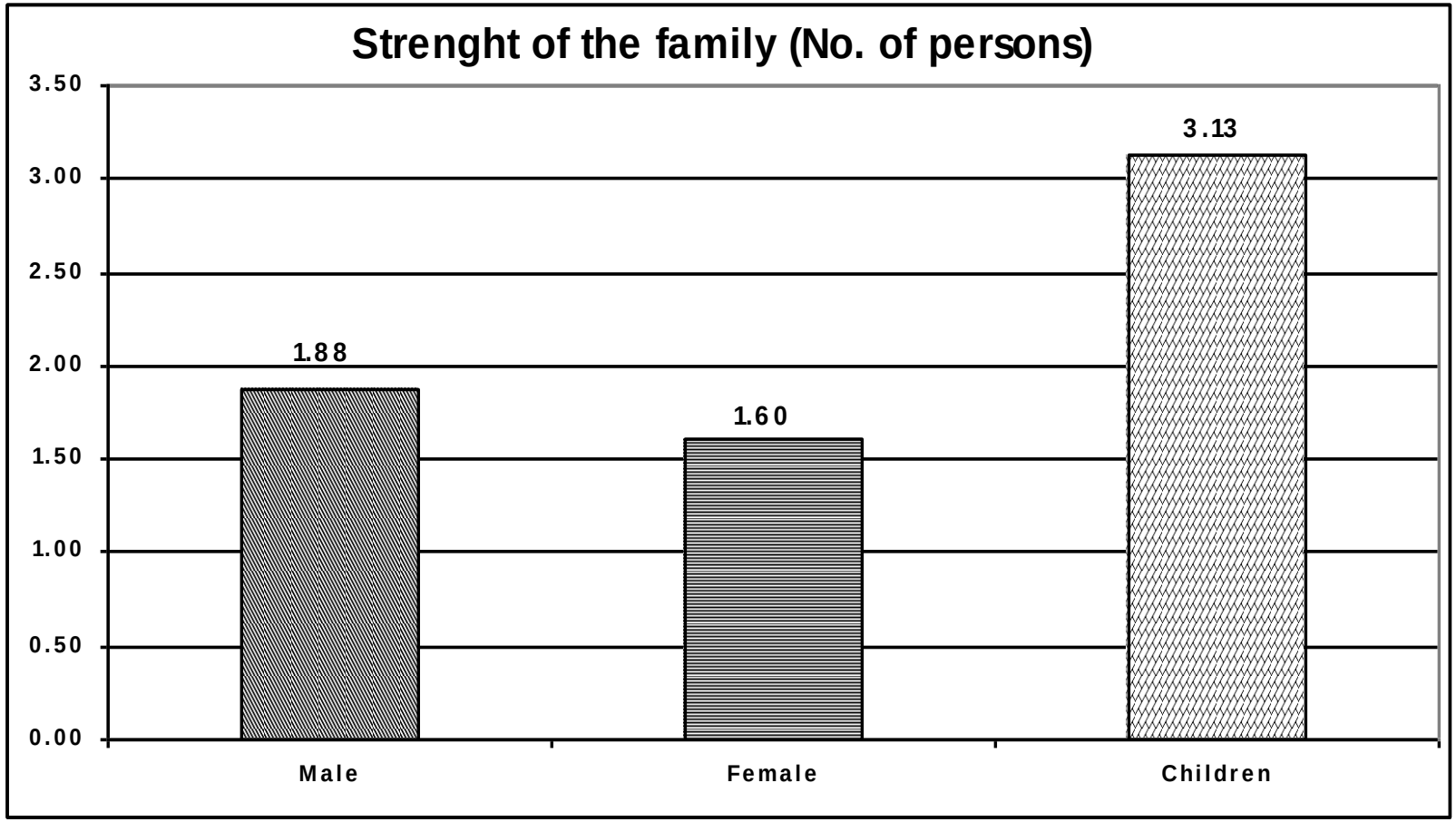


Fig. 2 Distribution of farmers according to size of family.

for earning of family income. **The workforce is also represented in Fig.3**

The study also depicted that the work force family members was found to maximum in the farmers family of adopting cropping system III (2.80 persons) and the minimum work force was found in the farmers family of adopting cropping system II (2.66 persons) per family.

Farm structure:

The farm structure determines the operational, organizational and managerial constraints of the farm business activity. It also reflects the level of income of family and other business activities. Operational holdings of the farmers are the basic unit of study. The physical and financial resources available to the farmers determine farm business activities and adoption of suitable cropping systems on their farms amongst the prevailing cropping system in the area. Opportunities for utilization of these resources and other factors that affect the crops production should be known prior to decision making process. Farmers own resource comprise chiefly of land, family labour, machinery and the other available assets and inputs. The distribution of these resources and their utilization in conjunction with the hired resources has been studied as follows:

a) Land utilization and irrigation pattern:

Land use is highly a dynamic process. Land resources constitute the fundamental base for all human activities. It is the most important natural resource of a country like India where agricultural sector is relatively more prominent than the manufacturing sector.

Land use pattern is a process, which assigns each tract of land in an area to its proper class in a system of classes. The classes in the system are defined in terms of the qualities or characteristics with which the classification is concerned. The land use pattern of a country at any particular time is determined by the physical, economic and institutional framework taken together. In other words the existing land use pattern has been evolved as the result of the action and interaction of various factors such as the physical characteristics of land, the institutional framework, the structure of other resources such as capital, labour *etc.* The land use pattern of sample farmers is presented in table 4.2.3 as per different prevailing cropping system.

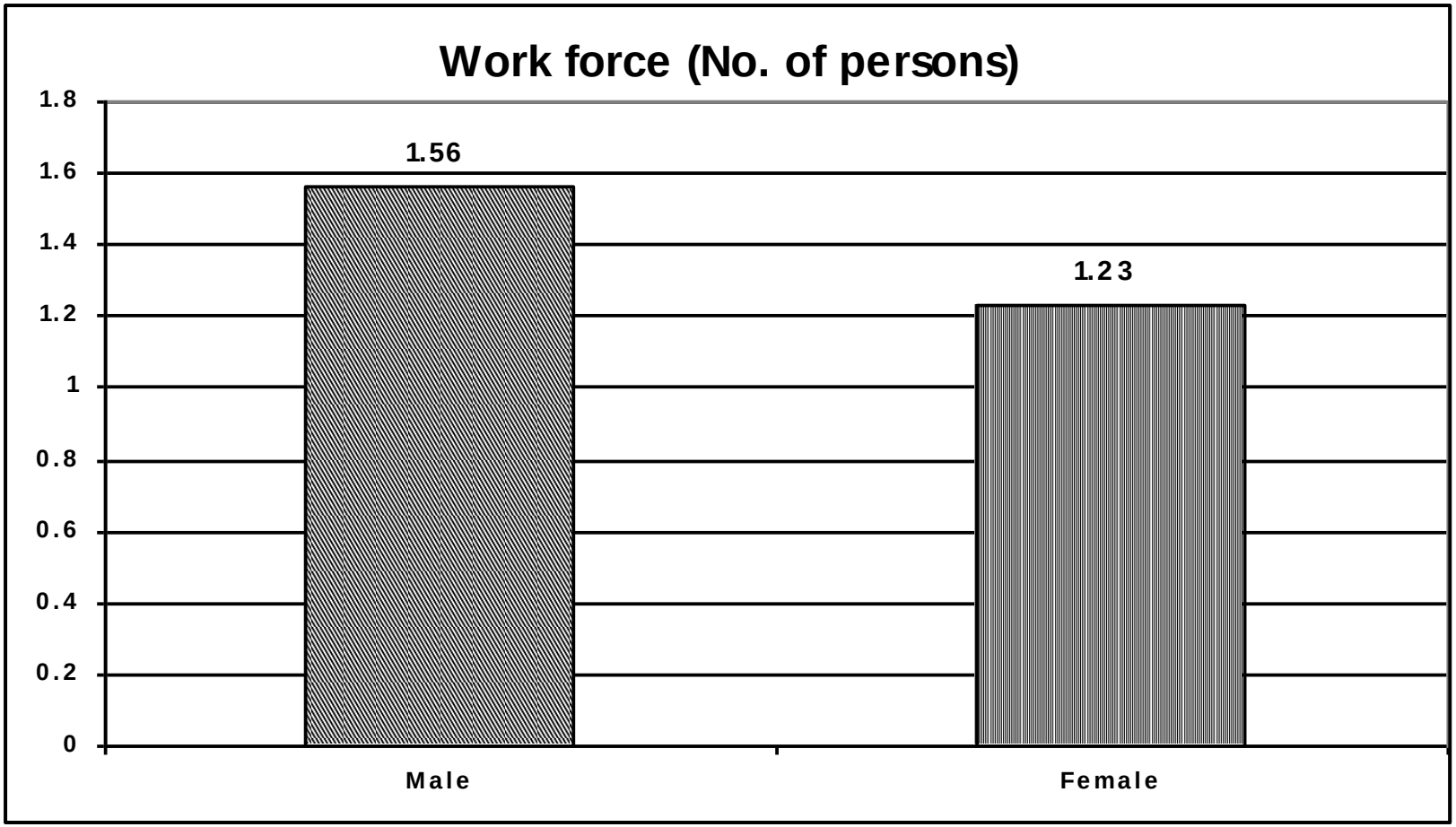


Fig. 3 Distribution of farmers according to work force.

Table: 4.2.3 Land utilization and irrigation pattern of sample farmers as per different prevailing cropping system. (Hectare Per farm)

S.No.	Land use pattern	Cropping system				
		I	II	III	IV	Average
1.	Average size of holding	4.27	5.52	4.75	7.33	5.47 (100.00)
2.	Area under other use	0.06	0.11	0.09	0.17	0.11 (2.01)
3.	Cultivated area	4.21	5.41	4.66	7.16	5.36 (97.99)
4.	Irrigated area	2.81	2.91	2.49	3.07	2.82 (51.55)
5.	Area under Kharif crops	4.20	5.30	4.57	6.93	5.25 (95.98)
6.	Area under Rabi crops	3.54	3.36	3.54	5.29	3.93 (71.85)
7.	Gross cropped area	7.74	8.66	8.11	12.22	9.18 (167.82)
8.	Cropping intensity	183.85	160.07	174.03	170.67	172.16
9.	% irrigated area to cultivated area	66.75	53.79	53.43	42.88	54.21

Figure in parentheses show the percentage of total size of holding.

As observed from the data, the average size of farm holding of farmers was found to 5.47 hectares per farm. Among the total size of holding 0.11 hectare i.e. 2.01 per cent to total size of holding, area was under other use may be called uncultivated area. The remaining area of total size of holding except uncultivated area was found to on an average 5.36 hectares per farm i.e. 97.99 per cent area of size of holding was under cultivation. This shows that there was nominal fallow land and farmers are managing maximum area under cultivation.

The study also depicted that the maximum size of holding was found 7.33 hectare with the farmers prevailing in "cropping system IV" followed by 5.22 hectare with the farmers prevailing in "cropping system II", 4.75 hectare with the farmers prevailing in "cropping system III" and the minimum size of holding was found 4.27 hectare with the farmers prevailing in "cropping system I".

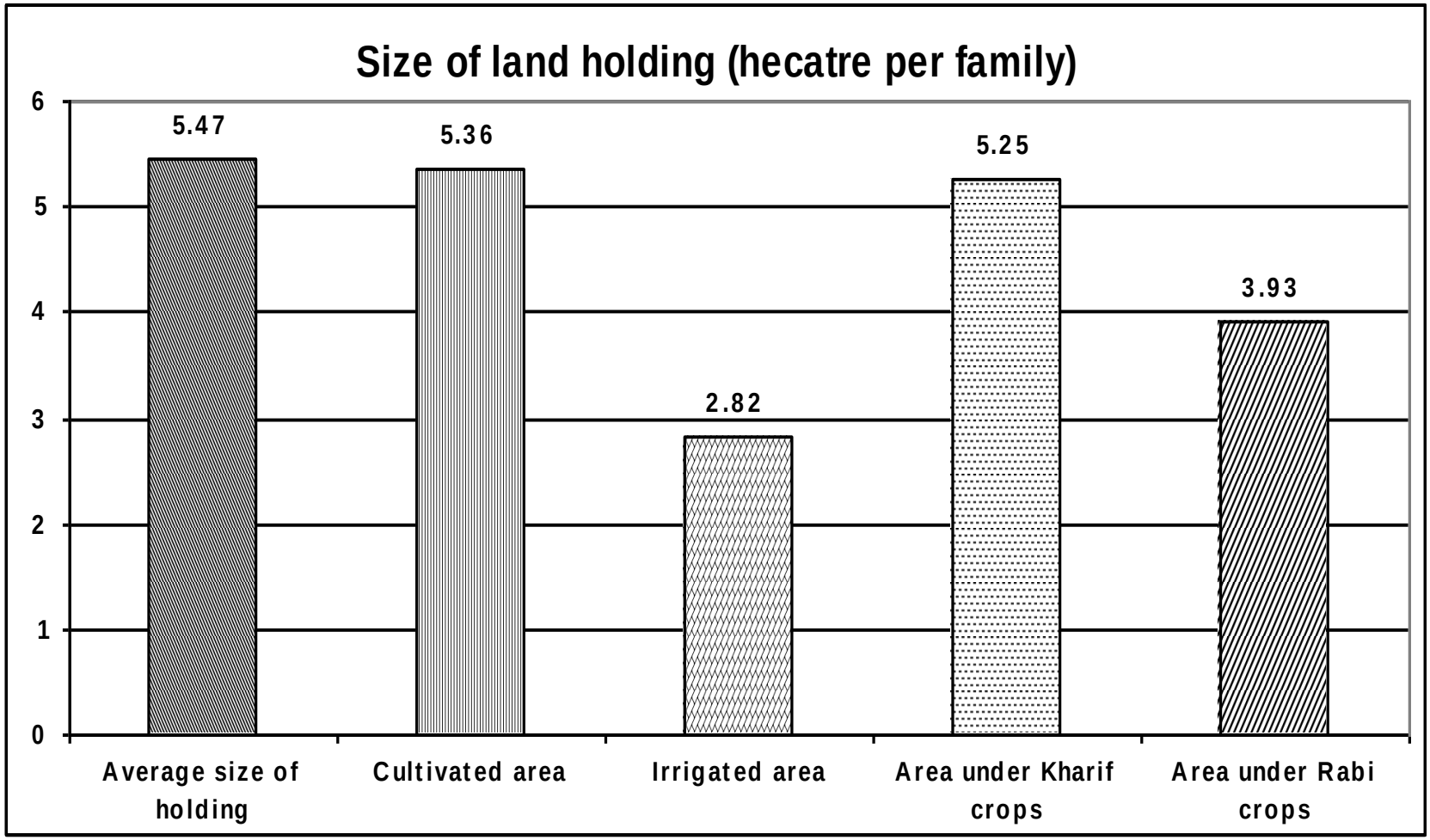


Fig. 4 Land utilization and irrigation pattern of sample farmers

Irrigation is compulsory for multiple cropping system particularly in vegetable based cropping system. Irrigation is also necessary for higher production of crops one hand and the other hand increasing the gross cropped area due to double cropped area under cultivation. The irrigation facilities also responsive for prevailing cropping system or diversification from low irrigated crop towards higher irrigated one. The irrigation facilities or availability of irrigation water increase the cultivated area particularly in rabi season. The irrigation also provided life saving water at the time of failure of rainfall at some critical stage of the crops. The irrigated area as a percentage of size of holding was found to on an average 51.55 per cent which shows unsatisfactory as per the irrigation availability in the area.

The study reveals that the percentage of maximum irrigated area to cultivated area was found in "cropping system I" 66.75 per cent followed by "cropping system II" 53.79 per cent, "cropping system III" 53.43 per cent and "cropping system IV" 42.88 per cent. On an average the percentage irrigated area to cultivated area was found to 54.21 per cent.

In study area, kharif crops were found to dominate over rabi crops due to low irrigation facilities. The kharif crops were grown on average in 5.25 hectare per farm i.e. accounted 95.98 per cent of size of holding followed by rabi crops which were grown on an average in 3.93 hectare per farm i.e. 71.85 per cent of size of holding. The grossed cropped area was not satisfactory due to limitation of irrigation which caused to lowering the rabi area in the year. It shows that the doubled cropped area was found to limited at farm condition due to certain limitations and only 167.82 per cent area was as gross cropped area to size of holding. The cropping intensity also not satisfactory and only it was 172.16 per cent. **The land utilization and irrigation pattern are also presented in Fig.4.**

b) Cropping pattern:

Cropping pattern connotes the crop-mix grown in a particular area in an agricultural year. Cropping pattern determines the output mix in a particular region. Cropping pattern refers to adoption of particular type of crops by the farmers in a particular region. It is expressed at macro level, that is, district, taluk or village level. A change in cropping pattern implies a change in proportion of area under different crops.

It has significant bearing on widening the geographical inequalities in income distribution. Introduction of new agricultural technologies has influenced the crop-mix which is more prominent in agriculturally developed regions. The cropping pattern of sample farmers is presented in table 4.2.4 as per different prevailing cropping system.

Table: 4.4 Cropping pattern of sample farmers as per different prevailing cropping system.

(Hectare Per farm)

S.No.	Cropping pattern	Cropping system				
		I	II	III	IV	Average
A.	**Area under Kharif crops**	**4.20**	**5.30**	**4.57**	**6.93**	**5.25**
1.	Cotton	1.67	2.58	1.26	2.99	2.13
2.	Jowar	1.00	0.87	1.28	0.72	0.97
3.	Maize	0.61	0.69	1.14	0.50	0.74
4.	Green chilli	0.32	0.62	0.23	--	0.29
5.	Moong/ Urad	0.38	--	--	1.77	0.54
6.	Other Kharif	0.22	0.54	0.66	0.95	0.59
B.	**Area under Rabi crops**	**3.54**	**3.36**	**3.54**	**5.29**	**3.93**
1.	Wheat	2.33	1.72	1.26	2.07	**1.85**
2.	Gram	0.32	0.77	1.13	1.45	**0.92**
3.	Tomato	--	0.87	--		**0.87**
4.	Onion	--	--	1.14		**1.14**
5.	Potato	--	--	--	1.77	**1.77**
6.	Other rabi	0.89	--	--	--	**0.89**

It can be observed from the data that the area was dominated by kharif crops. Among the kharif crops, the major crops occupied on an average area of 2.13 hectare by cotton followed by 0.97 hectare by jowar, 0.74 hectare by maize, 0.29 hectare by green chilli, 0.54 hectare by moong/urad and 0.59 hectare by other kharif crops.

Among the rabi crops, the major crops occupied on an average area of 1.85 hectare by wheat followed by 0.92 hectare by gram and remaining rabi area was distributed to different vegetable crops.

Study reveals that the vegetable crops under study coverage the area of 0.29 hectare by green chilli, 0.87 hectare by tomato, 1.14 hectare by onion and 1.77 hectare by potato.

c) Fixed assets on the sample farm:

Fixed assets comprises the value of the fixed capital like farm building, implements and machinery and the value of miscellaneous assets which are presented in the table 4.2.5 as per different prevailing cropping system.

Table: 4.2.5 Fixed assets of sample farmers as per different prevailing cropping system.

(Rs. thousand per farm)

S.No.	Particulars of assets	Cropping system				
		I	II	III	IV	Average
1.	Farm building	113.86	123.58	116.61	121.18	118.81
2.	Bullock	13.93	15.03	12.63	14.50	14.02
3.	Implements and machinery	111.32	155.17	155.19	180.06	150.44
4.	Total value	239.10	293.77	284.42	315.74	283.26

The values of fixed farm assets in general determine the absolute farm production unit, which is invested during the past years in farming process. Among the total value of fixed capital, the costly assets was found to implements and machinery accounting Rs.150.44 thousand per family followed by expenditure on farm house accounting Rs.118.81 thousand per family. The total value of fixed assets is important for farmers to know the level of improved farm practices adopted by them. The total value of fixed assets was found to Rs.283.26 thousand per farm.

4.3 Cost structure of vegetable based cropping system:

In raising of crop farmers use so many material inputs required for its cultivation. The important inputs are yield attributing and essential materials, without which farmers can not reap the crops at farm level. It is well known fact that raising of crop is a biological activity. So, plant growth is a function of ecological environment and its management with their factors of production. The climatic factor is not possible to manage in hand of farmers' upto certain limit but input requirement and its management is almost possible to promote suitable and balanced requirement for the growth of desired crop production.

The resource use pattern of farmers in production process of different cropping system indicates the degree of resource management, their choice and decision-making in selection among different alternative resources to get maximum profit. These resource use pattern determine the level of cost of production. Labour utilization (Human, bullock, and machine), seed, manures and fertilizers, plant protection measures, irrigation and other cost were the basic resources used in crop production process. Hence, in present study, these factors were considered in cost analysis in the form of money expenditure. The details regarding utilization pattern of resources in cultivation process of different crops of existing cropping system are presented as

follows.

Input utilization pattern in cultivation of different crops of existing cropping system:

Since the present study focus on economic rather than anthropological and the chief distinguishing criteria is the profitability of crops cultivation. For this purpose it is necessary to asses how the work force (family labour and hired labour) is engaged in different practices of crops cultivation. It shows the employment status of labour force engaged in crops cultivation.

To measure the level of utilization of package of practices in production process of crops under existing "cropping system", many studies recommended a best way of analysis i.e. expenditure on particular components of technology utilized on a unit area (this may be purchased or self). The expenditure incurred on particular component of technology shows its quality as well as quantity. Therefore, this expenditure method of analysis of input utilization was adopted to analyze the cost of production per unit of area of crops at different levels of input utilization. The patterns of input utilization in crops cultivation are depicted in following tables as per different prevailing cropping system.

Cropping system I: (Green chilli-Chickpea)

Table: 4.3.1 Input utilization pattern in cultivation of different crops in cropping system I (Green chilli-chickpea).

S.No.	Practices	Green-chilli		Chickpea	
		per farm	per hectare	per farm	per hectare
1.	Area	0.32	1.00	0.32	1.00
2.	Human labour (days)				
a.	Family	26	82	14	43
b.	Hired	5	15	6	19
c.	Total	31	96	20	62
3.	Bullock labour (days)	2	6	1	4
4.	Machine labour (hour)	3	8	2	8
5.	Seed and seed treatment	1666	5205	1036	3239
6.	Fertilizer and manure	9000	2812	739	2308
7.	Plant protection measure	677	2117	345	1078
8.	Irrigation charges	723	2259	466	1455
9.	Other material	163	508	209	652

The above data revealed that in overall there was high difference of human labour utilization pattern in cultivation of green chilli and chickpea. It is concluded that in

green chilli cultivation the human labour incurred to be on an average 96 days per hectare, similarly, in chickpea cultivation the human labour incurred to be on an average 62 days per hectare.

The bullock labour days and machine hours utilization pattern in different crops cultivation of existing "cropping system I" revealed the farmers utilized 6 days of bullock labour and 8 hours of machine labour in green chilli cultivation on per hectare basis followed by 4 days of bullock labour and 8 hours of machine labour in chickpea cultivation on per hectare basis.

Agricultural scientist suggested that to reap higher production it is essential that seeds used should be of proven quality and recommended as high yielding. During study it was observed that generally farmers used recommended seed and seed treatment in crop production. Study revealed that with the adoption of high yielding variety of crops, the cost incurred for the use of seed and seed treatment was found to Rs.5205 per hectare in green chilli cultivation followed by Rs.3239 per hectare of chickpea cultivation.

With the introduction of high yielding variety the use of chemical fertilizers has increased considerably. The use of chemical fertilizer was found to common practices amongst the green chilli and chickpea producers in the area, but the lacunae lies injudicious application of N.P.K. per unit of area. The cost incurred for the use of fertilizer and manure was found to Rs.2812 per hectare in green chilli cultivation followed by Rs.2308 per hectare of chickpea cultivation.

Recommended plant protection measures should be used and haphazard use of insecticides and pesticides should be avoided to get the optimum yield. But the study revealed that there was low adoption of plant protection measures by the farmers. The cost incurred for the use of plant protection measures was found to Rs.2117 per hectare in green chilli cultivation followed by Rs.1078 per hectare of chickpea cultivation.

Irrigation is essential factor of production in green chilli and chickpea cultivation. Many study revealed that in stares moisture condition, green chilli production was affected adversely. In the area due to erratic and low rainfall condition, rabi crop production found to low in rainfed condition. The gram crop is mostly cultivated under rainfed condition with use of palewa (sowing time irrigation). The cost incurred for the

use of irrigation was found to Rs.2259 per hectare in green chilli cultivation followed by Rs.1455 per hectare in chickpea (gram) cultivation.

Cropping system II: (Jowar - Tomato)

Table: 4.3.2 Input utilization pattern in cultivation of different crops in cropping system II (Jowar - Tomato).

S.No.	Practices	Jowar		Tomato	
		per farm	per hectare	per farm	per hectare
1.	Area	0.87	1.00	0.87	1.00
2.	Human labour (days)				
a.	Family	55	63	75	87
b.	Hired	0	0	4	5
c.	Total	55	63	79	92
3.	Bullock labour (days)	4	5	1	1
4.	Machine labour (hour)	3	3	4	5
5.	Seed and seed treatment	235	270	3478	3997
6.	Fertilizer and manure	1807	2077	2495	2868
7.	Plant protection measure	619	711	1910	2195
8.	Irrigation charges	--	--	1986	2283
9.	Other material	78	90	1213	1395

It is concluded that in jowar cultivation the human labour incurred to be on an average 63 days per hectare, similarly, in tomato cultivation the human labour incurred to be on an average 92 days per hectare.

The bullock labour days and machine hours utilization pattern in different crops cultivation of existing "cropping system II" revealed the farmers utilized 5 days of bullock labour and 3 hours of machine labour in jowar cultivation on per hectare basis followed by 1 days of bullock labour and 5 hours of machine labour in tomato cultivation on per hectare basis.

Study revealed that with the adoption of high yielding variety of crops, the cost incurred for the use of seed and seed treatment was found to Rs.270 per hectare in jowar cultivation followed by Rs.3997 per hectare of tomato cultivation.

The cost incurred for the use of fertilizer and manure was found to Rs.2077 per hectare in jowar cultivation followed by Rs.2868 per hectare of tomato cultivation.

The cost incurred for the use of plant protection measures was found to Rs.711 per hectare in jowar cultivation followed by Rs.2195 per hectare of tomato cultivation.

Jowar is a kharif crop hence, irrigation is not necessary but cost incurred for the use of irrigation was found to Rs.2283 per hectare in tomato cultivation.

Cropping system III: (Maize - Onion)

Table: 4.3.3 Input utilization pattern in cultivation of different crops in cropping system III (Maize - Onion).

S.No.	Practices	Maize		Onion	
		per farm	per hectare	per farm	per hectare
1.	Area	1.14	1.00	1.14	1.00
2.	Human labour (days)				
a.	Family	62	54	70	61
b.	Hired	14	12	23	20
c.	Total	76	66	93	81
3.	Bullock labour (days)	6	5	4	4
4.	Machine labour (hour)	3	2	8	7
5.	Seed and seed treatment	392	344	2836	2488
6.	Fertilizer and manure	2227	1954	2906	2549
7.	Plant protection measure	750	658	2471	2167
8.	Irrigation charges	--	--	3339	2929
9.	Other material	97	85	635	557

It is concluded that in maize cultivation the human labour incurred to be on an average 66 days per hectare, similarly, in onion cultivation the human labour incurred to be on an average 81 days per hectare. The bullock labour days and machine hours utilization pattern in different crops cultivation of existing "cropping system III" revealed the farmers utilized 5 days of bullock labour and 2 hours of machine labour in maize cultivation on per hectare basis followed by 4 days of bullock labour and 7 hours of machine labour in onion cultivation on per hectare basis.

Study revealed that with the adoption of high yielding variety of crops, the cost incurred for the use of seed and seed treatment was found to Rs.344 per hectare in maize cultivation followed by Rs.2488 per hectare of onion cultivation.

The cost incurred for the use of fertilizer and manure was found to Rs.2227 per hectare in maize cultivation followed by Rs.2549 per hectare of onion cultivation.

The cost incurred for the use of plant protection measures was found to Rs.750 per hectare in maize cultivation followed by Rs.2167 per hectare of onion cultivation.

Maize is a kharif crop hence; irrigation is not necessary but cost incurred for the use of irrigation was found to Rs.2929 per hectare in onion cultivation.

Cropping system IV: (Moong/Urad - Potato)

Table: 4.3.4 Input utilization pattern in cultivation of different crops in cropping system IV (Moong/Urad - Potato).

S.No.	Practices	Moong/Urad		Potato	
		per farm	per hectare	per farm	per hectare
1.	Area	1.77	1.00	1.77	1.00
2.	Human labour (days)				
a.	Family	81	46	129	73
b.	Hired	17	9	22	13
c.	Total	98	55	151	86
3.	Bullock labour (days)	5	3	2	1
4.	Machine labour (hour)	5	3	8	4
5.	Seed and seed treatment	6680	3774	51141	28893
6.	Fertilizer and manure	2942	1662	6997	3953
7.	Plant protection measure	1082	611	4255	2404
8.	Irrigation charges	--	--	5677	3208
9.	Other material	445	252	1360	769

It is concluded that in moong/urad cultivation the human labour incurred to be on an average 55 days per hectare, similarly, in potato cultivation the human labour incurred to be on an average 86 days per hectare. The bullock labour days and machine hours utilization pattern in different crops cultivation of existing "cropping system IV" revealed the farmers utilized 3 days of bullock labour and 3 hours of machine labour in moong/urad cultivation on per hectare basis followed by 1 days of bullock labour and 4 hours of machine labour in potato cultivation on per hectare basis.

Study revealed that with the adoption of high yielding variety of crops, the cost incurred for the use of seed and seed treatment was found to Rs.3774 per hectare in moong/urad cultivation followed by Rs.28893 per hectare of potato cultivation.

The cost incurred for the use of fertilizer and manure was found to Rs.1662 per hectare in moong/urad cultivation followed by Rs.3953 per hectare of potato cultivation.

The cost incurred for the use of plant protection measures was found to Rs.611 per hectare in moong/urad cultivation followed by Rs.2404 per hectare of tomato cultivation.

Moong/urad is a kharif crop hence; irrigation is not necessary but cost incurred for the use of irrigation was found to Rs.3208 per hectare in potato cultivation.

Cost of cultivation of crops per hectare of existing cropping systems:

i. Cost of chickpea, jowar, maize, moong/urad:

A study on economics of cultivation of different cropping system prevailing in area is pertinent to find out their profitability in order to choose best alternative resources, cultivation practices and scale of production etc. Secondly, it gives an estimate of the amount, the farmers would be require for cultivating as per size of crop area with different level of technological adoption. It is a well known fact that profitability of crop production depends upon the cost of production, yield per unit of area and their relative market prices. Hence, to determine the profitability from prevailing cropping system, the cost of cultivation on cost concept basis of crops under taken was determine and presented in table 4.3.5.

Table: 4.3.5 Cost of cultivation of crops per hectare of existing cropping systems.

(Rs/ha)

S.No.	Cost particulars	Chickpea	Jowar	Maize	Moong/urad
1.	Hired human labour	3325	0	2100	1575
2.	Bullock labour	1200	1500	1500	900
3.	Machine power	4000	1500	1000	1500
4.	Seed + treatment	3239	270	344	3774
5.	Manure + Fertilizer	2308	2077	1954	1662
6.	Plant protection	1078	711	658	611
7.	Irrigation charges	1455	--	--	--
8.	Other costs	652	90	85	252
9.	Interest on working capital	360	128	159	214
10.	Depreciation	1867	1876	1996	1436
11.	Land revenue	175	162	163	163
	Cost-A_1	**19659**	**8314**	**9959**	**12087**
12.	Interest on fixed capital	187	188	200	144
	Cost-B_1	**19846**	**8502**	**10159**	**12231**
13.	Rental value of land	4000	4000	4000	4000
	Cost-B_2	**23846**	**12502**	**14159**	**16231**
14.	Imputed value of family labour	7525	11025	9450	8050
	Cost-C_1	**27371**	**19527**	**19609**	**20281**
	Cost-C_2	**31371**	**23527**	**23609**	**24281**
	Cost-C_3	**34508**	**25880**	**25970**	**26709**

On the basis of different cost concepts, the cost of cultivation of different crops under prevailing cropping system per hectare on sample holding determine that on an average the cost of chickpea (Cost A_1, operational cost) was found to Rs.19659 per hectare, while, on an average the cost of jowar (Cost A_1, operational cost) was found to Rs.8314 per hectare, on an average the cost of maize (Cost A_1, operational cost) was found to Rs.9959 per hectare and on an average the cost of moong/urad (Cost A_1,

operational cost) was found to Rs.12087 per hectare.

The cost A_1 which is the actual farm investment made by farmers is more important in analysis of cost of cultivation. Cost A_2 was not considered in the study because farmers cultivated their own land.

The total cost estimates i.e. cost C_1, C_2 and C_3 based on the imputed values of family labour would give an unrealistic and even misleading picture of costs. It is attributable to the fact that farmers try to minimize only out of pocket expenses of cultivation and that by and large, they make maximum use of resources they own, but it is also not justifiable to take into account only paid out costs. To determine the cost structure cost C_1, C_2 and C_3 were also analyzed in the present study.

It is revealed that the average Cost C_3 of chickpea cultivation was found to Rs.34508 per hectare followed by Cost C_3 of jowar cultivation was found to Rs.25880 per hectare, Cost C_3 of maize cultivation was found to Rs.25970 per hectare and Cost C_3 of moong/urad cultivation was found to Rs.26709 per hectare respectively.

ii. Cost of green chilli, tomato, onion and potato:

To determine the profitability from prevailing cropping system, the cost of cultivation on cost concept basis of vegetable under taken was determine and presented in table 4.3.6.

Table: 4.3.6 Cost of cultivation of vegetables per hectare of existing cropping systems.

(Rs/ha)

S.No.	Cost particulars	Chilli	Tomato	Onion	Potato
1.	Hired human labour	2625	875	3500	2275
2.	Bullock labour	1800	300	1200	300
3.	Machine power	4000	2500	3500	2000
4.	Seed + treatment	5205	3997	2488	28893
5.	Manure + Fertilizer	2812	2868	2549	3953
6.	Plant protection	2117	2195	2167	2404
7.	Irrigation charges	2259	2283	2929	3208
8.	Other costs	508	1395	557	769
9.	Interest on working capital	444	342	394	913
10.	Depreciation	1867	1876	1996	1436
11.	Land revenue	186	192	178	180
	Cost-A_1	**23823**	**18823**	**21458**	**46331**
12.	Interest on fixed capital	187	188	200	144
	Cost-B_1	**24010**	**19011**	**21658**	**46475**
13.	Rental value of land	5000	5000	5000	5000
	Cost-B_2	**29010**	**24011**	**26658**	**51475**
14.	Imputed value of family labour	14350	15225	10675	12775
	Cost-C_1	**38360**	**34236**	**32333**	**59250**
	Cost-C_2	**43360**	**39236**	**37333**	**64250**
	Cost-C_3	**47696**	**43160**	**41066**	**70674**

On the basis of different cost concepts, the cost of cultivation of different vegetables under prevailing cropping system per hectare on sample holding determine that on an average the cost of green chilli (Cost A_1, operational cost) was found to Rs.23823 per hectare, while, on an average the cost of tomato (Cost A_1, operational cost) was found to Rs.18823 per hectare, on an average the cost of onion (Cost A_1, operational cost) was found to Rs.21458 per hectare and on an average the cost of potato (Cost A_1, operational cost) was found to Rs.46331 per hectare.

It is revealed that the average Cost C_3 of green chilli cultivation was found to Rs.47696 per hectare followed by Cost C_3 of tomato cultivation was found to Rs.43160 per hectare, Cost C_3 of onion cultivation was found to Rs.41066 per hectare and Cost C_3 of potato cultivation was found to Rs.70674 per hectare respectively.

iii Cost of cultivation of different cropping system:

The detail cost as per cost concepts of different cropping systems is presented in table 4.3.7.

Table: 4.3.7 Cost of cultivation of different cropping systems. **(Rs./ha)**

S.No.	Cost particulars	Cropping system			
		I	II	III	IV
1.	Cost-A_1	43482	27137	31417	58418
2.	Cost-B_1	43856	27513	31817	58706
3.	Cost-B_2	52856	36513	40817	67706
4.	Cost-C_1	65731	53763	51942	79531
5.	Cost-C_2	74731	62763	60942	88531
6.	Cost-C_3	82204	69040	67036	97383

As already discussed, the main vegetable based cropping systems of the area are: **cropping system-I (Green Chilli – Chickpea), cropping system-II (Jowar – Tomato), cropping system-III (Maize - Onion) and cropping system-IV (Moong/Urad – Potato)**. The cost of cultivation of different cropping system on per hectare basis found to vary depending upon the cost component and different combination for cropping systems.

Data shows that cost A_1 which may be treated as operation cost is important for economist and farmers also because it is determined as paid out cost from pocket. Among the operational cost A_1, the maximum cost incurred was found in "cropping system IV" Rs.58418 per hectare followed by "cropping system I" Rs.43482 per hectare, "cropping system III" Rs.31417 per hectare and "cropping system II" Rs.27137 per hectare respectively.

On the other hand, on the basis of data analysis on cost C_3, it is inferred that the maximum cost incurred was found in "cropping system IV" Rs.97383 per hectare followed by "cropping system I" Rs.82204 per hectare, "cropping system II" Rs.69040 per hectare and "cropping system III" Rs.67036 per hectare respectively.

4.4 Profitability of vegetable based cropping system:

The level of profitability from different crops and vegetable production in prevailing cropping system depends upon so many factors. Among these factors, cost of production, yield level, gross return from disposal of crops and vegetables, family labour employment availability are the main in terms of money gain. To findout the profitability of different vegetable based cropping system detail economic analysis have been considered as below:

Productivity realized from different cropping system:

Beside cost of cultivation incurred in crops and vegetables production on per hectare basis, the yield realized analysis of different crops and vegetable in prevailing cropping system is the relevant tool where the prime motive of the activity is profit measure in production process. Economist has for obvious reason not developed suitable measures to evaluate cost, returns and profit in terms other than money because mostly yield is fluctuating with several biotic and abiotic factors. On the other hand, the yield of crops and different vegetable can not compare in volume. Hence, in present study, the yield parameter in respective terms of gross return from the yield was considered for comparison of profitability. The yield level and their respective gross returns are presented in table 4.4.1.

Table: 4.4.1 Yield of crops and vegetable and their respective gross returns under different cropping system.

S.No.			Yield (q./ha)	Gross income (Rs./ha)
1.	Cropping system I	Green Chill	35.86	77268
		Chickpea	13.67	49208
2.	Cropping system II	Jowar	18.99	32279
		Tomato	239.85	76751
3.	Cropping system III	Maize	22.71	36342
		Onion	147.59	81165
4.	Cropping system IV	Moong/Urad	5.23	36274
		Potato	209.90	94453

It has been found in various studies that the yield of crops and vegetables is directly influencing with level of technologies used in production, method of practices adopted and certain other reasons. It is considerable point, the actual farm yields (quantum) realized from different crops and vegetables can not be economically compared because all the crops have different market price so their value are different. Hence, the profitability from yield level of crops and vegetables needs to be compared under monetary terms on the gross return basis. The data on yield grain in quintal on per hectare of area revealed that green chilli crop realized on an average 35.86 q/ha followed by chickpea realized on an average 13.67 q/ha, jowar realized on an average 18.99 q/ha, tomato realized on an average 239.85 q/ha, maize realized on an average 22.71 q/ha, onion realized on an average 147.59 q/ha, moong/urad realized on an average 5.23 q/ha and potato realized on an average 209.90 q/ha respectively.

Returns realized in different cropping system:

As discussed earlier that many economists suggested that the returns should be measure in terms of money, in agriculture the returns measurement are still difficult. Essentially the difficulty is in the correct estimation of both the quantitative (yield) and market prices of the product at various level in the time, place and method involvement in marketing process. To avoid these difficulties, in present study the returns from crops production in different vegetable based cropping system in the form of gross return "rupees per hectare" were analyzed. In study net profit, family labour income, farm business income and B.C.ratio are the tools employed for estimating the profit measures of crops and vegetable production. For this purpose, the profitability of crops and vegetables per hectare at different profitability measures is presented in table 4.4.2.

Table: 4.4.2 Returns and profitability of crops and vegetable production in prevailing cropping system.

(Rs/ha)

S.No.	Cost particulars	Cropping system			
		I	II	III	IV
1.	Cost-C_3	82204	69040	67036	97383
2.	Gross income	126476	109030	117507	130727
3.	Net income	44272	39990	50471	33344
4.	Family labour income	73620	72517	76690	63021
5.	Farm business income	82994	81893	86090	72309
6.	B.C. Ratio	1.54	1.58	1.75	1.34

It was observed during study that the market price of crops and vegetables per quintal was received by different farmers found to variation. It was due to size of

marketing cost, time of selling and quality of produce which made differences on total gross return, accordingly.

The study revealed that the gross income was realized maximum in the "cropping system IV" Rs.130727 per hectare, while the minimum gross income realized in "cropping system II" Rs.109030 per hectare. On the other hand, the gross income was realized in the "cropping system I" was Rs.126476 per hectare, followed by "cropping system III" Rs.117507 per hectare.

Gross income is not real income. The net income is real income for which farmers are interested to realize as highest as possible. The study reveals that the highest net income Rs.50471 per hectare was realized by "cropping system III" followed by the "cropping system I" realized Rs.44272 per hectare, "cropping system II" realized Rs.39990 per hectare and the minimum net income was realized by "cropping system IV" Rs.33344 per hectare.

The other measurement of farm profit like family labour income, farm business income and B.C. ratio was also calculated as below

The study reveals that the highest family labour income Rs.76690 per hectare was realized by "cropping system III" followed by the "cropping system I" realized Rs.73620 per hectare, "cropping system II" realized Rs.72517 per hectare and the minimum family labour income was realized by "cropping system IV" Rs.63021 per hectare.

The study reveals that the highest farm business income Rs.86090 per hectare was realized by "cropping system III" followed by the "cropping system I" realized Rs.82994 per hectare, "cropping system II" realized Rs.81893 per hectare and the minimum farm business income was realized by "cropping system IV" Rs.72309 per hectare.

The B.C. ratio is the important economic tool measurement of return over per rupees expenditure. The study reveals that the highest B.C.ratio 1.75 was realized by "cropping system III" followed by the "cropping system II" realized B.C.ratio of 1.58, "cropping system I" realized B.C.ratio of 1.54 and the minimum B.C.ratio 1.34 was realized by "cropping system IV" respectively.

4.5 Constraints related to existing cropping system:

There have been some constraints in prevailing cropping system.

The constraints analysis was reported based on the opinion survey of the sampled farmers. Thus, the generalizations of result are the feedback of the vegetable based cropping system prevailing in the area. The main constraints related to existing vegetable based cropping system are presented in table 4.5.1.

Table: 4.5.1 Production constraints identified by the sample farmers.

S.No.	Socio Economic constraints	Frequency N=75	% to total number	Rank obtained
A.	**Natural cause**			
1.	Low fertility of soil	50	66.67	iii
2.	Unfavorable climate	58	77.33	ii
3.	Uncertainty of rain	65	86.67	i
4.	Damage due to insect pest	35	46.67	iv
	Average	**52**	**69.33**	**Ist**
B.	**Social cause**			
1.	Unavailability of labour at time	25	33.33	iii
2.	Low working capacity of labour	20	26.67	iv
3.	Family problems	30	40.00	i
4.	Not proper management of family labour	28	37.33	ii
	Average	**26**	**34.67**	**Vth**
C.	**Economic cause**			
1.	Economic poverty	55	73.33	ii
2.	Have not purchased recommended inputs	50	66.67	iii
3.	Unavailability of irrigation facilities	60	80.00	i
4.	Have not done agronomical practices proper and at the time	35	46.67	iv
	Average	**50**	**66.67**	**IInd**
D.	**Technological cause**			
1.	Lack of technological knowledge	38	50.67	iv
2.	Unavailability of technical suggestions and guidance	42	56.00	iii
3.	Unavailability of training and demonstrations	45	60.00	ii
4.	Costly improved technology	58	77.33	i
	Average	**46**	**61.33**	**IIIrd**
E.	**Institutional infrastructure cause**			
1.	Unavailability of inputs at time	50	66.67	ii
2.	Do not performed agricultural practices at time	45	60.00	iii
3.	Unavailability of proper loaning system	25	33.33	iv
4.	Unavailability of proper distribution system	60	80.00	i
	Average	**45**	**60.00**	**IVth**

The constraints in prevailing vegetable based cropping system, confronted by farmers are divided into five segments and each segment has its own importance in production process. The most important constraints was “natural causes” got rank Ist among all the constraint followed by “economic cause” (rank IInd), ‘technological cause” (rank IIIrd), “institutional infrastructure cause” (rank IVth) and “social cause” (rank Vth) respectively.

Among the “natural cause”, the maximum number of farmers (86.67%) reported “uncertainty of rain” followed by “unfavorable climate” (77.33%), “low fertility of soil”

(66.67%) and “damage due to insect pest” (46.67%) respectively.

Among the “economic cause”, the maximum number of farmers (80.00%) reported “unavailability of irrigation facilities” followed by “economic poverty” (73.33%), “have not purchased recommended inputs” (66.67%) and “have not done agronomical practices proper and at the time” (46.67%) respectively.

Among the “technological cause”, the maximum number of farmers (77.33%) reported “costly improved technology” followed by “unavailability of training and demonstrations” (60.00%), “unavailability of technical suggestions and guidance” (56.00%) and “lack of technological knowledge” (50.67%) respectively.

Among the “institutional infrastructure cause”, the maximum number of farmers (80.00%) reported “unavailability of proper distribution system” followed by “unavailability of inputs at time” (66.67%), “do not performed agricultural practices at time” (60.00%) and “unavailability of proper loaning system” (33.33%) respectively.

Among the “social cause”, the maximum number of farmers (40.00%) reported “family problems” followed by “not proper management of family labour” (37.33%), “unavailability of labour at time” (33.33%) and “low working capacity of labour” (26.67%) respectively.

4.6 Suggestions for increasing production level of vegetable based cropping system:

The suggestions for increasing production level of different vegetable based cropping system, opinion survey from respondent cultivators were recorded on following points. The detail of suggestions is determined in table 4.6.1.

Table: 4.6.1 Suggestions for increasing production level of vegetable based cropping system.

S.No.	Suggestions	Frequency (n=75)	%to total	Rank
1.	Ensuring proper use of irrigation water	50	66.67	V
2.	The preference should be given for drip and micro sprinkler irrigation	55	73.33*	IV
3.	Timely supply of the quality inputs	40	53.33	VIII
4.	Self provisioning of inputs and appropriate practices on farm	35	46.67	IX
5.	Training of farmers in modern methods of crop production	60	80.00*	III
6.	Emphasis should be given on dynamic crops	62	82.67*	II
7.	Location specific crop planning should be needed	45	60.00	VII
8.	Area for intensive cultivation should be demarketed	65	86.67*	I
9.	Popularization of high yielding varieties supported by strong seed programme	48	64.00	VI
10.	Average	51	68.00	

*** higher than average value**

The suggestions was divided into two groups i.e. important suggestions having higher than average value and normal suggestion lower than average value.

The major suggestions confronted by 86.67 per cent farmers were “area for intensive cultivation should be demarketed”. It is fact that the area under study has tremendous potential for the production of vegetable along with crop production. As the adoption of improved production technology covering substantial part of the area, systematic efforts could be made to identify areas for special attention in terms of the growing of economic vegetable based cropping system.

The 82.67 per cent farmers among the total suggested that “emphasis should be given on dynamic crops”. Many study suggested that there are certain crops emerge as the dynamic crops in the area viz. maize among cereals and onion among the vegetable. These crops also have better prospects for value addition and these are found in small scale. Therefore, these can be cultivated even by the small farmers wherever the condition are favourable.

The 80.00 per cent farmers among the total suggested that “training of farmers in modern methods of crop production”. Inadequate attention has been placed on training for farmers in the scientific method of cultivation. Due to this notion, agricultural producers have been denied the benefit of agricultural science in their farming operations. Proper attention should be given to the producers in respect of farmers’ field school to enable them to understand modern method of production and to practice them

in the field condition.

The 73.33 per cent farmers among the total suggested that “the preference should be given for drip and micro sprinkler irrigation”. The area under study is scarce with irrigation water and the higher area is under rainfed condition. In this situation water saving device should be given more preference to brought higher area under irrigation.

Among the normal suggestions, the 66.67 per cent farmers among the total suggested that “ensuring proper use of irrigation water”. Irrigation is one of among the several factors responsible for low yields, but the inefficient use of water certainly caused economically in cropping system. Efforts thus need to be made to insure the proper use of water for example in rainfed conditions there are good prospect of vegetable cultivation with supplementary irrigation facilities.

The 64.00 per cent farmers among the total suggested that “popularization of high yielding varieties supported by strong seed programme”. The genetic potential of grain yield of crops is still under estimated as a result of strong and dominating effects of economy. The fact is that the ultimate aim of farmers is to get higher remunerative income through use of superior varieties existing once in yielding ability, disease and insect resistance and other characteristics.

The 60.00 per cent farmers among the total suggested that “location specific crop planning should be needed”. The specific feature of different climatic zone in the state found to close relation in production process of crops. The potentiality of study area should be carefully and farmer should be advised accordingly for specific crop planning.

The 53.33 per cent farmers among the total suggested that “timely supply of the quality inputs”. There are problems with the timing of the application as well as the quality of the inputs in double cropping system due to unavailability of timely and quality inputs in time. Step should be taken timely and assured supply of quality inputs.

The 46.67 per cent farmers among the total suggested that “self provisioning of inputs and appropriate practices on farm”. Self provisioning of inputs is always advantages, provided the productivity of these inputs is comparable to the purchase inputs. The inputs and practices which reduce costs with out suffering productivity may be popularized.

CHAPTER - V

SUMMARY, CONCLUSION AND SUGGESTION

Summary:-

The overwhelming majority of farmers in Khargone district of Madhya Pradesh is small to medium scale farmers. The small and medium farms are unable to provide satisfactory family income with cultivation of non commercial crops. In this technological stage the progressive farmers are shifting from subsistent farming to commercial farming in some extent. Due to this change towards vegetable cultivation as high-value produce, opportunities have help the vegetable growers to augment their incomes and bail them out of the vicious circle of poverty. The emerging opportunities in the changing economic environment need to be capitalized for the benefit of the farmers. Factors such as rising per capita income, changing food consumption systems, growing urbanization and globalization are pushing up demand for vegetable as high value commodities in both domestic and international markets and are creating opportunities for vegetable growers.

Cropping system is an important component of a farming system. It represents their interaction with farm resources, other farm enterprises and available technology which determine their make up. Many research studies denoted that vegetable based cropping system, are found to producing maximum remuneration with available suitable agro climatic condition and other factors receiving greater emphasis by farmers. Proper and well adopted vegetable based cropping system increase supply of balanced food, feed and cash needs of farmers, without extra expense. Hence, it is essential to know the cost and profit structure of these vegetable based cropping system and prevailing constraints in the area for decreasing production level of each crop under vegetable based cropping system are the common of intent study. As cost and return structure of farming influences the choice of crop and nature of investment of farmers. Keeping the above points in mind this study was under taken with the following specific objectives**.**

Objectives:

5. To analyze the cost structure of vegetable based cropping system.
6. To determine the profitability of vegetable based cropping system.

7. To study the constraints related to existing cropping system
8. To suggest ways and means for increasing production level of vegetable based cropping system.

Khargone district in Madhya Pradesh was purposively selected for the study owing to well acquaintance with the researcher about area. The Khargone district is one of the district in the State where maximum farmers are having small to medium holding in which they are mostly cultivating cotton, chilli and vegetables in their cropping system to reaping maximum income and employment. Vegetable based cropping system is newly practices by farmers hence; attempt was made for economic analysis.

Multi stage sampling technique was used for drawing a sample for the present study. At first stage, Khargone block in Khargone district was selected purposively due to higher area under vegetable based cropping system. At second stage of selection, a list of all the villages in the selected block was prepared where these practices are common prevailing by farmers. Among these villages, top 5 villages having maximum area under vegetable based cropping system was further selected purposively for the study. At the third stage of sampling, a list of all the farmers of these selected villages was prepared who are the major adopters of vegetable based cropping system. Among this list 75 farmers was selected on random basis. Thus, 75 vegetable growers were selected for study by sample random sampling method.

For the present study, both primary and secondary data was collected. Primary data was collected using pre-testing interview schedule through survey method. The data was considered for the year of 2014-15. The estimation of costs and returns of crops cultivation was based on different costs and returns concepts measure as recommended by “Special Expert Committee on cost estimates, GOI. New Delhi”, was used in this study.

Cost A_1 = All actual expenses in cash and kind incurred in production of vegetable based cropping system by owner operator

Cost A_2 = Cost A_1 + rent paid for leased in land

Cost B_1 = Cost A_2 + interest on fixed capital (excluding land)

Cost B_2 = Cost B_1 + imputed rental value of owned land

Cost C_1 = Cost B_1 + imputed value of family labour

Cost C_2 = Cost B_2 + imputed value of family labour

Cost C_3 = Cost C_2 + 10% of Cost C_2 (As managerial cost)

For the estimation of profitability, the following income measures were used.

a) Net farm income (NFI) = Gross income – Cost C_3 (total cost)

b) Family labour income (FLI) = Gross income – Cost B_2

c) Farm business income (FBI) = Gross income –Cost A_1

d) B:C ratio (Benefit cost ratio) = Gross income/ Gross expenses

Conclusions:

The main conclusions arrived at, in the study are as follows:

1. During the study it was observed that ingeneral following vegetable based cropping system is prevailing in study area. The whole study was considered only of this commonly prevailing cropping system.

i. Cropping system-I **Green chilli - Chickpea**

ii. Cropping system-II **Jowar - Tomato**

iii. Cropping system-III **Maize - Onion**

iv. Cropping system-IV **Moong/Urad - Potato**

2. As observed from the data, the average size of farm holding of farmers was found to 5.47 hectares per farm. Among the total size of holding 0.11 hectare i.e. 2.01 per cent to total size of holding, area was under other use may be called uncultivated area. The remaining area of total size of holding except uncultivated area was found to on an average 5.36 hectares per farm i.e. 97.99 per cent area of size of holding was under cultivation.

3. The study also depicted that the maximum size of holding was found 7.33 hectare with the farmers prevailing in "cropping system IV" followed by 5.22 hectare with the farmers prevailing in "cropping system II", 4.75 hectare with the farmers prevailing in "cropping system III" and the minimum size of holding was found 4.27 hectare with the farmers prevailing in "cropping system I".

4. The irrigated area as a percentage of size of holding was found to on an average 51.55 per cent which shows unsatisfactory as per the irrigation availability in the area. The study reveals that the percentage of maximum irrigated area to cultivated area was found in "cropping system I" 66.75 per cent followed by "cropping system

II" 53.79 per cent, "cropping system III" 53.43 per cent and "cropping system IV" 42.88 per cent. On an average the percentage irrigated area to cultivated area was found to 54.21 per cent.

5. It can be observed from the data that the area was dominated by kharif crops. Among the kharif crops, the major crops occupied on an average area of 2.13 hectare by cotton followed by 0.97 hectare by jowar, 0.74 hectare by maize, 0.29 hectare by green chilli, 0.54 hectare by moong/urad and 0.59 hectare by other kharif crops.
6. Among the rabi crops, the major crops occupied on an average area of 1.85 hectare by wheat followed by 0.92 hectare by gram and remaining rabi area was distributed to different vegetable crops.
7. Study reveals that the vegetable crops under study coverage the area of 0.29 hectare by green chilli, 0.87 hectare by tomato, 1.14 hectare by onion and 1.77 hectare by potato.
8. The cost of cultivation of different crops under prevailing cropping system per hectare on sample holding determine that on an average the cost of chickpea (Cost A_1, operational cost) was found to Rs.19659 per hectare, while, on an average the cost of jowar (Cost A_1, operational cost) was found to Rs.8314 per hectare, on an average the cost of maize (Cost A_1, operational cost) was found to Rs.9959 per hectare and on an average the cost of moong/urad (Cost A_1, operational cost) was found to Rs.12087 per hectare. The cost A_1 which is the actual farm investment made by farmers is more important in analysis of cost of cultivation.
9. It is revealed that the average Cost C_3 of chickpea cultivation was found to Rs.34508 per hectare followed by Cost C_3 of jowar cultivation was found to Rs.25880 per hectare, Cost C_3 of maize cultivation was found to Rs.25970 per hectare and Cost C_3 of moong/urad cultivation was found to Rs.26709 per hectare respectively.
10. The cost of cultivation of different vegetables under prevailing cropping system per hectare on sample holding determine that on an average the cost of green chilli (Cost A_1, operational cost) was found to Rs.23823 per hectare, while, on an average the cost of tomato (Cost A_1, operational cost) was found to Rs.18823 per hectare, on an average the cost of onion (Cost A_1, operational cost) was found to Rs.21458 per

hectare and on an average the cost of potato (Cost A_1, operational cost) was found to Rs.46331 per hectare.

11. It is revealed that the average Cost C_3 of green chilli cultivation was found to Rs.47696 per hectare followed by Cost C_3 of tomato cultivation was found to Rs.43160 per hectare, Cost C_3 of onion cultivation was found to Rs.41066 per hectare and Cost C_3 of potato cultivation was found to Rs.70674 per hectare respectively.

12. Data shows that cost A_1 which may be treated as operation cost is important for economist and farmers also because it is determined as paid out cost from pocket. Among the operational cost A_1, the maximum cost incurred was found in "cropping system IV" Rs.58418 per hectare followed by "cropping system I" Rs.43482 per hectare, "cropping system III" Rs.31417 per hectare and "cropping system II" Rs.27137 per hectare respectively.

13. On the other hand, on the basis of data analysis on cost C_3, it is inferred that the maximum cost incurred was found in "cropping system IV" Rs.97383 per hectare followed by "cropping system I" Rs.82204 per hectare, "cropping system II" Rs.69040 per hectare and "cropping system III" Rs.67036 per hectare respectively.

14. The data on yield grain in quintal on per hectare of area revealed that green chilli crop realized on an average 35.86 q/ha followed by chickpea realized on an average 13.67 q/ha, jowar realized on an average 18.99 q/ha, tomato realized on an average 239.85 q/ha, maize realized on an average 22.71 q/ha, onion realized on an average 147.59 q/ha, moong/urad realized on an average 5.23 q/ha and potato realized on an average 209.90 q/ha respectively.

15. The study revealed that the gross income was realized maximum in the "cropping system IV" Rs.130727 per hectare, while the minimum gross income realized in "cropping system II" Rs.109030 per hectare. On the other hand, the gross income was realized in the "cropping system I" was Rs.126476 per hectare, followed by "cropping system III" Rs.117507 per hectare.

16. The net income is real income for which farmers are interested to realize as highest as possible. The study reveals that the highest net income Rs.50471 per hectare was realized by "cropping system III" followed by the "cropping system I" realized

Rs.44272 per hectare, "cropping system II" realized Rs.39990 per hectare and the minimum net income was realized by "cropping system IV" Rs.33344 per hectare.

17. The study reveals that the highest B.C.ratio 1.75 was realized by "cropping system III" followed by the "cropping system II" realized B.C.ratio of 1.58, "cropping system I" realized B.C.ratio of 1.54 and the minimum B.C.ratio 1.34 was realized by "cropping system IV" respectively.

18. The most important constraints was “natural causes” got rank Ist among all the constraint followed by “economic cause” (rank IInd), ‘technological cause” (rank IIIrd), “institutional infrastructure cause” (rank IVth) and “social cause” (rank Vth) respectively.

19. The major suggestions confronted by 86.67 per cent farmers were “area for intensive cultivation should be demarketed” followed by 82.67 per cent farmers among the total suggested that “emphasis should be given on dynamic crops”, 80.00 per cent farmers among the total suggested that “training of farmers in modern methods of crop production” and 73.33 per cent farmers among the total suggested that “the preference should be given for drip and micro sprinkler irrigation”.

Suggestion:

Following suggestion are recommended on the basis of observation during study and result obtained after analysis of data in respect to increase, improve and adopt the economic viable cropping system on economic basis:

1. Proper and well adopted vegetable based cropping system increases supply of balance food and cash needs of farmers, with nominal extra expenses on farm. Experimental evidence has also proved that yield stability monetary return is greater with vegetable based cropping system in irrigated and semi irrigated area. Hence, it is suggested to improve this system and popularized in area, which will increase income, employment opportunities and balance diet availability.

2. In vegetable based cropping system, maize-onion are most important in the area followed by chilli-chickpea. It is also observed during study these systems are commonly popular in the area. Hence, experimental evidence has also proved that yield stability monetary return is greater with these double cropping systems in the

area. Hence, it is suggested to improve this system and popularized in area for maximum use of cultivated area under cultivation.

3. More stress should be given to develop suitable varieties of crops which are less water demanding; this would not be only increase the income of farmers, but also improved the marketed surplus and soil quality. The agricultural planning agencies should initiate intensive cultivation of crops and emphasize use of recommended optimum levels of fertilizers and plant protection measures by adequate and timely extension services.
4. A shift in cropping pattern in favour of grain crops towards vegetables is well established in the area under study. Though, this is a welcome feature in terms of profitability to farmers but it is at the cost of making the zone deficient in the staple food crops of the zone because the soil of the area is not so fertile and lack of irrigation make unable for multiple cropping in the area. Hence, government needs to implement suitable policies such as promotion of high yielding varieties under scientific management, ensuring remunerative prices for these food crops to ensure sustained food grain production.
5. Constraints like uncertainty of rain and unavailability of irrigation facilities, might be solve with taking care of water harvesting system near by farms. On the other hand, problems like costly improved technology and unavailability of proper distribution system of agricultural produce also were most severe in crop and vegetable production. Hence, there is need to strengthen institutional support for provision of input supply at low cost level, infrastructure facility and formulate appropriate policies for safe guarding the interest of the farmers regarding disposal of their produce.

CHAPTER - VI

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