STUDY ON ADOPTION OF GRAM PRODUCTION TECHNOLOGY IN DIARA LAND OF BIHAR

BY

NEERAJ KUMAR

A THESIS SUBMITTED TO
THE RAJENDRA AGRICULTURAL UNIVERSITY, BIHAR, PUSA
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Pusa (Samastipur) - 848125

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DEPARTMENT OF EXTENSION EDUCATION

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2013

DEDICATED

TO

MY RESPECTED PARENTS

AND MY FAMILY

"WHOSE PERPETUAL AFFECTION AND BLESSINGS ALWAYS INSPIRED ME FOR HIGHER AMBITION IN LIFE"

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This is to certify that the work recorded in this thesis en titled ***"STUDY ON ADOPTION OF GRAM PRODUCTION TECHNOLOGY IN DIARA LAND OF BIHAR."*** Submitted in the partial fulfillment of the requirements for the award of the degree of ***MASTER OF SCIENCE IN AGRICULTURE (EXTENSION EDUCATION)*** of the faculty of Post-Graduate Studies, Rajendra Agricultural University, Bihar, Pusa (Samastipur) is the faithful record of bona fide research work carried out by ***MR. NEERAJ KUMAR*** under my supervision and guidance.

No part of this thesis has so far been submitted for any other degree or diploma. The assistance and help received during the investigation and source of literature have been dully acknowledged.

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ABSTRACT

The Diara ecosystem, whose potentials are yet to be exploited, is situated between the natural levees of rivers, which are periodically eroded and formed due to meandering, braiding and course changing of rivers and remain inundated under flood water for different periods of time, features a riverine landscape with unstable land surfaces, subject to annually erosion and re-deposition with assortment of sediments depending upon the velocity and duration of flood. The topography of Diara forms a confused pattern of up, mid and low land depending upon the period of stay of flood water, which makes agricultural operations more crucial and challenging. These areas have been identified as future Grain Bank of the Country by the Scientists. The such ecosystem exists in Eastern U.P., Bihar and West Bengal. The area under the system has been estimated as 11.76 lakh ha in Bihar under different river basins. Out of which Ganga diara is the most extensive region covering about 5.33 lakh ha area. The present aims to study the prospect of Gram production technology in Diara land of Bihar so that appropriate socio-economic, knowledge based adoption could be framed to enhance the productivity/profitability of these areas. The study is based on primary data (2011-12) collected from a sample of 100 Diara farmers selected through Multi Stage Random Sampling Technique from Mokama block of Patna district. It is found that majority of respondents of Socio-economics profile is medium level. The knowledge level and extent of adoption of Gram production technology is medium level.Over 90 percent of Diara areas are un-irrigated and the cropping pattern is based on subsistence farming. The crops faced mild to severe moisture stress at different stages of crop growth/development and consequently the crop yield was very low. These areas are subject to various biophysical, technological and socio-economic impediments, which affect the livelihood of entire ecosystem. The agro-ecological constraints includes duration and extent of flood, variable soil fertility, undulating topography etc. while the socio-economic constraints includes fragmented/small size of land holding, insufficiency of transfer of technology, poverty, underemployment/ unemployment, lack of communication and transportation, non- availability of quality inputs and their high prices and market imperfection in realizing remunerative prices of their produce. The credit facilities with provision of crop insurance, timely supply of seeds, fertilizes etc. at subsidized prices and extending benefits of Agricultural Produce Market (regulation) Act for Diara farmers are the few measures required to be addressed on priority basis in order to fulfill the desired change as expected in these areas.

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INTRODUCTION

The state of Bihar with a geographical area of about 94.2 thousand square km is divided by river Ganges into two parts, the North Bihar with an area of 53.3 thousand square km and the South Bihar having an area of 40.9 thousand square km. Based on soil characterization, rainfall, temperature and terrain, three main agro-climatic zones have been identified. These are: Zone-I, North Bihar Alluvial Plain, Zone-II, North East Alluvial Plain, Zone-III, A South Bihar East Alluvial Plain and Zone-III B, South Bihar West Alluvial Plain, each with its own unique prospects. Though endowed with good soil, adequate rainfall and good ground water availability state has not yet realized its full agricultural potential. The agricultural productivity is one of the lowest in the country, leading to rural poverty, malnutrition and heavy migration of labor. Further, the task of meeting future food security which is 350 MT by the year 2020, i.e. additional food grains of 10-11 MT every year without eroding the ecological balance posing a great challenge before the country in which the state has to play the lead role. Thus, new strategies have to evolve which should be tuned from crop based in context of entire cropping system taking the path of integrated natural resource management, particularly in unexploited vast dry and rain-fed fragile ecosystems of Bihar state.

At present production stability is very essential for ensuring national food security and meeting global market requirement for overall prosperity and welfare of human being. As population explosion in country is mounting great pressure on the available natural resources not only for food security but also for nutritional security too. This broad objective can be achieved essentially through crop intensification or management practices leading towards ever-green revolution or rainbow revolution.

Keeping these facts in mind, The Government of Bihar came out with a comprehensive Agricultural Road Map with salient objectives. It aims to fill up substantial yield gaps of agricultural commodities on the one hand and low farmers' income and widespread rural poverty on the other hand.

The major goals of Agricultural Road Map,2012 are,:

- To ensure increase in income of farmers to viable levels, especially considering the small size of holdings.
- To ensure food security through increase productivity combined with profitability.
- To foster nutritional security through raising levels of productivity as well as raising living standards of rural societies.
- To revitalize farming in order to create gainful employment and to check migration.
- To ensure agricultural growth with justice, with programme focusing on gender and human aspects.

Table No. 1 Land Utilization pattern of Bihar (Lakh acre)

Items	Current status
Total geographical area	234.00
Forest	15.55
Land put to non agricultural uses	41.15
Barren & uncultivated land	10.90
Permanent pastures	0.425
Land under miscellaneous trees and groves	5.975
Culturable wasteland	1.15
Current fallow land	3.30
Other fallow land	15.075
Net cultivated area	140.475

Agro Climatic Zones of Bihar State

Fig No. 1

Major problems affecting land and soil in Bihar

Bihar is endowed with natural resources like fertile land, plenty of surface and sub- surface water, with predominantly an agricultural economy. In the southern region of the natural levee of the Ganga, there is a vast stretch of back waters known as "Tal, (low order monsoon stream)" comprising lands extending from Buxar to Pakur where most of the rivers and rivulets coming from the south get them submerged. Tal and Diara lands are spread over 1.25 million ha in the state of Bihar and constitute nearly 20 percent of the total cultivable land of the state They have their specific social,economic and topographic characteristics that call for special measures to bring about radical transformation of the existing situation. The Tal and Diara lands are inundated by water for varying periods, and are difficult to manage for agricultural produce.The important Soil condition of Bihar state may be seen here under the following details given here as:

Table No. 2 Soil Condition of Bihar

Sl. No.	*Particulars*	*Area in lakh ha.*
1	*Saline and alkaline soil (Chaur lands)*	*4.14*
2	*Diara land*	*11.76*
3	*Tal land*	*0.96*
4	*Bhudan land*	*0.92*
5	*Culturable waste land*	*0.58*
6	*Other fallow land*	*1.61*
	Total	***28.61***

Source :-State Farmer Commission, 2009

Soil and water conservation technique under this region on the individual farmer's field such as contour bunding, contour trenches, retaining wall, check dam etc. have been found to be of immense benefit in not only for arresting soil erosion but also improving the productivity of various crops.

The Diara ecosystem, whose potentials are yet to be exploited, mostly situated between the natural levees of rivers, which are periodically eroded and formed due to meandering, braiding and course changing of rivers and remain inundated under flood water for different periods of time. It features a riverine landscape with unstable land surfaces, subject to annually erosion and redeposition with assortment of sediments depending upon the velocity and duration of flood. The topography of Diara forms a confused pattern of up, mid and low land depending upon the period of stay of flood

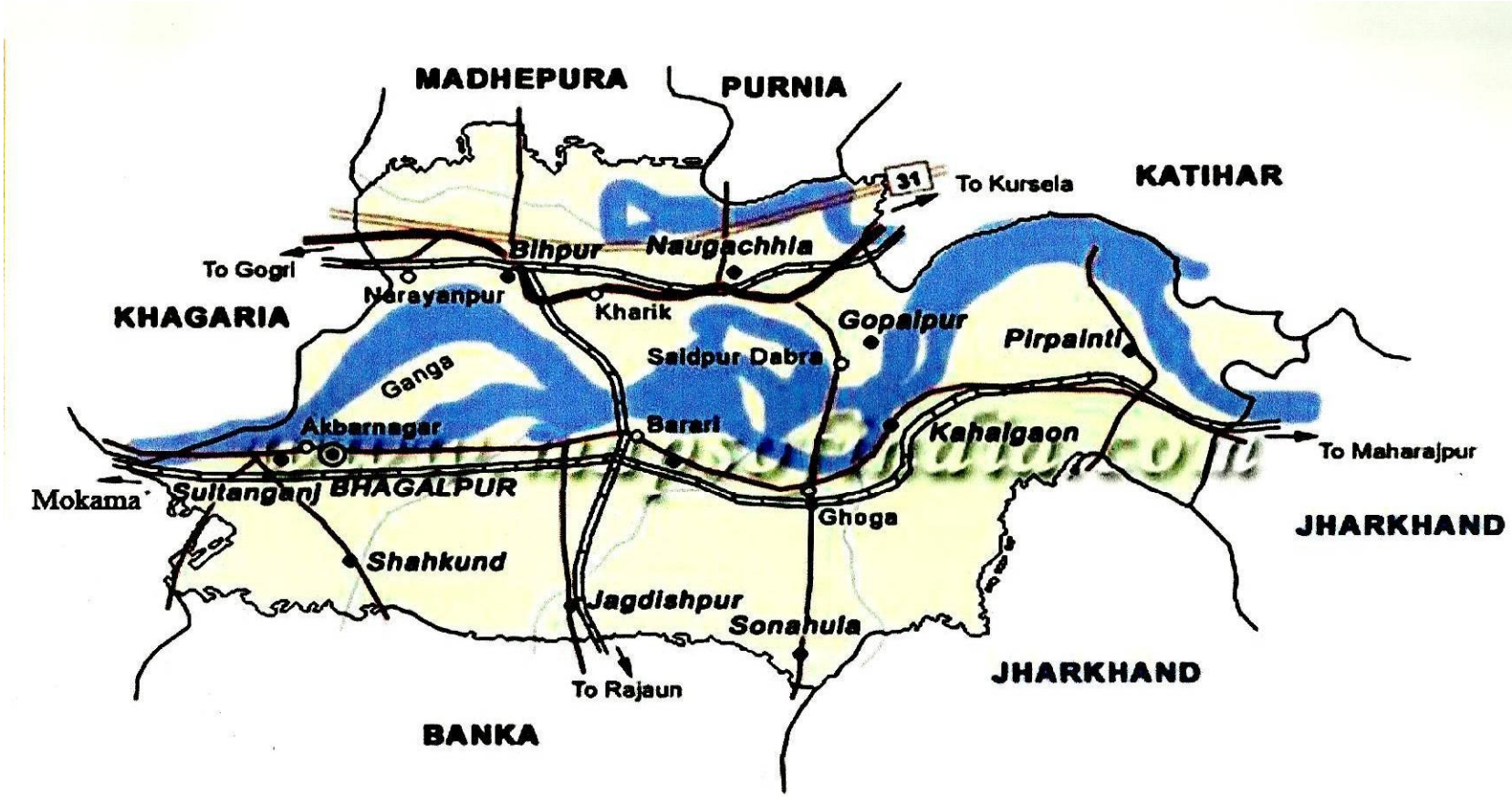

Fig 2. Denotes the Diara Land of Bihar

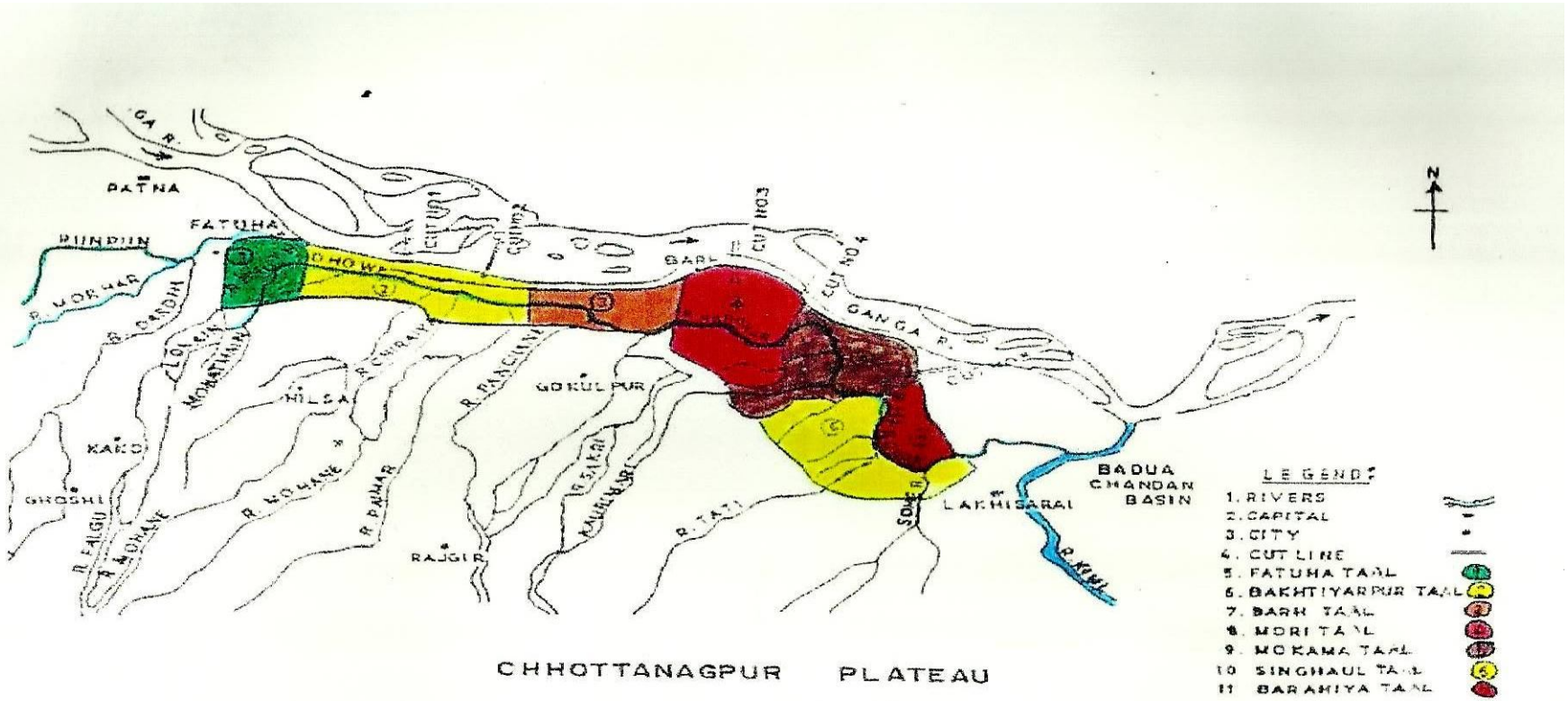

Figure 1. Index map of Mokama group of Taals

Fig 3.Mokama Tal of Bihar state

(*phaseolus mungo*) is grown extensively as a cash crop during post monsoon period (September) in mid-land of Diara with recession of floodwater. In mid-low land and low-land, different types of millets are also grown as cash crops before flood and in mid land to upland after flood.

In 2020, the pulses and oilseed demand of the country will be around 22 and 35 millions tones but our current production is only 14 and 24 million tones respectively. It lacks behind we are lacking behind by 8 and 11 million tones respectively (Varshney,2009). In the year 2030 pulse requirement in the country is projected to be 32 million tones. In India pulses are grown annually on an area of about 23.35 million ha with a production of 15.57 million tones with average productivity of meager 659 kg/ha which is very meager. (Anonymous 2009-11).

Gram (*Cicer arietinum L.*) is an important pulse crop of the semi-arid tropics, particularly in the rain fed ecology of India. The daily per capita availability of 14g gram is a source of 2.3% (56 k cal) energy and 4.7F% (2.7g) protein to Indian population, beside calcium and iron (10-12%), net availability of gram per capita per day has come down from 22.5g (1951) to 12.9g (2010). Globally, gram is cultivated on about 10.4 million ha area adding 8.57 million tons of grain to the total food basket, with an average productivity of 826 kg/ha. India grows chickpeas on about 7.58 million ha, producing 6.91 million tones with productivity of 911 kg/ha, represents 30% and 38% of the national pulse acreage and production, respectively (Anonymous, 2009).The state of Bihar grows Gram on about 59336 ha, producing 76818 MT with productivity of 1295Kg/ha (Source: Bihar Kisan Diary, 2013).

India stands first in the world in terms area and production of both pulses and oilseeds, but still there is a wide gap between demand and supply of both pulses and oilseeds. Annually, we need about 38 and 20 kg of pulses and edible oil, respectively on per capita consumption, but at present, availability is only 14 and 6.5 kg of pulses and edible oil, respectively. Even though, the total pulses production being 15 million tones, is not sufficient to meet the growing demand due to rapid increase of population and improved standard of life. As a consequence, per capita daily availability of pulses has come down from around 69 g in 1961 to about 34 g in 2009 (Anonymous, 2009). The shortage of pulses and oilseeds has aggravated the problem of malnutrition among the vast population of the country. Thus, there is an urgent demand for meeting increasing requirement by manipulating the production

technologies appropriately. Specially, increasing the area under these crops and by enhancing the productivity of an area can increase the production of pulses and oilseeds. But the area under pulses and oilseeds does not seem likely to expand, as the land has become limiting factor due to growth industrialization and urbanization. Thus, the functional allocation of lands for each these component (pulse, oil seeds, cereals, etc.) has lost its reality.

1.1 EMERGENCE AND STATEMENT OF PROBLEM

The riverine area of Bihar, famous for its pulses and oilseeds production has the potential which remains submerged in water for four to five month during the mansoon season. During this time, water from the Ganga, Punpun, Falgu, Skri, Mahaane and Dhoba rivers flood this 'tal' area and the water level rises from 10 to 15 feet. The possible reasons of water logging of the Tal/Diara are presented in figure no.4. There is no arrangement of pumping out this water, as result of which, the whole stretch of land lies useless for six to seven months in every year. The, cultivation of one rabi crop specially the pulse cultivation is only possible, which is done during the moist soil conditions. The silt deposited on the ground during the floods adds to the fertility of the soil. Therefore, a comprehensive scheme needs to be worked out for water entry (August to September) and water exit from this area (5 October). The farmers of this area have an acute shortage of high-quality seeds. In fact, the grains of one year are used as seeds during the next year.

Absence of proper high-quality seeds of pulses leads to reduction in total produce as well as sprouted stalks. Absence of a proper road network in the wide, long and expansive 'Tal/Diara' area is another problem, which makes it difficult to reach the interiors of the riverine plains. The makeshift pathways etched across the farms invite the presence of cattle that in turn ruin the crops. The extensive network of rivers over the 'tal area again proves to be a deterrent to cross-area travel. Thus, effort should be put into constructing and developing a comprehensive road and bridge network for proper development.

The absence of proper godowns and seed storage facilities leads to wastage of crops as it becomes very difficult to bring over and store the produce from the 'Tal' area, which lies 20-25 km in the interior region, with devastating rains, storms and floods wrecking havoc. Similar destruction is caused by crop fires during the

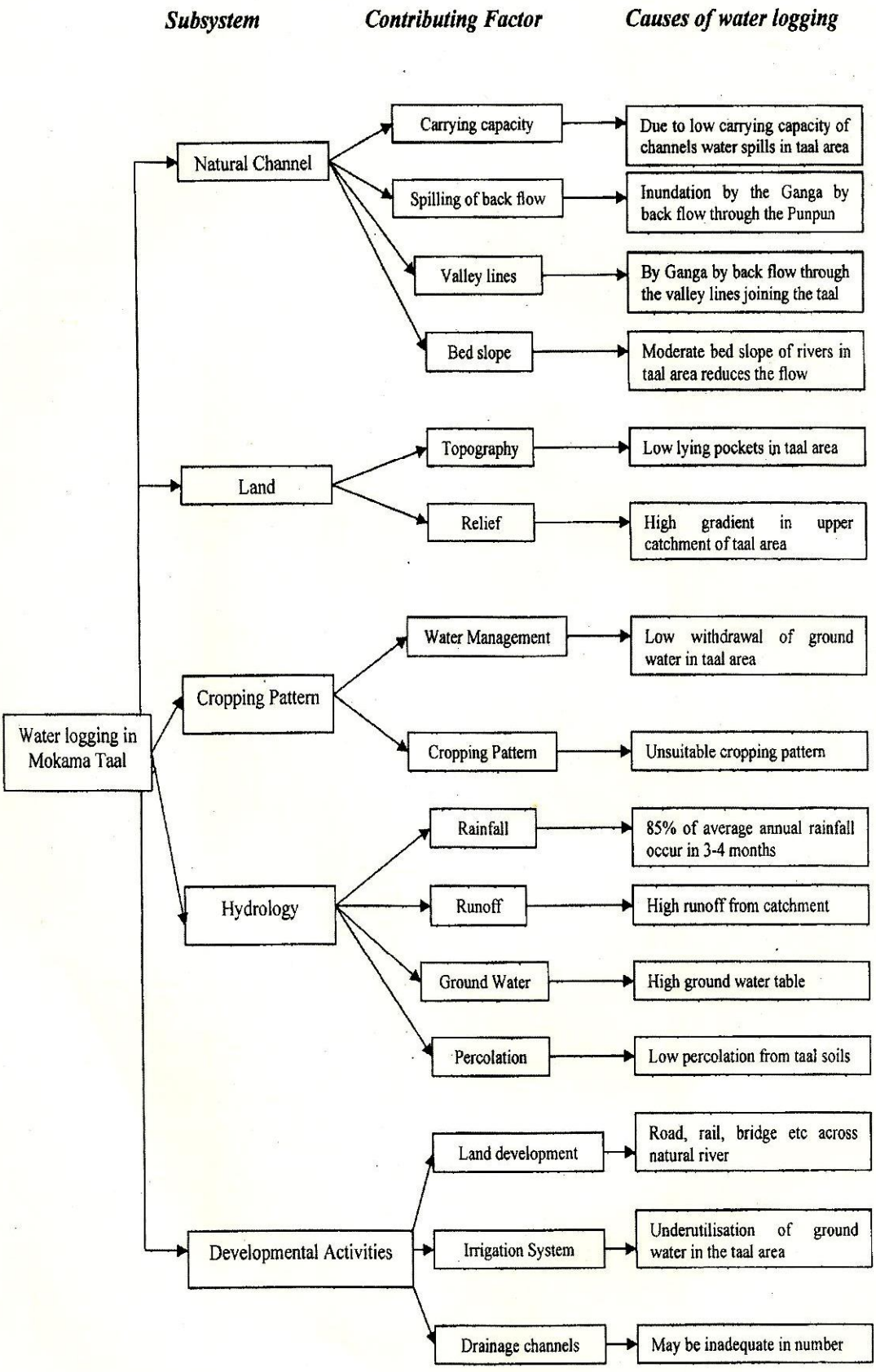

Fig No.4 Possible Causes of Water-Logging in Mokama Area of Tal/Diara.

summers when oppresseive, dry 'loo' blows over the fields. The fact that the farmers of Barhiya-Mokama-Fatuha 'Tal' area often do not get a profitable, or even reasonable, price for their produce only adds to their woes. Surprisingly, there's no arrangement to buy at fair compensatory prices the agricultural produce of this "pulses bowl" .The government should tackle this problem to make the pulses and oilseeds production financially and economically viable for the farmers of this area. The development of a comprehensive irrigation system and ensuring electricity supply to this facilities-deprived stretch of land would not only lead to the development of this region, but also make it possible to grow two to three crops in each year.

Amid the rocking economic conditions of the country and our valiant march towards self-sufficiency in food, the Barhiya-Mokama-Fatuha 'Tal' area has a very important role to play. With the integrated development of the southern riverine stretch of Bihar. This region has the potential to turn into a greenary for the entire country. Taking steps to improve productivity and increase efficiency of cultivation in this area can lead Bihar towards self-sufficiency, in pulses and oilseeds. In order to provide a much needed feedback in the policy framework, present study planned to undertake this problem to study on adoption on Adoption of Gram Production Technology in Diara Land of Bihar with source of the outstanding objectives:

1.2 OBJECTIVE OF THE STUDY

The study was carried out with the following specific objectives:-

1. To assess the socio-economic profile of gram producer.
2. To explore the knowledge level of gram producers.
3. To analyse the extent of adoption of gram production technology by the producers.
4. To assess the constraints in adoption of gram production technology as perceived by them.
5. To suggest extension strategies for enhancing the gram production in Diara area of Bihar.

1.3 IMPORTANCE OF THE PRESENT STUDY

The scope of pulses and oilseeds production is having paramount importance in the north-eastern state of Bihar, especially in the riverine stretch to the south of the Ganga. The Barhiya-Mokama-Fatuha riverine stretch, of around 1,034 sq. km land area, covers parts of Patna, Nalanda, Lakhisarai, Munger and Sheikpura districts has immense potential for cultivation of pulses (Chana, Masoor, Matar, Khesari, etc.). and oilseeds (Sarso, Raai, Teesee, Tori etc) crops. It can boost the pulses and oilseeds

production in the riverine areas of Patna, Nalanda, Lakhisarai, Munger and Sheikpura districts as well as in Bhojpur, Bhagalpur and Sahibaganj districs of Bihar.Although Indian government had laid down a special pulses production scheme in 1955-56 under the joint effort of former Prime Minister Pt. Jawaharlal Nehru and Bihar's Chief Minister Dr. Shri Krishan Singh yet unfortunately, the Barhiaya- Mokama- Fatuha riverine area scheme was unable to take off in true spirit. Whenever, these riverine soils are highly fertile and appropriate for the production of pulses and oilseeds. Former Agriculture Minister of Bihar, late Kapildeo Singh has also tried to develop the Barhiya-Mokama-Fatuha riverine area.In the process borewells were dug, sluice gates were constructed and systemized, irrigation measures were adopted but at the end, despite his best efforts, the riverine area scheme could not be implemented positively because the efforts of the Centre and the state governments were disjointed. As a result, the production kept on declining with the pace of time. But after formulation of Agricultural Road Map,the area again got the attention by our policy planners in order to get the enhancement of pulses and oilseed production of state through adopting a strategy to exploit the vast potential of Tal/Diara areas.At present, a special plan has been formulated to develop the Tal and Diara Areas of Bihar under state plan fund.

1.4 LIMITATION OF THE STUDY

The present study was confined to the study on adoption of Gram production technology of the Diara land of Bihar taking the programme farmers as the respondents. Moreover, the study was conducted in only one block i.e. Mokama block of Patna district. Wider coverage was not possible due to shortage of time and resources at the disposal of the investigator. Though the student investigator utmost has taken every care to make the study more realistic in a very systematic way but while collecting data, possibility of some errors cannot be ruled out. During the study incorporating limited number of progressive farmer as the sample of study,restrict the generalization as it requires broad based sampling of the entire region.

1.5 ORGANISATION OF THE THESIS

The dissertation has been divided into five chapters. The first one deals with a brief introduction, the emergence and statement of problem, the objective along with its importance and limitation of the study. A review of relevant studies related with

the different variables under study is presented in the second chapter. This is followed by third chapter in which research methods and techniques which were applied during the study have been described. The interpretation of data and discussion of the result constitute the content of the fourth chapter. The implications of the findings and suggested areas for future investigation have also been given in the thesis alongwith summary and conclusion of the thesis as the last chapter The literature consulted and quoted in the thesis has been documented in a Bibliography section immediately after the chapter summary and conclusion. The applied interview schedule used for the study is placed at the end of the dissertation as the appendix.

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REVIEW OF LITERATURE

One of the important aspects of research is the review of past literature. The researcher has to review the concerning literature at every stage. It is not a one shot exercise but a continuous process, while going through the literature, the researcher gets acquainted with the subject-matter, techniques, materials and guide his efforts in desirable direction. Through review, researcher comes to know about the methods, procedures and techniques as well as results of past studies. It provides clues and guidance throughout the process. The efforts were made to compile research findings of the research studies possessing more or less similar in India and abroad related to adoption of agricultural production technology by the farmers under following heads:

2.1 To assess the socio-economic profile of gram producer.

2.2 To explore the knowledge level of gram producers.

2.3 To analyse the extent of adoption of gram production technology by the producers.

2.4 To assess the constraints in adoption of gram production technology as perceived by them.

2.5 To suggest the extension strategies for enhancing the gram production in Diara area of Bihar.

2.1 Socio-economic profile of gram producers.

Age

Pandit (1984) in a study of impact of lab to land program on adoption behavior of farmers in Munger district of Bihar, reported that there was no significant relationship between the adoption of recommended agricultural technologies of paddy, maize and mustard production and the age and family size of the adopted farmers.

Katarya (1989) reported that age of the farmers reflected negative and significant association with all the three categories of adoption scores and inferred that higher the age, lower will be the adoption.

Reddy & Bhaskaran (1989) in a study found that the extent of influence in terms of awareness, knowledge or adoption of improved practices varied with different categories of farmers and was found to he high in middle aged farmers.

Sharma et *al.* (1989) reported that the adoption of technology was comparatively more among farmers of middle age.

Supe *et al.* (1990) concluded that age of farmers had no relation with adoption behaviour of farmers.

Kumar (1993) reported in his study that age, caste, size of family, cropping intensity and irrigation index were not significantly associated with adoption of arhar production technology.

Narayana & Reddy (1994) studied the correlation of adoption of recommended technologies and found that age emerged to hold negative association with the adoption of crop technologies but it was not statistically significant.

Sengar & Saxena (1997) studied association of variables with adoption of improved farm technology in Baster district of Madhya Pradesh. The study revealed that the age emerged to hold negative but significant association with adoption of modern farm technology.

Sarkar *et al.* (1998) observed significant and negative association of age with the adoption of farm innovation.

Borker *et al.* (2000) reported that age of farmers had positive and significant association with the level of knowledge towards use of bio-fertilizers.

Gogoi *et al.* (2000) revealed that the majority of both trained (60%) and untrained (57%) respondents were of middle age group.

Saxena and Singh (2000) found that age had positive relationship with their adoption of organic farming practices.

Ranish *et al.* (2001) in the study conducted in villages of Hisar and Fatehabad tehsils revealed that age was negatively contributing to the adoption of rapeseed-mustard production technology.

Kumar (2002) revealed that the age of farmers had negative but significantly contributed with level of adoption. It means that young farmers were good adopters of new farm technology than aged one. Observations of Kumar (2003) and Mudgal (2003) revealed similar conclusions.

Singh *et al.* (2007) observed that most of the farmers were middle aged group (30-50) in both profile of the farmers.

Yomota and Tan-Cruz (2007) revealed that age is positively related with the rate of adoption. The result is contrary to what Roger (2003) stated that young farmers are more willing to adopt a new innovation than an elder one because they are more open.

Naik *et al.* (2009) concluded that the age were showing positive but non significant relationship with the knowledge level of respondents regarding organic farming practices.

Caste

Rai (1965) noticed that caste was related to adoption of improved practices. The adoption of fertilizer was highest in higher caste than the lower caste farmers.

Mundra & Batham (1967) reported that adoption of improved practices was higher in higher cast and lower in lower caste.

Pal (1970) found that the caste was positively and significantly associated with adoption of improved farm practices and package of practices.

Rauf (1984) mentioned that there was no significant association of caste of wheat growers with their extent of adoption of improved wheat practices in Morang-Sunsary Irrigation Project of Nepal.

Singh (1984) revealed that caste of farmers of valley and hilly regions of Manipur state did not influence significantly their adoption of scientific rice production practices.

Yadav and Gangwar (1987) reported that caste contributed significantly in differentiating the adopters from non-adopters. The study was conducted in Darbhanga district or North Bihar.

Sexena *et al.* (1990) in their study of Malwa Region found that caste and adoption behaviour of farmers were positively correlated.

Singh (1992) studied in Morsand villages of Pusa Block and revealed that caste was strongly associated with symbolic adoption of the respondent.

Kumar (1993) studied that caste was not significantly associated with adoption of arhar production technology.

Ranish *et al.* (2001) revealed that caste was non-significant and exerted positive influence on the adoption level of rapeseed-mustard production technology.

Kumar (2003) reported a positive but non-significant relationship between caste and adoption.

Education

Chand & Gupta (1966) reported that the innovators and early adopters in general were better educated. The coefficient between literacy status and adoption index was positive and significant. This showed that education added to innovativeness of farmers. Joon & Singh (1969) however, contradicted the above findings and reported that education was not the differentiating characteristics between adopters and non-adopters.

Supe & Salode (1975) found higher formal education developed more contact with source of information about modem farming practices and adoption of level of farmers.

Madalia & Rajwadi (1976) revealed that educational status of farmers and adoption showed positive relationship. In case of illiterate, the average adoption percent was 51.67: for farmers upto 7^{th} standard the adoption was 70.64 per cent. for farmers upto 11^{th} standard the adoption percent was 72.60 and it was 75 per cent for those who received college education.

Kulkarni & Patil (1984) reported that education was found to be an important factor influencing adoption behaviour of farmers and reported that there was a statistically significant relationship between education and adoption.

Pandit (1984) in a study conducted in Munger district or Bihar found that the adoption index of recommended agricultural technologies of paddy, maize and mustard production was positively and significantly correlated with the educational and social participation of the adopted farmers.

Jha (1988) reported that education was positively and significantly correlatcd with adoption of high yielding varieties of paddy.

Katarya (1989) concluded that higher the formal educational possessed by the farmers, higher would he the adoption of improved technology.

Sharma *et al.* (1989) reported that there was no definite trend of adoption with respect to educational level of farmers.

Saxena *et al.* (1990) in their study conducted in Malwa-region reported that educational status of a farmer and adoption were found to be positively and significantly correlated.

Supe *et. al.* (1990) asserted that there was significant relationship between adoption and education. This factor affected the adoption behaviour of dryland farmers.

Narayana & Reddy (1994) analyzed the correlation of adoption of recommended technologies and noted the level of formal education was related to the level of education, but its correlation value was not significant.

Sengar & Saxena (1997) reported the existence of positive and significant association of education with adoption of improved farm technology.

Malik & Arya (1998) found that farmer's education was influential motivating them to adopt the crop production technology.

Sherpa *et al.* (1998) concluded that education of the head of household had a significant impact on adoption of agricultural technology.

Waman (1998) studied adoption of onion production technology and its correlation found that level of education significantly influenced the adoption behaviour.

Singh (2000) reported that education of beekeepers had positive and significant association with level of adoption. He further revealed that level of adoption of honey production technologies increased with increase in educational level of beekeeper.

Borker *et al.* (2000) revealed that the highly significant association seen between education of the farmers with their knowledge level of bio-fertilizers.

Saxena and Singh (2000) was observed that the education had positive relationship with their adoption of organic farming practices

Ranish *et al.* (2001) reported that education was highly significantly correlated with the adoption of rapeseed-mustard production technology.

Kumar (2002) in his study reported that education was positively and significantly correlated with extent of adoption.

Kumar (2003) reported a positive and highly significant relationship between education and adoption.

Mudgal (2003) in his study reported a positive and significant relationship between education and adoption in all category of farmers.

.Singh *et al.* (2007) observed that large numbers of respondents were educated up to middle and high and above 33 percent in both categories of the respondents.

Yomota and Tan-Cruz (2007) reported that farmers were having higher level of education who willing to fully adopt organic farming.

Dhruw (2008) observed that the maximum number of respondents were found to be educated up to primary school 35.83 per cent followed by 25.00 per cent of the respondents who educated up to middle school where as 20.83 percent respondents were illiterate .

Ramesh and Santha (2008) reported that education was found a have a positive and significant relationship with adoption of the respondents. The farmers with higher education would have easily understood the environmental pollution due to application inorganic farming.

Occupation

Singh *et al.* (1985) reported that the socio-personal and economic variables i.e. education, social participation, occupation and total milk production important factors for adoption of dairy innovation.

Singh and Singh (1988) revealed that the effects of family main occupation on the adoption rate of A.I. in buffaloes was significant.

Rahman *et al.* (1990) shared the opinion that occupation was significantly related with the family who occupation agriculture as their main occupation.

Family-size

Ola (1977) found that family size had positive association with the level of adoption of technologies of paddy demonstrated in National Demonstration.

Gaurha & Pyasi (1983) noted a positive correlation between size of family and extent of adoption of farm technologies by demonstrating farmers. In case of non-demonstrative farmers, this relationship was negative.

Shakya & Flim (1986) found that adoption of modern rice production technology was not related with family size.

Kunzru *et al.* (1989) reported that adoption of green fodder production technology was significantly but negatively correlated with the family size.

Saxena *et al.* (1990) found that the size of the family had no association with acceptance of technology.

Sengar & Saxena (1997) found existence of a negative and significant association between the size of family and adoption of improved farm practices.

Sherpa *et al.* (1998) reported that size of family had a significant bearing on adoption of agricultural technology by the farmers.

Ranish *et al.* (2001) revealed that family size was negatively contributing to the adoption of rapeseed mustard production technology.

Kumar (2003) concluded negative but non-significant relationship was found between size of family and adoption.

Yomota and Tan-Cruz (2007) observed that number of house hold members involved in farming positively and significant factor that affect the rate of adoption.

Annual Income

Vishnoi and Bose (1961) reported that there was no association between family income and a gain in knowledge of new technology.

Rauf (1984) revealed that significant and positive correlation between family income and adoption.

Singh (1984) indicated significant and positive relation between gross family income and use-adoption in case of valley farmers. This relationship was positive but non-significant in case of hilly farmers.

Tantray & Abdul (1987) concluded that most of the innovations in the study area were accepted by the farmers who were economically sound.

Yadav & Gangwar (1987) found that income of previous year was the most important factors, which affected the adoption of new rice technology.

Katarya (1989) reported that income was positively and significantly, related to the adoption.

Kunzru *et al.* (1989) found that adoption of green fodder production technology was positively and significantly correlated with annual income.

Phadtare *et al.* (1990) concluded that annual income of the respondent was statistically significant with the level of adoption.

Bhatkar *et at.* (1997) reported that family income of sugarcane growers was found to be positively correlated with adoption of recommended package of practices of sugarcane cultivation.

Kumar (2000) studied on Acceptability of Fertilizer Technology in Rice Crop in Gaya District and found that family income was significantly related with the adoption.

Kumar (2003) while studying adoption behaviour of banana growers in Vaishali. Bihar reported family income has a positive and significant relationship with adoption.

Gogoi and Phukan (2000) stated that income showed significant association with the extent of adoption of improved rice cultivation practices. The highest percentage of non-adoption belonged to middle and low-income group, respectively.

Deshmukh *et al.* (2007) observed that the annual income and found that priority of respondents (81.59%) fall under medium level of income having Rs. 1,001 to 37,000 per annum.

Dhruw (2008) found that the maximum (40.83%) numbers of the respondents were having annual income between Rs. 20,001 to 40,000.

Size of land holding

Joon & Singh (1969) observed that size of land holding was found to be significantly and positively associated with the adoption of high yielding varieties.

Nirmala & Manoharan (1977) found clear-cut influence of size of holding on the adoption level of improved farm practices.

Ola (1977) concluded that farm size had positive association with level of adoption of technologies of paddy demonstrated in National Demonstration.

Pandit (1984) reported that the used adoption index of recommended agricultural technologies of paddy. Maize and mustard production was positively and significantly correlated with the size of land holding of the adopted farmers.

Shakya & Flim (1986) found that adoption of modern rice production technology was not related with farm size.

Jaiswal *et al.* (1987) reported that big farmers mostly adopt all practices where as medium farmers adopt only depth of sowing, fertilizer application and number of irrigation, and small farmers adopt only harvesting and spacing row to row method as compared to other practices.

Jaiswal & Dubolia (1990) found that the farmers having medium size land holding adopt the technology to the maximum extent.

Saxena *et al.* (1990) reported that size of land holding was highly correlated with adoption of wheat technology.

Supe *et al.* (1990) reported that there was a significant relationship between and size of land holding and the adoption behaviour of dryland farmers.

Kumar (1995) observed that as the size of holding increases there was definite sign of more adoption of recommended rice technology.

Singh (1995) found that the farmers of large size holding were better adopter of modem rice cultivation practices vis-a-vis marginal and small categories of farmers.

Bhatkar *et al.* (1997) concluded that land holding of sugarcane growers was significant and positive relationship with adoption of recommended package of practices of sugarcane cultivation.

Sujata & Annamali (1998) analyzed the differential adoption behaviour and the characteristics of farmers. The study brought to focus that farm size was positively and significantly associated with adoption behaviour.

Waman *et al.* (1998) studied on adoption of onion production technology and its correlation and reported that size of family had significantly influenced the adoption behaviour.

Borkar *et al.* (2000) revealed that size of holding had positive and significant relationship with level of knowledge. They further reported that with increase in size of holding, the amount of knowledge also increases.

Borkar *et al.* (2000) observed that land holding of the farmers was found significantly associated with knowledge level of bio-fertilizers.

Gogoi and Phukan (2000) revealed that a high degree association was found between size of land holding and extent of adoption in improved rice cultivation.

Ranish *et al.* (2001) revealed that land holding was highly significantly correlated with adoption of rapeseed-mustard production technology.

Kumar (2002) reported that size of holding found to contribute positively towards extent of adoption but the beta coefficient were not found significant statistically.

Kumar (2003) reported that size of land holding has a positive and highly significant relationship with adoption of banana production technology.

Dhruw (2008) stated that the maximum (37.50%) number of the respondents had small size of land holdings (1 to 2 ha.)

Patel (2008) stated that most of the respondents (30.66%) had small (1 to 2 ha.) sized land holding.

Credit Orientation

Limije (2000) observed that significant and positive correlation between the credit facilities with the adoption of soyabean production technology.

Saxena and Singh (2000) observed that the no. of animals had positive relationship with their adoption of organic framing practices.

Verma *et al.* (2000) found that extent of knowledge and awareness about improved production technology of soybean were positively and significantly related with adoption level.

Ranganath *et al.* (2001) found that numbers of animal were having non-significant relationship with the adoption of organic framing practices.

Mukim (2004) indicated that the majority of respondents (96.09%) acquired the credit and credit acquisition had positive and significant association with the adoption of sunflower production technology.

Mishra (2006) reported that credit acquisition had a non-significant relationship with extent of adoption of recommended sugarcane production technology.

Svotwa *et al.* (2007) reported that the problem having with small flock of livestock could be a great set back to the success of organic farming as cattle are mostly the source of organic manures.

Deshmukh *et al.* (2007) observed that majority of respondents had medium (79.51%) extension contact.

Marddl *et al.* (2007) found that extension contact was positively and highly significantly correlated with adoption level of sustainable sugarcane cultivation practices.

Dhruw (2008) found that the maximum (61.66%) number of the respondents had medium level of contact with the extension contact. The farmers generally contacted the RAEO's / Gram Sevaks and other Extension Personnel Weekly, for information and guidance about recommended maize production technology.

Dhruw (2008) indicated that the majority of the respondents (50%) had taken loan form Nationalized bank.

Ramesh and Santha (2008) revealed that the farmers who had more livestock got more organic manure resulting with higher adoption.

Social-partcipation

Kulkarni & Patil (1984) reported that there is a positive and significant association between the farmer's social participation and their adoption. The percentage of high adopters was more in case of farmers having high social participation score. It can, therefore, be concluded that more the social participation of the farmers in voluntary organization more was the adoption level and vice-versa.

Pandit (1984) reported that the use of adoption index of recommended agricultural technologies of paddy, maize and mustard was positively and significantly correlated with the social participation of the adopted farmers.

Verma (1989) found that social participation was significantly associated with knowledge about skill and adoption of rice production technology.

Supe *et al.* (1990) reported that there was significant relationship between adoption and social participation.

Kumar (1993) revealed that social participation had positive and highly significant association with adoption of arhar production technology.

Verma *et al.* (2000) found that extent of knowledge and awareness about improved production technology of soybean were positively and significantly related with adoption level.

Ranish *et al.* (2001) reported that social participation was negatively contributing to the adoption of rapeseed-mustard production technology.

Kumar (2003) reported social participation was highly significantly and positively associated with adoption.

Shrivastava and Lakhera (2005) found social participation to have positive and highly significant relation with the level of perception on utility and coverage as perceived by trainees.

Deshmukh *et al.* (2007) observed that majority of respondents had medium (79.51%) extension contact.

Marddl *et al.* (2007) found that extension contact was positively and highly significantly correlated with adoption level of sustainable sugarcane cultivation practices.

Dhruw (2008) found that the maximum (61.66%) number of the respondents had medium level of contact with the extension contact. The farmers generally contacted the RAEO's / Gramsevaks and other extension personnel weekly, for information and guidance about recommended maize production technology.

Patel (2008) concluded that the respondents has no membership in any organization (42.68%) including very poor social participation.

Ramesh and Santha (2008) revealed that positive and significant relationship was observed between social participation and extent of adoption of farming practices by the respondents

Mass-media used

Gupta *et al.* (2003) indicated that electronic media, television and radio were mostly used and preferred for seeking information or agriculture and development.

Mazher *et al.* (2003) revealed that a significant proportion of small farmers (70.00%) gathered information through their fellow farmers and progressive farmers and large farmers (20.00%) got information about sugarcane production technologies through the agriculture department (extension wing) and the research institute. While (10.00%) to (20.00%) percent large farmers gathered though mass media (radio, television and printed material etc.)

Deshmukh *et al.* (2007) observed that the majority of the respondents were utilizing the village leaders as source of information.

Maraddl *et al.* (2007) shows that attitude towards sustainable cultivation practices of the respondents had significant contribution influencing the extent of adoption of sustainable cultivation.

Pandit *et al.* (2007) observed that attitude of farmers towards sericulture showed positive and significant relationship with the adoption of mulberry cultivation and silkworm rearing.

Ramesh and Santha (2008) found that higher information source utilization by the respondents would have helped them to accept the practices to higher level.

2.2 Acquisition of knowledge related with gram producers.

Singh (1983) in his study of farmers behaviour towards modern pulses technology in adopted village of Phulwarishariff block of Patna district revealed that the adopted farmers in general possessed more knowledge about modern pulses technology than non-adopted farmers.

Pandit (1984) reported that adopted farmers under Lab-to Land program were found superior in their level of knowledge as compared to non-adopters.

Ashby (1987) study revealed that variability of a technology under farm conditions and its acceptability to farmers is determined many factors both technical and non-technical. He further observed, knowledge component influence the acceptability to great extent because of its inherent influence on farmers ability to manipulate other factors of production optimally.

Kumar (1989) in a study conducted in a Gaya district of Bihar reported that 67 per cent of the farmers possessed low 33 per cent medium and non of the farmers possessed high and very high level of knowledge about oilseed production technology.

Singh (1992) in a study of Morsand village under Pusa Block found that there was a wide variation in knowledge level possessed by respondents as a result of the front line demonstration. The study further revealed that 20.54 per cent of respondents did not have any knowledge about Rajmash production technology, 9.82 per cent had low knowledge, 60.71 per cent had high knowledge and 8.93 per cent had very high knowledge. In the very first year the front line demonstration made a favourable impact on the knowledge gained by the respondents.

Kumar (1993) in a study revealed that a maximum of 51 per cent of the respondents were having low level of knowledge and only 3 per cent of the respondents had medium level of knowledge of arhar production technology.

Prasad (1993) found that knowledge about technology was as an important contributor towards adoption level of technology and crop production.

Kumar (1993) found level of knowledge as an important contributors towards the symbolic and option of farmers of the experimental group. The direct effect and correlation coefficient was found to be at par with each other. But, knowledge did not emerge as dominating factor in case of farmers of the control group because the direct effect was low and r value was also non-significant.

Singh and Gill (1993) found knowledge as one of the most important factors related to adoption of various package of practices, while reviewing the findings of adoption researches.

Kumar (1995) in his study of productivity associates factors in Gaya District of Bihar also observed that knowledge and productivity of rice was positively and significantly associated with each other. The regression analysis carried out to measure the contribution of the selected variables also confirmed that beta coefficient was highly significant and of relatively high magnitude in comparison to other variables included under the study.

Senger and Saxena (1997) also reported close and significant association of knowledge with the level of adoption of improved crop practices in their study conducted in Bastar District of Madhya Pradesh.

Deshmukh *et al.* (1997) reported very strong, positive and highly significant association between knowledge and adoption of improved farm practices related with summer groundnut cultivation in Maharashtra state.

Malik and Arya (1998) while analyzing the impact of different farmer's traits on adoption of technology found that technical know-how was one of the influential factor affecting the adoption of production technology.

Meena and Malik (2000) studied knowledge and extent of adoption of improved fodder cultivation practices of farmers belonging to different land holding categories in Karnal district of Haryana State. They reported that farmers had adequate knowledge and extent of adoption regarding sowing time, seed rate and land preparation. Low adoption levels were found for weed control and plant protection. Knowledge showed a highly significant positive relationship with extent of adoption of improved fodder cultivation practices.

Chandrakala and Eswarappa (2000) revealed that 58 per cent of farm women labourers had high knowledge level followed by medium (21 %) and low (21 %) level of knowledge of improved dairy management practices.

Kumar (2000) revealed that majority of farmers i.e. 58 per cent were in high knowledge category followed by 27 per cent in medium knowledge category.

Ankulwar *et al.* (2001) reported that the majority of the respondent (73 %) had medium level of knowledge followed by 17 per cent and 10 per cent respondents had low and high level of knowledge respectively towards sunflower practices in Latur Districts.

Verma *et al.* (2000) reveled that the per cent (100.00%) soyabean growers had knowledge about improved variety and intercultural operations (97.22%). The practices like seed treatment and use of Rhizobium and PSB culture were known to more than 50.00 per cent of the farmers but the major factor responsible for the lower yield were lack of use of quality seed 37.22% per cent imbalanced use of fertilizers 34.44% and use of FYM 20.00% besides that poor or less management of diseases 12.775, weed 15.55% and insect pest 31.11% were observed respectively.

Kumar (2002) reported that majority of farmers had medium level of knowledge (53.75%) followed by low (31.25%) and high (15.00%) level of knowledge towards boro rice production technology. Further to report that the level of knowledge of farmers in different components of boro rice production technology was highest in land preparation (77.50%) followed by use of cold tolerant varieties (67.50%) and lowest in plant measures (22.50%).

Shakaya *et.al.* (2008) reported that chickpea grower had poor knowledge about soil treatment that high yielding varieties and bio-fertilizer, while majority of had knowledge about critical silage of irrigation. The majority of the respondents had awareness regarding recommended doses of manures and fertilizer, and psychological factors had significant positive relationship with knowledge level of chickpea grower except age land holding and farm mechanism compulsions attributes towards chickpea production technology indicated effect on knowledge of chickpea grower.

Sidram (2008) reported that majority of the respondents (63.33%) had medium level of knowledge about organic pigeon pea farming practices.

Patel (2008) found that maximum (74.00%) of the respondents had medium level of knowledge regarding recommended soybean production technology.

Naik *et al.* (2009) observed that organic farming practices are new to the farmers and hence, the knowledge level was low about the most of the practices.

2.3 Extent of adoption of gram production technology by the producers.

Since adoption is very important area of extension research, there are good volumes of literature available covering different aspects of adoption especially after advent of exotic varieties and production technologies on the production scene and sincere efforts of change agencies for transfer of generated technology to the users. In this section, attempt has been made to review such studies of recent past which were concentrated in the area of different components of crop production technology.

Jaiswal *et al.* (1970) reported that level of adoption of high yielding varieties of the respondents were below 50 per cent of the cropped area this was mainly due to security orientations.

The Monitoring Survey Report of Directorate of Agriculture, Rajasthan (1983) revealed that there were variation in the extent of adoption of mung production technology. It was found that only 2 per cent contact and 3 per cent non-contact farmers adopted seed treatment in paddy. Fifty two per cent contact farmers and 47 per cent non-contact farmers used improved seed of pulses. The survey further, indicated 47 per cent contact farmers and 53 per cent non-contact farmers adopted proper seed rate of paddy 40 per cent contact farmers and 32 per cent non-contact farmers had adopted top dressing. Timely weeding and hoeing were done by 31 per cent contact famlers and 30 per cent non-contact farmers, whereas plant protection measures were adopted by 31 per cent contact farmers and 28 per cent non-contact farmers.

The Monitoring-cum-Evaluation Survey Report of Department of Agriculture, Bihar (Kharif 1983-84) revealed that the major components of the Chick pea production technology were not adopted fully as per recommendation by both the contact and non-contact farmers. The report brought to sharp focus that 72 per cent contact farmers had fully adopted the recommended seed rate. In case of non-contact farmers, 62 per cent adopted fully, 26.4 per cent partially and 11.6 per cent did not adopt the recommended seed rate. The findings further revealed that 37.7 per cent contact farmers and 32.3 non-contact farmers had applied full dose of nitrogen, 49.8 per cent contact farmers and 40.1 per cent non-contact farmers had given partial dose of nitrogen and 15.5 per cent contact and 28.1 per cent non-contact farmers did not apply nitrogen at all. As regards the case of phosphatic fertilizers, 24.3 per cent contact and 18.1 per cent non-contact farmers had given full dose of phosphate, 47.7 per cent contact and 41.0 per cent non-contact farmers had applied partial dose and 25.9 per cent contact and 41.8 per cent non-contact farmers did not apply phosphatic

fertilizer at all. In case of potassic fertilizers, 15.7 per cent and 11.9 per cent farmers had applied full dose of potash, 40.4 per cent contact farmers and 37.1 per cent non-contact farmers did not apply potash at all. The survey further revealed that 27.1 per cent contact farmers and 17.3 per cent non-contact farmers had adopted seed treatment.

Rai (1985) reported that the average level of adoption of new production technology of the mustard variety 'Varuna' by the farmers in seven adopted villages around Dholi campus of R.A.U., Bihar was 36.77 per cent. The level of adoption for the two non monetary inputs (like time of sowing and seed treatment) was 46.5 per cent and for the monetary inputs (like fertilizer usage weed control, input control, disease control and the use of irrigation water) was 32.7 per cent.

Kumar (1986) reported that cent-percent contact farmers and non-contact farmers had adopted seeds of high yielding varieties of rice. Cent-per cent contact farmers had adopted the recommended seed rate whereas in case of non-contact farmers only 38.70 per cent had adopted recommended seed rate. Sixty per cent of contact farmers and 49 per cent of non-contact farmers had applied all the three nutrients, namely N, P and K. The per hectare use of NPK of contact farmers was 49.76 kg, 32.60 kg and 21.50 kg respectively. In case of non-contact farmers the per hectare use of NPK was 32.87 kg, 20.06 and 18.76 kg respectively. As regards plant protection measures 33.30 per cent contact farmers and 27.75 per cent non contact farmers had adopted spraying.

Jaiswal *et al.* (1987) observed that the adoption level of recommended wheat production technology in Bundalkhand region was 74.56 per cent. They further reported that seeds of improved varieties had been adopted by all the farmers irrespective of this categories 75 per cent adopters have adopted seed rate method or sowing and depth or sowing. They further reported that practices whose adoption ranged between 50 to 75 per cent were: Ploughing, time of sowing, spacing, fertilizer application, seed treatment, weed control measures and irrigation. The practices whose adoption ranged from 25 to 30 per cent were: soil treatment and soil testing. The practice whose adoption was less than 25 per cent was disease control measures.

Verma (1987) observed that the respondents had partially adopted the package of practices of sugarcane and they had also diluted the recommended dose.

Sreenivasula *et al.* (1988) found that majority of the respondents were non adopters with respect to the recommended practices such as seed treatment, chemical fertilizers and plant protection measures.

Singh (1988) in his study observed that cent-per cent contact farmers and 75 per cent non-contact farmers were using high yielding varieties of rice seeds. A relatively higher percentage of the contact farmers had adopted low cost technology, namely, seed treatments, bio fertilizers like algae and azolla and zinc sulphate than non-contact farmers. He further reported that average dose of nitrogen used per hectare was 47.74 kg and 25.56 kg by contact and non-contact farmers respectively as against recommended 60 kg N/ha. The average quantity of phosphorus used per hectare was 26.40 and 18.36 kg by contact and non-contact farmers as against recommended dose of 40 kg/ha. The average quantity of potash use was 11.14 kg and 7.30 kg by contact and non-contact farmers as against recommended 30 kg/ha.

Kumar (1989) in his study of Gaya district of Bihar in relation to oilseeds production technologies found that 97 per cent of the farmers had low level of adoption and only 3 per cent had moderate level of adoption and concluded that the level of adoption of oilseed production technology in the area of investigation was low.

Sivanarayana and Reddy (1993) reported that all the recommended practices of mung production technology were not fully and uniformly adopted by small and marginal farmers. This could be evidenced, perhaps, on account of differential perception on the part of farmers with respect to the nature of technologies as fast moving or slow moving with implications of relative advantage. Compatibility, complexity and simplicity embodied in them.

Gupta and Sood (1993) analyzed the technological gap on the production of paddy in Kurukshetra district of Haryana State in case of contact and fellow farmers. The study revealed that contact farmers had an overall technological gap (40.20 per cent whereas the fellow farmers had a technological gap of 47.75 per cent. Thus, the study suggested that contact farmers had a higher rate of adoption than the fellow farmers. It was further revealed that 30.83 per cent contact farmers were in low gap group, 54.17 per cent in the medium and 15 per cent were in high gap group, whereas 7.50 per cent of fellow farmers in low gap group, 68.50 per cent in medium and 24 per cent were in high gap group.

Kumar (1993) in his study found that level of adoption of arhar production technology among farmers varied between very low to medium. A maximum of 74 per cent and a minimum of 2 per cent of the respondents had very low and medium level of adoption respectively. He also indicated that technology related to plant protection were not being adopted by almost all the farmers. None of them had treated arhar seeds with rhizobium culture. A majority of farmers were not using recommended varieties of arhar seed.

Pandya and Vekaria (1994) reported low to high level of adoption of banana production technology with a maximum of 52 per cent respondents in medium level of production.

Dash and Das (1996) studied the adoption of pulses production technology in the State of Orissa. The findings revealed that there existed wide variation in the level of adoption of different package of practices by farmers. Farmers were found to adopt fertilizer in a better way than other components. Seed treatment was attached with least preference in the level of adoption. Rank order of the package of practices further revealed that the plant protection aspects were also found at the bottom level of adoption by the farmers.

Pochaiah *et al.* (1997) conducted item analysis of the adoption of wheat production practices. The study revealed that majority paddy farmers have adopted fully the production practices viz., planting of two-three seedlings per hill (80%), puddling with paddy pudler (68.3%) and transplanting 20-25 days old seedlings (66.7%). Application of plant nutrients NPK were partially adopted by cent-per cent farmers under study. However, the extent of adoption was more in nitrogen, followed by phosphorus and potash. This trend was visible with almost all the farmers. The seed rate of wheat was also adopted partially because 75 per cent farmers were found not using the recommended seed rate.

Naika and Nagabhushanam (1997) conducted a study to analyze the extent of adoption of crop technology in Eastern zone of Karnataka with 215 farmers as a sample. The study noted variation in extent of adoption of crop technologies. Majority of farmers have followed variety, seed rate and time of sowing and spacing. Farmers were found using nitrogen better than phosphorus and potash. On an average 12 per cent were found using potash. The extent of adoption of plant protection measures was partial because of its high cost and non-availability in time. However, the farmers

were found convinced of the benefit of plant protection measures in protecting the crop from possible damage caused by pests and diseases.

Devi and Manoharan (1997) reported that there existed wide variation in the level of adoption of various components of crop production practices. Results of the study also revealed that cent-per cent adoption was in variety, time of sowings application of farm yard manure and insect-pest control. Medium level of adoption was found in case of mulching and selection of seedlings. None of the respondents, however, applied weedicides in the field.

Bhatkar *et al.* (1997) in their findings revealed that almost all respondents (93.33%) adopted improved variety of crop on their farm. It further indicated that majority of farmers adopted improved cultivation practices viz., earthing up (64%). spacing (73%) and control of diseases (54%). As much as 42 per cent farmers adopted the treatment of seeds with fungicides. An overall analysis of distribution of respondents across of the level of adoption portrayed that majority of farmers (64%) were mediocre in adoption of the recommended crop practices. Only one fifth of the farmers had high level of adoption, whereas the percentage in low adoption category was found to be meager (15.33%).

Krishnamurthy *et al.* (1998) in their study on extent of adoption of recommended practices observed that 100 per cent of the respondents followed the simple practices like sowing time, variety, seed rate and time of harvest. Ninety per cent of farmers were following the practices like application of nitrogenous and phosphatic fertilizers whereas in case of potash their percentage was computed to the level of 82 per cent only. The important practices like chemical weed control and chemical plant protection measures were followed only by 11 and 16 per cent of farmers respectively. The practice seed treatment was adopted by only 3.84 per cent of farmers.

Padmaiah *et al.* (1998) conducted the study to analyze the adoption behaviour of farmers with respect to improved production practices in Mahabubnagar district of Andhra Pradesh. The study revealed wide gap in adoption of production practices between the farmers of Model watershed and non watershed areas. The farmers of watershed area were found to belong to high adoption category of adoption of recommended improved production practices. High score of adoption of recommended practices were mainly because of sincere and concerted efforts made by the watershed staffs in order to optimize production in watershed area.

Nagabhushanam and Karthikeyan (1998) studied the pulses yield pattern of progressive and non-progressive farmers and found that progressive farmers had adopted almost all the recommended package of practices in comparison to the non-progressive farmers. The yield gap was narrow in case of progressive farmers.

Jayalakshmi and Algesan (1998) found that fertilizer application and plant protection measures farmers did not adopt any other recommended technologies in a big way. However, there were difference in the level of adoption among different categories of farmers. Among small and medium farmers, higher adoption level was noticed with small farmers with respect to improved varieties, farm yard manure application, inorganic fertilizer and plant protection chemicals application. For medium farmers, high adoption level was obtained with seed treatment using fungicides. The adoption level generally in big farms was comparatively lesser which is might be due to negligence on the technology adoption with increase in area and also to avoid risk.

Bople *et al.* (1999) concluded that those practices involving least cost, skill and adequate availability of input in local setting were adopted by majority and the variable infrastructure facilities and sources of information were comparatively more important in adoption of integrated pest management (IPM) technology in cotton.

Waman *et al.* (2000) reported that a majority of onion growers had a medium level of adoption of the recommended onion production technology. They also reported that the level of education, size of family, interest in modern farming and sources of information were found to be significantly influence adoption behaviour.

Chandrakala and Eswasaffa (2000) showed that 42 per cent of the farm women labourers had medium level of over all adoption followed by low (32%) and high (26%) level of over all adoption.

Kumar (2000) reported that majority of farmers, as to say 48 percent, were having medium acceptability of fertilizers technology in relation to pulses crop.

Senkondo *et al.* (2000) reported that farming appreciation of rainwater harvesting as a factor contribution to increased crop yield was positively and significantly explaining the intensity of adoption of rainwater harvesting. This suggests that higher yields attained with the use of rainwater harvesting techniques will encourage adoption of the techniques.

Ankulwar *et al.* (2001) concluded that in case of adoption of recommended package of practices of sunflower, reported that majority of the respondents (73%)

had medium level of adoption followed by 17 per cent, 11 per cent respondents had low and high level of adoption, respectively.

Ansari and Sinha (2001) concluded that majority of the farmers trainees had medium level of symbolic adoption in respect to lentil production technology and multiple regression analysis revealed that the three variable namely risk preference, education and size of holding contributed significantly in symbolic adoption.

Kumar and Athimuthu (2001) reported that nearly two thirds of the rice growers (65 %) belonged to medium adopters categories followed by low adopters to the extent of 23 per cent and the rest 12 per cent fell under high level of adopters.

Dhamodaran and Vasanthakumar (2001) reported that farm size had shown negative and significant relationship with extent of adoption. Increase in farm size decrease the extent of adoption possible due to difficulties of supervision.

Ranish *et al.* (2001) study conducted in villages from Hisar and Fatehabad tehsils and indicated that 68.42 per cent small farmers have medium level of adoption followed by 31.58 per cent in low level. In the medium farmers category 71.42 per cent had medium level of adoption followed by 14.29 per cent each from high and low level of adoption, respectively. In large category of farmers 54.24 per cent had medium level of adoption followed by 32.20 per cent having high level and 13.56 per cent had low level of adoption.

Resmy *et al.* (2001) study conducted in Alappuza district in Kerala revealed that 36.6 per cent of the farmers had high level of overall adoption of sustainable coconut and banana cultivation practices closely followed by medium (35.8%) and low (27.3%) level of adoption. They, further revealed that majority of small farmers (51.6%) had medium level of adoption there was white majority of big farmers (53.3%) had high level of adoption. They also reported that in case of banana more than 60 per cent of small and big farmers fully adopted some practices like selecting the planting material and rhizome treatment partial level of adoption in practices like selection of varieties for intercropping, selection of suckers at proper age, method of planting sucker quality of compost to be applied.

Sahu *et al.* (2010) reported that KVK's area playing vital role across the rural economy in area diverse as animal husbandary, horticulture, plant protection and food processing. KVK's role in these section is crucial as its is ideally placed to disseminate field total proven technology location specific problem and concerns on

the providing natural socio-economic condition, needs and priorities in this study extent of adoption of selected improved cultivation practices of wheat production technology.

Singh *et al.* (2011) reported that socio economic and psychological characteristics of cluster bean grower and to explore the relationships between selected characteristics of the farmers and extent of adoption. Data were collected through interviewing during the year 2008 from randomly selected of Bikaner and chum district of Rajasthan with the sample size of 316 respondents they were cultivation of cluster bean for last 5 years. Results indicated that more than half of the respondents were in age from 14 and above 56 years medium level of land holding.

Chote and Borkar (2000) revealed that the majority of farmers (42.00%) had medium level of adoption, followed by high and low categories.

Ranganatha *et al.* (2001) reported that approximate half of the farmers (49%) were medium adopter, while 30 per cent of them were low and high adopter of organic farming practices in rice cultivations.

Khan *et al.* (2002) found form the study that majority (70.00%) of rice grower had medium level of adoption of eco-friendly technologies (EFTs).

Ramesh and Santha (2002) observed that extent of adoption of all the organic farming practices was generally higher among the farmers, especially in water management, land preparation and storage practices.

Wasnik and Bhaskar (2004) concluded that there was a low adoption of eco-friendly cotton cultivation practices in the watershed area due to lack of proper understanding, realization and perception of farm families about eco-friendly cotton cultivation practices.

Thoke and Gunjal (2010) reported that the impact of the Front Line Demonstration on adoption behaviour of the farmers, the present study was planned and conducted. Looking to this fact, the present study was undertaken on a purposive sampling of 112 chickpea growers of Khadak Malegaon Village of Niphad tehsil of Nasik District of Maharashtra with the objectives to study the personal and socio-economic profile and to ascertain the level of adoption chickpea growers. The study reveals that most of the respondents were from middle age group i.e. between 26 to 45 years, received education up to Higher Secondary, size of land holding between 4.01

to 7.00 acres. Majority (54.46 per cent) of chickpea growers were having farming experience between 9 years to 17 years, having medium social participation and annual income between Rs. 75,551 to Rs. 1,50,765. Most of the respondents (60.72 per cent) were having their land at 2-3 places. The study on adoption indicated that, the majority of chickpea growers (70.54 per cent) had medium level of adoption. It can be stated that the level of adoption of the chickpea cultivation practices by majority of the chickpea gram growers was satisfactory.

Jaisridhar *et al.* (2012) found that Study on "Adoption and Marketing behaviour of Maize growers", aimed to bring out a strategy to increase the adoption level of maize growers. The study was undertaken at three blocks viz. Udumalpet, Pollachi and Palladam blocks of Coimbatore district in Tamil Nadu. The analysis of extent of adoption indicated that the most favorable season for sowing was adopted by most of the farmers (54.44%). Majority of the farmers followed all the maize field practices like basal urea application (61.11%), top dressing (60.00%), micronutrient application (46.70%), seed treatment (34.50%), weed crop protection (78.90%) and water management (74.40%). Most of the farmers in the study area (53.33%) harvested the produce only when the seeds became dry and hard. The analysis of marketing behaviour indicated that the farmers sold the cobs in nearby town transporting through tractor. Study also indicated that one half of the respondents sold the entire harvested produce immediately after harvest through wholesalers. Majority of the farmers did grading and weighing before marketing the produce. Most of the farmers did not follow the storage pest protection measures. The nieghbour farmers living in the same village were the main sources of information to the vast majority of maize growers. The crucial characteristics of the maize growers towards marketing behaviour were educational status, socioeconomic status, extension agency contact, storage facilities, market perception and market potential indication.

Rombade *et al.* (2011) reported that about, seventy per cent and eighty five per cent area in India and Maharashtra comes under rainfed farming, respectively. It is an urgent need to exploit the new avenues to increase the production from rainfed areas by adopting modern technology. It is generally observed that only 30 to 40 per cent of modern technology is adopted by fruit growers. There is dearth of research studies on the aspect of adoption level of recommended package of practices of kagzilime. Majority of the respondents (44.16 per cent) adopted the advocated

kagzilime cultivation practices to a medium extent. The characteristics like education, social participation, source of information, knowledge, socio-economic status, annual income, were positively and significantly related with adoption of kagzilime production technology.

Maraddl *et al.* (2007) revealed that 63.33 per cent of the respondents belonged to medium over all adopter category followed by low (26.67%) and high (10%) adoption categories.

Pandit *et al.* (2007) observed that majority of the farmers were found be medium level adopter both in mulberry cultivation (45.83%) as well as silk rearing (68.75%).

Singh *et al.* (2008) recorded that the majority of respondents were medium level adopters of vermi culture technology and there was tremendous adoption gap among farmers which needed to be bridged by various means of extension.

2.4 Constraints in adoption of gram production technology as perceived by them.

Behra and Sahoo (1975) observed that main reasons for adoption or partial adoption of package of practices of pea were lack of finance, non-availability of inputs in time and lack of technical knowledge. Ray (1976) reported that low spread of high yielding variety of paddy were due to lack of irrigation facilities and farmers unawareness about advantages of high yielding varieties. Singh (1983) revealed that reasons for partial adoption of high yielding variety paddy cultivation may be largely attributed to inadequate practical skills by farmers and non-availability of inputs in time. The monitoring Survey Report of Directorate of Agriculture, Rajasthan (1983) reported that most important constraints in adoption of high yielding varieties pulse were high cost, shortage of labour, non-availability of inputs and lack of knowledge about the practices.

The monitoring survey Report of Department of Agricultural Govt. of Bihar (1984-85) reported that lack of purchasing power, lack of irrigation facilities, non-availability of inputs and lack of extension advice were perceived as the most important constraints in adoption of high yielding variety of paddy cultivation.

Singh (1988) reported that non-availability of high yielding varieties of seeds in time for different top-sequence of fields was the most important constraints for low and non-adoption of high yielding varieties seeds followed by their susceptibility to

pests and diseases. Lack of labour and high cost due to increase in wage of agricultural labourers were two very important reasons for low and non-adoption of no-cast technology, namely transplanting of seedlings on Choudhary and Singh (2000) found that knowledge about oil seed production technology certified as potential predictors affecting the adoption of oil seed technology.

Jaiswal and Sharma (1990) found that lack of knowledge and technical guidance regarding proper use of plant protection measures. High cost of fertilizer came as the impediments for its adequate use, whereas lack of awareness was viewed as dominant constraint affecting adoption of chemical seed treatment in pulse Choudhary (1990) reported lack of knowledge, lack of availability of inputs on time and high cost of input were important reasons for partial and non adoption of recommended package of practices of high yielding varieties of rice cultivation.

Tantary and Nanda (1991) made in depth probe into constraints in increasing rice production in J and K State. The findings revealed that main constraint in Kashmir valley was of economical nature. This was followed by constraints related to input availability. The third important constraint composed of technical know-how and do-how items of sunflower production technology. Both of these items were considered of equal important by the respondents. The study further revealed that farmers attributed high cost of production and non availability of input at proper time as two major constraints increasing rice production.

Palmate and Babul (1993) summarized the constraints and reasons reported in the adoption research. They conserved that researchers in general reported lack of knowledge, lack of source of supply and their high costs, lack of education non-availability of credit facilities as major impediments in the adoption of various packages of practices of crop technologies. They further observed that socio-cultural beliefs, habits and traditions of farming community often hinder adoption of the modern scientific practices.

Sivanarayana and Reddy (1993) analyzed the reasons for partial and adoption of lentil production technologies with marginal and small farmers. All the respondents of both the categories commonly expressed eleven reasons for partial adoption of certain of practices. They included insufficient farm power, non-availability of irrigation water in time to puddle the field, lack of knowledge about use of recommended seed rate, lack of technical guidance and demonstrations, unaware of method of planting and maintenance of optimum plant population, high cost of

fertilizer and non-availability of quality fertilizer. The total respondents of both the categories commonly expressed various reasons for adoption of certain of practices. They were non-availability of green leaf manure incorporation, lack of time to grow green manure crop in the field, lack of technical knowledge and guidance, non-availability of pest/disease free seeds, non-availability of irrigation water at time of nursery raising, difficulty in maintenance of wet nursery, lack of knowledge about seed treatment, non-availability of chemical in time of weedicide application, non-availability of equipments, lack of knowledge about zinc phosphate, non-availability rat traps at peak period, lack of knowledge about use of sulphas tablets and unaware of multidose poison.

Singh (1995) analyzed constraints responsible for yield gap in pulse as reported by the farmers in his study. The findings related to constraints expressed by farmers revealed that farmers by and large were found agreeing in constraints ranking. Farmers perceived high cost of plant nutrients as the most serious constraints responsible for yield gap in rice. Appearance of new diseases and pests and the unavailability of effective chemicals at reasonably affordable price were viewed as the second important constraints for not getting the optimum yield for high yielding variety of paddy. Farmers in general were of the opinion that high cost of labour and its on availability at peak time is the third important constraints. Non-availability of irrigation water in time was viewed as serious constraints by the farmers.

Kumar (1995) analysed the constraints faced by marginal, small and medium categories of farmers in rice cultivation in central Bihar findings revealed variation in constraints because the three groups of farmers viewed it differently. High cost of fertilizer was considered as the most serious constraints by marginal and small farmer, where in case of medium farmers it stood at third place. Medium farmers viewed unavailability of labour coupled with high wage rate as the most serious constraint. This is simply because that medium farmers having strong economic base in comparison to marginal and small were not very scared of fertilizer prices but they are afraid of high labour cost and availability throughout crop growing season owing to the fact that their cultivation heavily depend on efficiency and turn out of labour input. Unavailability of seed, risk of crop failure and non-remunerative price of pulse was viewed as the second important constraint by marginal, small and medium farmers respectively.

Swant and Patil (1997) analyzed the constraints in adoption of improved mung cultivation practices. The study revealed differential perception of farmers of different practices involved in mung farming. Lack of knowledge was viewed as most serious constraints related to seed and seed treatment. Regarding the transplanting of paddy farmers were of the opinion that it was time consuming and unavailability of trained manpower came in the way of its adoption. Difficulty in changing the habit of labourers and additional requirement of labours were viewed as the important constraints in kits adoption. Non-availability of fertilizer in time and its high cost were the serious constraints for application of recommended doses in mung cultivation. Lack of knowledge about chemicals and non-availability of plant protection appliances were regarded as two important constraints responsible for partial adoption of plant protection recommendations.

Sharma, *et al.* (1997) reported lack of knowledge about improved varieties was perceived as the most important constraints and ranked first by the farmers. This was followed by lack of latest technical know-how and time availability of technology at village level were also realized as important constraints and ranked second and third respectively. Lack of training facilities for acquiring new technology and inadequate knowledge about fertilizers were viewed as constraints in order. The feeling of farmers that extension workers are not properly trained was the constraint, which attracted least attention by the farmers.

Khan (1998) analysed the constraints of slow adoption of new agricultural technologies is Kurram Agency of N.W.F.P. Pakistan. The findings revealed lack of capital, limited transport network and focus of extension agencies of large farmers were the major constraints responsible for slow adoption.

Samy (1998) findings indicate lack of knowledge to implement new technology and perceived risk as major knowledge transfer constraint. However, farmer identified inadequate number of on-farmer visits by extension worker as moderate constraint. Three input transfer, non-availability of pesticides and inadequate number of tractors. Lack of credit was identified as moderate constraints. Farmers identification of tractors. Lack of credit was identified as moderate constraints. Farmers identification of constraints was positively related to their attitude towards technology.

Nayak, (2000) reported that the major constraints faced by ber growers in adoption of improved cultivation practices were lack of knowledge (81.66%) followed by use of improved seedlings (77.66%).

Soni *et al.* (2000) concluded that lack of knowledge was major constraint in adoption of improved varieties of crops and plant protection measures. As far as fertilizer application was considered the majority of the farmers expressed that the high cost of fertilizers was the main reason for adoption.

Ankulwar *et al.* (2001) the data regarding the constraints face by sunflower growers in adoption of recommended package of practices revealed that the major constraints were difficulty of use of honey bees for full setting (97%), delay in getting the payment of seed produced (93%), high cost of labour (91%), difficulty in maintaining seed purity because of high cross pollination (87%). Uncertainty of rainfall, fluctuation in price, inadequate available tie of inputs, lack of training facilities and insufficient organization of demonstration plots at villages were the other constraints faced by the sunflower growers.

Dhruw (2008) found that the important personal constraints faced by the respondents were low level of education, other occupation and large size of family, non-adoption of technology in large scale under personal constraints, scattered land, high interest rate and non availability of loan in time under socioeconomic constraint, not eager to adopt innovation and lack of proper incentive under socio psychological constraint, lack of training and non availability of information in proper time perceived as important constraints, lack of knowledge about the adoption of improved technology and non availability of Agricultural inputs for maize production perceived as major technical constraints, lack of irrigation facility and lack of marketing facility were considered as other constraints.

2.5 Extension strategies for enhancing the gram production in Diara area of Bihar.

Gunawardana *et al.* (2006) conducted a study to investigate the preferred agricultural information sources and channels to improved farm practices of farmers. The study suggested that a well-equipped agricultural information centre must be established in Kisan Seve Kendra to provide necessary information to the tribal and non-tribal farmers the area and to arrange media forum groups (radio and television)

to discuss the content of radio/television agricultural programmes, which would enable effective transfer of new technologies.

Kumar *et al.* (2007) were concerned in their study to determine the credibility of sources of information used by sugarcane growers.

Patil and Sawant (2008) revealed that articles on agricultural status ranked first and articles on agricultural research and technology was second, while articles on poultry, markets, and farmers' agitation were found very meager. The agricultural articles occupied a meager space (37 800 cm^2), less than 3% of all articles. Among the articles, papers on agricultural status occupied the maximum space. The situation pertaining to farm articles in the farm periodical has not changed much over the years. Recognizing that the print media is an important instrument in the provision of agricultural information for farming decisions, it is suggested that efforts need to be made to incorporate more number of farm articles in periodicals. Newspapers and periodicals were found one of the requirements for a literate rural and urban population. Articles in periodicals were very important for the transfer of farm technology to the farmers.

Ani and Baba (2009) concluded that among the electronic mass media taken under study; radio was the most utilized source by the respondents, and that farm income, age, educational level and farming experience of the respondents had positive coefficients and significant relationship with the utilization of electronic mass media organs. It is suggested among others that there should be provisions of digital electronics gadgets to meet with the recent development in technologies in agricultural information dissemination system.

Sanyal (2009) suggested that Group Special Mobile (GSM wireless-cellphone) technology offers a ray of hope for technology transfer. The per capita uptake of this technology has apparently been far greater in developing nations than in developed countries and India is no exception. Challenge lies ahead in its implementation through an integrated and interdisciplinary approach.

Krishnamurthy *et al.* (2009) based on their findings of their findings of the study revealed that lack of leisure time was the major problem encountered by majority of the farmers in listening and viewing the farm programmers regularly.

Regarding the suggestions, most of the respondents suggested to increase the broadcasting and telecasting time of the farm programmers.

Amrutha and Hugar (2010) reported in their research that Radio and Newspapers (5.55%) were the general sources of market information fore farmers at the household and village levels. However, commission agents were the most sought after sources of market information for all the categories of farmers (72% of small, 56% of medium and 68% of large farmers) at the market level followed by input dealers. In view of the poor awareness of farmers on market information, it is suggested to strengthen the dissemination of market information through formal agencies like APMC's, KVK'S etc using latest information and communication technology through mass media.

Kumar (2010) was carried out a study in Tungabhadra (TBP) and Upper Krishna (UKP) Projects of Karnataka, during the year 2008-09. on the basis of study it was suggested to disseminate the distributory and FIC level information through mass media like newspapers, local TV channels and radio. For this purpose, the existing data base/documentation needs to be improved.

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RESEARCH METHODOLOGY

The chapter of research methodology deals an action plan of research enterprise. This section narrates the methods and procedure of investigation used during the entire course of study. For convenience, it is being presented under the following sub- heads:

3.1 Location of the study

3.2 Sampling procedure

3.3 Variables and their measurement

3.4 Tools and techniques for data collection

3.5 Statistical analysis

3.1 Location of the study

The present study was carried out inMokama block of Patna districtof Bihar. The block H.Q. of Mokama is located 90 KM east of Patna capital town of Bihar and is on the rail route connecting Kolkata and New Delhi via Patna. It lies at 25^0 23'N longitude and $85^0$55' E latitude with an altitude of 38 meters (125ft.)MSL. It is situated on the southern banks of the Ganga. The land strip along the North of Ganga is called "Diara" which submerge in Ganga during monsoon. On the South of Mokama is the Tal region which also gets with the backwaters of the Ganga during the monsoon season.. The main occupation of this region is agriculture. The crops grown in this area are Lentil, Gram, Mustard and vegetables. Papaya is also grown in some patches. However, the major portion of the Diara and Tal lands remain submerge for three to four months during each and every year.

Out of different Tal of Bihar Mokama Tal (Lake) is located in the central region of the state with its unique in many respects. It is vast in expanse and ephemeral in nature. The area gets submerged under deep water during monsoon period and becomes unfit for cultivation of kharif crops (grown during April to September). Cultivation of *rabi* crops (grown during October to March) also suffers in productivity if drainage of the area is not complete by their sowing time

(15 October). The State and Central Government has executed a number of schemes and some more are in planning stage for draining out water from the Tal and reclaiming land for agriculture. The strong farmers' lobby has been influencing policy making and planning with the result that the focus remains only on agriculture produce and other aspects of development are lost sight of.

Mokama Tal is not just one single Tal but a group of seven Tals such as Fatuha Tal, Bakhtiarpur Tal, Barh Tal, More Tal, Mokama Tal, Barahiya Tal and Singaul Tal. Covering an area of 1,062 square kilometers and the width varying from 6.5 to 17.6 kilometers. It has very unique features. It is a saucer shaped depression running along the right bank of the river Ganga. Most of the area remains submerged under 4-6 meter deep water during monsoon and cultivation of rainy season crops over is not possible. Even cultivation of winter season crops suffers if the drainage and reclamation of the area get delayed beyond sowing time(15 Oct.).Which is considered as the main problem.

The river Harohar, known as Dhowa and Mohane in upper reaches and running from west to east, is the master drain of the tal area. The land between the Ganga an the Tal area is rather high and natural drainage across the land is not possible. The northern strip of the Tal, therefore, drains from north to south, the ground drainage slope is very flat, varying from 0.6 to 0.1 meter per kilometer, from west to east and there is a cross slope from south to north. Several rivers that rise in the hills on the south flow northward and join the river Harohar flowing in the valley of the Tal area. These rivers are aggrading in several reaches. The Tal area acts as a delta for these rivers.

Table No. 3 Demographical Details OfMokama Block

Total area of Mokama Tal	:	1,062 sq. km
Total population	:	1,68,036
Village	:	23
Town	:	1
Literacy rate	:	96%
Male literacy rate	:	96%
Female literacy rate	:	93%
Male population	:	53.49%
Female population	:	46.51%

3.2 Sampling procedure

Patna district of Bihar comprises with 23 blocks, out of which Mokama block was selected purposively because the majority of gram growers residing in the Diara land of Mokama.A list of progressive farmers with respect to Gram growers from Mokama block was prepared first hand with the help of BAO, KVK's Scientists, SMS and Extension officials working in this area. Out of the list 100 gram producers, who were involved in Gram cultivation regularly were selected randomly from the list as the sample for the purpose of the study.

3.3 Variables and their measurements:-

On the basis of the available literature and past studies in the concerned areaalongwith discussion with the Scientists working in the department of Agronomy and Extension Education, Rajendra Agricultural University, Pusa; many pertinent variables were finalized for the study.The list of selected variables along with their measurement procedures have been presented here in details as;

A.	Independent variables	Measurements
(i)	Age	Chronological age will be ascertained
(ii)	Caste	General/ BC I/ BC II/ SC
(iii)	Education	Illiterate/Matriculation/Intermediate/Graduate/PG
(iv)	Occupation	Agriculture/Service/Business/Other
(v)	Family size	Small/Medium/Large
(vi)	Annual Income	Income in a year from agricultural source only
(vii)	Size of land holdings	Marginal/Small/Medium/Large
(viii)	Credit-orientation	Nationalised/Money lenders/Live stock population/ possession
(ix)	Social-participation	Membership/Office bearer of panchayat/ Organisation
(x)	Mass- media used	Newspaper/TV/Radio/Magazines etc

During the study two dependent variables were finalized. They were:-

B. Dependent Variables

B.	Variables	Measurements
(i)	Knowledge Level	Suitable measurement developed
(ii)	Extent of adoption	Suitable measurement developed

The operational definition of each selected variable and their measurements procedure are being discussed here in details:

3.3.1 Independent variables

AGE

It refers to the chronological number of completed years as reported by the respondents at the time of interview. The age in term of completed year as reported by the respondents on the basis of their remembrance were recorded. For the purpose of meaningful conclusion, the age of the respondents were put into three classes i.e., young age, middle age and old age on the basis of the standardized system. The details of description of the respondents based on the these three categories are given below:

Class		Age (in years)
Young	-	Up to 35 years
Middle	-	36-50 years
Old	-	Above 50

CASTE

Caste is social system, the membership of which is determined by birth and is endogamous in nature. In other words, it is a closed class system, which clearly distinguishes the status and role for its member in particular society. The respondents of the study were classified in three categories during the study on the basis of their caste structure. The details are given here as:-

Class		Scores
Scheduled Class (SC/ST)	-	1
Backward Class (BCI/BCII)	-	2
General	-	3

EDUCATION

Education is the key element in the bringing out of desirable changes in the human behavior. During the study, the term education refers to the level of formal education received by the selected respondents. The educational levels of selected gram growers were measured with the help of scale developed by Pareek and Trivedi (1963); which appears here as:-

Level of education		Scores
Illiterate	-	0
Can read only	-	1
Can read & write only	-	2
Primary education	-	3
Middle education	-	4
High school education	-	5
College education	-	6

The various educational levels taken in the study were finally divided into four major classes for the purpose of convenience. They are :

Class		Scores
Illiterate	-	Can read only
Literate	-	Can read & write + formal schooling up to primary
Educated	-	Matric/Intermediate
Highly educated	-	Graduate and above

OCCUPATION

This was operationalized as the nature of job occupied by the respondent. During the present study, occupation refers to the involvement of activity in terms of their farming and other allied professions. The occupation of the respondents which contributed more than 50% of their total income was considered as their main occupation while other which contributed less than 50 % of the total income was known as their subsidiary occupation during the study. For the presentation of the results pertaining to occupation, of the respondent were categorised in following manner:-

Categories		Scores
Agriculture (sole)	-	1
Agriculture + Allied	-	2
Agriculture + Services	-	3

FAMLY SIZE

It refers the number of family members residing under same roof and shared the single kitchen. The respondents during the study was asked to indicate the number of their family members. Based on the numbers as reported by them, the size of family has been is categorised in following manner:

Family size		**Scores**
Small family (up to 4 member)	-	1
Medium family (5- 8)	-	2
Large family (above 8)	-	3

ANNUAL INCOME

The annual income of the respondents was taken into consideration during the study on the basis of their different sources of income. The selected respondents were categarised into different group based on their annual income from different sources.

Categories		**Scores**
Very low(up to Rs.1 lakh)	-	1
Low(Rs.1 – 2.5 lakhs)	-	2
Medium(Rs.2.5 – up to 5lakhs)	-	3
High above (Rs.5 lakhs and above)	-	4

SIZE OF LAND HOLDINGS

It denotes to the total area of land which respondent owned. This variable includes the area under houses, farmyard, net cultivable land and other type of land owned by respondents. The area of land was recorded in hectares. The number of hectare of land under cultivation was taken as the measure of size of land holding. The respondents were classified into four groups according to their size of land holding owned by them. The classification is given here as:-

Categories		**Land holding (ha)**
Marginal	-	Up to 1 ha.
Small	-	More than 1 to 2 ha.
Medium	-	More than 2 to 4 ha.
Large	-	Above 4 ha.

CREDIT ORIENTATION

The availability of credit is essential to purchase the required inputs which may influence the extent of adoption of agricultural innovation among farmers. The adoption of improved agricultural technology requires more capital investment in farming to purchase the various inputs like fertilizer, pesticides improved seed, implements etc. Sources of credit were identified during the study which included cooperative society, nationalized banks, money lenders, friends, neighbours, relatives etc and each sources was given equal weightage which ascertain the availability of credit to the farmers. The measurement procedure followed in the study were as:

Categories		Scores
Nationalized Bank	-	4
Co-operative society	-	3
Moneylenders	-	2
Friends/ Neighbors/ Relatives/ Others	-	1

SOCIAL PARTICIPATION

It refers to the extent social participation of the respondent. The scoring procedure related with of social participation scale is given here as:

Categories		Scores
No member of any social organization	-	0
Member of one social organization	-	1
Member of more than one social organization	-	2

MASS MEDIA USED

It refers frequency of contact for obtaining information on Gram production by the respondents. To measure the frequency of utilization of these information sources each respondent was asked to indicate on a four point continuum to how often he used information about improved production practices of Gram from each of the sources. The possible range of respondent stand through scoring procedure as given below for each items.

Response		Score
Most often	-	3
Often	-	2
Some time	-	1
Never	-	0

The total score for individual respondent was obtained by adding the score obtained by him from different sources.

3.3.2 DEPENDENTS VARIABLES

A set of dependent variables were incorporated in the study such as; knowledge level of Gram production technology and extent of adoption along with different constraints perceived by respondents during the adoption of Gram production technology. These are now explained here as;

1. Knowledge Level

In Psychology, knowledge is often referred to as the totality of cognitive behavior with reference to a physical and hypothetical object. In other world, knowledge is the totality of understood information possessed by a person related with any object, issue or situation.

Procedure of scoring

For quantification of the knowledge device lets each correct answer assigned one score and for every incorrect answer or on no reply zero score was assigned. As the total number of question in the knowledge were 40. Thus the total knowledge score of each respondent was divided by the total number of items in knowledge and multiplied by 100.

Collection of items

The content of knowledge scale is composed with questions called items related with the improved Gram production technology. The items were collected in consultation with the teacher, scientists and research workers involved in the specialized area. Further the total knowledge score was divided into different categories for the purpose of comparative description:

Category		Level of Knowledge in percentage
Low	-	0-25
Medium	-	25-50
High	-	50-75
Very high	-	75-100

2. Extent of adoption

According to Leagans (1985) defined adoption as a decision to make full use of an innovation as best course of action. Adoption is not only a complex physical process, but a mental process as well as symbolic and is achieved through technical knowledge and conviction of its value; the second one is external which is achieved through selected services such as seed, fertilizers, credit, markets and education. This definition implies that when adopters are satisfied with the innovation he used to adopt the innovation. Further, it is modified in terms of the study, measure the extent of adoption related with improved Gram production technology. Recommended Gram production technology related to locale of the research was identified in consultation with scientist of R.A.U., Pusa. These technologies were related to different components of Gram production. The total such Gram practices selected was 25. A respondent was given a score of one for total use of recommended technology. Thus total adoption score of a respondents would vary between 0 to 25. The composite adoption index was computed in terms of percentage with the help of following formula as given in original scale.

$$\text{Adoption Index} = \frac{\text{Optained Score}}{\text{Total obtainable score}} \times 100$$

Category		Adoption Index
Low	-	0-25
Medium	-	25-50
High	-	50-75
Very high	-	75-100

3.3.3 Constraints perceived by farmers

Farmers were asked to identify constraints which they felt most important. Thus constraints perceived by them was arranged in decreasing order on the basis of number of choices worked out for each constraints and further classification would be made on the basis of their socio-economic, agro-ecological and technological constraints. The ranking orders were also made for each constraints based on their percentage scores.

3.4 Tools and techniques of data collection

Interview schedule was the main tool used during the study for the data collection. The schedule structured containing all the items on which the information were supposed to collect in addition to the direct interview with the respondent in face to face situation.

3.5 Plan of analysis and statistical measurement

Following statistical tools were used for the analysis and inter predation of the data.

Frequency and percentage

Frequency and percentage was used in description analysis for making simple comparison. For calculating percentage, the frequency of particular cell was multiplied by 100 and divide by number of respondents in that particular category to which cell they belongs.

Mean

The average of n numbers is obtained by finding their sum (by adding) and then dividing it by n.

Let $x_1 + x_2 + \text{----} + x_n$ be n numbers, then their average or arithmetic mean is given by

$$\overline{X} = \frac{\chi_1 + \chi_2 + \chi_3 + \text{----} + n_n}{n} = \frac{\sum_{i=1}^{n} \chi_i}{n}$$

Where,

$\overline{X}$ =Arithmetic mean of data

$\sum_{i=1}^{n} \chi_i$ = sum of number of variables

n = number of independent variables

Standard deviation

$$\sigma = \sqrt{\frac{\sum(X - \overline{X})}{n}}$$

Where,

σ = Standard deviation

X = Variable value in data

$\overline{X}$ = Arithmetic mean of data

n = Total number of population

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FINDINGS AND DISCUSSION

The chapter presents, the findings of investigation along with discussion which has been arrived after subjecting data to statistical analysis with suitable interpretation. Keeping in the view, the objectives of this study, the findings and discussion havebeen presented here in following sub-heads:

4.1. The socio-economic profile of selected gram producers.

4.2. The knowledge level of selected gram producers.

4.3. The extent of adoption of gram production technology by the gram producers.

4.4. The major constraints in adoption of gram production technology as perceived by the gram producers.

4. 5 The suitable extension strategies for enhancing the gram production inDiara Lands of Bihar.

4.1 The socio-economic profile of selected gram producers.

The objective of the present study was to ascertain the socio-economic profile of selected gram producers of Diara land situated Mokama block of Patna district. The findings and discussion relating to this aspect of the study are being presented here across different selected independent variables such as; age, caste, education, occupation, family size, annual income, size of land holdings, credit-orientation, social-participation and use of mass-media. The frequency distribution along with its percentage scores of selected gram producers for each of the selected independent variables have been presented here through different tables followed relevant discussions pertaining to each variable.

4.1.1Age

On the basis of the reported age of respondents, they were classified into three age groups viz. young age group (up to 35 years of age) middle age group (36 to 50 years of age) and old age group (above 50 years of age). The distribution of selected respondents have been presented here in table No.4

Table:4 Distribution of selected gram producers according to their age.

Sl. No.	Age groups	f	%
1.	Young (Up to 35 years)	13	13.00
2.	Middle (36 to 50 years)	65	65.00
3.	Old (above 50 years)	22	22.00

It is evident from the Table-4 that majority i.e. (65.00 %) of the respondent were belong middle age group i.e. followed by 22% from the old age group and 13% from the young age groups 36-50 years of age. Similar results were obtained by Singh *et al.* (2007) where majority of respondents were found in the age of 35-50 years and above in their study. The relatively large percentage of gram producers were found to have 36-50years age group owing to fact that after attaining the 35years of age, the farmers were found to turn their attention towards farming in most of the Indian villages. Similar observations were also borne out from the studies of Gogai *et al.*(2000) which indicates that majority of trained(60%) respondents were of middle age group. Fig 5.denotes the age groups of the selected gram producers in histogram.

4.1.2. Caste

Caste is a social class, membership of which is determined by birth. It involves particular social restrictions and privileges on the basis of the same. The selected respondents of the study were divided into four categories viz. General, Backward Class-I (BC-I), Backward Class-II(BC-II) and scheduled caste(SC).On the basis of their details of findings has been presented here in Table.5

Table 5: Distribution of selected gram producers according to their caste.

Sl. No.	Category	f	%
1	General	42	42.00
2	BC-I	16	16.00
3	BC-II	31	31.00
4	SC	11	11.00

The table 5.Revealsthat, a relatively large percentage of gram producers were from the general caste category, indicating their percentage score of 42.00, followed by backward class-II(31.00percent), backward class-I(16.00percent) and scheduled

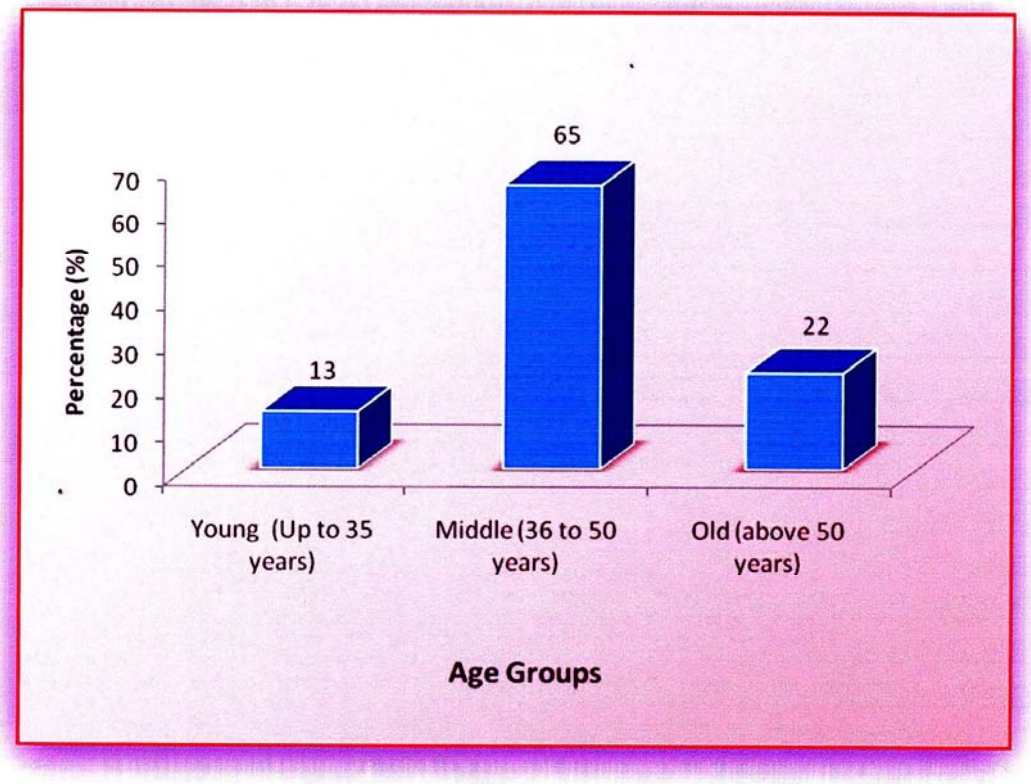

Fig:5 Distribution of selected gram producers according to their age

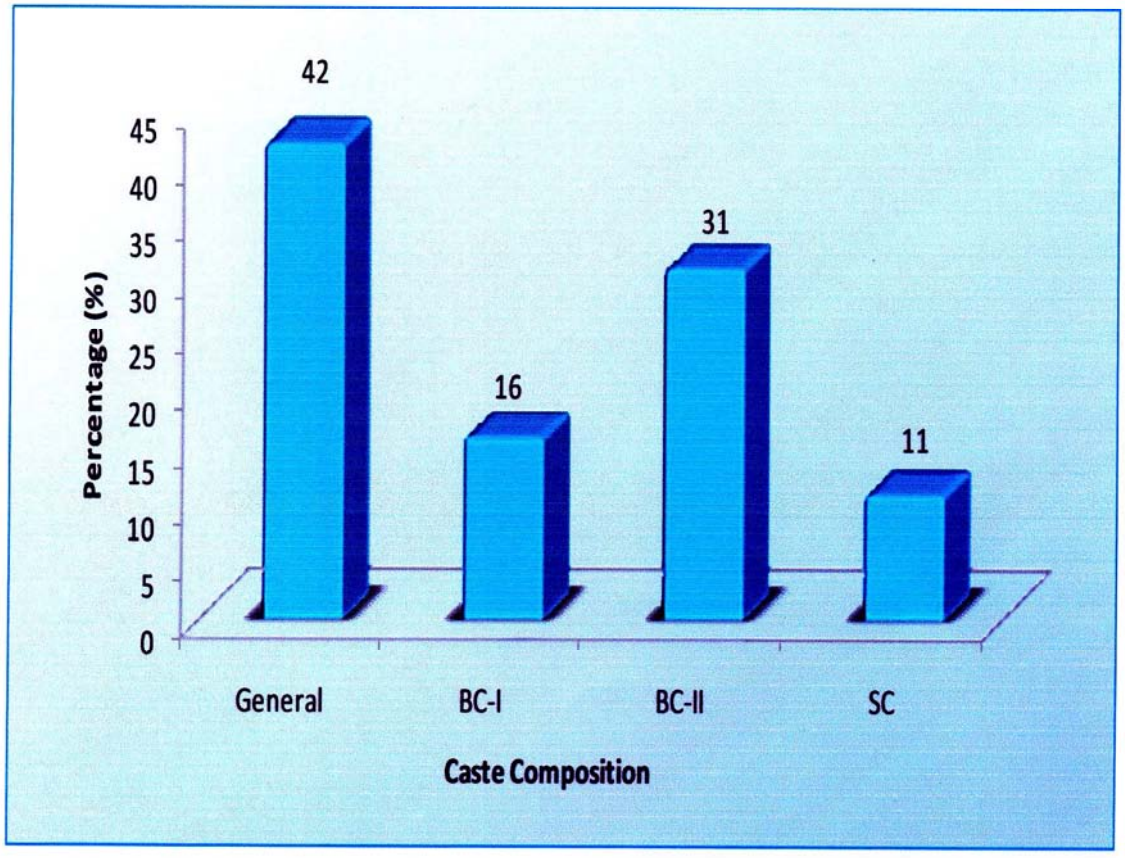

Fig. 6: Distribution of selected gram producers according to their caste.

caste was found in tune of 10.00percent only. Similar observations were found in the study of Singh and Dalal (2006) where majority of the buffalo owners were belonged in general caste. Since, the target group of respondents were the gram producers who had been rated on different parameter based on the socio-economic strata hence, the population of scheduled caste still lagged behind to attain the ownership status of Tal/Diara areas of Bihar. The observed findings in tune of the study of Rai (1965) that the adoption of fertilizers was highest in higher caste than the lower caste farmers. Fig 6.depicts the observed findings through the histogram.

4.1.3. Education

Since, education is an important indicator of socio-economic status that determines the rate of adoption of any technology hence it is often found more easy to convince an educated respondents about usefulness of any technological innovation that to any illiterate respondents. The selected respondents of the present study were classified into five categories on the basis of their educational attainments viz. illiterate, can read and write, matriculation, intermediate and graduate. The frequency distribution along with its percentage score for each level of education are presented here in Table-6.

Table6: Distribution of selected gram producers according to their education.

Sl. No.	Category	f	%
1	Illiterate	09	09.00
2	Can read and write	11	11.00
3	Matriculation	19	19.00
4	Intermediate	30	30.00
5	Graduate	31	31.00

The table 6 shows that the majority of the gram producers were found highly educated i.e. in the group of graduate and above respondents were found to possess 31.00% followed by intermediate indicating its percentage score of 30.00%, matriculation 19.00%, can read and write 11.00% and illiterate were found only 09.00 %. The study counterparts the study of Naik *et al.* (2009) by which it was found that education had positive and significant correlation with knowledge of the respondents regarding the farming. Also, the study of Singh *et al.*(2007) supports the trend that large numbers of respondents were educated up to middle and high and

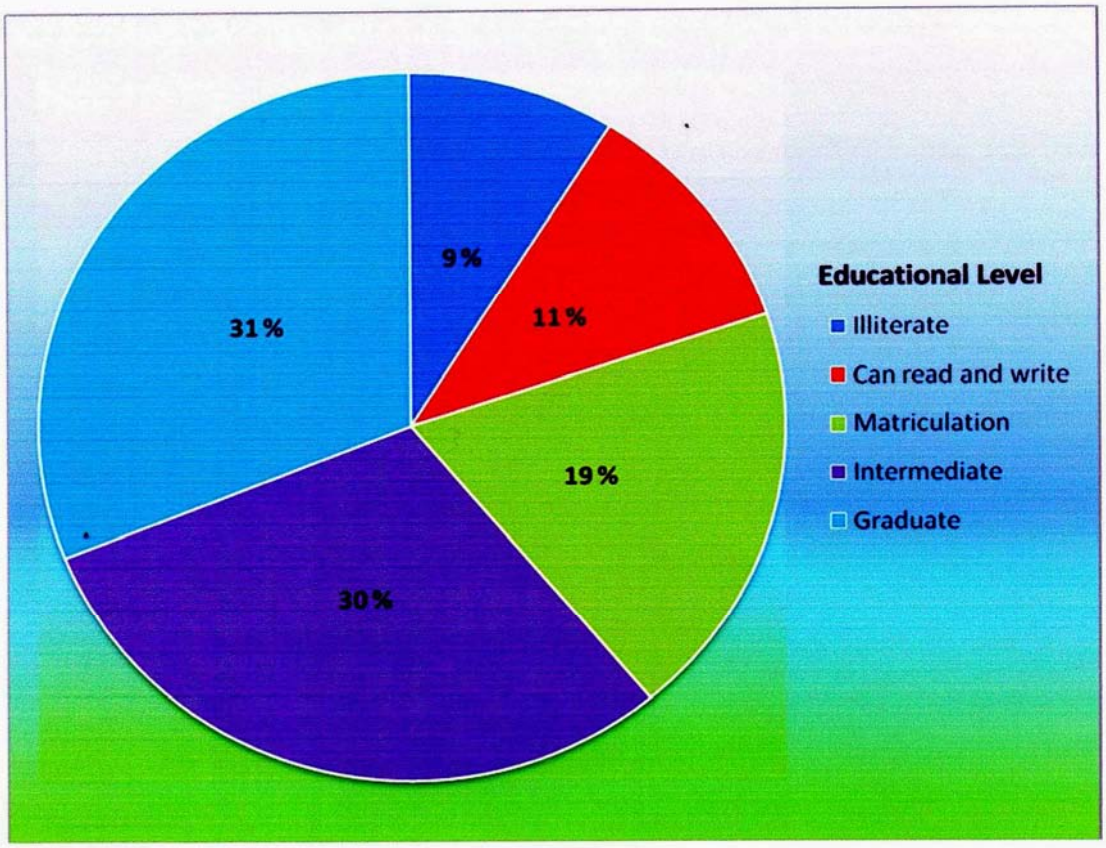

Fig: 7 Distribution of selected gram producers according to their education.

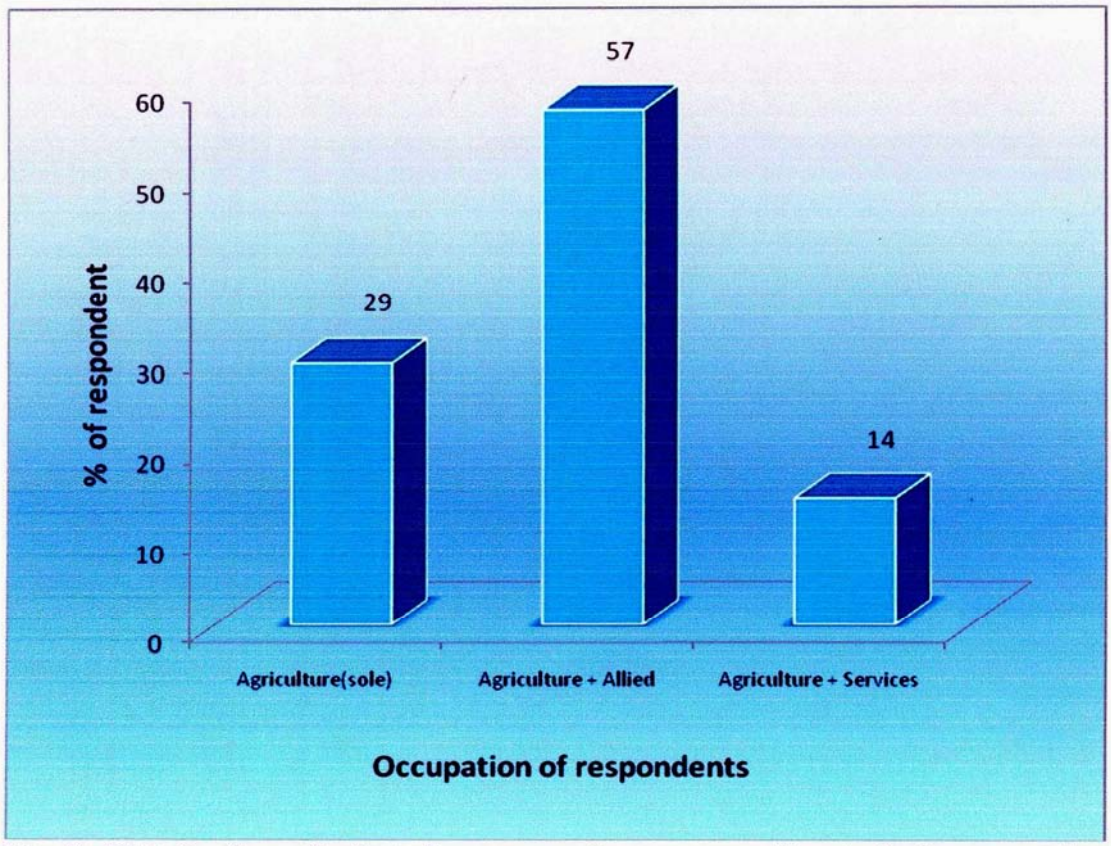

Fig. 8: Distribution of selected gram producers according to their occupation.

matric level i.e., 33 percent in both categories of the respondents. The education level of the selected gram producers is presented herewith through pie-chart in Fig.7.

4.1.4. Occupation

Occupation is an important segment of socio-economic status of the individual which effects the economic and social life of the family. The selected respondents of the study were divided into four group on basis of their occupational status. The distribution of occupation of the selected respondents along with their percentage scores are given here in Table 7.

Table 7: Distributionof selected gram producers according to their occupation.

Sl. No.	Category	f	%
1	Agriculture(sole)	29	29.00
2	Agriculture + Allied	57	57.00
3	Agriculture + Services	14	14.00

It is evident from the table-7, that majority of the gram producers were found to had farming with allied profession(agro- based trading profession) in tune of its percentage score 57.00%. Further, it was found that 29.00% of gram growers were having farming only as their major occupation followed by farming with services/jobs indicating its percentage score of 14.00. The present study counterparts with the findings of Prasad *et al.* (2006) in which they observed that majority of farmer' were found to have the cattle rearing as their main occupation, which commonly grouped here in the category of farming with trading/business. Similar results were also borne out from the studies of Singh and Singh (1988) that there was positive effect of family main occupation on the adoption of occupation and also support the assumption of the findings. In rural village of Bihar state, most of the progressive farmers opted different agro based activities for economic gain that are commonly considered as the micro trading and business which often helped them to survive with the village life and also provide impetus to enhance their socio-economic status.Fig.8 shows the different level of occupation as possessed by the respondents.

4.1.5. Family size

It plays an important role in determining the economic behavior of the family regarding income and expenditure on the basis of family size of farmers, the family size of the respondents were classified into three categories during the study. The results came out through the family size are given here in table 8.

Table 8:Distributionof selected gram producers accordingto their family size

Sl. No.	Family size	f	%
1	Small up to 4 members	29	29.00
2	Medium 4-8 members	40	40.00
3	Large more than 8 members	31	31.00

The table 8 revealed that in case of gram producers the highest percentage score obtained by in the group of medium size family (40.00 %)followed by large size family (31.00 %)and then by small size family (29.00%). Similar results were also found by Krishnamurthy (1999) in his study which supported the assumption that majority (89.17%) of the respondents were found to have more than five members in their family. The Pie-chart depicted in Fig 9 shows the family size of selected gram producers of the present study.

4.1.6. Annual Income

The selected respondents were classified into four groups on the basis of their annual income viz. very low, low, medium and high. The frequency distribution and the percentage score of respondents with respect to their annual income has been presented here through Table-9.

Table 9:Distribution of selected gram producers according to their annual income

Sl. No.	Category	f	%
1	Very low (up to Rs.1lakh)	10	10.00
2	Low (Rs.1lakh to Rs.2.5lakhs)	29	29.00
3	Medium (Rs.2.5lakhs to Rs.5lakh)	53	53.00
4	High (Rs. More than 5lakhs)	9	9.00

The table 9 reveals that maximum percentage of score with respect to the annual income of gram growers has emerged as the medium level of income from agriculture 53.00 % followed by low level of income group 29.00 %, very low level of annual income 10.00% and high group of annual income was found only in tune of 9.00% .Similar results were also obtained by Deshmukh *et al.* (2007) in which they revealed from their study that the annual income of respondents(81.59%) fall under

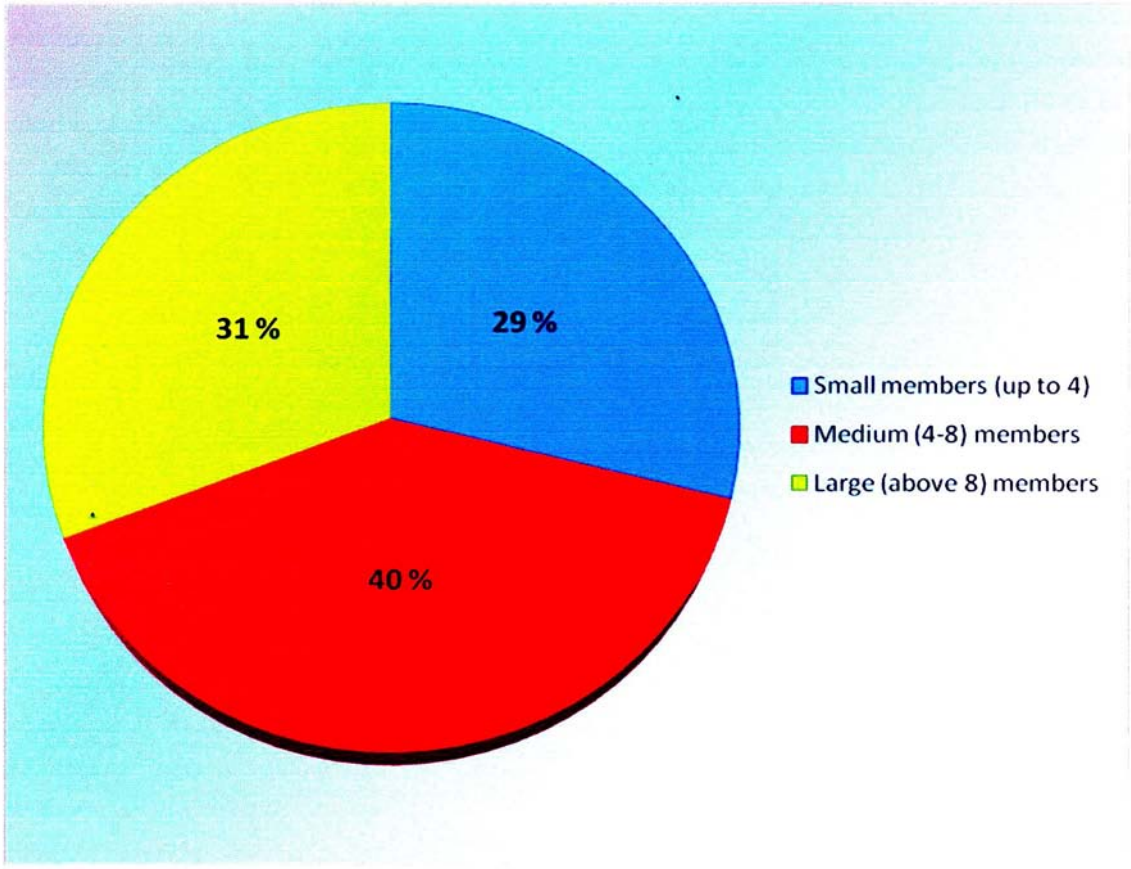

Fig: 9 Distribution of selected gram producers according to their family size.

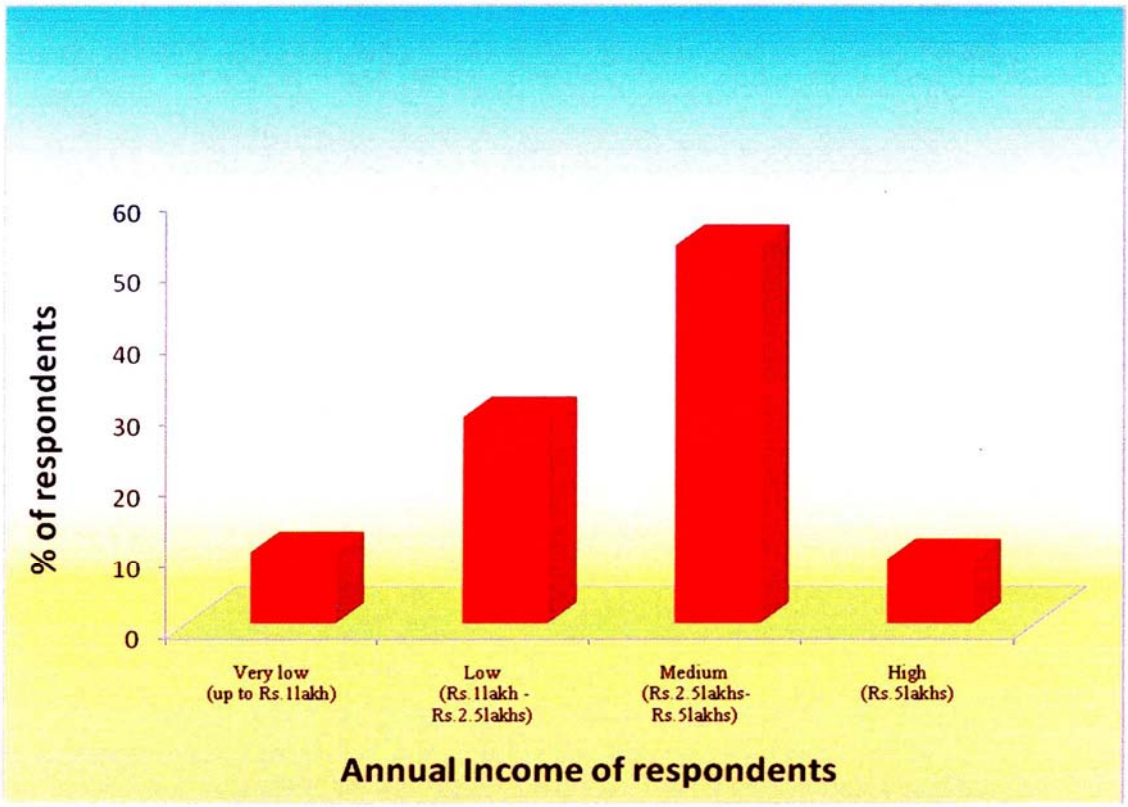

Fig. 10: Distribution of selected gram producers according to their annual income.

medium level of income. The study reported by Sarwamangala *et al*. (1998) shown that majority of respondents have occupied their place in lower family income group, which amply support the assumptions of the findings. The annual income of gram producers in form of histogram is given under text through Fig.10.

4.1.7. Size of landholding

The selected respondents of the study were divided into four groups on the basis of their size of land holding possessed by them. The frequency and percentage scores of selected respondents has been presented here in Table-10

Table10 : Distribution of gram producers according to their size of land holding.

Sl. No.	Category	f	%
1	Marginal (up to 1 ha)	11	11.00
2	Small (1.1 to 2 ha)	28	28.00
3	Medium (2.1 to 4 ha)	53	53.00
4	Large (above 4 ha)	8	8.00

It is clear from Table-10 that majority of selected respondents (53.00 %) were medium farmers followed by small farmers (28.00 %), marginal farmer (11.00%) and large farmers (8.00%). The result of the study contradicts to the study of Krishnamurthy *et al*.(2008) where they found that majority i.e. 93.00% of respondents had large farm holding in their study. In the state of Bihar still marginal and small farmers constitute nearly 88 percent of the total farming group, under the circumstances the existing findings reveal the true picture of the farming community residing under the study area. The studies of Jaiswal and Dubolia (1990) also found that the farmers having medium size land holding adopt the technology to the maximum extent that support the assumption of the study. The selected respondents across their land holding pattern were being depicted through Fig.11.

4.1.8. Credit orientation

The respondents of the study were further divided into four groups on the basis of their credit orientation as possessed by them. The frequency distribution alongwith their percentage scores of respondents with respect to their credit orientation has been presented here in Table 11

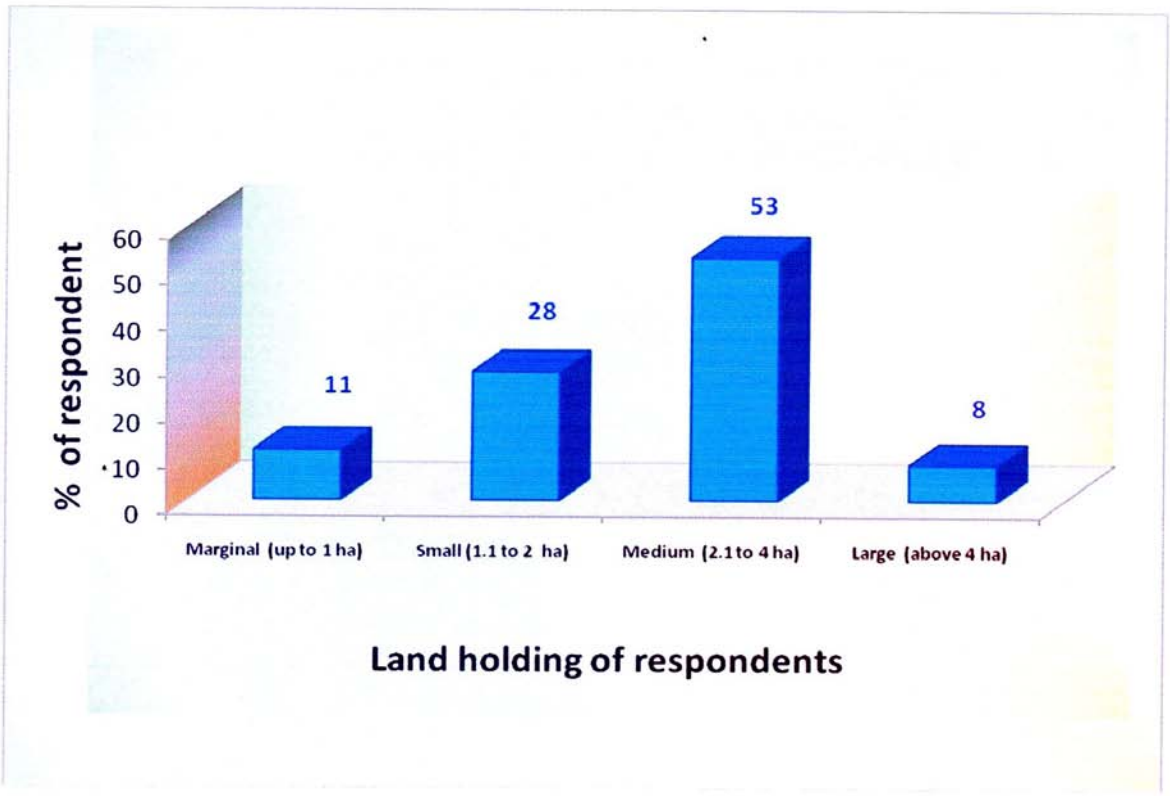

Fig.11: Distribution of selected gram producers according to their land holding

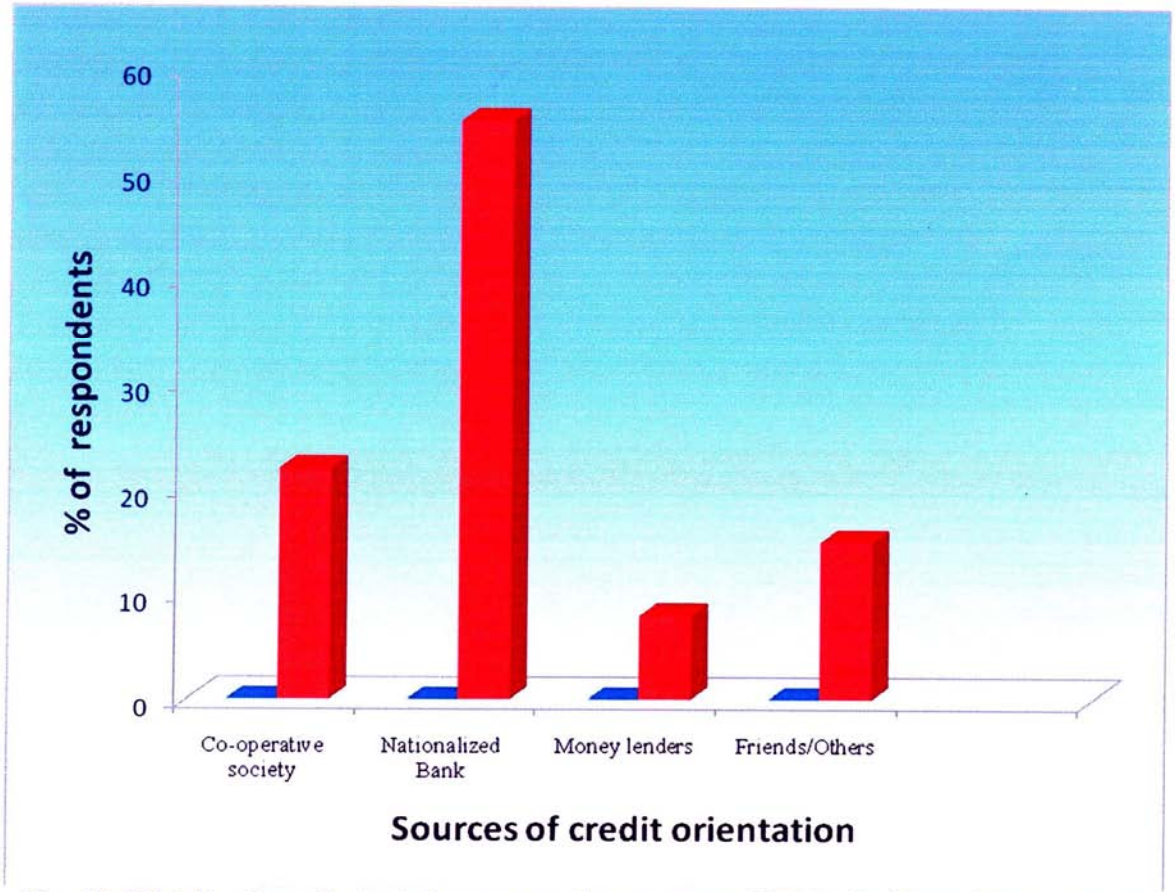

Fig. 12: Distribution of selected gram producers according to their credit orientation.

Table 11: Distribution of gram producers according to their credit orientation

Sl.No.	Particulars	f	%
1	Co-operative society	22	22.00
2	Nationalized Bank	55	55.00
3	Money lenders	8	8.00
4	Friends/ Neighbors/ Relatives/ Others	15	15.00

This findings suggest that maximum number of selected respondents were found to have their credit source from the member of Nationalized Bank (55.00%) followed by Co-operative Society (22.00%) then Friends/ Neighbors/ Relatives/ Others were found in tune of 15.00% and 8.00%were found to have their credit from money lenders. Similar results were also borne out from the studies of Dhruw (2008) who indicated that the majority of the respondents(50%) had taken loan from nationalized bank. Which supported the assumption of the findings. Fig 12 given here shows the sources of credit orientation of the selected gram producers.

4.1.9. Social participation:

Social participation refers to the extent of involvement of farmers in various social institution. The selected respondents were classified into three group on the basis of their social participation during the course of study.

Table. 12: Frequency distribution and percentage scores of selected respondents with respect to their social participation.

Sl. No.	Category	f	%
1	No Member of any organization	11	11.00
2	Member of one organization	56	56.00
3	Member of more than one organization	33	33.00

The findings reveal that majority of respondents were (56.00 %) member of one organization while 33.00% of respondents were found to have their membership in more than one organization. The total 11.00 % respondents were found to have no membership in any social institution. Deshmukh *et al.*(2007)concluded that(45.13%) of the respondents were the member of one organization while remaining per cent of the respondents was belong to more than one (38.88%)and no membership category indicated in tune of 15.97% . Dhruw (2008) concluded that the maximum (41.66%) number of the respondents had membership in one organization. The depiction through Fig.13 denotes the extent social participation of selected gram producers.

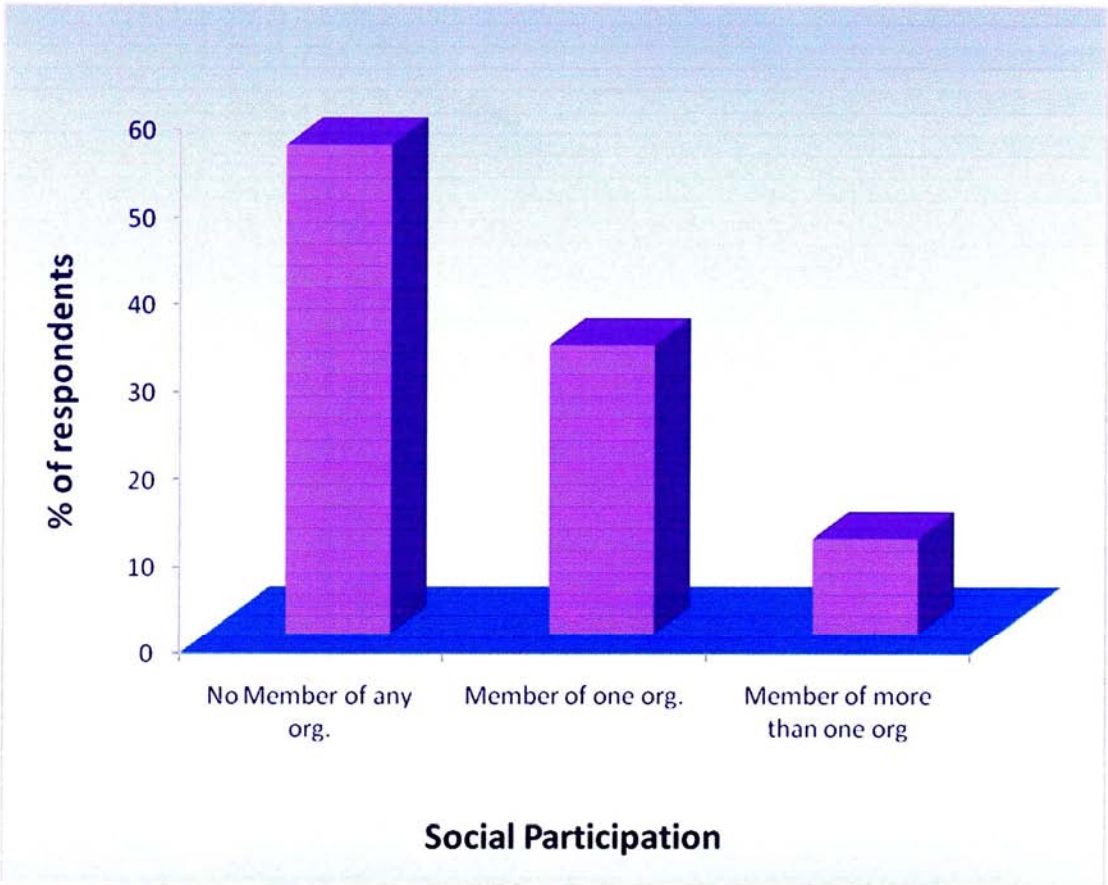

Fig. 13: Distribution of selected gram producers according to their social participation.

4.1.10. Mass media used:

Source of information utilized was considered as an important variables that play vital role in adoption of new innovation. Source of information in the present study refers outside contact of the gram producers for acquiring knowledge with the latest information pertaining to the available technologies. During the study, it was observed that respondent established close linkage with various information sources viz. personal cosmopolite, personal localite and mass media sources which played significant role in adoption level of pulse production. The details result of pertaining to this variable are shown in table.13

Table. 13: Frequency distribution of Gram producers with respect to their mass-media used.

Sl.No.	Source of information			Most often	Often	Some time	Never
A.	**Personal cosmopolite**						
	1	Block officers	f	41	23	19	17
			%	41.00	23.00	19.00	17.00
	2	Scientists	f	45	30	21	4
			%	45.00	30.00	21.00	4.00
B.	**Personal localite**						
	1	Relatives	f	35	45	17	3
			%	35.00	45.00	17.00	3.00
	2	Neighbours	f	29	34	29	8
			%	29.00	34.00	29.00	8.00
	3	Local leaders	f	37	29	31	3
			%	37.00	29.00	31.00	3.00
C.	**Mass-Media**						
	1	T.V.	f	46	32	19	3
			%	46.00	32.00	19.00	3.00
	2	Newspaper	f	36	27	32	5
			%	36.00	27.00	32.00	5.00
	3	Progressive farmer	f	41	23	34	4
			%	41.00	23.00	34.00	4.00

It is evident from the part A of the table that gram growers were found to collect the most often from the Scientists 45.00%, followed by Block officers 41.00% In part B local leaders were emerged as the most influential personality in providing information in tune of 37.00%, followed by the relatives 35.00% and neighbours 35.00%. In part C of table it was found that T.V. was the most preferred information source utilized by the (46.00%), progressive farmers followed by the Newspaper in tune of 41.00% the other source of progressive farmers were found to provide least information to the responds.

4.2 The knowledge level of gram producers.

Table:14 Knowledge level of gram producers across different components of gram production technology.

Sl. No.	Components	f	%	Rank
1	Land preparation	73	73.00	I
2	Varieties	67	67.00	II
3	Seed treatment	59	59.00	III
4	Plant protection measures	33	33.00	IV
5	Use of weedicides	27	27.00	V
6	Post harvest	19	19.00	VI
7	Drainage	10	10.00	VII

The results depicted in table 14 reveal that the level of knowledge of farmers in different component of gram production technology was highest in the area of land preparation (73.00 %) followed by the selection of varieties (67.00 %), seed treatment (59.00%), plant protection measure(33.00%), Use of weedicides (27.00%), post-harvest(19.00%) and drainage (10.00%) respectively.

Based on the level of knowledge related with different component of Gram production technology of the respondents, the results have been further discussed into four category i.e., low, medium, high and very high level of knowledge groups; details of which are presented here in the Table-15

Since, knowledge is an important component of human behavior and is a treasure for adoption of innovation among the farmers, hence, individual possessing varying level of knowledge in different component of gram production were found to adopt differently the package of practices related with gram production. More specifically, the study emphasized on determining the level of knowledge with respect to Gram production technology among the selected respondents. The details of findings are given here as:-

Table.15: Frequency distribution along with percentage scores pertaining to knowledge level about gram production technology.

Sl. No.	Level of Knowledge	f	%
1	Low (0-25)	15	15.00
2	Medium (25-50)	52	52.00
3	High (50-75)	19	19.00
4	Very high(75-100)	14	14.00

The perusal table 15 shows that maximum of (52.00 percent) of respondents had medium level of knowledge towards gram production technology followed by 19.00percent of gram producers who had high level of knowledge. The 15% of the

selected respondents were found to had low knowledge while only 14% of the selected gram growers were found to show very low level of knowledge. The knowledge test used during the study was primarily depend on remembrance and recall at the time of interview. Whatever may be the probable reason of the lower level of knowledge related with gram production there is much scope to help and guide the Gram producers through suitable extension effort for enhancing their knowledge base across the different desired component of gram production technology to boost the production potential of gram crop in Diara land of Bihar.

The desired details pertaining to package of practices for enhancing the knowledge base of gram producers are being given here as;

i **Land preparation:-** During cultivation of gram crop, the first practice is land preparation. Though kans (*Saccharum spontaneum*)is reported to be effective in improvement of sandy soil by slowing down the speed of flood water and deposition of silt, its eradication poses serious problems specially when farmers cultivate this texturally improved diara land. Deep ploughing with mould –board plough is only effective way to eliminate this weed but it is expensive.

ii **Varieties:-** Due to lack of knowledge of improved seeds of gram, farmers usually grow their traditional varieties, which causes poor replacement of seeds of gram. Seed-Village Scheme for production of certified seed such as Rajendra Chana-1(DHG 82-10), DHG 83-1,BG 256,C-235 are being demonstrated presently in the study area.

iii **Seed treatment:-**Seed treatment with *Trichoderma viride* to control wilt, spray of NPV or neem seed kernel extract and spray of *Bacillus thuringiensis* var. *kurstaki* for controlling pod-borer in Gram and chemical methods of seed treatment with chloropyriphos to control cut-worm(locally known as kajrapillu), spray of monocrotophos against gram pod borer are the common practices for seed treatment in these areas.

iv **Plant protection measure:-**A comprehensive plant protection measure involving integrated management approach need to be adopted to mitigate these alarming problems. The use of tolerant resistant varieties, crop rotation, early and timely seeding, short duration varieties, sowing at right soil moisture are the important areas for intervention.

v **Use of weedicides :-***Kateli* or *kataiya* (*Circiumarvense*)pose a serious problem at the harvesting level of gram. Another problematic weed is Akta (*Vicia sativa*)

which covers the canopy of gram crop and reduces plant growth and development by curtailing sun-light resulting in poor crop yield. Pulling out this weed by hand at its juvenile stage appears to be the only effective way. Spraying of 2,4-D which also help in controlling the weeds.

vi **Post harvest:-**In absence of godowns and seed storage facilities leads to wastage of crops as it becomes very difficult to bring over and store the produce from the diara area, which lies 20-25 km in the remote region. The devastating rains, storms and floods are also creating havoc in these areas. Similar destruction is caused by crop fires during the summers when oppresseive, dry 'loo' blows over the fields. The fact that the farmers of Barhiya-Mokama-Fatuha 'Tal' area do not get a profitable, or even reasonable price for their produce that adds to their woes. Surprisingly, there's no arrangement to buy at fair compensatory prices the agricultural produce from this "pulses bowl" .The government should tackle this problem through adopting a strategies to make the pulses and oilseeds production financially and economically viable for the farmers of this region.

vii **Drainage:-**The drainage of water from diara land at proper time to ensure timely sowing of rainfed crops(pulses and oilseeds) is one of the most important requirements. Both early as well as late drainage of flood water are not desirable. When flood water gets drained out early, farmers are forced to sow the gram too early to establish these crops on the basis of residual soil moisture.

4.3 The extent of adoption of gram production technology.

One of the major objective of the study was to ascertain the extent of adoption in relation to Gram production technology in Diara land of Bihar. During the study two options were given to respondents.

i To ascertain the respondents to assess the extent of adoption across the different components of Gram production technology.

ii To determine the extent of adoption in relation to different levels indicating their percentage score. The results summarise in table 16. Refer the adoption pattern of the selected gram growers across the different component of the crop. The details of the results are being present here as alongwith ranking component wise.

Table 16: Frequency distribution along with percentage score of respondents pertaining to the extent of adoption.

Sl.No.	Components	f	%	Rank
1	Use of high yielding variety of gram seed	72	72.00	I
2	Treatment of seed with fungicides	54	54.00	III
3	Use of recommended seed rate	59	59.00	II
4	Method of sowing	22	22.00	VIII
5	Use of adequate timely fertilizer	37	37.00	VI
6	Use of plant protection measure	51	51.00	IV
7	Water management	27	27.00	VII
8	Preventive measure against weedspecies	49	49.00	V

The results summarized in table-16 indicate that level of adoption of farmers in different component of gram production technology was highest in area of use of high yielding variety of gram seed (72.00%) followed by use of recommended seed rate(59.00%) ,treatment of seed with fungicides (54.00 %), use of plant protection(51.00%),preventive measure against weed species(49.00%), use of adequate timely fertilizers(37.00%),water management(27.00%)and with the method of sowing(22.00%).

It is very interesting to note that the extent of adoption of Gram production technology among the gram producers were found moderate and medium. Producers were adopt high yielding variety of gram seed but not in tune sense because they don't have faith about these new varieties, they prefered traditional variety in place of new ones. The selected gram producers were not so much worry about seed rate as they were often found to adopt the broadcasting method of sowing which causes poor crop establishment and production. Since, the plant protection measure is the most important aspects such as use of fungicides, insect-pests and diseases which ultimately decide success and failure of crops. Hence, Gram producers need to be fully trained in choosing and applying the right chemical at proper time with recommended concentration effectiveness. In diara land water management and land preparation were the important components of gram production. The respondents were further grouped into four categories with respect to their extent of adoption as it was the soul objective of the study.

Table No: 17. Extent of adoption of Gram production technology by the selected gram producers.

Sl. No.	Level of Adoption (%)	f	%
1	Low (0-25%)	12	12.00
2	Medium (25-50%)	52	52.00
3	High (50-75%)	25	25.00
4	Very High (75-100%)	11	11.00

The perusal of Table 17 reveals that a maximum of about 52% of the respondents had medium level of adoption whenever 25% of the respondents were found to had high level of adoption and 12% had shown their low level of adoption while only 11% of respondents had shown very high level of adoption. The results indicates that the extent of adoption of gram production technology in medium level is highest (52.00%) consistent with the medium level of knowledge which was also found 52%. It explains that if the knowledge level is higher, adoption level would also show the higher. After medium level of the knowledge level is high in high group and the adoption level is also high in high group in terms of medium level of knowledge. When the knowledge level is low, the extent of adoption is also found low as knowledge was found to be the most important factor for non-adoption. Though the package of technology for crop production has been developed, yet it requires faster dissemination among the users. Similar observations were also borne out from the studies of Rombade, B. D. *et al.*(2011) in which they observed that during the study of adoption of recommended package of practices of kagzilime by the growers, majority of the respondents (44.16 per cent) adopted and advocated kagzilime cultivation practices to a medium extent. The characteristics like education, social participation, source of information, knowledge, socio-economic status, annul income, were positively and significantly related with adoption of kagzilime production technology.

4.4 Constraints in adoption of gram production technology as perceived by respondents

Any knowledge or technology which is generated or developed require its quick diffusion in the social system and adoption by the farm community on large scale. But in view of some constraints it might be possible that adoption rate would be lower. During the study these constraints had been considered as the socio-economic, agro-ecological and technological constraints. One of the set objectives of the present

study was to reveal the constraints percieved by gram producers in Diara land which prevent them from adopting new gram production technology. This would help the extension worker to assess the needs and to develop suitable strategies for extension system accordingly. Thus, farmers were asked to express themselves about the major constraints as perceived by them. The details of results are being presented here in the following table:-

Table No.-18.Socio-economic constraints faced by gram producers in Diara land.

Sl. No.	Particulars	f	%	Rank
1.	Low Price of crop	81	81.00	I
2.	Land dispute problem	77	77.00	II
3.	Lack of credit facility	68	68.00	III
4.	Education and health facilities	49	49.00	IV
5.	No crop insurance	36	36.00	V
6.	Group and caste rivalary	30	30.00	VI
7.	Animal husbandry	25	25.00	VII
8.	Poor Transport and Communication facilities	23	23.00	VIII
9.	Lack of Reliable inputs (Seeds, fertilizers, chemicals)	17	17.00	IX

The perusal of table shows that the low price of crop was major concern by the growers because if farmers didn't get the right price of the gram crop they turn their attention towards other crops through which they received more profit. In diara land of Mokama the farmers turned from gram to lentil due to better price offered by local market. Govt. agencies must take action for giving the better price of gram crop because the green gram, dry gram(dal) and its by product are very costly and in high demand with more market value. The other constraints was the land dispute problem in Diara land due to absence of boundry (aari), muscleman capture the newly formed diara and cultivate such lands forcefully or harvest the crops sown by other farmers. The only solution of these problem is to get these land surveyed afresh and land records updated, based on old map, khatians and old land revenue receipts. New Mustakils need to be indicated in new map for locating the land after silt deposition. Lack of credit facility/finance was another important constraint as perceived by the respondents in adoption of improved technologies such as fertilizer/seed drill in most of the sample diara farms. Landless laboures are mostly find it difficult to get loan from financial institution. Therefore, the farmers should be provided credit facilities with provision of crop insurance. Lack of education and health care facilities, no crop insurance, group and caste rivalary, animal husbandry, least developed poor transport

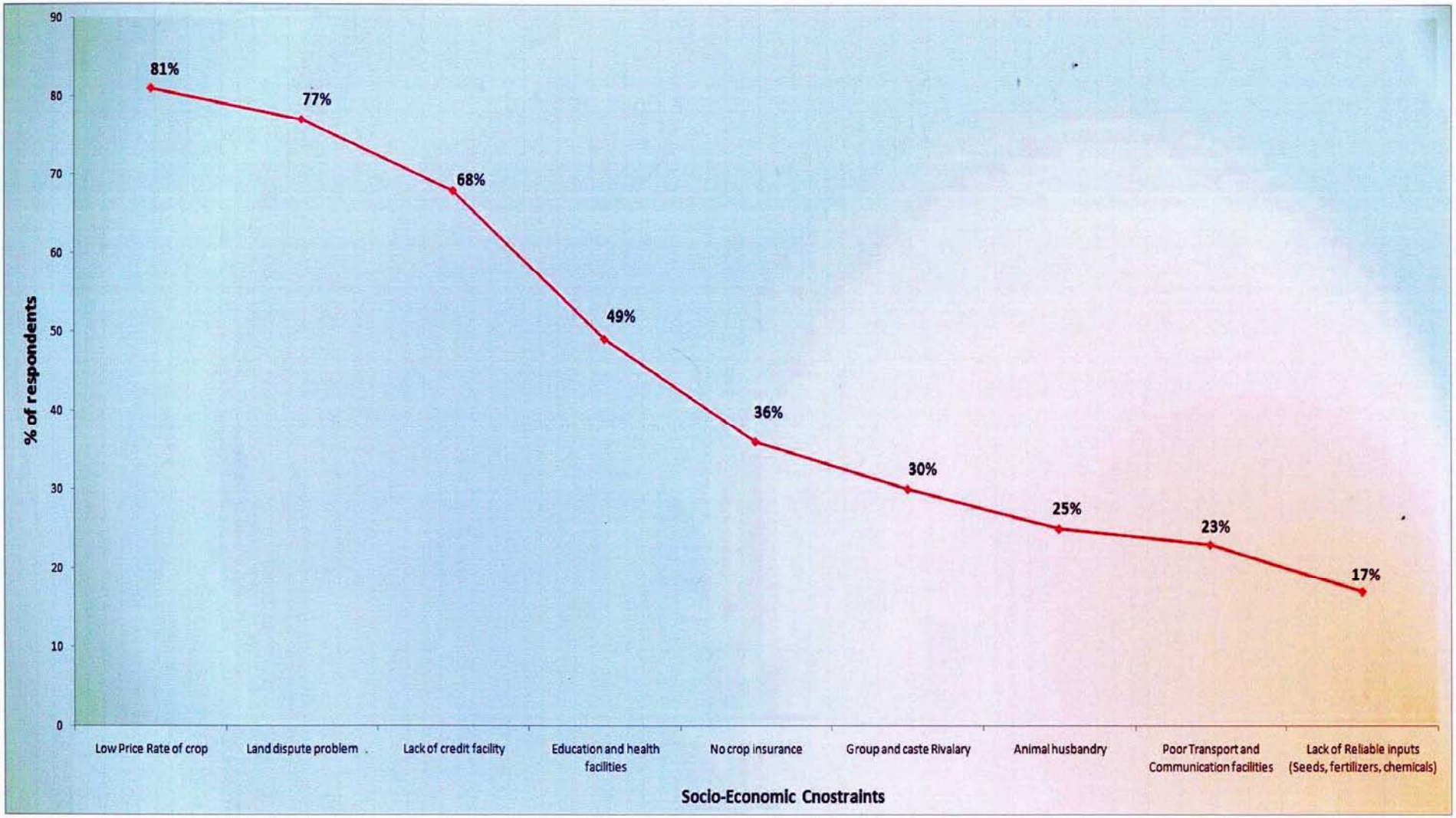

Fig. 14: Socio-economic constraints about gram production technology as perceived by the respondents.

and communication facilities, was the other important problems faced by diara farmers. The farmers were required to transport their seeds by boat or the back of horses as *kutcha* road for movement of tractor etc. does not exist till soil remains wet. Since, the practices of surface seeding and *Tanra* sowing are being fastly replaced by tractor seeding, the problem of transporting seed will be solved automatically and lack of reliable inputs centre were the major socio-economic constraints as perceived by them.

These group of constraints suggest that the Govt. should consider to provide good pricing of gram in local market , resolve land dispute problem, provide credit facility through banks, NGO's and other welfare associations. The developed transport and communication facilities should be developed in order to provide timely seeds, fungicides, weedicides and pesticides inputs to their crop.

Table No.-19.Agro- ecological constraints faced by gram growers in Diara land.

Sl. No.	Particulars	f	%	Rank
1.	Duration and extent of flood	49	49.00	I
2.	Undulating topography of land	36	36.00	II
3.	Variability in soil fertility	24	24.00	III

The table 19 reveals that the duration and extent of flood were the major concern by the selected respondents of Diara areas followed by variability in soil fertility and undulating topography of land.

1. **Duration and extent of flood**:- Due to long duration of flood, summer as well as kharif crops usually fail and rabi crops get delayed, which results in lower productivity/profitability
2. **Undulating topography of land**:- Due to meandering, braiding and course change of rivers the Diara area have been divided into confused pattern of mid and low land by numerous dead and alive streams.
3. **Variability in soil fertility**:- The flood creates variability in soil fertility due to erosion and sand deposition, which varies with depth and from field to field. Some farmers expressed their grievances about lack of government policy and programmes which are essentially needed for the development of diara land.

Table No.-20.Technologicalconstraints faced by gram producers in Diaraland.

Sl. No.	Particulars	f	%	Rank
1.	Drainage problem	92	92.00	I
2.	Lack of timely supply of improved seed	79	79.00	II
3.	Sowing by broadcasting method	73	73.00	III
4.	Plant Protection measure a) Insect-pest i)Pod borer ii) Cut worm b)Diseases i)Blight ii)Wilt	63	63.00	IV
5.	No use of balanced dose of fertilizers	49	49.00	V
6.	Problem of weeds	42	42.00	VI

The results containing in table 20 demonstrate that the drainage pattern in Diara is the main point of concern for the planners. Farmers seek timely supply of improved seed followed by broadcasting of seed which affect poor crop stand, no facility of plant protection measure found for use of gram growers in diara areas.

1. **Drainage problem:-**The drainage of water from Diara land at proper time to ensure timely sowing of rainfed crops(pulses and oilseeds) is one of the most important requirements. Both early as well as late drainage of flood water are not very much desirable because of When flood water gets drained out early, farmers are forced to sow the pulses and oilseeds too early to establish these crops on residual soil moisture. Farmers cannot wait for arrival of optimum time of sowing as this may lead to depletion of soil moisture and rendering the field unfit for cultivation. The early sown crop is liable to be damaged in the event of heavy rains which usually occur during Hathia Nakshtra (27 September to 9 October). Heavy rains results in soil compact and reduction in aeration to roots of pulse crop which affect the growth and development adversely. Water-logging is still worse as it causes mortality of seedlings. The attack of cut-worm and weed problem generally increase in the years of shorter duration of flooding. Late drainage of floodwater causes delay in sowing and late sown pulses and oilseeds suffer more due to insect-pest and disease pressure. Late sown gram and oilseeds crops were found to suffer mostly under this situation.

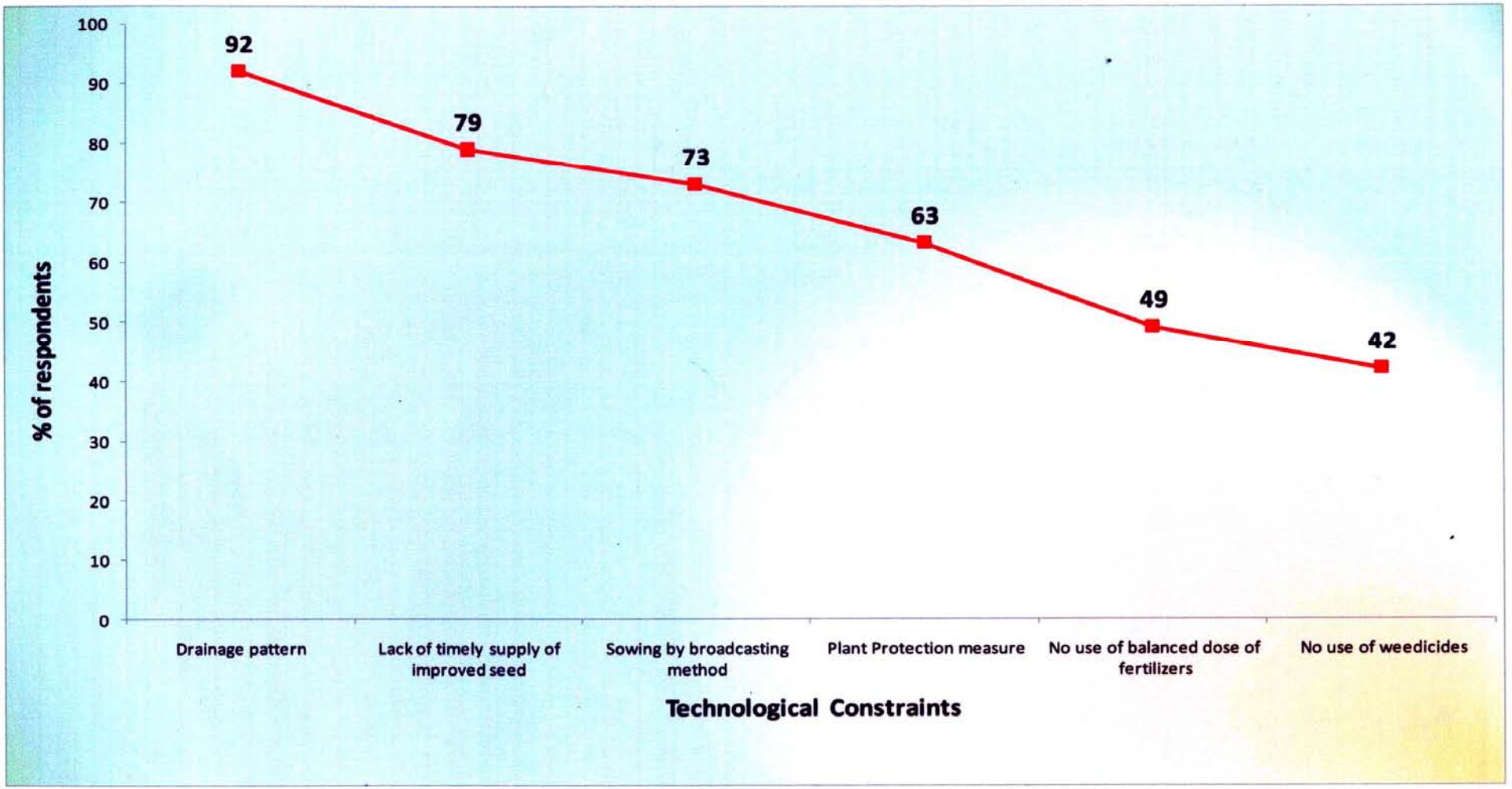

Fig. 15: Technological constraints about gram production technology as perceived by the respondents.

2. **Lack of timely supply of improved seed:-**Due to lack of improved seeds of pulses, farmers usually grow their traditional varieties. There is very poor replacement of seeds of gram. Seeds purchased from private seed dealers do not perform well as they had not been tested earlier under this harsh environment.
3. **Sowing by broadcasting of seed:-**Results in higher dose of seed and poor crop produce, which ultimately affects the yield and profit. None of the farmers was using seed/fertilizer drill.
4. **Plant protection measure:-**The attack of insect-pests and diseases in pulse crops of diara land is much severe and perhaps this is one of the main reasons for instability and poor yields. Cut-worm and pod borer in gram, root rot, wilt and, occasionally *Bortyis gray-mold* in gram were the main concern in the area of plant protection measures as perceived by the selected respondents.
5. **No use of balanced dose of fertilizers:-**Lack of application of balanced dose of fertilizer were perceived as the main constraints during the study.
6. **Problem of weed:-**There are number of weeds in diara lands, some large-sized weeds present in patches cause obstruction in movement of tractors and seed–drills. They are cut by sickle and removed before sowing. However, *Kateli*or *kataiya* (*Circiumarvense*) pose a serious problem at the harvesting time of gram. Another problematic weed is *Akta* (*Vicia sativa)* which covers the canopy of gram crop and reduces plant growth and development by curtailing sun light resulting in poor crop yield.

4.5 Extensions strategies for enhancing the gram production in Diara area of Bihar

The perusal of Table 21 demonstrated that there were broadly six sub-groups of suggested strategies as given by the selected gram growers of Diara land. The different sub-groups were further assigned with ranking in which the given sub-groups got the rank in order of their merits. The first sub-group which received highest rank among the all is the careful design for planned drainage channel for removing the water. The next sub-head was identified as the support price for their produce. The timely supply of certified seed was received the third rank in order of its ranking while plant protection measures received the fourth rank in the series. Provision for appropriate weedicides

alongwith appropriate mechanism to eradicate the Kans (*Saccharum spontaneum*) from the infested under the strategies for diara development in Bihar.

Table No. 21

Sl. No.	Suggested strategies	Total No. of Gram growers	Rank
(i)	Carefully designing of planned drainge channel.	100	I
(ii)	Support price for their produce	81	II
(iii)	Timely supply of certified seed	79	III
(iv)	Plant protection measures	63	IV
(v)	Arrangement of appropriate weedicides.	59	V
(vi)	Eradication of Kans etc infested lands (*Saccharum spontaneum).*	52	VI

The drainage of water from Diara area may be tackled by following means:-

1. Desiltation of old pynes and rivulets passing through *Tal* land.
2. Repair of existing damaged slice gates to make them functional.
3. Construction of new bridges and culverts over rivers with a provision of slice gate for regulating water drainage as well as retention as per need.

The drainage of water from one side to the other side through the openings of the bridges and culverts provided alongwith on the Pucca road passing through *Tal* area *viz.* on Mokamah-Sarmera road is not functional properly. This water level in the western side of road remains much higher than that in eastern side of road. As a result of this, rice crops grown on upland *Tal* in western side often damage due to flood and enough pressure on the road is exerted leading to breaches. According to farmers, adequate numbers of bridges have not been provided. Hence, there is need to provide adequate number of bridges on Mokamah-Sermera road to allow quick passage of water from western side of road to eastern side in order to save the rice crop and reducing the possibility of road breach.

2. Support price for their produce:- The minimum support price for different pulses crop grown in Diara lands of Bihar are not being provided to the growers of the region. Although some by-back programmes are being initiated by the state Government specifically for pulses grown in this area get systematic minimum support price has to be fixed up, so that farmers can get the benefits out of the same scheme.

3. **Timely supply of certified seed:-** Pulses varieties suitable for Diara land condition are recommended based on researches. Accordingly foundation seeds are being made available to the progressive farmers (trained in seed production)in selected villages in each Panchayat on the pattern of "Seed-Village Scheme" for production of certified and truthful seeds so that local farmers may buy the improved seeds locally for their sowing purpose without moving from pillar to post. Gram varieties *Rajendra Chana*-1 (DHG 82-10, DHG 83-1, BG – 256) performed well under diara land situation and need to be promoted in a large area in order to enhance the production of pulses crops.
4. **Plant protection measure:-** A comprehensive plant protection measures involving Integrated Pest Management(IPM) approach need to be adopted to mitigate then alarming problems. The use of cultural (tolerant/resistant varieties, crop rotation, early and timely seeding, short duration varieties, sowing at right soil moisture (sowing at higher soil moisture leads to more seedling mortality), mechanical (erection of bridperchers, yellow-colour painted tin plates with greased surfaces, pheromone traps etc), biological (seed treatment with *Trichodermaviride,* to control wilt, spray of NPV or *neem* seed kernel extract and spray of *Bacillus thuringiensis*var, *kurstaki* for controlling pod-borer in gram) and chemical method (seed treatment with chlorpyriphos to control cut-worm, spray of chlorpyriphos or Monocrotophos or Endosulfan against gram pod-borer, Metasystox or Dimethoate against aphids in oilseed, and Dicofol or Monocrotophos spray against red mite in lentil, seed treatment with fungicides (Captan, Bavistinetc) aginst seedling mortality in gram and lentil, spray of Indofil M-45 or Tilt against lentil rust, SAFF (Carbendazim 12% + Mancozeb 63& WP) against stem-phillium blight in lentil and gram, Karathane and Sulfex against powdery mildew in pea, need to be adopted as per need . More emphasis should be given on prophylactic measures. Repeated spraying of single one type of insecticide especially those belonging to cypermethrin group should be discouraged as it would lead to development of resistance pod-borer.
5. **Arrangement of appropriate weedicides:** The method for controlling *kateli* weed in rainfed crop has not yet been perfected because it has deep root system and spreads through fluffs carried away by wind in summer and transported thereafter by floodwater in *kharif.* At present pulling out this weed

by hand at its juvenile stage appears to be the only effective way. In case of irrigated wheat, the young plant of this weed may be pulled out easily by hand after applying first irrigation, when soil is still wet, Spraying of 2, 4-D (when growing with wheat) may give temporary relief as it has high regeneration capacity.

In order to control *Akta,* surface seeding of gram should be avoided as previously shattered seeds of this weed germinate along with freshly sown gram seeds. If gram crop is at all to be taken, it should be raised by tractor-sowing method so that germinated weeds get killed.

6. **Eradication of kans (*Saccharum spontaneum*):-** Though kans is reported to be effective in improvement of sandy soil by slowing down the speed of flood water and thereby deposition of silt, its eradication poses serious problems when farmers intend to cultivate this texturally improved land. Deep ploughing with mould-board plough is only effective way to eliminate this weed but it is expensive.The state govt. in past had extend some subsidy for kans eradication and this needs to be revived for the benefit of farmers.

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SUMMARY AND CONCLUSION

The Diara ecosystem, whose potentials are yet to be exploited, is situated between the natural levees of rivers, which are periodically eroded and formed due to meandering, braiding and course changing of rivers and remain inundated under flood water for different periods of time, features a riverine landscape with unstable land surfaces, subject annually to erosion and redeposition with assortment of sediments depending upon the velocity and duration of flood. The topography of Diara forms a confûsed pattern of up, mid and low land depending upon the period of stay of flood water, which makes agricultural operations more crucial and challenging. These areas have been identified as future Pulse Grain Bank of the Country by the Scientists.

5.1 Emergence and statement of problem

The riverine area of Bihar, famous for its pulses and oilseeds production potential, remains submerged in water for four to five month during the monsoon season. During this time, water from the Ganga, Punpun, Falgu, Skri, Mahaane and Dhoba rivers flood this Diara area and the water level rises from 10 to 15 feet. There is no arrangement of pumping out this water, as result of which, the whole stretch of land lies useless for six to seven months in a year. Thus, cultivation of one rabi crop specially the pulse cultivation is possible, which is done only during the moist soil conditions. The silt deposited on the ground during the floods adds to the fertility of the soil. Thus, a comprehensive scheme needs to be worked out for water entry (August to September) and water exit from this area (5 October). The farmers here have an acute shortage of high-quality seeds. In fact, the grains of one year are used as seeds during the next year. Absence of proper high-quality seeds leads to reduction in total produce as well as sprouted stalks. Absence of a proper road network in the wide, long and expansive 'Tal/Diara' area is another problem, which makes it difficult to reach the interiors of the riverine plains. The makeshift pathways etched across the farms invite the presence of cattle that in turn ruin the crops. The extensive network of rivers over the Diara area again proves to be a deterrent to cross-area travel. Thus, effort should be put into constructing and developing a comprehensive road and bridge network here.

The fact that the farmers of Barhiya-Mokama-Fatuha 'Tal' area do not get a profitable, or even reasonable, price for their produce only adds to their woes. Surprisingly, there's no arrangement to buy at fair compensatory prices the agricultural produce of this "pulses bowl" .The government should tackle this problem to make the pulses and oilseeds production financially and economically viable for the farmers of this area. The development of a comprehensive irrigation system and ensuring electricity supply to this facilities-deprived stretch of land would not only lead to the development of this region, but also make it possible to grow two-three crops in a year.

Amid the rocking economic conditions of the country and our valiant march towards self-sufficiency in food, the Barhiya-Mokama-Fatuha Diara area has a very important role to play. With the integrated development of the southern riverine stretch of Bihar. This region has the potential to turn into a granary for the entire country. Taking steps to improve productivity and increase efficiency of cultivation in this area can lead Bihar towards self-sufficiency, in pulses and oilseeds. In order to provide a much needed feedback in the policy framework, present study planned to undertake the problem.

Thus the study concentrated upon the following specific research objectives:-

1. To assess the socio-economic profile of gram producer.
2. To explore the knowledge level of gram producers.
3. To analyze the extent of adoption of gram production technology by the producers.
4. To assess the constraints in adoption of gram production technology as perceived by them.
5. To suggest the extension strategies for enhancing the gram production in Diara area of Bihar.

5.2 Research methodology

In Patna district of Bihar state has 23 blocks, out of which the present study was concertated in Mokama block purposively because the majority of Gram growers reside in the Diara land of Mokama. A list of progressive farmers with respect to Gram growers from Mokama block was prepared with the help of BAO, KVK's Scientists, SMS, Extension officers working in this area and the respondents would be convenient as they were well acquainted with the objective of socio-economic researches.

Several visits were made to Mokama block office and consultation were made with respect to the list of progressive farmers residing in the different Panchayats of block. Finally 100 progressive farmers, who were involved in Gram cultivation regularly were selected as the group of sample for the study. They had selected randomly from the universe of progressive farmer's list.

The socio-economic characteristics of the respondents namely age, caste, education. Occupation, family size, annual income, size of land holdings, credit orientation, social participation and mass-media used were taken as the independent variables for the study on the basis of review of the relevant past studies. The selected dependent variables were acquisition of knowledge through different sources and extent of adoption of Gram production technology.

For collection of relevant data, a personal interview schedule was specially desinged and prepared to get the desired response of farmers in face to face situation. The data were further subjected to put under statistical analysis such as frequency, percentage, mean and standard deviation for presenting meaningful results and findings.

5.3 Salient Findings

Salient findings of the study are being presented here as:

5.3.1 To assess the socio-economic profile of gram producers.

i. It is found that in case of gram growers, majority i.e. (65.00 %) of the respondent were belong to (36-50) years age group. Further it was observed by 22.00 percent of farmers attained the 50 years & above of the age group, followed by 13.00 percent who have the age group up to 35years.

ii. The result reveal that large percentage of progressive farmers were belonged to general caste category, indicating their percentage 42.00percent, followed by backward class-II(31.00percent), backward class-I(16.00percent) and scheduled caste was found in tune of 10.00perent. Since the target group of respondents were the progressive farmers who had been rated on different parameter based on the socio-economic strata hence, the population of scheduled caste still lagged behind to attain the status; however some were attained at present indicating its percentage score of 11% among the progressive farmers group.

iii It is found that majority of the gram growers were found highly educated i.e. in the group of graduate respondents (31.00%) followed by intermediate with (30.00%), matriculation (19.00%), can read and write (11.00%)and illiterate (09.00 %).

iv. It is found that majority of the progressive farmers were farming with allied services (agro based trading profession) 57.00%. Further, it was found that 29.00% of progressive farmers were having farming only as their major occupation followed by farming with services/jobs were 14.00%.

v. The results reveal that (40.00 %) possess medium level of family size followed by large (31.00 %) level of family size and small members (29.00%) level

vi. Maximum percentage of score with respect to progressive farmers has borne out from medium category of income from agriculture (53.00 %) medium level of annual income of gram production technology followed by low income group (29.00 %), very low (10.00%) level of annual income and high group of annual income was (9.00%) .

vii. Majority of respondents (53.00 %) were medium farmers followed by small farmers (28.00 %), large farmers (8.00 %) and marginal farmer (11.00%). But in the state of Bihar still marginal and small farmers constitute nearly 88 percent of the total farming group.

viii. Maximum number of respondents were the member of nationalized Bank (55.00%) followed by co-operative society (22.00%), Friends/ Neighbors/ Relatives/ Others were (15.00%) and (8.0%) in money lenders category.

ix. Majority of respondents were (56.00 %) member of one organization and (33.00 %) member of one organization and (11.00 %) having no membership.

x. It is evident from that input seller was the most preferred information source utilized by (45.00%) of the total sampled respondents for obtaining first hand information about of gram production. The next to it was the Block Official as the often utilized by (41.00%) of them for the same purpose. Next to these relative most often (45.00%) neighbours often (34.00%) local leaders most often (37.00%) and T.V. was utilized by most often (46.00%), News paper (36.00%) and progressive farmers (41.00%).

3.2 To explore the knowledge level of gram producers.

i. The level of knowledge of farmers in different component of gram production technology was highest in the area on land preparation (73.00 %) followed by varieties (67.00 %), seed treatment, type of land, plant protection measure, weedicides, post-harvest and drainage respectively. Maximum of 52.00 percent of respondents had medium level of knowledge (between 25-50percent) followed by 19.00percent high and 15.00percent low type knowledge. Only 14.00percent of total respondents had very high level of knowledge.

5.3.3 To analyse the extent of adoption of gram production technology by the . producers

i. The level of adoption of farmers in different component of gram production technology was highest in area of use of high yielding variety of gram seed (80.00%) followed by use of recommended seed rate (78.00%) ,treatment of seed with fungicides (67.00 %), use of plant protection(63.00%), preventive measure against weed species(57.00%), use of adequate timely fertilizers(48.00%),water management(37.00%)and method of sowing(22.00%). The perusal indicates that a maximum of about 52.00 percent of the respondents had medium level of adoption while 25.00percent of the respondents had high level of adoption. 12.00 percent had low while only 11.00 percent of respondents had very high level of adoption.

5.3.4 To assess the constraints in adoption of gram production technology as perceived by them.

i. The low price of crop were major concern for farmers followed by land dispute problem in Diara land, lack of credit facility, education and health facilities, no crop insurance, group and caste rivalary, animal husbandry, poor transport and communication facilities and lack of reliable inputs, land dispute problem. The table shows that the duration and extent of flood were major concern in Diara followed by variability in soil fertility and undulating topography of land.Some farmers expressed their grievances about lack of Govt. policy and programmes. The drainage pattern in Diara is the main point of concern for the planners. Farmers seek timely supply of improved seed followed by broadcasting of seed which affect poor crop stand, no plant protection measure, lack of fungicides, no use of balanced use of fertilizers, no use of weedicides and also no use of sowing implement.

5.3.5 To suggest the extension strategies for enhancing the gram production in Diara area of Bihar

The agricultural technologies are generally developed / refined for a vast agro-ecological zone and recommended as blanket approach for adoption. Whereas the agro-ecological situations of diara areas are totally different than the normal irrigated or rain fed situations. Therefore, there is need for initiating efforts for inclusion of research activities under Farming System Research approach in diara areas, so that integration of agricultural enterprises is effectively applied and goal of sustainable crop production / profitability is achieved. It will be more appropriate if a National Research Centre (NRC) on Diara Land is established with the specific mandate of conducting researches and transfer of technology in these areas, if any desired change is expected on sustainable basis.

5.4 Conclusion

On the basis of findings borne out through this systematic study, it can be concluded that diara lands of Bihar has a vast potentials which spread over more than 11 lakhs hectare falling under different riverine belts of Ganga, Gandak, Burdhi Gandak, Kosi and Sone. The highest area underlies with the Ganga Diara in which prospects of pulses, oilseeds and vegetables production have attracted the Government to frame out appropriate suitable strategy so that production potential of Ganga diara would be exploited. The present study describe the basic characteristics of the Ganga diara with its concerts efforts under Mokama block of Patna district. The gram cultivation in this area has a unique attraction among the farmers in view of proximity with the state capital city i.e. Patna were they often sell their produces with the reasonable price. Based on the problem encountered by the gram growers in Mokama. There is need to developed a suitable strategy incorporating the agricultural, technological and social expertise. So that the curse of the region can be converted into bone of the area which ultimately provides prosperity among the residents living under such problematic region of the state.

Suggestion for future research

The research has its own limitation with respect to the tie and resources. The problems of farmers in agriculture are mixed with social, political, cultural and economic factors. Hence solution should be also demand the multi-disciplinary approach in order to operationalise any methodology of their development.

The following are few protections which should be considered for future research.

- The study should be conducted with a large sample and large area in different agro-climatic zone of the state.
- Investigation should be done to find out the reason why they do not grow gram in large tract.
- There is need to assess potency with large set of variables for still better explanation of variability of the dependent variable.
- It should have been better to have at least the data of three or four agricultural years for greater generation of findings.
- The change in other respect of social system as a consequence of gram production technology should also be measured.

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DEPARTMENT OF EXTENSION EDUCATION
RAJENDRA AGRICULTURAL UNIVERSITY, PUSA
INTERVIEW SCHEDULE

- **Name of farmer :-**
- **Village :-**
- **Block :-**
- **Age :-**
- **Caste**

General	BC I	BC II	SC/ST

- **Education**

Illiterate	Can read and write
Matriculation/ Intermediate	Graduate/post graduate

- **Occupation**

Category	**Annual income (Rs.)**
Agriculture (sole)	
Agriculture+Allied	
Agriculture + Service	
Others	

- **Family size**

Total members	**Male**	**Female**	**Children**

- **Annual Income**

From agriculture sources Rs. .....P/A
From other sources Rs. .....P/A

- **Size of land holdings (In Acre/Kattha/Bigha)**

Total land	**Upland**	**Medium land**	**Low land**

- **Credit orientation**

Nationalized Bank	-	
Co-operative society	-	
Money lenders	-	
Friends/ Neighbors/ Relatives/ Others	-	

Live stock	Total numbers	Income
Cow		
Buffalo		
Goat		
Others		

- **Social participation** yes/no

Organization	Participation(Y/N)	Member	Office bearer	Year
Panchayat				
Co-operative				
Yuva mandal				
School				
Health centre				
Farmer club				
Cultural program				
SHG				
Anganwari				
Kisan mela				
KVK				
SAU				
Others				

- **Mass-media used**

Source	Always	Sometimes/occasional	Never
T.V			
Radio			
News paper			
Telephone			
Leaflet/pamphlet			
Agriculture magazine			
Progressive farmer			
Friends			
Neighbour			
Relative			
Co-operative society			
Kisan Diwas			
Training			
Others			

- **Diara land details**
- **Status of Soil Testing**
    - **Have you gone through soil test ? Yes/No**
    - **When and what were soil value?**
- **Source of irrigation**
- **Major crops grown during *Kharif/ Rabi***
-

Season	Name of Crops	Area	Production	Productivity	Type of Land Used
Rabi					
Kharif					

KNOWLEDGE TEST: ABOUT PULSE (GRAM) PRODUCTION TECHNOLOGIES

- Type of Land
- Land preparation
- Soil
- Varieties

Crop	Varieties	Seed Rate	Period	% Area	Production	Productivity
1						
2						
3						
4						

- ***Seed Treatment***

Crop	% of seed	Chemical used dose	Culture/bio-fertilizer used dose
1			
2			
3			
4			

- **Preparatory tillage**
- **Time and sowing**
- **Methods of sowing**
- **Seed treatment** **yes/no** **details**
- **Fertilizer**

Sl. No	Crop	% Area	N Application Method dose P Application Method dose K Application Method	Replication	Others application methods
1					
2					
3					
4					

- ***Plant protection***
  - *insecticide*

1	
2	
3	

  - ***Pesticide***

1	
2	
3	

  - **Weedicides**

1	
2	

- ***Irrigation***

Sl No.	Crop	%area	No. of Irrigation	Time of irrigation	Methods
1					
2					
3					

- **Water management**
- **Post harvest**
- **Storage**
- **Value addition**

Sl No.	Crop	% produce	Type
1			
2			
3			
4			

- **Farmer's perception**
- **Factor influencing production & productivity of pulse (gram)**

1			
2			
3			
4			
5			

- **Suggestive measures**

1			
2			
3			
4			
5			
6			
7			
8			

- **Potential productivity which can be achieved**

Sl No.	Crop	Productivity
1		
2		
3		
4		

Land on contract (Reason)	Have taken	Have given

- **Crop yields under various conditions:**

Name of crops	Varieties	Gram
Experimental Yield (Kg/ha)		
Demonstration		
Yield/progressive farmers		
Yields (Kg/ha)		

- **Extent of adoption about Gram Production technologies**

1 What is the total area under gram cultivation you have?. .....

2 What is the area that was brought under high yielding varieties of gram Katha/Acre? .....

3 Among the following package of practices recommended for high yielding varieties of gram, which are the practices you have adopted

(a) Use of high yielding varieties of gram seed ( )

(b) Treating the seed with fungicides ( )

(c) Use of recommended seed rate ( )

(d) Methods of sowing ( )

(e) Use of adequate and timely fertilizer ( )

(f) Use of plant protection measure ( )

(g) Water management ( )

(h) Preventive measure against weed species ( )

CONSTRAINTS RECEIVED DURING SOWING OF GRAM CROP

- Economic constraints faced by gram growers.

Sl. No.	Components
1.	Low profit due to high cost of cultivation
2.	High price of chemicals for plant protection
3.	High price of manures and fertilizers.

- Technological constraints faced by gram growers.

Sl. No.	Components
1.	Infestation with disease
2.	Wilt problem rated
3.	Incidence of insect/pest
4.	Lack of seed improved varieties
5.	Incidence of cascutta
6.	Lack of irrigation facilities
7.	Low yield level
8.	Rainfed paira cropping

- Socio-personal constraints faced by gram growers.

Sl. No.	Components
1.	Lack of knowledge regarding gram production technology.
2.	Lack of extension approach
3.	Lack of training facilities
4.	Difficulty in the use of dose given per hectare
5.	Poverty of respondents