EMPIRICAL STUDY OF MONKEY MENACE AND ITS ECONOMIC IMPACT ON THE FARM ECONOMY IN UDHAMPUR DISTRICT OF UNION TERRITORY OF JAMMU AND KASHMIR

by

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(J-19-M-620)

A Thesis submitted to

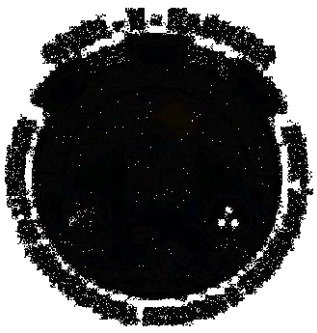
Faculty of Agriculture

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE IN AGRICULTURE

AGRICULTURAL ECONOMICS



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2021

CERTIFICATE - I

This is to certify that the thesis entitled "**Empirical Study of Monkey Menace and Its Economic Impact on the Farm Economy in Udhampur District of Union Territory of Jammu And Kashmir**" submitted in partial fulfillment of the requirements for the degree of **Master of Science in Agriculture (Agricultural Economics)** to the Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, is original work and has similarities with published work not more than minor similarities as per UGC norms of 2018 adopted by the University. Further, the level of minor similarities has been declared after checking the manuscript with URKUND software provided by the University.

The work has been carried out by **Mr. Vijaya Pramathi V S**, under my supervision and guidance. No part of the thesis has been submitted for any other degree of diploma. It is further certified that help and assistance received during the course of thesis investigation have been duly acknowledged.

Dr. Jyoti Kachroo

(Major Advisor)

Place: Jammu

Date: 13.10.21

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CERTIFICATE-II

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This is to certify that the thesis entitled, "**Empirical Study of Monkey Menace and its Economic Impact on the Farm Economy in Udhampur district of Union Territory of Jammu and Kashmir**" submitted by **Mr. Vijaya Pramathi V. S.**, Registration No. **J-19-M-620**, to the Faculty of **Agriculture**, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, in partial fulfillment of the requirements for the degree of **M. Sc. (Ag.)** in **Agricultural Economics**, was examined and approved by the advisory committee and external examiner (s) on **30.11.2021.**

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Vijaya Pramathi V S

Place: Jammu

Date: 13.10.2021

Abstract

Title of the Thesis	:	Empirical Study of Monkey Menace and Its Economic Impact on the Farm Economy in Udhampur District of Union Territory of Jammu And Kashmir
Name of the Student	:	Vijaya Pramathi V S
and Registration No.	:	J-19-M-620
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Name of University	:	Sher-e-Kashmir University of Agriculture Science and Technology of Jammu

This study was conducted in Udhampur district where 120 farmers of 12 different villages of 3 blocks were interviewed to identify the economic impact of monkey menace in cereals and vegetables. It was noted that wheat was predominantly cultivated as *Rabi* crop, maize as *Kharif* crop and bengal gram and black gram as summer crops in both menace affected and menace free areas. On an average a herd of 75 monkeys raided the farm lands particularly during day time. Cereals were damaged both during their vegetative stage and reproductive stage whereas the damage in vegetables and horticultural crops were prominent during their reproductive stage. It was also noted that monkeys did no harm to okra plants and minimal damage was observed in onion, garlic and potato. The per farm yield loss was found to be highest in maize (Rs.4661/-), followed by wheat (Rs.1176/-). Tomato was found to be the most damaged vegetable crop (Rs.1007.6/-). The least damage was found in potato (Rs.379/-) and okra (Rs.382/-). An additional cost of cultivation was incurred on famers in order to watch and ward-off the monkeys. The increase in cost of cultivation was highest for maize (Rs.10960/ha) followed by wheat (Rs.5605/ha) and tomato (Rs.4125/ha). The extent of decrease in productivity was found to be highest in wheat with a yield gap of 14.22 q/ha followed by tomato (81.06q/ha). This study will in some sense succeed to bridge the gap between the policy makers and victims of the monkey menace and will also help all the stake holders of this issue to further strengthen their understanding and address the problem in the study area with impactful strategies.

Keywords: *cropping pattern, economic loss, monkey menace, crop loss, animal menace, monkey, man-monkey conflict*

Signature of Major Advisor

Signature of the Student

LIST OF ABBREVIATIONS USED

Sr. No.	Abbreviation	Meaning
1.	%	Per cent
2.	/	Per
3.	et al.	et alii (and others)
4.	*etc.*	et cetera (and other things)
5.	Fig.	Figure
6.	*i.e.*	id est (that is)
7.	viz.	vi delicet (namely)
8.	Sr.No.	Serial Number
9.	B	Bearing
10.	NB	Non-Bearing
11.	FYM	Farm Yard Manure
12.	Govt.	Government
13.	Hrs	Hours
14.	L	Low
15.	M	Moderate
16.	H	High
17.	MP	Main product
18.	BP	By-product
19.	GDP	Gross Domestic Product
20.	Ha	Hectare
21.	Kg	Kilogram
23	Q	Quintal
24	Mt	million ton
25	p.a	per annum
26	P	Page
27	pp.	Pages
28	No.	Number
29	Sq	Square
30	Km	Kilometer
31	HL	Human labour
32	TWS	Total Weighted Score
33	MPA	Menace Prone Area
35	MFA	Menace Free Area

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Chapter 1

Introduction

India’s estimated food grain production during 2018-19 (crop year) was record 284.95 million tonnes and horticultural production was record 313.9 million metric tonnes (Anonymous, 2020). TheCompound Agricultural Growth Rate (CAGR) of India was16.45 per cent over financial year 2010-11 to account US$ 38.21 billion in financial year 2018-19. Even so, the benefits are so far fetched to every last farmer and is put down to face hardships like fragmented land holdings, lack of proper marketing channels, price fluctuations, erratic rains, scarcity of labour, un-rehearsed mechanization.Apart from thisto resolve the problem of low per capita farm land availability and also to facilitate food requirements to the ever increasing populationmore and more forest areas are encroached. As a result of which human and wildlife habitats have started overlapping and the number of human and wildlife conflicts have increased.

Human-Wildlife Conflict (HWC) is described as "contact between people and wildlife in which one or both parties suffer negative repercussions, whether perceived or actual, when one party's behaviour has a detrimental influence on the other" (Conover, 2001; Decker *et al*., 2002). The HWC has been around since time immemorial. History dating back to Nile delta accounts provides insights of animal menace like hippopotamuses ravaging farms, crocodiles attacking cattle in Egypt and elephants plundering harvests all throughout Africa and the world (Barnes, 1996).The renowned fossil, "Taung skull" found in South Africa also belonged to a kid who was a victim of eagle assault, two million years ago (Berger, 2006). As human settlements expand, so does the negative interaction between human and wildlife species. Protected areas become conservation islands surrounded by landscapes dominated by human-dominated landscapes.

Rhesus macaque (*Macaca mulatta*), Bonnet macaque (*Macaca radiata*), Assamese macaque (*Macaca asamensis*), and Hanuman langur (*Semnopithecus entellus*) are some of the monkey species that are responsible for majority of crop raiding in the country. The number and nuisance caused by them have been increasing with time as most of the monkeys are protected by Wildlife Protection Act and also

by Indian constitution under article 48A of Part IV and article 51A of Part IVA. Loss of habitat, overlapping territories, unavailability of food and shelter have been some of the many reasons that have led the monkeys to raid in the farm lands and attack the human settlements. Many investigation and studies have been conducted all around the country to estimate the population and also various other attributes of the monkeys like behavior, reasons for territory change, reason for raiding, and so on. Most opinion based surveys made on monkey menace clearly states that people perceive monkeys as a threat to human safety and crops grown. The problem of regular crop raiding by monkeys on fields has forced the farmers to leave their lands uncultivated or change the traditional crops that they had been growing.

Jammu and Kashmir has also suffered greatly from the crop raiding by monkeys. All India Network Project on Vertebrate Pest Management (AINPVPM) conducted studies spanning over a decade which estimated that the extent of damage caused by common monkey alone among all other animals is about 10-30 per cent. Nuisance caused by monkeys have affected almost every district of the Jammu region. In the year 2016-17, 2826 hectares of land were left uncultivated due to menace caused by the monkeys in Kathua region of the Jammu division (Anonymous, 2018). The monkeys have been annually damaging majority of crops such as maize, wheat, rice, vegetables covering an area of approximately 15,596 hectares and fruit crops such as mango, guava, bear, grapes, citrus fruit, litchi, sandy pear, peach, plum and apricot covering an area of about 68,384 hectares in more than 250 villages of Jammu, Kathua, Udhampur and Reasi districts of Jammu division (Anonymous, 2013).

Even though economic burden caused due to destruction of crops is the immediate and profound problem of the Human-Monkey conflict, the mere existence of monkeys in the vicinity of human settlements has created huge negative externalities. Over hundreds of people suffer monkey bites every day in the country and this has resulted in unwanted expenditure such as on vaccines for the victim as they pose a threat of getting infected by many disease causing germs like the Herpes B, virus10 etc. Unlike other countries, religious and traditional beliefs regarding monkeys make the conflict even more convoluted. Frequent conflicts at blown out proportions have cost human lives in the recent days. It impacts the people's food security, livelihood and psycho-social wellbeing.

As it is clear that the problem of animal menace especially that of the monkeys in Jammu is an issue that impacts directly on the socio economic conditions of the people, it is essential to study this in detail to address this issue to keep up the morale of farmers. The ad-hoc studies have been providing some information regarding this issue but detailed information regarding the monkey menace is essential. Thus an effort was made through this research to gather detailed and systematic information on monkey menace in the study area.

1.1 Objectives of the Study

Keeping account of facts discussed above, the present investigation entitled "**Empirical Study of Monkey Menace and its Economic Impact on the Farm Economy in Udhampur district of Union Territory of Jammu and Kashmir"** was carried out with the following objectives :-

1. To study the cropping pattern in areas prone to monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.
2. To assess the extent of area, type and stage of crops damaged by monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.
3. To assess and estimate the extent of economic losses in various cereals, vegetables and other horticultural crops triggered by monkey menace in the study area.

1.2 Scope of the Study

The crop production in Udhampur district has been under serious threat from monkeys.The problem of crop raiding has left farmers with very few options other than giving up agriculture as a profitable venture. The diversity of problems faced by the farmers whose farm lands have been raided constantly by the monkeys has been brought to light in this study. Economic burden on farms growing various crops have been analysed. Various measures have been suggested in this study to overcome the problem based on the results. Thus, the study will in some sense bridge the gap between the policy makers and victims of the monkey menace and will also help all the stake holders of this issue to further strengthen their understanding and address the problem in the study area with impactful strategies. The findings can also be useful in other parts of country having more or less similar conditions.

1.3 Organization of the Study

This study on "Empirical Study of Monkey Menace and its Economic Impact on the Farm Economy in Udhampur district of Union Territory of Jammu and Kashmir" was thoroughly designed taking the time available and wherewithal at the disposal into consideration. Chapter-1 gives the preface of the present research problem at hand, object case of the study and future reach of the subject. The wide-range of review of literature available on cropping pattern, human animal conflict has been described as per the requirements of the object case of the study in Chapter 2. Chapter 3 describes the comprehensive methodology employed to select the sample population, collection of the data and its analysis. Chapter 4 presents the results of this particular study and these results have been discussed thoroughly with reference to the available literature in Chapter 5. Finally, the summary and the conclusions deduced from the study have been described in Chapter 6. The research work carried out in two successive phases, the first phase of the study was to review the literature, preliminarily survey of the study area, finalization of the schedule and collection of data where as the second one was to compile the data, analyze the data and present a well written thesis, *etc.*

Chapter 2

Review of Literature

Having a detailed and thorough review of literature is very important for any researcher as it guides him/her towards right path of research. It also motivates and acts as a beam of guidance to a new researcher who is about to continue in the same path. Keeping the above view in light an extensive work is conducted to bring together the visions of different researchers pertaining to the topic of the present study. This chapter is then subdivided into 3 parts, each covering an objective of the study.

2.1 To study the cropping pattern in areas prone to monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.

2.2 To assess the extent of area, type and stage of crops damaged by monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.

2.3 To assess and estimate the extent of economic losses in various cereals, vegetables and other horticultural crops triggered by monkey menace in the study area.

2.1 To study the cropping pattern in areas prone to monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.

Sangral (2015) reported that the cropping pattern in Jammu and Kashmir was a traditional system of subsistence farming without any surplus. But there has been the complementary relationship between the commercialization and cropping pattern of the state with the advent of new agricultural strategy. The farmers are gradually aiming towards higher earnings and thus are diversifying to commercial crops.

Akhter and Acharya (2015) in his study observed there are micro-level variations in the agro-climatic conditions in Jammu and Kashmir which facilitates various cropping patterns. Access to irrigation water influences the cropping structure to a great extent. Also, this particular study showed that the farmers of Jammu and Kashmir were adapting themselves towards diversified high value crops instead of traditional crops.

Shah and Anbuvel (2016) states that various abiotic factors like soil, temperature, rainfall, topography, etc plays an important role in determining the

cropping pattern of the area. Productivity of various crops have been hindered particularly due to the topography of Kashmir region of Jammu and Kashmir. From past few decades, greater change in the cropping pattern has been observed in the region, where the food crops (particularly paddy) are replaced by the cash crop (particularly apple) at a much quicker rate than before.

Kaloo (2021) is of the opinion that even though agriculture is the major occupation of the union territory of J&K, farmers are losing interest in farming and cites various reasons such as non profitability of crop venture and consolidated land holding and so on. He further throws light upon the fact that area under food grains has shown a decreasing trend from past two decades and the possible reasons for that are low yield, lack of research, low seed replacement ratio, etc. Rice being the staple crop has not shown much variation in terms of cultivated area, but has shown a decreasing trend in yield where as wheat has shown upward trend both in terms of area and production. The author is of the opinion that, there is diversifying trend and farmers are shifting towards commercial crops in place of food grains.

2.2 Extent of area, type and stage of crops damaged by monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.

Veeramani *et al*. (1995) reported that paddy, coconut, arecanut, coffee, tea, rubber, cashew, oil palm, pepper, mango, sugarcane were among the major crops raided by wild animals like elephant, wild boar, porcupine, gaur, *sambar*, bonnet macaque, common langur, deer *etc*. in the place of study *i.e*, Kerala. Cultivators of the affected region demanded a compensation of Rs 1.06 crore of which Forest department sanctioned only 8.2 per cent between 1985 to 1993. Erecting thorny bush barriers and constructing stone wall were some of the preventive measures taken by the farmers. Barbed wire fencing and displaying colour cloths were also found to be effective. Forest Department has installed electric fences in some areas.

Genov *et al*. (1996) attempted to assess the crop damage caused by wild boar and deer during 1990-94 in Marema Regional Park, Italy. May to July (when wheat, barley, oat, grass grown for hay, legumes and peaches were available) and August to October (when maize, sunflower and grapes matured) were the seasons where the damage was found to be extensively high. Wild ungulates were responsible for 25 to 62 per cent of

the damage in wheat. The study also supports the claim that the vicinity of crop field and natural habitat was a crucial factor for assessment of crop raid by wild animals.

Hill (2000) revealed that baboons were the reason for heavy crop losses in field crops like maize and cassava which were in the proximity of Budongo Forest Reserve in Uganda. Noticeable increase was observed in cost of production of farmers in the affected region as farmers were compelled to protect the crops from baboon raid by employing more labourers for watch and warding off other than the direct damage caused to the standing crop.

Chhangani and Mohnot (2004) made an attempt to study the crop damage by wild boar raiding in Aravalli region of Rajasthan. Wild boars were feeding on 39 different species of crops in and around the study area, of which 13 were field crop, 19 vegetable crops and 7 of them were flowers and fruits. The farmers used preventative methods like watching the fields, using watchdogs, fencing around the fields, etc. The study discovered that the people were ignorant towards wildlife conservation in the study area.

Rugunda (2004) observed the crop damage around the areas of Lake Mburo National Park of Uganda. Making use of random crop plots and area estimation techniques in a portion of raided fields, the intensity of raiding was quantified. Conservation of natural habitats around the human settlements was proven as a difficult task owing to the dense population. The animal species were identified by observing their footprints and other marks left behind. The extent of crop damage was predicted by factors like population density, distance from the park boundary and cropping season. It was clear from the study that the damage caused by raiding animals was posing a serious threat to the subsistent farmers of the study area.

Sahoo and Mohnot (2004) collected the baseline data on monkey and langur menace on agricultural and horticultural crops in Himachal Pradesh during 1997-98. It was noticed that major agricultural crops like wheat, potato, and maize and horticultural crops like pear, almond and apple were the most targeted crops by monkeys and langurs.An economic loss of Rs. 2000-8000/- per farm in case of agricultural crops and more than that in case of horticultural crops was incurred to farmers annually.

Veeramani *et al*. (2004) reported that majority of people who had an interface with wildlife conservation in Marayur Forest Range, Kerala had their own lands and their main source of income from the cultivation of the crops grown in their own land. The main crops grown were paddy, sugarcane and vegetables which were also the highly raided crops by the animals like wild boar, elephant and gaur.

Chiyo*et al.* (2005) studied the correlation between crop raid by elephants and availability of natural forage and available crop sources outside the boundary of Kibale National Forest Park, Uganda during 1996-1997. The study indicated that the crop raids by elephants were high during dry season and was more inclined towards like banana and maize. It was also noticed that the raiding pattern was influenced by the time of maize ripening and not on the forage quality. The crop availability had greater influence in the forest areas in comparison to forage quality in savanna regions.

Tefft*et al.* (2005) examined the crop damage by wild turkey (*Meleagris gallopavo*) through a mail survey in United States and Canada. Wild turkey was responsible for major crop loss in 23 different crops in the area of study. The researchers suggested precise guidelines and strategies to combat the existing problem in the study area to the wildlife managers

Tweheyo *et al.* (2005) studied the pattern of crop raiding by primates like *Pan troglodytes, Papio Anubis* and other animals like *Potamochoeus procus* and *Hystrix cristata.* And found out that primates were responsible for 73 per cent of crop damage and also reported that 79 per cent of respondents felt that baboons were the most dangerous of the entire crop raiding species in and around the Budongo Forest Reserve, Uganda. Even though primate crop raiding was the major issue, farmers also suffered crop losses due to other factors like drought, poor sowing, wildfires, etc.

Devault *et al.* (2007) studied patterns of wildlife havoc in corn and soybean in Northern Indiana. The study explained the association of particular locations where havoc was observed and its distance from presumed corridors of animals in that area.Using GIS and GPS coordinates, damage points were located for both corn and soybean. The most points of damage were close to forest patches and logistic regression analysis indicated that wildlife damage probability was influenced greatly by the distance of forest from the damage point.

Honda (2009) recognizedthe factors that influence the spread and number of boar, deer, black bear and japanese macaque in Japan. The study revealed that all the species under studypreferred farmlands that were near to the edge of the forest and avoided the unforested areas. wild boar, sika deer and black bears preferred areas that were dominated by mast bearing species and grasslands. The extent of feeding was considerably less in densely populated areas, areas with low winter temperatures, deep snow areas.

Fungo*et al.* (2010) studied Mabira forest reserve to determine the crop raiding species, crops that were raided, and the factors that influence the raiding as perceived by the farmers and the methods devised by them to control the raiding. Around 70 affected household were interviewed regarding the menace caused by animals like red-tailed monkeys, grey-cheeked mangabeys, bush pigs, rodents, porcupines and antelopes. Major crop raiders were red tailed monkeys and grey-cheeked mangabeys. They raided crops by red tailed monkeys and grey-cheeked mangabeyswere maize, bananas and passion fruits. Roughly about 40-70 per cent of the crop yield losses were attributed to the crop raiding incidents. Maize was the most preferred crop followed by fruit crops and cassava was the least preferred crop by the crop raiding species. Susceptibility of the crop, intercrop and weed management were vital factors contributing to the extent of crop raiding by crop raiding species. Guarding, use of scarecrows and smearing with cow dung were some the indigenous practices that the farmers followed to avoid the crop raiding. It was suggested to the farmers by authors to avoid planting of species like banana and maize as intercrops and instead were asked to plant crops that were least preferred by the wild animal like rubber, coffee.

Monney *et al*. (2010) examined the situation of elephant crop raiding in and around Kakum Conservation Area in Ghana. Elephants had affected around 35 farms which had a spread of around 2.3 ha which were distributed among 30 farmers of 7 communities in and around the reserve. Irrespective of the season, the elephants raided a variety of cash crops as well as the food crops which included orange, cocoa, cassava, banana and tomato. It was noticed through the study that the farms that were near to the reserve and bigger in size were preferred by the elephants. The study suggested that the farmers must construct chilli fences around their farms to keep the elephants at bay.

Charoo *et al.* (2011) assessed interaction patterns of Asiatic black bear (*Ursusthi betanus*) humans in the border areas of Dachigam (~1,000 km2) in Kashmir, India. The researcher interviewed the villagers living in the study area and concluded that human-bear interactions were of three types: Crop damage, Attack on human beings and Attack on livestock. The study provided sufficient evidence to say that the use of resources was overlapped by both bear and human beings in the study area. 72 per cent of the respondents were of the opinion that they were dependent on the forest resources that existed in the natural bear habitats. 85 per cent claimed crop depredation was the major threat of the conflict. The raiding was at its peak during the months of june, july, august, September when bears were most active which also co-incided with the peak cropping period. Attack on livestock was the least common factor amongst other categories interactions. The study recommended that intensification of indigenous crop protection methods, improvement in livestock night shelters, and proper surveillance of conflict areas by strengthening management systems.

Weladji and Granados (2012) collected the secondary data on crop damage caused by elephants in three communities in and around Benoue National Park, Cameroon. The study discovered that there was an increase in elephant crop raiding reports from 40 per cent since 1998 to 58 per cent in 2012. Eventhough there was increase in number of human elephant conflict, people were not in favour of hunting concessions and were least concerned about the after effects of conflict. Elephant damage increased due to immigration. The study advised the communities to take up properland use planning and prevent encroachment.

Karanth *et al.* (2013) studied human-wildlife conflict pattern in Kanha Tiger Reserve of Western Ghats, India. The researcher interviewed 735 households covering an area of 5154 sq. kms to model the conflict data in a systematic manner that could help the managers to identify important conflict hotspots, map crop and livestock risk probability and factors influencing the crop and livestock loss. It was observed from the study that that 73 per cent of the respondents suffered crop loss, 33 per cent suffered livestock loss and less than 8 per cent of respondents suffered human injury or death. It was noticed from the study that crop loss and livestock loss was mainly influenced by factors like high number of cropping months per year and proximity of grazing to the park respectively. Physical protective structures were proven to be the only effective mitigation technique to reduce livestock loss. 0.93 and 0.60 were the average

probabilities for crop loss and livestock loss respectively. The households located inside the buffer zone suffered highest livestock and crop loss and they also claimed the highest compensation.

Khatun *et al.* (2013) assessed crop damage caused by human-langur conflicts in six villages of Keshabpur in the Jessore district of Bangladesh from September 2009 to August 2010. The study throws light upon the perception of locals towards langur inflicted crop damage and association of demographic variables towards crop damage and conflicts. Fruit crops were the most targeted crop species during their fruiting stages by common langurs among 27 other crops grown around in the study area. 55 per cent of the sample respondents found that the local deterring methods took a huge toll on the economy and also their children's education even though they were found effective. However 59 per cent of the respondents reported that the langur damage was found to be tolerable. The researcher conducted linear regression analysis and found out that occupation of respondents, their landholding status, and their religious beliefs had a profound impact on the conservational attitudes towards langurs. The author was of the opinion that immediate mitigation methods have to be undertaken in order to avoid future human langur conflict.

Ramkumar *et al*. (2014) studied the elephant conflict and effectiveness of mitigating measures in Coimbatore district of Tamil Nadu. 32 gram panchayats were affected by crop raiding by elephants. 24 out of 31 crop species grown in the study areas were raided at various intensities by elephants with total frequency of 2124. The study recorded that, Odanthurai panchayat faced highest crop raiding attempts Madukarai faced lowest crop raiding attempts. Crops such as Banana (139.49 acres), sorghum (122.35 acres), arecanut (18993 trees) and coconut (4701 trees) were the most targeted crops and crops like marigold, sapota, pearl millet, millet, jatropha and brinjal were the least targeted. Family herds were noticed to be highly responsible for crop damage (66–75 %) than solitary males (25–34 %). Elephant proof trench was proven to be the best amongst all the other mitigation techniques followed by the locals around the study area.

Rao *et al*. (2015) thoroughly studied the nature and extent of human-wild boar conflicts in southern India. About 36 per cent of agricultural crops were damaged by wild species in which crop damage by wild boar held a major share. The main reason for invasion of wild boars into cultivated crop lands of rice, oilseeds, sorghum, fruits and

vegetables was due to over exploitation of forest resources by humans that compelled the wild boars to move into the cropped lands from their natural habitats. The extent of damage in *Zea mays* was around 10-75 per cent, *Arachis hypogeal* was around 5-56 per cent, *Sorghum vulgare* was around 5-30 per cent, *Oryza sativa* was around 10-35 per cent, pulses 5-20 per cent and vegetables 10-30 per cent. The proximity of crop fields to forest area was the deciding factor for the extent of crop damage. The various Indigenous Traditional Knowledge's (ITKs) used by the locals to control wild boar attacks were enlisted by the authors.

2.3 To assess and estimate the extent of economic losses in various cereals, vegetables and other horticultural crops triggered by monkey menace in the study area.

Irby *et al*. (1996) approximated the economic damage caused by native ungulates to forage crops during 1992 in USA. In this study that was conducted on 2200 randomnly selected farms and ranches, about 51 per cent were of the opinion that wild ungulates were interfering on 97 per cent of agricultural operations. White tailed deer was found out to be a major threat in the study area among all other ungulates that were responsible for crop damage. The estimated losses on sample farms in Montana during 1992 were calculated to be US $ 12.2 million.

Wywialowski (1996) in top ten maize producing states of United States of America during 1992 studied the distribution and degree of damage caused by wild animals like Racoons, white tailed deer, bears etc on maize. The study suggested that there was no uniform distribution of losses in maize fields of the study area caused by deer and other unidentified animals. The average loss of 1.7 bushels/ha with an estimated production loss of $92 million was observed in the study area. The authors urged the farmers and also the policy makers to take a note on the seriousness of the issue and act responsibly to avoid further losses of this extent.

Brittingham *et al*. (1997) aggregated primary data through mailed questionnaire from 1,003 farmers to study and critically analyze the disparity in the losses and the animals that were responsible for the cause. Among the total farmers, around 25 per cent of them evaluated the destruction of the crop to be very severe or severe, 46 per cent of them evaluated it to be moderate and 29 per cent of them evaluated it to be very little or none in accordance to the study. The average loss in crop due to wildlife was estimated

to be in the range of 6 per cent in case of wheat and 10 per cent in corn grain. The white-tailed deer was found to cause destruction of all crops among the various wild animals, except for soybeans. The total commercial value loss caused by wildlife to the farmers was greater than $70 million approximately, for six crops (corn grain, wheat, oats, silage, soybean and alfalfa). Damage caused by deer, around 31 per cent of farmers adopted different farming strategies than the one that existed before. The different techniques used to check the damage caused by the deer were noise devices (5%), shooting (27%), repellents (7%), chasing (13%) and fencing (9.3%). Shooting and fencing were considered to be at least moderately effective among the different techniques used.

Treves (1998) observed and documented the loss of crops due to livestock and wildlife in an area consisting of six villages around the Kibale National Park in Uganda, over a period of 24 months. Through the study, she found that 85 per cent of the crops damaged were due to wildlife, and the main animals responsible for these damages were elephants, baboons, red tail monkeys, chimpanzees, and bush pigs. It was found that fields within a half kilometre radius from the forest boundaries had an average loss of 4-7 per cent of the crop per season, but the damages were of a skewed pattern. However, cassava and maize fields were on occasion completely destroyed. Elephants inflicted major calamitous damages to the farms, but their intrusions were highly localised and rare occurrences. The study also revealed that livestock too, had caused a considerable amount of damage to the crops, but the farmers seldom complained about this issue, as they were compensated for such instances. Ultimately, most wildlife-caused crop damages were faced by the farmers living in a narrow band near the forest edge. The legal issues of prohibition of killing these wild animals only increased the risk perception amongst these farmers. The author thus suggested providing fair compensation for these losses, and also channelizing the economic advantages to the locals, to raise their tolerance for wildlife.

Miah *et al*. (2001) conducted a study to scrutinize the issue of crop damage caused by animals and find out conventional methods to deterrence at Chunati Wildlife Sanctuary located in Bangladesh. According to the study, the major animals that caused the issue include elephants, wild dog, wild boar, red-breasted parakeet, porcupine, barking deer, monkey and hoary-bellied squirrel. An average loss of US $961.82 was recorded as the damage caused per hectare for seven crops. Scaring the animals away, protecting the crops, utilizing traps and scarecrows were the simple methods that was

developed and put into practice to avoid the conflict between man and wildlife. The prevailing crop protection principles were castigated by the authors and advocated the shifting and assembling of crop fields and also suggested to generate a buffer zone in the region linking the sanctuary and non-sanctuary as it would increase conservation of fieldsfrom the attack of wildlife.

Prasad and Reddy (2002) studied about the man animal dispute and alleviation in Koundiya Wildlife Sanctury located in Andra Pradesh. According to the study, in 1984, the elephants had once again appeared in the forest region of Chittoor district after a period of 200 years from Tamil Nadu. The major reasons for the damage caused by the elephants were lack of fodder in forests and presence of lure crops in linking regions. The Agricultural crops that the elephants damaged include sugarcane, ragi, sorghum and orchards like banana, mango and coconut. In the district 3,814 crops were damaged and Rs 23.68 lakhs was paid as compensation as found by the authors. Shift in cropping pattern, growing more of fodder, creating electric fences along the border of the sanctuary, enhancing water facilities and conducting awareness campaigns were some of the measures adopted to alleviate this dispute.

Rao *et al*. (2002) assessed crop harm and domesticated animals ravaging by untamed life in 10 towns arranged in the cushion zone of Nanda Devi Biosphere Hold in Chamoli area of Uttaranchal, India during 1996-97. Misfortunes from regions close to backwoods added to more than 50% of absolute misfortunes for each harvest in all towns. Other than food grains, agricultural yields likewise endured most extreme harm. Significant natural life specialists liable for crop harm were wild hog, bear, porcupine, monkey, musk deer and partridge (chokor). Monkey and wild hog alone represented around 50 to 60 per cent of complete harvest harm in the investigation towns. The investigation underlined the need to attempt reasonable and fitting defensive measures to limit the yield misfortunes. Change in trimming examples and yield arrangement, especially in development of restorative plants, were additionally proposed. The investigation likewise proposed reasonable and speedy payment of remuneration for crop misfortune.

Weladji and Tchamba (2003) distinguished the reasons for clashes between neighborhood individuals and the Benoue Natural life Preservation Region (BWCA), which incorporates the Benoue Public Park, in northern Cameroon. The degree of harm fluctuated among networks. Elephants, mandrills, monkeys, warthogs and green parrots

represented 97% of yield harm. The contribution of nearby individuals in criminal operations, their absence of admittance to normal assets, and harm by natural life were recognized as chief reasons for clashes around there. Nearby individuals, park staff and expert chasing guides had different and contrasting insights about the reasons for the struggles. The investigation inferred that under the current natural life strategy, struggle among individuals and Benoue Untamed life Preservation Territory (BWCA) was hard to determine. The investigation recommended co-administration of untamed life including all partners, foundation of yield harm control groups and advancement of substantial advantages to neighborhood individuals.

Sahoo and Mohnot (2004) conducted a survey under the auspices of the Indo-US Primate Programme in Himachal Pradesh from June 1997 to February 1998, to collect the baseline information on depredations to agriculture/horticulture crops by native monkeys and langurs. The study revealed that major agricultural crops targeted by monkeys were maize, potato, wheat, vegetables and pulses and horticultural crops like apple, pear, cherries, plum, almond, walnut and apricot etc. The per farm perceived economic loss from crop damage by monkeys ranged between Rs. 2,000-8,000 in case of crops, while it was more than Rs 8,000 for fruit crops for the year 1997-1998. The study indicated that no compensation was ever claimed by respondents from Forest Department of the state. The author suggested a comprehensive study on community participation programme for monkey management, habitat conservation and other aspects related to crop damage by monkeys in order to understand the depth of problem.

The damage caused by the asian wild elephants to the crops in Jhapa district located in Nepal was gauged by Yadav from 1999 to 2001. Regression analysis was conducted to define crop invading depending on stretch between the wards and habitat of wildlife. Paired T-test was conducted in contrast to the economic loss. According to the study, 277 houses were demolished and 66 people were killed in 5 districts by the elephants, within span of one and half decades and during this period 23elephants were also found to be killed. Elephants' damage differed among different wards and during the years 1999 and 2001, a loss of around US$ 54567 and US$ 33669 were recorded, respectively. To deter these elephants, the farmers belonging to the area of study, on an average spent US$ 176 to US$ 229 annually.

In Jigme Singye Wangchuk National Park located in Bhutan, Wang *et al*. (2006) evaluated the effect of crop damagecaused by the wildlife on daily lives of the local agro pastoralists. 274 farmers facing major financial losses as a result of the damage caused to their crops by wild pigs, sambars, macaques, barking deer were selected as a sample as a part of the study. According to this study, 97 per cent of crop damage was noted to be caused by the wild animals. Non-lethal techniques like guarding, carrying out religious rituals and fencing were adopted by the farmers to safe guard their crops. It was seen that the farmers found fault in setting up of parks, policies for its conservation and Forest and Nature Conservation Act, 1995 as the major reason for rise in the damage of crop due to wildlife. It was recommended by the authors that the administration measure should be taken towards increasing tolerance within the farmers and to reduce the losses brought about by macaque and wild pigs.

Kaswamila *et al*. (2007) estimated in three semi-arid villages, the effect of wildlife on income and security of food. These villages were located next to Mkomazi Game Reserve and Lake Manyara National Park present in North-Eastern Tanzania. It was found that both food security of the household and income were affected by the crop damage caused by the wildlife. On an average, the income of the household reduced by 1.3 per cent and the damage of crop was accounted to be 0.08 ton per year. They recommended control actions such as providing economic bonuses, to reduce the reliance on natural resources soft loans were provided to start non-farm activities, the buffer zone of the reserve to be increased and creating fence around the reserves.

Prashanth *et al.* (2013) studied crop raiding by Gaur (*Bos gaurus*) in a Mookambika wildlife sanctuary, Kollur, Karnataka for a period of two years. The study showed that the maximum crop raiding cases were reported in the months of March, April and May i.e. during summer (56.84 per cent) and minimum cases during June, July and August i.e. during monsoons (9.79 per cent). Maximum damage was caused by a medium sized herd (9-12 individuals) and severe damage was caused to paddy crop. Farms located inside the core area were mostly affected as compared to the farms located in the periphery of the sanctuary. The study observed direct relation between the climatic conditions of the park in dry months and crop raiding cases. The study revealed that the maximum farmers (71 per cent) preferred manual guarding as a crop protection strategy.

Govind and Jayson (2014) conducted a study in Thrissur District, Kerala, India, from April 2009 to March 2012, to assess the crop damage by wild animals and economic loss incurred to the marginal farmers and reported that The most damage was caused by Asian elephants (*Elephas maximus*), with an estimated annual economic loss of Rs. 17,35,625/-, followed by wild pig (*Suss crofa*) (Rs. 3,736/- per ha per year) and Indian crested porcupine (*Hystrix indica*) (Rs. 615.47/- per ha per annum). The damage caused by Malabar giant squirrels (*Ratufa indica*) feeding on tender coconuts (*Cocos nucifera*) was estimated to be Rs. 2247/- a year in the Forest Ranges near the Wildlife Sanctuaries. In the rice fields surrounding ChulannurPeafowl Sanctuary in Kerala, Indian peafowl (*Pavo cristatus*) and other birds contributed to a considerable economic loss of Rs. 16,615.45/- per ha.

Mwakatobe *et al.* (2014) reported that crop damage is a serious source of conflict in communities adjacent to protected areas. The results indicatedcrop raiding differed dramatically on farms along a distance gradient from the protected region, according to the findings. The most destructive wild creatures were reported to be baboons, followed by elephants, which were particularly destructive in the settlements near the protected region. Households suffered enormous financial losses as a result of wild animals. They call for more research into crop yield gaps caused by crop-raiding wild animals and human-primate conflict in communities near protected areas. In order to effectively protect crops from wild animals, they recommend that local communities adopt a combination of methods to reduce the levels of crop raiding.

Okello *et al.* (2014) examined field evidences and interviewed expert key informants on current intensity and frequency of human-elephants in Amboseli ecosystem, Kenya. According to the study, generally, the most prevalent threats to elephants (score of 1 lowest to 10 highest) were competition for critical resources (6.32 ± 0.44) followed by blocking of migration (6.24 ± 0.46), harassment of elephants (4.83 ± 0.75), poaching (4.57 ± 0.37), and retaliatory killings (3.78 ± 0.31).Crop raiding was the most common threat posed to people by elephants (6.95 0.26), followed by environmental degradation (6.71 ± 0.46), general insecurity (5.76 ± 0.65), property destruction (5.16 ± 0.41), injury and death to livestock (3.78 ± 0.37), and injury and death to people (2.71 ± 0.27). Crop raiding received the highest average score of 7.90 0.24 for the severity of the risks, followed by environmental devastation and degradation (6.89 ± 0.43).

Saraswat *et al.* (2015) studied the human monkey interaction and stated that Human-rhesus macaque conflict due to crop raiding is a major problem affecting northern India, particularly the states of Himachal Pradesh and Uttarakhand. Management techniques are challenging both due to the commensal nature of the macaque as well as the culturally significant status of the species in India. Studies on wildlife crop raiding indicate that people's reactions to crop raiding are strongly influenced by their attitudes towards the species involved and that insights into these perceptions are critical to work towards conflict-resolution measures. Hence, they investigated the attitudes and perceptions of farmers in Bilaspur district, Himachal Pradesh, towards the rhesus macaque (*Macaca mulatta*) and the impact of macaque crop raiding on their lives. The results of their study indicate that farmers hold ambivalent attitudes towards the rhesus macaque and mixed opinions regarding its management.

Ayyappan *et al.* (2016) in their paper mentions the different ways in which human wildlife conflicts occur which are : i) Killing of humans ii) Killing of livestock iii) Accidental injury iv) Damage to agricultural crops v) Property damage. They go on to explain the fundamental causes of Human-Wildlife Conflicts, which include the loss of species-specific habitats, habitat degradation and fragmentation, intensive agricultural practices, insufficient prey base and food material, increased human and livestock populations, competitive exclusion of wild herbivores, land use transformation, developmental activities, and a growing interest in ecotourism. Further they also suggest some measures that are ready for pilot testing such as use of barrier crops, physical barriers, for wild boars, use of male excreta, castor barrier for nilgai and de-branching of overlapping tree canopy, non preferential crops for monkeys and many such that helps to mitigate the problems of human wildlife conflict.

Walia (2016) reported that the proportion of area affected by animal menace was about 33 per cent of total cropped area, which was found to be relatively higher in cereals and fodder crops compared to vegetable crops. The extent of decline in productivity levels of vegetables was low compared to cereals. There was an average increase of 24.44, 19.07 and 25.66 per cent in the cost of cultivation of maize, paddy and wheat, respectively on overall situation compared to non-menace prone area. The total economic losses on account of animal menace in crops were estimated at Rs 25358/- farm in which the share of production losses was comparatively high (about 54 per cent) to increase in total cost of cultivation. It was suggested for the farmers to allocate more

area to the crops like ginger, turmeric, garlic and okra in which the economic losses were quite low.

Metuku (2018) in his paper ‘Monkey menace, its management’ reports monkey migration into human civilization is caused by the drying up of water bodies and the lack of food sources in the forests. Human settlements in and surrounding forests are displacing animals from their natural habitats, which has a direct impact on wild animal food availability. As a result, wild animals' competition for food, water, and space has spread beyond forest areas. Monkeys' life expectancy grew as a result of their proximity to villages and cities, which provided them with guaranteed food and safety, allowing them to spend more time with them for breeding and survival. The monkeys wreak havoc on crops, resulting in significant losses. Despite the fact that author argues, despite efforts put by various state governments to control the monkey threat, the success rate is far from ideal. India needs strategic integration, from a new institutional system to finding new technological solutions.

Chapter 3

Materials and Methods

The present chapter describes the details of methodological procedures followed to accomplish the specific requirements of the stated objectives of the study. The present chapter has been described in following sub-heads:

3.1 Selection of study area

3.2 Sampling design

3.3 Data collection

3.4 Analytical framework

3.5 Limitations of the study

3.1 Selection of the Study Area

In the case of present investigation, as time and wherewithal were a concern, the selection of study area might have a biased edge towards the information that was already available regarding the issue. Even though, most of the districts of Jammu division suffer from monkey menace, Udhampur district was purposively selected keeping these reasons into consideration:

- District Udhampur had and still has maximum number of households that are affected due to Monkey menace as compared to other districts of Jammu division.
- District also has vast area under range lands, groves, forests, *etc.* suitable for hiding/ breeding for monkeys.

3.2 Sampling Design

Sampling design refers to the procedure of selection of ultimate respondents for data collection. Two-stage random sampling design was used for the selection of 120 respondents. At the first stage of sampling, out of seventeen blocks of Udhampur district, a sample of three blocks namely; Tikhri, Sewna and Jaganoo were selected purposively as the extent of damage in these blocks ranged in between 10-80 per cent. At the 2nd stage of sampling, the list of villages for selected blocks was prepared with the help of officials of concerned blocks. In total, there were 8, 8 and 30 villages in Tikhri, Sewna and Jaganoo blocks, respectively. From the list of 46 villages so

prepared a sample of 12 villages was drawn i.e, 4 villages from each of the three blocks were selected randomly for this study.

Table 3.1 Distribution of sample among selected blocks and villages of study area

Sr. No.	Name of Village/Block	Number of farmers selected	Per cent to total
A	**Tikhri block**		33.33
1	Tikri B	10	
2	Mand east	10	
3	Cheryi	10	
4	Lehnu	10	
	Sub-Total	40	
B	**Sewna block**		33.33
1	Laddan	10	
2	Sewna	10	
3	Pakhlai	10	
4	Kaira	10	
	Sub-Total	40	
C	**Jaganoo block**		33.33
1	Dhadil	10	
2	Kuh	10	
3	Roun	10	
4	Ritti	10	
	Sub-Total	40	
	Total	120	100

At the third stage of sampling, the list of farmers having high gravity of monkey menace *i.e.* farmers having land adjoining to the potential passages, hiding places, resting places *etc.* of monkeys for the selected villages was prepared and a list of farmers who were not affected by monkey menace was also prepared. From the lists so prepared, a sample of 60 farmers from each category was drawn randomly from the selected village through equal allocation method *i.e.* 5 households from each of the two categories. The block-wise detail of selected villages of Tikhri, Sewna and Jaganoo blocks for the primary data collection is compiled in Table 3.1 and schematic sampling plan has been depicted in Figure 3.1.

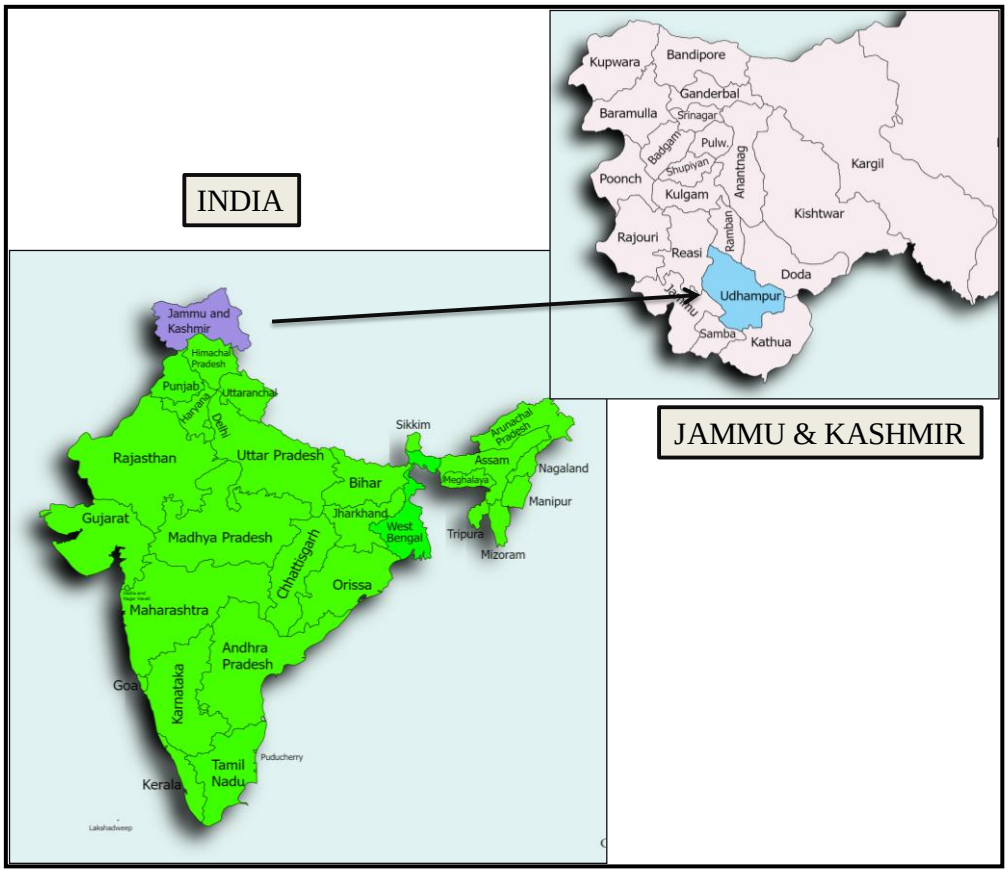

Figure 3.1 Location map of study area

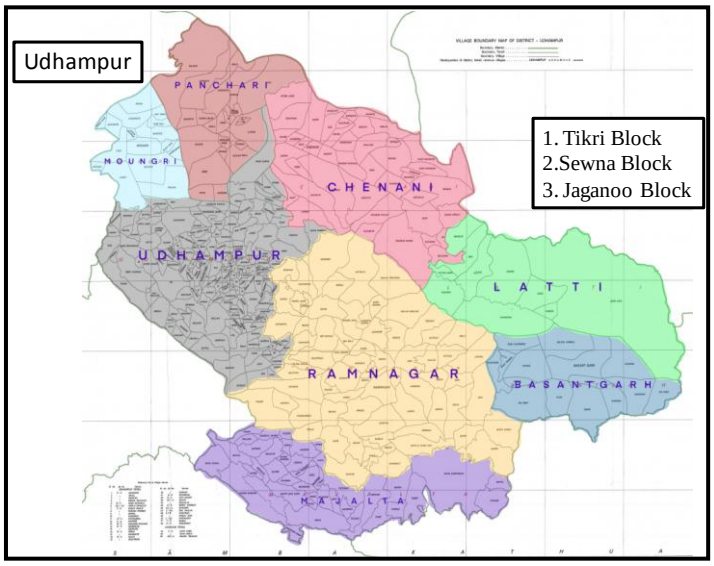

Figure 3.2 Schematic representation of sampling design

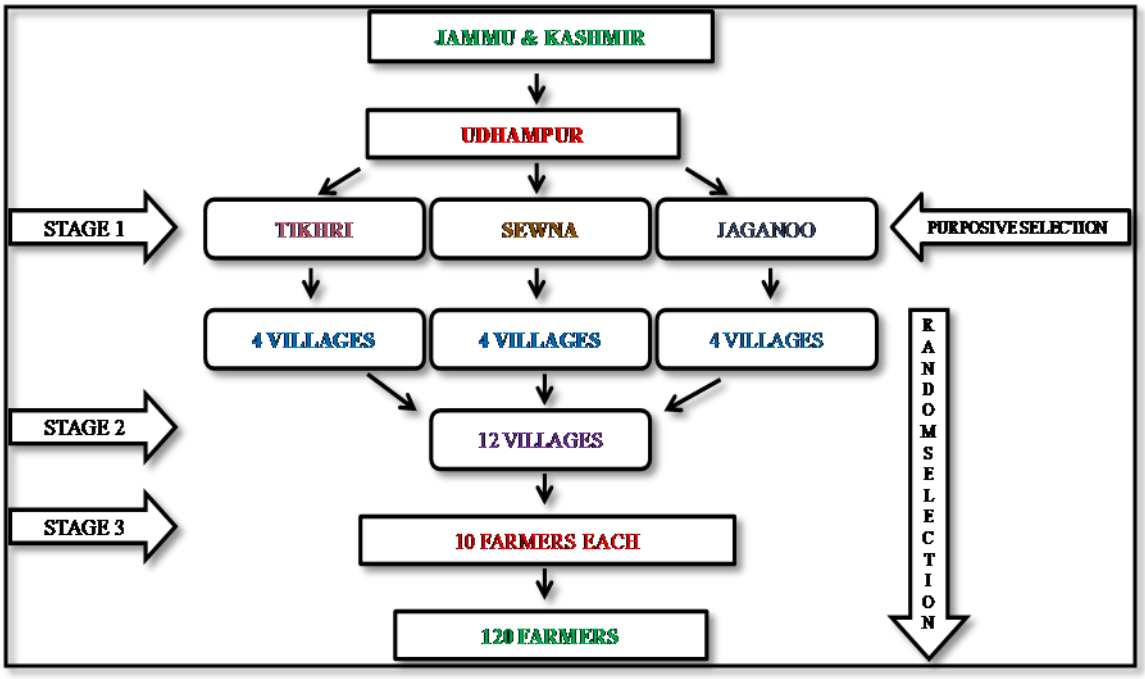

Figure 3.3 Schematic representation of sampling

3.3 Data Collection

In order to meet out the requirements of specific objectives of the study, both primary as well as secondary data were collected.

3.3.1 Primary data

The data were collected through the personal survey method on specifically designed survey schedule. Before preparing the survey schedule a preliminary survey was conducted in the study area to have an overview of cropping pattern and crop production practices. Accordingly, the survey schedule was prepared and pre-tested in order to examine the relevance of structured questions. After making the necessary modifications the survey schedule was finalized. The primary data from the selected households were collected during the agricultural year 2020-21.

The detailed information collected from the sample households is as under:

1. Demographic parameters such as age, head of the family and family members, *etc.*
2. Farm inventories like, buildings, land holding, farm machinery & implements, livestock, fruit tree inventory. *etc.*
3. Land use and cropping patternand labour use pattern in important crops.
4. Entry points for monkey to crop fields, extent of losses.

5. Problems associated with monkey menace, proportion of cultivated area (menace and menace free)
6. Economic losses associated with monkey menace with respect to decrease in production and increase in cost of cultivation associated with watch & ward.

3.3.2 Secondary data

The secondary data related to measures taken by the government to curb the population of monkey *etc.* were collected from various published or unpublished sources like; books, journal, reports, websites, *etc.* to meet out the requirements of objectives of the study.

3.4 Analytical Framework

Simple tabular analysis of data has been carried out to meet out the required specific objectives of the study. Different mathematical and statistical tools were employed for the analysis of data. The collected data was scrutinized and compiled in excel worksheet. The data was processed in the excel worksheets using statistical and mathematical tools available in the excel package. The parameters of demographic features like family size, age wise distribution, inventory of buildings, inventory of farm implements and machinery, land utilization and cropping pattern *etc.* have been presented by working out averages and percentages in relevant chapter. Similarly, economic losses associated with monkey menace, cost of cultivation for menace affected and menace free farms have also been analyzed by working out averages and percentages. In addition to averages and percentages, standard indices and ratio estimates were also estimated which are as under:

3.4.1 Cropping pattern

In order to study the cropping pattern in areas prone to monkey menace of Udhampur district of Union Territory of Jammu and Kashmir, a thorough and detailed schedule was prepared, the sample farmers was interviewed regarding the schedule and the responses was compiled, analysed and tabulated to arrive at a meaningful result. Secondary data regarding this was collected from journals, directories, and authorized government websites.

$$Cropping\ Pattern(P_i) = \frac{A_i}{A_t}$$

Where,

P_i = Proportion of area under i^{th} crop

A_i = Actual area under i^{th} crop

A_t = Total cropped area during the agricultural year.

$$Cropping\ Intensity(\%) = \frac{Gross\ Cropped\ Area}{Net\ Sown\ Area} \times 100$$

ii) Extent of Area, Type of Crop and Stage of Crop Damaged

To assess the extent of area, type and stage of crops damaged by monkey menace in the study area, a detailed schedule was prepared and each sample respondent was interviewed regarding the particular objective. And to understand the attitudes of local people towards monkey menace, questionnaire based "opinion survey" was conducted.

iii) To estimate the extent of economic losses in various cereals, vegetables and horticultural crops triggered by monkey menace in the study area.

The aggregate economic losses (AEL) mainly occur due to the following reasons:

- Decrease in income as a result of loss of production.
- Increase in cost of cultivation due to costs incurred on precautionary methods exercised by the farmers (ACP).

The responses obtained from the sample farmers was compiled and then was subjected to suitable analytical tools.

Total Economic Losses:

$$AEL_i = \sum PL_i + \sum ACC_i$$

AEL_i : Aggregate Economic Losses ofi^{th}crop

PL_i : Production losses ofi^{th}crop

ACC_i : Additional cost of cultivation incurred on i^{th} crop

i)Total production losses:

The total production losses was estimated by taking difference in productivity levels of different crops under menace, non menace and overall situation as per formula given below

$$PL = AP_m(P_{nm} - P_{om}) + AP_b(P_{nb} - P_{ob})$$

AP_m = Average price of the main product of i^{th} crop (Rs/q).

P_{nm}= Productivity of main product of i^{th} crop under menace free area (q/ha).

P_{om}= Overall existing productivity of main product (menace & menace free area) of i^{th} crop (q/ha).

AP_b= Average price of by-product of the i^{th} crop (Rs/q).

P_{nb}= Productivity of by-product of i^{th} crop under menace free area (q/ha).

P_{ob}= Overall existing productivity of by-product (menace & non menace area) of i^{th} crop (q/ha).

Overall existing productivity:

$$P_{om} = \frac{(Pnm * An) + (Pmm * Am)}{An + Am}$$

P_{nm} = Productivity of main product of i^{th} crop under area free from menace(q/ha).

P_{mm} = Productivity of main product of i^{th} crop under area affected by monkeys(q/ha).

A_n = Menace free area under i^{th} crop(ha/farm).

A_m = menace prone area under i^{th} crop(ha/farm).

ii) Additional cost on watch & ward and fencing (ACC)

In order to work out the additional cost on watch & ward and fencing, the total cost of cutlivation under non-menace, menace prone and overall situation (non-menace + menace) were estimated for maize, wheat, oat, potato, onion and so on. During the survey it was found that in general, the input use pattern and common cultural practices in different crops were reported to be same for both menace and non-menace areas. However, watch & ward and fencing activities were performed to protect the crops from stray and wild animals which increased the total cost of cultivation under menace prone areas. The estimation of total expenditure in general crop cultivation operations and watch & ward and fencing for selected crops is as under:

Cost of Cultivation

a) Cost of cultivation in general crop operation (menace free area)

$$\boldsymbol{Total\ Cost\ (TC) = Total\ Fixed\ Cost\ (TFC) + Total\ Variable\ Cost\ (TVC)}$$

Total fixed cost

A farmer has no control over these costs, as these stands incurred even if nothing is produced. These are also known as overhead costs and are based upon initial capital investments. It includes:

$$\boldsymbol{TFC = I+D+R}$$

I = Interest on Initial Fixed investment(Rs/ha).

D = Depreciation on major and minor implements (Rs/ha).

R = Rental Value of owned land (Rs/ha).

Total variable cost

Variable cost is associated with variable factors of production and it varies with the level of output produced on the farm. The farmer has some control over these costs at a given time *i.e.* these can be increased or decreased as per his discretion. The recurring or variable cost includes expenditure on the following items used in crop production:

- Seeds & planting materials
- Human labour
- Bullock labour and tractor charges
- Manure and fertilizers
- Irrigation charges
- Plant protection chemicals
- Watch & ward and fencing against wild and stray animals
- Charges of thresher
- Miscellaneous expenses
- Interest on total working capital calculated for half of the crop period

The cost has been appropriated proportionally among the crops on the basis of area under different crops.

$$\boldsymbol{TVC = \sum_{i=1}^{n} P_i X_i + \sum_{i=1}^{n} (P_i X_i) * r * \frac{k_i}{2}}$$

P_i = Price of i^{th} input per unit

X_i =Quantity of i^{th} input used

K_i = Crop peroid of i^{th} crop in months

r = Monthly interest rate charged on working capital

b) Cost of Cultivation (menace-prone area) :

$$TC = TFC + (TVC + Additional\ cost\ incurred\ for\ managementof\ monkey\ menace)$$

TC = Total cost

TFC = Total fixed cost

TVC = Total variable cost

3.5 Limitations of the Study

This study was carried out thoroughly using relevant scientific methodology. With due respect to the time and resources available for this study, it was conducted in only one district of the union territory and the relevant primary data was obtained from 120 respondents from 12 different villages of 3 different blocks of the district. The implications of this study are based on the data gathered from the experience and memory of the respondents as very little or no farm records were maintained. As the data was collected from repeated survey the innate lacunae related with survey method of data collection might have affected the results.

Plate 1 : Glimpses of survey conducted in Udhampur

Chapter 4

Results

In this chapter, the results are presented on different aspects of the sample farmers viz., socio-economic conditions, cropping pattern, inputs use pattern, production and productivities of different crop enterprises, labour use pattern, status of animal menace in the study area, causes and problems of animal menace and losses associated with animal menace, and so on. The results of the study have been presented under the following sections:

4.1 Profile of the study area

4.2 Socio-economic profile of sample households

4.3 Cropping pattern in the study area

4.4 Extent and pattern of monkey menace in study area

4.5 Economic losses as a result of monkey menace

4.6 Suggestions to address the problem of monkey menace

4.1 Profile of the Study Area

4.1.1 Historical background

Udhampur district also known as Devika Nagari is in the Indian Union Territory of Jammu and Kashmir. The Udhampur city which serves as the capital of the district also serves as the northern command headquarters of the Indian Army. It has a rich history going back to thousands of years; it has been mentioned in ancient texts of India. The Sultanates from the west arrived to this region around 13 to 14th century B.C. Since then, the state of Kashmir was ruled over by many dynasties including the Mughals and Afghans. During late 19th century, Prince Udham Singh proposed township in this area. Maharaja Gulab Singh acknowledging the benefits of a township on the path of Royal caravan's travel to Kashmir approved the proposal and named the township as Udhampur after his son. After the independence, this princely state of Kashmir of which Udhampur was a part of, ultimately acceded to Indian union.

4.1.2 Location and boundaries

Udhampur is situated at an elevation of 2,500 feet (760 metres) in a valley of the Siwalik Range in the south-western part of the union territory of Jammu and Kashmir, northern India. It is about 20 miles (32 km) northeast of Jammu. It is bounded by Reasi district on the west, Ramban on the north, Doda on North-East, Samba & Kathua on the

South-East and Jammu on the South-West. The co-ordinates of the district lie between $32^0$34' to $39^0$30' N and $74^0$16' to $75^0$38' E.

4.1.3 Physiographic features

i) Climate and rainfall

The temperature in the district has a wide variation from as high as 45^0 C in summer months of May, June, July and as low as 1.5^0 C in the winter months of December, January, and February. This wide range of temperature has been observed due to variation in altitude ranging from 600 meters and 3000 meters above mean sea level in the district. The district receives serious rainfall during July, August and September and little showers during January and February also. Table 4 gives the rainfall statistics of Udhampur district for the months, June, July, August and September. It is evident from the data that the mean rainfall received during the monsoon season is 1071.6 mm and the district receives highest during the month of august with the mean of 418.4 mm and the average number of heavy rainy days ranging from 1-2. The average annual rainy days ranges between 46-60 days, but some parts of the district receive 60-65 days of rainfall on an average every year.

Table 4.1 Rainfall statistics for the four monsoon months of Udhampur

Sl. No	Months	Mean (mm)	C.V
1	June	104.6	70.9
2	July	397.5	46.8
3	August	418.4	51.0
4	September	151.1	83.4
	Monsoon	1071.6	34.9
	Annual	1591.6	38.9

Source: JK final, India metrological Dept.

ii) Geomorphology

Physio graphically, the district is characterized by

- High Hill Ranges: Complex and high mountainous terrain covered partly by PirPanjal ranges and partly by outer Himalayas in NW-SE direction whose major slope is towards south and southwest, while the high hills exist in the northern and eastern part of the area and vary in elevation from 1100 m to 2400 m amsl.
- Valleys (Dune): Deep narrow valley.

- Terraces: Five river terraces occur on either bank of Chenab River. Paired terraces are observed in the area between Talwara and Derababa. The alluvial terraces are also observed along the Tawi River.
- Meanders: Meanders are seen in the lower reaches, scrolls. Paleo-channels are common in Chenab and Tawi-Sutlej.
- The major soil types found are the Mountainous Soil and Sub-Mountainous Soil.
- The important geological formations are Quaternary Alluvium, Tertiary (Siwaliks, Murrees), Older Crystalline & Metamorphic rocks

4.1.4 Administrative set up

For smooth and effective functioning of Udhampur District as a whole, the administration of the district is divided into 4 subdivisions namely, Dudu, Basantgarh, Chenani, Ramnagar which comprises of 8 tehsils namely Udhampur, Chenani, Basantgarh, Chenani, Latti, Moungri, Pancahri and Majalta. The 8 tehsils have been further subdivided into 17 developmental blocks namely Chanunta, Chenani, Dudu, Ghordi, Jaganoo, Khoon, Kulwanta, LattiMarothi, Majalta, Moungri, Narsoo, Panchari, Parlidhar, Ramnagar, Sewna, Tikri, Udhampur consisting 205 panchayats. There are totally 357 villages, 122 Patwarhalqas, 21 niabats and 30 G.Q. circles in Udhampur district. The Deputy Commissioner along with the Additional Deputy Commissioner, Assistant Commissioner, District Judge, Superintendent of Police, Chief Executive Officer of ZilaParishad and other senior officers of the State Government look after the development and regulatory functions in the district. At the tehsil level, the Tehsildar, Naib-tehsildar, Block Development Officer, and other officers look after their respective departments for development and regulatory functions. The administrative set up of Udhampur district has been presented in Table 4.2

Table 4.2 Administrative set up of Udhampur District

Sr. No.	Description	Number
1	No. of sub-Divisions	4
2	No. of Tehsils	8
3	Developmental blocks	17
4	Panchayats	205
5	Total Villages	357
6	Patwar halqas	122
7	Niabats	21
8	G.Q. Circles	30

Source: Udhampur Abstract (2018-19)

4.1.5 Demographic features

i) Salient features

Age, sex, education level, income level, marital status, occupation, religion, birth rate, death rate, average size of a family, *etc.*, when statistically expressed represents the overall socio-economic fabric of the population i.e, the demographic features of that population. The highlights of the important demographic features of Udhampur district is given in Table 4.3. The table presented reveals that district Udhampur covers 5.63 per cent of total area and 4.46 per cent of total population of the union territory of Jammu & Kashmir. The bulk of the population *i.e*, about (80.4 per cent) has their households in the rural areas of the district. With 870 females for every 1000 male in the district, the sex ratio is relatively low when compare with that of the union territory as a whole (892 females for every 1000 males). The union territory has a literacy rate of 67.16 per cent, whereas the Udhampur district has a literacy rate of 68.49 per cent which is higher than the Union territory as a whole. The district Udhampur comprises of roughly around 20 per cent of the total cropped area of the entire Jammu and Kashmir with a cropping intensity of 158 which is higher than the cropping intensity of the Jammu and Kashmir as a whole (136.6).

Table 4.3 Area and population of Udhampur district in comparison with Jammu & Kashmir (2018-19)

Sr. No.	Particulars	Udhampur	Jammu& Kashmir	Per cent w.r.t. U.T
1	Area (Sq. km)	2380	42241	5.63
2	Tehsils (No.)	8	217	3.68
3	Development blocks (No.)	15	310	4.83
4	Population (No.)	557689	12500000	4.46
5	Rural population (No.)	449481	9108600	4.93
6	Urban population (No.)	108208	3433242	3.15
7	Total cropped area (ha)	83432	400000	20.85
8	Net sown area (ha)	43556	909000	4.79
9	Cropping intensity (Per cent)	158	136.6	115
10	Sex-ratio (females per 1000 males)	870	892	97.53
11	Literacy rate (Per cent)	68.49	67.16	81.56
I	Male	78.36	76.75	
II	Female	57.01	56.43	

Source: Statistical Year book of Udhampur (2018-19), Department of Agriculture J&K

ii) Population

There are 17 blocks in Udhampur district which has a total population of 5,57,689 of which 4,49,481 live in the rural areas and 1,08,208 in urban areas. Block wise population of the entire district is presented in the Table 4.4. The 17 blocks in total comprise of 205 panchayats and 357 villages of which majority of population (29.40%) resides in Udhampur block followed by Chenani block (9.17%) and Ramnagar block (7.86%). Block Sewna had the lowest population among the different blocks of the district.

Table 4.4 Block-wise population of Udhampur district

Sr. No.	Block	Population			
		Rural	Urban	Total	Percentage w.r.t district
1	Udhampur	75481	88472	163953	29.40
2	Panchari	26260	-	26260	4.71
3	Chenani	46943	4185	51128	9.17
4	Majalta	24460	-	24460	4.39
5	Ramnagar	36552	6292	43844	7.86
6	Ghordi	40949	-	40949	7.34
7	BasantGarh	16630	-	16630	2.98
8	Kulwanta	17619	-	17619	3.16
9	Latti- Marothi	22772		22772	4.08
10	Moungri	17217	-	17217	3.09
11	Narsoo	15345	5709	21054	3.78
12	ParliDhar	13843	-	13843	2.48
13	Sewna	11315	-	11315	2.03
14	Chanunta	14357	-	14357	2.57
15	Jaganoo	24593	3550	28143	5.05
16	Khoon	25907	-	25907	4.65
17	Tikri	19238	-	19238	3.45
	Udhampur District	449481	108208	557689	

Source: Udhampur at Glance (2018-19), Census 2011

4.1.6 Land utilization pattern

The land utilization pattern of the Udhampur district is presented in the Table 4.5. The total geographical area reported under district Udhampur is 2.38 lakh hectares of which forest lands cover an area of 1.04 lakh hectares which constitutes up to 43.78 per cent of the total geographical area. The total cropped area of 0.83 lakh hectares have been reported by revenue department of J&K for the agricultural year 2018-19 which accounts to about 35.05 per cent of the total geographical area under Udhampur district. Apart from these 0.43 lakh hectares, 0.05 lakh hectares, 0.002 lakh hectares have been reported under uncultivable, permanent pastures and grazing and fallow lands respectively. The number of operational land holdings was summed up to be 63880 which covered an area of 57674.05 hectares. 0.09 lakh hectares of land had assured irrigation. Rice (30.44%) accounted for the most area under irrigation followed by wheat (21.84%).

Table 4.5 Land utilization pattern of Udhampur District of Jammu & Kashmir

Sr. No.	Particulars	Area (ha)	Per cent to total area
1.	Total geographical area	238000	100
2.	Forests	104206	43.78
3	Barren and uncultivable land	43366	18.22
4.	Area under pasture/grazing land	5572	2.34
6.	Fallow land	281	0.11
7.	Net sown area	43556	18.3
8.	Total cropped area	83432	35.05
9.	Net Irrigated area	5821	2.44
10.	Gross irrigated area	9129	3.83
11.	Number of operational holdings	63880	

Source: Assistant Commissioner Revenue data- Jammu

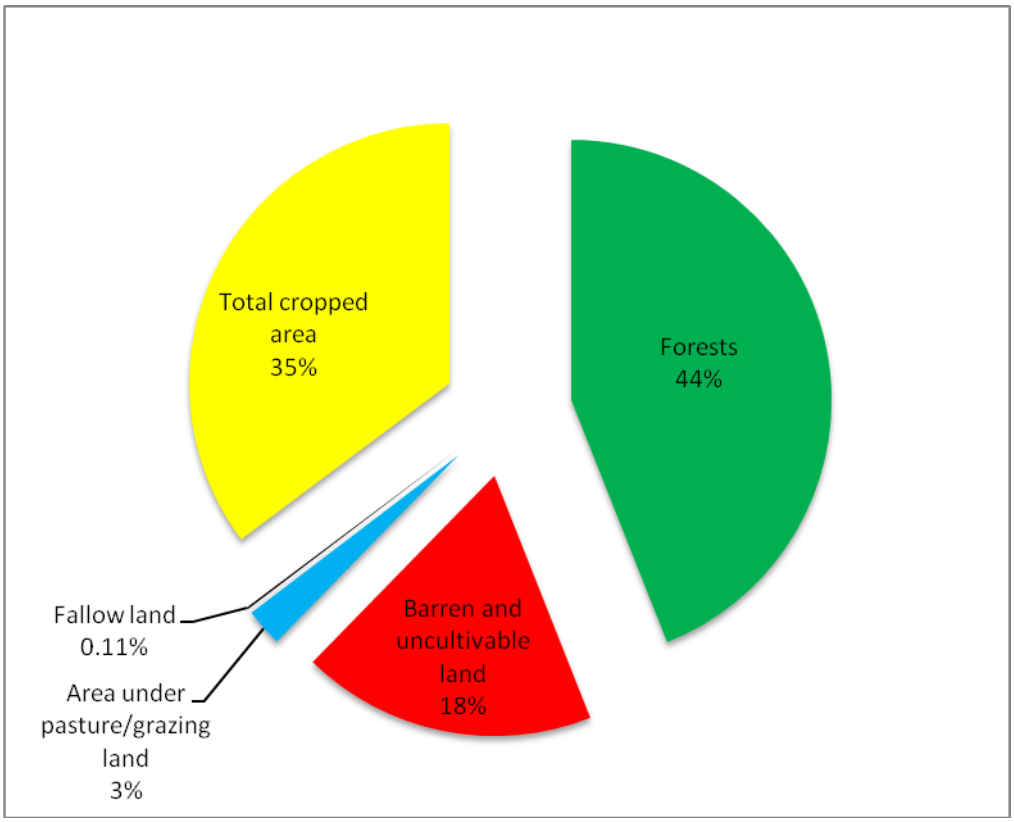

Figure 4.1 Land utilization pattern of Udhampur

4.1.7 Cropping pattern in Udhampur district of Jammu & Kashmir

The three main crops cultivated in the district Udhampur were maize and paddy during *kharif* season and wheat during *rabi* season. Wheat which was grown extensively in the district covered an area of 35569 hectares which accounted to about 43.78 per cent of total area under cultivation during the agricultural year 2018-19. Maize which was grown mostly in the *kharif* season covered an area of 27290 hectares which accounted to 33.60 per cent of total area under cultivation during 2018-19. Paddy was grown in small area compared to wheat and maize in only about 6685 hectares of land. Pulses were grown in an area of 1371 hectares and oilseed in 2407 ha of land during 2018-19. According to the records of Revenue department 353 hectares of land was reported under vegetable cultivation during 2018-19 which covers about 0.43 per cent of total area under cultivation. Citrus and mango were the top two fruits with respect to area under cultivation in the district with 1778 and 1022 hectares under cultivation respectively. The total are under fruits was recorded by revenue department to be 11809.65 hectares during 2018-19. The area under cultivation of various crops has been presented in the Table 4.6.

Table 4.6 Area under major field and horticultural crops in Udhampur district

Sr. No.	Major field crops cultivated	Total area sown(ha)	Per cent area
A	**Cereals**		
I	Wheat	35569	43.78
II	Maize	27290	33.60
III	Paddy	6685	8.23
B	**Pulses**	1371	1.69
C	**Oil seeds**	2407	2.96
D	**Fruits**		
I	Mango	1022	8.65
II	Citrus	1778	15.05
III	Plum	116	0.98
IV	Apricot	272	2.30
V	Peach	284	2.40
VI	Pear	723	6.12
E	**Vegetables**	353	0.43
F	**Others**	7916	9.74

Source: Udhampur at Glance (2018-19), Census

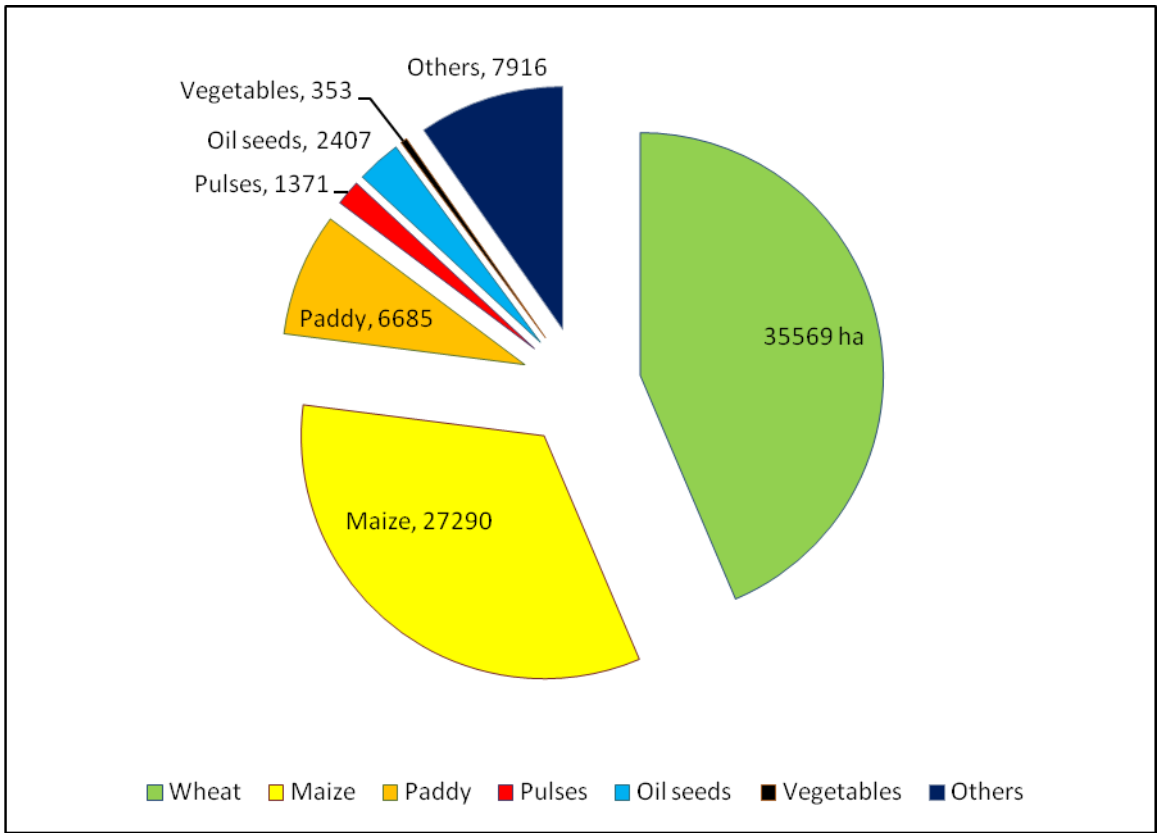

Figure 4.2 Cropping pattern of Udhampur

4.1.8 Livestock Inventory

Livestock rearing is an important occupation of the folk in rural areas in general and is of prime importance if the population is migratory. According to 20th livestock census report, district's major share of livestock was that of the sheep and goat combined (52.97) followed by cattle (22.57). Cattle population in the district was 2,05,243 of which 58,937 were exotic breeds and 1,46,206 were of indigenous origin. Total number of buffaloes, pigs, Sheep, Goat and other domesticated animals in Udhampur district were 1,06,370, 96,437, 2,59,600, and 70,329 respectively. The total livestock population of the district summed up to be 11,47,300 in number. The detailed summary of livestock population is presented in the Table 4.7

Table 4.7 Livestock inventory of Udhampur district of J&K

Sl. no	Type of animal	Male	Female	Milking	Dry	Total	Percentage
1	Cattle						
	Exotic	9645	49292	21721	5562	58937	22.57
	Indigenous	61414	84892	32902	15802	146306	
2	Buffalo	9846	70079	29742	11275	103946	9.06
3	Pig					106370	9.27
4	Sheep	Exotic				63531	52.97
		Indigenous				32906	
5	Goat					259600	
6	Others					70329	6.13
TOTAL						1147300	100

Source: Live stock census 2019

4.2 Socio-economic Summary of the Sample Farms

This particular section discusses the socio-economic indicators like family system, age & gender wise distribution, inventory of tools & equipments, investment pattern on farm land, area & production of fruit trees and land utilization pattern of the sampled farms. It gives an idea on the infrastructural and financial condition of the sampled farms.

4.2.1 Family structure

The total no of households interviewed for the study was 120, out of which 99 households that make up 82.5 per cent of the total respondents were living in joint

families. While the rest if the 21 households were living as a nuclear family. Table 4.8 provides the summary of the family system prevalent in the study area.

Table 4.8 Pattern of family structure on sample farms

Sr. No.	Family system	Number
1	Joint	99 (82.5)
2	Nucleus	21 (17.5)
	Total	120 (100)

Note: Figures in parentheses indicate percentages to total in each category

4.2.2 Age-wise distribution

Age of a person is a vital factor which allows him/her in effective decision-making process and also in performing various tasks related to farming. Agriculture is one such enterprise where a number of factors both biotic and abiotic influence the success and thus most decisions are to be taken in such a way that it tackle most of the risk bearing elements. The skills required to take such decisions develop gradually with experience and learning ability of a person over a period of time. In general, it is the young individuals who venture into risky farm management decisions, whereas the veterans look for a more or less stable management decisions. The farm decisions such as investment on farm buildings and machinery or adoption of a new crop enterprise are taken in cooperation by head of the family and other family members. Taking these things in to consideration, the distribution of the head of the family and other family members of sampled farms based on their age was analyzed and is presented:

i) Head of the family

The age-wise division of the family heads on the sample farms has been analyzed and presented in the Table 4.9. Males constituted for 90.83 per cent of the total population as the heads of the family of which 48.62 per cent, 29.35 per cent and 22.02 per cent fell under the age group of 40-60 year of age, above 60 years of age and 25-40 years of age respectively. Of the female heads of the family 9 were of the age group of above 60 years and only 2 of them were of the age group between 45-60 years of age. None of the family heads were below 25 years of age, which may be due to the fact that in general, the family member who is elder in the family or has ownership of assets like land, buildings *etc.* act as head of the family, thus, the majority of heads were above the age of 40 years. This indicates that heads of the sample farms were quite experienced and capable of handling matter related to organization of farm.

ii) Total population

The distribution of total population on the sampled farms has been presented in Table 4.9. The size of family on an average was estimated to be around 7.6 mainly due to joint family system that was prevalent in the study area. 38.56 per cent of the total population fell under the category of 25-40 years of age. 10.73 per cent of the population was in the age group of less than 15 years. 8.03 percent of the population was of the age group between 15-20 years of age, likewise 10.63 per cent, 11.93 per cent and 20.07 per cent of the population were of the age groups 20-25 years, above 60 years and 40-60 years respectively. The sex-ratio of the sample population was found out to be 901:1000, which indicated higher proportion of males as compared to that of the females in the total sample population.

Table 4.9 Age and gender-wise distribution of the total population on sample farms

(Number)

		Head of families		Total population		
Sr. No.	Age group (Years)	Male	Female	Male	Female	Total
1	<15	-	-	43 (8.86)	56 (12.81)	99 (10.73)
2	15-20	-	-	36 (7.42)	38 (8.7)	74 (8.03)
3	20-25	-	-	50 (10.31)	48 (10.98)	98 (10.63)
4	25-40	24 (22.02)	-	184 (38.76)	164 (38.44)	348 (38.61)
5	40-60	53 (48.62)	2 (18.18)	96 (19.79)	89 (20.37)	185 (20.07)
6	Above 60	32 (29.35)	9 (81.81)	76 (14.84)	42 (8.67)	118 (11.93)
	Total	109 (90.83)	11 (9.16)	485 (52.60)	437 (47.41)	922 (100)
Average family size		-	-	-	-	7.68
Sex-Ratio (females per 1000 males)		-	-	-	-	901.03

Note: Figures in parentheses indicate percentages to total in each category

4.2.3 Investment on farm buildings

The study area's investment pattern on farm buildings has been presented in Table 4.10. It was observed that 77.5 per cent of the residential houses were pucca houses and 22.5 per cent of the houses were a mix of kuccha and pucca house. There were no kuccha houses found on the sampled farms. 98.14 per cent investment on farm buildings was made on residential buildings and the rest 1.86 per cent was made on cattle sheds. In total amongst all the respondents there were 73 cattle sheds out of which 62 (84.93) of them

were kuccha sheds and 7 (9.50) of them were pucca sheds and the rest 4 (5.47) were a mix of both kuccha and pucca sheds.

Table 4.10 Inventory and value of buildings on sample farms

(Per farm)

Sr. No.	Particulars	Number	Present Value (Rs)	Annual Repairs (Rs)
A	**Residential house**			
I	Kuccha	- -	- -	- -
II	Pucca	93 (77.50)	1012500 (89.01)	13670 (52.24)
III	Mixed	27 (22.50)	125000 (10.99)	12500 (47.76)
	Sub-Total	120 (62.17)	1137500 (98.14)	26170 (83.16)
B	**Cattle shed**			
I	Kuccha	62 (84.93)	10333 (47.88)	1620 (30.57)
II	Pucca	7 (9.50)	8750 (40.54)	1980 (37.36)
III	Mixed	4 (5.47)	2500 (1.16)	1700 (3.21)
	Sub-Total	73 (37.80)	21583 (1.86)	5300 (16.84)
	Total	193 (100)	1159083 (100)	31470 (100)

Note: Figures in parentheses indicate percentages to total in each category

4.2.4 Inventory of farm tools and implements

Farm tools being one of the basic requirements most important parts of any farm enterprise at any given time provides an idea of the present stage of technology at production. In this regard the farm inventory has been studied and presented in table 4.11. The mean availability of major farm machinery was only 1.24 units on sample households in comparison to the 10.4 units of minor farm implements. Table 4.11 hints that the absolute number of major farm tools and implements were very low in comparison to the minor and simple farm tools and machinery, simply because of the high initial cost and maintenance cost. Respondents were happier to hire the services of major power operated implements rather than purchasing on their own.

Table 4.11 Inventory of farm machinery, tools and implements on sample farms

(Per farm)

Sr. No.	Particulars	Number	Value (Rs)	Annual repairs (Rs)
A	**Major farm machinery**			
I	Tractor	0.13 (0.97)	7153.00 (18.14)	1450.00
II	Power tiller	0.05 (0.39)	5705.38 (14.47)	733.00
III	Chaff cutter	0.39 (3.01)	2247.43 (5.70)	428.00
V	Water lifting pump	0.13 (1.00)	1690.00 (4.29)	86.00
VII	Sprayer/Duster	1.55 (11.94)	1854.00 (4.70)	41.00
	Sub-total	2.24 (17.31)	18649.81 (47.30)	2738.00
B	**Minor Implements**			
I	Plough	0.30 (2.32)	9450.00 (23.97)	1457.00
A	Wooden	0.03 (0.23)	45.00	7.00
B	Iron	0.27 (2.09)	8100.00	1450.00
II	Spade	2.40 (18.55)	1440.00 (3.65)	13.00
III	Hoe	0.70 (5.41)	350.00 (0.89)	13.00
IV	Rake	1.40 (10.82)	560.00 (1.42)	13.00
V	Sickle	3.10 (23.96)	775.00 (1.97)	13.00
VI	Axe	1.50 (11.59)	1200.00 (3.04)	26.00
VII	Planker	1.00 (7.73)	7000.00 (17.76)	733.00
	Sub-total	10.70 (82.69)	20775.00 (52.70)	2268.00
	Total	12.94 (100.00)	39424.81 (100.00)	5006.00

Note: Figures in parentheses indicate percentages to total in each category

4.3 Cropping Pattern in the Study Area

The cropping pattern of any particular region in an agricultural year gives out an overview of different crops grown in proportions with respect to other crops cultivated in that region. The scrutiny of cropping pattern helps us understand the importance of crops relative to others grown in that particular region.

4.3.1 Land inventory and allocation

The Table 4.13 gives us an overview of the average land allocation pattern on the sampled farms. It clearly indicates that maximum per centage (94.8 per cent) of land was put to cultivation with field crops, vegetables (84.81 per cent) or fruits (10.5 per cent). The average fallow land per farm at the time of survey in the study area was only 2.6 per cent of the total area under study. Of the total area under study mere 9.3 per cent of the area had irrigation facilities in the form of tube wells and the rest of the farmers were totally dependent on rains.

Table 4.12 Land allocation pattern on sample farms

(ha/farm)

Sr. No.	Particulars	Irrigated	Un-Irrigated	Total
1	Cultivated Land	0.03 (3.7)	0.64 (81.01)	0.67 (84.81)
2	Orchards	0.06 (7.5)	0.02 (2.6)	0.08 (10.5)
3	Current fallow	0.01 (1.2)	0.01 (1.2)	0.02 (2.6)
4	Others	0 0	0.02 (2.6)	0.02 (2.6)
	Total size of holding	0.1 (12.7)	0.69 (87.3)	0.79 (100)
	Area under irrigation (%)			9.3

Note: Figures in parentheses indicate percentages to total in each category

4.3.2 Inventory of fruits tree and production

i) Fruit tree inventory

Important fruit crops grown in the region were mango, lime and guava. Highest per centage of fruit tree found planted on the sampled farms was lime (240 trees), of which only 15 trees were bearing and most of them (225 trees) were still young and unyielding. Mango on the other hand had better percentage of yielding and well-established trees (75 trees) and 30 trees were replanted and still young, yet to yield. In total there were 133 guava trees of which 73 were at bearing stage and 60 of them were yet to bear a stable yield. Both aonla and litchi orchards were newly established in the

farms that were sampled which comprised of 72 plants in total. The ratio of bearing and non-bearing trees in total on the sampled farms was 1:1.42.

Table 4.13 Inventory of fruit trees on sample farms

(Number)

Sr. No.	Crops	Bearing	Non-bearing	Total
1	Mango	75 (42.85)	30 (7.26)	105 (17.85)
2	Litchi	0 (0)	22 (5.32)	22 (3.74)
3	Aonla	0 (0)	50 (12.1)	50 (8.5)
4	Lime	15 (8.57)	225 (54.47)	240 (40.81)
5	Guava	73 (41.71)	60 (14.52)	133 (22.61)
	Total	163 (100)	387 (100)	550 (100)
	B and N-B trees			1:1.42

Note: Figures in parentheses indicate percentages to total in each category

ii) Area and production of fruit crops on sampled farms

In terms of area under cultivation on the sampled farms, Mango (2.35) occupied the first place followed by Guava (2.28) and Lime (2.02). The average productivity of the fruit crops mango, lime and guava were 3.33 q/ha, 2.29 q/ha and 4.24 q/ha respectively. The produce harvested on the sampled farms was 42 quintals of mango, 40 kg of lime and 7 quintals of guava.

Table 4.14 Area and production of different fruit crops on sample farms

Sr. No.	Crops	Area (ha)	Per cent	Production (q/farm)	Productivity (q/ha)
1	Mango	2.35	30.63	42	3.33
2	Lime	2.02	26.33	0.4	2.29
3	Guava	2.28	29.72	7	4.24
4	Any other	1.01	13.16	0.3	1.53
	Total	7.67	100	49.7	

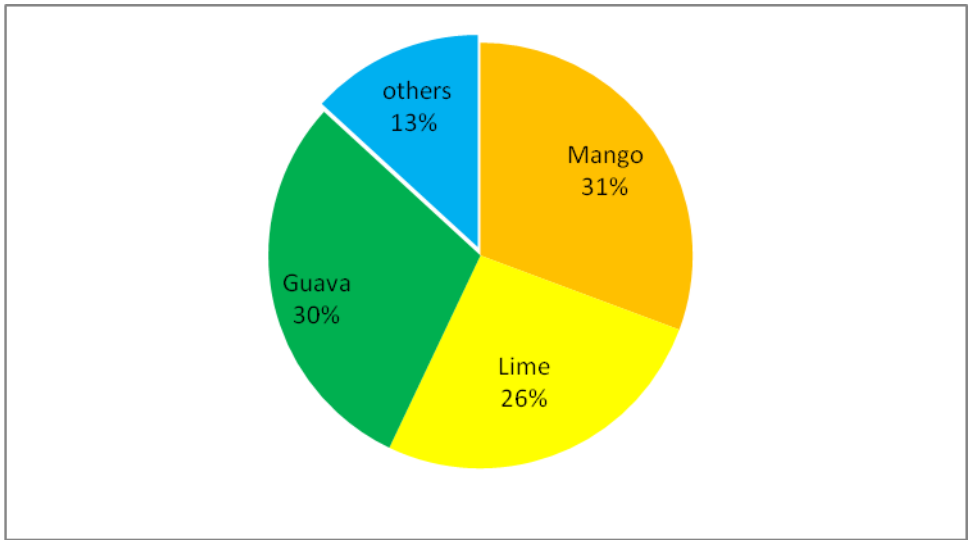

Figure 4.3 Share of different fruit trees among total cropped area

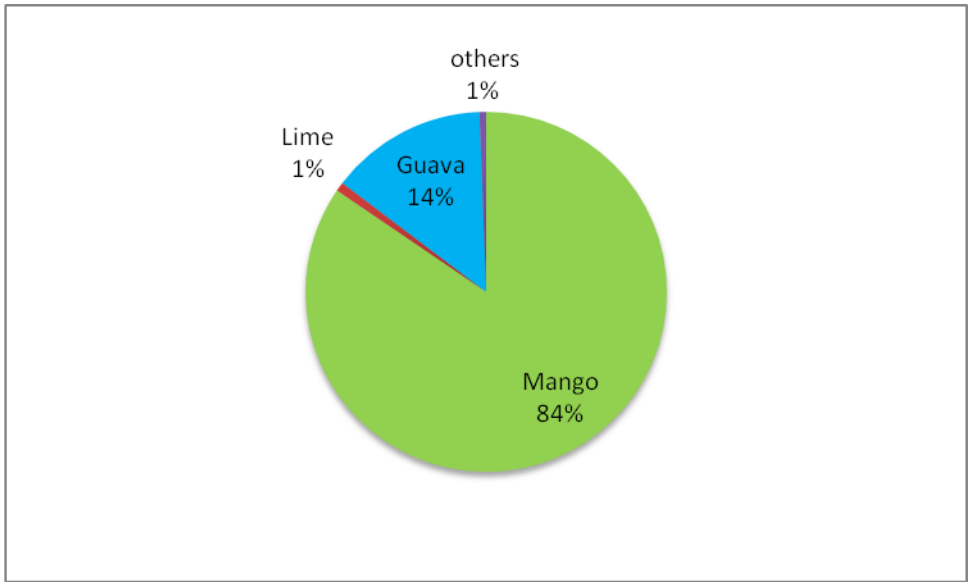

Figure 4.4 Share of production of different fruits on sampled farms

4.3.3 Cropping Pattern

Area and percentage of different crops grown in the menace free area; menace affected area are presented in the Table 4.15. Under menace affected patches average area per farm at the time of sowing and after the menace was recorded through the surveys conducted. The table reveals that in menace prone areas of the sampled farms, wheat (59.69 %) was the maximum per farm area cultivated crop followed by bengal gram (25.43 %) and black gram (21.11 %). We can also understand by observation that vegetables were grown only in very small patches to meet out the local needs. Onion had the highest share in terms of per farm area under cultivation on sampled farms which was 5.24 per cent followed by okra (1.25 %) and tomato (1.10 %). The highest area under production in menace free farms was for wheat (61.09 %) followed by bengal gram (4.96 %) and maize (4.41 %).Onion was the most cropped vegetable under non menace area too hose share amongst all the other crops was 1.14 per cent.

Table 4.15 Cropping pattern under menace prone and menace free scenarios on sample farms

(Per farm)

Sr. No.	Crops	After Menace		Before menace		Non menace	
		Area (ha)	Per cent	Area (ha)	Per cent	Area (ha)	Per cent
A	**Cereals**						
I	Wheat	0.0860	35.29	0.5056	56.69	0.5404	61.09
II	Maize	0.0088	3.61	0.0388	4.35	0.0438	4.96
B	**Vegetables**						
I	Okra	0.0030	1.25	0.0034	0.38	0.0067	0.76
II	Tomato	0.0027	1.10	0.0072	0.80	0.0067	0.76
III	Pumpkin	0.0020	0.83	0.0034	0.38	0.0034	0.38
IV	Potato	0.0022	0.89	0.0034	0.38	0.0067	0.76
V	Onion	0.0128	5.24	0.0150	1.68	0.0101	1.14
C	**Pulses**						
I	Gram	0.0619	25.43	0.2065	23.15	0.1905	21.54
II	Mash	0.0514	21.11	0.0843	9.45	0.0390	4.41
D	**Oilseed**						
	Mustard	0.2023	1.907	0.0042	0.47	0.0202	2.29
E	**Fodder**						
	Oat	0.0094	3.86	0.0202	2.27	0.0169	1.91
	Total cropped area/farm	0.2436		0.8919		0.8847	
	Net area sown	0.35	100	1.266	100	1.7667	100
	Cropping intensity (Per cent)	142.33		142.33		199.7	

4.3.4 Crop production under menace prone and menace free areas on sampled farms

The production data of important cereal, vegetable and other crops grown in the area are summed up in the table 4.16. Wheat which is the major crop in the area had cumulative production of 648.51 quintals on farm lands that were free from monkey menace as against to the cumulative production of 182.77 quintals on farm lands that were raided by monkeys. The cumulative production of maize, okra, tomato, pumpkin potato, onion, Bengal gram, black gram and mustard stood at 34.20, 42.42, 101.85, 75.88, 105.22, 191.62, 124.30, 25.47 and 1.21 quintals respectively as against 19.53, 19.12, 40.58, 45.53, 33.72, 241.60, 40.40, 33.5, 3.09 quintals on farms that were raided by monkeys at least once during its production period. Unrealized yield was found to be highest for wheat which was 503.58 quintals followed by Bengal gram which was 94.28 quintals and tomato which was 67.18 quintals. The difference between the menace prone area's production and that of menace affected area's production for mustard was minimum followed by okra which was 0.16 and 2.13 quintals respectively.

Table 4.16 Pattern of production of different crops (main product and by-product) under menace free and menace prone areas on sampled farms

(quintals)

Sr. No.	Crops	Menace free Area		Menace Area		Overall Existing production		Overall Potential production		Unrealized yield
		MP	BP	MP	BP	MP	BP	MP	BP	
	Cereals									
1	Wheat	648.51	0.25	182.77	0.08	751.65	0.33	1255.23	0.33	503.58
2	Maize	34.20	2.68	19.53	1.10	41.06	3.78	64.45	3.78	23.38
	Vegetables									
3	Okra	42.42	-	19.12	-	61.61	-	63.74	-	2.13
4	Tomato	101.85	-	40.58	-	141.48	-	208.67	-	67.18
5	Pumpkin	75.88	-	45.53	-	121.41	-	151.76	-	30.35
6	Potato	105.22	-	33.72	-	138.94	-	157.00	-	26.00
7	Onion	191.62	-	241.60	-	433.22	-	475.85	-	42.64
	Pulses									
8	Gram	124.30	-	40.40	-	164.71	-	258.99	-	94.29
9	Mash	25.47	-	33.54	-	59.01	-	80.47	-	21.45
	Oilseed									
10	Mustard	1.21	-	3.09	-	18.72	-	18.89	-	0.16
	Fodder									
11	Oat	20.23	-	31.55		31.53	-	44.52	-	12.99

Note: MP=Main product, BP= By-product

4.3.5 Productivity under menace prone and menace free areas on sampled farms

The productivity of various cereal, vegetables and other crops are calculated and presented under the table 4.17. In cereals under area prone to monkey menace, wheat had productivity of 6.02 quintals per hectare whereas the productivity was 19.78 quintals per hectare under area free from menace. The average productivity of wheat in both menace prone and menace free area was 11.86 quintals per hectare. Maize had productivity of 8.39 quintals per hectare whereas the productivity was 13.10 quintals per hectare under area free from menace.

Table 4.17 Productivity of different crops under menace free and menace prone areas

(q/ha)

Sr. No.	Crops	Area prone to Menace	Area free from Menace	Overall Productivity
	Cereals			
1	Wheat	6.02	19.78	11.86
2	Maize	8.39	13.10	8.34
	Vegetables			
3	Okra	94.50	104.22	100.98
4	Tomato	93.75	250	169.51
5	Pumpkin	225	375	300.00
6	Potato	166.66	260	228.89
7	Onion	268.31	315.67	287.39
	Pulses			
8	Gram	3.26	10.87	6.91
9	Mash	6.63	10.78	7.97
	Oilseed			
10	Mustard	5.584	6.98	6.74
	Fodder			
11	Oat	9.30	20.00	14.16

The average productivity of maize in both menace prone and menace free area was 8.34 quintals per hectare. Among selected few vegetables grown in the study area, the productivity of okra, tomato, pumpkin, potato and onion under menace prone area were 94.50, 93.75, 225, 166.66 and 268.31 quintals per hectare respectively. Whereas under area free from menace, the productivity of the same vegetables mentioned above were 104.22, 250, 375, 260, 315.67 quintals per hectare.

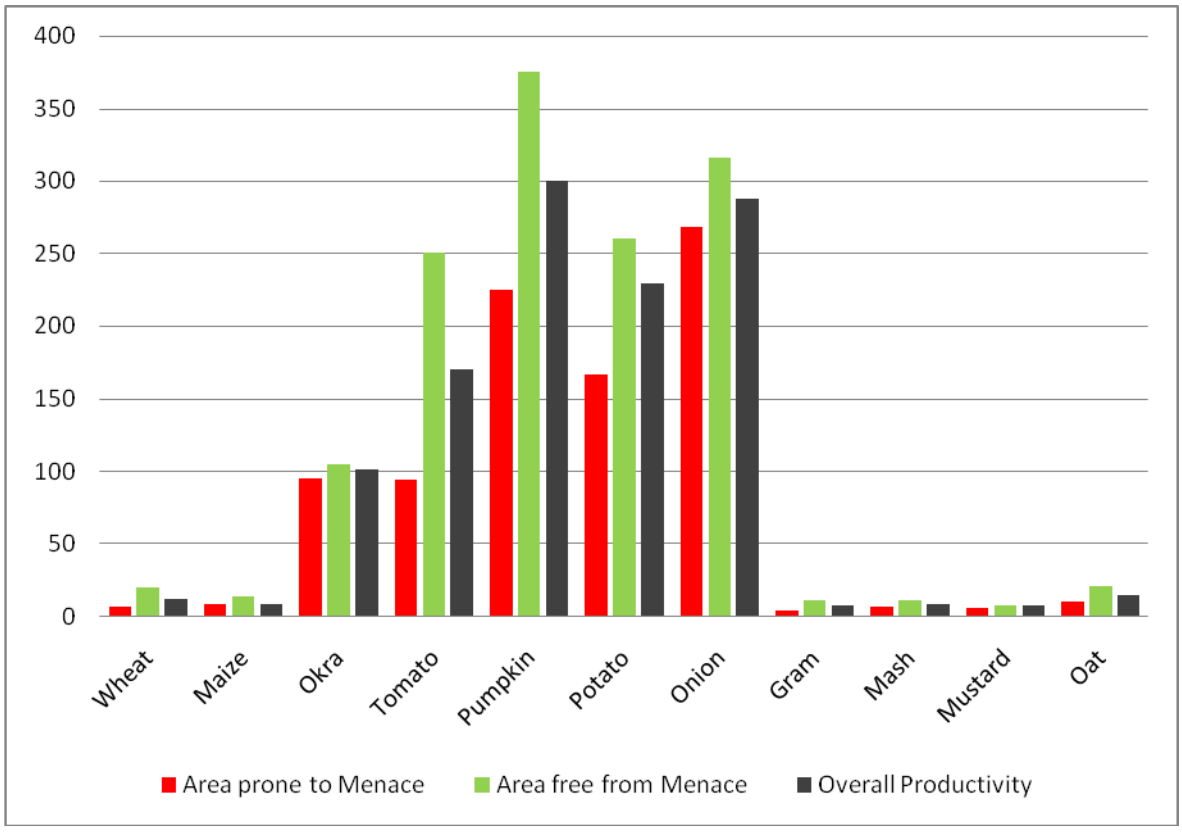

Figure 4.5 Productivity levels of different crops

The average productivity of the above said vegetables were 10.98, 169.51, 300, 228.89, 287.39 quintals per hectare respectively. Amongst other crop groups, gram, mash, mustard and oats had productivity of 3.26, 6.63, 5.58, 9.30 quintals per hectare under area prone to menace. The same crops whereas in areas free from menace had productivity of 10.87, 10.78, 6.98 and 20 quintals per hectare with an average productivity of 6.91, 7.97, 6.74, 14.16 quintals per hectare.

4.4 Extent of Monkey Menace in Study Area

4.4.1 Status of monkey menace in Udhampur district

The monkey menace has affected each and every district of Jammu division at various levels whose overall picture in terms of area affected, number of families affected, villages affected and percentage losses are compiled by agriculture department of Jammu. Kathua district (6542 Ha) is most affected by the menace in terms of highest area affected, followed by Udhampur (5558 Ha) and Jammu (5236 Ha). Likewise in terms of population affected, 15183 families in Udhampur district, 10612 families in Rajouri and 9567 families in Doda district are the major three districts whose residents are constantly under the threat from menace caused by monkeys. The percentage of losses as perceived by the farmers ranges between 15-40 per cent in all the districts throughout the division of Jammu

Table 4.18 Monkey menace affected Districts and level of damage to the crops in Jammu Division

S. NO	District	Area affected (Ha)	Families Affected	Percentage loss
1	Kathua	6542	9310	20-25
2	Ramban	4260	6590	25-30
3	Reasi	4164	8151	15-20
4	Kishtwar	1152	8714	20-25
5	Udhampur	5558	15183	15-40
6	Samba	1609	3500	15-20
7	Jammu	5236	9581	35-40
8	Doda	1915	9657	20-30
9	Rajouri	3078	10612	15-30
10	Poonch	NR	NR	NR
Total	33523	81298		15-40

NR= Not reported; Source: Agriculture department, Jammu

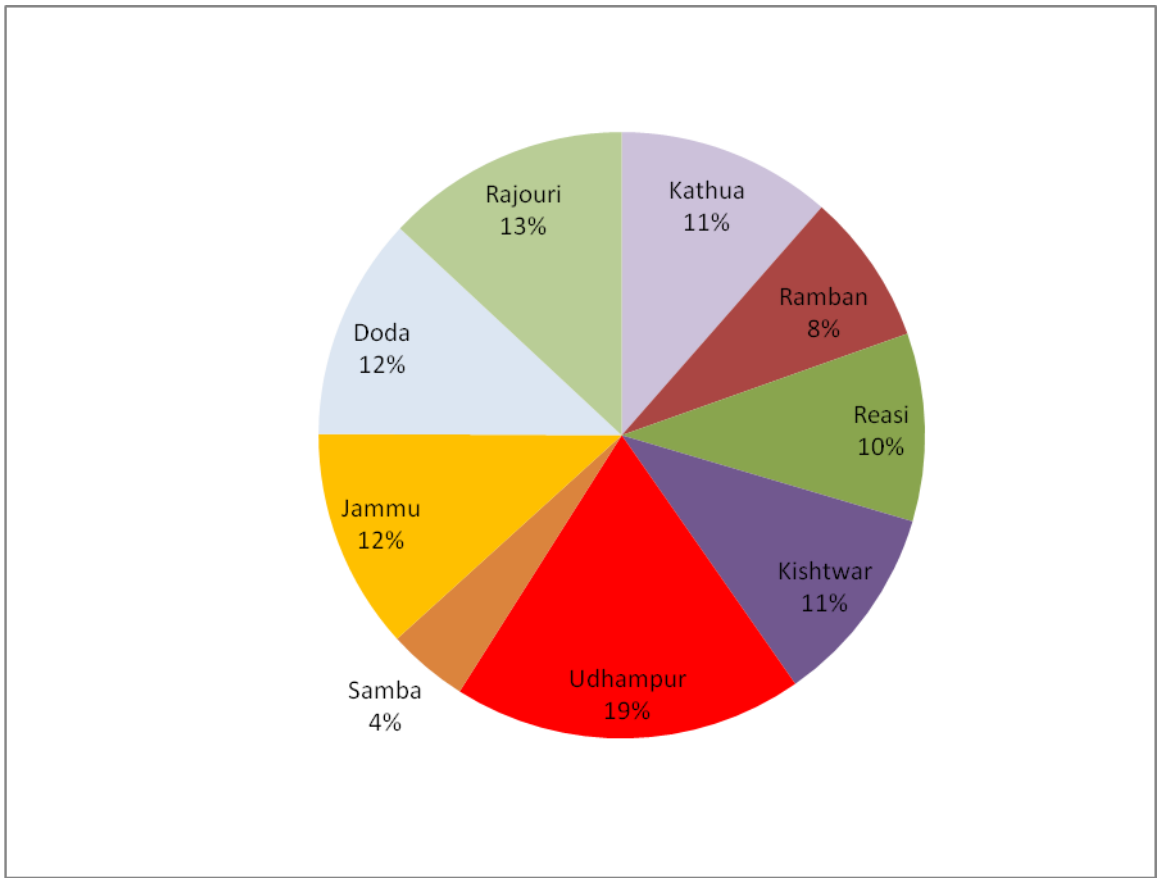

Figure 4.6 Percentage of families affected by monkey menace

4.4.2 Origin of monkey menace

There was difference in opinion about the time when the problem of monkey menace started in the study area, the distribution of which is summarized under the Table 4.19. 65per cent of the total farmers (39) who were enquired responded that the crop losses due to monkey attacks began to pose as a major problem somewhere between the last 5-10 years. Whereas 13.3 per cent of the farmers (8) suggested that it started was not a big threat until the last 2-5 years. The rest i.e, 21.6 per cent of them were positive that the menace had been their serious problem for over a decade now.

Table 4.19 Distribution of respondents on the basis of origin of monkey menace

Sr. No.	Particulars	Monkey Menace
1	2yr back	- -
2	2-5 yr back	8 (13.3)
3	5-10 yr back	39 (65)
4	>10 yrs	13 (21.6)
	Total	60 (100.00)

Note: Figures in parentheses indicate percentages to total in each category

4.4.3 Herd size of attacking monkeys

When the sample farmers were interviewed for the average herd size of monkeys that raided their fields, there was a huge variation in number that the respondents provided. The total number of monkeys raiding at once ranged between 50–100 and thus average herd size was calculated as 75.

Table 4.20 Average herd size of monkeys raiding crop fields

Sr. No.	Particulars	Number	Range (Number)
1	Monkey	75	50-100

4.4.4 Resting places and paths crossed by the monkeys

Monkeys more or else remained in groups throughout the year in the outskirts of the village in temples or any big trees. There were nearly 3 such resting points around the sample villages. The sample farms affected by monkeys were at an average distance of 1.09 km with a range of 0.25 - 5 kms from their resting points in the village. When the sample respondents were enquired about their perception about crop raiding routes of monkeys, 17 of them said that the monkeys followed a specific route while crop riding.

Amongst these 17, 13 of them i.e., 79.41% identified village path as their routes while 4 of them i.e. 20.58% responded that monkeys openly wandered around on the roads as they set out to raid on the farms. As much as 43 respondents i.e., 71.42% of the respondents said that monkeys did not particularly follow any specific route, they arbitrarily chose different routes as they wrecked the sample farms.

Table 4.21 Resting, entry points, distance of natural habitat and routes followed by monkeys (Multiple responses)

Sl. No	Particulars	No.	Route		No.	Percentage
1	Average Entry points	4	Specific route	Village path	13	76.47
				Road	4	23.53
			Arbitrary route		43	71.67
2	Common resting spots	3	Distance (km)		1.09	
			Range (km)		0.25-5	

4.4.5 Frequency of crop raiding

The farmers from monkey menace affected sample farms were enquired for weekly frequency of crop raiding by monkeys. 60 farmers responded that monkeys attacked the farms with a frequency of more than 2 times per week during day time. 52 of 60 farmers recorded their response that monkeys attacked their fields during night once a week, whereas 6 farmers comprising 10% recorded that monkey raided their farmers twice a week during night time. And two farmers (2.5%) recorded raiding of more than two times a week during night.

Table 4.22 Distribution of respondents regarding frequency of crop raiding by monkeys

(Weekly)

Sr. No.	Particulars	Day	Per cent	Night	Per cent
1	Once	-	-	52	87.5
2	Twice	-	-	6	10
3	>Twice	60	100	2	2.5
	Total	60	100	60	100
		(100.00)		(100.00)	

4.4.6 Purpose of raiding as perceived by the respondents

When the farmers were interviewed regarding the purpose of raiding by monkeys, 80 per cent of the respondents opinionated that they came in search of food and 15 per cent of them observed them coming in search of water and the rest 3 per cent felt that there was no particular reason observed for their raiding.

Table 4.23 Perception of respondents regarding the purpose of raids by monkeys

(Multiple response)

Sr. No.	Purpose	Number	Per cent
1	Feeding	48	80
2	Resting	-	-
3	Search of water	9	15
4	Wandering	3	5

4.4.7 Degree of damage

The respondents were asked to rate the degree of damage on their farms by monkeys on a scale of low, medium and high whose responses are summarized in the table 4.24. 83.40 per cent of the farmers alleged that there was high degree of damage, whereas 10 per cent and 6.66 per cent of them perceived the extent of damage was medium and low respectively.

Table 4.24 Degree of monkey menace on sample farms

Sr.No.	Particulars	L		M		H		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1	Monkey	4	6.66	6	10.00	50	83.40	60	100.00

N= Nil, L= Low, M= Moderate, H= High

4.4.8 Pattern of damage during different seasons

Degree of menace during summer, winter and rainy seasons are recorded and presented in the table 4.25.

Table 4.25 Seasonal variation in degree of damage caused by monkeys

Sr. No.	Season	Low		Medium		High		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1	Summer	3	5.00	13	21.66	44	73.33	60	100
2	Winter	13	21.66	27	45.00	20	33.33	60	100
3	Rainy	11	18.33	22	36.66	27	45.00	60	100

N= Nil, L= Low, M= Moderate, H= High

Out of the 60 respondents suffering from monkey menace about 73.33 and 33.33 per cent reported the problem of monkey as of high degree, 21.66 and 45.00 per cent reported the problem as medium degree, 5.00 and 21.66 per cent reported the problem as low degree during the summer and winter seasons respectively, while 45.00 per cent reported it as high, 36.66 per cent as medium and 18.33 per cent as low extent during the rainy season.

4.4.9 Damage caused by monkeys at different stages of crop plants.

i) Sowing and vegetative stage

Degree of menace during sowing and vegetative stage of cereals and vegetables are recorded and presented in the table 4.26. Out of the 60 respondents suffering from monkey menace about 51.67 and 8.33 per cent reported the problem of monkey as of high degree, 33.33 and 41.67 per cent reported the problem as medium degree whereas 11.67 and 28.33 per cent reported the problem as low degree on cereal and vegetable crops respectively. 3.33 per cent and 5.00 per cent of the respondents reported that there was no incidence of crop raiding during sowing & vegetative stage on cereal and vegetable crops respectively.

Table 4.26 Extent of crop damage by monkeys at the time of sowing and vegetative stage

Sr.	Particulars	Damage									
No.		N	Per cent	L	Per cent	M	Per cent	H	Per cent	Total	Per cent
A	Cereals	2	3.33	7	11.67	20	33.33	31	51.67	60	100
B	Vegetables	3	5.00	17	28.33	25	41.67	5	8.33	60	100

N= Nil, L= Low, M= Moderate, H= High

ii) Reproductive and Maturity Stage

Degree of menace during reproductive & maturity stage are recorded and presented in the table 4.27.

Table 4.27 Crop damage by monkeys at reproductive and maturity stage

Sr. No.	Particulars	Damage				
		N	L	M	H	Total
A	Cereals	- -	2 (3.33)	31 (51.70)	27 (45.00)	60 (100.00)
B	Vegetables	- -	31 (51.70)	7 (11.70)	22 (36.70)	60 (100.00)

N= Nil, L= Low, M= Moderate, H= High

Note: Figures in parentheses indicate percentages to total in each category

Out of the 60 respondents suffering from monkey menace 45.00 per cent reported the damage as high, 51.70 per cent of them reported the damage as medium and 3.33 per cent of them reported the damage as low on cereal crops. 36.70 per cent reported the damage as high, 11.70 per cent of the respondents reported the damage as medium and 51.70 per cent of the respondents reported he damage as low on vegetable crops.

4.4.10 Extent of crop damage

The cropping pattern under the menace area before the crop raiding incidents and after the crop raiding by monkeys has been summarized and presented in table 4.28.

Table 4.28 Extent of monkey menace in different field crops

(ha)

Sl.no	Crops	Total Area before menace	Area Before Menace/farm	Total Area Left After Menace	Area After Menace/farm	Change in area/farm	Total change in area	Percent change
1	Wheat	30.33	0.5056	5.15	0.0860	0.4197	25.17	82.8
2	Maize	2.32	0.0388	0.52	0.0088	0.0300	1.79	77.3
3	Oat	1.21	0.0202	0.56	0.0094	0.0108	0.64	53.5
4	Okra	0.20	0.0034	0.18	0.0030	0.0003	0.02	10.0
5	Tomato	0.43	0.0072	0.16	0.0027	0.0045	0.26	62.5
6	Pumpkin	0.20	0.0034	0.12	0.0020	0.0013	0.08	40.0
7	Potato	0.20	0.0034	0.12	0.0022	0.0012	0.07	35.9
8	Onion	0.90	0.0150	0.76	0.0128	0.0023	0.13	15.0
9	Bengal Gram	12.38	0.2065	3.71	0.0619	0.1445	8.67	70.0
10	Black Gram	5.05	0.0843	3.08	0.0514	0.0329	1.97	39.0
11	Mustard	0.25	0.0042	0.20	0.0034	0.0008	0.05	20.0

The total area before incidents of menace was highest for wheat (30.32 ha) followed by bengal gram (12.98 ha). The percentage change in the cropped area gives an idea about the extent of damage on that particular crop. Amongst all the crops, wheat occupies the highest per farm area of 0.5056 ha followed by bengal gram with farm area of 0.2065 ha

and black gram with per farm area of 0.0843 ha before monkey menace on farms. The change in area per farm for wheat was 0.0860 ha, for maize was 0.0088 ha, for tomato was 0.0045 ha, for bengal gram was 0.1440 ha. The percentage change in area before and after menace was highest for wheat which was 82.8 per cent followed by maize that was 77.3 per cent, bengal gram that was 70.0 per cent and tomato that was 62.5 per cent respectively. The lowest change in area was observed for okra that was 10.0 per cent.

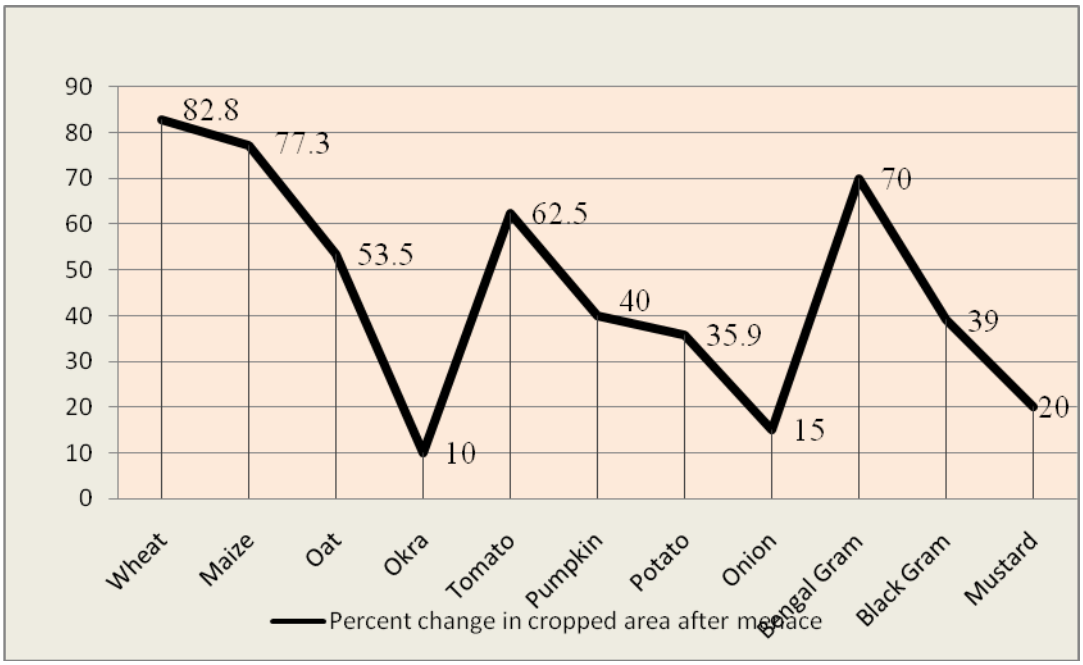

Figure 4.7 Extent of change in cropped area after menace

4.4.12 Causes of increasing monkey menace

The outbreak of monkey population in districts of Jammu division has caused havoc among the farming community who are residing and cultivating in areas where monkeys have regularly been raiding. A sincere attempt was made in this study to understand the perception of the menace affected people in the study area about the reasons for the menace. For this reason the sources for the menace had been divided into five categories *i.e.* administrative issues, decrease in the forest/common land produce, developmental activities & encroachments, status of fodder/ fruits in forest and social/religious factors. The sample respondents were interviewed regarding the sources of menace and their responses were recorded and presented in the table 4.30. Off the five administrative causes 75 per cent of the total respondents opinionated that monkeys released by forest department was the main reason for the havoc caused. As far as their natural habitats were concerned, 51.67 per cent of the sampled farmers believed that extinction of fruit yielding forest tree species was the prominent reason that caused the

monkeys to enter human settlements. Also 58.33 per cent of the sampled farmers were of the opinion that destruction of natural water reservoirs due to developmental activities in the forest areas has left monkeys no other option than raiding into villages where food and water are easily accessible. 58.33 per cent of the respondents completely believed that, villagers feeding the monkeys made monkeys settle on trees and in deserted temples on the borders of villages.

Table 4.29 Perception of respondents regarding the causes for monkey menace

Sr. No.	Particulars	Number	Per cent
1	**Administrative causes**		
I	Animals released by forest department	45	75
II	Provision of wild life protection	5	8.3
III	Failure of government in controlling menace	10	16.6
2	**Low Productivity of forests/common lands related causes**		
I	Due to land degradation	1	1.67
II	Due to scanty tree cover	3	5
III	Due to extinction of a few forest tree species	31	51.67
IV	Frequent forest fires	5	8.33
V	Low survival of Plantation Programme in forests	20	33.33
3	**Developmental activities and encroachments related causes**		
I	Disturbances in natural habitats (through roads, buildings *etc.*)of animals	14	23.33
II	Poor management of forests and common lands	11	18.33
III	Damage to natural water reservoirs	35	58.33
4	**Status of fodder/fruits in forests**		
I	Low availability of fodder/ wild fruits	39	65
II	Low availability of fodder/ wild fruits due to obnoxious weeds	21	35
5	**Social / Religious factors**		
I	Feeding monkeys due to religious belief around roads/ inhabited areas	35	58.33
II	Lack of co-operation in fencing and watch & ward	25	41.67

Plate 2: Rhesus monkey responsible for crop damages and langur (natural enemy of rhesus monkey)

Plate 3 : Crop Damage due to Monkey Menace in Sample Farms

4.4.14 Problems associated with monkey menace

Yield losses are not the only problem that arises due to the presence of monkeys near human settlement but numerous other problems are also associated. Monkey menace causes a range of problems in different categories of agriculture. Out of the sample population surveyed for monkey problems related to field crops majority (76.67%*)* found watching and warding off the monkeys as a serious problem followed by low productivity/production (61.67%) and decline in germination rate as a result of monkey mobility on sown farms whereas farmers witnessed least difficulties in harvesting the field crops. With monkeys wandering around drying and storage of produce on farms become highly impossible is what about 58 per cent of the respondents believe. Monkeys also interfere with the livestock management causing numerous problems like disturbing the peace of domestic animals and feeding on the feed that is meant for livestock. A very few respondents reported attacks on their livestock and spreading of diseases due to presence of monkeys around the farm animals. Monkeys being arboreal creatures pose a very serious threat to plantations of fruit and fodder trees. Farmers majorly (70%) complained about the damage monkeys have been causing over the years to the economic parts of tree and also time spent on watch and ward seemed to be problematic and tiresome to 56.67 % of sample farmers. Damaging the vegetative parts of the trees along with fruits resulted in significant decrease in productivity and left the farmers with no or very less economically viable produce. Inhabitations of monkeys in human settlements make the general walk of life difficult and irritating. Monkeys causing nuisance in localities like shoplifting, damage to the sheltering structures, cables were one of the severe problems faced by the general public in the menace affected districts of Udhampur. Monkeys seemed to be one of the reasons for the road accidents and blockage of traffic. Monkeys not only damaged the household and farm materials but also quite often attacked the humans who were guarding their farms. These conflicts have on many occasions resulted in serious physical injuries on farmer's behalf. The respondents have also reported damages caused to the properties like poly-houses and water storage tanks in the districts of Udhampur. The indirect problems in the social life like polluted water sources, littered streets and verandas/balconies, danger of serious attacks on children calls for a serious action on the part of concerned authorities leaving aside the above-mentioned problems dealt by farmers on their fields.

Table No 4.30 Problems associated with monkey menace

Sr. No.	Nature of problem	Low	Moderate	High	Very high	Total	TWS	Rank
A	**Field crops**							
1	Watch and ward	3 (5.00)	4 (6.67)	9 (15.00)	46 (76.67)	60 (100)	222	I -
2	Low productivity/production	2 (3.33)	8 (13.33)	13 (21.67)	37 (61.67)	60 (100)	205	II -
3	Harvesting operations become difficult	26 (43.33)	22 (36.67)	8 (13.33)	4 (6.67)	60 (100)	110	VIII -
4	Harvesting operations becomes more time consuming	18 (30.00)	26 (43.33)	4 (6.67)	12 (20.00)	60 (100)	130	VI -
5	In-convenience in storing harvested produce	12 (20.00)	13 (21.67)	19 (31.67)	16 (26.67)	60 (100)	159	V -
6	Discourage farming	17 (28.33)	23 (38.33)	14 (23.33)	6 (10.00)	60 (100)	129	VII -
7	Destroys sown seeds and affects germination	- -	6 (10.00)	30 (50.00)	24 (40.00)	60 (100)	198	III -
8	Unnecessary expenditure on fencing	5 (8.33)	15 (25.00)	22 (36.67)	18 (30.00)	60 (100)	173	IV -
B	**Livestock**							
1	Disturb the domestic animals	12 (20.00)	10 (16.67)	17 (28.33)	21 (35.00)	60 (100)	167	I -
2	Feed on domestic fodder	11 (18.33)	13 (21.67)	16 (26.67)	20 (33.33)	60 (100)	165	II -
3	Attack on domestic animals	35 (58.33)	22 (36.67)	3 (5.00)	- -	60 (100)	88	IV -
4	Infestation of domestic animals	20 (33.33)	33 (55.00)	5 (8.33)	2 (3.33)	60 (100)	109	III -

C	**Plantation crop (Fruit and Fodder trees)**							
1	Damage to fruits by monkey	- -	8 (13.33)	10 (16.67)	42 (70.00)	60 (100)	214	I -
2	Uprooting/ damage of new plantations	19 (31.67)	30 (50.00)	10 (16.67)	1 (1.67)	60 (100)	113	IV -
3	Low productivity	3 (5.00)	15 (25.00)	25 (41.67)	17 (28.33)	60 (100)	176	III -
4	Watch and ward	2 (3.33)	2 (3.33)	22 (36.67)	34 (56.67)	60 (100)	208	II -
D	**General**							
1	Responsible for road accidents	56 (93.33)	4 (6.67)	- -	- -	60 (100)	64	VI -
2	Nuisance in locality	16 (26.67)	2 (3.33)	12 (20.00)	46 76.67)	60 (100)	240	I -
3	Blockage of traffic	46 (76.67)	12 (20.00)	2 (3.33)	- -	60 (100)	76	V -
4	Damage of property like polyhouse, water storage tank, roof, etc by monkey	26 (43.33)	16 (26.67)	12 (20.00)	6 (10.00)	60 (100)	118	II -
5	Damage to household and farm	36 (60.00)	6 (10.00)	6 (10.00)	12 (20.00)	60 (100)	114	III -
6	Attack on humans	26 (43.33)	30 (50.00)	4 (6.66)	- -	60 (100)	98	IV -

Note: Figures in parentheses indicate percentages to total in each category

4.5 Economic Losses as a Result of Monkey Menace

During the survey, it was found the farmers of the study area were found to protect their crops against wild and stray animals in menace prone areas by adopting different management strategies like guarding, fencing, sound etc. With this background the cost structure of important crops grown by the sample households for general crop production activities and cost involved in protection of crops against wild and stray animals has been analyzed is discussed as under:

4.5.1 Labour use pattern in selected crops on sampled farms

The crop wise estimation of the labour use and expenditure on watch & ward and fencing was not possible exclusively because the crops of a particular season in a given locality were grown simultaneously and while performing the watch & ward for one crop another is automatically protected. Therefore, the average expenditure on labour use for watch & ward and fencing was calculated for the entire menace prone area and then allocated proportionately among the different crops grown in the area. The details of labour use for watch & ward and fencing have been estimated for menace and menace free areas and are presented separately in Table 4.32.

The table 4.31 reveals that the average labour requirement for cultivation for wheat was 26.59 man days. The labour requirement on sample farms for maize, oat, mustard, tomato, potato, onion and bengal gram on an average was 36.08, 24.58, 38.40, 89.68, 127.42, 136.44, 27.44 man days respectively. Labour utilization was found to be minimum in oats (24.58 man days) followed by wheat (26.59 man days). Harvesting utilized most proportion of labour in almost all the crops. The average labour requirement for harvesting in wheat, maize, oat, mustard, tomato, potato, onion and bengal gram was 20, 27, 20, 18, 44, 61.49, 69.04 and 20 man days respectively which accounted to 75.22, 74.83, 81.37, 46.88, 49.06, 48.26, 50.60 and 72.89 per cent of the total labour requirement. It was observed the vegetable crops like potato, tomato and onion required more man power for the operations like land preparation, sowing, and fertilizer application compared to other crops. Hence the total labour requirement was found to be high in these crops as when compared to other crops grown in the study area.

Table 4.31 Labour use pattern for selected crops

Sr. No.	Operations	Crops							
		Wheat	**Maize**	**Oat**	**Mustard**	**Tomato**	**Potato**	**Onion**	**Gram**
	Human Labour								
1	Land preparation	1.93 (7.26)	1.93 (5.35)	1.93 (7.85)	1.93 (5.03)	3.05 (3.40)	3.05 (2.39)	2.50 (1.83)	1.93 (7.03)
2	Sowing	0.47 (1.77)	2.50 (6.93)	0.47 (1.91)	5.00 (13.02)	15.00 (16.73)	16.02 (12.57)	15.81 (11.59)	2.50 (9.11)
3	Manures & Fertilizer Application	1.69 (6.36)	1.69 (4.68)	0.88 (3.58)	6.91 (17.99)	10.20 (11.37)	13.78 (10.81)	10.58 (7.75)	1.69 (6.16)
4	Weeding & Intercultural operations	0.88 (3.31)	0.88 (2.44)	0.86 (3.50)	0.94 (2.45)	11.10 (12.38)	20.27 (15.91)	21.71 (15.91)	0.88 (3.21)
5	Irrigation	- (-)	- (-)	- (-)	- (-)	2.33 (2.60)	2.00 (1.57)	2.00 (1.47)	- (-)
6	Plant protection	0.44 (1.65)	0.44 (1.22)	0.44 (1.79)	0.44 (1.15)	4.00 (4.46)	10.81 (8.48)	14.80 (10.85)	0.44 (1.60)
7	Harvesting & carrying to threshing floor	20.00 (75.22)	27.00 (74.83)	20.00 (81.37)	18.00 (46.88)	44.00 (49.06)	61.49 (48.26)	69.04 (50.60)	20.00 (72.89)
8	Threshing/Shelling	1.18 (4.44)	1.64 (4.55)	- (-)	5.18 (13.49)	- (-)	- (-)	- (-)	- (-)
	Total	26.59 (100)	36.08 (100)	24.58 (100)	38.40 (100)	89.68 (100)	127.42 (100)	136.44 (100)	27.44 (100)

Note: Figures in parentheses indicate percentages to total in each category

4.5.2 Labour use pattern in watch, ward and fencing

The mean outflow of cash utilized on labour used for watch & ward was worked out for the study area prone to menace as a whole and then it was allocated among the different crops proportionately, that were grown. Table 4.34 gives out the details of labour hours utilized for watch, ward, fencing and other activities related to protection of crop plants from monkeys. On an average 39 and 23 man-days per farm were spent on watch and fencing respectively. Most number of man-days was spent in watching and fencing of wheat followed by maize, oat and bengal gram which were 21.92, 11.21 and 3.58 respectively on menace affected farms. Vegetables demanded relatively less no of man-days in comparison to other crop groups.

Table 4.32 Pattern of labour use on watch & ward and fencing of field crops on sample farms

(man-days/ha)

Sr. No.	Crops	Watch & ward		Fencing	Total	
		MPA	MFA	MPA	MPA	MFA
1	Wheat	13.79	10.58	8.13	21.92	10.58
2	Maize	7.05	5.09	4.16	11.21	5.09
3	Oat	2.37	2.23	1.40	3.77	2.23
4	Gram	2.25	1.91	1.33	3.58	1.91
5	Potato	0.82	1.02	0.49	1.31	1.02
6	Onion	0.84	1.37	0.49	1.33	1.37
7	Mustard	0.84	1.00	0.49	1.33	1.00
8	Tomato	5.19	5.19	3.06	8.25	5.19

Note: MPA= Menace prone area; MFA= Menace free area.

4.5.3 Expenditure pattern on fencing, watch and ward.

The overview of expenditure on watch & ward and fencing of fields on account labour and fencing material have been estimated on hectare basis for selected field crops and is presented in Table 4.33 and Figure 4.4. A cursory view of the table clearly suggests that per cent increase in expenditure on watch & ward and fencing was on a higher side among maize i.e. Rs 5605 followed by wheat (Rs 10960) accounting for about 28 and 23 per cent in menace prone area compared to non-menace area. In case of oat and Bengal gram there was about 6 per cent and 15 per cent increase in cost of cultivation on account of fencing and watching. In general, there was about 44 per cent increase in the cost of cultivation in crops grown in the area on account of fencing and watching. The total expenditure in case of vegetables was comparatively low or there was no increase at all as compared to other crops.

Table 4.33 Pattern of expenditure on watch & ward and fencing in different crops on sample farms

(`/ ha)

Sr.No.	Crops	Labour		Fencing material	Total		Per cent increase
		MPA	MFA	MPA	MPA	MFA	
1	Wheat	6895	5290	4065	10960.00	5290	107.18
2	Maize	3525	2545	2080	5605.00	2545	120.24
3	Oat	1185	1115	700	1885.00	1115	69.06
4	Gram	1125	955	665	1790.00	955	87.43
5	Potato	510	400	245	655.00	400	63.75
6	Onion	685	400	245	665.00	400	66.25
7	Mustard	500	420	245	665.00	420	58.33
8	Tomato	4705	2595	1530	4125.00	2595	140.27

Note: MPA= Menace prone area; MFA= Menace free area.

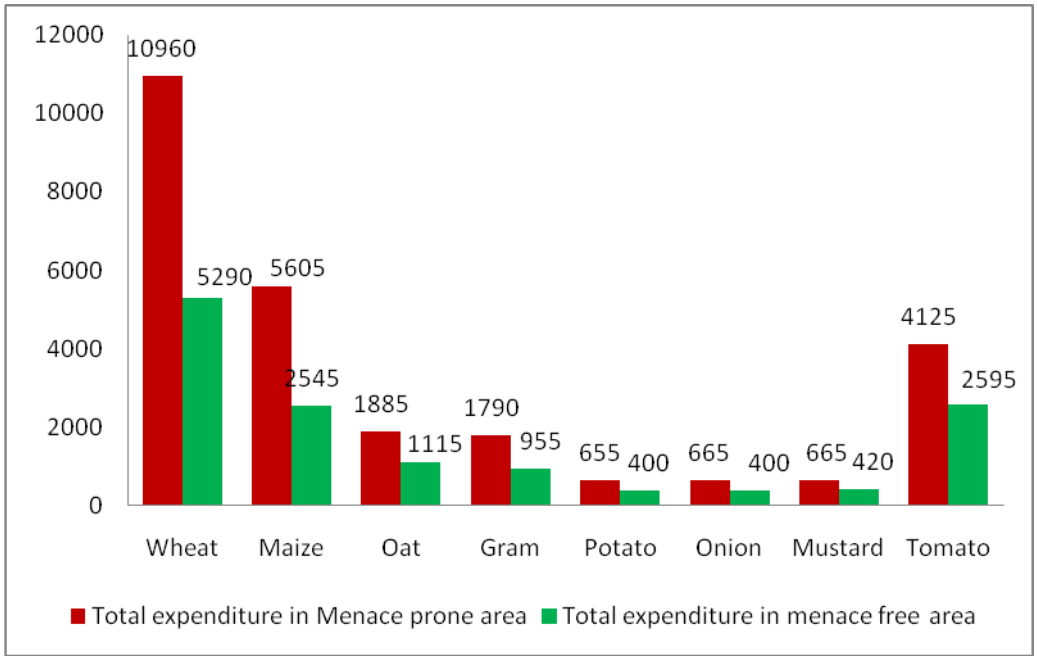

Figure 4.8 Pattern of expenditure on watch, ward and fencing

4.5.4 Preventive measures adopted by farmers

The respondents adopted various measures on their own at an individual scale to tackle the crisis at hand. The measures adopted and their effectiveness as perceived by the respondents has been documented in table 4.36 and table 4.37respectively. 50 respondents accounting to about 41.66 per cent were found guarding and warding off the monkeys all by themselves that raided their farms. 8 of the respondents accounting to 6.67 per cent had adopted live fencing as a defense strategy against monkeys, whereas 1 (0.83 per cent) of them had adopted bamboo fencing, 16 (13.33 per cent) of them had adopted bush fencing, 25 (20.83 per cent) of them had watch dogs guarding their farms, 14 (11.67 per cent) of them used loud speakers to ward off, 4 (3.33 per cent) of them tried lighting a fire at entry points and 2 (1.67 per cent) of them had stopped cultivating during rainy and summer months as their defense against the monkey threat. Furthermore, out of all the 120 respondents only 31 (25.83 per cent) of them felt the measures they have adopted were effective whereas 37 (30.83 per cent) and 52 (43.33 per cent) of them felt it was partially effective and not effective at all respectively.

Table 4.34 Preventive measures adopted for management monkeys menace on sample farms

(Number)

Preventive measures against Monkeys							
Guarding	**Live fence**	**BF**	**BuF**	**Dogs**	**S**	**Fire**	**CCP**
50 (41.66)	8 (6.67)	1 (0.83)	16 (13.33)	25 (20.83)	14 (11.67)	4 (3.33)	2 (1.67)

Note: i) BF=Bamboo fence, BuF=Bush fence, S=Sound, Prev=Prevention of fire in the forest, CCP-Change in cropping pattern (introduction of garlic, ginger, turmeric, okra)
ii) Figures in parentheses indicate percentages to total in each category

Table 4.35 Distribution of respondents regarding the effectiveness of preventive measures adopted against monkeys on sample farms

(Number)

Sl. No	Particulars	Number	Per cent
1	Effective	31	25.83
2	Partially effective	37	30.83
3	In-effective	52	43.33
	Total households	120	100.00

4.5.5 Cost of cultivation under non-menace and menace prone areas

Based on the pattern of resource use in the study area in normal crop production activities and also after accounting to the additional expenditure incurred on fencing, watch & ward in menace prone areas, the cost of cultivation for menace free area,

menace prone area situation the cost of cultivation of different crops was worked out and is given in Table 4.34. The total cost of cultivation of selected crops in non-menace area varied between Rs 35739 in mustard to Rs 94087 in potato. The cost of cultivation in menace free area for wheat and maize was Rs 57055 and Rs 48553 respectively. Among the selected vegetables, the cost of cultivation was highest for potato that was Rs 94087.3 followed by onion that was Rs 76582.9 and tomato that was Rs 67834.8. The cost of cultivation for pulse crop, bengal gram was Rs 48023.

The cost of cultivation in menace prone areas was generally higher than that of the menace free areas. The total cost of cultivation of selected crops in menace area varied between Rs 36394 in mustard to Rs 94,742 in potato. The cost of cultivation in menace free area for maize and wheat was Rs 62,660 and Rs 50,834 respectively. Among the selected vegetables, the cost of cultivation was highest for potato that was Rs 94,742.3 followed by onion that was Rs 77,247.9 and tomato that was Rs 71,959.8. Likewise cost of cultivation for pulse crop, bengal gram was Rs 48,688. The additional cost incurred was attributed to expenditure incurred on management of monkeys on their respective crop lands.

The increase in cost of cultivation in the menace prone area over the menace free area has been presented in table 4.35. The difference is highest in case of wheat which was Rs 5605 followed by maize which was Rs 2280 and tomato which was Rs 4125 which accounted for 38.26, 15.57, 28.16 per cent increase in their respective cost of cultivation. The difference in cost of cultivation for potato was Rs 665 which amounted to 4.47 per cent increase over the menace free area's cost of cultivation and that for onion was Rs 665 which amounted to 4.54 per cent increase over the menace free area's cost of cultivation. The difference for pulse crops like Bengal gram and black gram were Rs 665 each and that for oil seed crop like mustard was Rs 655 which accounted for about 4.54 and 4.47 per cent increase in the cost of cultivation respectively.

Table 4.36 Cost of cultivation of selected crops grown on sample farms

(`/ ha)

Sr. No.	Particulars	Maize	Wheat	Tomato	Potato	Onion	Gram	Mustard
A	**Non-menace area**							
1.	**Fixed costs**							
I	Interest on fixed capital	786.40	786.40	786.40	786.40	786.40	786.40	786.40
II	Depreciation	6234.00	6234.00	6234.00	6234.00	6234.00	6234.00	6534.00
III	Rental value of owned land	140.00	140.00	140.00	140.00	140.00	140.00	140.00
	Total Fixed cost	7160.40	7160.40	7160.40	7160.40	7160.40	7160.40	7160.40
2.	**Working Capital**							
I	Material inputs	13851.60	16357.00	31560.00	43839.80	35646.00	18050.00	6172.00
II	Total labour	17984.00	19847.50	15680.00	24166.60	19847.00	12500.00	13135.00
III	Bullock labour/Tractor charges	8000.00	10866.00	10000.00	14000.00	10000.00	8000.00	7654.00
IV	Total working capital	31156.30	47070.50	57240.00	82006.40	65493.00	38550.50	26961.00
	Interest on working capital @ 6%	1557.80	2824.20	3434.40	4920.30	3929.50	2313.30	1617.60
V	Total variable cost	41393.40	49894.70	60674.40	86926.80	69422.50	40863.00	28578.60
	Total cost (1+2)	**48553.8**	**57055.1**	**67834.8**	**94087.3**	**76582.9**	**48023.4**	**35739**
B	**Menace Prone Area**							
1	Total fixed cost	7160.40	7160.40	7160.40	7160.40	7160.40	7160.40	7160.40
	Watch & ward and fencing	5605.00	10960.00	6235.00	755.00	930.00	1790.00	745.00
	Working Capital	31156.30	19027.40	15212.40	14077.40	14087.40	14087.40	17547.40
	Total Working Capital	42116.30	52675.50	59030.00	82661.40	66158.00	39215.00	31086.00
	Interest on working capital @ 6%	1557.80	2824.20	3434.40	4920.30	3929.50	2313.00	1617.60
2	Total variable cost	43674.10	55499.70	62464.40	87581.80	70087.50	41528.00	32703.60
	Total cost (1+2)	**50834.5**	**62660.1**	**71959.8**	**94742.2**	**77247.9**	**48688.4**	**36394**

Table 4.37 Change in cost of cultivation in menace prone area over menace free area

Sr. No.	Crops	Cost of cultivation		Change in menace area over non menace area	Percent change
	Cereals	**NMPA**	**MPA**	**NMPA**	
1	Wheat	48553.81	50834.56	5605	38.26
2	Maize	57055.13	62660.13	2280	15.57
	Vegetables				
3	Tomato	67834.80	71959.80	4125	28.16
4	Potato	94087.33	94742.33	655	4.47
5	Onion	76582.98	77249.98	665	4.54
	Pulses				
6	Bengal gram	48023.45	48688.45	665	4.54
	Oilseed				
7	Mustard	35739.06	36394.06	655	4.47
	Total				14650.60

4.5.6 Production losses due to menace

The economic losses as a result of the direct yield losses caused by the physical damage of the economic parts of the crops by the monkeys has been estimated and presented in Table 4.36. The cursory view of the table clearly indicates the losses in wheat per farm was Rs 2922.39, the same in maize was Rs 4611.00. In case of vegetables like okra, tomato, potato, onion, and pumpkin the losses per farm were Rs 382.43, Rs 6040.04, Rs 379.39, Rs 1292.69 and Rs 1007.76 respectively. The pulse crops like bengal gram and black gram suffered a per farm loss up to an extent of Rs 4040.84/- and Rs 2725.93/-. The per farm losses in case of mustard and oats were Rs 148.30/- and Rs 255.92/- respectively. The total economic losses as a result of yield loss on sample farms summed up to Rs 23806.69/- per farm.

Table 4.38 Economic losses due to yield loss as a result of monkey menace

Sr. No.	Crops	`/ha	`/farm	Per cent to total of per farm
	Cereals			
1	Wheat	24170.63	2922.39	12.28
2	Maize	24822.75	4611.00	19.37
	Vegetables			
3	Okra	4128.85	382.43	1.61
4	Tomato	167950.00	6040.04	25.37
5	Potato	57200.00	379.39	1.59
6	Onion	115128.00	1292.69	5.43
7	Pumpkin	60700.00	1007.76	4.23
	Pulses			
8	Bengal Gram	25765.23	4040.84	16.97
9	Black Gram	28960.00	2725.93	11.45
	Oilseed			
10	Mustard	715.12	148.30	0.62
	Fodder			
11	Oat	20185.19	255.92	1.07
	Total	627321.90	23806.69	100.00

4.5.7 Total losses incurred on sampled farms on account of monkey menace

Table 4.37 discusses about the total losses incurred on the sample farms due to monkey menace. Total losses are calculated as a sum of production losses that had occurred and also the additional cost incurred on account of watching, warding off and fencing of farms where monkey raiding was prevalent. The total economic loss per farm in wheat was Rs 8527.39/- which included Rs 2922.39/- worth yield losses and Rs 5605.00/- of additional cost for preventive measures. Likewise, the total economic losses per farm in maize, okra, tomato, potato, onion, pumpkin, bengal gram, black gram, mustard, oats were Rs 6891.00/-, Rs 382.43/-, Rs 10165.04/-, Rs 1034.39/-, Rs 1957.69/-, Rs 1685.41/-, Rs 4705.84/-, Rs 3335.58/-, Rs 803.30/-, Rs 255.92/- respectively. Here additional cost in warding off and fencing was incurred maximum in wheat (Rs.5605/-), followed by tomato (Rs.4125/-) and maize (Rs.2280.68); whereas yield loss was noticed maximum in tomato (Rs 6040.04/-) followed by maize (Rs. 4611/-), bengal gram (Rs.4040.04/-) and wheat (Rs.2922.39/-).

Table 4.39 Pattern of economic losses as a result of monkey menace in different crops on sample farms

(`)

Sr. No.	Crops	Yield losses/farm	Increase in cost of cultivation/farm	Total economic losses/farm	Per hectare
	Cereals				
1	Wheat	2922.39	5605.00	8527.39	26200.44
2	Maize	4611.00	2280.00	6891.00	29811.20
	Vegetables				
3	Okra	382.43	-	382.43	4125.83
4	Tomato	6040.04	4125.00	10165.04	125216.42
5	Potato	379.39	655.00	1034.39	38082.95
6	Onion	1292.69	665.00	1957.69	72152.52
7	Pumpkin	1007.76	677.65	1685.41	44102.43
	Pulses				
8	Bengal gram	4040.84	665.00	4705.84	174291.85
9	Black Gram	2725.93	609.65	3335.58	105178.40
	Oilseed				
10	Mustard	148.30	655.00	803.30	2308.22
	Fodder				
11	Oat	255.92	-	255.92	22185.19
	Total	**13599.00**	**16336.56**	29935.56	**480359.08**

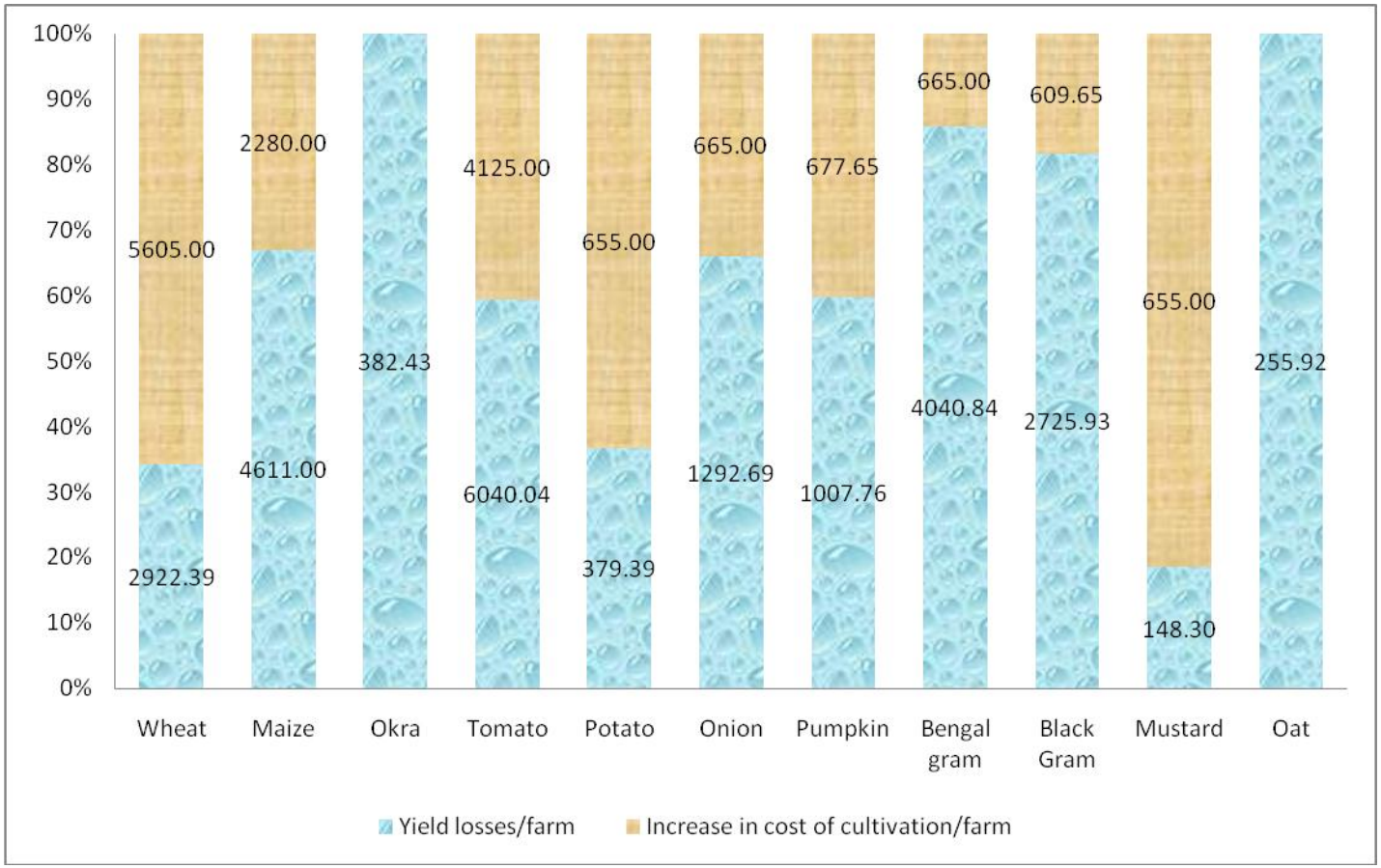

Figure 4.9 Total economic losses due to monkey menace

Plate 4 : Inspection of the extent of damage caused by monkeys on sample farms

4.6 Suggestions from farmers to address the problem of monkey menace

In order to effectively address the problems of monkey menace in the study area, suggestions were sought from the sample respondents on different aspects which are described as below:

Monkeys caused considerable losses in most of the crops grown by the sample respondents. The suggestions to address the problem of menace by these animals on the main aspects like increasing population of wild animals, low productivity of crops, watch and ward, scarcity of food/fodder in forests were sought from the respondents and are depicted in Table 4.40.

i) Measures to curb increasing monkey population

The problem of monkey menace has become a major issue since last 5-10 years as reported by the majority of the respondents. It was informed that the number of monkeys raiding the field crops was continuously increasing. The Table 4.40 clearly indicates that among the various options, sterilization of monkeys and relocation were suggested by about 65 and 22.50 per cent of the respondents. However, about 12.50 per cent of the respondents were of the view that the population of monkeys may also be checked if provision is made for hunting. Releasing of animal predators like tigers, leopards, *etc.* was also an option given the respondents were of the view that they will also be a threat to human and livestock.

ii) Low productivity of crops

As indicated in previous section that the productivity levels of different field crops was quite low in menace prone areas as compared to menace free areas. In this case about 41.66 per cent of the respondents suggested that there should be no cultivation of crops in fringe areas adjoining to forests/common lands (Table 4.59). About 58.33 per cent of the respondents indicated that the productivity level of crops can be increased by the adoption of alternate crops like ginger, turmeric, garlic *etc.* which are not preferred by monkeys. They were of the view that by doing so their frequency of raiding the fields will be reduced over a period of time.

iii) Watch and ward

Watch and ward is the major problem in the menace prone area as it adds to the cost of cultivation. Among the various suggestions regarding the watch and ward of monkeys, highest proportion of respondents *i.e.* about 49.17 per cent considered it would be of great help if government stepped up and provided assistance for fencing and 23.33 per cent believed

collective fencing was an effective and economically feasible measure. About 10.83 and 9.17 per cent of the respondents were of the view that individual fencing and watch and ward becomes mandatory on account of increased menace. 7.50 per cent of the respondents suggested collective guarding as measure to address the problem of monkey menace in the study area.

Table 4.40 Suggestions from farmers to address the problem of monkey menace

Sr. No.	Particulars	Number	Per cent
A	**Measures to curb the population of Monkeys**		
I	Sterilization	78	65.00
II	Release of few predators	-	-
III	Hunting/ killing	15	12.50
IV	Relocation	27	22.50
B	**Measures to improve productivity of crops grown**		
I	Steer clear of planting crops in the border areas of forests	50	41.67
II	Taking up of crops that are less prone to attack	70	58.33
C	**Measures to improve Watch and ward**		
I	Individual fencing	13	10.83
II	Collective fencing	28	23.33
III	Assistance by govt. for fencing	59	49.17
IV	Guarding by individual farmer	11	9.17
V	Collective guarding	9	7.50
D	**Measures to improve availability of food/fodder in forests**		
I	Renewal of natural flora/fauna	20	16.67
II	Management of obnoxious weeds	27	22.50
III	Controlling forest fires	16	13.33
IV	Planting multi-purpose tree species	8	6.67
V	Supervision of water sources in natural habitats of monkeys	36	30.00
VI	Ban on de-forestation	13	10.83
E	**Others**		
I	Ban on feeding	95	79.17
	Total Respondents	120	

iv) Scarcity of food/fodder in forests

The frequency of raids to field crops by monkey increases when there is scarcity of sufficient food and fodder resources in the forests or inhabited areas. 10.83 per cent of the respondents suggested ban on increased cutting of trees *i.e.* deforestation by the government. In order to increase the availability of wild animals' food and fodder resources in their naturally habited areas measures like rejuvenation of natural flora/fauna in forests and common lands, plantation of multi-purpose plant species and management of obnoxious weeds in forest and common lands were suggested by the 16.67, 6.67 and 30.00 per cent of the respondents. About 13.33 per cent of the respondents also considered controlling the forest fires to protect available flora and fauna in the forest/common lands adjoining to the sample households to avoid the rush out of monkeys from the forest areas to agricultural fields due to forest fires.

Chapter 5

Discussion

Even though the economic burden caused due to the destruction of crops is the immediate and profound problem of the Human-Monkey conflict, the mere existence of monkeys in the vicinity of human settlements has created substantial negative externalities. Keeping in view the above problems, a research study was conducted titled, "**Empirical Study of Monkey Menace and its Economic Impact on the Farm Economy in Udhampur district of Union Territory of Jammu and Kashmir**" and results obtained during the course of this present investigation are discussed in this chapter under the following headings:

Cropping pattern

Under menace-affected patches average area per farm at the time of sowing and after the menace was recorded through the survey conducted. In menace-prone areas of the sample farms, wheat (59.69 %) was the maximum per farm area cultivated crop, followed by bengal gram (25.43 %) and black gram (21.11 %) due to the unavailability of a permanent water source. We can also understand by the observation that vegetables were grown only in very small patches to meet out the local needs and only one protected structure (greenhouse) was observed where the tomato was cultivated on a commercial scale. Onion had the highest share in terms of per farm area under cultivation on sampled farms which was 5.24 per cent, followed by okra (1.25 %) and tomato (1.10 %). The highest area under production in menace-free farms was for wheat (61.09 %), followed by bengal gram (4.96 %) and maize (4.41 %). Onion was the most cropped vegetable under non-menace area too whose share amongst all the other crops was 1.14 per cent. Paddy was not found to be grown in any of the farms that were sampled as predominantly the farmers depended on rains for irrigation

Crop production and productivity under menace prone and menace free areas

Wheat which is the major crop in the area had cumulative production of 648.51 quintals on farmlands that were free from monkey menace as against the cumulative production of 182.77 quintals on farmlands that were raided by monkeys. The cumulative production of maize, okra, tomato, pumpkin potato, onion, bengal gram, black gram and mustard stood at 34.20, 42.42, 101.85, 75.88, 105.22, 191.62, 124.30, 25.47 and 1.21

quintals, respectively as against 19.53, 19.12, 40.58, 45.53, 33.72, 241.60, 40.40, 33.5, 3.09 quintals on farms that were raided by monkeys at least once during its production period. The unrealized yield was found to be highest for wheat, followed by bengal gram and tomato.

In cereals under area prone to monkey menace, wheat had productivity of 6.02 quintals per hectare, whereas the productivity was 19.78 quintals per hectare under area free from the menace. The average productivity of wheat in both menace-prone and menace-free area was 11.86 quintals per hectare. Maize had productivity of 8.39 quintals per hectare whereas the productivity was 13.10 quintals per hectare under area free from menace. The average productivity of maize in both menace prone and menace free area was 8.34quintals per hectare. Among selected few vegetables grown in the study area, the productivity of okra, tomato, pumpkin, potato and onion under menace prone area were 94.50, 93.75, 225, 166.66 and 268.31 quintals per hectare respectively. Whereas under area free from menace, the productivity of the same vegetables mentioned above were 104.22, 250, 375, 260, 315.67 quintals per hectare. The average productivity of the above said vegetables were 10.98, 169.51, 300, 228.89, 287.39 quintals per hectare, respectively. Amongst other crop groups, gram, mash, mustard and oats had productivity of 3.26, 6.63, 5.58, 9.30 quintals per hectare under area prone to menace. The same crops whereas in areas free from menace had productivity of 10.87, 10.78, 6.98 and 20 quintals per hectare with an average productivity of 6.91, 7.97, 6.74, 14.16 quintals per hectare. Walia (2016) studied impact of stray and wild animals raiding in Himachal Pradesh and reported that the productivity in menace area was less in comparison to non menace area. She reported a difference in productivity of maize, paddy and wheat to an extent of 16, 13, 15 quintals per hectare which was in accordance with this present study.

Origin and status of monkey menace in Udhampur district

There was difference in opinion about the time from when the problem of monkey menace started in the study area. Sixty five percent of the total farmers (39) who were enquired responded that the crop losses due to monkey attacks began to pose as a major problem somewhere between the last 5-10 years. Whereas 13.3 per cent of the farmers (8) suggested that it started was not a big threat until the last 2-5 years. The rest i.e, 21.6 percent of them were positive that the menace had been their serious problem for over a decade now. The increased population of monkeys in past decade was

attributed to extension of village boundaries, exhaustion of resources like water and wild fruit trees in the natural habitats and availability of perennial source of food.

The monkey menace has affected each and every district of Jammu division at various levels whose overall picture in terms of area affected, number of families affected, villages affected and percentage losses are complied by agriculture department of Jammu. It is evident from the table that Kathua district (6542 Ha) is most affected by the menace in terms of highest area affected, followed by Udhampur (5558 Ha) and Jammu (5236 Ha). Likewise in terms of population affected, 15183 families in Udhampur district, 10612 families in Rajouri and 9567 families in Doda district are the major three districts whose residents are constantly under the threat from menace caused by monkeys. The percentage of losses as perceived by the farmers ranges between 15-40 percent in all the districts throughout the division of Jammu. The improvements in the life expectancy of monkeys due to guaranteed food and safety due to stray feeding and negligible information on wildlife conservation has resulted in such sharp increase in population of monkeys in various parts of the country. (Metuku, 2018)

Herd size of attacking monkeys

When the sample farmers were interviewed for the average herd size of monkeys, it was observed that average herd comprised of nearly 75 monkeys, with a range of 50-100 monkeys per herd. Different respondents of the sample area faced the problem of different herd size in the problematic area. The range extended between 20-50 for the farmers who grew crops like okra and potato, but was 40-100 for the farmers growing wheat and maize. Hence, an average of 75 monkey herd size was taken into consideration. Imam and Ahmed (2013) studied the average population of monkeys in different localities of Aligarh district and estimated the average herd size to be in the range of 38 to 69 monkeys per herd which also bore similarities with results reported by Walia (2016).

Resting places and paths crossed by the monkeys

Monkeys more or else remained throughout the year in the outskirts of the village in temples or any big trees in groups. They rested throughout in those hideouts. There were nearly 3 such resting points around the sample villages. The sample farms affected by monkeys were at an average distance of 1.09 km with a range of 0.25-5kms from their resting points in the village. When the sample respondents were enquired

about their perception about crop raiding route of monkeys, 17 of them said that the monkeys followed a specific route while crop raiding. Amongst these 79.41% identified village path as their routes while 4 of them i.e. 20.58% responded that monkeys openly wandered around on the roads as they set out to raid on the farms. As much as 71.42% of the respondents said that monkeys did not particularly follow any specific route, they arbitrarily chose different routes as they wrecked the sample farms. This was due to the fact that, the farmers tried to scare them way from their regular routes by standing guard. This led monkeys to choose other random routes to enter the village. The villages near the vicinity of monkey's natural habitats were more prone to attacks and also the fields that were closer to roads and harbored big trees served monkeys their purpose for resting. Walia (2016) studied the impact of stray and wild animal raiding on crops and reported that on an average there were 3.6 and 2.4 entry points for wild and stray animals, respectively in the sample villages. Similar findings were also reported by Honda (2009), Fungo (2010), Monney *et al.* (2010), Veeramni (2004), Chiyo *et al.* (2005), Devault *et al.* (2007).

Frequency of crop raiding

The farmers from monkey menace affected sample farms were enquired for weekly frequency of crop raiding by monkeys. 60 farmers responded that monkeys attacked the farms with a frequency of more than 2 times per week during day time. 52 of 60 farmers recorded their response that monkeys attacked their fields during night once a week, whereas 6 farmers comprising 10% recorded that monkeys raided their farmers twice a week during night time. And two farmers (2.5%) recorded raiding of more than two times a week during night. The main reason for the monkeys to attack during the night was the absence of the farmers in the fields in the night during cold winters. Basically monkeys are diurnal and hence their activity was mostly confined to day time, apart from that they only wandered where there was some sort of light availability in the form of street lights or such. Hill (2000) also reported that main threat by baboons was that they raided the crops frequently even after they were scared away by the local farmers of Bundango forest reserve of Tanzania.

Purpose of Raiding as perceived by the respondents

When the farmers were interviewed regarding the purpose of raiding by monkeys, 80 per cent of the respondents opinionated that they came in search of food

and 15 per cent of them observed them coming in search of water and the rest 3 percent felt that there was no particular reason observed for their raiding. Due to acute deforestation and human encroachment in the forest area as well as decline in forest food resources, monkeys have made their way into the nearby villages for their food and water. In the due process of search of food and water, the farm crops were also being destroyed. The monkeys usually tend to stay in places where perennial sources of food availability is ensured and as the crop fields served the purpose, the monkeys began settling down in the villages and started raiding frequently. Similar scenarios of wild animal's raiding the crop fields in search of food has been reported all around the world through various studies conducted by Prasad and Reddy (2002), Sahoo and Mohnot (2004), Govind and Jayson (2014), Mwakatobe *et al.* (2014)

Degree of damage

Degree of damage reported on their farms by monkeys were on a scale of low, medium and high. About 83 percent of the farmers alleged that there was high degree of damage, whereas 10 per cent and 6.66 percent of them perceived the extent of damage was medium and low, respectively. Since the monkeys preferred all sorts of crops, the damage was more or less prevalent in all crops. They usually damaged maize, tomato, cucurbits and other fruit bearing vegetables during the reproductive phase and wheat was damaged both during its vegetative stage and also the reproductive stage. It was noticed that along with foraging, they simply uprooted the growing plants and due to their mobility in the fields the germination percentage in the menace prone areas took a serious hit. This in turn contributed towards low productivity in the areas where monkeys were present. High crop damage by crop raiding incidents are reported by various researchers across different wild and stray animals which ranged from 5%-75% as recorded by Rao *et al.* in 2015. Similar extent of damage is also reported by various other authors like, Ram Kumar *et al.* (2014), Walia in 2016 and Metuku in 2018.

Pattern of damage during different seasons

Out of the 60 respondents suffering from monkey menace about 73.33 and 33.33 per cent reported the problem of monkey as of high degree, 21.66 and 45.00 percent reported the problem as medium degree, 5.00 and 21.66 per cent reported the problem as low degree during the summer and winter seasons respectively, while 45.00 per cent reported it as high, 36.66 per cent as medium and 18.33 per cent as low extent during the

rainy season. Since crops like wheat and maize are sown during winter, but starts its yielding season from the month of February, there was a high yield loss due to monkey menace during winter. And due to presence of crops like tomato and mash in summer season, monkeys also preferred raiding the farmer's field during summers. Similar studies revealing the seasonal pattern of animal menace has been reported by Genov *et al.* (1996) who studied raiding incidents of wild boar and established that raiding mostly happened during summer and rainy seasons. Researchers like Prashant *et al.* (2013) and Walia (2016) also reported similar preferences in gaur and monkeys, respectively.

Damage caused by monkeys at different stages of crop plants.

Degree of menace during sowing and vegetative stage of cereals and vegetables: Out of 60 respondents suffering from monkey menace about 51.67 and 8.33 per cent reported the problem of monkey as of high degree, 33.33 and 41.67 percent reported the problem as medium degree whereas 11.67 and 28.33 per cent reported the problem as low degree on cereal and vegetable crops, respectively during sowing and vegetative phase. 3.33 per cent and 5.00 per cent of the respondents reported that there was no incidence of crop raiding during sowing & vegetative stage on cereal and vegetable crops, respectively. Since the monkeys were also involved in simply up-rooting the crops for no apparent reason and destroying them, the damage during times like sowing was also troublesome. Research conducted by various other authors like Walia (2016), Wang *et al.* (2006) and Sahoo and Mohnot (2004) also yielded similar results.

Out of the 60 respondents suffering from monkey menace 45.00 per cent reported the damage as high, 51.70 per cent of them reported the damage as medium and 3.33 per cent of them reported the damage as low on cereal crops during sowing and reproductive stage. 36.70 per cent reported the damage as high, 11.70 per cent of the respondents reported the damage as medium and 51.70 per cent of the respondents reported the damage as low on vegetable crops. Research conducted by various other authors like Walia (2016), Wang *et al.* (2006) and Sahoo and Mohnot (2004) have also yielded similar results.

Extent of crop damage

The percentage change in the cropped area gives an idea about the extent of damage on that particular crop. Amongst all the crops, wheat occupies the highest per farm area of 0.5056 ha followed by bengal gram with farm area of 0.2065 ha and black

gram with per farm area of 0.0843 ha before monkey menace on farms. The change in area per farm for wheat was 0.0860 ha, for maize was 0.0088 ha, for tomato was 0.0045 ha, for bengal gram was 0.1440 ha. The percentage change in area before and after menace was highest for wheat which was 82.8 per cent followed by maize that was 77.3 per cent, bengal gram that was 70.0 percent and tomato that was 62.5 per cent, respectively. The lowest change in area was observed for okra that was 10.0 per cent. This may be due to the extensive monkey menace over the years. Farmers have failed to save their crops in spite of measures like watching, warding off and fencing. Studies conducted across the globe by various authors like Veeramani *et al.* (1995), Fungo (2010), Chiyo (2005), Charoo *et al.* (2011) Metuku (2018) have also calculated the extent of crop damage and have reported the damage at varying degrees.

Causes for increasing monkey menace

The outbreak of monkey population in districts of Jammu division has caused havoc among the farming community that are residing and cultivating in areas where monkeys have regularly been raiding. A sincere attempt was made in this study to understand the perception of the menace affected people in the study area about the reasons for the menace. For this reason the sources for the menace had been divided into five categories *i.e.* administrative issues, decrease in the forest/common land produce, developmental activities & encroachments, status of fodder/ fruits in forest and social/religious factors. Off the five administrative causes 75 percent of the total respondents opinionated that, monkeys released by forest department was the main reason for the havoc caused. As far as their natural habitats were concerned, 51.67 percent of the sample farmers believed that extinction of fruit yielding forest tree species was the prominent reason that caused the monkeys to enter human settlements. Also 58.33 percent of the sampled farmers were of the opinion that destruction of natural water reservoirs due to developmental activities in the forest areas has left monkeys no other option than raiding into villages where food and water are easily accessible. 58.33 percent of the respondents completely believed that, villagers feeding the monkeys made monkeys settle on trees and in deserted temples on the borders of villages. Similar results have been reported by Walia (2016).

Problems associated with monkey menace

Yield losses are not the only problem that arises due to the presence of monkeys near human settlement but numerous other problems are also associated. Monkey menace causes a range of problems in different categories of agriculture. Out of the sample population surveyed for monkey problems related to field crops majority (76.67%*)* found watching and warding off the monkeys as a serious problem followed by low productivity/production (61.67%) and decline in germination rate as a result of monkey mobility on sown farms whereas farmers witnessed least difficulties in harvesting the field crops. With monkeys wandering around drying and storage of produce on farms become highly impossible is what about 58 per cent of the respondents believe. Monkeys also interfere with the livestock management causing numerous problems like disturbing the peace of domestic animals and feeding on the feed that is meant for livestock. A very few respondents reported attacks on their livestock and spreading of diseases due to presence of monkeys around the farm animals. Monkeys being arboreal creatures pose a very serious threat to plantations of fruit and fodder trees. Farmers majorly (70%) complained about the damage monkeys have been causing over the years to the economic parts of tree and also time spent on watch and ward seemed to be problematic and tiresome to 56.67 % of sample farmers. Damaging the vegetative parts of the trees along with fruits resulted in significant decrease in productivity and left the farmers with no or very less economically viable produce. Inhabitations of monkeys in human settlements make the general walk of life difficult and irritating. Monkeys causing nuisance in localities like shoplifting, damage to the sheltering structures, cables was one of the severe problems faced by the general public in the menace affected districts of Udhampur. Monkeys seemed to be one of the reasons for road accidents and blockage of traffic. Monkeys not only damaged the household and farm materials but also quite often attacked the humans who were guarding their farms. These conflicts have on many occasions resulted in serious physical injuries on farmer's behalf. The respondents have also reported damages caused to the properties like poly-houses and water storage tanks in the districts of Udhampur. The indirect problems in the social life like polluted water sources, littered streets and verandas/balconies, the danger of serious attacks on children calls for serious action on the part of concerned authorities leaving aside the above mentioned problems dealt by farmers on their fields. Studies conducted across the globe by various researchers like Veeramani *et al.* (1995), Fungo (2010), Chiyo (2005), Charoo *et al.* (2011) Metuku (2018) have also reported various problems associated with monkey menace.

Labour use pattern in selected crops on sampled farms

The crop-wise estimation of the labour use and expenditure on watch & ward and fencing was not possible exclusively because the crops of a particular season in a given locality were grown simultaneously and while performing the watch & ward for one crop another is automatically protected. Therefore, the average expenditure on labour use for watch & ward and fencing was calculated for the entire menace prone area and then allocated proportionately among the different crops grown in the area. The details of labour use for watch & ward and fencing have been estimated for menace and non-menace and are presented.

Labour utilization was found to be minimum in oats followed by bengal gram and mustard. Harvesting utilized most proportion of labour followed by in wheat crop. Onion utilized most of its man days on harvesting, followed by sowing and inters cultural operations. Harvesting of potatoes demanded highest man power among all the other operations followed by It was observed the vegetable crops like potato, tomato and onion required more man power for the operations like sowing, fertilizer application and inter cultural operations. Walia (2016) has also reported results that substantiate the present study.

Labour use pattern in watch & ward and fencing

The crop wise estimation of the labour use and expenditure on watch & ward and fencing was not possible exclusively because the crops of a particular season in a given locality were grown simultaneously and while performing the watch & ward for one crop another is automatically protected. Therefore, the average expenditure on labour use for watch & ward and fencing was calculated for the entire menace prone area and then allocated proportionately among the different crops grown in the area. The details of labour use for watch & ward and fencing have been estimated for menace and menace free areas and are presented

Labour utilization was found to be minimum in oats (24.58 man days) followed by wheat (26.59 man days). Harvesting utilized most proportion of labour in almost all the crops. The average labour requirement for harvesting in wheat, maize, oat, mustard, tomato, potato, onion and bengal gram accounted to 75.22, 74.83, 81.37, 46.88, 49.06, 48.26, 50.60 and 72.89 per cent of the total labour requirement. It was observed the vegetable crops like potato, tomato and onion required more man power for the

operations like land preparation, sowing, and fertilizer application compared to other crops. Hence the total labour requirement was found to be high in these crops as when compared to other crops grown in the study area. Weladji and Tchamba (2003), Wang *et al.* (2006), Mwakatobe *et al.* (2014), Walia (2016) have also reported that there was additional labour utilization in order to protect the crops to a great extent in the form of guarding in areas that are prone to animal menace.

Expenditure pattern on fencing, watch and ward.

Per cent increase in expenditure on watch & ward and fencing was on a higher side among maize followed by wheat accounting for about 28 and 23 percent in menace prone area compared to non-menace area. In the case of oat and bengal gram there was about a 6 percent and 15 per cent increase in cost of cultivation on account of fencing and watching. In general, there was about a 44 percent increase in the cost of cultivation in crops grown in the area on account of fencing and watching. The total expenditure in the case of vegetables was comparatively low, or there was no increase at all as compared to other crops. Weladji and Tchamba (2003), Wang *et al.* (2006), Mwakatobe *et al.* (2014), Walia (2016) have also reported that there was additional labour utilization in order to protect the crops to a great extent in the form of guarding in areas that are prone to animal menace which directly increased the cost of cultivation on the part of affected farmers.

Preventive measures adopted by farmers

The respondents adopted various measures on their own at an individual scale to tackle the crisis at hand. Fifty respondents accounting for about 41.66 per cent, were found guarding and warding off the monkeys all by themselves that raided their farms. Eight of the respondents accounting for 6.67 per cent, had adopted live fencing as a defense strategy against monkeys, whereas 1 (0.83 per cent) of them had adopted bamboo fencing, 16 (13.33 per cent) of them had adopted bush fencing, 25 (20.83 per cent) of them had watch dogs guarding their farms, 14 (11.67 per cent) of them used loud speakers to ward off, 4 (3.33 per cent) of them tried lighting a fire at entry points and 2 (1.67 per cent) of them had stopped cultivating during rainy and summer months as their defense strategy against the monkey threat. Furthermore, out of all the 120 respondents, only 31 (25.83 per cent) of them felt the measures they have adopted were effective, whereas 30.83 per cent and 43.33 per cent of them felt it was partially

effective and not effective at all, respectively. Mwakatobe *et al.* (2014) also reported that local communities in and around Serengeti national park adopted preventive measures like watching and warding off, use of noise and fencing. Similar preventive measures adopted by victims were also reported by Hill (2000), Kagoro-Rugunda (2004), Fungo (2011).

Cost of cultivation under non-menace and menace prone areas

Based on the pattern of resource use in the study area in normal crop production activities and also after accounting to the additional expenditure incurred on fencing, watch & ward in menace prone areas, the cost of cultivation for menace free area, menace prone area situation the cost of cultivation of different crops was worked out. The total cost of cultivation of selected crops in non-menace areas varied from Rs 35,739/- in mustard to Rs 94,087/- in potato. The cost of cultivation in menace-free areas for wheat and maize was Rs 57,055/- and Rs 48,553/- respectively. Among the selected vegetables, the cost of cultivation was highest for potato that was Rs 94,087.3/- followed by onion that was Rs 76,582.9/- and tomato that was Rs 67,834.8/-. The cost of cultivation for pulse crop, bengal gram, was Rs 48023/-.

The cost of cultivation in menace-prone areas was generally higher than that of the menace-free areas. The total cost of cultivation of selected crops in menace areas varied from Rs 36,394/- in mustard to Rs 94,742/- in potato. The cost of cultivation in the menace-free area for maize and wheat was Rs 62,660/- and Rs 50834/- respectively. Among the selected vegetables, the cost of cultivation was highest for potato that was Rs 94,742.3/- followed by onion that was Rs 77,247.9/- and tomato that was Rs 71,959.8/-. Likewise, the cost of cultivation for pulse crop, bengal gram, was Rs 48,688/-. The additional cost incurred was attributed to expenditure incurred on the management of monkeys on their respective crop lands.

The difference is highest in the case of maize which was Rs 5605/-, followed by wheat which was Rs 2280/- and tomato, which was Rs 4165/- which accounted for 8.85, 4.16, 2.42 per cent increase in their respective cost of cultivation. The difference in cost of cultivation for potato was Rs 665/-, which amounted to a 0.65 per cent increase over the menace-free area's cost of cultivation and that for onion was Rs 665/-, which amounted to a 0.80 per cent increase over the menace free area's cost of cultivation. The difference for pulse crops like bengal gram and black gram was Rs 665 each and that for

oilseed crop like mustard was Rs 655, which accounted for about 1.23 and 1.15 percent increase in the cost of cultivation, respectively. A study was conducted by Hill (2000) on Baboon raiding and has reported similar findings. He argues that the increase in the cost of cultivation is mainly due to the cost of crop protection against baboons per household in Papua New Guinea, which averaged between $ 96 and $ 519 per year. Among crop protection measures, costs associated with labour for guarding crops cut the mammoth share.

Total losses incurred on sampled farms on account of monkey menace

The economic losses as a result of the direct yield losses caused by the physical damage of the economic parts of the crops by the monkeys have been estimated and the cursory view clearly indicates the losses in wheat per farm was Rs 2922.39/-, the same in maize was Rs 4611.00/-. In the case of vegetables like okra, tomato, potato, onion and pumpkin, the losses per farm were Rs 382.43/-, Rs 6040.04/-, Rs 379.39/-, Rs 1292.69/- and Rs 1007.76/-, respectively. The pulse crops like bengal gram and black gram suffered a per farm loss up to the extent of Rs 4040.84/- and Rs 2725.93/-. The per farm losses in the case of mustard and oats were Rs 148.30/- and Rs 255.92/-, respectively. The total economic losses as a result of yield loss on sample farms summed up to Rs 17407.43/- per farm. Various authors across the globe have reported production losses due to animal menace. Sahoo and Mohnot (2004) have reported losses of 2000 to 8000 Rupees per farm. Irby *et al.* (1996) has reported a loss of 12.2 Million USD in total due to Native ungulates in Montana, USA. Wywialowski (1996) has reported a loss of 92 million USD in total due to wild animals in USA. Walia has reported a loss of 25358 rupees per farm due to monkeys in Himachal Pradesh, India.

Total losses are calculated as a sum of production losses that had occurred and also the additional cost incurred on account of watching, warding off and fencing of farms where monkey raiding was prevalent. The total economic loss per farm in wheat was Rs 5203.07/-, which included Rs 2922.39/- worth yield losses and Rs 2280.68/- of additional cost for preventive measures. Likewise, the total economic losses per farm in maize, okra, tomato, potato, onion, pumpkin, Bengal gram, black gram, mustard, oats were Rs 10216/-, Rs 382.43/-, Rs 5132.76/-, Rs 1034.93/-, Rs 1947.69/-, Rs 4925.04/-, Rs 4705.84/-, Rs 3380.83/-, Rs 1741/-, Rs 255.92/- respectively. Here additional cost in warding off and fencing was incurred maximum in maize (Rs.5605/-), followed by tomato (Rs.4125/-) and wheat (Rs.2280.68/-); whereas yield loss was noticed maximum

in Maize (Rs 4611/-) followed by Bengal gram (Rs.4040.84/-), pumpkin (Rs. 1007.76/-) and wheat (Rs.2922.39/-). Various authors across the globe have reported production losses due to animal menace. Sahoo and Mohnot (2004) have reported losses of 2000 to 8000 Rupees per farm, Irby *et al.* (1996) has reported a loss of 12.2 Million USD in total due to Native ungulates in Montana, USA, Wywialowski (1996) has reported a loss of 92 million USD in total due to wild animals in USA, Walia has reported a loss of 25358 rupees per farm due to monkeys in Himachal Pradesh, India.

Suggestions to address the problem of monkey menace

1. Cultivation of those crops that are not preferred by monkeys. Fruit crops: Aonla, Lime, Lemon; Root crops: Ginger, Turmeric, Colocasia, Alocasia, Yam (Zimikand); Flower crops: Marigold, Chrysanthemum; Aromatic plants: Lemon grass and Lavender.
2. Enriching habitats in deep forest areas so that sufficient food remains available to them, thereby localizing monkey population within the deep forest by raising natural wild fruit plant viz, Fig, Cluster fig, Kainth, Jamun, Banyan, Karanda, Kokua, Mulberry, etc.
3. Technological interventions viz. Installation of Solar fencing, Electric fencing (non-lethal), Monkey Repellents, Monkey Scare guns and Laser guided alarms around the field, etc.
4. Use of annoying and smelling substances like dry fish packets spread around the field.
5. Maintaining a balance by releasing predators / natural enemies (Langur).
6. Sterilization of monkeys.
7. The monkey figure in Schedule II Part-1 17-A of the Act should be declared Vermin in view of Section 2(34), 61 & 62 of the Wildlife Protection Act 1972.

Chapter 6

Summary and Conclusion

To resolve the problem of low per capita farm land availability and also to facilitate food requirements to the ever-increasing population, more and more forest areas have been encroached and brought under cultivation, as a result of which human and wildlife habitats have started overlapping and the number of human and wildlife conflicts has increased.

Thus an effort was made through this research to gather detailed and systematic information on monkey menace in the study area. The specific objectives with which the study was carried out were:-

1. To study the cropping pattern in areas prone to monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.
2. To assess the extent of area, type and stage of crops damaged by monkey menace in Udhampur district of Union Territory of Jammu and Kashmir.
3. To assess and estimate the extent of economic losses in various cereals, vegetables and other horticultural crops triggered by monkey menace in the study area.

Major Findings

1. The data collected from the sample households suggested that the joint family system prevailed in the study area with an average family size of 7.8.

2. Age-wise distribution of heads of the family suggested that close to 90 per cent of the family heads were of masculine gender and 48.62 per cent of the family heads came under the age group of 46-60 years.

3. The average size of land holding of the sample households was found to be 0.79 ha. 84.81 per cent of the area was put under cultivation and on an average, only 9.3 percent of the total area was under irrigation.

4. Important fruit crops grown in the region were mango, lime and guava. The highest percentage of fruit trees found planted on the sample farms was lime (240 trees) followed by mango (105 trees), guava (133 trees). Both Aonla and Litchi comprised of 72 plants in total. The ratio of Bearing and non-bearing trees in total on the sample farms was 1:1.42.

5. Wheat (59.69 %) was the maximum per farm area cultivated crop, followed by bengal gram (25.43 %) and black gram (21.11 %). Onion had the highest share in terms of per farm area under cultivation of vegetables on sample farms, which was 5.24 per cent followed by okra (1.25 %) and tomato (1.10 %). The highest area under production in menace-free farms was for wheat (61.09 %) followed by bengal gram (4.96 %) and maize (4.41 %). Onion was the most cropped vegetable under the non-menace area too.
6. Un-realized yield was found to be highest for wheat which was 503.58 quintals, followed by bengal gram which was 94.28 quintals and tomato, which was 67.18 quintals. The difference between the menace-prone area's production and that of menace free area's production for mustard was minimum, followed by okra which was 0.16 and 2.13 quintals, respectively, which indicates these crops were least preferred by monkeys.
7. Kathua district (6542 Ha) is most affected by the menace in terms of the highest area affected, followed by Udhampur (5558 Ha) and Jammu (5236 Ha). Likewise, in terms of population affected, 15183 families in Udhampur district, 10612 families in Rajouri and 9567 families in doda district are the major three districts whose residents are constantly under threat from menace caused by monkeys.
8. Sixty-five percent of the total farmers who were enquired were conclusive that the crop losses due to monkey attacks began to pose as a major problem somewhere between the last 5-10 years.
9. The total number of monkeys raiding as a herd ranged from 50 to 100 and thus average herd size was calculated as 75.
10. Monkeys more or less remained throughout the year in the outskirts of the village in temples or any big trees in groups. They rested throughout in those hideouts. There were nearly three such resting points around the sample villages. The sample farms affected by monkeys were at an average distance of 1.09 km with a range of 0.25-5kms from their resting points in the village.
11. As far as the frequency of crop-raiding by animals was concerned, respondents opined that monkeys attacked the farms more than two times per week during day time and usually once or twice at night.

12. The pattern of crop-raiding was not uniform throughout the year. The extent of crop menace and damage was found to be high during the summer and winter seasons when compared to the rainy season.

13. The provision of wildlife protection act, failure of government in controlling the menace, ineffective tagging of cattle, land degradation, the excessive infestation of forests/common lands by obnoxious weeds, deforestation by the government for roads and by local people for domestic uses, shrinkage of food and fodder resources by developmental activities, low dependency of people on agriculture, feeding of monkeys and lack of co-operation in watch and ward, *etc.*, were reported to be the major causes for increased monkey menace in the study area.

14. The extent of animal menace varied across the crops. The percentage change in area before and after menace was highest for wheat which was 82.8 per cent followed by maize that was 77.3 per cent, bengal gram that was 70.0 per cent and tomato that was 62.5 per cent, respectively. The lowest change in area was observed for okra that was 10.0 per cent.

15. Under area prone to monkey menace, the productivity of wheat was 6.02 quintals per hectare, whereas the productivity was 19.78 quintals per hectare under area free from the menace. Productivity of maize was 8.39 quintals per hectare under menace-prone area, whereas the productivity was 13.10 quintals per hectare under area free from the menace. The productivities of okra, tomato, pumpkin, potato and onion under menace-prone areas were 94.50, 93.75, 225, 166.66 and 268.31 quintals per hectare, respectively. Whereas under area free from menace, the productivity of the same vegetables mentioned above were 104.22, 250, 375, 260, 315.67 quintals per hectare.

16. On average, the existing production (main product) of cereals, vegetables was estimated at 13.21, 14.94 q/farm. It would have been 21.99, 17.61 q/farm respectively, if there had been no animal menace.

17. The production losses in field crops on account of animal menace were estimated at Rs 14650/farm in which the share of tomato was highest (25.37 %), followed by maize (19.37%) and bengal gram (16.97 %).

18. Cost structure analysis of the selected crops indicated that the total cost of cultivation under menace-free areas ranged between Rs 36159/ha in the case of mustard to Rs 94487/ha in potato. In general, it was higher in the case of vegetables.

19. The total cost of cultivation of selected field crops on menace-prone areas ranged from Rs 36904/ha in the case of mustard to Rs 95497/ha in the case of potato. It was higher in comparison to menace-free areas.

20. The estimated total economic loss per farm in wheat was Rs 8527.39/-. Likewise, the total economic losses per farm in maize, okra, tomato, potato, onion, pumpkin, bengal gram, black gram, mustard, oats were Rs 6891.00/-, Rs 382.43/-, Rs 10165.04/-, Rs 1034.39/-, Rs 1957.69/-, Rs 1685.41/-, Rs 4705.84/-, Rs 3335.58/-, Rs 803.30/-, Rs 255.92/- respectively

Suggestions

1. Cultivation of those crops that are not preferred by monkeys.
Fruit crops: Aonla, lime, lemon; Root crops viz. Ginger, Turmeric, colocasia, alocasia, yam (zimikand); Flower crops: marigold, chrysanthemum; Aromatic plants: Lemon grass and lavender.

2. Promotion of dairy farming on large scale.

3. Enriching habitats in deep forest areas so that sufficient food remains available to them thereby localizing monkey population within deep forest by raising natural wild fruit plant viz, Fig, cluster fig, kainth, jamun, banyan, karanda, kokua, mulberry etc.

4. Technological interventions viz. Installation of Solar fencing, Electric fencing (non-lethal), monkey repellents, monkey scare guns and laser guided alarms around the field etc.

5. Use of annoying and smelling substances like dry fish packets spread around the field.

6. Maintaining a balance by releasing predators / natural enemies (Langur).

7. Sterilization of monkeys.

8. The monkey figure in Schedule II Part-1 17-A of the Act should be declared Vermin in view of Section 2(34), 61 & 62 of the Wildlife Protection Act 1972.

Policy Implications

1. Sterilization/ Castration: A female monkey can be sterilized in just one and a half minutes and that a male vasectomy takes about the same time. It is easily possible for one small team to efficiently sterilize at least 60 monkeys in a day. As a result of the constant efforts are to be put in by the forest department and other concerned authorities.
2. Wildlife (Protection Act 1972): Wildlife department's notice that reads any feeding, luring, baiting to monkeys is an offence under the provisions of the Wildlife Protection Act and punishable, should be implemented in letter and spirit to check the animal conflict.
3. Amendments in the Wildlife (Protection Act 1972): Rhesus macaque (*Macaca mulatta*) figure in Schedule II Part-1 17-A of the Act can be declared Vermin in view of Section 2(34), 61 & 62 of the Act.
4. Inter-departmental Co-ordination: There is a need for departments (i.e., Agriculture, Horticulture, Animal Husbandry, Wildlife & Forest and SKUAST-Jammu) to work as a unit to effectively solve the crisis.

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CERTIFICATE- IV

Certified that all necessary corrections as suggested by the external examiner and advisory committee have been duly incorporated in the thesis entitled "**Empirical Study of Monkey Menace and Its Economic Impact on the Farm Economy in Udhampur District of Union Territory of Jammu And Kashmir**" submitted by **Mr.Vijaya Pramathi V S,** Registration No. **J-19-M-620**.

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