A study on effect of climate change on Vegetable Production Technology in Ujjain Block of Ujjain District (M.P.)

Thesis

Submitted To

Rajmata Vijaya Raje Krishi Vishwa Vidyalaya, Gwalior

In partial fulfilment of the requirements for the degree of

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In

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(Agricultural Extension and Communication)

By

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College of Agriculture

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CERTIFICATE - I

This is to certify that the thesis entitled **"A Study on Effect of Climate Change on Vegetable Production Technology in Ujjain Block of Ujjain District (M.P.)"** submitted in partial fulfillment of the requirements for the Degree of **MASTER OF SCIENCE** in **Agricultural Extension and Communication** of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior is a record of the bona-fide research work carried out by **Miss Bhanupriya Bagdi** I.D. No. **RA/IN/016/2012** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.

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

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Place: Indore

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Chairman of the Advisory Committee

MEMBER OF STUDENT'S ADVISORY COMMITTEE

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(Co-chairman) Dr. V. K. Swarnkar **.....**

(Member) Dr. S. K. Jain **.....**

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CERTIFICATE-II

This is to certify that thesis entitled **"A Study on Effect of Climate Change on Vegetable Production Technology in Ujjain Block of Ujjain District (M.P.)"** submitted by **Miss. Bhanupriya Bagdi** to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior in partial fulfilment of the requirements for the degree of Master of Science in **Agriculture** in the Department of **Agricultural Extension and Communication** has been accepted after evaluation by the External Examiner and approved by the Student's Advisory Committee after an oral examination of the same.

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(Bhanupriya Bagdi)

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Chapter - I

INTRODUCTION

Vegetables play a vital role in the maintenance of human health. A balanced diet is essential to sustain good health. For a well-balanced diet, about 300 gram vegetables are required containing root vegetable, green vegetables and others vegetables, but only 130 grams per capita is available. Most of the leafy vegetables and root crops are rich in minerals like Ca, Fe, and phosphorous some leafy vegetables are rich in microelements like copper, manganese zinc and vitamin A, B, C. In the vegetable production climate plays a major role and now a days climate change is rapidly affecting the vegetable production.

The importance of vegetables in providing food and nutritional security and amelioration of nutrient deficiencies has been realised world over (Prasad et al. 2014). Many parts of vegetable plants are consumed as food worldwide - roots, tubers, bulbs, corms, leaf and fruit. According to the ministry's estimates, based on information provided by the States and Union Territories, the production of vegetables is estimated to be around 175 million tonnes. The area under the horticulture crops has recorded to 249 lakh hectares in 2016-17. IFAD (International Fund for Agriculture Development) (2009) has reported that climate change is expected to put 49 million additional people at risk of hunger by 2020, and 132 million by 2050 (Devendra 2012).

Climate change is a statistical variation in properties of the climate system that include in global temperature, rainfall, sunlight, precipitation etc. Agriculture production depends on environmental, varietal and management factors. Climate plays a major role as its positive and negative impact immediately influences crop productivity. Awareness among the farmers about the climate change is very necessary for crop output in terms of production. Farmer’s perception about the climate is more important to mitigate the ill effect of weather or climate to some extent. In the recent years extreme weather events like excessive deficit rainfall, flood, severe frost, temperature and

drought are occurring more commonly affecting agricultural production and productivity which leads to decrease farmer's income (Bhan et al. 2014).

Climate change refers to any change in climate over time, whether due to natural variability or/and as a result of human activity (IPCC, 2007a). It has become a major concern to society because of its potentially adverse impacts worldwide. The average annual temperature of the Earth's surface has risen over the last century. Not only is the temperature rising, but the rate of warming itself is increasing too. The earth's climate has warmed on average by about 0.70C over the past 100 years with decades of the 1990s and 2000s being the warmest in the instrumental record (Watson, 2010). In ecological terms, this is a very rapid change. Most of the countries are facing the problems of rising temperature, melting of glaciers, rising of sea-level leading to inundation of the coastal areas, changes in precipitation patterns leading to increased risk of recurrent droughts and devastating floods.

Climate change impacts and associated vulnerability are of particular concern to developing countries, where large parts of the population depend on climate sensitive sectors like agriculture for their livelihood. By adversely affecting freshwater availability and quality, biodiversity and desertification, climate change tends to disproportionately affect the poorest in the society, exacerbating inequities in access to food, water and health. India is considered to be especially vulnerable to the impacts of climate change with an extraordinary variety of climatic regions, ranging from tropical in the south to temperate and alpine in the Himalayan north, where elevated regions receive sustained winter snowfall. The north of the country has a continental climate with severe summer conditions that alternates with cold winters when temperatures plunge to freezing point. In contrast are the coastal regions of the country, where the warmth is unvarying and the rains are frequent.

Climate change is likely to affect all the natural ecosystems as well as socio-economic systems as shown by the National Communications Report of India to the UNFCCC (INC, 2004). Various studies have indicated a probability of 10 to 40 per cent loss in crop production in the country due to the anticipated

rise in temperature by 2080. Climate change and agriculture are interrelated processes, both of which take place on a global scale (Parry *et al.*, 2007). Global warming is projected to have significant impacts on conditions affecting agriculture, including temperature, precipitation and glacial run-off (Funk *et al*., 2008 and McCarthy *et al*., 2001).

Agriculture places heavy burden on the environment in the process of providing humanity with food and fiber, while climate is the primary determinant of agricultural productivity. In India, climate change is putting additional stress on ecological and socioeconomic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. With its huge and growing population, India is considered to be especially vulnerable to the impacts of climate change. Like most other developing countries, people in India are dependent to a large extent on its natural resources for livelihood and economy. Any adverse impacts on these natural resources will have repercussion on the nation's livelihood security and economy and widen the gap between the rich and the poor.

Climate change is predicted by scientists to have the main impact on agriculture, economy and livelihood of the populations of developing countries and India is one of them, where large parts of the population depend on climate sensitive sectors like agriculture for livelihood. By adversely affecting freshwater availability and quality, biodiversity and desertification, climate change tends to disproportionately affect the poorest in the society, exacerbating inequities in access to food, water and health. Climate change therefore is intrinsically linked to other environmental issues and to the challenge of sustainable development.

In order to understand how human beings would respond to climate change, it is essential to study people's perceptions of climate and the environment in general (Vedwan and Rhoades, 2001). Human expectations regarding weather and climate sometimes lead to perceptions of climate change which are not supported by observational evidences (Rebetcz, 2000). A better understanding of how farmers' perceive climate change, ongoing

adaptation measures, and the factors influencing the decision to adapt farming practices is needed to craft policies and programmes aimed at promoting successful adaptation of the agricultural sector (Bryan *et al*., 2009).

As the understanding on global climate and its change is pre requisite to take appropriate initiatives to combat climate change. The only solution for these huge populations seems to be adequate and relevant adaptation strategies. It has been reported that there is a large deficit of information and knowledge in this vulnerable region which impedes decision making and assessment of climate related risks, and adaptation (Mc Sweeney *et al.,* 2010). Adaptation to climate change requires that farmers first notice that the climate has altered. Farmers then need to identify potentially useful adaptations and implement them.

A lower agricultural production and productivity due to climate change has implication for food prices, which in turn affect the livelihood and food security status of household in a country. Under the circumstances improved and sustainable agriculture technology according to forecast based, agro advisories and full information about factor effecting of climate change are more useful to reduce vulnerability and improve adoptability of agriculture to climate change. In Ujjain district of Madhya Pradesh major vegetable crops grown are Tomato, Okra, Sponge gourd, Bottle Gourd, Brinjal, Chili, Cucurbits etc. In vegetable growing areas of Ujjain, many factor are available which directly connected with climate change and like average temperature increase, change in rainfall amount and pattern, change in climatic variability.

Keeping in view of the above points, the present study entitled, “A study on effect of climate change on vegetable Production Technology in Ujjain block of Ujjain District (M.P.)” was designed and undertaken with the following specific objectives :-

Objectives of the study:

1. To analyse the relationship between socio-economic, communication and psychological attributes of vegetable growers and their perception on impact of climate change.

2. To study the farmers perception on the impact of climate change.

3. To determine the major cropping mechanism adopted by vegetable growers to mitigate the effect of climate change.

4. To know the constraints faced by vegetable growers and their suggestions

Scope of the study:

The present investigation is an effort to know the effect of climate change on vegetable production technology.

Thus the study will explore the new way to reach out among the farming community through dissemination of useful information about climate change. This will also help to policy maker to make appropriate plans and policies for strengthening the farmers community with latest technology. The study would be useful to extension workers, administrators, communication experts, researchers and planners who are engaged in generating and disseminating improved vegetable production technology, looking to the extent of effect of climate change on vegetable growing and way to suggest to mitigate the adversity of climate change.

Limitations of the study:

Large number of factors may be responsible for changes in climatic conditions and its adverse effect on vegetables. However, with some limitations of the scholar, efforts were taken to consider most of the important variables for investigation, so that all the objectives of the study can be justified. It is not easy to evidently say that particular change is occurring and vegetable production is

being directly impacted by that, therefore, the present study has been carried out under a set of following limitations:

1. The scientific knowledge on effect of climate change is increasing all the time, as are practical experiences in responding to adaptation needs. But, this knowledge has not been fully exploited, which, imposed lot of problem in collecting reviews.
2. In India lack of research and credible evidence on the effect of climate change was major challenge to find out the correctness of findings.
3. Selected issues were considered under study due to limited understanding of local farmers on such basic issues as the nature and scale of effects of climate change on vegetable.
4. The investigation was confined to 120 respondents, selected from Ujjain block of Ujjain districts.
5. Complete findings of the study are based on past experiences, memories and verbally expressed opinions of the farmers.
6. All necessary efforts were made to select and use of standardized tools and techniques of data collection and analysis of data, yet their accuracy may not guaranteed.

Organization of the study:

The study is organized into six chapters. The first chapter of the study deals with introduction, objectives, significance and limitation of the study. Review of literature has been discussed in second chapter. The third chapter describes the research methodology concepts, sample and data collection. The fourth chapter deals with analysis and interpretation of data. The findings along with discussions are discussed in chapter five and chapter six summarizes the findings and implications of the study.

Chapter - II

REVIEW OF LITERATURE

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

(I) Socio-personal, Socio-economic, Communication and Psychological profile of vegetable growers.

(II) Farmers perception on effect of climate change (rainfall and temperature) on vegetable production technology.

(III) Relationship between the independent and dependent variable.

(IV) Various problems faced by vegetable growers and there suggestions.

2.1 Socio-personal, socio-economic, Communication and Psychological profile of vegetable growers:

2.1.1 Age:

More (2000) found that about 20 percent of respondents were from young age group, while 68 percent were from middle age group and about 22 per cent were belonged to old age group.

Singh and Bhagat (2002) found that more than fifty percent (56%) vegetable growers belonged to middle age group and 72 percent vegetable growers possessed less farm machinery and equipment.

Suresh (2004) observed that 64.58 per cent of respondents belong to middle age followed by 17.92 per cent in young age and 17.50 per cent in old age.

Shakya (2007) reported that majority (72.50%) of respondent belonged to middle age group.

Bagri (2009) reported that 56.66 percent respondent belonged to middle age group.

Sorhang and Kristiansen (2011) reported that those over 69 years old seems to be less adaptive, however, younger people seem to some extent to be more likely to adopt adaptation strategies.

2.1.2 Education:

Baragi (1997) reported that out of the total respondents, 28.84 percent had low education. 38.33 percent had medium and 33.33 percent had higher education level.

Barodia et al. (2005) found that most of the vegetable growers belonged to young age group and 25 percent had education up to high school level had more number of farm power, 46.69 percent were having low experience in vegetable growing.

Rajput et al. (2005) revealed that majority of the farm woman (58.33) belonged to young age group, more than half of total (55.84%) were illiterate, nearly forty percent belonged to low income group (Rs 15,000 to Rs 30,000/-)

Verma and Yadav (2013) observed that most of the farmers under study were literate.

Reddy and Shenoy (2013) observed that majority of farmers were illiterates followed by the education level up to primary and secondary school level.

Deressa et al. (2009) and Akponikpe et al. (2010) revealed that farmers with higher levels of education are more likely to adapt better to climate changes, Most of the farmers have no formal education (58 %), followed by primary or literacy levels (29%) and secondary education levels (10%).

Dhaka et al. (2010) reported that the respondent's level of education greatly increases the probability of adaptation to cope with effect of climate change.

2.1.3 Caste:

Solanki and Lodha (2005) concluded that a majority of farm woman were from other backward classes followed by scheduled castes and scheduled tribes.

Rajput et al. (2005) revealed that majority of the farm woman (59.17%) of farm woman belonged to other backward classes.

Barodia et al. (2005) found that most of the vegetable growers belonged to other backward classes.

Dhruw (2008) observed that maximum number of the respondents (68.33%) belonging to schedule tribes, followed by 15.93 per cent were under other backward caste, 13.34 per cent respondents were from general caste and only 2.50 per cent respondents belonged to schedule caste.

Yuwraj (2010) found that majority of respondents (92.86%) belonged to general caste, followed by 7.14 per cent who belonged to other backward class, and none of the respondents were found in the category of schedule tribes and schedule caste.

2.1.4 Size of Land Holding:

Adger *et al.* (2003) stated that climate change will have greater negative impacts on poorer farm households as they have the lowest capacity to adapt

to changes in climatic conditions. Adaptation measures are therefore important to help these communities to better face extreme weather conditions and associated climatic variations.

Suresh (2004) observed that majority of the respondents (68.75%) were having medium size of land holding followed by high (19.17%) and low (12.08%) size of land holding.

Bradshaw *et al*. (2004) studied on adaptation of agricultural technologies and indicated that farm size has both negative and positive effects on adaptation, showing that the effect of farm size on technology adaptation is inconclusive.

Barodia et al. (2005) found that 50 % of the vegetable growers were having large size of land holding. Majority of the growers were growing vegetable in one hectare of land.

Karjagi (2006) revealed that 62.22 per cent of the respondents have belonged to small holding (<2 ha) followed by medium (2.1 to 8.0 ha) and large holding (> 8 ha), which accounts for 24.44 per cent and 13.34 percent, respectively.

Maddison (2007) study shows that subsistence farmers are more capable of perceiving the changes.

Solanki (2009) revealed that majority of the vegetable growers had medium size of land holding.

Patel (2012) reported that higher number of respondents had medium size of land holdings followed by large and small.

Badole (2014) reported that higher number of the vegetable growers medium size of land holding group followed by large and small size of land holding group.

2.1.5 Farm Mechanization:

Sarkar *et al.* (1997) reported that farm implement significantly and positively associated with adoption of farm innovation.

Singh and Bhagat (2002) found that 72 percent vegetable growers possessed less farm machinery and equipment.

De (2004) reported that implements were negatively related with scientific temperament of farmers.

Taram (2011) reported in his study that the higher percentage of beneficiaries had medium farm mechanization

2.1.6 Annual production:

Latha et al. (2013) found that leaf yield of Amaranthus and palak varied significantly due to application of different organic manure and inorganic fertilizer.

Singh et al. (2013) found that green pea give higher 30.9% green pod yield.

2.1.7 Annual income:

Bhariarmkar et al. (1998) found that majority of the respondent growing vegetable crops belonged to low level of annual income group.

Farooqui et al. (1992) concluded that majority of the respondents growing chilli and vegetable crop belonged to middle level of annual income.

Bairagi (1997) found that majority of the vegetable growers belonged to low annual income group.

Udday (2007) reported that majority of the vegetable growers belonged to low annual income group.

2.1.8 Information Seeking Behaviour:

Nhemachena and Hassan (2007) and D'Emden *et al. (*2008) argued that information seeking behavior through extension increases the likelihood of adapting to climate changes.

Yirga (2007) stated that studies in developing countries, including Ethiopia, reported a strong positive relationship between information seeking behaviour and the adaptation behavior of farmers.

Deressa et al. (2009) reported that information seeking behavior might increase the likelihood of adapting to climate changes.

Solanki (2009) stated that the higher percentage of respondents were found in middle age group, medium information seeking behaviour, medium size of land holding, medium attitude toward improved technology and medium innovativeness.

Mandleni (2011) revealed that access to information seemed to be an important element that motivated adaptation to climate change among farmers.

Luni *et al.* (2012) reported that only 11.8 per cent of the respondents replied that they have heard about it. The source of information was cited as radio by 6.9 per cent, staffs of NGOs by 2.5 per cent and teachers at school by 1.5 per cent of the respondents.

Patel (2012) reported that higher number of respondents in medium information seeking behaviour category followed by high and low information seeking behaviour.

Patel (2013) reported that out of total vegetable growers, 60.83 per cent were in the category of medium Information seeking behaviour, followed by 20.83 per cent had low and only 18.34 per cent vegetable growers had high Information seeking behavior.

Badole (2014) reported that higher number of the vegetable growers had medium information seeking behaviour followed by low and high information seeking behavior.

2.1.9 Knowledge level towards climate change:

Sreedaya and Kumari (2000) concluded that most of the vegetable farmers had high knowledge about vegetable cultivation and most of them needed training in the area of plant protection

Bhople and sinde (2002) found that majority of vegetable growers had medium level of knowledge and adoption.

Kumar et al. (2014) studied that agriculture sector is most sensitive to climate change it affects the food security of India. This study estimate the impact of climatic and non-climatic factors on food grain productivity of facilitate the development of appropriate farm policies to cope with climate change.

Bhan et al. (2014) found that majority of the farmers surveyed from different villages expressed that increase in temperature with rainfall are the incidence more favorable for improving the population of insect-pest and disease-causing pathogens. These weather events generally occurred during cloudy weather conditions.

2.1.10 Risk bearing ability:

Pandeti (2005) reported that majority of small farmers (47.50%) had low risk taking ability, whereas, 47.50 per cent of medium and 37.50 per cent of big farmers had medium and high risk taking ability, respectively.

Reddy (2005) reported that 56 per cent belonged to medium risk orientation category followed by high (28%) and low (19.33%) risk orientation categories.

Sarkar et al. (2010) measured the risk perception of people about climate change and reported that 70 percent people perceived increase in crop

disease followed by reduction in agriculture production (46%), increase in salinity (40%), increase in insect and pest attacks (20%) etc.

Lal et al. (2011) found that involvement of middle man, cheating by the traders, low sale price of potato, shortage of electricity, gluts, poor quality and adulterated fungicide, lack of cold storage facilities, low risk bearing ability of the potato farmers, lack of motivation from SDA and state Department of Horticulture and unavailability of good quality potato seed to the farmers were the most serious constraints.

Kaur (2013) studied that most of the respondents engaged in fruit cultivation were in the age group of 36 to 53 years, belong to nuclear family, had matriculation as their education level, operational land holding of 4.40 to 20.02 acres and had fruit growing as their main occupation. Most of the respondent were medium on extension contacts, mass media exposure, risk bearing capacity and scientific orientation.

2.1.11 Economic Motivation:

Patel (2000) reported that economic motivation had significant relationship with production.

Barodia (2005) reported that most of the vegetable growers had high economic motivation.

Rajput et al. *(*2005) reported that the higher percentage (47.50%) of the respondent were having medium economic motivation.

Bagri (2009) reported that most of the pea growers had medium economic motivation.

2.2 Effect of climate change on vegetable production technology:

Shrinivasa Rao et al. (2001) found that physiological aspects of water stress and some of the well established changes in physiology and metabolism that result from water deficit. Plants are highly integrated organisms and when

water stress disturbs the different processes in a plant system, control mechanisms play an important role for adjusting other processes to maintain functional balance and thus cope with adversity. It is important however to identify the physiological mechanisms that assist the plant to survive and grow under moisture limited environment.

NEST (2004), IPCC (2007b) and Apata *et al.* (2009) reported that climate change will have a strong impact on Nigeria, particularly in the areas of agriculture, land use, energy, biodiversity, health and water resources.

CBS (2006) mentioned that about 96 per cent of the total water use in the country suffers a lot from erratic weather patterns such as heat stress, longer dry seasons and uncertain rainfall, since 64 per cent of the cultivated area fully depends on monsoon rainfall.

Ebi *et al.* (2007) reported that declined yield due to unfavorable weather and climate will lead to vulnerability in the form of food insecurity, hunger and shorter life expectancies.

Food and Agriculture Organisation (FAO) in (2007) estimated that higher temperatures were envisaged as well as changes in rainfall patterns, which were expected to result in increased spread of existing vector-borne diseases and macro parasites of animals as well as the emergence and spread of new diseases.

IPCC in 2007 projected for India an acceleration of warming above that observed in the 20th century, a decrease in precipitation, and an increase in the occurrence of extreme weather events.

Bhushal *et al.* (2009) reported that erratic rainfall patterns and hailstorm contributing to soil erosion, soil fertility loss, and crop damage are having an adverse impact on livelihoods of most of these communities, thus increasing risk to food security.

Aggarwal (2009) argued that a 1°C increase in temperature with no associated CO2 increase could lead to a decrease of 6 million tonnes of wheat production. This loss is projected to increase to 27.5 million tonnes at 5°C increase in mean temperature. It was estimated that yield loss would be 3.9 million tonnes due to climate change by 2020, 11.7 million tonnes by 2050 and 23.5 million tonnes by 2080.

Arya (2010) argued that according to people's perception, climate change has effect the physiological event in all plants, like flowering, fruiting and fruit size, their quality and quantity.

Rawat (2010) reported that almost every one interviewed suggested that there is a change in cropping pattern since the last 5-6 years.

Sharma (2010) reported that 36 percent of the respondents had positive and affirmative perception, that is, they had perceived that the change in climate certainly had an effect on them. Whereas, 24 per cent had perceived that it had no effect in the area. However, those who were ambiguous in their responses were found to be 40 per cent.

Sarkar and Padaria (2010) reported that increased incidences of pests, reduction in acreage of some crops (Cultivation of some vegetables like tomato, potato has been decreased due to high temperature in winter season as these crops require low temperature), reduction in yield, increased cost of cultivation etc. were important perceived risks in agriculture that increase vulnerability among farmers.

Pande and Akermann (2010) stated that according to farmers the weather situation has changed drastically compared to some decades ago. In interviews, farmers reported experiencing recent changes in climate in terms of increasing temperatures and generally in terms of a decrease in precipitation during the monsoon season.

Arya (2010) conducted a study about perceptions on climate change in village communities of Garhwal Himalaya and stated that respondents

perceived unseasonable rainfall, decreasing moisture and increasing heat. They also observed drought, low crop production, snowfall and fluctuations in temperature. Increased soil erosion due to heavy rainfall in the rainy season, and decreased water level due to high temperatures were other observations.

Subudhi et al. (2011) concluded that the average rainfall at Kandhamal is around 1500mm, though it receives high amount rainfall but most of the rainfall (84%) occurred during unplanned. So most of the crops get low yield due to improper crop planning. It is observed that rainfall during June to September is more than 100 mm and cropping pattern like paddy (110 days) mustard is suitable to the region. Also, if the rain can be harvested and reused for another crop by using sprinkler or drip irrigation, it will give benefit to the farmers. The pentad analysis shows that the pentads which received less than 12.5 mm may be looked into at 75% probability level and different steps may be made to irrigate during that period from pond or irrigation.

Gopal et. al. (2014) studied that due to climate change, there was significant impact on agriculture and allied areas and led to biotic and abiotic stresses. The study focused on the analyzing the awareness of the dryland farmers on the climate change and also extent of adoption of adaptation and mitigation measures for climate change. Study was conducted in Chittoor district of Andhra Pradesh with 120 dryland farmers by following appropriate sampling procedure. Structured schedules were prepared for both awareness and adoption of measures for climate change. There was 84.47 percent of awareness on climate related changes followed by 74.27 percent on crop related changes, 73.61 percent on animal husbandry related changes and 61.21 percent on soil and water related changes.

Ranzzi et al. (2012) found that temperature and its associated seasonal pattern are critical components of agricultural production system. Rising a temperatures associated with climate change will likely have a detrimental impact on crop production, livestock, fishery and allied sectors. It is predicted that for every 20 C (which has been predicted by 2030) rise in temperature, the GDP will reduce by 5 per cent. The pre-monsoon and monsoon temperatures

also indicate a warming trend. Most vegetables are sensitive to environmental extremes, thus periodic high temperature and soil moisture stress conditions are likely to reduce yield, on average. But research also shows that higher CO2 concentration could offset the negative effect of higher temperature especially in the case of leafy vegetables that would benefit from increased rates of photosynthesis.

Ayyogari et al. (2014) found vegetables are also being hit by the consequences of climate change such as global warming, changes in seasonal and monsoon pattern and biotic and abiotic factors. Under changing climatic situations crop failures, shortage of yields, reduction in quality and increasing pest and disease problems are common and they render the vegetable cultivation unprofitable. As many physiological processes and enzymatic activities are temperature dependent, they are going to be largely effected. Drought and salinity are the two important consequences of increase in temperature worsening vegetable cultivation. These effects of climate change also influence the pest and disease occurrences, host-pathogen interactions, distribution and ecology of insects, time of appearance, there by becoming major setback to vegetable cultivation. Potato, among the all vegetables, is most vulnerable to climate change due to its exact climatic requirement for various physiological processes.

Kumar et al. (2014) revealed that net return of onion with sugarcane was much higher as compared to farmer practice. It was also noticed that infestation of borers was very low in sugarcane with onion in comparison to treatment one and two. Result have clearly indicate that intercropping of onion with autumn planting sugarcane is economically viable and physible option to replace the existing cropping system without left sugarcane which is highly suitable cash crop in agro-marketing condition of western Uttar Pradesh and crop-animal husbandry based farming system which is predominant and success farming system considered by majority of the farmer.

2.3 Major cropping mechanism adopted by the farmer to mitigate the effect of climate change:

Shrivastava et al. (2007) found that organic farming is becoming a major tool for sustaining the soil quality degraded by intensive use of synthetic chemicals for increasing crop production and therefore, use of bio-agents as biofertilizer or biopesticide is an integral part organic farming especially in vegetable cultivation. In vegetable based cropping system use many microbial inoculants and organic farming practices. Three crop taken in rotation were okra, pea and cow pea in a year. Under crop management practices, inoculated bio agent and crop residues increased the yield of vegetable.

Singh et al. (2008) conclude that Rice-wheat cropping system involving potato, vegetable peas and groundnut and water management treatments in rice to increase the production, economics and water use efficiency. Inclusion of potato, vegetable peas and groundnut in rice-wheat cropping system increased the production, economics and land use efficiency on an average by 95, 75 and 11% respectively. Rice equivalent yield was maximum in rice-groundnut-potato-wheat, which was at par with rice-potato-wheat followed by rice-vegetable peas-wheat as against traditional rice-wheat system.

Kumar et al. 2009. Studied that five cropping sequences considering the off-seasonality of 2 months were selected for evaluation. The cropping sequence of squash-french-bean-tomato-spinach gave highest economic yield with production efficiency followed by capsicum-tomato-spinach. Pooled analysis of two years data showed higher gross returns in cropping sequence of squash-frenchbean-tomato-squash, whereas highest net returns However, highest B:C ratio of 3.14 was obtained for cropping sequence of capsicum-tomato-spinach. Lowest net returns and B**:**C ratio (1.34) were recorded in cropping sequence of tomato-cucumber-frenchbean-coriander.

Prakash (2014) found that potato based five cropping system, viz rice-potato-wheat, maize-potato, blackgram-potato-cowpea and cowpea-potato-okra were tested during 2010-11 to 2012-13 at Kanpur, India. The highest total productivity was obtained under cowpea-potato-okra cropping system, while blackgram-potato-greengram system gave the highest potato equivalent yield with maximum net return and benefit- cost ratio.

2.4 Relationship between dependent and independent variables:

Maddison (2007) reported that the coefficient on the farmer experience is negatively signed and statistically significant at the 1 per cent level. Experienced farmers are significantly less likely to perceive no change in the climate.

Dhaka *et al.* (2010) revealed that the age, farming experience, innovativeness, environmental consciousness and exposures to mass media had a positive and significant relationship with farmer perceptions to climate change.

Pande and Akermann (2010) reported that altered climate change, noticed climate change frequency of droughts, age and sex all had no significance effect on adaptation.

Sorhang and Kristiansen (2011) reported that there seems to be a positive relationship between education and how active the farmers are in adaptation strategies, and those households where the head of household has 10 years or more in school are most likely to adopt more numbers of adaptation strategies.

2.5 Various problems faced by vegetable growers:

Desai et al. (1997) found that non availability of availability of implement (45.94 %) inadequate capital for the purchase of seeds and fertilizers (31.75%) and non availability of improved seed in time (31.75 %) were the main constrains pertaining to the availability of resource. The main constraints were lack of knowledge about profitable crop rotation (26.35%) and labor shortage performing timely operation (24.33%) also stated that respondent faces the constraints like non availability of plant protection of pesticides/fungicide (22.97%) very few contact farmers (14.86%) experienced. The constraints like non-availability of timely guidance and insufficient information about the agricultural technology communicated by VLWs (4.05%).

Singh (2000) concluded that difficulties as lack of knowledge about balanced fertilizer application, lack of availability of labor in time, lack of timely and adequate financial support, improper counseling given by the private pesticides or fertilizer dealer.

Prabhudesai and Korikamthimath (2008) revealed that several socio economic constraints like fragmented land holding and costly and timely non availability of local farm labor and dependence on migratory labor force neighboring states, relucent of youth to take up farming as a vocation.

Singh et. al. (2009) revealed that the farmers major constraints were lack of knowledge (54.86 %), lack of technical guidance (54.59%), high cost of input (53.20%), and lack of money (42.98%). In case of plant protection measures, farmers gave top rank to high cost of pesticides as main constraints.

Bhan et al. (2014) found that majority of the farmers surveyed from different villages expressed that increase in temperature with rainfall are the incidence more favorable for improving the population of insect-pest and disease-causing pathogens. These weather events generally occurred during cloudy weather conditions.

* * *

Chapter- III

MATERIAL AND METHODS

The chapter methodology deals with where and how the study was carried out. For scientific study of any research problem, the researcher has to adopt appropriate materials, methods and procedures in order to arrive at useful conclusions. Keeping this view in mind, this chapter deals with where and how research work was carried out, how to construct the interview schedules, methods used for the selection of the respondents, ways adopted for the quantification of qualitative data and preparation of primary and secondary tables. The details of the procedure used in this study are given here as under.

3.1 Sampling techniques used:

a) Location of the study

b) Selection of the block

c) Selection of villages

d) Selection of respondents

3.2 Research design

3.3 Variables, their operationalization and measurement

3.4 Instrument and method of data collection

3.5 Processing and statistical analysis of data

3.6 Derivation of hypotheses

3.1 Sampling techniques used:

a) Location of the study:

The study was carried out in Ujjain district of (M.P.). The Ujjain district is situated in the malwa plateau in western part of the Madhya Pradesh. The district lies at 23.17˚ N latitude and 75.79˚ E longitude at a height of 596 meters, above the mean sea level. It is bordered by Ratlam, Agar malwa, Shajapur, Dewas, Indore and Dhar districts.

Climate and Soil:

Ujjain district comes under malwa region of Madhya Pradesh. Due to its altitude of about 550 to 600 meters above mean sea level, the region has comparatively cool evenings against the hot days during the summer season. Even if the day temperature reaches 42 to 43 degree Celsius, the night temperatures are always in range of 20 to 22 degrees making the climate much cooler than the other areas of the region. The year is popularly divided into three seasons- summer, the rains, and winter. Summer extends over the months of mid-March to mid-May. The average maximum temperature during the summer months is 37 °C, which typically rises to around 42 °C on a few days. The rainy season starts with the first showers of mid-June and extends to the middle of September. Most of the rain falls during the southwest monsoon spell, and ranges from about 80 cm in the west to about 10.5 cm in the east. Indore and the immediately surrounding areas receive an average of 90 cm of rainfall a year. The growing period lasts from 90 to 150 days, during which the average daily temperature is below 30°C, but seldom falls below 20°C. Winter is the longest of the three seasons, extending for about five months i.e., October to mid-March. The average daily minimum temperature ranges from 6°C to 9°C, though on some nights it can fall as low as 3°C. Some cultivators believe that an occasional winter shower during these months known as Mawta is helpful to the early summer wheat and germ crops.

Table 3.1.1: General features of Agriculture of Ujjain district

S. No.	Particulars	
1.	Total Geographical area (Sq.km)	6091
2.	Total population of Ujjain district	1986000
3.	No. of Block	06
4.	No. of Tahseel	07
5.	No. of Janpad Panchayat	06
6.	No. of Village Panchayat	609
7.	No. of Villages	1096
8.	Forest land (ha)	3149
9.	Net cultivated area (ha)	498787
10.	Total cropped area (ha)	925168
11.	Non cultivable area (ha)	64674
12.	Crop intensity (%)	139
13.	Average rainfall (mm)	890
14.	Average Maximum Temperature (Celsius)	31.0
15.	Average Minimum Temperature (Celsius)	17.0

Source – District statistics book 2012, Agriculture Department Ujjain 2012-13.

b) Selection of block:

The Ujjain district comprises of 6 blocks, out of which the Ujjain block have been selected for the study because in this block maximum villages had been taken by NHM.

c) Selection of villages:

The Ujjain block comprises of 131 villages. List of vegetable crop growing villages was taken from NHM Ujjain, out of which 6 villages were taken on the basis of availability of respondent and adopted by NHM Ujjain were named as chandesari, chandesara, nauganv, bakaniya, kesuni and manpura were selected randomly.

d) Selection of respondents:

Village wise list of the farmers of six selected villages have been prepared with the help of NHM. From this list 120 farmers were selected proportionately for the study.

Table 3.1.2 Selected villages and number of selected farmers

S. No.	Name of villages	Total vegetable growers	No. of selected vegetable growers
1.	Chandesari	120	24
2.	Chandesara	100	20
3.	Nauganv	80	16
4.	Bakaniya	110	22
5.	Kesuni	90	18
6.	Manpura	100	20
	Total	**600**	**120**

3.2 Research design:

The design of research is the most important and crucial aspect of research methodology. It is the entire process of planning and carrying out the research. To seek the answer of the research question, a descriptive research design was used in the investigation because it is a sort of fact finding operation with adequate interpretation and states clearly the characteristics of a particular situation or group or individual.

Data collection method:

Data were collected by the researcher personally using pre-structured interview schedule.

3.3 Variables, their operationalization and measurement:

S.No.	VARIABLES	MEASURMENTS
A.	**Independent Variables**	
(a)	**Socio-Personal**	
1.	Age	Structured Schedule
2.	Education	Structured Schedule
3.	Caste	Structured Schedule
(b)	**Socio-economical**	
4.	Land Holding	Structured Schedule
5.	Farm Mechanization	Structured Schedule
6.	Annual Production	Structured Schedule
7.	Annual income	Structured Schedule
(c)	**Communcation Variable**	
8.	Information Seeking behavior	Structured Schedule
(d)	**Psycological Behaviour**	
9.	Knowledge level towards climate change	Structured Schedule
10.	Risk bearing ability	Structured Schedule
11.	Economic motivation	Scale of supe and singh(1996)
B.	**Dependent variable (y)**	
1.	Effect of climate change on vegetable production technology	Index will be developed on the basis of parameter of climate change effect on vegetable grown by the farmers which are given through NHM functionaries.

3.3 Operationalisation of independent variables and their measurement:

3.3.1 Age:

It refers to the number of years an individual has completed at the time of investigation and was measured as per actual chronological age of the respondents. The category formulated were –

S. No.	Categories	Score
1.	Young age group (Up to 35 years)	1
2.	Middle age group (36 - 55 years)	2
3.	Old age group (56 years and above)	3

3.3.2 Education:

It refers to the ability or inability to read and write and the formal education obtained by the respondents, and the categories formulated were as follows:-

S No.	Categories	Score
1.	Illiterate	1
2.	Up to High School	2
3.	Up to Higher Secondary	3
4.	Graduate	4

3.3.3 Caste:

It is the social category in which the members are assigned a permanent status with a given social hierarchy. The respondents were categorized as:

S. No.	Category	Scores
1.	General	4
2.	Other backward classes	3
3.	Schedules Castes	2
4.	Schedules Tribes	1

3.3.4 Land holding:

(i) Total land holding:

It refers to the size of land owned or lease-based cultivated by the respondents in hectares. Accordingly, the respondents were categorized as marginal, small, medium and large farmers.

S. No.	Categories	Range	Score
1.	Marginal	Up to 1 ha	1
2.	Small	1.-2.5 ha	2
3.	Medium	2.5-5 ha	3
4.	Large	Above 5 ha	4

(ii) Percentage of total land holding under vegetable crop:

S. No.	Categories	Range	Score
1.	Percentage	1-25	1
2.	Percentage	26-50	2
3.	Percentage	51-75	3

3.3.5 Farm Mechanization:

Farm mechanization may be determined by the farm power utilization pattern in farming through use of machine and implements. It consists of number of farm machines and modern implements possessed by beneficiaries. In study for level of firm mechanization measurement self scoring was used in which the respondents were asked if they possessed those machines and implements or not. The respondents were categorized into three groups.

S. No.	Categories	Range
1.	Low (1-5 items)	Mean-S.D.
2.	Medium (6 to 10 item)	Mean±S.D.
3.	High (more than 10)	Mean+S.D.

3.3.6 Annual production of vegetable crops:

It refers to the production level of vegetable crop. It was operationalized as the yield of vegetable per unit area of an individual grower and was measured in tonnes per hectare. The categories were formulated on the basis of range of yield per hectares obtained by growers and average yield of size of land holdings. On the basis of production level scores, the respondents were placed in three categories:

S. No.	**Categories** (In Tonnes)	**Score**
1.	Low production level (1-5)	1
2.	Medium production level (6-10)	2
3.	High production level (above10)	3

3.3.7 Annual income:

It refers to the annual income of the respondent in rupees earned through all the sources of occupation. On the basis of annual income, the respondents were classified into following three categories:

S. No.	**Categories**	**Income**	**Scores**
1.	Low annual income	Rs. 50000 – 150000/-	1
2.	Medium annual income	Rs. 150001 – 300000/-	2
3.	High annual income	Above 300000	3

(c) Communication Variable:

3.3.8 Information seeking behaviour:

It refers to the degree of frequency of contact by flower growers with various information sources. This is the pattern by which flower growers get information either seeking on its own or as a consequence of behaviour. The information seeking behaviour was measured with the help of structural schedule method. This attribute has 8 statements. The responses of the

respondents were obtained on 3 point continuum i.e. never, some time and always. The scoring was done in the order of 1, 2 and 3 respectively. On the basis of mean ±SD it was categorized into three categories as below:

S.No.	Category	Scores
1.	Low	Mean-S.D.
2.	Medium	Mean ± S.D.
3.	High	Mean +S.D.

(d) Psycological Variables:

3.3.9 Knowledge level towards climate change:

Knowledge as defined, is body of understood information possessed by individual vegetable growers. It also explained that knowledge is the part of a person's information, which is in accordance with established fact. In present study knowledge refers to the information possessed by vegetable growers regarding vegetable production technology. Level of knowledge of vegetable growers regarding vegetable production technology was measured with the help of structural schedule. This scale has 8 statements for vegetable considered for study. The responses of the vegetable growers were obtained on 3 point continuum i.e. complete agree, agree and partial agree. The scoring was done in the order of 3, 2 and 1 respectively. On this basis it was categorized into three categories below:

S. No.	Categories	Range
1.	Low	1
2.	Medium	2
3.	High	3

3.3.10 Risk bearing ability:

Risk taking ability is a degree to which an individual takes risk and shows courage in facing the problems that arise in vegetable cultivation. The vegetable

growers are taking challenges for uncertainty in vegetable cultivation which they have to bear. This scale consists of 6 statements. The responses of the vegetable growers were obtained on 3 point continuums i.e. complete agree, agree and partial agree. The scoring was done in the order of 3, 2 and 1 respectively. On this basis it was categorized into three categories as below:

S. No.	Categories	Score
1.	Low	1
2.	Medium	2
3.	High	3

3.3.11 Economic motivation:

It refers to occupational success in terms of profit maximization and the relative value on individual places on economic and it was measured with the help of "Economic Motivation scale" developed by Supe and Singh (1969). The scale consisted of six items, of which statement number six was negatively keyed. Responses were recorded on three point continuum as complete agree, agree and partial agree and were given 3, 2 and 1 scores, respectively. The total scores explains the degree of economic motivation of an individual. On the basis of minimum and maximum scores obtained by individual vegetable growers, the categories were formulated as follows:

S. No.	Categories	Scores
1.	Low economic motivation	1
2.	Medium economic motivation	2
3.	High economic motivation	3

3.4. Operationalisation of dependent variable:

One of the objectives of the study was to assess effect of climate change with respect to vegetable production technology. This variable is measured by following the procedure given below:

Effect of climate change on vegetable production technology:

Effect of Climate change is a particular concern to developing countries, where large parts of the population depend on climate sensitive sectors like agriculture for livelihood. So farmers perspectives are equally important to quantify the climate change impacts on vegetable production technology. Effect of climate change at the local level is difficult to assess due to lack of data and poor understanding of microclimate. Farmers were asked about changes occurred in vegetable production technology according to their past experiences as effects of climate change and sudden changes performed by them in vegetable production technology.

In the present study, farmers perception on effect of climate change on vegetable production technology was taken as dependent variable. It was measured on three-point continuum as partially agree, agree and completely agree and were given weight of 1, 2 and 3 respectively. This is computed by using scoring technique adopted for the purpose. The total score obtained by the vegetable growers from all 10 aspects was the effect score of individual vegetable grower and the index is prepared under the following climate change parameters – Rainfall and Temperature.

Finally this raw effect score obtained by farmers perception was converted into effect index as below:

$$\textbf{Effect of climate change} = \frac{\text{Obtained score}}{\text{Obtainable score}} \textbf{X} 100$$

3.4.1 Farmers perception on effect of change in rainfall pattern:

Rainfall is a crucial factor for the success of vegetable production. The abnormal pattern of rainfall over the past few years has caused great fluctuation in vegetable production. The performance of vegetable crop is directly related to the availability of water. So farmers perceptions are very much useful to

establish the fact that the particular region is facing direct or indirect problems in vegetable production technology due to change in rainfall pattern.

In the present study, Farmers perception on effect of change in rainfall pattern was measured on three-point continuum as partial agree, agree and complete agree and were given weight of 1, 2 and 3 respectively and was computed by using scoring technique adopted for the purpose. The total score obtained by the vegetable growers from all 10 aspects was the effect score from individual farmer perception.

On the basis of average score obtained by farmers perception the categorization of vegetable growers were divided into 3 groups.

S. No.	Categories	Scores
1.	Low	1
2.	Medium	2
3.	High	3

3.4.2 Farmers perception on effect of change in temperature pattern:

Out all the climatic factors, affecting vegetable production, temperature may be considered as the most important as it affects growth and development of vegetable crops during different phases of growth such as seed germination, general survival development of economic parts, flowering, pollination and fruit set quality of produced, seed production, seed storage, seed dormancy, occurrence of diseases and pests. Temperature is the most important factor which determines what crop to be grown in a certain place.

In the present study, Farmers perception on effect of change in temperature parameter was measured on three-point continuum as partial agree, agree and complete agree and were given weight of 1, 2 and 3 respectively and was computed by using scoring technique adopted for the purpose. The total score obtained by the vegetable growers from all 10 aspects was the temperature effect score from individual farmer perception.

On the basis of average score obtained by farmers perception the categorization of vegetable growers were divided into 3 groups.

S. No.	Categories	Scores
1.	Low	1
2.	Medium	2
3.	High	3

3.5 Source, instrument, methods of data collection:

1) Source of data collection:

1.1 Primary data:

The respondents of the selected villages were the primary source of data collection. The primary data were collected personally by the researcher by interviewing the selected respondents with the help of structured and pretested interview schedule.

1.2 Secondary data:

The secondary data were collected from NHM, Department of Horticulture, Ujjain, magazines and publications etc.

2) Instrument of data collection:

The primary data were collected with the help of interview schedule, which was prepared on the basis of objectives of the study. For the convenience of data collection, the interview schedule was prepared in Hindi. The interview schedule was pre-tested to a sample of 10 farmers in non sampled area before the actual collection of the data.

The secondary data were obtained from NHM, Department of Horticulture, Ujjain and published journals and books.

3) Method of data collection:

The data were collected through a well-structured and pre-tested interview schedule. The researcher personally met the respondents and explained to them about the purpose of this study. The data were collected and recorded in the interview schedule.

3.7 **Processing and statistical analysis of data:**

Data collected were both qualitative as well as quantitative. The quantitative data has been interpreted in the form of degree of achievement like low, medium and high etc. and quantitative data were tabulated on the basis of approved categorization method as described earlier. The following statistical techniques were used in the study:-

1) Percentage

2) Mean

3) Standard deviation

4) Correlation of coefficient

1) Percentage:

The term percentage means a fraction whose denomination is 100 and the numeration of the fraction is called percentage. For calculating percentage, frequency was multiplied by 100 and divided by total respondents.

$$P = \frac{X}{N} \times 100$$

Where,

P = Percentage

X = Frequency of respondents

N = Total number of respondents

2) Mean:

Mean was obtained by dividing the sum of the scores by the total number of respondents, according to the following formula –

$$\text{Mean} = \frac{\sum_{i=1}^{n} Xi}{n} \quad [i = 1,2,3,.....n]$$

Where,

X = Mean

Xi = Sum of all the pairs in a distribution

n = Total number of items involved.

3) Standard deviation:

The standard deviation was obtained by the square root of the average of the square deviation from mean by the following formula:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n - 1}}$$

Where,

S.D. = Standard deviation,

Xi = Individual score of the ith respondent

X = Mean of the sample

n = Total number of respondents

4) Karl Pearson's coefficients of correlation

To find out the relationship between the selected independent and dependent variable Karl Pearson's coefficient of correlation 'r' was used by following formula:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2]\,[n(\sum y^2) - (\sum y)^2]}}$$

Where,

r = Coefficient of Correlation

x = Value independent variables

y = Value of dependent variables

n = Number of respondents

Testing the significance of r

The significance of r can be tested by Student's t test. The test statistics is given by:

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

3.7 Hypotheses of the study:

On the basis of objectives and variables taken into account, following null hypotheses were formulated for the study:-

1. There is no relationship between age of respondent and effect of change in rainfall parameter on vegetable production technology.

2. There is no relationship between education of respondent and effect of change in rainfall parameter on vegetable production technology.

3. There is no relationship between caste of respondent and effect of change in rainfall parameter on vegetable production technology.

4. There is no relationship between land holding of respondent and effect of change in rainfall parameter on vegetable production technology.

5. There is no relationship between farm mechanization of respondent and effect of change in rainfall parameter on vegetable production technology.

6. There is no relationship between annual production of respondent and effect of change in rainfall parameter on vegetable production technology.

7. There is no relationship between annual income of respondent and effect of change in rainfall parameter on vegetable production technology.

8. There is no relationship between information seeking behaviour of respondent and effect of change in rainfall parameter on vegetable production technology.

9. There is no relationship between knowledge level of respondent and effect of change in rainfall parameter on vegetable production technology.

10. There is no relationship between risk bearing ability of respondent and effect of change in rainfall parameter on vegetable production technology.

11. There is no relationship between economic motivation of respondent and effect of change in rainfall parameter on vegetable production technology.

12. There is no relationship between age of respondent and effect of change in temperature parameter on vegetable production technology.

13. There is no relationship between education of respondent and effect of change in temperature parameter on vegetable production technology.

14. There is no relationship between caste of respondent and effect of change in temperature parameter on vegetable production technology.

15. There is no relationship between total land holding of respondent and effect of change in temperature parameter on vegetable production technology.

16. There is no relationship between farm mechanization of respondent and effect of change in temperature parameter on vegetable production technology.

17. There is no relationship between annual production of respondent and effect of change in temperature parameter on vegetable production technology.

18. There is no relationship between annual income of respondent and effect of change in temperature parameter on vegetable production technology.

19. There is no relationship between information seeking behaviour of respondent and effect of change in temperature parameter on vegetable production technology.

20. There is no relationship between knowledge level of respondent and effect of change in temperature parameter on vegetable production technology.

21. There is no relationship between risk bearing ability of respondent and effect of change in temperature parameter on vegetable production technology.

22. There is no relationship between economic motivation of respondent and effect of change in temperature parameter on vegetable production technology.

Chapter- IV

RESULTS

This chapter deals with the analysis and interpretation of collected data, which were collected from the sample of 120 vegetable growers with reference to effect of climate change on vegetable production technology through the presented structured interview schedule. Calculation was made on percentage basis, mean, standard deviation and correlation were also applied. The data were processed keeping in view of the objectives of the study. This chapter has been divided into the following sub-heads.

4.1 Socio- economic, Communication and psychological profile of vegetable growers.

4.2 Farmers perception on effect of change in rainfall pattern on vegetable production technology

4.3 Relationship between rainfall effect and independent variable

4.4 Farmers perception on effect of change in temperature pattern on vegetable production technology.

4.5 Relationship between temperature effect and independent variable

4.6 Major cropping mechanism adopted by vegetable growers to mitigate the effect of climate change

4.7 Various constraints faced by vegetable growers.

4.8 Suggestions to overcome the constraints

4.1 Socio-economic profile of vegetable growers:

The profile of respondent of Ujjain district of Madhya Pradesh has been studied in terms of Socio- personal and economic variables.

4.1.1 Age:

The age of vegetable growers was considered as length of number of years in their present life. The distribution as per their age group is presented in table 4.1.

Table 4.1: Distribution of respondent according to their age.

S. No.	Categories	Frequency	Percentage
1.	Young age group (Up to 35 years)	26	21.66
2.	Middle age group (36 – 55 years)	78	65.00
3.	Old age group (56 and above)	16	13.34
Total		**120**	**100.00**

The data presented in Table 4.1 indicate that out of the total vegetable growers, 65.00 per cent belonged to middle age group, 21.66 per cent belonged to young age group and 13.34 per cent belonged to old age group.

Thus, it can be concluded that majority of 65.00 per cent respondent were from middle age group (36 – 55 years age).

4.1.2 Education:

Education was considered as the number of years of formal education acquired by the respondent which may affect the development of their socio economic status. The distribution of vegetable growers as per their education is presented in table 4.2.

Table 4.2: Distribution of respondent according to their education

S. No.	Category	Frequency	Percentage
1.	Illiterate	22	18.34
2.	Up to high school	24	20.00
3.	Up to higher secondary	53	44.16
4.	Up to College	21	17.50
Total		**120**	**100.00**

The data in Table 4.2 reveals that out of the total vegetable growers, 18.34 per cent were illiterate, 20.00 per cent received education high school,

44.16 per cent were higher secondary level and 17.50 per cent were found educated up to college level.

Higher percentage 44.16 per cent of respondent were having education up to higher secondary**.**

4.1.3 Caste :

The distribution of farmers as per their caste has been presented in Table 4.3.

Table 4.3: Distribution of respondent according to their caste.

S. No.	Category	Frequency	Percentage
1.	General	10	8.33
2.	Other backward classes	93	77.50
3.	Scheduled castes	9	7.50
4.	Scheduled tribes	8	6.66
Total		**120**	**100.00**

The data in the Table 4.3 revealed that out of the total vegetable growers, 8.33 percent belonged to general caste, 77.50 per cent were from other backward classes, 7.50 percent were from scheduled castes and 6.66 percent were found from scheduled tribes category.

Thus, it may be inferred from the data that the higher percentage 77.50 per cent of respondent belonged to other backward classes.

4.1.4 Total land holding and percentage of area under vegetable crop:

It refers to the size of land owned by the respondents in hectares and the area of land under cultivation of vegetable possessed by an individual vegetable grower. The distribution of vegetable growers as per their total land holding and area under vegetable is presented in table 4.4.

Table 4.4: Distribution of respondent according to their total land holding and percentage of area under vegetable crop of total land holding.

S. No.	Category	Frequency	Percentage
	Total land holding		
1.	Marginal (up to 1 ha)	56	46.67
2.	Small (1-2.5 ha)	44	36.67
3.	Medium (2.5-5 ha)	16	13.33
4.	Large (above 5 ha)	04	3.33
	Total	**120**	**100**
	Percentage of area under vegetable crop		
1.	(1-25 %) area	76	63.34
2.	(26-50%) area	28	23.33
3.	(51-75 %) area	16	13.33
Total		**120**	**100.00**

The data in the Table 4.4 shows that out of the total vegetable growers, 46.67 per cent were marginal farmer, 36.67 per cent were small farmer, 13.33 were medium farmer and 3.33 percent were large farmer. The data in Table 4.4 also shows that out of the total vegetable growers, 63.34 per cent respondent grow vegetable under 1-25 percent area of total land holding, 23.33 percent respondent grow vegetable under 26-50 percent of total land holding, 13.33 percent of respondent grow vegetable on 51-75 percent of total land holding.

It may be also concluded that majority 36.67 per cent of respondents were small farmer and the maximum 63.34 per cent respondent grow vegetable under 1-25 percent area of total land holding.

4.1.5 Farm Mechanization:

Farm mechanization may be determined by the farm power utilization pattern in farming through use of machine and implements. The distribution of vegetable growers as per their farm mechanization is presented in table 4.5.

Table 4.5: Distribution of respondent according to their farm mechanization.

S. No.	Category	Frequency	Percentage
1.	Low	25	20.83
2.	Medium	75	62.50
3.	High	20	16.67
Total		**120**	**100.00**

The data in the Table 4.5 shows that out of total vegetable growers, 20.83 per cent had low farm mechanization, 62.50 per cent had medium farm mechanization and 16.67 per cent had high farm mechanization.

Thus, it may be concluded that majority of the respondent 62.50 per cent had medium farm mechanization.

4.1.6 Annual production of vegetable crop:

It refers to the production level of vegetable crop. The distribution of vegetable growers as per their annual production is presented in table 4.6.

Table 4.6: Distribution of respondent according to their production.

S. No.	Categories	Frequency	Percentage
1.	Low (1-5t)	76	63.33
2.	Medium (6-10 t)	24	20.00
3.	High (Above 10 t)	20	16.67
Total		**120**	**100.00**

The data of Table 4.6 revealed that out of total vegetable growers, 63.33 per cent had low production, while 20 per cent had medium production and 16.67 per cent had high production of vegetable.

Thus, it may be concluded that majority 63.33 per cent respondent had low production (1-5 t) among vegetable growers.

4.1.7 Annual income:

Annual income of farm family refers to the total sum amount received by all the sources in the year. It describes the economic condition of human beings. Categorization of annual income as low, medium and high has been given as below:

Table 4.7: Distribution of respondent according to their annual income.

S. No.	Categories	Frequency	Percentage
1.	Low (Rs. 50000 – 200000)	73	60.83
2.	Medium (Rs. 200001 – 450000)	34	28.33
3.	High (Above 450000)	13	10.84
Total		**120**	**100.00**

The data presented in Table 4.7 indicate that out of the total vegetable growers, 60.83 per cent were found in low income group, 28.33 per cent were found in medium income group and 10.84 per cent were in high income group.

Thus, it can be concluded that the maximum respondent 60.83 per cent had low income from vegetable production.

4.1.8 Information Seeking Behavior:

It refers to the degree of frequency of contact by vegetable grower with various information sources. The distribution of vegetable growers as per their information seeking behavior is presented in table 4.8:

Table 4.8: Distribution of the vegetable growers according to their information seeking behavior.

S. No.	Category	Frequency	Percentage
1	Low	33	27.50
2	Medium	44	36.67
3	High	43	35.83
	Total	**120**	**100**

The result presented in Table 4.8 showed that out of the total vegetable growers, the highest proportion of the vegetable growers 36.67 per cent had

medium followed by high 35.83 per cent and 27.50 percent low information seeking behavior respectively.

Thus it may be concluded that out of the total respondents, maximum percentage 36.67 per cent had medium information seeking behavior.

4.1.9 Knowledge level towards climate change:

Knowledge as defined, is body of understood information possessed by individual vegetable growers towards the climate change. The distribution of vegetable growers as per their knowledge level is presented in table 4.9.

Table 4.9: Distribution of respondent according to their Knowledge level:

S. No.	Categories	Frequency	Percentage
1.	Low	53	44.17
2.	Medium	60	50.00
3.	High	7	5.83
	Total	**120**	**100.00**

The data presented in Table 4.9 reveals that out of total vegetable growers, 44.17 per cent had low knowledge level of climate change in concern of vegetable production, whereas 50.00 per cent had medium knowledge level and 5.83 per cent had high knowledge level of knowledge related to climate change for vegetable production.

Thus it may be concluded that out of the total, maximum percentage 50.00 per cent respondents had medium knowledge level of climate change.

4.1.10 Risk bearing ability:

Risk bearing ability is a degree to which an individual takes risk and shows courage in facing the problems that arise in vegetable cultivation. The distribution of vegetable growers as per their risk bearing ability is presented in table 4.10.

Table 4.10: Distribution of respondent according to risk bearing ability

S. No.	Categories	Frequency	Percentage
1.	Low	28	23.33
2.	Medium	58	48.33
3.	High	34	28.33
Total		**120**	**100.00**

The data presented in Table 4.10 revealed that out of the total vegetable growers, 48.33 per cent had medium risk bearing ability, 28.33 per cent had high risk bearing ability and 23.33 per cent had low risk bearing ability.

Thus, it may be concluded from the data that maximum 48.33 per cent of the respondent had medium risk bearing ability.

4.1.10 Economic motivation:

It refers to the values or attitude for which the vegetable grower attached greater importance to profit maximization. The distribution of vegetable growers as per their economic motivation is presented in table 4.11.

Table 4.11: Distribution of respondent according to their economic motivation.

S. No.	Categories	Frequency	Percentage
1.	Low	12	10.00
2.	Medium	76	63.33
3.	High	32	26.67
Total		**120**	**100.00**

The data presented in Table 4.11 revealed that out of the total vegetable growers, 63.33 per cent had medium economic motivation, 26.67 per cent had high economic motivation and 10.00 per cent had low economic motivation.

Thus, it may be concluded from the data that maximum 63.33 per cent of the respondent had medium economic motivation.

4.2 Effect of climate change on vegetable production technology :

Effect of Climate change is a particular concern to developing countries, where large parts of the population depend on climate sensitive sectors like agriculture for livelihood. Farmers perspectives are equally important to quantify the climate change impacts on vegetable production technology. Farmers were asked about changes occurred in vegetable production technology according to their past experiences as effects of climate change and sudden changes performed by them in vegetable production technology.

4.2.1 Effect of change in rainfall pattern on vegetable production technology:

To ascertain the effect of change in rainfall pattern on various aspects, farmers were asked for their general perception on change in rainfall parameter. The score of each farmer is calculated. The frequency and percentage is presented in the table 4.12

Table 4.12: Farmers Perception on Effect of Change in Rainfall pattern on Vegetable Production Technology:

S. No.	Aspects	Partial agree		Agree		Complete agree	
		f	%	f	%	f	%
1.	Vegetable production	18	15	54	45	48	40
2.	Use of traditional crop variety	28	23.33	48	40	44	36.66
3.	Quality of vegetable	24	20	54	45	42	35
4.	Cropping pattern	32	26.66	46	38.33	42	35
5.	Availability of water for irrigation	34	28.33	48	40	38	31.66
6.	Availability of fresh vegetable	36	30	44	36.66	42	35
7.	Insect and disease attack	28	23.33	48	40	44	36.66
8.	Weed attack	54	45	36	30	30	25
9.	Increase of expenditure	16	13.33	48	40	56	46.66
10.	One of major cause of low availability of vegetables	18	15	54	45	48	40

1. Effect of change in rainfall pattern on vegetable production:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent agree followed by complete agree 40 per cent and partial agree 15 per cent regarding decreased in vegetable production.

2. Effect of change in rainfall pattern on use of traditional crop variety:

The data presented in Table 4.12 showed that majority of the respondents 40 per cent agree followed by complete agree 36.66 per cent and partial agree 23.33 per cent regarding decreased in use of traditional crop variety.

3. Effect of change in rainfall pattern on quality of vegetable:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent agree followed by complete agree 35 per cent and partial agree 20 per cent regarding decreased in quality of vegetable crop**.**

4. Effect of change in rainfall pattern in cropping pattern:

The data presented in Table 4.12 showed that majority of the respondents 38.33 per cent agree followed by complete agree 35 per cent and partial agree 26.66 per cent regarding Change in cropping pattern**.**

5. Effect of change in rainfall pattern on availability of water for irrigation:

The data presented in Table 4.12 showed that majority of the respondents 40 per cent agree followed by complete agree 31.66 per cent and partial agree 28.33 per cent regarding decrease in availability of water for irrigation**.**

6. Effect of change in rainfall pattern on availability of fresh vegetable:

The data presented in Table 4.12 showed that majority of the respondents 36.66 per cent agree followed by complete agree 35 per cent and partial agree 30 per cent regarding decreased in availability of fresh vegetable**.**

7. Effect of change in rainfall pattern on insect and disease attack:

The data presented in Table 4.12 showed that majority of the respondents 40 per cent agree followed by complete agree 36.66 per cent and partial agree 23.33 per cent regarding increased in insect, pest and disease attack**.**

8. Effect of change in rainfall pattern on weed attack:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent partial agree followed by agree 30 per cent and complete agree 25 per cent regarding increased in weed attack**.**

9. Effect of change in rainfall pattern on increase in expenditure:

The data presented in Table 4.12 showed that majority of the respondents 46.66 per cent complete agree followed by agree 40 per cent and partial agree 13.33 per cent regarding the increased in expenditure for vegetable production**.**

10. Effect of change in rainfall pattern is one of major cause of low availability of vegetables:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent agree followed by complete agree 40 per cent and partial agree 15 per cent regarding change in rainfall pattern is one of major cause of low availability of vegetables.

Table 4.13: Distribution of respondents according to their perception on effect of change in rainfall pattern:

S. No.	Categories	Frequency	Percentage
1.	Low	32	26.66
2.	Medium	46	38.33
3.	High	42	35.00
Total		**120**	**100.00**

The data presented in Table 4.13 revealed that out of the total vegetable growers, 38.33 per cent had medium perception on effect of change in rainfall pattern, 35.00 per cent had high perception on effect of change in rainfall

pattern and 26.66 per cent had low perception on effect of change in rainfall pattern.

Thus, it may be concluded from the data that maximum 38.33 per cent of the respondent had medium perception on effect of change in rainfall pattern on vegetable production technology.

4.3 Relationship between dependent and independent variable:

Table 4.14 Relationship between profile of respondent and farmers perception on effect of change in rainfall pattern on vegetable production technology.

S. No.	Independent variables (X)	Dependent variable (Y)	't' value
1.	Age	0.233NS	0.063
2.	Education	0.058*	2.174*
3.	Caste	0.010NS	0.036
4.	Total land holding and percentage of area under vegetable crop	0.049NS 0.562NS	1.155 1.293
5.	Farm mechanization	0.782NS	0.110
6.	Annual production	0.13NS	0.261
7.	Annual income	-0.160NS	1.561
8.	Information seeking behavior	0.125*	1.784*
9.	Knowledge level towards climate change	0.068*	2.153*
10.	Risk bearing ability	0.033NS	0.731
11.	Economic motivation	0.122NS	0.992
	't' Table value	t = 1.6545 at 5 % t = 2.349 at 1%	

NS = Non- significant *Significant at 5 % level **Significant at 1% level.

The variables namely education, information seeking behavior and knowledge level towards climate change had positive and significant relationship with farmers perception on effect of change in rainfall pattern on vegetable production technology.

However, other variables namely age, caste, total land holding and percentage area under vegetable crop, farm mechanization, annual production, risk bearing ability and economic motivation had positive and non-significant relationship with farmers perception on effect of change in rainfall pattern on vegetable production technology.

While annual income had negative and non-significant relationship.

4.3.1 Age and rainfall effect

In the case of age, computed correlation coefficient (0.233) was found to be non-significant. This led to the acceptation of null hypothesis number 1. Hence, it may be concluded that age of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.2 Education and rainfall effect

In the case of education, computed correlation coefficient (0.058) was found to be to be significant at 5 per cent level. This led to the rejection of null hypothesis number 2. Hence, it may be concluded that education of respondents had influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.3 Caste and rainfall effect

In the case of caste, computed correlation coefficient (0.010) was found to be non-significant. This led to the acceptation of null hypothesis number 3. Hence, it may be concluded that caste of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.4 Total land holding and rainfall effect

In the case of total land holding and percentage area under vegetable computed correlation coefficient are (0.049) and (0.562) respectively and was found to be non-significant. This led to the acceptation of null hypothesis number 4. Hence, it may be concluded that total land holding and percentage

area under vegetable of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.5 Farm mechanization and rainfall effect

In the case of farm mechanization, computed correlation coefficient (0.782) was found to be non-significant. This led to the acceptation of null hypothesis number 5. Hence, it may be concluded that farm mechanization of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.6 Annual production and rainfall effect

In the case of annual production, computed correlation coefficient (0.13) was found to be non-significant. This led to the acceptation of null hypothesis number 6. Hence, it may be concluded that annual production of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.7 Annual income and rainfall effect

In the case of annual income, computed correlation coefficient (-0.160) was found to be non-significant. This led to the acceptation of null hypothesis number 7. Hence, it may be concluded that annual income of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.8 Information seeking behavior and rainfall effect

In the case of information seeking behavior, computed correlation coefficient (0.125) was found to be significant at 5 per cent level. This led to the rejection of null hypothesis number 8. Hence, it may be concluded that information seeking behavior of respondents had influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.9 Knowledge level towards climate change and rainfall effect

In the case of knowledge level, computed correlation coefficient (0.068) was found to be significant at 5 per cent level. This led to the rejection of null hypothesis number 9. Hence, it may be concluded that knowledge level

towards climate change of respondents has influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.10 Risk bearing ability and rainfall effect

In the case of risk bearing ability, computed correlation coefficient (0.033) was found to be non-significant. This led to the acceptation of null hypothesis number 10. Hence, it may be concluded that risk bearing ability of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3.11 Economic motivation and rainfall effect

In the case of economic motivation, computed correlation coefficient (0.122) was found to be non-significant. This led to the acceptation of null hypothesis number 11. Hence, it may be concluded that economic motivation of respondents had no influence on the effect of change in rainfall pattern on vegetable production technology.

4.3 Effect of change in temperature pattern on vegetable production technology:

To ascertain the effect of change in temperature pattern on various aspects, respondents were asked for their general perception on change in temperature parameter. The score of each farmer is calculated. The frequency and percentage is presented in the table 4.15.

Table 4.15: Farmers Perception on Effect of change in temperature pattern on vegetable production technology:

S.No	Aspects	Partial agree		Agree		Complete agree	
		f	%	f	%	f	%
1.	Vegetable production	12	10	46	38.33	62	51.66
2.	Use of traditional crop variety	24	20	52	43.33	44	36.66
3.	Quality of vegetable	18	15	46	38.33	56	46.66
4.	Cropping pattern	28	23.33	48	40	44	36.66
5.	Availability of water for irrigation	46	38.33	38	31.66	36	30
6.	Availability of fresh vegetable	36	30	38	31.66	46	38.33
7.	Insect and disease attack	24	20	32	26.66	64	53.33
8.	Weed attack	48	40	44	36.66	28	23.33
9.	Increase of expenditure	32	26.66	42	35	46	38.33
10.	One of major cause of low availability of vegetables	34	28.33	38	31.66	48	40

1. Effect of temperature change on vegetable production:

The data presented in Table 4.15 showed that majority of the respondents 51.66 per cent completely agree followed by agree 38.33 per cent and partial agree 10 per cent regarding decreased in vegetable production.

2. Effect of temperature change on use of traditional crop variety:

The data presented in Table 4.15 showed that majority of the respondents 43.33 per cent agree followed by complete agree 36.66 per cent and partial agree 20 per cent regarding decreased in use of traditional crop variety.

3. Effect of temperature change on quality of vegetable:

The data presented in Table 4.15 showed that majority of the respondents 46.66 per cent complete agree followed by agree 38.33 per cent and partial agree 15 per cent regarding decreased in quality of vegetable crop**.**

4. Effect of temperature change on cropping pattern:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent agree followed by complete agree 36.66 per cent and partial agree 23.33 per cent regarding Change in cropping pattern**.**

5. Effect of temperature change on availability of water for irrigation:

The data presented in Table 4.15 showed that majority of the respondents 38.33 per cent partial agree followed by agree 31.66 per cent and complete agree 30 per cent regarding decrease in availability of water for irrigation **.**

6. Effect of temperature change on availability of fresh vegetable:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent agree followed by complete agree 36.66 per cent and partial agree 23.33 per cent regarding decreased in availability of fresh vegetable**.**

7. Effect of temperature change on insect and disease attack:

The data presented in Table 4.15 showed that majority of the respondents 53.33 per cent complete agree followed by agree 26.66 per cent and partial agree 20 per cent regarding increased in insect, pest and disease attack**.**

8. Effect of temperature change on weed attack:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent partial agree followed by agree 36.66 per cent and complete agree 23.33 per cent regarding increased in weed attack**.**

9. Effect of temperature change on increase in expenditure:

The data presented in Table 4.15 showed that majority of the respondents 38.33 per cent complete agree followed by agree 35 per cent and partial agree 26.66 per cent regarding the increased in expenditure for vegetable production**.**

10. Effect of temperature change is one of major cause of low availability of vegetables:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent complete agree followed by agree 31.66 per cent and partial agree 28.33 per cent regarding temperature change is one of major cause of low availability of vegetables.

Table 4.16: Distribution of respondents according to their perception on effect of change in temperature pattern:

S. No.	Categories	Frequency	Percentage
1.	Low	28	23.33
2.	Medium	52	43.33
3.	High	40	33.33
Total		**120**	**100.00**

The data presented in Table 4.16 revealed that out of the total vegetable growers, 43.33 per cent had medium perception on effect of change in temperature pattern, 33.33 per cent had high perception on effect of change in temperature pattern and 23.33 per cent had low perception on effect of change in temperature pattern.

Thus, it may be concluded from the data that maximum 43.33 per cent of the respondent had medium perception on effect of change in temperature pattern on vegetable production technology.

4.3 Relationship between dependent and independent variable:

Table 4.17: Relationship between profile of respondent and farmers perception on effect of change in temperature pattern.

S.No.	Independent variables (X)	Dependent variable (Y)	't' value
1.	Age	0.266NS	0.075
2.	Education	0.053*	1.672*
3.	Caste	0.076NS	0.055
4.	Total land holding and percentage of area under vegetable crop	0.034NS 0.565NS	1.121 1.329
5.	Farm mechanization	0.831NS	0.110
6.	Annual production	0.417NS	0.232
7.	Annual income	-0.049NS	1.01
8.	Information seeking behavior	0.325*	1.845*
9.	Knowledge level towards climate change	0.096*	2.213*
10.	Risk bearing ability	0.211NS	0.578
11.	Economic motivation	0.132NS	0.892
	't' Table value	t = 1.6545 at 5 % t = 2.3501 at 1%	

NS = Non- significant *Significant at 5 % level **Significant at 1% level.

The variables namely education, information seeking behavior and knowledge level towards climate change had positive and significant relationship with farmers perception on effect of change in temperature pattern on vegetable production technology.

However, other variables namely age, caste, total land holding and percentage of area under vegetable crop, farm mechanization, annual production, risk bearing ability and economic motivation had positive but non-significant relationship with farmers perception on effect of change in temperature pattern on vegetable production technology.

While annual income had had negative and non-significant relationship.

4.5.1 Age and temperature effect

In the case of age, computed correlation coefficient (0.266) was found to be non-significant. This led to the acceptation of null hypothesis number 12. Hence, it may be concluded that age of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.2 Education and temperature effect

In the case of education, computed correlation coefficient (0.053) was found to be to be significant at 5 per cent level. This led to the rejection of null hypothesis number 13. Hence, it may be concluded that education of respondents had influence on the effect of change in temperature pattern on vegetable production technology.

4.5.3 Caste and temperature effect

In the case of caste, computed correlation coefficient (0.076) was found to be non-significant. This led to the acceptation of null hypothesis number 14. Hence, it may be concluded that caste of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.4 Total land holding and temperature effect

In the case of total land holding and percentage area under vegetable computed correlation coefficient are (0.034) and (0.565) respectively and was found to be non-significant. This led to the acceptation of null hypothesis number 15. Hence, it may be concluded that total land holding and percentage area under vegetable of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.5 Farm mechanization and temperature effect

In the case of farm mechanization, computed correlation coefficient (0.831) was found to be non-significant. This led to the acceptation of null hypothesis number 16. Hence, it may be concluded that farm mechanization

of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.6 Annual production and temperature effect

In the case of annual production, computed correlation coefficient (0.417) was found to be non-significant. This led to the acceptation of null hypothesis number 17. Hence, it may be concluded that annual production of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.7 Annual income and temperature effect

In the case of annual income, computed correlation coefficient (-0.049) was found to be non-significant. This led to the acceptation of null hypothesis number 18. Hence, it may be concluded that annual income of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.8 Information seeking behavior and temperature effect

In the case of information seeking behavior, computed correlation coefficient (0.325) was found to be significant at 5 per cent level. This led to the rejection of null hypothesis number 19. Hence, it may be concluded that information seeking behavior of respondents had influence on the effect of change in temperature pattern on vegetable production technology.

4.5.9 Knowledge level towards climate change and temperature effect

In the case of knowledge level, computed correlation coefficient (0.096) was found to be significant at 5 per cent level. This led to the rejection of null hypothesis number 20. Hence, it may be concluded that knowledge level towards climate change of respondents has influence on the effect of change in temperature pattern on vegetable production technology.

4.5.10 Risk bearing ability and temperature effect

In the case of risk bearing ability, computed correlation coefficient (0.211) was found to be non-significant. This led to the acceptation of null hypothesis number 21.

Hence, it may be concluded that risk bearing ability of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.5.11 Economic motivation and temperature effect

In the case of economic motivation, computed correlation coefficient (0.132) was found to be non-significant. This led to the acceptation of null hypothesis number 22. Hence, it may be concluded that economic motivation of respondents had no influence on the effect of change in temperature pattern on vegetable production technology.

4.6 Major cropping mechanism adopted by vegetable growers to mitigate the effect of climate change:

Farmers were asked about changes performed by them due to various changing or adverse climatic factors. Adoption of new crops by farmers by replacing the old crop (grown 5 years ago) to reduce the effect. The table 4.18 shows the frequency of respondents who adopt new crop in place of old crop to mitigate the effect of climate change on their vegetable production.

Table 4.18: Distribution of respondents who adopt new crop to mitigate the effect of climate change

S. No.	Season	Old crops	Frequency	Replaced by	Frequency
1.	**Kharif**	Okra	36	Pulses	38
2.		Cucumber	23	Brinjal	22
3.		Tomato	32	Soybean	36
4.		Bittergourd	29	Maize	24
1.	**Rabi**	Garlic	36	Potao	36
2.		Spinach	18	Wheat	33
3.		Pea	32	Tomato	23
4.		Cabbage	34	Pea	28
1.	**Summer**	Onion	34	Colocasia	16
2.		Tomato	37	Green gram	24
3.		Chilli	31	Cow pea	38
4.		Cucumber	18	Musk melon	42

Table 4.19: Distribution of respondents who adopted the new cropping mechanism to mitigate the effect of climate change:

S No.	Old vegetables pattern (5 year ago)	New vegetable pattern (present)	Frequency	Percentage
1.	Okra- Garlic- Onion	Pulses-Potato-Colocasia	45	37.50
2.	Cucumber- Pea- Tomato	Brinjal-Tomato-Green gram	40	33.33
3.	Tomato-Spinach-Chilli	Soybean-Wheat-Cowpea	35	29.16
	Total		**120**	**100**

The data presented in Table 4.19 reveals that out of total vegetable growers, 37.50 per cent farmers shifted from old vegetable pattern Okra-Garlic-Onion to new vegetable pattern Pulses-Potato-Colocasia due to climate change followed by those vegetable growers, 33.33 per cent who shifted from old vegetable pattern Cucumber- Pea- Tomato to new vegetable pattern Brinjal-Tomato-Green gram. Rest vegetable growers 29.16 per cent shifted from old vegetable pattern Tomato-Spinach-Chilli to new vegetable cropping pattern Soybean-Wheat-Cowpea due to climate change.

Thus it may be concluded that out of the total, maximum percentage 37.50 per cent of vegetable growers adopted Pulses-Potato-Colocasia vegetable pattern. This vegetable pattern replaced old vegetable pattern of Okra- Garlic-Onion in vegetable production due to climate change.

4.7 Various Constraints faced by vegetable growers.

Table 4.20 Constraints faced by Respondent in vegetable production.

S.No.	Constraints	Frequency	Percentage	Rank
1	Lack of information about weather services	98	81.66	I
2	Uncertainity of Monsoon	86	77.5	II
3	Lack of Storage facility	78	65	IV
4	Occurrence of uncertain disaster	55	45.83	VI
5	Lack of transportation facility	64	53.33	V
6	Low price of vegetable in local market and fluctuation in market price	90	75	III

The constraints reported by the respondents in production of vegetable crop are presented in table 4.20. It is evident from the data that the major constraints as expressed by the respondent were Lack of information about weather services (81.66%) followed by uncertainity of Monsoon (77.5%), Low price of vegetable in local market and fluctuation in market price (75%), Lack of Storage facility (65%), Lack of transportation facility (53.33%), Occurrence of uncertain disaster (45.83%).

4.8 Suggestions obtained from the vegetable growers to overcome the constraints

Table 4.21: Suggestions to overcome the constraints:

S. No.	Suggestions	Frequency	Per cent	Rank
1	Weather forecast information should be more frequent and timely in villages	98	81.66	I
2	Location specific water storage structure should be developed for effective utilization of rainwater	76	63.33	VI
3	Proper storage facility should provided	87	72.5	IV
4	Training programmes should be organized on disaster management in village	79	65.83	V
5	Transportation facilities should be increases	95	79.16	II
6	Proper and timely information on fluctuation in market price of vegetable should be provided	92	76.66	III

As regards to suggestions given by the respondents to overcome the constraints faced by them, the findings have been presented in the Table 4.21 The data revealed that the majority of the respondents (81.66%) were of the opinion that Weather forecast information should be more frequent and timely in villages followed by 79.16% of the respondents suggested that transportation facilities should be increase, Proper and timely information on fluctuation in market price of vegetable should be provide (76.66%), Proper storage facility should provide (72.5%), Training programmes should be organize on disaster management in village (65.83), and Location specific water storage structure should be developed for effective utilization of rainwater (63.33%).

Chapter – V

DISCUSSION

The study was designed to find out effect of climate change on vegetable production technology in Ujjain block of Ujjain district (M.P.). The findings of the present study, along with discussion are presented here for drawing out generalization in the following manner:

1. Socio-economic profile of vegetable growers.
2. Effect of climate change on vegetable production technology:

(a) Farmers perception on effect of change in rainfall pattern on vegetable production technology

(b) Farmers perception on effect of change in temperature pattern on vegetable production technology

3. The relationship between dependent and independent variables.
4. Various problems faced by vegetable growers and Suggestions to overcome them

5.1 Socio-Economic, Communication and psychological attributes of vegetable growers:

The results of the present study showed that majority of respondent 65.00 percent belonged to middle age group (36 to 55 years), 21.66 and 13.34 per cent belonged to young and old age group respectively. The reason behind the result was that the farmers selected for the study was taken from list of vegetable growers provided by NHM and majority of farmers adopted by NHM were from middle age group which was considered as actively working age groups. The finding found supports with the work of choudhary (1995), Singh and Bhagat (2002) and Shaikh (2002)

In case of education of vegetable growers, majority of 44.16% were having education up to higher secondary, 18.34 per cent, 20.00 per cent and 17.50 per cent were illiterate, up to high school and up to college level

respectively. The reason of this result is that the NHM adopted majority of farmers who had good level of education. The finding is supported by Baragi (1997).

The result revealed that the higher percentage (77.50%) of respondent belonged to other backward classes, 8.33, 7.50 and 6.66 percent were belonged to general caste, scheduled castes and scheduled tribes category respectively. The reason of this result is in the study villages majority of farmers belong to OBC category. The finding of this result is supported with the result of Barodia et al. (2005).

The study reveals that majority of 46.67 per cent were marginal farmer, 36.67, 13.33 and 3.33 per cent were small, medium and large farmer respectively. The finding is supported by Karjagi (2006). Out of the total vegetable growers, the highest proportion of the vegetable growers 63.34 per cent had 1-25% area of total land holding under vegetable. The vegetable cultivation is risky due to uncertainty in nature and certain biotic and abiotic factors hence the farmers grow vegetables in small portion of their total land and on remaining portion they used to grow other crops. The above results are in line with the findings of Solanki (2009) and Badole (2014).

The study reveals that the highest proportion of the vegetable growers 62.50% had medium level of farm mechanization, 20.83 and 16.67 per cent had low and high farm mechanization respectively. Due to small area under vegetable and marginal land holding of vegetable growers implies medium farm mechanization. The finding of this study is in line of Singh and Bhagat (2002).

In case of production the study revealed that majority (63.33%) of respondent had low production while 20 and 16.67 per cent had medium and high production of vegetable respectively. The possible reason is that majority of farmers grow vegetable on small portion of their total land holding, so they get production according to the area. The present investigation confirmed the finding of Rahangdale (2011)

In case of annual income of vegetable growers, 60.83 percent belong to low annual income (50000-200000), 28.33 and 10.84 per cent were found in medium and high income group respectively. Respondents were having small area and low production under vegetable, that's why they do not get high annual income. The finding is in the conformity of Bairagi (2002) and udday (2002).

The result of study reveals that the highest proportion of the vegetable growers 36.67 per cent had medium information seeking behavior, while 35.83 and 27.50 percent had high and low information seeking behaviour respectively. The possible reason for this might be that the vegetable growers have limited source of information for receiving new information of vegetable production technology. The above results are in line with the findings of Solanki (2009), Patel (2012), Patel (2013) and Badole (2014).

In case of knowledge level, the study revealed that higher percentage of respondent 50.00 percent had medium knowledge level towards climate change, 44.17 and 5.83 per cent had low and high knowledge related to climate change for vegetable production. The medium knowledge of vegetable growers about climate change might be due to technical communication gap and lack of information about weather forecasting, changing environmental condition and climatic situation in rural areas.

In case of risk bearing ability, the study revealed that the higher percentage of respondent 48.33 percent had medium risk bearing capacity, 28.33 and 23.33 per cent had high and low risk bearing ability respectively. This might be due to poor production, low net worth of vegetable growers. This finding is supported by Kaur (2013).

The study further depicted that majority 63.33 percent of respondent had medium economic motivation 26.67 and 10.00 per cent had high and low economic motivation respectively. The reason for medium economic motivation of vegetable growers might be due to low economic position of them. This finding is similar to that of Rajput et al. (2005) and Bagri (2009).

5.2 Effect of climate change on vegetable production technology:

In the present study, farmers perception on effect of climate change regarding vegetable production technology was taken as dependent variable and the effect of climate change on vegetable production technology is measured by the farmers perception on the following two climatic parameters: Rainfall and Temperature.

5.2.1 Effect of change in rainfall pattern on vegetable production technology:

Vegetables are composed of 80 – 90% of water and they have produced remaining 5 – 20% through photosynthesis. So water is one of the basic requirements for vegetable production. Both too much and too little moisture is harmful to vegetable crops and reduce yield. Moisture influences the seed germination, vegetative growth, flowering, fruit set, maturity, quality of vegetable, seed production, diseases and pest occurrence and seed viability in storage. Abundant water favors the vegetative phase of growth by rapid increase in cell division. Under the moderate water supply plant growth decreases.

To ascertain the effect of change in rainfall pattern on various aspects, farmers were asked for their general perception on change in rainfall parameter:

1. Effect of change in rainfall pattern on vegetable production:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent agree followed by completely agree 40 per cent and partially agree 15 per cent regarding decreased in vegetable production. The reason for low production is because of availability of both too much and too little moisture is harmful to vegetable crops and reduce yield. The finding is supported by Ebi *et al.* (2007), Ayyogari et al. (2014).

2. Effect of change in rainfall pattern on use of traditional crop variety:

The data presented in Table 4.12 showed that majority of the respondents 40 per cent agree followed by completely agree 36.66 per cent

and partially agree 23.33 per cent regarding decreased in use of traditional crop variety. This result found due to the traditional varieties have been usually started by the farmer themselves and such varieties are being used by farmers for many generations but from past few years due to changing rainfall pattern they do not get good yield and therefore using the improved and tolerant varieties of vegetable is the only solution.

3. Effect of change in rainfall pattern on quality of vegetable:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent agree followed by completely agree 35 per cent and partially agree 20 per cent regarding decreased in quality of vegetable crop**.** The result is due to vegetables are composed of 80 – 90% of water and they have produced remaining 5-20% through photosynthesis. Water is one of the basic requirements for good quality of vegetable production. The finding is supported by Ayyogari et al. (2014).

4. Effect of change in rainfall pattern in cropping pattern:

The data presented in Table 4.12 showed that majority of the respondents 38.33 per cent agree followed by completely agree 35 per cent and partially agree 26.66 per cent regarding Change in cropping pattern**.** The reason of this result is each vegetable crop grows well when they meet there water requirement in which the rate of photosynthesis is normal. The change in cropping pattern adopted by farmer when alarming situation is occurred and to mitigate the effect of changing rainfall pattern, the change in cropping pattern is the best solution. The finding is supported by Singh et al. (2008).

5. Effect of change in rainfall pattern on availability of water for irrigation:

The data presented in Table 4.12 showed that majority of the respondents 40 per cent agree followed by completely agree 31.66 per cent and partially agree 28.33 per cent regarding decrease in availability of water for irrigation**.** The reason is availability of water for irrigation is directly related with the proper rainfall. The finding is supported by Ranzzi et al. (2012)

6. Effect of change in rainfall pattern on availability of fresh vegetable:

The data presented in Table 4.12 showed that majority of the respondents 36.66 per cent agree followed by completely agree 35 per cent and partially agree 30 per cent regarding decreased in availability of fresh vegetable**.** The reason behind the result is that due to fluctuation in rainfall, vegetable production is decreased which also reduced the availability of fresh vegetables in the market. The finding is supported by Ayyogari et al. (2014)

7. Effect of change in rainfall pattern on insect and disease attack:

The data presented in Table 4.12 showed that majority of the respondents 40 per cent agree followed by completely agree 36.66 per cent and partially agree 23.33 per cent regarding increased in insect, pest and disease attack. The reason behind the result is moisture is one of favorable condition for pest and disease attack. Moisture influences the pest population and disease in vegetable crops. This finding is supported by FAO (2007), Kumar et al. (2014).

8. Effect of change in rainfall pattern on weed attack:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent partially agree followed by agree 30 per cent and completely agree 25 per cent regarding increased in weed attack**.** The reason behind the result is that availability of moisture to soil favours the growth of weed and increasing the weed population**.**

9. Effect of change in rainfall pattern on increase in expenditure:

The data presented in Table 4.12 showed that majority of the respondents 46.66 per cent completely agree followed by agree 40 per cent and partially agree 13.33 per cent regarding the increased in expenditure for vegetable production. This reason may be due to either the condition of excess rainfall or low rainfall farmers will have to do management in both situation

which ultimately increase the cost of cultivation of the farmer. This finding is supported by Sarkar and Padaria (2010)

10. Effect of change in rainfall pattern is one of major cause of low availability of vegetables:

The data presented in Table 4.12 showed that majority of the respondents 45 per cent agree followed by completely agree 40 per cent and partially agree 15 per cent regarding change in rainfall pattern is one of major cause of low availability of vegetables. This result is due to water is one of the basic requirements for vegetable production. Both too much and too little moisture is harmful to vegetable crops and reduce yield. Moisture influences the seed germination, vegetative growth, flowering, fruit-set, maturity, quality of vegetable, seed production, diseases and pest occurrence and seed viability in storage.

5.2.2 Overall farmers perception on effect of change in rainfall pattern on vegetable production technology:

The present finding revealed that out of the total vegetable growers, 38.33 per cent had medium perception on effect of change in rainfall pattern, 35.00 per cent had high perception on effect of change in rainfall pattern and 26.66 per cent had low perception on effect of change in rainfall pattern.

5.3 Relationship between profile of respondent and effect of change in rainfall pattern on vegetable production technology:

1) Age

The age of the respondents showed positive but non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason for this finding was that, not only the young farmers but also the older farmers were equally affected by the changing rainfall pattern in vegetable production technology. The work of Barodia et. al. (2005), Pande and Akermann (2010), Singh et. al. (2005) and Aware (2008) confirm the present finding.

2) Education

The education of the respondents showed positive and significant relationship at 5% level of significance with effect of change in rainfall pattern on vegetable production technology. The reason for this finding was that, educated farmers have better opportunity to acquire more scientific information by way of information seeking behavior, Knowledge of climate change and weather forecasting to get clarification on monsoon and adaptation of recommended production technology accordingly. The work of Sorhang and Kristiansen (2011) confirm the present finding.

3) Caste

The caste of the respondents showed positive and non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason for this finding was that, effect of climate change on vegetable production technology was irrespective of caste from which the farmer belongs.

4) Land holding

In case of total land holding and area under vegetable crop of the respondents showed positive and non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason behind them was that climate change is a natural phenomenon which equally affect either small or large farmer in their production technology irrespective of their land holding.

5) Farm mechanization

In case of farm mechanization of the respondents showed positive and non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason behind the result is fluctuation in rainfall pattern is a weather condition and its effect had no relation with the farm mechanization of the farmer.

6) Annual production

In case of annual production of the respondents showed positive but non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason is rainfall is natural climatic factor and its effect remains same for a particular region irrespective of farmers annual production.

7) Annual income

In case of annual income of the respondents showed negative and non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason behind this result is effect of rainfall fluctuation will be same for all the farmers irrespective of farmers annual income.

8) Information seeking behavior

In case of Information seeking behavior of the respondents showed positive and significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason for this result may be regular flow of weather information through all sources of information like by the NHM and weather forecasting station will promote the vegetable production technology. This may be due to the fact that interaction with the NHM has increased the knowledge of respondents about the forthcoming monsoon and farmers save themselves from the upcoming adverse situation by following the proper adaptation strategies. The work of Sorhang and Kristiansen (2011) confirm the present finding.

9) Knowledge level towards climate change

The knowledge level of the respondent showed positive and significant relationship with effect of change in rainfall pattern on vegetable production technology. Now a days, sources of information carry more information of climate change towards production technology which is the reason of this result. It is certain that farmers were adequately exposed to these source and such climatic information increased the knowledge level of farmers towards climate

change. Hence, the positive relationship was observed. This finding is supported by Lakshminarayan and Singh (2005).

10) Risk bearing ability

In case of risk bearing ability of the respondents showed positive and non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason behind the result is that risk bearing ability is the ability of farmer to face any risk came infront of him it may be either his success or failure and it has no relation with the effect of changing rainfall pattern.

11) Economic Motivation

The economic motivation of respondents showed non significant relationship with effect of change in rainfall pattern on vegetable production technology. The reason is due to it is the value of an individual in economic terms but it is not related to changing climatic condition. The work of Rahangdale (2011) confirms the present finding.

5.4 Effect of change in temperature parameter on vegetable production technology:

Out of all the climatic factors affecting vegetable production, temperature may be considered as the most important. Temperature affects growth & development of vegetable crops during different phases of growth such as seed germination, general survival, development of economic parts, flowering, pollination and fruit set, quality of produced, seed production, seed storage, seed dormancy, occurrence of diseases and pests.

Optimum temperature:

Each vegetable crop grows well in a favorable range of temperature and this is called optimum temperature range in which the rate of photosynthesis is normal. The growth & development of some of the vegetable crops are affected at temperature less than 5°C, warm season crops cease growing at that temperature. Growth normally increases with increasing temperature up to 40°C but not beyond that. Thus vegetables crops are classified as cool season

& warm season crops. Cool season vegetables generally survive even at temperature ranging from 0 – 5°C. Some crops like asparagus, onion, & spinach can withstand frost better than the others. Crops like garden beet, broad bean and Cole crops can tolerate a minimum temperature of 5°C but lower temperature at maturity may cause injury. Many of them when exposed to chilling temperature bolt. Carrot, cauliflower, peas, potato, lettuce, celery, chicory, parsley & mustard can tolerate a minimum temperature of 7°C. Thus according to their requirement of temperature for their growth and development, temperature below 18°C are cool season crops and temperature above 18°C are warm season crops.

To ascertain the effect of change in temperature pattern on various aspects, farmers were asked for their general perception on change in temperature parameter:

1. Effect of temperature change on vegetable production:

The data presented in Table 4.15 showed that majority of the respondents 51.66 per cent completely agree followed by agree 38.33 per cent and partially agree 10 per cent regarding decreased in vegetable production. The temperature requirement of vegetable crops for better production is differ for different crops. Most of the cool season crops require lower temperature during their early growth period and higher temperature during flowering, fruit setting and seed maturity. So, fluctuation in optimum temperature results in decreasing of production. The finding is supported by Aggarwal (2009), Ayyogari et al. (2014)

2. Effect of temperature change on use of traditional crop variety:

The data presented in Table 4.15 showed that majority of the respondents 43.33 per cent agree followed by completely agree 36.66 per cent and partially agree 20 per cent regarding decreased in use of traditional crop variety. The reason is due to the traditional varieties have been usually started by the farmer themselves and such varieties are being used by farmers for many generations but from past few years due to fluctuating temperature they

will not get good yield and therefore using the improved and tolerant varieties of vegetable is the only solution.

3. Effect of temperature change on quality of vegetable:

The data presented in Table 4.15 showed that majority of the respondents 46.66 per cent completely agree followed by agree 38.33 per cent and partially agree 15 per cent regarding decreased in quality of vegetable crop**.** The reason behind the result is that the quality of produced like color development, attainment of proper size were important aspects for vegetable growers because better quality vegetables always fetch higher market price and temperature below and above the optimum temperature affect the quality of crop. This finding is supported by Arya (2010), Ayyogari et al. (2014)

4. Effect of temperature change in cropping pattern:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent agree followed by completely agree 36.66 per cent and partially agree 23.33 per cent regarding Change in cropping pattern**.** The reason is each vegetable crop grows well in a favorable range of temperature called optimum temperature range in which the rate of photosynthesis is normal. To mitigate the effect of changing temperature, the change in cropping pattern is best solution. This finding is supported by Rawat (2010)

5. Effect of temperature change on availability of water for irrigation:

The data presented in Table 4.15 showed that majority of the respondents 38.33 per cent partially agree followed by agree 31.66 per cent and completely agree 30 per cent regarding decrease in availability of water for irrigation. The reason of this result if the farmer have proper irrigation facility then they have low effect of temperature on irrigation water. This finding is proved by Pande and Akermann (2010) and Arya (2010)

6. Effect of temperature change on availability of fresh vegetable:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent agree followed by completely agree 36.66 per cent and partially agree 23.33 per cent regarding decreased in availability of fresh vegetable**.** The reason behind result is because of vegetables are perishable crop and due to poor storage facility, fluctuating temperature will decrease both the productivity and availability of fresh vegetables. This finding is proved by Ranzzi et al. (2012)

7. Effect of temperature change on insect and disease attack:

The data presented in Table 4.15 showed that majority of the respondents 53.33 per cent completely agree followed by agree 26.66 per cent and partially agree 20 per cent regarding increased in insect, pest and disease attack**.** The reason of this result is due to higher and lower temperature condition. Pests and diseases occurs at certain level of temperature. For ex. Late blight of potato and tomato becomes epidemic at fairly lower temperature condition and bacterial wilt of tomato occurs at higher temperature condition. While insect population increases and become active at higher temperature condition. This finding is supported by Sarkar and Padaria (2010)

8. Effect of temperature change on weed attack:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent partially agree followed by agree 36.66 per cent and completely agree 23.33 per cent regarding increased in weed attack**.** The reason behind the low score is because the high and low temperature it also affect the growth and population of weeds.

9. Effect of temperature change on increase in expenditure:

The data presented in Table 4.15 showed that majority of the respondents 38.33 per cent completely agree followed by agree 35 per cent and partially agree 26.66 per cent regarding the increased in expenditure for vegetable production**.** The reason behind the result is due to the management practices like mulching, blanching, herbigation, increase irrigation etc to reduce

the changing temperature effect will ultimately increase the cost of cultivation to the farmer. This finding is supported by Sarkar and Padaria (2010)

10. Effect of temperature change is one of major cause of low availability of vegetables:

The data presented in Table 4.15 showed that majority of the respondents 40 per cent completely agree followed by agree 31.66 per cent and partially agree 28.33 per cent regarding temperature change is one of major cause of low availability of vegetables. This result is because of temperature affects growth & development of vegetable crops during different phases of growth such as seed germination, general survival, development of economic parts, flowering, pollination and fruit set, quality of produced, seed production, seed storage, seed dormancy, occurrence of diseases and pests. This finding is supported by Ayyogari et al. (2014)**.**

5.4.1 Overall farmers perception on effect of change in temperature pattern on vegetable production technology:

The data presented in table 4.16 revealed that out of the total vegetable growers, 43.33 per cent had medium perception on effect of change in temperature pattern, 33.33 per cent had high perception on effect of change in temperature pattern and 23.33 per cent had low perception on effect of change in temperature pattern.

5.5 Relationship between profile of respondent and farmers perception on effect of change in temperature pattern:

1) Age

The age of the respondents showed positive but non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason for this finding was that, not only the young farmers but also the older farmers were equally affected by the extreme temperature in vegetable production technology. The work of Barodia et al (2005), Singh et. al. (2005) and Aware (2008) confirm the present finding.

2) Education

The education of the respondents showed positive and significant relationship at 5% level of significance with effect of change in temperature pattern on vegetable production technology. The reason for this finding was that, educated farmers have better opportunity to acquire more scientific information by way of information seeking behavior, Knowledge of climate change and weather forecasting to get clarification on changing temperature and adaptation of recommended production technology accordingly.

3) Caste

The caste of the respondents showed positive and non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason for this finding was that, effect of climate change on vegetable production technology was irrespective to the caste from which the farmer belongs.

4) Land holding

In case of total land holding and area under vegetable crop of the respondents showed positive and non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason behind it was that climate change is a natural phenomenon which equally affect either small or large farmer in their production technology irrespective of their land holding.

5) Farm mechanization

In case of farm mechanization of the respondents showed positive and non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason behind the result is fluctuation in temperature is a weather condition and its effect has no relation with the number of farm mechanization of the farmer.

6) Annual production

In case of annual production of the respondents showed positive and non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason may be that the temperature is one of a climatic factor and its effect remains same for a particular region irrespective of farmers annual production.

7) Annual income

In case of annual income of the respondents showed negative and non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason behind this result is effect of extreme temperature will be same for all the farmers irrespective of farmers annual income.

8) Information seeking behavior

In case of Information seeking behavior of the respondents showed positive and significant relationship with effect of change in temperature pattern on vegetable production technology. The reason for this was regular flow of weather and climatic information through all source of information by NHM and other organizations will promote vegetable production technology. This may be due to the fact that interaction with the NHM has increased the knowledge of farmers about the changing temperature and farmers save themselves from the upcoming adverse situation by following the proper adaptation strategies.

9) Knowledge level towards climate change

The knowledge level of the respondent showed significant relationship with effect of change in temperature pattern on vegetable production technology. The reason of this result is due to now a days, sources of information carry more information of climate change towards production technology. It is certain that farmers were adequately exposed to these source and such climatic information increased the knowledge level of farmers towards the climate change. Hence, the positive relationship was observed. This finding is supported by Lakshminarayan and Singh (2005).

10) Risk bearing ability

In case of risk bearing ability of the respondents showed positive and non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason behind the result is that risk bearing ability is the ability of farmer to face any risk came infront of him it may be either his success or failure and it has no relation with the effect of changing temperature pattern.

11) Economic Motivation

The economic motivation of respondents showed non significant relationship with effect of change in temperature pattern on vegetable production technology. The reason is due to it is the value of an individual in economic terms but it is not related to changing climatic condition. The work of Rahangdale (2011) confirms the present finding.

5.6 Adoption of the new cropping mechanism to mitigate the effect of climate change:

The study concluded that out of total vegetable growers, 37.50 per cent farmers shifted from old vegetable pattern okra-garlic-onion to new vegetable pattern Pulses-Potato-Colocasia due to climate change followed by those vegetable growers (33.33 per cent) who shifted from old vegetable pattern Cucumber**-** Pea**-** Tomato to new vegetable pattern Brinjal**-**Tomato**-** Green gram. Rest vegetable growers (29.16 per cent) shifted from old vegetable pattern Tomato-Spinach-Chilli to new cropping pattern Soybean-Wheat-Cowpea due to climate change.

Thus it may be concluded that out of the total, maximum percentage (37.50%) of vegetable growers adopted Pulses-Potato-Colocasia vegetable pattern. This vegetable pattern replaced old vegetable pattern of Okra**-** Garlic**-** Onion in vegetable production due to climate change.

Crop replacement due to various factor of climate change:

S. No.	Season	Old crops	Replaced by	Due to
1.	Kharif	Okra	Pulses	Water stagnation (Fungal disease – root rot, Damping off)
2.		Cucumber	Brinjal	Fungal disease – Downey Mildew
3.		Tomato	Soybean	Excess water (Fungal disease)
4.		Bitter gourd	Maize	Insect attack
1.	Rabi	Garlic	Potato	Low temperature at the time of sowing
2.		Pea	Tomato	Low temperature at the time of maturity
3.		Spinach	Wheat	Pest attack
4.		Cabbage	Pea	Low temperature (bolting)
1.	Summer	Onion	Colocasia	High Temperature (onion become more pungent)
2.		Tomato	Green gram	High Temperature (the fruits become puffy and red pigment development is permanently damaged)
3.		Chilli	Cow pea	High Temperature (opt temp. is 18-30°C above this flowering and fruit drop)
4.		Cucumber	Musk melon	High Temperature (Opt. temp. is 15-24°C above this no proper fruit growth)

5.7 Constraints faced by Respondent in vegetable production:

The constraints reported by the respondents in production of vegetable crop are presented in table. It is evident from the data that the major constraints as expressed by the respondent were Lack of information about weather services (81.66%) followed by uncertainity of Monsoon (77.5%), Low price of vegetable in local market (75%), Lack of Storage facility (65%), Lack of transportation facility (53.33%), Occurrence of certain disaster (45.83).

5.8 Suggestions to overcome the constraints:

As regards to suggestions given by the respondents to overcome the constraints faced by them, the findings have been presented in the Table 4.20 The data revealed that the majority of the respondents (81.66%) were of the opinion that Weather forecast information should be more frequent and timely in villages followed by 79.16% of the respondents suggested that Transportation facilities should be increases, Proper and timely information on fluctuation in market price of vegetable should be provided (76.66%), Proper storage facility should provided (72.5%), Training programmes should be organized on disaster management in village (65.83), and Location specific water storage structure should be developed for effective utilization of rainwater (63.33%).

Chapter- VI

SUMMARY, CONCLUSION AND SUGGESTIONS

6.1 Summary

6.1.1 Introduction

Vegetables play a vital role in the maintenance of human health. For a well-balanced diet, about 300 gram vegetables are required containing root vegetable, green vegetables and others vegetables, but only 130 grams per capita is available. According to the ministry's estimates, based on information provided by the States and Union Territories, the production of vegetables is estimated to be around 175 mt. IFAD (2009) has reported that climate change is expected to put 49 million additional people at risk of hunger by 2020, and 132 million by 2050 (Devendra 2012).

Climate change has an adverse impact on productivity and quality besides aggravate the environmental stress on vegetable crops. Environmental stresses like increasing temperature, reduced irrigation water availability, flooding and salinity are thought to be the major limiting factors in enhancing vegetable productivity. Though the climate varies are beyond human control, its intensity and extreme impact of environmental stress on vegetable crops can be reduced to some extent and enhance the production as well, if the integrated approaches like cultural management practices including nutrient and tillage residue management, water management, mulching, improved pest management, and breeding approaches are adopted.

Objectives of the study:

1. To analysis the relationship between socio-economic, communication and psychological attributes of vegetable growers and their perception on impact of climate change.
2. To study the farmers perception on the impact of climate change.
3. To determine the major cropping mechanism adopted by vegetable growers to mitigate the effect of climate change.

4. To know the constraints faced by vegetable growers and their suggestions.

6.1.2 Brief methodology:

For fulfillment of these objectives, the study was conducted in Ujjain district. Out of six blocks of district, Ujjain block was purposively selected for study. The study was conducted in six villages where the maximum farmer are vegetable growers has been popularized among the vegetable growers by NHM Ujjain. After the selection of villages, a village wise list of farmers of six selected villages have been prepared. From this list 120 farmers have been selected proportionately for the present study. The data were collected using survey method through a pre-tested interview schedule and responses were recorded. Collected data were then tabulated and analyzed using percentage, mean, rank order, correlation and standard deviation.

6.1.3 Profile of vegetable growers:

As regards the profile of vegetable growers are concerned, the finding of study can be summarized that –

- Majority of respondent 65.00 percent belonged to middle age group, 21.66 per cent belonged to young age group and 13.34 per cent belonged to old age group respectively.
- Majority of 44.16% were having education up to higher secondary 1,8.34 per cent were illiterate, 20.00 per cent received education high school and 17.50 per cent were found educated up to college level.
- Majority of 77.50% respondent were belonged to other backward classes, 8.33 percent belonged to general caste, 7.50 percent were scheduled castes and 6.66 percent were found from scheduled tribes category.
- Majority of 46.67 per cent were marginal farmer, 36.67 per cent were small farmer, 13.33 were medium farmer and 3.33 per cent were large farmer. Majority of vegetable growers 63.34 per cent had 1-25% area of total land holding under vegetable.

- Majority of vegetable growers 62.50% had medium level of farm mechanization, 20.83 per cent had low farm mechanization, and 16.67 per cent had high farm mechanization.
- Majority of 63.33% respondent had medium production while 20 per cent had low production and 16.67 per cent had high production of vegetable.
- Majority of 60.83 percent belong to low annual income, 28.33 per cent were found in medium income group and 10.84 per cent were in high income group.
- Majority of 36.67 per cent had medium information seeking behavior followed by high information seeking behavior 35.83 per cent and low information seeking behavior 27.50 percent respectively.
- Majority of 50.00 percent had medium knowledge level towards climate change, 44.17 per cent had low knowledge level of climate change in concern of vegetable production, whereas only 5.83 per cent had high knowledge level of climate change.
- Majority of 48.33 percent had medium risk bearing capacity, 28.33 per cent had high risk bearing ability and 23.33 per cent had low risk bearing ability.
- Majority 63.33 percent of respondent had medium economic motivation 26.67 per cent had high economic motivation and 10.00 per cent had low economic motivation.

6.1.4 Effect of change in rainfall pattern on vegetable production technology:

Majority of 38.33 per cent had medium perception on effect of change in rainfall pattern, 35.00 per cent and 26.66 per cent had high and low perception on effect of change in rainfall pattern on vegetable production technology respectively.

6.1.5 Relationship between profile of respondent and farmers perception on effect of change in rainfall pattern:

The farmers perception on effect of change in rainfall pattern on vegetable production technology had significant relationship with education, information seeking behavior and knowledge level towards climate change. While with age, caste, total land holding and area under vegetable crop, farm mechanization, annual production, annual income, risk bearing ability and economic motivation of vegetable growers were found to have non-significant relationship.

6.1.6 Effect of change in temperature pattern on vegetable production technology:

Majority of 43.33 per cent had medium perception on effect of change in temperature pattern, 33.33 per cent and 23.33 per cent had high and low perception on effect of change in temperature pattern on vegetable production technology respectively.

6.1.6 Relationship between profile of respondent and farmers perception on effect of change in temperature pattern:

The farmers perception on effect of change in temperature pattern on vegetable production technology had significant relationship with education, information seeking behavior and knowledge level towards climate change. While with age, caste, total land holding and area under vegetable crop, farm mechanization, annual production, annual income, risk bearing ability and economic motivation of vegetable growers were found to have non-significant correlation.

6.1.8 Adoption of the new cropping mechanism to mitigate the effect of climate change

Majority of 37.50 per cent farmers shifted to new cropping pattern Pulses-Potato-Colocasia followed by 33.33 per cent who shifted to Brinjal-Tomato-Green gram and 29.16 per cent shifted to new cropping pattern Soybean-Wheat-Cowpea from the old vegetable cropping pattern due to climate change.

6.1.9 Constraints faced by Respondent in vegetable production:

The constraints reported by the respondents in production of vegetable crop were Lack of information about weather services, uncertainity of Monsoon, Low price of vegetable in local market, Lack of Storage facility, Lack of transportation facility, Occurrence of certain disaster.

6.1.10 Suggestions to overcome the constraints:

As regards to suggestions given by the respondents to overcome the constraints were of the opinion that Weather forecast information should be more frequent and timely in villages, transportation facilities should be increases, Proper and timely information on fluctuation in market price of vegetable should be provide, Proper storage facility should provide, Training programmes should be organize on disaster management in village, and Location specific water storage structure should be develope for effective utilization of rainwater.

6.2 Conclusion -

6.2.1 Profile of beneficiaries –

In the case of socio-personal economic attributes, most of the beneficiaries belonged to middle age group and literate, maximum beneficiaries belonged to OBC caste, maximum beneficiaries having marginal land holding, maximum beneficiaries having medium level farm mechanization, maximum beneficiaries having low annual production and low annual income,

With regard to communication attribute the study revealed that maximum beneficiaries had medium level of information seeking behavior.

Psychological attribute indicated that maximum beneficiaries having medium level of Knowledge towards climate change, maximum beneficiaries had medium level of risk taking ability and maximum beneficiaries having medium level of economic motivation.

6.2.2 Effect of climate change on vegetable production technology:

In case of Effect of climate change on vegetable production technology, Majority of respondents had medium perception on effect of climate change on vegetable production technology followed by high and low respectively.

6.2.3 Relationship between profile of respondent and farmers perception on effect of climate change on vegetable production technology:

The farmers perception on effect of climate change on vegetable production technology had significant relationship with education, information seeking behavior and knowledge level towards climate change. While with age, caste, total land holding and area under vegetable crop, farm mechanization, annual production, annual income, risk bearing ability and economic motivation of vegetable growers were found to have non-significant correlation.

6.2.4 Adoption of the new cropping mechanism to mitigate the effect of climate change

In case of adoption of the new cropping mechanism majority of farmers shifted to new cropping mechanism Pulses-Potato-Colocasia followed by respondents who shifted to Brinjal**-**Tomato**-**Green gram and Soybean-Wheat-Cowpea from the old vegetable pattern due to climate change.

6.2.5 Constraints faced by Respondent in vegetable production:

The constraints reported by the respondents in production of vegetable crop were Lack of information about weather services followed by uncertainity of Monsoon, Low price of vegetable in local market, Lack of Storage facility, Lack of transportation facility, Occurrence of certain disaster.

6.2 Suggestions to overcome the constraints:

Similarly suggestions given by beneficiaries were of the opinion that Weather forecast information should be more frequent and timely in villages, transportation facilities should be increase, proper and timely information on

fluctuation in market price of vegetable should be provided, Proper storage facility should provide, training programmes should be organize on disaster management in village, and Location specific water storage structure should be develop for effective utilization of rainwater.

6.4 Suggestions for further research work:

1. The present study was confined to six villages only. Hence the result may not be applicable to a large area. For appropriate generalization, similar work should be undertaken on a large scale
2. Assessment of climate change on vegetable crop should be made in large area.
3. Assessment of constraints on vegetable production in concern of climate change.
4. The limited independent variables were included in the study. Other relevant variables may also be included for further study.

Chapter - VII

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(INTERVIEW SCHEDULE)

Topic:

"A study on Effect of climate change on vegetable production technology in Ujjain block of Ujjain District (M.P.)"

PART-1

GENERAL INFORMATION

Village- , Block- Ujjain, District- Ujjain

Name of farmer: .....

(A) Independent variables:

1. **Age: ……..**
2. **Education:**

Illiterate	High school	Higher Secondary	Degree & above

3. **Caste: ……**

4. **Land Holding: ……**
   Percentage of vegetable land holding: ……

5. **Farm mechanization:**

Indigenous plough	Mould board plough	leveller (pata)
Cultivator	Sprayer/duster	Seed drill
Thresher	One pair bullock	Pump diesel/electric

6. **Annual Production** : ……(in tonnes)

7. Annual Income : …….

8. Information Seeking Behaviour:

Source	**Least**	**Partial**	**Always**
Friends/ Relatives			
N.G.O			
RAEO			
Agriculture Scientist			
Radio/Television			
News paper			
Other			

9. Knowledge level towards climate change:

S. no.	**Statement**	**P.A.**	**A.**	**C.A.**
1	Climate is getting warmer			
2	Weather has become unpredictable			
3	Duration of seasons is changing			
4	Occurrence of extreme weather conditions			
5	Risk of crop failure has increased			
6	Pollution is increasing in the atmosphere			
7	Occurrence of natural disasters are increasing			

8	Human health problems are increasing			

P.A.- Partial agree A. – Agree C.A.- Complete agree

10. Risk Bearing Ability :

S.No	Statement	P.A.	A.	C.A.
1	farmer wants to take more profit from small area but wants to take minimum risk			
2	farmer who have ability to take more risk, have good economic condition			
3	From risk bearing ability succes opportunity of farmer is increase			
4	Adoption of new technology have risk but it still gets success			
5	Crop diversification or multiple cropping is better to decrease the risk than mono cropping			
6	Farmer should not adopt any new technology untill he saw other farmer is sucessfully using it			

11. Economic Motivation:

S.No	Statement	P.A.	A.	C.A.
1	Farmer should work for more production and profit			
2	A succesful farmer is one who get good profit			
3	Farmer should adopt all the new technologies in his farming from which he take good income			

4	Farmer should grow cash crops and catch crops			
5	Farmer should give economic help to there children			
6	Farmer should earn to sustain his life but life is not only limited to earn for money purpose			

Dependent Variables –

12 Effect of climate change on vegetable production technology –

Farmers perception on impact of climate change on vegetable production technology for last years:

S.No	Statement	Change in Temp.			Change in Rainfall		
		C.A.	A.	P.A	C.A.	A.	P.A
1	Vegetable production is decreased						
2	Use of traditional crop variety is decreased						
3	Decrease in quality of vegetable						
4	Cropping pattern has changed						
5	Availability of irrigation water is decreased						
6	Availability of fresh vegetable is decreased						
7	Insect and disease attack in vegetable is increased						
8	Increase in attack of seasonal weeds						

9	Increase in expenditure of farmer in vegetable production						
10	It is one of major cause of low availability of nutritious vegetable						

13 Major cropping mechanism adopted by vegetable growers to mitigate the effect of climate change –

S.No	Old vegetable (5 year ago)	New Vegetable (Present crop)	Due to

14 Various Constraints faced by vegetable grower:

S.No	Constraints	Yes	No	Suggestion
1	Lack of information about weather services			
2	Uncertainity of monsoon			
3	Lack of storage facility			
4	Ocurrence of uncertain disaster			
5	Lack of transportation facility			
6	Low price of vegetable in local market and fluctuation in market price			

राजमाता विजियाराजे कृषि विश्वविद्यालय ग्वालियर (म. प्र.)

विस्तार शिक्षा विभाग, कृषि महाविद्यालय इंदौर (म.प्र.)

साक्षात्कार प्रश्नावली (2016-18)

शोधकर्ता - **निर्देशक -**

भानुप्रिया बागड़ी **डॉ. संध्या चौधरी**

M.Sc. कृषि विस्तार शिक्षा विभाग **सह प्राध्यापक**

शोध का विषय -

"A study on effect of climate change on vegetable production technology in Ujjain block of Ujjain district (M.P.)"

सामान्य जानकारी

कृषक का नामः .....

ग्रामः..... विकासखंड..... जिला.....

Independent Variables -

1 आयु (वर्षों में) : .....

2 शैक्षणिक स्तर :– (1) अशिक्षित (2) हायर स्कूल (3) हायर सेकेण्डरी (4) स्नातक या अधिक

3 जाति :– (1) सामान्य (2) पिछड़ा वर्ग (3) अनुसूचित जाति (4) अनुसूचित जनजाति

4 भूमि :– कुल भूमि ..... (.एकड़ में), सब्जी के अंतर्गत ..... (एकड़ में)

5 प्रक्षेत्र शक्ति :–

1	बैल जोड़ी	6	थ्रेशर/विनोवर

2	ट्रेक्टर / कल्टीवेटर	7	डीजल पम्प / विद्युत पम्प
3	सीडड्रिल	8	गोबर गैस संयंत्र
4	देशी हल	9	नाडेप टाँका
5	स्प्रेयर	10	अन्य

6 सब्जियों से वार्षिक उत्पादन -

7 वार्षिक आय (रू. में) :–

क्रं.	**व्यवसाय**	**वार्षिक आय**	क्रं.	**व्यवसाय**	**वार्षिक आय**
१	कृषि से		४	व्यापार	
२	पशुपालन से		५	मजदूरी से	
३	नौकरी से			कुल वार्षिक आय	

8 व्यव्हार सम्बंधित जानकारी -

स्त्रोतों के नाम	**हमेशा**	**अक्सर**	**कभी-कभी**
दोस्तों / रिश्तेदार			
N.G.O			
RAEO			
कृषि वैज्ञानिक			

रेडियो / टेलीविज़न			
समाचार पत्र/ पत्रिका			
अन्य			

9 मौसम के बदलाव से सम्बंधित ज्ञान का स्तर –

क्रं	कथन	पूर्ण सहमत	सहमत	अंशतः सहमत
1	मौसम गर्म होती जा रही है।			
2	जलवायु में अनिश्चितता बढ़ गई है।			
3	विभिन्न मौसमों की अवधि परिवर्तित हो रही है।			
4	अप्रत्यासित/अनुचित जलवायुवीय घटनाओं की आवृति बढ रहीं है।			
5	खराब मौसम की वजह से फसलों के खराब होने की घटनायें बढ़ रही है।			
6	वातावरण मे प्रदुषण का स्तर बढ़ रहा है।			
7	प्राकृतिक आपदायें दिन ब दिन बढ़ रहा है।			
8	जलवायु परिवर्तित से मनुष्यों में स्वास्थ्य संबंधि समस्यायें बढ़ रही है।			

10 जोखिम वहन करने की क्षमता :–

क्रं	कथन	पूर्णतः सहमत	सहमत	अंशतः सहमत

1	एक किसान छोटे से क्षेत्र से अधिक लाभ कमाना चाहता है परंतु जोखिम कम उठाना चाहता है।			
2	जो किसान अधिक जोखिम लेता है उसकी आर्थिक स्थिति औसत किसानों की तुलना मेंअच्छी होती है।			
3	जोखिम वहन करने से सफलता के अवसर बढ़ जाते है किसान को इस बात का ज्ञान होना अच्छी बात है।			
4	नई तकनीक को अपनाने में जोखिम होने के बावजूद उससे समृद्धि आती है।			
5	अधिक से अधिक फसल लगाकर जोखिम कम करना एक फसल लगाने से ज्यादा अच्छा है।			
6	किसान को नई तकनीक तब तक नहीं अपनानी चाहिए जब तक कि अन्य कृषक उसे सफलतापूर्वक न अपना लें।			

11 आर्थिक अभिप्रेरणा :–

क्रं	कथन	पूर्णतः सहमत	सहमत	अंशतः सहमत
1	किसान को अधिक उपज एवं आर्थिक लाभ के लिये काम करना चाहिए।			
2	एक सफल किसान वही है जिसे अधिक मुनाफा मिले।			
3	एक किसान को सभी ऐसी नई कृषि तकनीकी अपनाने का प्रयास करना चाहिए जिससे वह अधिक धन कमा सके।			
4	एक किसान को घरेलु उपयोग की तुलना में नगदी फसलों को उगाना चाहिए।			
5	जब तक किसान अपने बच्चों को आर्थिक मदद नहीं देगा उनकी अच्छी शुरुआत होना कटिन है।			
6	एक किसान को जीवन–यापन के लिए कमाना चाहिए परन्तु जीवन को मात्र रुपयों पैसों तक सीमित नहीं किया जा सकता।			

Dependent Variables –

12 सब्जियों की कृषिगत क्रियाओ में जलवायु परिवर्तन के प्रभाव –

विगत **पूर्व** वर्षों में जलवायु में परिवर्तन के कारण आपनें विभिन्न कृषि क्रियाओं में क्या परिवर्तन अनुभव किया है-

क्रं	कथन	तापमान परिवर्तन			वर्षा परिवर्तन		
		पू. स.	स	अं स .	पू . स	स	अं स .
1	जलवायु परिवर्तन के कारण सब्जियों का उत्पादन कम हुआ है।						
2	परम्परागत फसल प्रजातियों का उपयोग कम हुआ है।						
3	सब्जियां की गुण/क्वालिटी में गिरावट आई है।						
4	फसल पद्धति परिवर्तन हुई है।						
5	जलवायु परिवर्तन की वजह से सिंचाई के लिए जल की उपलब्धता कम हुई है।						
6	तजे सब्जियां की उपलब्धता कम हुई है।						
7	जलवायु में परिवर्तन के कारण फसलां मं कीटों एवं बीमारीयों का प्रकोप बढ़ा है।						
8	मौसमी खरपतवरों का पकोप फसलों मं बढ़ा है।						
9	जलवायु परिवर्तन के कारण खती में खर्च बढ़ता जा रहा है।						
10	सब्जियांकी कमी का एक वजह जलवायु परिवर्तन है।						

13 जलवायु परिवर्तन के प्रभाव को कम करने के लिए किसानो द्वारा फसल तंत्र में किया गया बदलाव –

क्रं	पांच वर्ष पहले लगायी जाने वाली फसल	जलवायु परिवरतन के कारण लगायी जाने वाली फसल	परिवर्तन का कारण

14 सब्जी के उत्पादन की उन्नत तकनीकी को अपनाने में किसानों की समस्यायें।

क्रं	समस्याए	हाँ	नहीं	सुझाव
1	मौसम जानकारी की कमी			
२	मानसून की अनियमितता			
३	भंडारण की कमी			
४	अचानक आपदा			
५	परिवहन साधनों की कमी			
6	साधारण बाज़ार में सब्जियों का कम मूल्य			