YIELD GAPS ANALYSIS OF MAJOR CROPS IN TERAI ZONE OF WEST BENGAL

Thesis submitted in part fulfilment of the requirements for the award of the degree of ***MASTER OF SCIENCE (AGRICULTURE)*** *in Agricultural Extension to the Tamil Nadu Agricultural University, Coimbatore*

By

PRAMOD CHAND LAKRA
(I.D. NO: 00 – 603 - 011)

DEPARTMENT OF AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY
CENTRE OF AGRICULTURAL AND RURAL DEVELOPMENT STUDIES
TAMIL NADU AGRICULTURAL UNIVERSITY
COIMBATORE- 641 003

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CERTIFICATE

This is to certify that the thesis entitled **"YIELD GAPS ANALYSIS OF MAJOR CROPS IN TERAI ZONE OF WEST BENGAL"** submitted in part fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in Agricultural Extension to the Tamil Nadu Agricultural University, Coimbatore is a record of bonafide research work carried out by **Thiru. PRAMOD CHAND LAKRA** under my supervision and guidance and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journal or magazine.

Place : Coimbatore
Date : 8/11/2002

K.A. Ponnusamy

(Dr. K. A. PONNUSAMY)
Chairman

Approved by

Chairman : K.A. Ponnusamy

(Dr. K. A. PONNUSAMY)

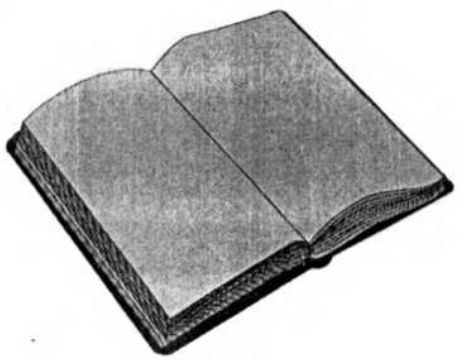
Members :

(Dr. H. PHILIP)

Meera Krishnamoorty

(Dr. MEERA KRISHNAMOORTY)

Date : 10.1.03
External examiner :



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Pramod Chand Lakra

(PRAMOD CHAND LAKRA)

Abstract

ABSTRACT

YIELD GAPS ANALYSIS OF MAJOR CROPS IN TERAI ZONE OF WEST BENGAL

By

PRAMOD CHAND LAKRA

DEGREE : **Master of Science (Agriculture) in Agricultural Extension**

CHAIRMAN : **Dr. K. A. PONNUSAMY**
Professor
AHRDP Cell
Tamil Nadu Agricultural University
Coimbatore – 641 003

2002

This research investigation entitled "Yield gaps analysis of major crops in Terai zone of West Bengal" was framed to assess the knowledge gap, technological gap and yield gaps of jute, paddy and potato cultivators. The study also reflected relationship between the socio-economic, personal and psychological characteristics with the knowledge gap, technological gap and yield gaps of the selected crops. The study further attempted to find the constraints, which led to the wide yield gaps between the potential yield and the knowledge gap.

Keeping this in view, an investigation was conducted in Terai zone of West Bengal. With the help of proportionate random sampling technique, a sample of 60 cultivators were selected from the farmers who cultivated jute as well as paddy crop in a single year, while another 60 potato cultivators were selected. Data were collected by personal interview method with the help of a well structured and pre-tested interview schedule.

Assessment of the yield gaps revealed that there existed a wide variation in yield gaps. The study revealed that the yield gaps on jute varied from 6.25 per cent to 73.33 per cent. In case of

paddy crop, yield gaps varied between 6.67 to 73.33 per cent, while potato crop yield gaps varied from 5 to 50 per cent .

The assessment of the knowledge gap and technological gap showed that most of the cultivators had medium level of gap. 17 characteristics were selected from the past research studies. The socio-economic characteristics that were studied revealed that most of the cultivators had lower level of annual income, material status and farm power status and had medium sized land holdings. The study of the personal characteristics revealed that majority of the cultivators were young aged, had education up to middle school but had medium level of social participation, mass media exposure and extension agency contact and had high level of farming experience. Majority of the cultivators belonged to nuclear families. The psychological characteristics of the cultivators revealed that most of them had high level of economic motivation, scientific orientation and progressiveness. Also, most of the cultivators had medium level of credit orientation, innovativeness and risk orientation.

Correlation analysis revealed that out of the 17 variables, 8 variables, namely education, material status, farm power status, social participation, mass media exposure, innovativeness, scientific orientation and progressiveness had a negatively significant relationship at one percent level of probability with the knowledge gap, technological gap and yield gaps of the selected crops. Only two independent variables, namely age and farming experience were not found to be significant.

Multiple regression analysis of the independent variables revealed that only farm power status, social participation, mass media exposure, scientific orientation, risk orientation and progressiveness were found to be significant with the knowledge gap, technological gap and yield gaps of the selected crops.

Stepwise regression was carried out to reveal the most important contributing variables. The independent variables *viz.*, annual income, material status, farm power status, social participation, mass media exposure, extension agency contact, risk orientation and progressiveness were found to have significant relationship with the knowledge gap, technological gap and yield gaps of the selected crops.

The constraint analysis revealed that the jute-paddy cultivators considered that higher pest incidence and lack of technology for the specific area was the major hindrance in achieving the required yield. Potato cultivators had the view that high costs of labour, high cost of input, higher pest incidence and weed management were the major hindrances in achieving higher yield.

Based on the assessment of yield gap, knowledge gap, technological gap and characteristics of the cultivators, constraints faced by them, appropriate suggestion and strategies were proposed to minimize the yield gaps.

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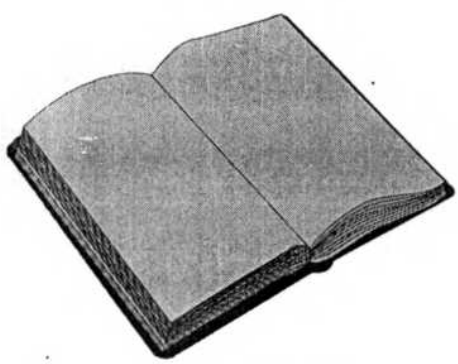


Introduction

INTRODUCTION

The agricultural sector has played a key role in the process of development in our country. Agriculture sustains the livelihood of 70.00 per cent of the population and contributes significantly to the GDP. The health of economy and well being of India thus depends much on the development of agriculture. Thus, more emphasis should be laid on the development of agriculture in the coming years.

During the successive plan periods, agricultural production showed a slightly higher growth as compared to the population growth. The growth rate of food grain production since the advent of the first plan in 1950 - 1951 has been 2.6 per cent. In mid 50's, the country produced 53 million tonnes of food grains, which has come to the level of 196.3 million tonnes in 2000 – 2001.

This was the outcome of careful technological intervention, agricultural development programs and strategies formulated and implemented by government to improve the food grain production base.

The impressive growth in agricultural production was seen mainly in the case of paddy and wheat. Since the introduction of high-yielding varieties, the production of wheat has gone up from 12.2 million tonnes in 1965 – 1966 to 68.53 million tonnes in 2000 – 2001. The paddy production in 2000 – 2001 has gone up to 85.5 million tonnes from 30 million tonnes in 1965 – 1966.

Though not as impressive as that of paddy and wheat, jute production increased from 16.70 lakh bales (bale = 180 kg) in 1965 – 1966 to 100 lakh bales. Similarly, the

potato production increased from 1.5 million tonnes to 28.7 million tonnes during the same period.

But production in India has encountered a declining trend in the year 2000 – 2001. The paddy production during the year was 85.5 million tonnes, about 4.5 million tonnes less than the year 1998 – 1999, the wheat production also suffered a serious setback during the year and it stood at 68.55 million tonnes, about 7 million tonnes less than that of previous year.

Though the country has been self-sufficient in food grain production, the planners and agriculture economists express serious concern about the slow rate of growth in production of principal crops in the country in the recent years.

Another dimension of the problem is related to per capita availability of cultivated area which continued to decline from 0.33 ha in 1950 to 1980 and 0.16 ha in 1980. Apart from these, continuous depletion of soil fertility and build up of salinity and alkalinity in soils are some of the problem faced at present. It has been estimated that land degradation has occurred in 175 million ha and flood proneness seemed to occur to that extent of 40 million.

West Bengal occupies an important position in the Indian agriculture. The economy of the state is predominantly agriculture-based economy. West Bengal is considered as one of the major producers of paddy, jute and potato. In the year 2000 – 2001 the state production in paddy was 13 million tonnes, while production of jute stood

at 7 million bales (1 bales = 180 kg). The production of potato was 7 million tonnes and stood second in production among the different states in India.

Though the production may have a reached a new level, the gap between the potential yield and actual yield was very high through out this period. When the production of some crops are compared with other States, production per unit area is far below than its potential. Ponnusamy (1985) reported that the yield of the state was about 60 per cent lower then the achievable potential yield. Similar trend was seen in case of jute, which showed a gap per cent of 44.39. In case of potato, the yield gap was only 24.24 per cent. Further Siddiq (2000) reported that with the exception of Tamil Nadu (15 per cent) and Punjab (22 per cent), the yield gap was in the range of 35 to 75 per cent in all the states including West Bengal.

Hence, there is strong need to channelize efforts to increase the crop yield. Increasing population and lesser per capita availability of land created an immediate necessity to increase productivity and bridge the gap between the potential yield and actual yield. Thus there is a need to identify different constraints and socio-economic, personal and psychological characteristics of the cultivators which may have influenced the knowledge and low rate of adoption leading to low yield and to tap the untapped land , labour and available technical resources.

Thus for a better understanding about the reasons for the yield gap, this investigation was taken up at micro level. The individual factors like knowledge and technological gap were considered for the purpose of analysis of yield gaps. The yield

gaps analysis also aims to identify factors responsible for the difference in best farmer yields and the average farmer yields.

The present study was, therefore, designed to focus on the technological gap and yield gaps that occur between the average farmer yield and the best farmer yield of the study area.

1.1. Objectives of the study

Keeping the above facts in view, the present study was planned with the following specific objectives.

1. To assess the yield gaps in jute, paddy and potato crops in Terai zone of West Bengal.
2. To assess the knowledge gap and technological gap in relation to jute, paddy and potato crops.
3. To study the socio-economic, personal and psychological characteristics of the farmers.
4. To examine the relationship between the socio-economic, personal and psychological characteristics with the yield gap, knowledge gap and technological gap.
5. To suggest appropriate strategies for minimizing yield gaps.

1.2. Hypotheses of the study

The hypotheses of the study for the present investigation are as follows

1. There may not be any yield gaps, knowledge gaps and technological gaps in relation to jute, paddy and potato crop.

2. There may not be any significant relationship between the socio-economic, personal and psychological characteristics with the yield gaps, knowledge gaps and technological gap and the yield gaps.

1.3. Scope and importance of the study

This study highlights three important crops of Terai zone of West Bengal. This study aims to analyse the knowledge gap, technological gap and yield gaps among the farmers who cultivate jute as well as paddy in a single year and the cultivators who produce potato. The immediate task of the study is to find the difference between an average farmer and the best farmer of that particular crop in the selected zone of research. Also, the constraint or the problem, which restricts them from obtaining the optimum possible yield. The study attempts to suggest appropriate strategy for overcoming the problem in relation to the various constraints faced.

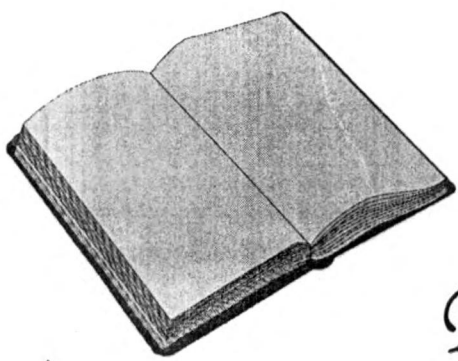
The attempt made in this study would be helpful to those interested in identifying the reasons for the existence of the wide yield gaps. The strategies of the study would also be helpful for bridging the gap in the yields of paddy, jute and potato which are the major crops in West Bengal.

1.4. Limitation of the study

The study takes no exception to the limitation of time, finance and conveyance facilities that are normally faced by any student researcher. However, every effort has been putforth to conduct this study as objectively and systematically as possible in a real field situation.

1.5. Organization of thesis

In addition to the introductory chapter, four more chapters have been organized in a logical sequence. The second chapter deals with the review of literature relevant to the study and the third chapter is on the research methodology followed in this study. The findings and discussion are presented in the fourth chapter, while summary and conclusion with implication are furnished in the fifth chapter. The pointers for future research are also included at the end of the fifth chapter for information of the successive social science researchers.



Review of Literature

REVIEW OF LITERATURE

Past is the guide for the future. Earlier researches are the spectacles to see the forthcoming findings. So review of previous researches will form a comparative message to bridge the research relationship gap between the past and future. Hence, in this chapter, an attempt has been made to review the contextually relevant literature, which had a sound and meaningful relation to the proposed research based on the objectives set forth. The literature collected are presented under the following headings.

2.1. Concept and studies on yield gap

2.2. Studies conducted on knowledge gap and technological gap

2.3. The socio-economic, personal and psychological characteristics of the respondents

2.4. Relationship between the socio-economic, personal and psychological characteristics of the respondents, yield gap, knowledge gap and technological gap

2.5. Constraints faced by the cultivators and suggestions to minimize the yield gaps

2.1. Concept and studies on yield gap

Each crop variety has its own yield potential. But the yield realized in the farmer's field is very different from the yield obtained under experimental conditions. There lie several environmental, physical, socio-economic factors responsible for such yield differentials. In view of rapidly growing population, this untapped

production reservoir otherwise known as 'yield gap' has become an emerging issue. The concept of yield gap has been conceived by different authors differently. The problem is of definition rather than measurement of yield gap. Hence, the review of literature on different studies of yield gaps are and presented below.

2.1.1. Concept on yield gaps

Herdt and Wickham (1975) defined yield gap as the difference between the yield potential at the experimental station during the particular season in a good year and the average national yield in the corresponding season.

Conceptual model of yield gap, given by Gomez (1977) introduced a yield level intermediate between the experimental yield and actual farm yield. The yield level, called potential yield was the yield obtained in a farmers field using improved technology. Thus, the yield gap could be divided into two components *viz.*, yield gap I and yield gap II. The difference between experimental yield and potential farm yield represented yield gap I, while the gap between potential farm yield and actual farm yield represented yield gap II.

Mukherji (1977) defined yield gap as the ratio between the potential yield as found in the national demonstration and the average state yield.

Swaminathan (1977) identified three types of yield gap, namely gap I, gap II and gap III for wheat crop. According to him, the gap between the yield possible on theoretical considerations and the best yield so far achieved can be referred to as gap I, which represents research gap. The gap II is the best yield obtained in a research

farm and progressive farmer's yield, which represents Research cum management gap. The gap III is the difference between the best average yield realized by a farmer in a state and the state average yield. The third gap can also be called as extension gap.

Gomez and Gomez (1983) further developed the conceptual model of yield gap by breaking the difference between the experiment station yield and the actual farm yield into three distinct parts by introducing two intermediate levels. The first part of the total yield gap, yield gap I is the difference between experiment station yield and potential farm yield, which is due to deficiencies in the farm environment beyond the farmer's capacity to modify. The second part, yield gap II, is the difference between the potential farm yield and economic farm yield, which represents the portion of the potential farm yield, which represents the portion of the farm yield uneconomical for the farmers to produce under his farm condition. The third part, yield gap III, is the difference between economic farm yield and actual farm yield and represents the additional yield that the farmer could economically produce on his farm.

Fale *et al.* (1985) also argued that yield obtained at experimental stations could not be achieved on farm because of differences in environment, input use and management. Therefore, they defined yield gap as the difference in yields obtained in demonstration plots and the actual farm yields.

Gangwar and Pandey (1985) reported that yield gap is the difference between average yield of a farm and yield obtained by progressive farmers or in the yield trials conducted on the farmer fields.

Rajagopalan (1986) identified two types of yield gap, namely yield gap I and yield gap II in rice crop. Difference between experimental station yield and potential farm yield was called as yield gap I. Yield gap II referred to the difference between potential farm yield and actual farm yield. Here potential farm yield refers to the intermediate between experiment station yield and actual farm yield.

Vasanthakumar and Selvaraj (1986) considered the gap between the potential farm yield actual farm yield and expressed in percentage as the yield gap.

Singh (1989) proposed the yield gap as the gap existing between the potential yield already attained by some progressive farmers and the average local yield with the similar agro-climatic and resource endowment situation such as block or tahsil.

Borthakur (1994) studied and conceptualized yield gaps at three levels. i). Yield gap I – was defined as the difference between the experimental station yield and the average farm yield largely attributed to the loss in transfer of technology to the farmers and was defined as 'technology gap'. ii) Yield gap II was identified as the difference between potential farm yield or demonstration plot yield and the average farm yield, this was termed as extension gap. The first two types of yield gaps indicated non-exploitation of the available yield potential on the farms of the area under the existing state of technological development. iii) Yield gap III was identified as the difference between the progressive farm yield and the average farm yield which might be due to farm specific constraints and managerial inefficiency. This gap was largely due to managerial inefficiency on the part of the farmer and was therefore, called the management gap.

Chaudhary (2000) modified Gomez (1977) definition and divided it into three components. The difference between theoretical yield and experimental yield was represented by yield gap 0. The gap between the experimental station yield and potential farm yield as yield gap I while the gap between the potential farm yield and actual yield was represented by yield gap II.

2.1.2. Studies on yield gaps

Tripathy (1977) reported that different package of practice individually acounted for the technological gaps. The gaps in various components were studied by the researcher. As far as rice was concerned, he concluded that about 17.00 per cent of the gap in the yield was due to technological gap.

Chandrasekaran (1979) observed that sugarcane yield gaps I and II were 45.42 and 28.32 tonnes per hectare respectively in Avanashi taluk of Coimbatore District.

Balasubramanian (1981) found existence of cent per cent gap in respect of seed treatment and top dressing of fertilizer for jowar, 51.90 per cent gap in adoption of super digest compost, it was concluded that this was the reason for the low yield.

Swarup and Pandey (1981) calculated the yield gap index in order to quantify the gap between the potential yield of national demonstration trial and the actual yield of wheat among states at farm level. The index was 60.00 per cent for India and it varied between 36.40 and 76.00 per cent among different states.

Chamala (1982) found a vast gap between the potential and actual productivity in rape and mustard.

Chandrakandan (1984) reported that the yield gap between first and second crop of paddy in Thanjavur district was 642.50 kg per hectare and 1490.00 kg per hectare respectively.

Chandrakandan (1985) observed that the yield gap I and yield gap II in sugarcane crop were 45.42 and 28.32 tonnes per hectare, respectively, in Avanashi block of Coimbatore.

Fale *et al.*, (1985) observed that the gaps between yield on experimental situation and those obtained on national demonstration plots (gap I) was quite narrow (2 q/ha or 3.83 per cent). However, the gap between potential yields and the actual yields on farmers field is very wide (i.e. 27 q/ha or 52 per cent). There existed difference in utilization of improved inputs such as fertilizer and labour. Higher level of input use was on national demonstration plots as compared to farmers level.

Ponnusamy (1985) observed the national level yield gaps in various crops and reported that the highest gap of 82.59 per cent existed in jowar followed by 80.86 per cent in bajra, 72.28 per cent in rice, 67.97 per cent in maize, 64.49 per cent in ragi and 59.64 per cent in wheat.

Bhatti *et al.* (1986) reported that there was a yield gap of 1.50 ton/ha between researcher's package of technology and the stimulated farmer's package of technology

and the stimulated farmer's practice in rice, making the latter less profitable in the Larkana district of Pakistan.

Hossain (1986) inferred that in rice crop, the low use of fertilizers resulted in the yield gap of 63.76 per cent in Bangaladesh.

Lakshmanan (1986) reported that the extent of yield gap in groundnut varied from 20.84 per cent in wet zone area to 29.05 per cent in dry zone. The gap was 25.41 per cent and 22.79 per cent in case of small and big farmers respectively. The reason for the variation was due to low fertilizer dose, irrigation and low perception of attributes.

Rajagopalan (1986) studied the potential yield obtained in the Thanjavur district of Tamil Nadu. He stated that yield gap revealed the scope for increasing production even under existing technology simply by more diffusion, even though further improvement may be possible through development of new technologies. He further stated that the yield gap in rice, sorghum, cumbu and ragi crop in Tamil Nadu state were 1764 kg/ha, 285 kg/ha, 231 kg/ha and 142 kg/ha respectively. The yield gap of below 1000 kg per acre was found with 68.5 per cent and above 1000 kg per acre was found with 26.1 per cent of the farmers for the cultivation of rice.

Yadav and Gangwar (1986) estimated yield gap of paddy in Bihar state at 8 and 10 quintal per hectare of paddy for early and late maturing varieties respectively.

Bhoite and Thorat (1987) found that three crucial factors like water management, nutrient management and pest control were together responsible for 50.00 per cent of the yield gap. Ecological factors such as temperature, soil and rainfall were together responsible for 19.80 per cent of the yield gap in rice crop.

Reddy (1987) reported the yield gaps of 7.20, 5.30, and 12.50 q/ha in Sataria between the yield of the demonstration plot and the research stations.

Anderson and Hazell (1989) reported that the variability in yield may be due to the use of modern varieties, their greater responsiveness to modern inputs variation in use, susceptibility to pests and diseases and weather conditions.

Sivakumar and Subramaniam (1990) observed the impact of the special food grain production programme in Tamil Nadu and revealed that the adoption of improved technologies had resulted in an increase in yield of 8.32 per cent in *kharif* and 6.67 per cent in *rabi* during 1988-89 in paddy.

Chandrakandan and Venkataram (1991) observed that the yield gaps in paddy, turmeric, sorghum and cotton were 4.00, 3.90, 3.41, 3.62 and 2.58 tons/ha respectively.

Uma (1991) found that yield gap I for rice in Thanjavur district was 679 kg per hectare in CR 1009, 760 kg per hectare in CO 43 and 912 kg per hectare in case of ADT 39. But gap II in old delta was 2011.70 kg per hectare in CR 1009 followed by CO 43 and ADT 39 with 1817.20 kg per hectare and 1506.35 kg per hectare,

respectively. The author further stated that the yield gap I was higher in coastal area (886.50 kg/ha) and yield gap II was higher in old delta with 1815.50 kg per hectare.

Singh *et al.* (2000) reported that a major yield gap existed in boro-rice ecosystem where the potential yield being quite high at 9.7 t/ha and actual yield at 6.43 t/ha still left a large gap (3.27 t/ha) to be achieved.

Becker and Johnson (2001) studied on cropping intensity and found that yield gaps were attributed to weeds and nitrogen increased cropping intensity and reduced fallow duration.

Thakral *et al.*, (2001) revealed that on an average seed yield of mustard in Frontline Demonstration was 25.90 per cent more than what farmers practised.

2.2. Studies conducted on knowledge gap and technological gap

2.2.1. Studies conducted on knowledge level and gap

Ratnakar (1990) reported that majority (56.90%) of the tribal farmers had medium level of knowledge with respect to mango cultivation, whereas majority (81.20%) of non-beneficiaries had low level of knowledge.

Singh *et al.* (1991) revealed that majority (63.16%) of the citrus growers had high knowledge gap about the improved production technology of citrus crop.

Sophia (1991) stated that among the dryland farmers more than 60 per cent possessed good knowledge in the dryland practices *viz.*, summer ploughing, seed rate,

seed treatment, pre monsoon sowing of cotton and cluster beans, inter cropping system, fertilizer application and chemical control of bollworms.

Swamidasan (1994) observed that half (50.00%) of the betelvine growers were found to possess low level of knowledge followed by high (30.00%) and medium (20.00%) level of knowledge on recommended betelvine cultivation practices.

Manjunath *et al.* (1995) revealed that a good number (53.00%) of farmers belonged to medium knowledge category, while 24.00 per cent and 23.00 per cent of farmers belonged to high and low knowledge category.

Yagananda (1997) revealed that more than 75.00 per cent of small and big coconut growers had knowledge on maintenance of nursery, selection of seedlings and planting of seedlings. Only few growers had lack of knowledge on the control of diseases and required spacing for planting the seedlings.

Alagirisamy (1999) inferred that 61.67 per cent of the vegetable growers possessed medium level followed by high level (21.67%) and low level (16.66%) of knowledge on cauliflower cultivation.

In the study done by Kavitha (1998) it was found that the majority of the paddy growers (50.83%) had medium level of knowledge about neem as botanical input.

Marimuthu (1998) reported that more than one-third of the respondents (37.50%) had high level of knowledge followed by medium (32.50%) and low (30.00%) level of knowledge on recommended banana cultivation practices.

Among the turmeric farmers, 58.60 per cent possessed good knowledge in the turmeric post harvest technologies followed by 31.40 and 10.00 per cent of low and high level of knowledge respectively in the study done by Arulmurugan (2000).

40.00 per cent of the respondents were found to possess medium level of knowledge followed by low (33.33%) and high (26.67%) knowledge levels about the weed management practices for paddy crop in the study of Subramanian (2000).

Venkatesan (2000) reported that majority of the tomato growers (65.00%) had medium to high level of knowledge about the recommended practices in tomato cultivation.

2.2.2. Studies conducted on technological gap

The technological gap was 50.00 per cent in case of seed treatment and plant protection measures for majority of farmers as reported by Manivannan (1980).

Sridharan (1981) found that among sericulturists, the technological gap was more in 70.00 per cent of farmers with regard to spacing and it was 0 – 25.00 per cent in 46.67 per cent of farmers regarding nitrogenous fertilizer application and it was 25 – 50 per cent in case of 57.50 per cent of farmers with regard to disease control measures.

Lakshmanan (1986) reported that the technological gap was cent per cent with respect to weedicide application and also stated that the technological gap was more than 70.00 per cent with respect to micronutrient application of phosphorous, application of potash and seed treatment.

The technological gap was zero to 85.00 per cent farmers of pulses minikit demonstrations as found by Swaminathan (1986).

In his study Sankaran (1987) observed that the technological gap was 0-25.00 per cent for majority of groundnut farmers in case of variety and gypsum application while it was 25.50 per cent in case of farmyard manure application, NPK application, seed treatment, micronutrients application and use of plant protection measures.

Venkataraman (1987) stated that only few farmers (16.67%) had a low technological gap. Majority of the farmers had moderate technological gap (62.22%) and only 21.11 per cent of farmers had high technological gap.

Narayanan (1996) found that more than half (68.00%) of the respondents had foreseen technological gap of about 40.00 per cent. A little less than one-third (32.00%) of them had less than 20.00 per cent technological gap on plant population maintenance, sett treatment, weed management, fertilizer management, water management, earthing up and plant protection measures on sugarcane cultivation.

Das *et al.* (1999) revealed that 40.00 per cent of the respondents had a medium level of adoption gap, while 22.00 per cent had low adoption gap and 28.00 per cent

had high adoption gap. The highest gap (59.00%) was observed in the case of plant protection measures, followed by irrigation (51.00%) and fertilizer (49.00%). The lowest gap (27.00%) was recorded in the case of agronomic practices by sorghum growers.

Jayalakshmi (2000) reported that about 80.00 per cent technological gap was found for the redgram varieties and little more than three-fourths per cent of technological gap was noticed with regard to control of storage pest.

The overall technological gap was 25.92 per cent in all the recommended practices which is considerably high in case of compost preparation (90.00%) followed by casing mixture (29.00%). The minimum technological gap was found in case of spawn and spawning (14.00%) and cropping (15.36%) (Singh *et. al.*, 2000).

Sudhakar and Kangasabapathi (2000) reported that the most important constraints faced by the respondents in the adoption of IPM technologies of cotton were high wages of labourers (73.33%) high cost and non-availability of bio-pesticide and HYV's seed in the market (70.23%) and non-co-operation of neighborhood farmers for sowing the same hybrid.

Barman and Pandey *et al.* (2001) indicated substantial technology adoption gap in terms of irrigation and manuring and fertilization for the rice crops produces in Assam results.

2.3. Socio-economic, personal and psychological characteristics of the cultivators

2.3.1. Age

Sophia (1991) reported that majority of the dry land farmers possessed primary level of education followed by middle (31.11%) and secondary education (18.99%).

Ponkathaperumal (1994) reported that a little more than half (51.00%) belonged to old age group, followed by 27.00 per cent in middle age and 22.00 per cent in young age group.

Krishnakumar (1996) found that majority of the rice growers were to be old aged.

Arulmurugan (2000) reported that majority of the farmers were middle aged.

Subramaninan (2000) found that 43.33 pre cent of the respondents belonged to the middle age group. 22.67 per cent were old aged and the rest were found to be in the young age group.

2.3.2. Educational Status

According to Sophia (1991), among dryland farmers, 42.22 per cent had primary level of education followed by middle (31.11%) and secondary (18.89%) education. Only a limited percentage (5.56%) were illiterate and collegiate (2.22%).

Senthilkumar (1994) stated that more than one-third (35.83%) of farmers had secondary level of education followed by middle level 33.33 per cent. Whereas 16.67 per cent had collegiate education, primary and illiterate levels of education, only 2.50 per cent had higher secondary level of education.

Krishnakumar (1996) stated that majority of the respondents (70.00%) were literate of which, 33.00 per cent had primary education, 16.00 per cent had middle level of education, 13.00 per cent had secondary education and 8.00 per cent had collegiate education. There were illiterates to the tune of 30.00 per cent.

Saxena *et al.* (1999) found that the education level of the respondent farmers having higher education graduates was 22.50 per cent, middle and secondary 28.73 per cent and primary 32.50 per cent and illiterate was found to be at 16.25 per cent.

2.3.3. Farming Experience

Pochiahn *et al.* (1993) stated that majority (55.80%) of the vegetable growers had medium level of farming experience followed by low (24.20%) and high levels (20.00%) of farming experience.

As revealed by Ponkathaperumal (1994) majority (64.00%) of the respondents were found to be with relatively more years (more than 10 years) of farming experience, nearly one-fourth (26.00%) had 5 to 10 years of farming experience and the rest (10.00%) had less than five years of farming experience.

Swamidasan (1994) revealed that 46.00 per cent of betelvine growers had medium level of experience in farming. This was followed by low level (37.14%) and high levels (22.68%).

Venkattakumar (1997) stated that nearly 50.00 per cent of the coconut growers had low level of farming experience, whereas one-third (30.83%) of the coconut growers had medium level of farming experience. Nearly one-fifth (19.17%) of them possessed high level of farming experience.

According to Usharani (1998), 94.87 per cent of the respondents had high level of farming experience and only a meagre percentage (5.13%) of the respondent had low level of farming experience.

2.3.4. Annual Income

Krishnakumar (1996) found that majority of the paddy farmers (63.00%) belonged to low income group, nearly one-fourth (22.00%) of the respondents were categorised as medium level group.

Venkattakumar (1997) discussed that majority of the respondents (87.61%) possessed low to medium level of annual income and only a meagre proportion of them (12.39%) have had high level of income.

Usharani (1998) indicated that little above two-fifth (41.88%) of the respondents belonged to low level income group, whereas little above one-

third (36.75%) of the respondents belonged to high level of income group and little more than 21.37 per cent of them had medium level of income.

Venkatesan's (2000) study revealed that majority (63.33%) of the respondents belonged to low income group followed by medium (25.83%) and high (10.84%) income group.

2.3.5. Size of family

As regards size of family, 53.40 per cent of farm families were of nuclear type and the remaining 46.6 per cent joint family type were reported by Rajagopalan (1986).

Helen (1990) reported that 60.00 per cent of the respondents families lived in joint family system and had upto four members and the remaining 40.00 per cent family level in the nuclear family system with more than four members.

Rajakumar (1992) reported that among the total respondents, 41.67 per cent belonged to nuclear family with less than five members and 26.67 per cent belonged to nuclear family with more than five members. About 21.66 per cent of the respondents possessed joint family with more than five member and only one-tenth (10.00%) were joint families with less then five members.

Pushpa (1996) found that there was 60.48 per cent under joint families and 39.52 per cent under nuclear families. She also stated that the farmers involved

integrated farming system had 18.10 per cent families with 1 to 5 members and rest (81.90%) with more than five members.

Jayalakshmi (2000) found that were 38.40 per cent under joint family and 61.60 per cent under nuclear family. There were 53.33 per cent families with 1 – 5 members and 46.67 per cent families with more than 5 members.

2.3.6. Farm size

Gopalkrishnan (1994) observed that most of the farmers possessed small size land holdings followed by marginal and medium land holdings.

Ponkathaperumal (1994) revealed that nearly 39.00 per cent of the respondents were small farmers followed by 28.00 per cent who were medium farmers. One-tenth (10.00%) of the respondents were big farmers who had more than 10 acres of land.

Krishnakumar (1996) revealed that an equal percentage of farmers were found to be big, marginal and small farmers to the extent of 36.00 per cent, 33.00 per cent and 31.00 per cent respectively.

Velumani (1988) revealed that majority of the respondents possessed smaller land holdings.

Jayalakshmi (2000) revealed that 46.67 per cent of the farmers were small farmers followed by marginal (35.83%) and medium (14.17%) farmers, only meagre percentage of them were large farmers.

2.3.7. Material possession

Thiagarajan (1996) found that contact farmers had higher material possession and other farmers had lower material possession.

Venkattakumar (1997) observed that a little over half of the coconut growers (53.98%) had low level of material possession followed by 34.52 per cent of the respondents who had medium level of material possession. Only one-tenth of them had high level of material possession.

Usharani (1998) stated that the majority (64.10%) of the respondents had medium level of material possession followed by 34.52 per cent of the respondents who had medium level of material possession. Only one-tenth of them had high level of material possession.

Kavitha's (1998) study that a higher percentage (85.83%) of the respondents had medium level of material possession. Rest (24.27%) of the respondents had low and high level of material possession.

2.3.8. Farm power status

Babu (1990) stated that majority (51.00%) of the respondents fell under low category farm possession followed by high (29.80%) and medium category (19.20%).

Venkattakumar (1997) revealed that nearly an equal proportion of the respondents had low (46.02%) and medium (41.59%) level of farm power asset, whereas rest of the respondents had high level of farm power asset.

Usharani (1998) revealed that more than 88.89 per cent of the respondents had medium level of farm power and a meagre proportion (7.69%) of the respondents had high level of farm power assets and less proportion (3.42%) of the respondents had low level of farm power assets.

Subramanian (2000) inferred that nearly equal number of respondents had low (41.33%) and medium (37.33%) level of farm possession and nearly one-fifth (21.34%) of the respondents had high level of farm power possession.

2.3.9. Social Participation

Elangovan (1994) opined that majority of the respondents had medium level of social participation.

Ponkathaperumal (1994) reported that majority of the respondents (60.00%) belonged to medium level of social participation. Slightly more than one-fourth of the respondents (28.00%) were of low level of social participation and nearly 12 per cent of the respondents belong to high level of social participation.

The study conducted by Sujatha (1995) revealed that majority of the marginal farmers had medium level of participation.

Jayalakshmi (2000) revealed that half of the pulses growers had high level of social participation followed by low (43.33%) and only a meagre percentage of the pulse growers had medium level of social participation.

2.3.10. Mass media exposure

The majority of the farmers (74.70%) had medium level of mass media exposure, as reported by Rajagopalan (1986).

Jayaraman (1988) found that half of the paddy growers had medium level of mass media participation, while 29.17 per cent had high level and 20.83 per cent had low level of mass media participation.

Senthilkumar (1994) pointed out majority of the farmers (73.33%) were having medium degree of mass media exposure whereas 14.17 per cent of the farmers had low degree of media exposure and 7.50 per cent had high degree of exposure.

Hanumarangariah *et al.* (1988) study showed 23.00 per cent of the farmers with low mass media participation had low productivity of paddy, whereas 22.00 per cent of high mass media participation paddy growers had high productively.

Jayalakshmi (2000) study revealed that 41.67 per cent of the farmers were found to have low degree of mass media exposure, whereas 31.66 per cent of the farmers had high level and 26.67 per cent had medium level exposure.

Saravanan (2000) found that majority of the respondents (60.00%) and rest (18.33%) had high level of mass media exposure.

2.3.11. Extension Agency Contact

About two-thirds (64.00%) of the farmers were found to have medium level of contact with extension agency, were as reported by Rajagopalan (1986).

Sophia (1991) found that 54.45 per cent of the respondents had medium level of extension agency contact followed by 23.33 and 22.22 per cent had low and high level of extension agency contact.

Ponkathaperumal (1994) reported that only a few (14.00%) respondent possessed high extension agency contact, while a majority 59.00 per cent possessed medium and rest (27.00%) had low level of contact with extension agency.

Krishnan (1997) observed that 84.00 per cent of rasi cotton hybrid farmers had high level of contact with extension agency followed by medium and low and their percentages being 30.26 per cent respectively.

About 45.00 per cent of the cotton growers had medium level of extension agency contact as reported by Sriram (1997).

Venkatesan (2000) inferred that majority of the respondents were found to have medium (50.00%) to low (30.83%) level of extension agency contact.

2.3.12. Economic motivation

Ponkathaperumal (1994) reveals that majority (81.00%) of the respondents had medium level of economic motivation, one-tenth (10.00%) of the total respondents had low level of economic motivation and rest of the respondents (9.00%) had high level of economic motivation.

Krishnakumar (1996) observed that most of the respondents (66.00%) had medium level of economic motivation, followed by low and high levels of economic motivation to an extent of 19.00 per cent and 15.00 per cent respectively.

Usharani's (1998) study revealed that more than three-fourth (82.91%) of the respondents had medium level of economic motivation. A less proportion of the respondents had high (11.11%) and low (5.98%) levels of economic motivation.

Jayalakshmi's (2000) result show that 37.50 per cent of the respondents had medium level of economic motivation followed by low (31.67%) and high (30.83%) levels.

2.3.13. Credit Orientation

Seetharaman (1998) reported that 70.00 per cent of the small farmers had medium to high level of credit orientation.

Saravanan (1992) found that majority of the tapioca growers (59.16%) had medium level of innovativeness followed by high (22.50%) and low (18.34%) levels.

Bindu (1995) reported that farmers in high diversified farm had very low credit orientation.

2.3.14. Innovativeness

Dharmalingam (1990) found that 62.00 per cent of the rice farmers had medium level of innovativeness.

Krishnan (1997) found that 37.00 per cent of high innovativeness group followed by medium (36.00%) and low (27.00%) levels of innovativeness.

Nirmaladevi (1997) reported that majority of the respondents (53.34%) were found to possess moderate level of innovativeness followed by low level (33.33%) and high level (14.43%) of innovativeness was found with about one-tenth (13.33%) of respondents only.

Marimuthu (1994) indicated the 54.17 per cent of the respondents had medium level of innovativeness followed by low (28.33%) and high (17.50%) levels.

Venkatachalam (1999) reported that majority (66.67%) of the respondents had high level of innovativeness followed by medium (28.00%) and low (5.33%) levels.

Saravanan (2000) concluded that the coconut farmers had medium level of innovativeness (47.50%).

2.3.15. Risk orientation

Rajkumar (1992) in his research study observed that of the total respondents 63.30 per cent possessed medium risk orientation followed by 24.20 per cent possessing high risk orientation and 12.50 per cent possessed low risk orientation.

Jayakumar (1994) study reported that three-fourth of the respondents had a medium level of risk orientation.

Krishnakumar (1996) found that majority of the rice farmers had medium level of risk orientation (71.00%), while 16.00 per cent and 13.00 per cent of rice growers had high and low levels of risk orientation respectively.

Usharani (1998) reported that more than half of the respondents had high (54.70%) level of risk orientation, whereas one-fourth (25.64%) of them had low level of risk orientation. The rest one-fifth (19.66%) of them had medium level of risk orientation.

Jayalakshmi's (2000) study revealed that nearly an equal (39.64%) percentage of farmers were found to be in low and high level of risk orientation and 20.83 per cent of the farmers were found to have medium level of risk orientation.

2.3.16. Scientific orientation

Sakunthalai (1992) found that majority of the farmers in general were found to be medium in their scientific orientation.

According to Ponkathaperumal (1994) majority of (80.00%) respondents had medium level of scientific orientation, slightly more than one-tenth (11.00%) of the respondents had low level of scientific orientation. Rest of the respondents (9.00%) had high level of scientific orientation.

Krishnakumar's (1996) study revealed that a majority (68.00%) of the rice growers had medium level of scientific orientation followed by 17.00 per cent with

low level and 15.00 per cent of the rice growers had higher level of scientific orientation.

Alagirisamy (1999) found that 50.00 per cent of the vegetable growers in medium category followed by 27.50 and 22.50 per cent of them in low and high levels in their scientific orientation.

Arulmurugan (2000) revealed that more than two-fifth (42.60%) of the turmeric farmers possessed medium level of scientific orientation followed by one-third (33.90%) and one-fourth (24.00%) of turmeric farmers had low and high level of scientific orientation.

2.3.17. Progressiveness

Subramanian (1980) found that 62.23 per cent of paddy growers belonged to low level of progressiveness, 37.77 per cent belonged to high level of progressiveness.

Jayaraman (1988) revealed that 80.00 per cent of the paddy growers had high level of progressiveness while 15.84 per cent and 24.16 per cent possessed medium and low level of progressiveness respectively.

Kavitha (1998) study revealed that 50.83 per cent had medium level of progressiveness.

2.4. Relationship between the socio-economic, personal and psychological characteristics of the respondents and yield gap, knowledge gap and technological gap

2.4.1. Relationship between profile characteristics and yield gap among respondents

Vetriselvan (1992) opined that the yield gap among the marginal farmers was influenced by social participation and level of adoption, where as in case of small farmers, the yield gap was influenced by mass media exposure and economic motivation. Among the big farmers, crucial variables responsible for yield gap were educational status and social participation.

Nagoormeeran (2001) reported that education, experience, farm size, material possession, mass media exposure and risk orientation were found to have positive and significant association with yield of shrimp farmers.

Singh (1997) observed that risk bearing ability was found to have significant association with the yield gap among rice farmers, whereas age, education and size of holding were not found to be associated significantly with the yield gap.

Nagabhushanam and Karthikeyan (1998) found that land holding had positive and significant relationship with yield gap, whereas age, education, extension agency contact and social participation had non-significant relation with yield gap among paddy farmers.

Thiagarajan (1996) reported that age, occupation, income, mass media exposure and participation in development programmes had showed positive and significant relationship with yield gap.

2.4.2. Relationship between the socio-economic, personal and psychological characteristics of the respondents and knowledge gap

The relationship between the socio-economic, personal and psychological characteristics of the respondents and knowledge are presented in Table 1.

2.4.3. Relationship between the socio-economic, personal and psychological characteristics of the respondents and technological gap

Relationship between the socio-economic, personal and psychological characteristics of the respondents and adoption are presented in Table 2.

2.5. Constraints faced by the cultivators and suggestion to minimize the yield gaps

2.5.1. Constraints faced by the cultivators

Acharya (1972) revealed that lack of extension agency contact, lack of education and lack of irrigation were the major constraints in the adoption of technology.

Pal (1975) stated that timely availability of inputs is also important for proper adoption of technology by the farmers. Difficulties in obtaining seeds, chemical fertilizer, pesticide credit and inadequate irrigation facilities were the main constraints in rice farming.

Table 1. Matrix showing relationship between the socio-economic, personal and psychological characteristics of the respondents and knowledge

S. No.	Variables/ Authors	Rajupandi (1983)	Godhadapani (1985)	Chenniappan (1987)	Adhiguru (1991)	Pushpa (1991)	Sathiyanarayanan (1991)	Sophia (1991)	Saravanan (1992)	Karthikeyan (1994)	Swamidasan (1994)	Kishorekumar (1995)	Sujatha (1995)	Ravishankar (1995)	Subhashini (1996)	Alli (1996)	Bindu (1997)	Venkattakumar (1997)	Jagannadharaju (1997)	Kavitha (1998)	Nirmala (1999)	Arulmurugan (2000)	Lawrance (2000)	Sriram (2000)	Venkatesan (2000)	
1.	Age	NS			NES	NES		PS		PS		NS	NES	PS	PS	NS	NS		NES	NS	NES	NS		NS	NS	9/15
2.	Educational status	PS	PS	PS	PS	PS	PS	PS	PS	NES	PS	PS		PS	PS		PS	PS	PS	NS	PS	NS	NS	PS	NS	18/22
3.	Occupation																									
4.	Farm size	NS				PS	PS		NS			PS	PS	PS	PS		PS	PS	PS			NS	PS	PS	PS	12/15
5.	Farming experience											NS		NS												0/2
6.	Annual income	NS		NS			PS	PS									PS		PS					PS	PS	6/8
7.	Farm power status	NS		PS													PS			PS				PS		4/5
8.	Material possession														NS	NS										0/2
9.	Extension agency contact	NS					PS	PS				PS		PS					PS	NS	PS				PS	NS	7/10
10.	Mass media exposure	NS				PS	PS	PS			PS	PS		PS					PS		NS	NS	PS			8/11
11.	Information seeking behaviour														NS	NS								PS		1/3
12.	Urban contact						PS														PS					2/2
13.	Social participation	NS					PS		PS				PS				PS		PS		PS	PS	PS	PS		9/10
14.	Economic motivation						PS	PS					PS				PS	PS			PS		PS			7/7
15.	Scientific orientation						PS	PS	PS				PS		PS	PS	NS	PS			NS		NS			7/10
16.	Risk orientation		PS				PS	PS	PS				NS		PS		PS	PS			NS					7/9
17.	Credit orientation		NS						NS						NS							PS				1/4
18.	Innovativeness							PS	PS				PS					PS	PS					PS	NS	6/7
19.	Progressiveness																									0/0
20.	Market perception		PS					PS																		2/2

Table 2. Matrix showing relationship between the socio-economic, personal and psychological characteristics of the respondents and adoption

S. No.	Variables/ Authors	Ravi (1979)	Godhandapani (1985)	Olowa (1988)	Rajapandi (1983)	Adhiguru (1991)	Sathiyanarayanan (1991)	Karthikeyan (1994)	Ramesh (1994)	Nandhini (1995)	Kishorekumar (1995)	Sujatha (1995)	Alli (1997)	Bindu (1997)	Venkattakumar (1997)	Krishnakumar (1996)	Usharani(1998)	Kavitha (1998)	Sathiyaseelan (1998)	Sophia (1991)	Arulmurugan (2000)	Venkatesan (2000)	
1.	Age	NS	NS	PS	PS	NS	NS	PS	PS	NS		PS	NES		NS	PS	NES	NES	PS	NES		NS	11/18
2.	Educational status	NS	PS	PS	PS	PS	PS	NS	NS	PS	PS	PS	PS	NS	PS	PS		PS	NS	PS		NS	13/19
3.	Occupation									NS		NS										NS	0/3
4.	Farm size	NS	NS		NS	NS		PS	PS	PS	PS	PS	NS		PS	NS			NS			PS	8/14
5.	Farming experience	NS		NS		NS	NS			NS		NS				NS				NS		NS	0/9
6.	Annual income		NS				PS			PS				PS	NS								3/5
7.	Farm power status		PS					PS							PS								3/3
8.	Material possession			NS																			0/1
9.	Extension agency contact	PS	NS				PS	PS	PS	PS			PS			PS		PS		MS			8/10
10.	Mass media exposure	NS	PS				PS	PS		PS						PS		PS		PS	NS		7/9
11.	Information seeking behaviour																						0/0
12.	Urban contact						PS													PS			2/2
13.	Social participation		NS		PS	PS	PS	PS		PS	NS		NS		PS	PS		PS	MS			PS	9/13
14.	Economic motivation				PS	PS	PS		PS		PS		NS	PS	NS	PS	PS		MS	PS			9/12
15.	Scientific orientation					PS	PS				PS		MS	PS	MS	PS				PS			6/8
16.	Risk orientation						PS			NS	PS		NS		PS	PS	PS	PS		PS	PS	PS	9/11
17.	Credit orientation																				NS		0/1
18.	Innovativeness	PS							PS		PS		NS					PS	NS				4/6
19.	Progressiveness			NS																			0/1
20.	Market perception	PS																					

Barker *et al.* (1977) reported that natural factors were also important for achieving higher yield by farmers. They revealed that excessive rain, wind, flood and disease were the most important yield constraining factors to paddy production in Philippines.

Sukumar (1980) studied the constraints to agricultural production in North Arcot District of Tamil Nadu and concluded that the yield gap was more in case of small farmers was mainly due to lack of technical knowledge and adequate capital.

Dhanakumar and Perumal (1982) enumerated non-availability of labour as well as high labour cost, poor price for produce, non-availability of the credit at the required time and high cost of fertilizer as the most important constraints.

Chandrakandan (1984) revealed that out of several biophysical constraints identified, non-adequacy of irrigation water was the major constraint. About 86.7 per cent of the respondent faced this problem. Pests and diseases were reported by 80.00 percent, heavy downpour during *Kuravai* was reported by 40.00 per cent of the respondents, low fertility of soil by 30.00 per cent, saline-alkaline problem soils by 26.70 per cent and lack of drainage facilities by 23.00 per cent were the various socio-economic and situational constraints.

Haque (1985) reported that factors accounting for low yields of rice were enumerated as high price of inputs, lack of suitable plant protection measures,

topography, water logging, lack of adequate irrigation, lack of adequate capital, money lender exploitation, low and imbalanced use of fertilizer.

Kumar (1986) observed a wide 'performance gap' between potential and average yields of pulse crops in different states of India. According to him, low productivity of pulses in India might also be attributed to the low share of irrigated area to the total area under pulses. Apart from technological gaps, there was extremely slow flow of technology in the farmer's field and the management gap at the farmer's end resulted in low yield of pulses.

Rajasekhar (1986) in his yield gap study observed that 61.82 per cent of paddy growing farmers quoted high cost of input as main reason for yield gap, 60.00 per cent of them reported lack of funds and 40.27 per cent farmers reported incidence of disease. In the case of irrigated *cholam*, 84.62 percentage of growers attributed the use of traditional variety as a main factor for yield gap followed by high cost of input (43.59%) lack of own funds (41.83%) and inadequate power (41.03%).

Berkele (1988) reported that lack of improved varieties, poor adoption of fertilizers and low rates of their application, shortage of drought oxen and small implements, recurrent droughts in large parts of the country, inadequate crop protection from weeds, pests and disease, organizational and basic development problems, poorly developed research extension linkage, transport and infrastructural problems in rural areas, lack of properly structured extension activities, lack of fair

market prices for the produce and lack of national use plan and supporting regulations were the major factors for low yield of crops in small farms of Ethiopia.

Major constraints identified in rice productivity in Assam and Meghalaya were non-availability of inputs during cropping season, lack of plant protection measures and weed control and poor fertilizer management (Patel *et al.*, 1988).

Jaiswal and Sharma (1990) reported that the poor economic condition of farmers did not permit them to adopt plant protection practices which lead to a loss in production.

Uma (1991) reported that 50.00 per cent of the farmers expressed non-availability of labour as the main factor followed by lack of credit facilities (44.44%), lack of own fund (28.87%) and lack of awareness (22.22%) as the socio-economic constraints.

Delvadin *et al.* (1993) explained that non-availability of pesticides, lack of money, high price of pesticides, low price for the produce and lack of plant protection equipments were the major constraints in the adoption of plant protection measure.

Rambabu and Rao (1997) reported that the non-availability of labour was the major constraint as expressed by cent per cent of groundnut growers in carrying out inter cultivation practice for weed management.

Sohi *et al.* (1998) found that the major constraints leading to partial adoption of weedicides in wheat crop as expressed by the respondents were high cost of weedicides (48.27%), financial problem (39.65%) and lack of technical help (25.86%). They also found that the major constraints leading to non adoption of weedicide as pointed out by the respondents were high cost of weedicide (37.00%), financial problems (31.25%), inadequate family labour (27.08%), lack of equipment (14.78%) and lack of technical help (4.67%).

Subramaniam (2000) found that farmers faced different constraints with regard to cotton.

- Lack of assured irrigation (90.00%)
- Labour scarcity – (88.00%)
- High cost of inputs – (56.00%)
- Poor quality of inputs – (46.66%)

Jayalakshmi (2000) reported that the majority of the farmers (68.33%) found lack of knowledge and awareness as the main reason for the non-adoption of pulses technology.

Lawrance (2000) reported that lack of the awareness, high cost of herbicides, lack of electricity facilities were the other constraints experienced by the respondents.

2.5.2. Suggestions to overcome the constraints

Carson (1979) concluded that rice yield as well as production had reached their limit under the existing technological and socio-economic conditions in Taiwan

and suggested that the only possible way of increasing the yield was the non-monetary technology.

Ravichandran (1980) reported that reintroduction of subsidy, spread of HYV and soil testing were the suggestions expressed by the registered sugarcane grower to increase their innovative nature.

Bhaskaran and Praveena (1982) reported that suggestions given by the respondents for the improvement of dryland agriculture increased in the number of field demonstrations (78.00%), supply of agriculture inputs on subsidized rates (71.50%) and arrangements for training and continuous guidance.

Chamala (1982), while analyzing the yield gap of rape seed and mustard, found a vast gap between the potential and actual productivity of these crops and concluded that, if the available technology was implemented, the yield level can be increased three fold over the existing level.

Suryawanshi and Gaikwad (1984) analysed yield gap in rabi jowar in drought prone area of Ahmednagar district. It was estimated that the yield can be increased by more than three folds if the new technologies were adopted.

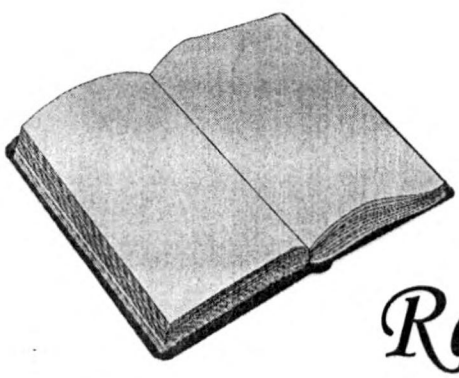
Yadav and Gangawar (1986) urged to strengthen the extension and input supply services in Bihar for the mitigation of yield gap which would be the future potential for increase in production of rice.

Uma (1991) revealed that irrespective of region, categories of farmer, status of farmers and season, the low yield gap I of 1000 kg/ha could be bridged, if the farmers were motivated to take some additional efforts in adopting recommended technologies.

Ajore and Singh *et al.* (1998) reported that the low yield of crops could be decreased and suggested that extension agency must organize effective educational activities like organization of demonstration and training programmes for full adoption of the technology by the farmers, to exploit full potential of the inputs like soil amendment, fertilizer etc.

Usharani (1998) reported that the lack of awareness and knowledge were the major constraints. Hence, different extension efforts like laying of model plots, farm level demonstrations to show the effectiveness of the practices, intensive teaching and trainings have to be formulated to provide adequate knowledge.

Singh *et al.* (2000) reported that the study of rice cultivation under different ecosystem showed a significant gap. In order to narrow the gap, the problems faced by the farmer could be successfully resolved by the researchers and others responsible for distribution and pricing of inputs.



Research Methodology

RESEARCH METHODOLOGY

This chapter elucidates the research methods and procedures followed in this study. The methodology adopted is grouped and presented in the following sub-heads.

3.1. Locale of research

3.2. Description of the study area

3.3. Selection, operationalisation and measurement of variables

3.4. Method of data collection

3.5. Statistical tools used

3.1. Locale of research

3.1.1. Selection of state

West Bengal was selected as the area of study. West Bengal was selected because of the familiarity of the researcher to the local dialect and cultural pattern of the area under investigation.

3.1.2. Selection of the zone

Terai zone of West Bengal was selected as the zone of study since there are not many studies on yield gaps in this region. Also the new Agricultural University (Uttar Bengal Krishi Viswavidayala), erstwhile campus of Bidhan Chandra Krishi Viswavidyala, Mohanpur had been established in the area which has jurisdiction over the Terai zones, Hill zones and old Alluvial zones of West Bengal. Terai zone is one of the most important zones of West Bengal among the six agro-climatic zones. This zone comprises of the plains of Jalpaiguri and Coochbeehar district, Siliguri sub-

division of Darjeeling district and Islampur sub-division of North Dinajpur district (Appendix 1).

3.1.3. Selection of the crop

Three crops *viz.*, jute, paddy and potato were selected based on the maximum cropped area such that each crop represented the different groups mainly cereals, fibre and tuber crop and which has the maximum acreage under Terai zone.

For assessing yield gaps, the productivity rate of *aman* (kharif) season crop mainly restricting to IET-1094 was taken up for the study. The jute crop has two cultivable species i.e. *Corchorus olitorius* and *Corchorus capsularis* but only *Corchorus capsularis* was taken up for the study, as the coverage of this crop is more compared to the other cultivable species.

3.1.4. Selection of the block

It was decided to select the block which had more area under jute as well as paddy crop cultivated in single year and potato. Among the 28 blocks of Terai zone, two blocks were selected namely Coochbeehar–II block for rice and jute while Dhupguri block was selected for the potato crop. Coochbeehar II block has the highest cropped area under jute and paddy and comes under the Jurisdiction of Coochbeehar district. While Dhupguri, which has the highest cropped area comes under Jalpaiguri district (Appendix 2).

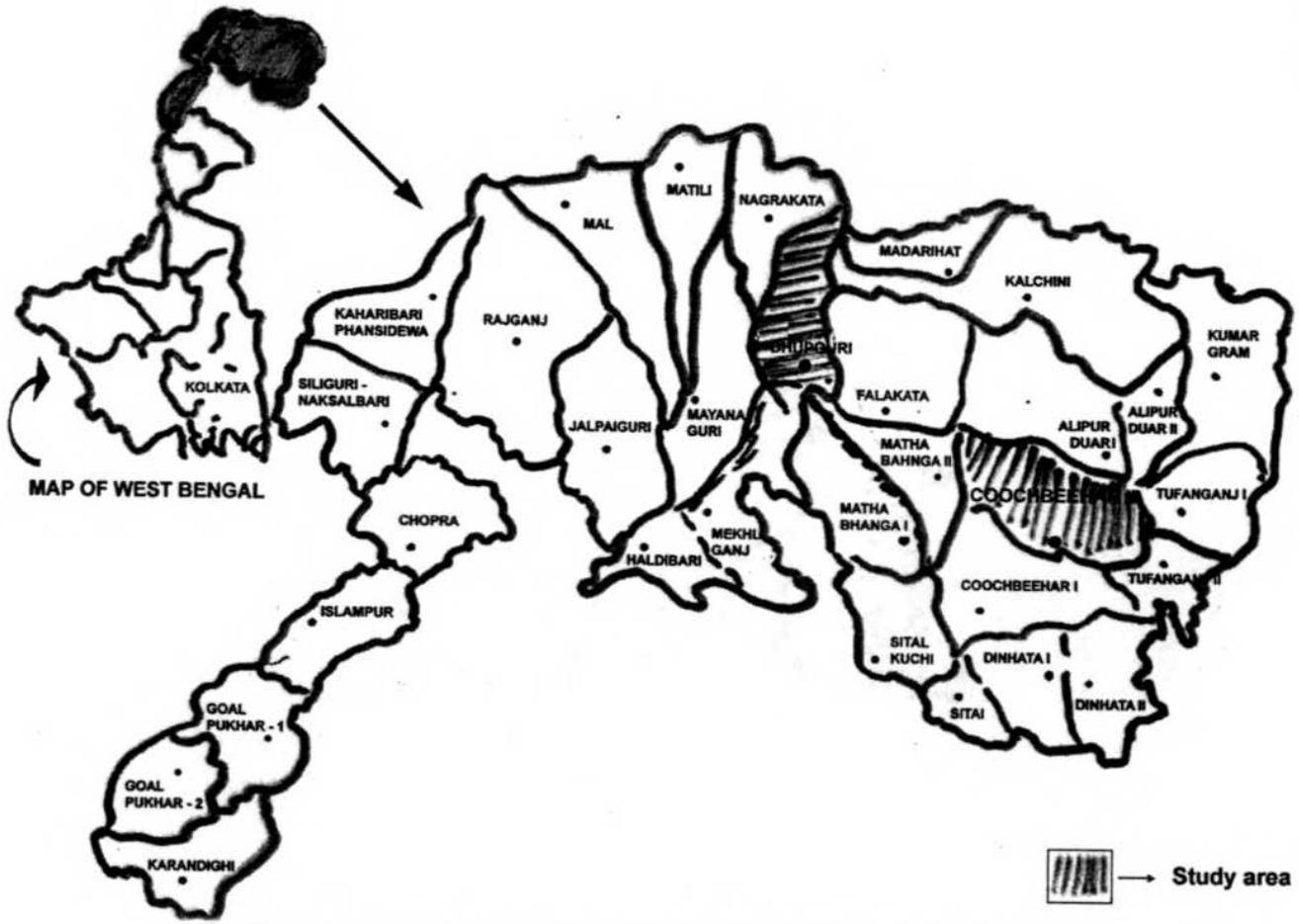


Fig 1. Map showing the study area (blocks of Terai zone)

3.1.5. Selection of villages

It was decided to select the village which has the maximum area under different crops. 5 villages each were selected which are given in the table 3 for jute as well as paddy and the rest of villages for potato.

The list of village which were selected for jute as well as paddy crop are as under

Table.3. List of selected village and the area under the jute and paddy in Coochbeehar block

S. No.	Selected village	Area under jute and paddy (in ha)
1.	Gopalpur	215
2.	Kholta	180
3.	Khapaidanga	175
4.	Ambari	172
5.	Bararangras	160

The list of selected village and the area under the potato crop in Dhupguri block are presented in the following Table 4.

Table 4. List of selected village and the area under the potato crop in Dhupguri block

S. No.	Selected village	Area under jute and paddy (in ha)
1.	Gairkata	172
2.	Madhyabaragiri	152
3.	Dakshin khairibari	137
4.	Thar Salbari	134
5.	Paraba Daukimari	120

3.1.6. Selection of cultivators

The number of cultivators for the study was limited to 120 depending on the availability of factors like time and facilities available.

The number of cultivators from each of the selected village were based on the proportionate random sampling method using the following formula.

$$Qi = \frac{Ai}{Bi} \times N$$

Where Qi = Number of cultivators selected from the i^{th} village

Ai = Total number of cultivators in the i^{th} village

Bi = Total number of cultivators in the six village selected

N = Sample size

The village wise distribution of sample respondents cultivating jute and paddy are presented in the Table 5.

Table.5. Village wise distribution of the sample cultivators for jute and paddy crops

S. No.	Name of the village	No. of cultivators	Cultivators selected
1.	Gopalpur	1900	16
2.	Kholta	1525	13
3.	Khapaidanga	1500	12
4.	Ambari	1350	11
5.	Bararangras	1000	8
Total		**7275**	**60**

The village wise distribution of sample respondents cultivating potato are presented in the table 6.

Table 6. Village wise distribution of the sample cultivators for potato cultivators

S. No.	Name of the village	No. of cultivators	Respondents selected
1.	Gairkata	1292	17
2.	Madhyabaragiri	1064	14
3.	Dakshin Khairibari	836	11
4.	Thar Salbari	260	10
5.	Paraba Daukimari	608	8
Total		**4560**	**60**

3.2. Description of the study area

In order to develop better understanding and to help in correlating the result with the actual field condition, background information about physical, social and economic conditions of the region is important.

Hence, information regarding the location, geographical features, climate, rainfall, cropping pattern are highlighted.

3.2.1. Location and geographical features

The Terai zone of West Bengal is comprised of the geographical area covering the entire Coochbeehar and Jalpaiguri districts, Siliguri sub-division of Darjeeling and Islampur sub-division of West Dinajpur districts. The zone lies between 26° 5' and 26° 56' North latitude and 88° 7' and 89° 53' Eastern longitude. The zone is bordered by Bhutan in the North, Assam in the East, Nepal and Bihar in the West and in the South by Bangladesh. To its North-West is the Hill zone and to its South-West is the New Alluvial zone of the agro-climatic zones of West Bengal.

The Coochbeehar–II block is located about 20 km from the district head quarter Coochbeehar which is also the head quarter to Coochbeehar–I block. The

Coochbeehar –II block is bounded by Coochbeehar – I block in the South, Mathabhanga block is the West, Alipurduar block in the South and Tufanganj block in the East.

The Dhupguri block is located about 30 km from Jalpaiguri which is the district head quarters. Dhupguri is bounded in the North by Nagrakata block, South-West and South-East by Mekhliganj block and Coochbehar district respectively, Falakata in the East and Mayanaguri in the West. The distribution of the blocks is appended.

3.2.2. General features

The Terai region of West Bengal is located at the foot hills of the Himalayan and Sub-Himalayan (Bhutan hills) mountain belts and of small stretches of riverain.

The physiography of Terai zone can be divided into further two zones:-

1. Peidmont zone – It spreads over the southern part of Darjeeling and northern part of Jalpaiguri district encompassing an area of 1500 sq. km with a general elevation of about 300 m above the mean sea level towards north and the minimum of 50 m towards 50 m above mean sea level.
2. Plain zone – It comprises the southern part of Jalpaiguri districts, entire Coochbeehar, Islampur sub-division of West Dinajpur district. Which is characterized by broad sandy ridges and leveled silty depressions.

The different land situations in Terai zone is given in Table 7.

Table 7. Distribution of area under different land situations in Terai zone (in ha.)

District / sub-division	Upland	Medium land	Low land	Total area
Coochbehar	44,366 (18.68)	1,67,000 (70.35)	26,070 (10.97)	2,37,526 (100.00)
Jalpaiguri	29,720 (12.92)	1,85,775 (80.60)	14,657 (6.45)	2,30,391 (100.00)
Siliguri	2,260 (7.59)	26,585 (89.30)	925 (3.11)	29.770 (100.00)
Islampur	59,180 (45.42)	67,360 (51.70)	3,750 (2.88)	1,30,290 (100.00)

3.2.3. Soil type

Based on the old concept of soil classification as prevailed, the soils of Terai zone of West Bengal is classified broadly as Teesta alluvium, Terai and Brown forest. Under USDA classification, the soil of this zone are grouped under entisol and enceptisols orders.

3.2.4. Climate

In Terai zone, 90 per cent of agriculture is attributed to rainfed cultivation. Hot weather is experienced during summer. The temperature of the zone ranges from 32.2° C (± 3.2° C) to 21° C (± 2° C). Relative humidity is generally high during month of July. During May, the relative humidity may reach a high of 95% and low during the month of mid-March which hovers around 45%. Instances of 80 – 30 cms deep hail storm fall can be observed. Meteorological situation in Terai region of North Bengal provides congenial condition of dew and fog.

3.2.5. Rainfall

The Terai zone falls in the category of high rainfall area. The rainfall shows a sharp increase in the third week of April reaching a maximum towards the middle and end of July. The highest rainfall in the zone varies from 273.6 mm to 342.9 mm. The rainfall is scanty during the period of mid-October to mid-April, when the rainfall varies from 0 – 133 mm/week.

3.2.6. Land use pattern

Little over one-fifth of the state's geographical area is covered by the Terai zone. The orchards, plantations and miscellaneous trees taken together account for 9 per cent of geographical area of the Terai zone. The proportion of area under cultivable wasteland and fallow land jointly accounts for a little over 2 per cent in the zone. The forest area accounts for 14% of the total available land. Barren land accounts for 4% and non agricultural land 15.49%. The remaining land accounted for the cultivable land.

3.2.7. Cropping system

The cropping system followed in Terai zone of West Bengal consists mainly of rice, jute, wheat and potato which are grown in sequence. A brief description about the cropping system, which generally consists of jute in pre-kharif, followed by rice in kharif and potato in rabi season and cropping system followed for other crops are shown in the Table 8.

Table 8. Cropping system followed under Terai zone

Pre-kharif	Kharif	Rabi
1) **Irrigated condition**		
Jute	Rice	Potato
Jute	Rice	Mustard
Rice	Rice	Vegetables
Jute/Veg	Rice	Potato/vegetables
2) **Unirrigated condition**		
Jute	Rice	Fallow
Jute	Rice	Pulses
Rice	Rice	Fallow
Fallow	Rice	Fallow

3.3. Selection, operationalisation and measurement of variables

3.3.1. Selection of variables

The value of this report largely depends upon the different variables taken into consideration for the study. The critical analysis, meaningful interpretation and conclusion can be brought out only when justifiable variables are selected and appropriate measurement of the variables are followed.

Based on review of the pertinent literature and discussion with extension specialist, seventeen variables were selected.

The interview schedule consisted of three parts. Part I contained general information and questions related to the independent variable while Part II had adoption and knowledge question for the jute-paddy cultivators and potato cultivators. Part III dealt with the different constraints faced by the respondents.

A summary of selected independent and dependent variables and procedure followed by different authors are given in Table 9.

Table 9. List of variables with their measurement procedure

S. No.	Variables	Procedure developed / followed by
	I. Independent variables	
1.	Age	Selvanayagam (1986)
2.	Educational status	Lawrance (2000)
3.	Farming experience	Pitchai (1987)
4.	Annual income	Prabhakar (2000)
5.	Size of family	Trivedi (1963)
6.	Farm power status	Velusamy (1999)
7.	Material status	Velusamy (1999)
8.	Farm size	Usharani (1998)
9.	Social participation status	Velusamy (1999)
10.	Mass media exposure	Jayasree (1993)
11.	Extension agency contact	Vijayaraghavan (1977)
12.	Economic motivation	Supe (1969)
13.	Credit orientation	Ravi (1988)
14.	Innovativeness	Singh (1977)
15.	Risk orientation	Supe (1969)
16.	Scientific orientation	Supe (1969)
17.	Progressiveness	Kavitha (1998)
	II. Dependent variables	
1.	Yield gap	Rajagopalan (1986)
2.	Knowledge gap	Jayalakshmi (2000)
3.	Technological gap	Jayalakshmi (2000)

3.3.2. Operationalisation and measurement of independent variables

When the variable is antecedent to the dependent variable, it is termed as independent variable. There were 17 independent variables selected for the study and their operationalisation and measurement are as follows.

3.3.2.1. Age

Age was operationalised as the number of completed years of respondents at the time of inquiry and the chronological age was taken as a measure. A score of one was assigned to each year. The respondents were classified into 3 groups as followed by Selvanayagam (1986).

Category	Age
Young	Upto 34 yrs
Middle	35 – 45 yrs
Old	Above 45 yrs

3.3.2.2. Education

Educational status was operationalised as the level of formal education attained by the individual respondent. Based on the level of formal education, they were grouped into 5 categories as followed by Lawrance (2000) with a slight modification.

Category	Score
Illiterate – No education	1
Primary – upto 5 years of schooling	2
Middle – upto 8 years of schooling	3
Secondary – upto 12 years of schooling	4
Collegiate – Degree and beyond	5

3.3.2.3. Farming experience

Farming experience referred to the actual completed years of experience the respondents possessed in practising agriculture. One score was allotted to every year of experience in farming. The scoring procedure of Pitchai (1987) was followed for this purpose.

Category	Score
Low – upto 5 yrs	1
Medium – 5-10 yrs	2
High – Above 10 yrs	3

3.3.2.4. Annual income from crop production

The annual income obtained from crop production was operationalised as the total income obtained by the respondent family from crop production for the past one year. The variable has been divided into four categories as followed by Prabhakar (2000).

Category	Score
Low – Below Rs.10,000	1
Lower middle – Rs.10,000 – 20,000	2
Upper middle – Rs.20,000 – 30,000	3
High – Rs.30,000 and above	4

3.3.2.5. Size of family

The size of the family refers to the number of individual of both the sexes living together in a household. The scoring procedure developed by Trivedi (1963) was followed in the study.

Nature of family	Category	Score
Family type	Nuclear family	2
	Joint family	1
Family size	Up to 5 members	1
	Above 5 members	2

Based on scores obtained, cumulative frequency was used. The families were classified into small, medium and large size using cumulative frequency method.

3.3.2.6. Farm size

Farm size is referred to as the number of acres cultivated by the respondent at the time of enquiry. As classified by the Government of West Bengal, the farm size scale adopted by Usharani (1998) was modified and used.

Category	Score
Marginal farmer (< 0.40 ha)	1
Small farmer (0.40 – 0.80 ha)	2
Medium farmer (0.81 – 4 ha)	3
Large farmer (> 4 ha)	4

3.3.2.7. Material status

This was operationalised as the farm and non-farm materials possessed and used by the respondent's family. The scoring procedure followed by Velusamy (1999) was adopted.

Category	Score
Wall clock	1
Battery operated transistor	2
Radio	3
Fan	4
Tape recorder	5
Biogas plant	6
T.V.	7
Two wheelers (Scooter, Motor cycle, moped etc.)	8
Video cassette player / VCR	9
Telephone	10
Automobiles	11

Using cumulative frequency, the cultivators were classified into low, medium and high levels of material status.

3.3.2.8. Farm power status

Farm power status referred to the possession of mechanised and manual operated farm equipments and implements by the cultivators. The scoring procedure followed was as that of Velusamy (1999).

Category	Score
Country plough	1
Iron plough	2
Working animals	3
Milch animals	4
Power sprayer	5
Oil engine	6
Bullock cart	7
Cattle shed-tiled	8
Pumpset	9
Tractor	10

Using the cumulative frequency, the cultivators were classified into low, medium and high.

3.3.2.9. Social participation status

Social participation status was operationalised as the degree of involvement/participation of the respondents in formal organisation either as a member or as an office bearer. The scoring procedure followed was as adopted by Velusamy (1999).

Nature	Score
No membership	1
Membership in one organisation	2
Membership in more than one organisation	3
Office bearer in one organisation	4
Office bearer in more than one organisation	5

Cumulative frequency was used to classify the cultivators into low, medium and high levels of social participation.

3.3.2.10. Mass media exposure

Mass media exposure was operationalised as the degree to which the farmers exposed themselves to the agricultural information available on radio, television, newspapers, magazines, leaflets etc. The scoring procedure with regard to radio, T.V., newspapers, leaflets and folders were as that followed by Jayasree (1993).

Details of exposure	Score
Regularly	4
Occasionally	3
Rarely	2
Never	1

Exposure to agricultural film shows, field days, agricultural festivals and agricultural exhibitions was measured by assigning one score to each exposure. Sum of the scores of the above items was taken as the final score of the cultivators and using cumulative frequency they were categorised as low, medium and high.

3.3.2.11. Extension agency contact

An individual farmer may gain knowledge and motivation by contacting the extension workers (Vijayaraghavan, 1977). The variable was measured in terms of frequency and the purpose of contacting the different change agents by the farmers. The following scoring procedure was used.

Frequency of contact	Score
Very frequently	5
Frequently	4
Occasionally	3
Rarely	2
Very rarely	1

Purpose of contact

Nature of contact	Score
Non-agriculture purpose	1
Agricultural purpose	2

Sum of the score of the above items was taken as the final score of the cultivators and using cumulative frequency they were categorised as low, medium and high.

3.3.2.12. Economic motivation

Economic motivation referred to the motivation in terms of profit maximisation and the relative value placed by a cultivators on economic ends. This scale was developed by Supe (1969). The scale consisted of six statements of which the first five were positive and the last one was negative. The response for each

statement was rated over a three point continuum which ranged from agree to disagree.

Sl. No.	Response	Agree	Undecided	Disagree
1.	Positive item	3	2	1
2.	Negative item	1	2	3

The maximum score an individual can get on this scale was 18 while the minimum was 6. Further, the cultivators were classified into low, medium, high categories based on the cumulative frequency.

3.3.2.13. Credit orientation

Credit orientation was operationalized as the tendency of the cultivators to borrow money for agricultural purposes from the lending agencies and the nationalised banks, Co-operatives etc. It was measured by the scale developed by Ravi (1988). The statements have been given in appendix III.

Statements	Response	Score
1	Yes	2
	No	1
2	No	2
	Yes	1
3	Fairly	2
	Badly	1
4	Agree	2
	Disagree	1
5	Yes	2
	No	1

Based on the cumulative frequency, the cultivators were classified into low medium and high.

3.3.2.14. Innovativeness

Innovativeness is defined as the degree to which an individual were adopting new ideas earlier than other members of the same social system. The questions, responses and scoring procedure developed by Singh (1977) was followed in the study. The details are as follows.

Statement	Score
As soon as it is brought to my knowledge	1
After I have seen it adopted by other farmers successfully	2
I prefer to wait and take my own time	3

3.3.2.15. Risk orientation

Risk orientation referred to the degree to which an individual was oriented towards risks and uncertainties in adopting any new ideas in farming. The scale developed by Supe (1969) and consisted of six statements with three point continuum, of which the statement one and five were negative. The response and scoring procedure was the same as described under economic motivation.

Response	Agree	Undecided	Disagree
Positive item	3	2	1
Negative item	1	2	3

Finally based on the cumulative frequency, the cultivators were classified as low, medium and high.

3.3.2.16. Scientific orientation

Scientific orientation is operationalised as the degree to which the farmer is oriented to the use of scientific methods in decision-making in farming. It was measured with the help of a scale developed by Supe (1969). The scale consists of six statements of which the second statement was negative. The scoring was similar to economic motivation which was based on three point continuum.

Response	Agree	Undecided	Disagree
Positive item	3	2	1
Negative item	1	2	3

Based on the cumulative frequency calculated, the cultivators were classified into low, medium and high categories.

3.3.2.17. Progressiveness

Progressiveness was operationalised as the degree to which farmers were receptive to modes, values and practices for measuring progressiveness. The scale followed by Kavitha (1998) was used. This scale consists of seven statements for which the respondents had to answer 'Yes' or 'No'.

A 'Yes' response was assigned the score of one and a 'No' response 'zero'. The progressiveness score for an individual was obtained by summing up the responses for each item. The responses were classified into low, medium and high using cumulative frequency method.

3.3.3. Operationalisation and measurement of dependent variables

3.3.3.1. Yield gap

Yield gap was defined as the difference between the potential yield and the actual yield obtained. It was operationalised as the difference between the best farmer yield in the Terai zone and the actual yield of the farmers selected.

Yield gap = Best farmer yield – Average farmer yield

$$\text{Gap percentage} = \frac{\text{Yield gap}}{\text{Best farmers yield}} \times 100$$

Cumulative frequency was used to categorise in to low, medium and high based on their gaps. Correlation, multiple regression and stepwise regression was followed to find a significant relationship with the selected independent variables of the study. Similarly simple correlation and multiple regression were followed to find the relationship and influence of knowledge gap and technological gap with yield gap.

3.3.3.2. Knowledge gap

English and English (1961) defined knowledge as a body of information possessed by an individual which was in accordance with established fact. To measure knowledge gap of the cultivators regarding the identified technologies on the selected crops *viz.*, paddy, jute and potato, it was measured as the percentage difference between the total possible score and the actual score obtained for the recommended technologies divided by total possible score.

$$\text{Knowledge gap} = \frac{\text{Total possible score} - \text{Actual score obtained for the recommended technologies.}}{\text{Total possible score}} \times 100$$

Based on the cumulative frequency, the respondents were categorised into three groups i.e. low, medium and high. Correlation, multiple regression and stepwise regression analysis were followed to find a significant relationship with the selected independent variables.

3.3.3.3. Technological gap

It was determined only after the adoption is computed. Therefore adoption and technological gap are interrelated, if one was known, the other can be assessed the technological gap was operationalised as the percentage difference between the recommended adoption score and the adopted score divided the recommended score multiplied by hundred. The gap was calculated with the formula

$$\text{Technological gap} = \frac{R - A}{R} \times 100$$

R= Maximum possible adoption score the respondent can obtain.

A= Score obtained by a respondent by virtue of the respondent adoption of the given technologies for the particular crop.

Correlation, multiple regression and stepwise regression were followed to find a significant relationship with the selected independent variables.

3.4. Method of data collection

Interview method of data collection was followed wherein the researcher could have first hand information from the farmers by means of a structured schedule. Interview methods give more reliable data. Therefore this method was followed.

Keeping in view the objectives and the variables under study, a comprehensive structured interview schedule covering all aspects was prepared. The items included in the interview schedule were structured which were found suitable to the different categories of respondents. The most relevant, unambiguous and practical questions were included in the schedule.

3.4.1. Pre-testing

Before giving a final shape to the interview schedule, the schedule was pre-tested in a non-sample area of Terai zone. Based on the experiences gained in the pre-testing, necessary modifications were made. The finalized schedule is appendix III.

3.4.2. Data collection

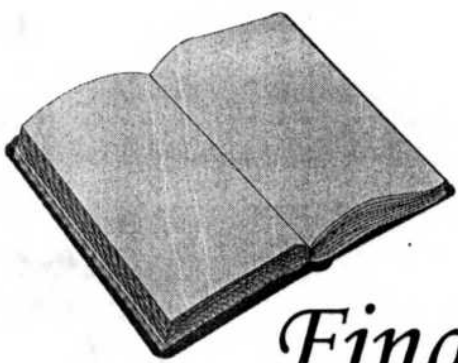
The data was collected during May - June 2002. Every respondent was personally contacted and interviewed with the help of schedule developed for the study. Every attempt was made to check and cross check the data collected.

3.4.3. Preparation of report

The data collected from the respondents were coded, tabulated and finally presented in the form of tables in order to make the findings meaningful and easily understandable. The findings which emerged from the analysis of data were suitably interpreted and conclusions were drawn.

3.5. Statistical tools used

1. Percentage analysis
2. Cumulative frequency
3. Correlation
4. Multiple regression
5. Stepwise regression



Findings and Discussion

FINDINGS AND DISCUSSION

The chapter elaborates the findings of the present study. The findings along with relevant discussion are given under the following sub-heads in the light of objectives set fourth.

4.1. Assessment of the yield gaps

4.2. Assessment of knowledge gap and technological gap

4.3. The socio-economic, personal and psychological characteristics of the farmers

4.4. Relationship between the socio-economic personal and psychological characteristics with the yield gap, knowledge gap and technological gap

4.5. Suggestions of appropriate strategies for minimizing yield gaps

4.1. Assessment of the yield gaps

Potential yield of the best farmer in Terai zone, the area and average yield per hectare of the cultivators (here after, the respondents who cultivate jute as well as paddy in a single year are referred to as jute-paddy cultivators, while the respondents cultivating potato crop are referred to as potato cultivators) were taken into account to assess the yield gap.

4.1.1. Distribution of the cultivators on the basis of their yield gap

To have a better understanding of the different categories of the cultivators, Table 10 categorize the respondents into low, medium and high yielding cultivator based on cumulative frequency as discussed in research methodology chapter.

Table 10. Distribution of the cultivators based on their yield gaps

Categories	Jute cultivator	Paddy cultivator	Potato cultivator	Overall
Low	16 (26.67)	14 (23.33)	19 (31.67)	34 (28.33)
Medium	20 (33.33)	30 (50.00)	22 (36.66)	47 (39.17)
High	24 (40.00)	16 (26.67)	19 (31.67)	39 (32.50)
	60 (100.00)	60 (100.00)	60 (100.00)	120 (100)

(Figures in the parenthesis indicate percentage)

Table 10 indicate among the jute-paddy cultivators, 40.00 per cent possessed higher level of yield gaps on jute crop compared to that 33.33 per cent of the respondents possessed medium level of yield gaps. The rest 26.67 per cent of the respondents possessed lower level category of yield gaps.

Table 10 indicated among the jute-paddy cultivators, 50.00 per cent of the cultivators had medium level of yield gap on paddy production. 26.67 per cent of the cultivators belonged to the higher group who possessed higher yield gap. The rest 23.33 per cent of the respondents had lower level of yield gaps.

The potato cultivators from the Table 10, it can be observed that 36.66 per cent possessed medium level of yield gap. 31.67 per cent possessed were on par with the cultivators who belonged to low and high level of yield gap on production of potatoes.

Overall it can be inferred that if taken over all for the three crops it was found from the table that almost 39.17 per cent of the respondents were found to belong to medium category with relation to yield gaps. 32.5 per cent of the respondents had high level of yield gaps on crop production. The rest (28.33%) of the respondents had low level of yield gap.

4.1.2. Distribution of the cultivators based on yield gaps and jute yield

The different yields and yield gaps obtained by the cultivator in jute are given in Table 11. The yield obtained by the cultivators varied from 6 to 22.5 q/ha. Majority (18.33%) of the respondents obtained a yield of 16.5 q/ha followed by 19.5 q/ha by 11.67 per cent of the respondents. Nearly 21 q/ha yield was obtained by 10.00 per cent of the respondents. This was followed by 13.5 q/ha, 15 q/ha, 18 q/ha and 22.5 q/ha yield by 8.33 per cent of the respondents. Next yield obtained were 9 q/ha, 10.5 q/ha and 12 q/ha by 6.67 per cent of the respondents. 3.33 percent share of the respondents had 6 and 7.5 q/ha yield of jute.

The average yield of the cultivators were 14.02 q/ha. The highest yield reported to be obtained in Terai zone was 24 q/ha. So a yield gaps of 1.5 to 18 q/ha was found between the best cultivator reported and the best farmer in Terai zone.

Table 11. Distribution of the cultivators based on yield gaps and jute yields

Sl. No.	Yield obtained q/ha	No of cultivators	Percentage	Yield gaps percent
1.	6.00	2	3.33	75.00
2.	7.50	2	3.33	68.75
3.	9.00	4	6.67	62.50
4.	10.50	4	6.67	56.25
5.	12.00	4	6.67	50.00
6.	13.50	5	8.33	43.75
7.	15.00	5	8.33	37.00
8.	16.50	11	18.33	31.25
9.	18.00	5	8.33	25.00
10.	19.50	7	11.67	18.75
11.	21.00	6	10.00	12.50
12.	22.50	5	8.33	6.25
Total	**841.00**	**60**	**100.00**	**41.675**

Average yield	=	14.01q/ha
Highest yield obtained by the cultivators	=	22.5 q/ha
Lowest yield obtained by the cultivators	=	6 q/ha

Highest yield reported to be obtained by the cultivator in Terai zone = 24 q/ha

Average yield gaps = 41.675

The yield gaps per cent analysis revealed that a maximum gap of 75.00 per cent was found while lowest yield gap of 6.25 per cent was found among the cultivators interviewed. 10 per cent of the cultivators had a yield gap of 12.50 per cent, 11.67 per cent of the cultivators had yield gap of 18.75, 18.33 per cent of the cultivators had a yield gap of 31.25 per cent. It was found that each of the 6.67 per cent cultivators had a yield gap of 25.00, 37.00 and 43.75 per cent. Also each of the 6.67 per cent of the cultivators had yield gaps of 50.00, 56.25 and 62.5 per cent. Another 3.33 per cent of the cultivators had a yield gap of 68.75 per cent.

Overall it revealed that most (18.33%) of the cultivators had a yield gap of 31.25 per cent. 3.33 per cent of the cultivators had a yield gap of 68.75 and 75.00 per cent respectively. The lowest yield gap was 6.25 per cent while the highest gap was found to be 75.00 per cent. These yield gaps were found with regard to jute-paddy cultivators who cultivated jute crop.

4.1.3. Distribution of the cultivators based on yield gaps and paddy yield

The different yields and yield gaps obtained by the cultivators in paddy are given in Table 12. Yield obtained by the cultivators varied from 12 to 42 q/ha. About 20.00 per cent of the cultivators obtained a yield of 33 q/ha, followed by 11.67 per

cent of the cultivators who obtained a yield of 42 q/ha and 10 per cent obtained 36 q/ha. Each of the 27 q/ha and 30 q/ha yield was obtained by 8.33 per cent of the cultivators respectively, followed by 31.59 q/ha yield was obtained by 5.00 per cent of the cultivators. Each of the 12, 15 and 34.5 q/ha yield was obtained by 6.67 per cent of cultivators. Each of the 3.00 per cent of the cultivators obtained 18, 21 and 37.5 q/ha of paddy respectively. Finally equal per cent (1.67%) of the cultivators had 22.5, 25.5, 28.5 and 39 q/ha of paddy.

The average yield of the cultivators was 30 q/ha. Highest and lowest yield obtained by the cultivator was 42 q/ha and 12 q/ha respectively. Highest yield reported to be obtained by the farmers in that particular area was 45 q/ha of paddy.

It could be inferred from Table 12 that there existed a yield gap of 3 to 33 q/ha of the yield difference between the best farmer yield reported in that particular area and the yield obtained by the cultivators.

Yield gaps per cent was found to vary from 6.67 per cent to 73.33 per cent. The highest yield gap was 73.33 per cent and the lowest yield gap was 6.67 per cent. 11.67 per cent of the cultivators had a yield gap of 6.67 per cent, while 6.67 per cent of the cultivators had a yield gap of 73.33 per cent.

20.00 per cent of the cultivators had a yield gap of 26.67 per cent, 10.00 per cent of the cultivators had a yield gap of 20.00 per cent, 8.67 per cent of the cultivators had a yield gap of 33.33 per cent, 8.33 per cent of the cultivators had a

yield of 40.00 per cent, while 5.00 per cent of the cultivators had a yield gap of 31.11 per cent. Each of the 6.67 per cent of the cultivators had a yield gap of 23.33 and 66.66 per cent. Again, each of 3.33 per cent of cultivators had a yield gap of 16.67, 53.33 and 60.00 per cent. The rest 1.67 per cent of the cultivators had yield gap of 13.3, 36.67, 43.33 and 50.00 per cent respectively.

Table 12. Distribution of the cultivators based on yield gaps and paddy yield

Sl. No.	Yield obtained q/ha	No of cultivators	Percentage	Yield gaps percent
1.	12.00	4	6.67	73.33
2.	15.00	4	6.67	66.66
3.	18.00	2	3.33	60.00
4.	21.00	2	3.33	53.33
5.	22.50	1	1.67	50.00
6.	25.50	1	1.67	43.33
7.	27.00	5	8.33	40.00
8.	28.50	1	1.67	36.67
9.	30.00	5	8.67	33.33
10.	31.50	3	5.00	31.11
11.	33.00	12	20.00	26.67
12.	34.50	4	6.67	23.33
13.	36.00	6	10.00	20.00
14.	37.50	2	3.33	16.67
15.	39.00	1	1.67	13.33
16.	42.00	7	11.67	6.67
	1800	**60**	**100.00**	**33.33**

Average yield = 30 q/ha

Highest yield obtained by the cultivator = 42 q/ha

Lowest yield obtained by the cultivator = 12 q/ha

Highest yield reported to be obtained by the cultivator in Terai zone = 45q/ha

Average yield gaps = 33.33 per cent

Overall it can be seen that the yield gap per cent varied from 6.67 to 73.33 per cent. 20.00 per cent of the cultivators had a yield gap of 26.67 per cent. While 1.67 per cent of the cultivators had a yield gap of 36.67, 43.33 and 50.00 per cent respectively. This yield gap were found with regard to jute-paddy cultivators who cultivated paddy crop.

4.1.4. Distribution of the cultivators based on yield gaps and potato yield

The different yields and yield gaps obtained by the cultivator in potato are given in Table 13. Yield obtained by the cultivators varied from 150 to 285 q/ha. Equal proportion of the cultivators (16.67%) obtained the yield of 165 to 180 q/ha. It was also found that equal proportion of the cultivators (13.33%) obtained the yields of 150, 210 and 240 q/ha. Again, 8.33 per cent of the cultivators obtained 195 and 285 q/ha. 255q/ha was obtained by 3.33 percent of the cultivators. The lowest yield (150 q/ha) was obtained by 13.33 per cent of the cultivators. The highest yield (285 q/ha) was obtained by 8.34 per cent of the cultivators.

About 13 per cent of the cultivators obtained 150 q/ha. 16.67 per cent of the cultivators obtained 165 and 180 q/ha. 195, 210 and 285 q/ha of yield/ha was obtained by an equal proportion (8.33%) of the cultivators followed by 255 quintal of yield/ha was obtained by 3.33 per cent of the cultivators.

The average yield of the cultivators was 204 q/ha. Highest and lowest yield obtained by the cultivators was 285 q/ha and 150 q/ha respectively. Highest yield reported to be obtained in that particular area was 300 q/ha.

It could be inferred from Table 13 that existed a yield gap of 5 to 225 q/ha of the yield between the highest cultivator yield reported in that particular zone and the yield obtained by the cultivators on the production of potatoes per hectare.

Table 13. Distribution of the cultivators based on yield gaps and potato yields

Sl. No.	Yield obtained q/ha	No of cultivators	Percentage	Yield gap percent
1.	150	8	13.33	50
2.	165	10	16.67	45
3.	180	10	16.67	40
4.	195	5	8.33	35
5.	210	8	8.33	30
6.	240	8	13.33	20
7.	255	2	3.33	15
8.	270	4	6.67	10
9.	285	5	8.34	5
	12440	**60**	**100.00**	**32**

Average yield = 204 q/ha

Highest yield obtained by the cultivator = 285 q/ha

Lowest yield obtained by the cultivator = 150 q/ha

Highest yield reported to be obtained by the cultivator in Terai zone = 300q/ha

Average yield gaps percentage = 32 per cent

The yield gap per cent study revealed that the yield gaps percentage varied from 5 to 50 per cent. 8.34 per cent of the cultivators had a yield gap of 5 per cent while the highest yield gap was found amongst 13.33 per cent of the cultivators 10.00 per cent of the cultivators had a yield gap of 6.67 per cent. 3.33 per cent of the cultivators had a yield gap of 15.00 per cent. While 13.33 per cent of them had a yield gap of 30.00 per cent. Each of the 8.33 per cent of the cultivators had a yield gap of 30.00 and 35 per cent. While each of the 16.67 per cent of the cultivators had yield gap of 40.00 and 45.00 per cent.

From the Table 13, it can be seen that the maximum number of the cultivators had a yield gap 40.00 and 45.00 per cent. The highest yield gap of 50.00 per cent was obtained by 13.33 per cent of the cultivators, while the lowest yield gap of 5.00 per cent was obtained 8.34 per cent of them. This yield gaps was found with regard to potato cultivating cultivators.

Discussion on knowledge gap and technological gap assessment

The assessment of the knowledge gap and technological gap reveal that most of the cultivators had only medium level of the aforesaid gaps. The reason for this may be the location of erstwhile Uttar Bengal Krishi Viswavidyalaya Campus of Bidhan Chandra Krishi Viswavidyalaya. As most of the villages are located just within the radius of 200 km. Hence, the extension agent may have done their job in extending the need of the cultivators. Due to this reason the cultivators had supposedly have better knowledge and adoption level.

4.2.1. Distribution of the cultivators based on their knowledge gap

The respondents are categorized based on their knowledge gap (Table 15). They were categorized into low, high and medium.

Table 14. Distribution of the cultivators based on their knowledge gap

Categories	Jute cultivator	Paddy cultivator	Potato cultivator	Overall
Low	22 (36.67)	10 (16.67)	16 (26.67)	32 (26.67)
Medium	15 (25)	39 (65)	24 (40)	51 (42.8)
High	23 (38.33)	11 (18.33)	20 (33.33)	37 (30.83)
Total	60 (100)	60 (100)	60 (100)	60 (100)

(Figures in the parentheses indicates percentage)

From the above table it can be predicated that most (38.33%) of the jute-paddy cultivators belonged to higher knowledge gap with regard to jute cultivation technologies. 36.87 per cent of the respondent belonged to lower knowledge gap category possessed lower knowledge gap. The rest one-fourth (25.00%) belonged to medium knowledge gap category, these cultivators possessed medium level of knowledge on cultivation technology of jute.

The jute-paddy cultivators majority (65.00%) of them possessed medium level of knowledge. 18.33 per cent of the cultivators belonged to higher category of knowledge gap possessing lower knowledge. The rest 16.67 per cent belonged to the lower category of knowledge gap who possessed better knowledge then others on the technology of paddy crop cultivation practice.

The potato cultivators, majority (40.00%) belonged to the medium category possessing medium level of knowledge gap. High and low category of knowledge gap was found among 33.33 and 26.67 per cent of the total potato cultivators.

Overall the observation made among the cultivators show that majority (51.00%) possessed medium level of knowledge gap followed by 30.83 possessed higher knowledge gap. The rest 26.67 per cent possessed lower knowledge gap.

4.2.2. Distribution of the respondents based on their technological gap

The technological gap of the cultivators were classified into low, medium, high on the basis of their cumulative frequency.

Table 15. Distribution of the cultivators based on their technological gap

Categories	Jute cultivator	Paddy cultivator	Potato cultivator	Overall
Low	18 (30)	8 (13.33)	17 (28.33)	30 (25)
Medium	16 (26.67)	40 (66.67)	26 (33.33)	54 (45)
High	26 (43.33)	12 (20)	17 (28.33)	36 (30)
Total	50 (100)	60 (100)	60 (100)	120 (100)

(Figures in the parentheses indicates percentage)

From the Table 15, it can be inferred that 43.33 per cent of the jute-paddy cultivating respondents had lower technological gap with regard to jute crop. 30.00 per cent of them had higher technological gap. Rest (26.67%) of the respondents had medium level of technological gap.

Also the above Table 15 indicated that the technological gap among the paddy cultivators. The majority (66.67%) had medium level of technological gap, one-fifth (20.00%) had low level of technological gap. The rest 13.33 per cent had low level of adoption behaviour.

Among the potato cultivators, 43.33 per cent had medium level of technological gap. The lower and higher level of technological gap were found among 57.66 per cent of the potato cultivators.

Overall it can be seen that 45.00 per cent of the cultivators showed medium level of technological gap with 30.00 per cent higher category of technological gap. One-fourth (25.00%) of them showed higher level of technological gap.

4.3. The socio-economic, personal and psychological characteristics of the farmers

For any social science research, a clear understanding of the composition of the object helps in a large way to interpret the data gathered in the study. Hence, the composition of the study were analysed and the findings are presented under different sub-headings.

4.3.1. Age

It could be observed from Table 16 (Fig. 2) that 41.67 per cent of the jute-paddy cultivators belonged to the young age group, 31.67 per cent cultivators belonged to the middle age group and 26.67 per cent to the old age group.

Similarly it could be seen with regard to potato cultivators, majority of whom were of young age (43.33%) followed by medium age (35.83%) and old age (21.67%).

Overall it could be inferred that the majority of the cultivators belonged to the young age group (42.5%), about one-third (35.83%) belonged to middle age group and the remaining (21.67%) were of old age.

These findings are in contrast with the findings of Krishnakumar (1996).

4.3.2. Education

It can be observed from Table 16 (Fig. 3) that 30.00 per cent of the jute-paddy cultivators had education up to middle level, 23.3 per cent had education upto the

Table 16. Socio-economic personal and psychological characteristics of cultivators

Sl. No.	Variables	Category	Jute-Paddy cultivators	Potato cultivators	Overall
1.	**Age**	Young	25 (41.67)	26 (43.33)	51 (42.5)
		Middle	19 (31.67)	24 (40.00)	43 (35.83)
		Old	16 (26.67)	10 (16.67)	26 (21.67)
2.	**Educational status**	Illiterate	6 (10.00)	5 (8.33)	11 (9.16)
		Primary	12 (20.00)	6 (10.00)	18 (15.00)
		Middle	18 (30.00)	24 (40.00)	42 (35.00)
		Secondary	14 (23.33)	16 (26.67)	30 (25.00)
		Collegiate	10 (16.70)	9 (15.00)	19 (15.80)
3.	**Farming experience**	Low	3 (5.00)	7 (11.67)	10 (8.33)
		Medium	19 (31.70)	11 (18.33)	30 (25.00)
		High	38 (63.30)	42 (70.00)	80 (66.67)
4.	**Annual income**	Low	2 (3.30)	6 (10.00)	8 (6.67)
		Lower middle	28 (46.70)	36 (60.00)	64 (53.30)
		Upper middle	21 (35.00)	12 (20.00)	33 (27.50)
		High	9 (15.06)	6 (10.00)	15 (12.50)
5.	**Size of family**	**Nuclear**			
		a. Upto 5	23 (38.83)	25 (41.67)	48 (40.00)
		b. More than 5	22 (36.67)	15 (25.00)	37 (30.83)
		Joint			
		a. Upto 5	-	-	-
		b. More than 5	15 (25.00)	20 (33.33)	35 (29.17)
6.	**Farm size**	Marginal farmers (>0.40 ha)	3 (5.00)	4 (6.70)	7 (11.67)
		Small farmers (0.40 – 0.80ha)	11 (18.30)	9 (15.00)	20 (16.67)
		Medium farmers (0.81 – 4 ha)	40 (66.70)	40 (66.70)	80 (66.70)
		Large farmer (>4 ha)	6 (10.00)	7 (11.70)	13 (10.83)
7.	**Material status**	Low	34 (56.67)	33 (55.00)	67 (55.83)
		Medium	6 (10.00)	16 (26.67)	22 (18.33)
		High	20 (33.33)	11 (18.33)	31 (25.83)
8.	**Farm power status**	Low	31 (51.67)	26 (43.33)	57 (47.50)
		Medium	21 (35.00)	24 (40.00)	45 (37.50)
		High	8 (13.30)	10 (16.67)	18 (15.00)

Contd....

Contd....

9.	**Social participation**	Low Medium High	35 (58.33) 16 (26.67) 9 (15.00)	7 (11.67) 51 (85.00) 2 (3.33)	42 (35.00) 67 (55.83) 11 (9.17)
10.	**Mass media exposure**	Low Medium High	20 (33.33) 23 (38.33) 17 (28.33)	15 (25.00) 33 (55.00) 12 (20.00)	45 (37.50) 56 (46.67) 29 (24.17)
11.	**Extension agency contact**	Low Medium High	19 (31.67) 25 (41.67) 16 (26.67)	19 (31.67) 26 (43.33) 15 (25.00)	38 (31.67) 51 (42.50) 31 (25.83)
12.	**Economic motivation**	Low Medium High	20 (33.33) 14 (23.33) 26 (40.00)	20 (33.33) 20 (33.33) 20 (33.33)	40 (33.33) 34 (28.33) 46 (38.33)
13.	**Credit orientation**	Low Medium High	15 (25.00) 5 (8.33) 40 (66.67)	19 (31.67) 14 (23.33) 27 (45.00)	34 (28.33) 19 (15.83) 67 (55.83)
14.	**Innovativeness**	Low Medium High	12 (20.00) 28 (46.70) 20 (33.33)	16 (26.67) 33 (55.00) 11 (18.33)	28 (33.33) 61 (50.83) 31 (25.83)
15.	**Risk orientation**	Low Medium High	20 (33.33) 23 (38.33) 17 (28.33)	23 (38.33) 21 (35.00) 16 (26.67)	43 (35.83) 44 (36.67) 33 (27.50)
16.	**Scientific orientation**	Low Medium High	14 (23.33) 13 (21.67) 33 (55.00)	13 (21.67) 15 (25.00) 32 (53.33)	27 (22.50) 28 (23.33) 65 (54.17)
17.	**Progressiveness**	Low Medium High	23 (38.33) 12 (20.00) 25 (41.67)	18 (30.00) 16 (26.67) 26 (43.33)	41 (34.17) 28 (23.33) 51 (42.50)

Fig 2. DISTRIBUTION OF CULTIVATORS BASED ON THEIR AGE

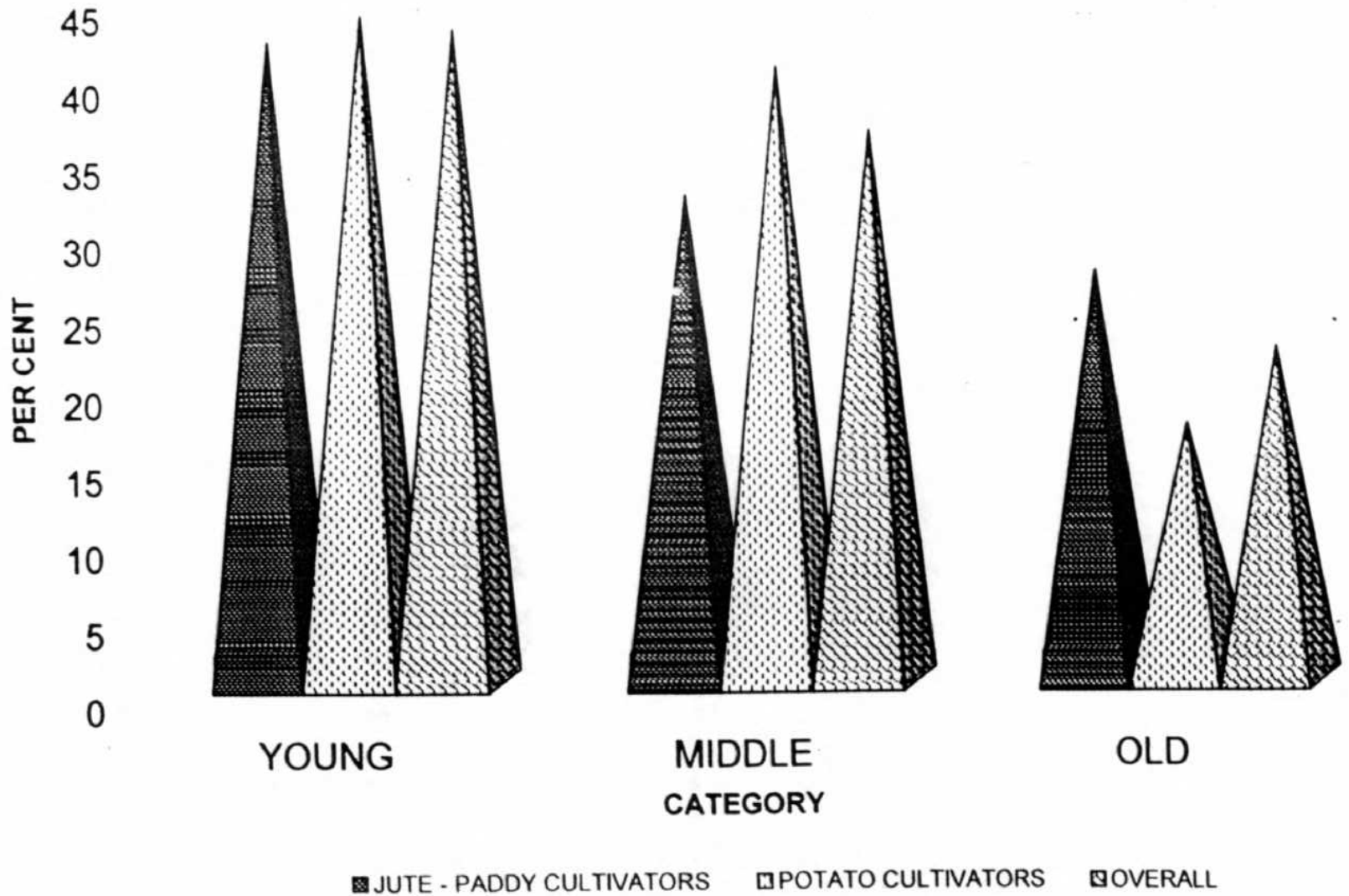
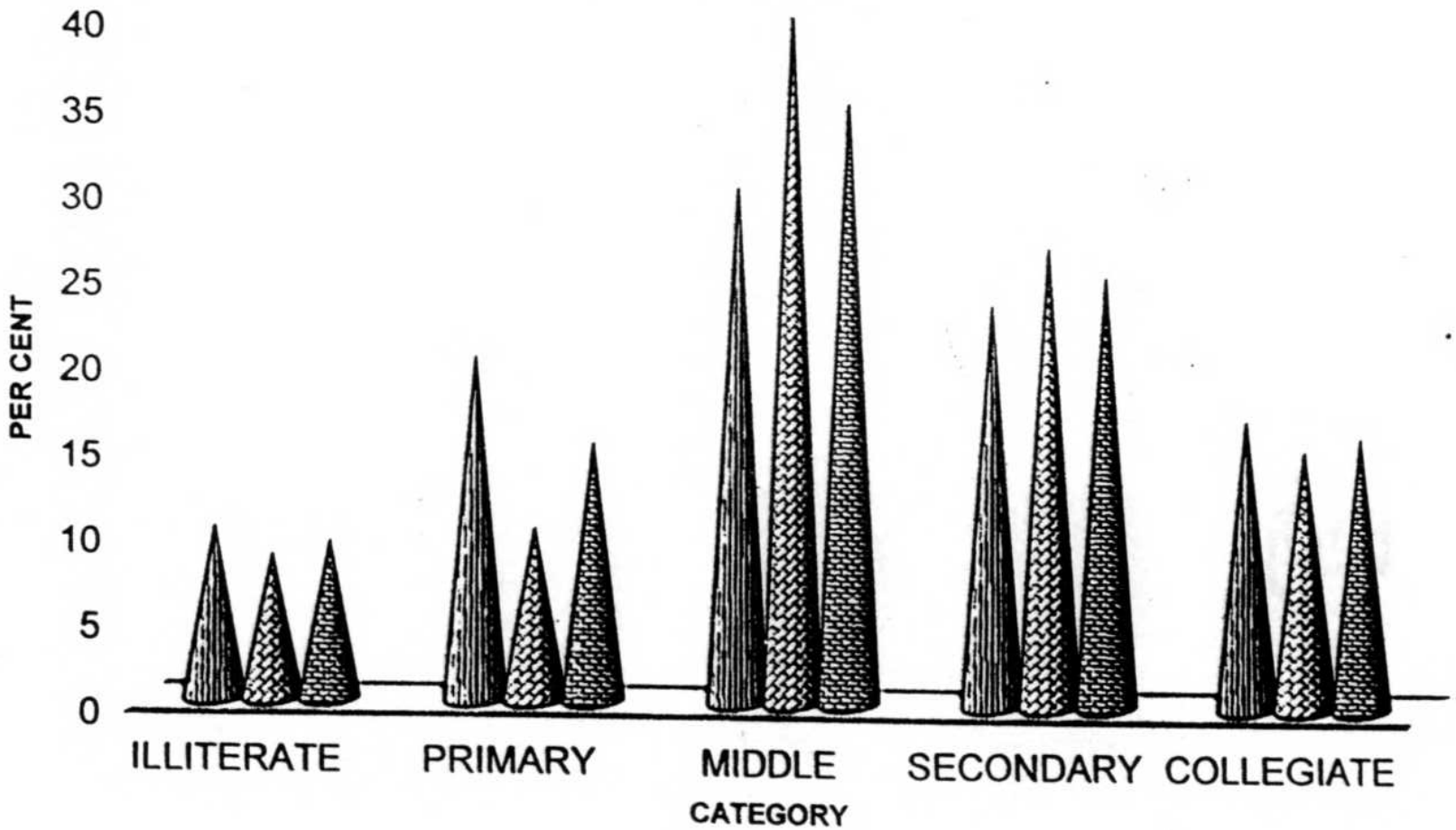


Fig 3. DISTRIBUTION OF CULTIVATORS BASED ON THEIR EDUCATIONAL STATUS



secondary level, followed by primary level (20%), collegiate level education (16.7%) and their were a few illiterates (10.00%).

For the potato cultivators, 40.00 per cent had medium level of education, 26.67 per cent had secondary level education followed by collegiate level (15.00%) and primary level (8.33%). A few of the cultivators (8.33%) were found to be illiterates.

Overall it can be inferred that most (35.00%) of the cultivators, 35.00 per cent had middle level education, one-fourth (25.00%) had secondary level education, 15.80 per cent of the cultivators had collegiate education followed by cultivators who had primary level education (15.00%). Rest of the respondents (9.16%) were found to be illiterates.

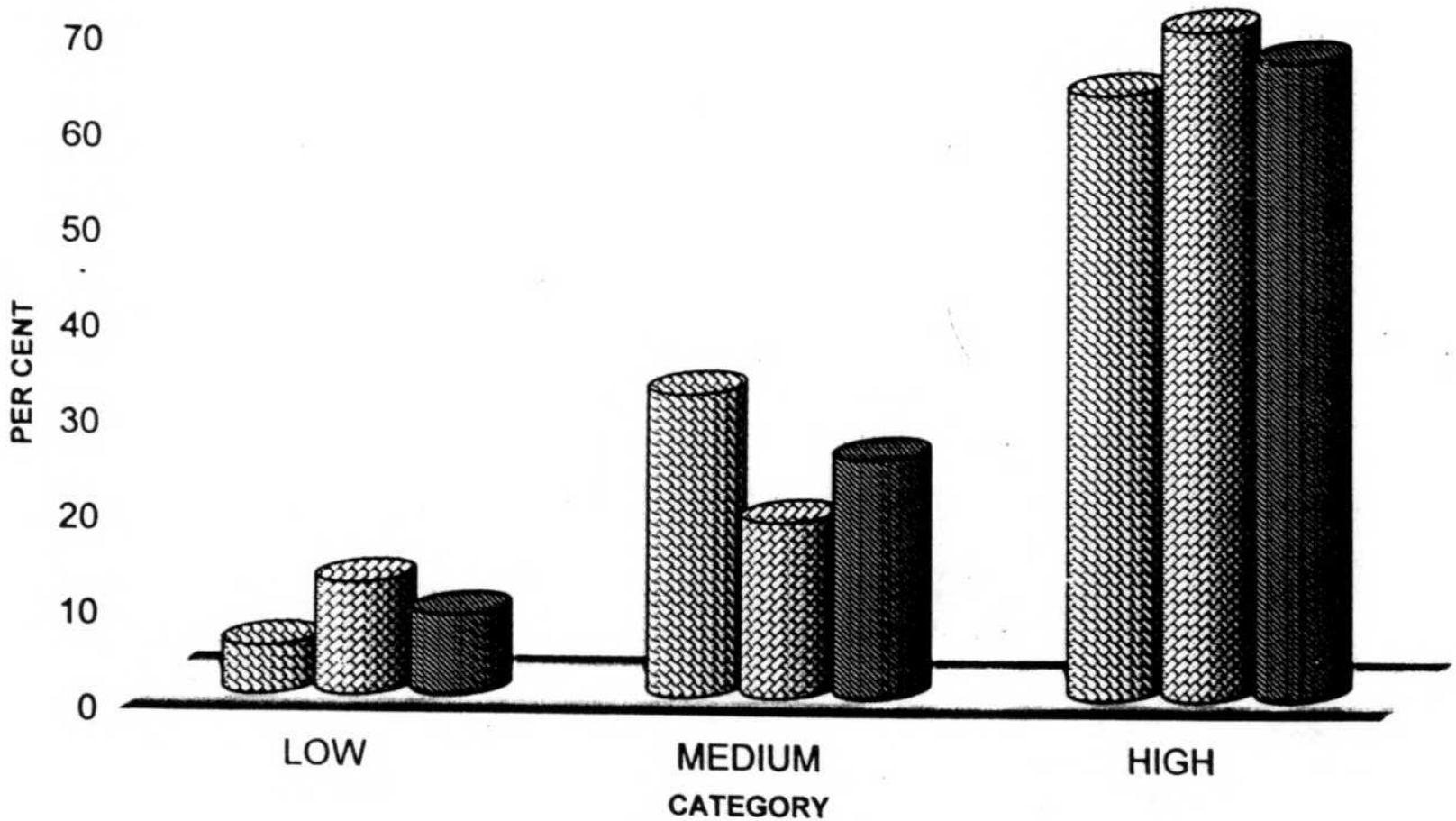
The research findings of Athimuthu (1990) supports this finding.

4.3.3. Farming Experience

It can be observed from Table 16 (Fig. 4) that of the cultivators cultivating jute-paddy, majority (63.30%) of the cultivators had high level of farming experience, whereas nearly one-third (31.70%) had medium level of farming experience. The rest 5.00 per cent of the cultivators had low level of farming experience.

It is also evident from the Table 16 that in case of cultivators cultivating potato, the majority (70%) had a high level of farming experience followed by middle

Fig 4. DISTRIBUTION OF CULTIVATORS BASED ON THEIR FARMING EXPERIENCE



level experience (18.33%). The rest (11.67%) of these cultivators had less farming experience.

Overall it could be seen from Table 16 that majority (66.67%) had high level of farming experience followed by one-fourth (25.00%) of the cultivators who possessed medium level of farming experience and the rest (8.33%) had low level of farming experience. The research findings are in accordance with those of Dharmalinga (1990).

4.3.4. Annual Income

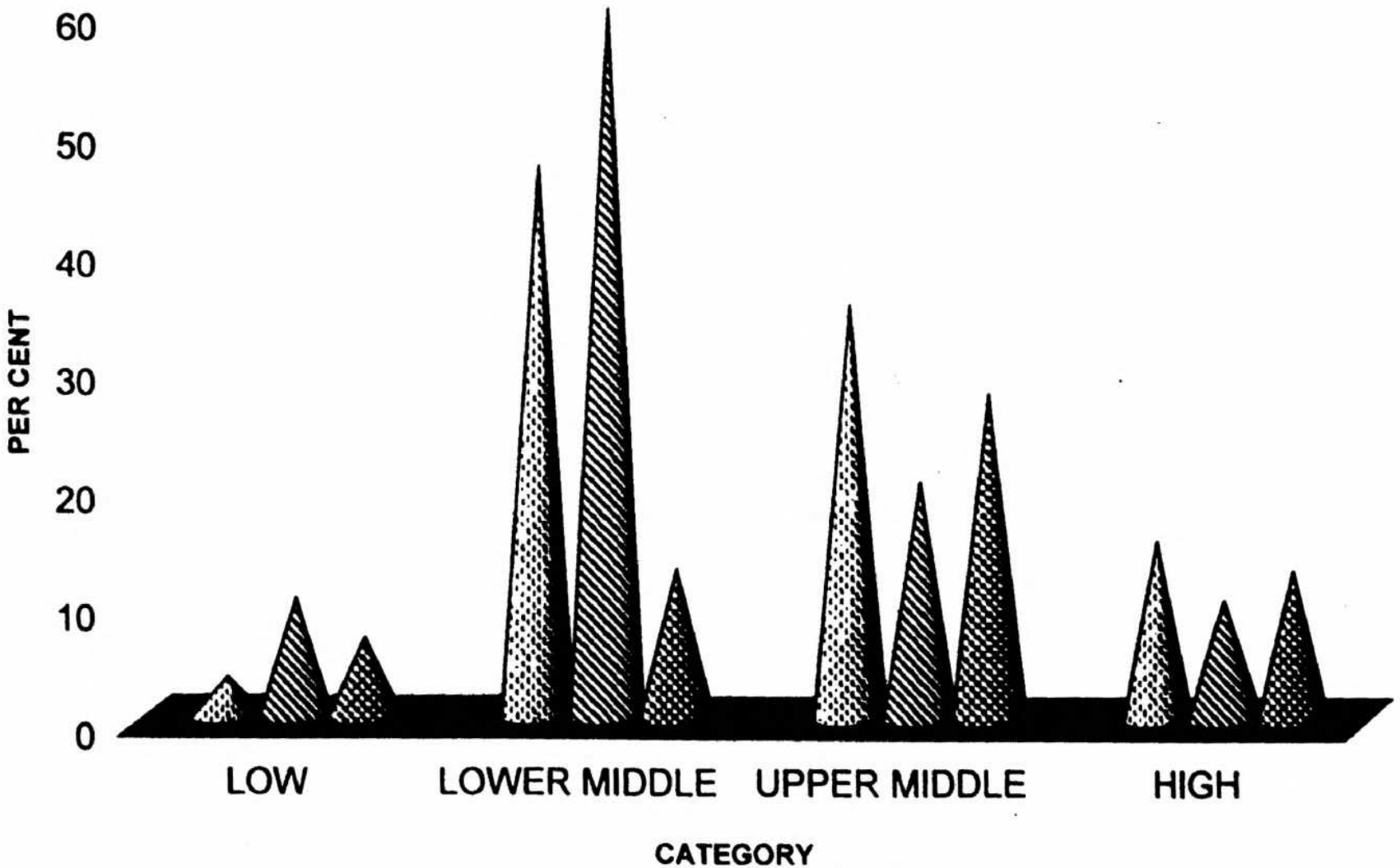
It can be observed from Table 16 (Fig. 5), that in case of jute-paddy cultivators, a maximum (46.70%) number belonged to lower middle income level and one-third (35.00%) of them belonged to upper middle income level. 15.00 per cent belonged to high income group and the rest (3.30%) belonged to lower level income group.

The majority (60.00%) of the potato cultivators had lower middle income level, followed by 20.00 per cent belonging to upper middle whereas the upper middle and lower group consisted 10 per cent each.

Overall it revealed that majority (53.33%) of the cultivators belonged to lower middle income level more than one-fourth (27.5%) belonged to upper middle followed by high level (12.5%). Rest comprised of lower income group (6.67%).

The findings are in accordance with those of Venkattakumar (1997).

Fig 5. DISTRIBUTION OF CULTIVATORS BASED ON THEIR ANNUAL INCOME



4.3.5. Size of family

It is evident from Table 16 (Fig. 6) that the maximum (38.33%) of the jute-paddy cultivators had members less than 5 followed by 36.77 per cent of the respondents who had a nuclear family with members more than 5. The rest 25.00 per cent had a joint family with more than 5 members.

Also from Table 16 can be seen that among potato cultivators, more than two-fifth (41.67%) belonged to nuclear family with less than 5 members followed by nuclear family with more than 5 members which was 25.00 per cent. The rest 33.33 per cent had a joint family with more than 5 members.

From the Table 16, it can be inferred that overall most (40.00%) of the potato cultivators had a nuclear family with less than 5 members followed by nuclear family with more than 5 members which was 30.83 per cent. This was followed by 29.17 per cent who belonged to joint family with more than 5 members. No joint family was found to have a member less than 5.

The findings are in accordance with the study of Rajkumar (1992).

4.3.6. Farm size

It can be predicted from Table 16 (Fig. 7) that majority (66.71%) of the jute-paddy cultivators were medium farmers. Small land holders constituted 18.30 per cent, followed by large farmers (10.00%). The rest 5 per cent were marginal farmers.

From Table 16, it can be inferred that the majority (66.7%) of potato cultivators were medium farmers (66.70%), whereas 15.00 per cent were small farmers (11.7%) and a few (6.70%) consisted of the marginal farmers.

Fig 6. DISTRIBUTION OF CULTIVATORS BASED ON THEIR FAMILY SIZE

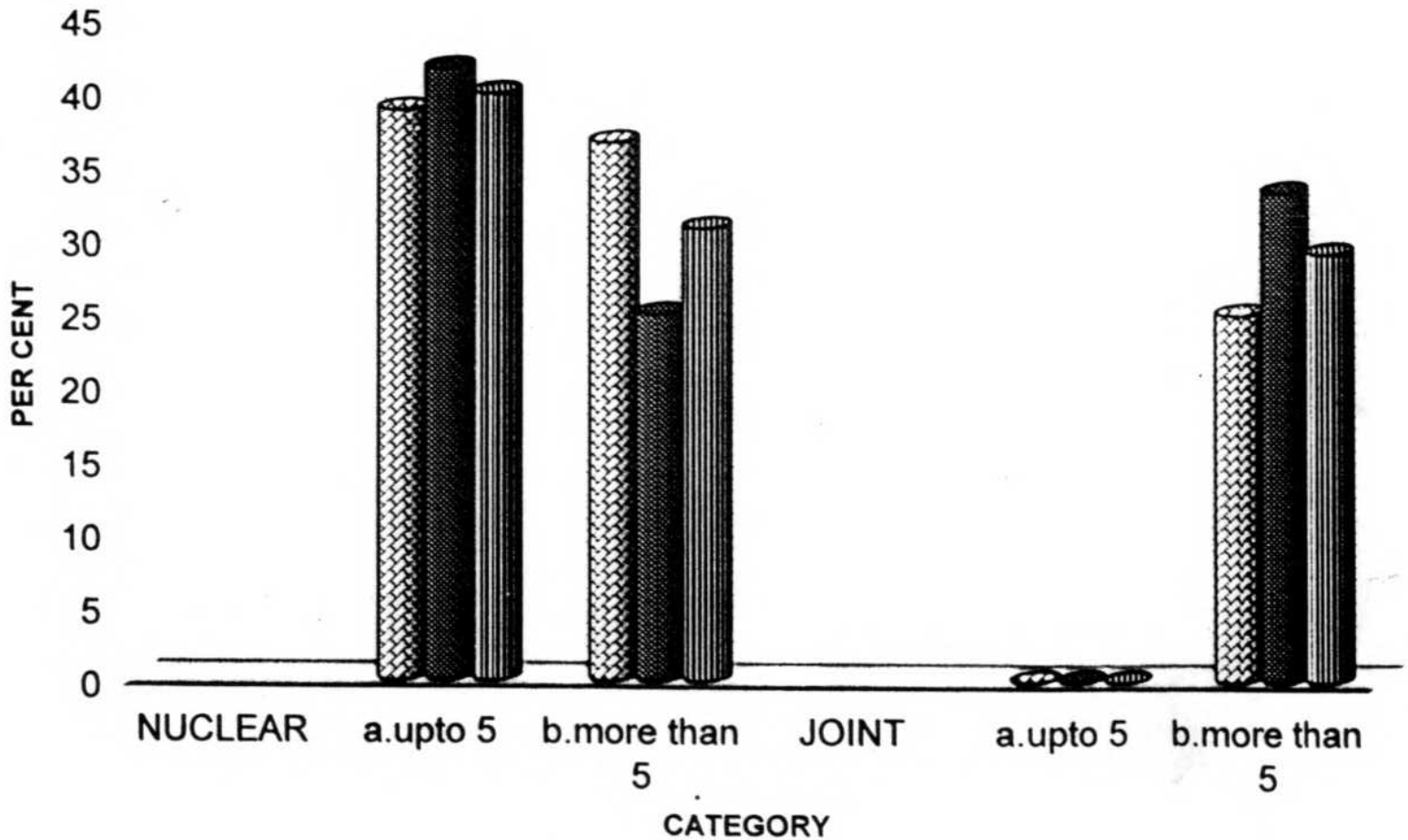
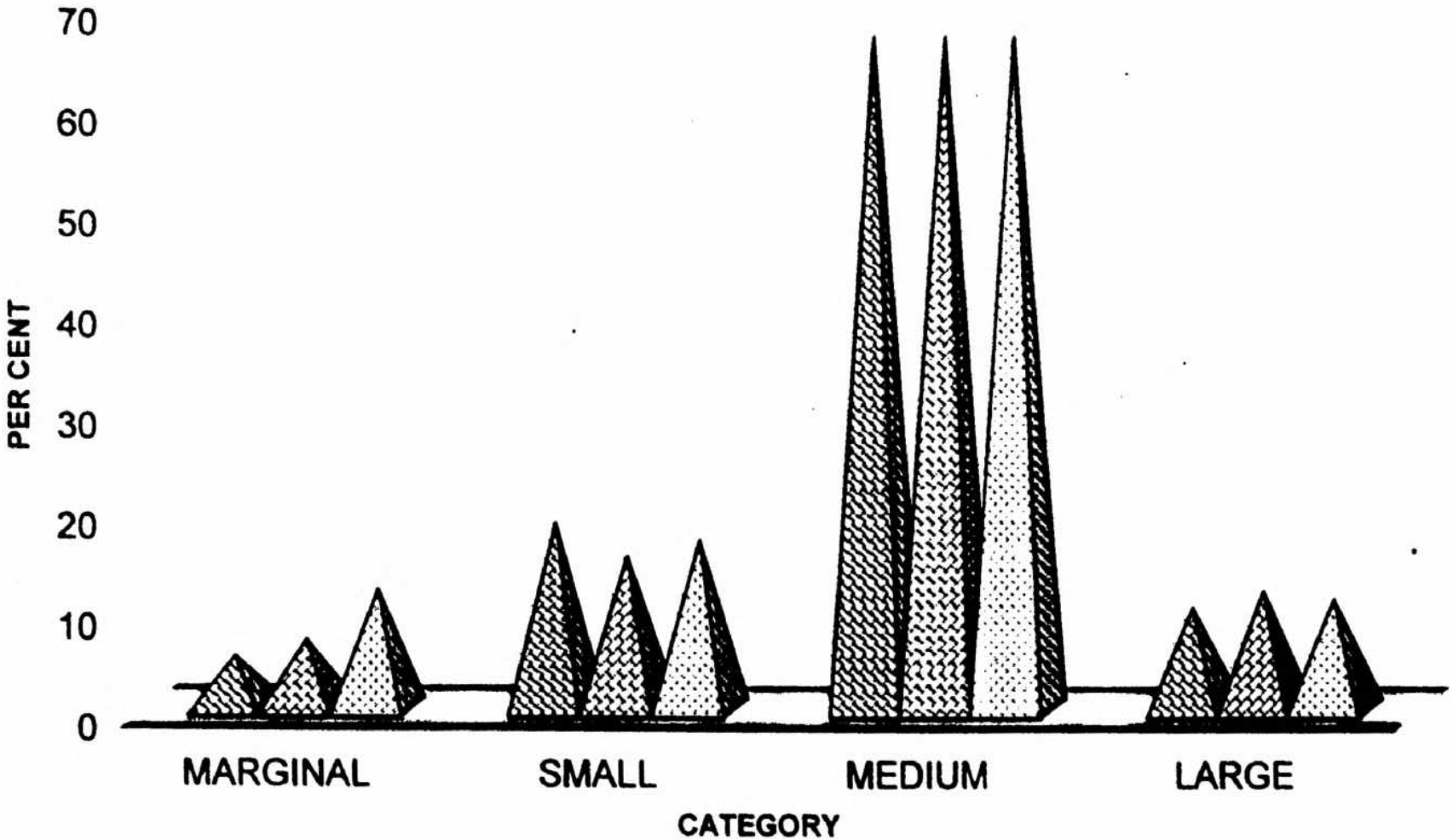


Fig 7. DISTRIBUTION OF CULTIVATORS BASED ON THEIR FARM SIZE



Overall, the Table reveals that majority (66.70%) of the cultivators belonged to medium land holding group. Small land holding members consisted of 18.30 per cent which was followed by large farmers (10.83%). Rest 5.80 per cent had marginal land holdings.

In this aspect the study differs from that of Jayalakshmi (2000).

4.3.7. Material status

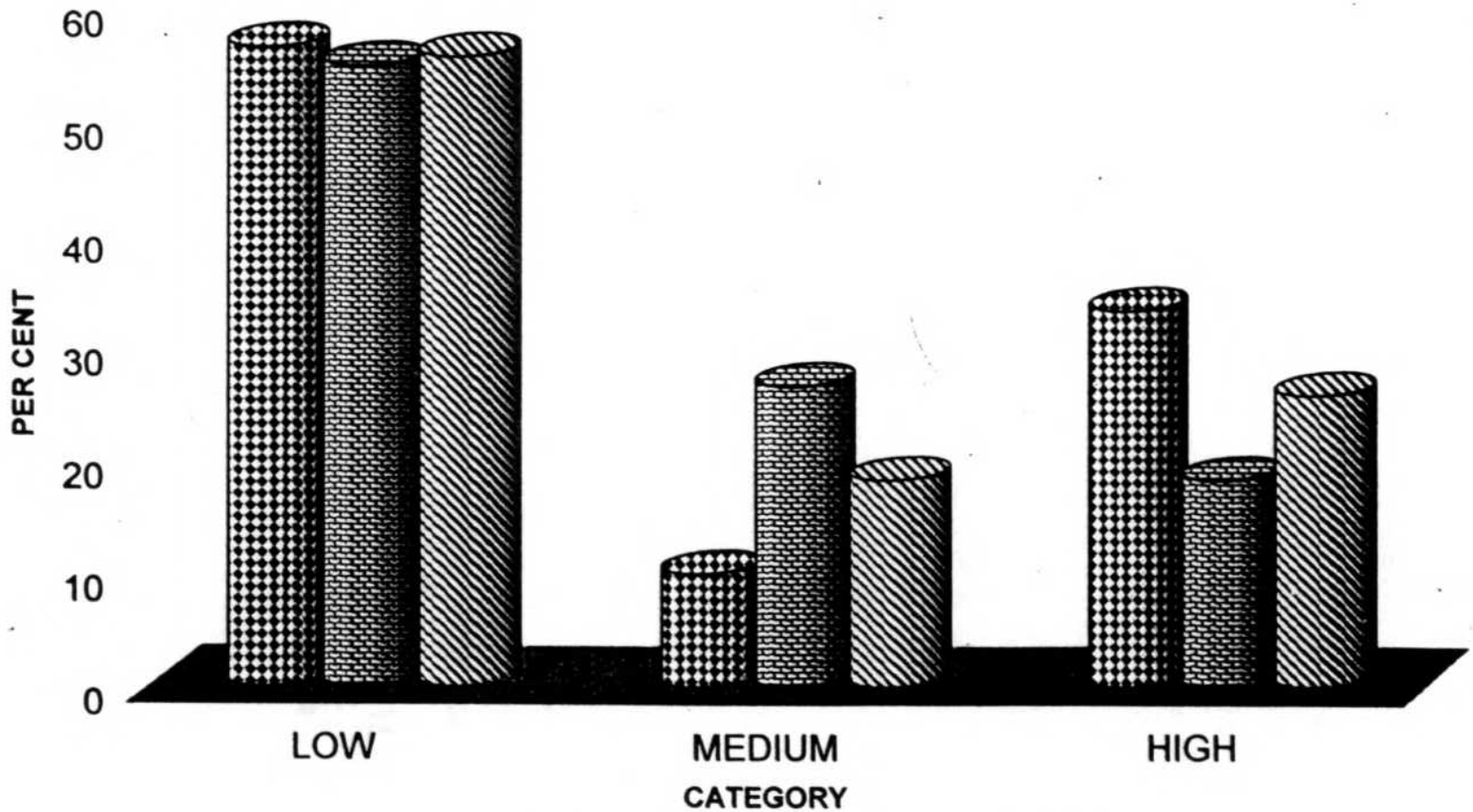
Table 14 indicates that majority (56.67%) of the cultivators belonged to the low level material status group while one-third (33.33%) of the cultivators had high level of material status. The rest 10.00 per cent belonged to medium level group of material status in case of jute-paddy cultivators.

Table 16 shows that in case of potato cultivators, majority (55.00%) belonged to low level material status group, followed by 26.67 per cent of medium level of material status. The rest (18.33 %) of the cultivators have high level material status group.

Overall, Table 16 reveals that majority (55.83%) of the cultivators belonged to low material status group, one-fourth (25.83%) possessed high material status and the rest 18.33 per cent of the cultivators possessed medium level of material status.

The finding of Venkattakumar (1997) are not in accordance with the present study.

Fig 8. DISTRIBUTION OF CULTIVATORS BASED ON THEIR MATERIAL STATUS



4.3.8. Farm power status

The Table 16 (Fig. 9) indicates that majority (51.67%) of the jute-paddy cultivators had low level of farm power status followed by 35.00 per cent who had medium level of farm power status. The rest 13.3 per cent possessed high level of farm power status.

Table 16 also indicates that the maximum (43.33%) of the potato cultivators possessed low level of farm power status followed by 40.00 per cent of the cultivators who had medium level of farm power status and 16.67 per cent belonged to high status level of farm power.

Overall, Table 14 indicates that while 7.5 per cent possessed low level of farm power status, 37.50 per cent possessed medium level of farm power status. The rest one-seventh (15.00%) possessed high level of farm power status.

These findings are in accordance with those of Babu (1990).

4.3.9. Social participation status

Table 16 (Fig. 10) reveals that for the jute-paddy cultivators, majority (58.33%) had high level of social participation, while 26.67 per cent had medium level of social participation One-seventh (15.00%) showed higher level of social participation.

In case of potato cultivators, Table 16 indicates that majority (85.00%) of them had medium level of social participation, which was followed by 11.67 per cent

Fig 9. DISTRIBUTION OF THE CULTIVATORS BASED ON THEIR FARM POWER STATUS

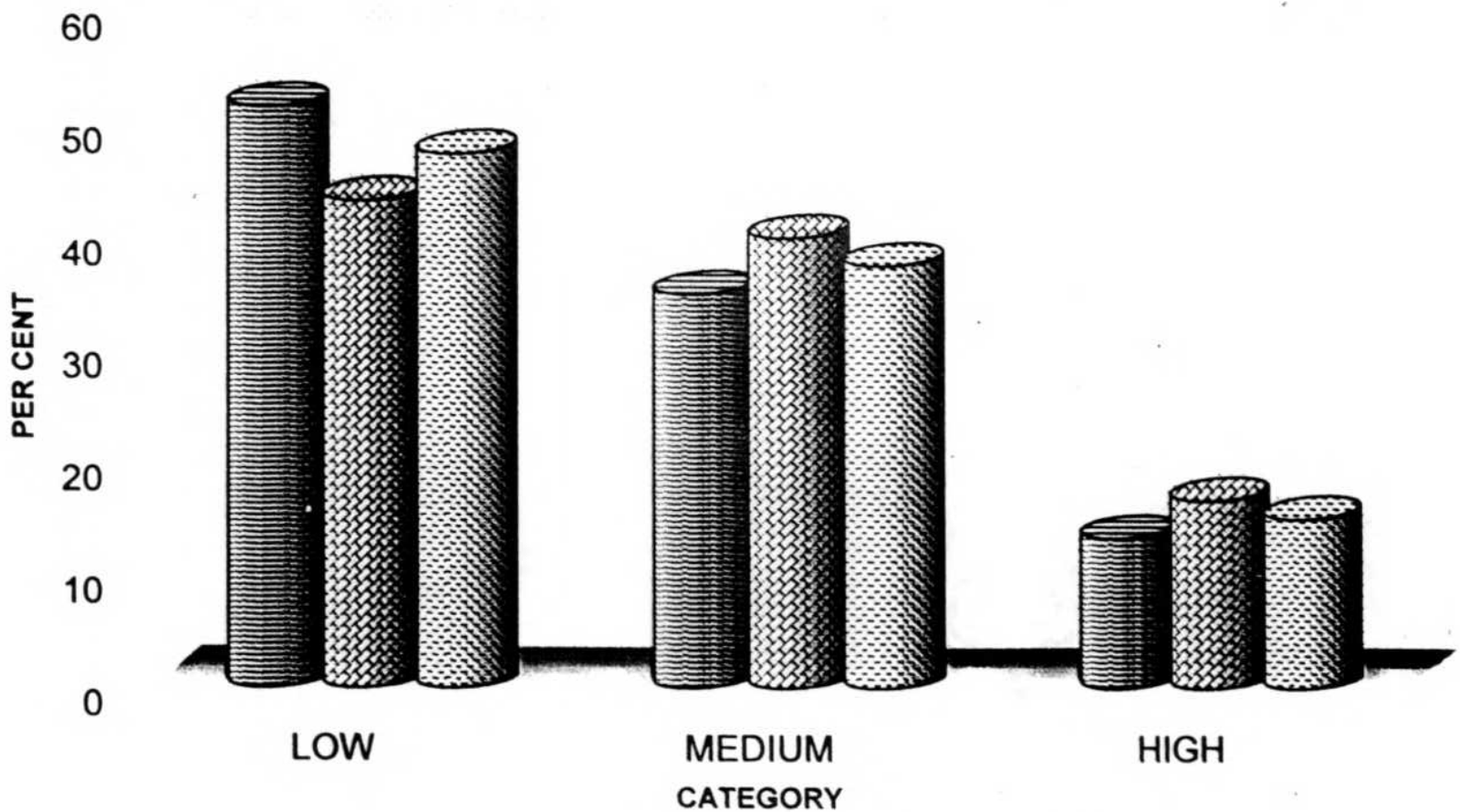
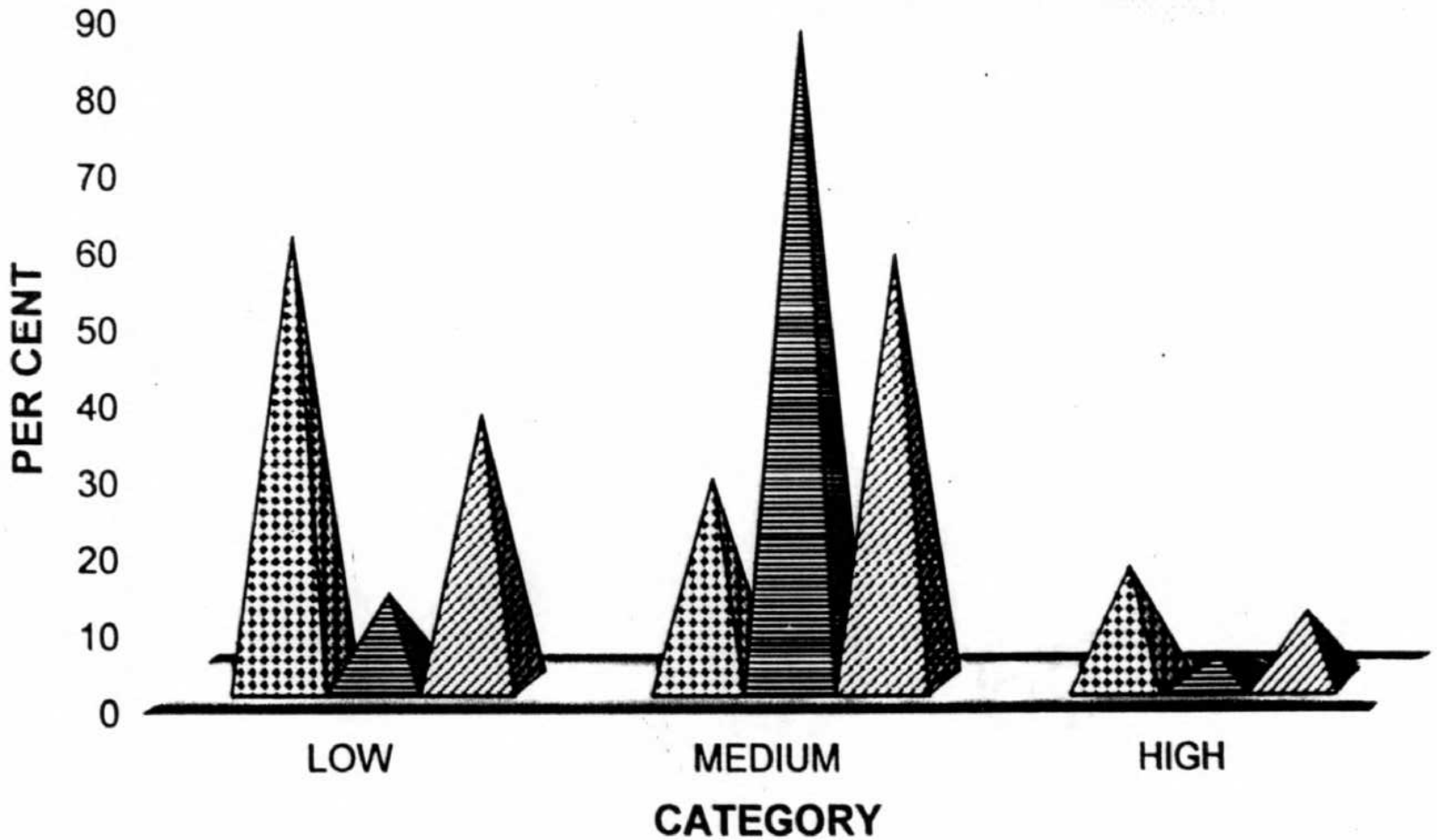


Fig 10. DISTRIBUTION OF CULTIVATORS BASED ON THEIR SOCIAL PARTICIPATION



of the cultivators who had low level of social participation. The rest 3.33 per cent belonged to the category having high level of social participation.

Overall, Table 16 shows that the majority (55.83%) of the cultivators had medium level of social participation followed by 35.00 per cent who had low level of social participation and the rest 9.17 per cent had high level of social participation.

The findings and study on social participation by Kavitha (1998) was found to be in accordance with the study.

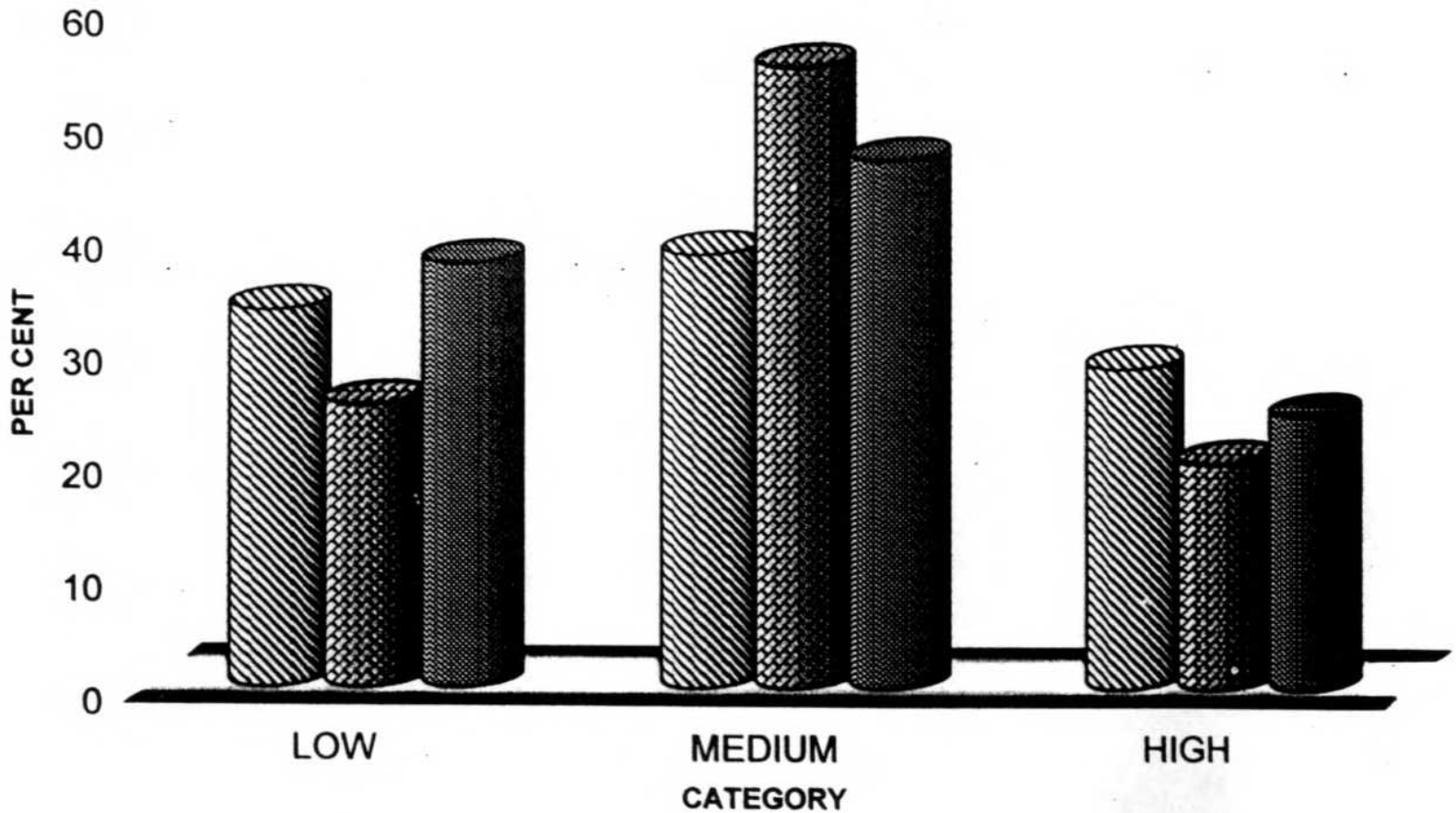
4.3.10. Mass Media exposure

From Table 16 (Fig. 11) it can be seen that in case of jute-paddy cultivators the maximum (38.33%) had medium level of mass media exposure and one-third (33.33%) of the cultivators had low level of exposure to mass media. This was followed by 28.33 per cent of the cultivators who had high level of mass media exposure.

Table 16 also indicates that among the potato cultivators, majority (55.00%) of the farmers had medium level of exposure, one-fourth (25.00%) of the cultivators had low level of mass media exposure and 20.00 per cent of these respondents had high level of exposure.

It can be inferred from Table 16 that overall, 46.67 per cent of the farmers had medium level of exposure followed by 37.50 per cent of the cultivators who had low

Fig 11. DISTRIBUTION OF CULTIVATORS BASED ON THEIR MASS MEDIA EXPOSURE



level of exposure. 24.17 per cent of the cultivators had high level of exposure to mass media.

This finding is in accordance with the findings of Saravanan (2000) who reported that maximum number of the cultivators had medium level of mass media exposure.

4.3.11. Extension agency contact

It could be noticed from Table 16 (Fig. 12) that among the jute-paddy cultivators, most (41.67%) of them had medium level of extension agency contact, 31.67 per cent had low level of extension agency contact, 26.67 per cent of the cultivators had high level of extension agency contact.

Also from Table 16 it can be noticed that among the potato cultivators, the maximum (43.33%) had medium level of extension agency contact, while 31.07 per cent had low level of extension agency contact and one-fourth (25.00%) had high level of extension agency contact.

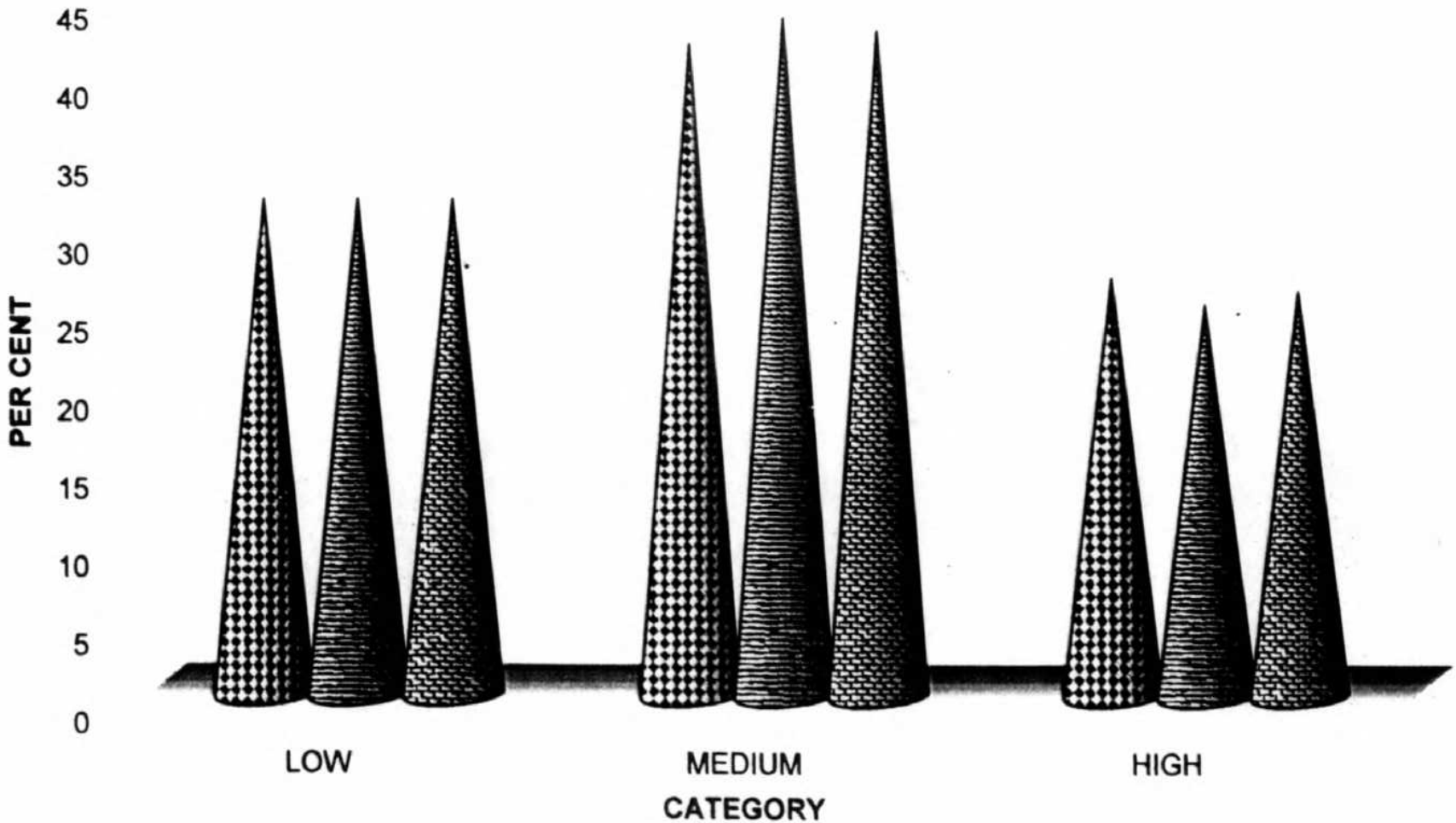
It can be inferred that overall, 42.50 per cent had medium level of extension agency contact, 31.67 per cent had low level of extension agency contact. Almost one fourth (25.83%) had high level of extension agency contact.

This finding is in line with Sophia (1991).

4.3.12. Economic motivation

It could be referred from Table 16 (Fig. 13) that the jute-paddy cultivators (40.00%) had high level of economic motivation while 28.33 per cent of the

Fig 12. DISTRIBUTION OF CULTIVATORS BASED ON THEIR EXTENSION AGENCY CONTACT



respondents had low level of economic motivation. The rest 23.33 had medium level of economic motivation.

Table 16 also shows that among the potato cultivators, the low, medium and high level of economic motivation was seen among 33.33 per cent and distribution was of equal proportions for the low, medium and high category.

Overall, it can be noticed that 36.67 per cent had high level of motivation while 30.83 per cent had lower level of economic motivation. The rest i.e. 28.33 per cent belonged to medium level of economic motivation.

The finding is in line with the findings of Jayalakshmi (2000).

4.3.13. Credit orientation

It could be inferred from Table 16 (Fig. 14) that majority (66.67%) of the jute-paddy cultivators had a high level of credit orientation, one-fourth (25.00%) had low level of credit orientation followed by 8.33 per cent of the cultivators who had medium level of credit orientation.

From Table 16 it could be indicated that among potato cultivators, 45.00 per cent had high level of credit orientation, 31.67 per cent showed low level of credit orientation. The rest 23.33 per cent had medium level of credit orientation.

Overall, it can be concluded that majority (55.83%) of the cultivators had high level of credit orientation followed by 28.33 per cent who had low level of credit orientation compared to 15.83 per cent who had medium level of credit orientation.

The finding is not in line with the findings of Bindu (1995).

Fig 13. DISTRIBUTION OF CULTIVATORS BASED ON THEIR ECONOMIC MOTIVATION

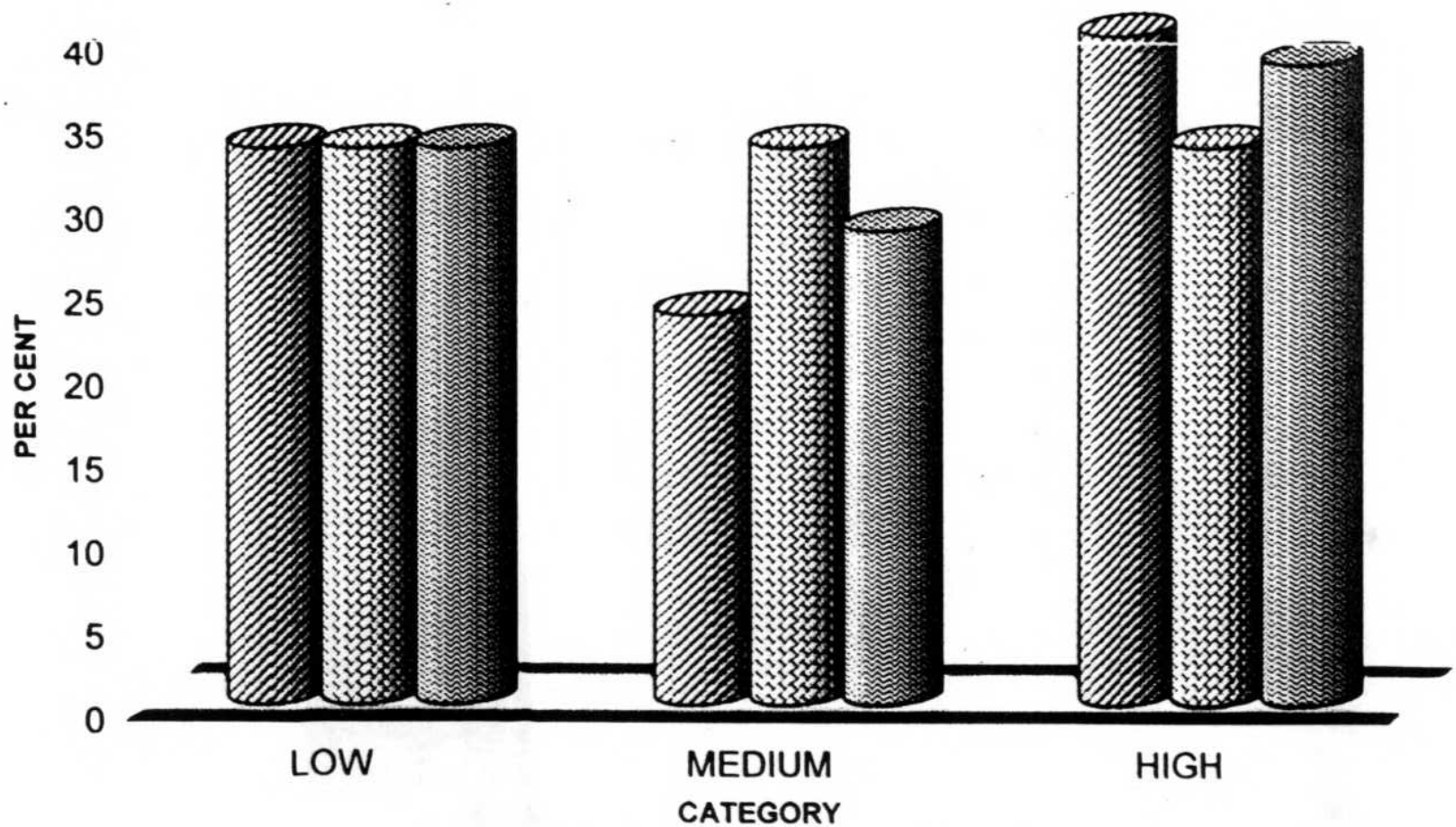
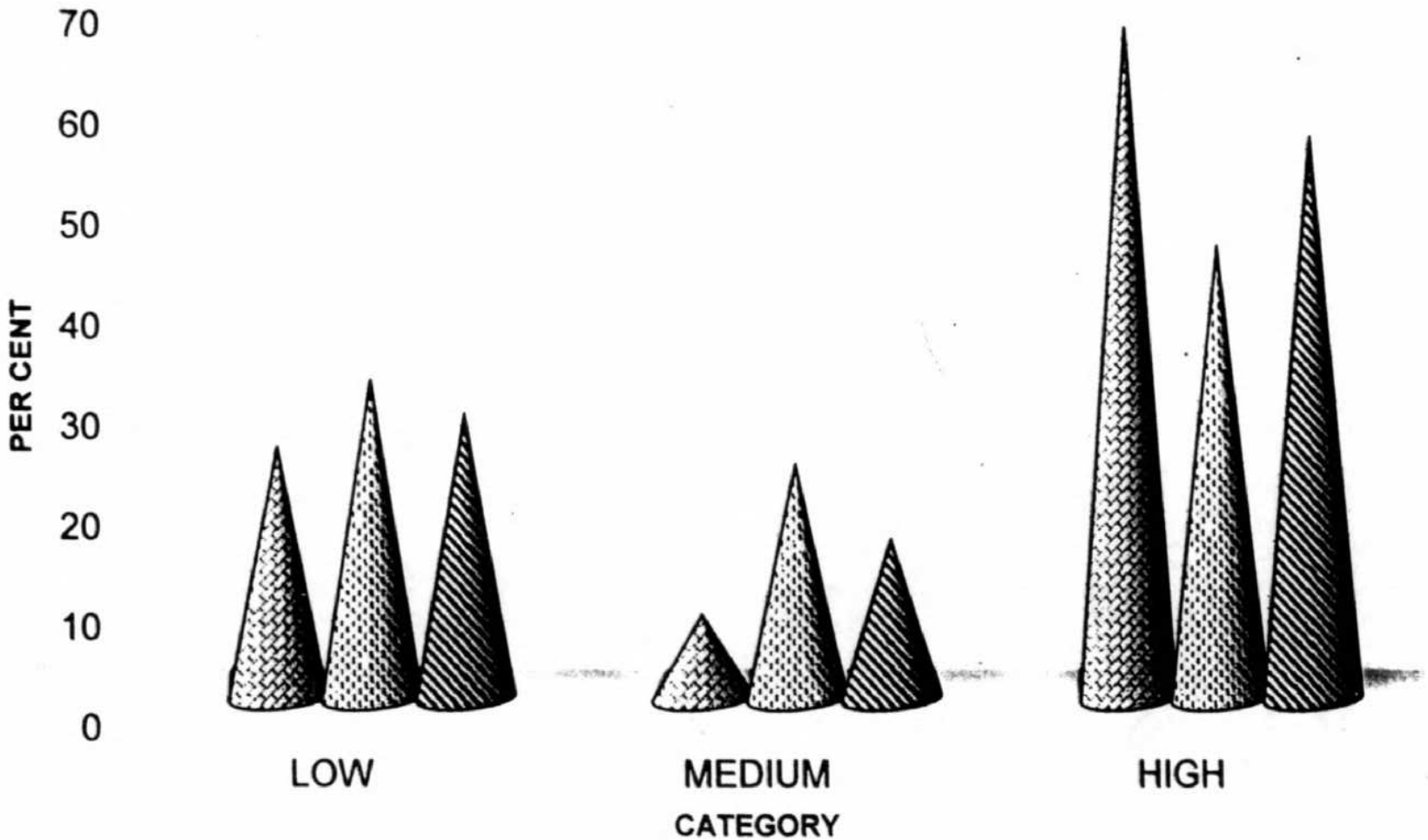


Fig 14. DISTRIBUTION OF CULTIVATORS BASED ON THEIR CREDIT ORIENTATION



4.3.14. Innovativeness

Among the jute-paddy cultivators, it could be referred from Table 16 (Fig. 15) that most (46.70%) of them had medium level of innovativeness. About one-third (33.33%) of the cultivators had high level of innovativeness. The rest one-fifth (20.00%) had low level of innovativeness.

Table 16 also shows that among potato cultivators, majority (55.00%) had medium level of innovativeness. Almost one-fourth (26.67%) had low level of innovativeness. While the rest (18.33%) had high level of innovativeness.

Overall, it can be seen that almost half (50.83%) possessed medium level of innovativeness and rest (25.33%) had low level of innovativeness.

The study is in line with the study of Saravanan (2000).

4.3.15. Risk orientation

Table 16 (Fig. 16) indicates that among the jute-paddy cultivators, 38.33 per cent had medium level of risk orientation. 33.33 per cent of the cultivators had low level of risk orientation and the rest 28.33 per cent had high level of risk orientation.

Table 16 also shows that most (38.33%) of the potato cultivating had low level of risk orientation while, 35.00% of them had medium level of risk orientation. The rest (26.67%) of them had high level of risk orientation.

It could be inferred from the above statement that a most (36.67%) of the cultivators had medium level of risk orientation followed by 35.83 per cent who

Fig 15. DISTRIBUTION OF CULTIVATORS BASED ON THEIR INNOVATIVENESS

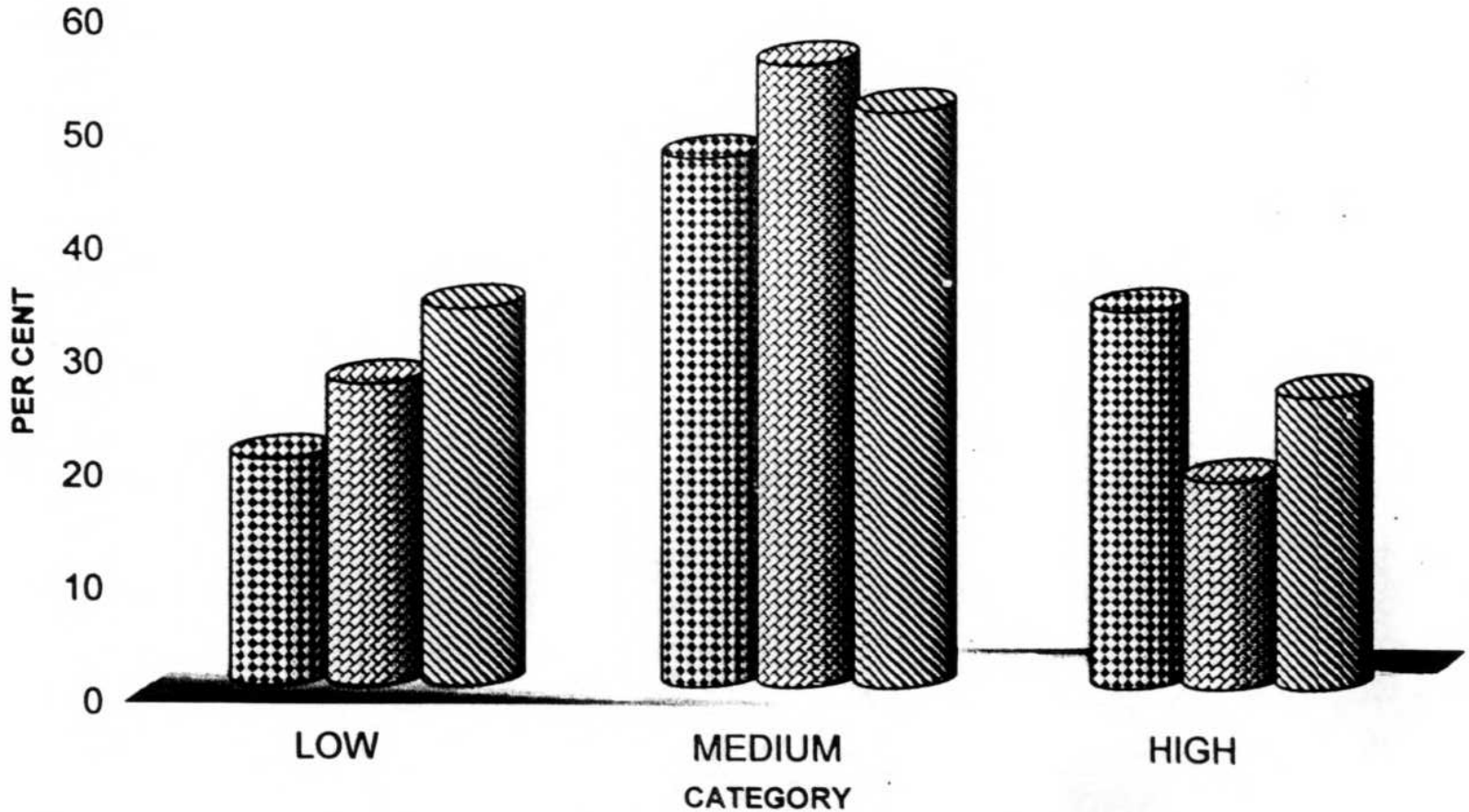
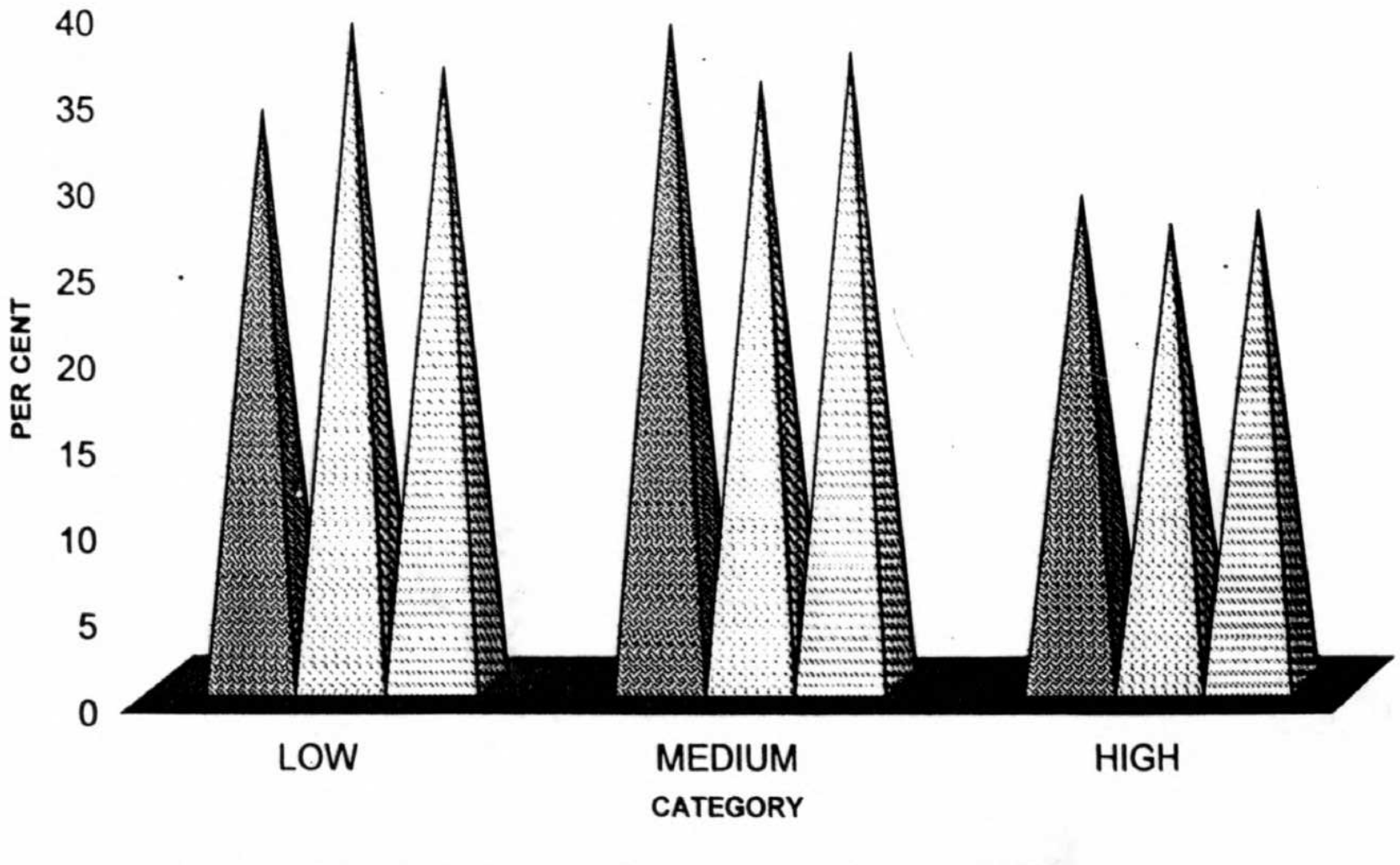


Fig 16. DISTRIBUTION OF CULTIVATORS BASED ON THEIR RISK ORIENTATION



possessed low level of risk orientation. The rest (27.50%) of them had high risk orientation.

The findings are in line with those of Rajkumar (1997).

4.3.16. Scientific orientation

Table 16 (Fig. 17) indicates that majority of (55.00%) the jute-paddy cultivators had high level of scientific orientation whereas 23.33 per cent had low level of scientific orientation. The rest 21.67 per cent had medium level of scientific orientation.

Table 16 also indicates that majority (53.33%) had high level of scientific orientation, among the potato cultivators. One-fourth (25.00%) of the cultivators belonged to the low level of scientific orientation and 21.67 per cent had low level of scientific orientation.

Overall Table 16 shows that majority (54.77%) of the total cultivators had high level of scientific orientation. Almost one-fourth (23.33%) of the cultivators had medium level of risk orientation and 22.50 per cent had low level of risk orientation.

This findings are in agreement with those of Jayalakshmi (2000).

4.3.17. Progressiveness

Table 16 (Fig. 18) indicates that most (41.67%) of the jute-paddy cultivators had high level of progressiveness, while 38.33 per cent of these cultivators had low level of progressiveness and one-fifth (20.00%) had medium level of progressiveness.

Fig 17. DISTRIBUTION OF CULTIVATORS BASED ON THEIR SCIENTIFIC ORIENTATION

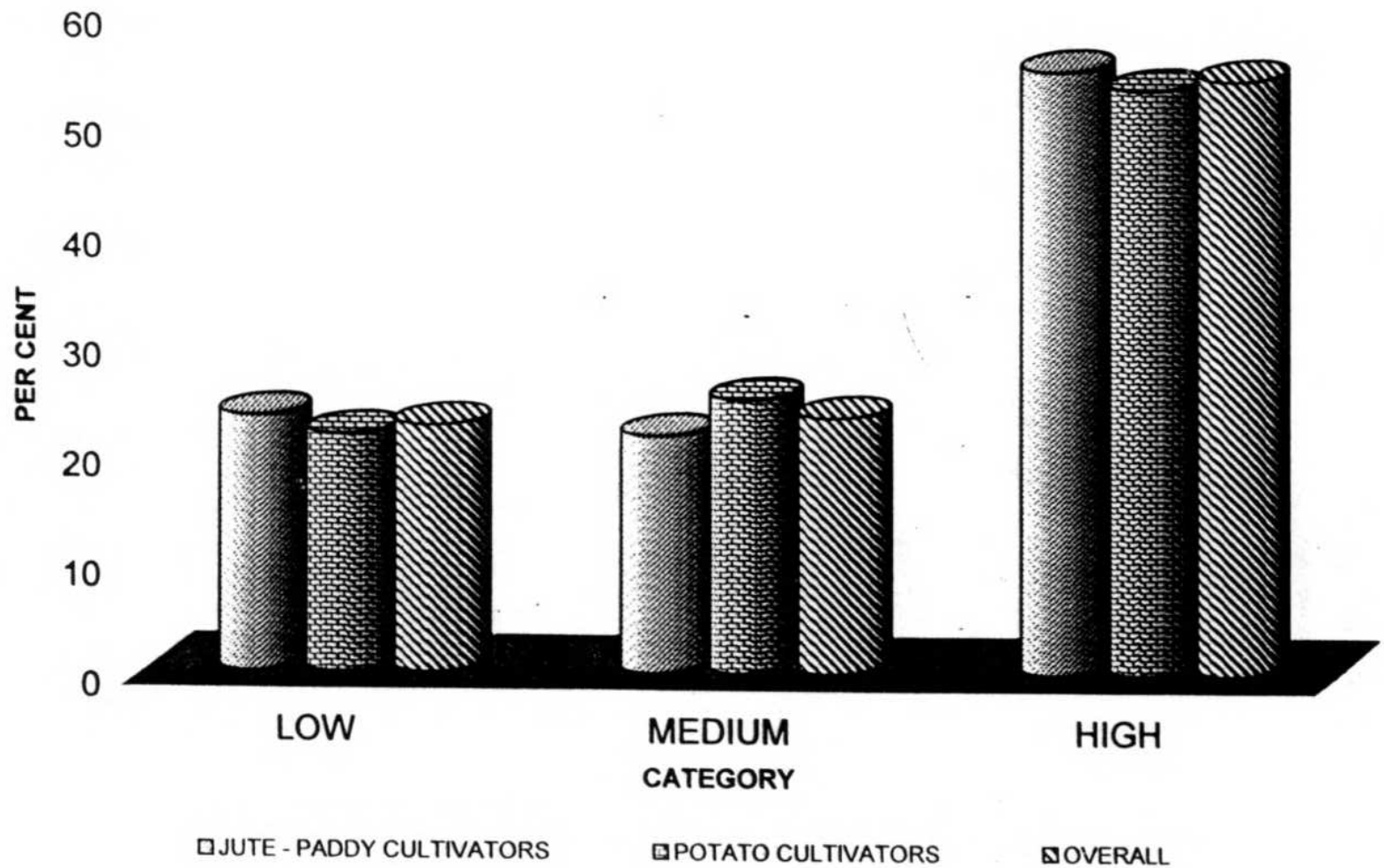


Fig 18. DISTRIBUTION OF CULTIVATORS BASED ON THEIR PROGRESSIVENESS

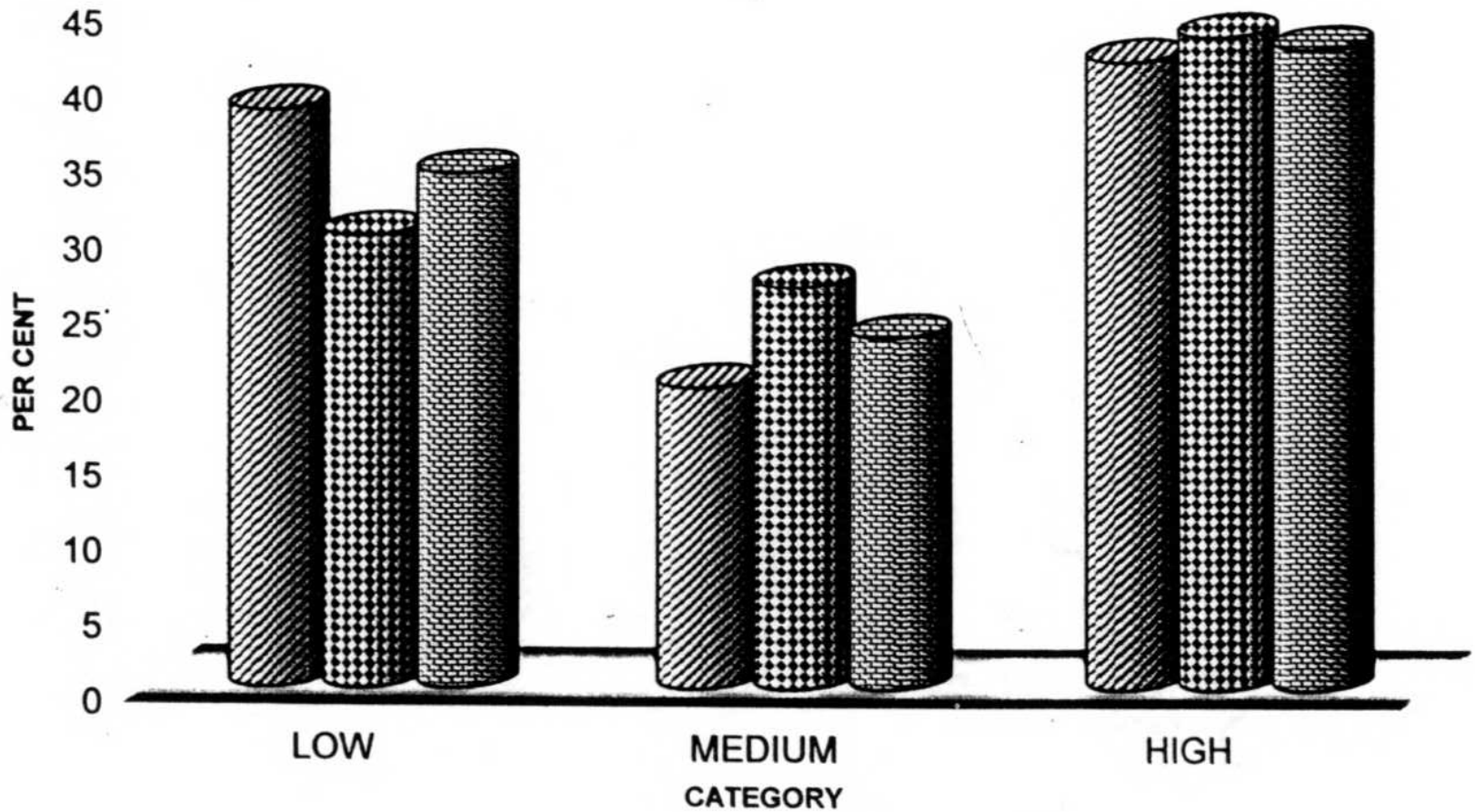


Table 16 also indicates that 43.33 per cent had high level of progressiveness among the potato cultivators followed by 30.00 per cent of the respondents who had low level of progressiveness. The rest (26.67%) had medium level of progressiveness

Overall, it could be concluded that a most (42.50%) of the cultivators had high level of progressiveness while 34.17 per cent had low level of progressiveness. The rest (23.33%) had medium level of progressiveness.

This finding of Lawrance (2000) does not corresponds with the present study.

4.4. Relationship and influence of the independent variables on technological gap and yield gaps

Based on the various findings, there is a need to find out the relation between all the variables. The previous findings dealt with yield gaps, characteristics of the cultivators and technology. Hence, there is an utmost need to relate all these variables and find out how these independent variables influence the dependent variable. To find out the significant relationship between the variables, statistical tools like correlation, multiple regression and stepwise regression were worked out. The relationship and influence of the independent variable with the knowledge gap and technological gap are presented below.

4.4.1. Relationship and influence of the independent variables on yield gaps, knowledge gaps and technological gaps of jute crop

To find out the significant relationship between the independent variables and the dependent variable for the jute crop, statistical analysis was carried out and presented in the following subtitles.

4.4.1.1. Relationship and influence of independent variables on yield gaps of jute crop

The independent variables and dependent variables were statistically analysed for getting a better view on the significance of the different independent variables on yield gaps. These were statistically analysed and the results of the analysis are presented as below.

Correlation analysis

From Table 17, it could be seen that material status (X_7), farm power status(X_8), social participation (X_9), mass media exposure (X_{10}) and scientific orientation (X_{16}) have shown significantly negative relationship with yield gaps at one per cent level of probability. Education (X_2), annual income (X_4) and farm size (X_6) were found to be negatively significant at five per cent level of probability. The other independent variables age (X_1) education (X_2), farming experience (X_3), size of family (X_5), farm size (X_6), extension agency contact (X_{11}), economic motivation (X_{12}), credit orientation (X_{13}), innovativeness (X_{14}) risk orientation (X_{15}) and progressiveness (X_{17}) of the respondents had no significant relationship with yield gaps.

Multiple regression analysis

Table 17 shows that all the independent variables together contributed 55.10 per cent of variation to the yield gaps. The 'F' value was found to be significant at five per cent level of probability and this means that there existed a significant contribution of independent variables on the dependent variable, yield gaps.

Table 17. Relationship and influence of independent variables on yield gap of jute crop.

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	0.211 NS	0.206	0.247	0.835 NS
X_2.	Educational status	-0.327*	0.868	2.240	0.388 NS
X_3.	Farming experience	0.170 NS	1.277	4.612	0.277 NS
X_4.	Annual income	-0.277*	1.077	3.414	0.315 NS
X_5.	Size of Family	0.117 NS	-0.129	0.428	-0.302 NS
X_6.	Farm size	-0.325*	-0.287	4.525	0.063 NS
X_7.	Material status	-0.496**	0.099	0.314	-0.317 NS
X_8.	Farm power status	-0.491**	-0.636	0.300	-2.121 *
X_9.	Social participation	-0.539**	-4.029	1.743	-2.312 NS
X_{10}.	Mass media Exposure	-0.570**	-1.775	0.948	-1.872 NS
X_{11}.	Extension agency contact	-0.145 NS	1.175	0.686	1.714 NS
X_{12}.	Economic motivation	-0.187 NS	-0.170	1.613	-0.105 NS
X_{13}.	Credit orientation	-0.124 NS	1.414	1.224	1.155 NS
X_{14}.	Innovativeness	0.245 NS	0.456	3.772	0.121 NS
X_{15}.	Risk orientation	0.103 NS	1.237	1.406	0.880 NS
X_{16}.	Scientific orientation	-0.331**	-0.919	1.294	-0.711 NS
X_{17}.	Progressiveness	-0.451 NS	-0.139	1.958	-0.071 NS

$R^2 = 0.551$ F value = 3.034*

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

Out of the 17 independent variables, only one variable (i.e.) farm power status (X_{10}) had negative influence on yield gaps. This means that a unit increase in occupation status would decrease the yields gaps by a factor of 0.636 units, *ceteris paribus*. The farm power status shows high significant this may be due to the fact that more of farm power would increase the efficiency which may reduce the yield gaps

All the other independent variables age (X_1), education (X_2), farming experience (X_3), annual income (X_4), size of family (X_5), farm size (X_6), material status (X_7), social participation (X_9), mass media exposure (X_{10}), extension agency contact (X_{11}), economic motivation (X_{12}), credit orientation (X_{13}), innovativeness (X_{14}), risk orientation (X_{15}), scientific orientation (X_{16}) and progressiveness (X_{17}) had no significant relationship with yield gap.

Stepwise regression analysis

The stepwise regression analysis of the independent variables towards the yield gap was worked out and presented in Table 17.

Table 18. Stepwise regression analysis of independent variables with yield gap of jute crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_8	Farm power status	-0.601	0.191	-3.149**
X_9	Social participation	-3.819	1.514	-2.522**
X_{10}	Mass media exposure	-2.166	0.712	-3.040**
X_{11}	Extension agency contact	-1.190	0.573	-2.075**

$R^2 = 0.503$ $F = 13.900$**

**- Significant at 0.01 level

The Table 18 shows that the independent variables, farm power status(X_8), social participation (X_9), mass media exposure (X_{10}) and extension agency contact (X_{11}) when considered in isolation from other independent variables explained 50.30 per cent of variation in yield gaps. The difference in variation explained by the eliminated variables was 4.58 per cent. This indicated that unit increase in farm power status (X_8), social participation (X_9), mass media exposure (X_{10}) and extension agency contact (X_{11}), *ceteris paribus*, would decrease the yield gaps by 0.601, 3.819, 2.166 and 1.190 respectively.

The use of more farm power would help as it would increase the efficiency and it may reduce the yield gaps significantly. The social participation may have helped them to adopt and have the newer ideas on the various technologies by virtue of the respondents being members or office bearers of the organisation and the increase of each unit would reduce the yield gaps. If respondents are exposed more to mass media which will change them for good and which would have been the reason for reducing the yield gaps.

4.4.1.2.Relationship and influence of the independent variables on knowledge gap of jute crop

The independent variables and dependent variable knowledge gap were statistically analysed. The results of the analysis were as follows.

Correlation analysis

It could be seen from Table 19 that out of the 17 independent variables, education (X_2), material status (X_7), farm power status (X_8), social participation (X_9),

Table 19. Relationship and influence of independent variables on knowledge gap of jute crop

Vari-able No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	0.168^{NS}	0.0166	0.036	-0.463^{NS}
X_2.	Educational status	-0.483**	-0.310	0.325	-0.952^{NS}
X_3.	Farming experience	0.127^{NS}	0.382	0.670	0.570^{NS}
X_4.	Annual income	-0.180^{NS}	0.451	0.496	0.911^{NS}
X_5.	Size of Family	0.181^{NS}	0.0364	0.62	0.585^{NS}
X_6.	Farm size	-0.245^{NS}	0.0920	0.657	0.140^{NS}
X_7.	Material status	-0.455**	0.2419	0.46	0.531^{NS}
X_8.	Farm power status	-0.503**	-0.0847	0.044	-1.943^{NS}
X_9.	Social participation	-0.440**	-0.346	0.253	-1.366^{NS}
X_{10}.	Mass media Exposure	-0.554**	-0.216	0.138	-1.567^{NS}
X_{11}.	Extension agency contact	-0.302*	-0.0309	0.100	-0.310^{NS}
X_{12}	Economic motivation	-0.383**	-0.206	0.234	-0.881^{NS}
X_{13}.	Credit orientation	-0.138^{NS}	0.258	0.178	1.452^{NS}
X_{14}.	Innovativeness	-0.283*	0.0352	0.548	0.059^{NS}
X_{15}.	Risk orientation	-0.076^{NS}	0.0413	0.204	0.202^{NS}
X_{16}.	Scientific orientation	-0.556**	-0.0421	0.188	-2.243*
X_{17}.	Progressiveness	-0.589**	-0.116	0.284	-0.408^{NS}

$R^2 = 0.609$ F value = 3.844*

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

mass media exposure (X_{10}), economic motivation (X_{12}), scientific orientation (X_{16}) and progressiveness (X_{17}) had a significantly negative relationship at one percent level of probability with the knowledge gap of the respondents. Only two independent variables namely extension agency contact (X_{11}) and innovativeness (X_{14}) had a significant negative relationship at five percent level of probability with the knowledge gap of the respondents.

Multiple regression analysis

From Table 19 it could be seen that all the independent variables together contributed 60.90 per cent of variation to the knowledge gap. The 'F' value was found to be significant at five per cent level of probability.

Out of the 17 independent variables, only one variable namely scientific orientation (X_{16}) had contributed significantly towards knowledge gap at five per cent level. The remaining independent variables had no contribution towards knowledge gap among the cultivators. The reason for this may be due the fact more scientific orientation makes one to have indepth of knowledge making one progressive, creative, skill oriented which in turn reduces the knowledge gap on the technologies of jute crop.

This indicated that a unit increase in scientific orientation (X_{16}), *ceteris paribus*, would decrease the knowledge gap by 0.421 units. More the involvement of respondents in scientific orientation, more the involvement of the respondents in the

scientific orientation their would be increase in knowledge. It has been inferred that different scientific change in enterprise would bring more interest hence leading to better knowledge.

Stepwise regression analysis

The stepwise regression analysis of independent variables towards the knowledge gap was worked out and is presented in Table 20. This was done in order to eliminate those independent variables whose contribution to the variation in the dependent variables was considered to be minimum.

Table 20. Stepwise regression analysis of independent variables with knowledge gap of jute crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_8	Farm power status	-0.074	0.028	-2.670**
X_9	Social participation	-0.490	0.128	-3.824**
X_{10}	Mass media exposure	-0.295	0.093	-3.152**

$R^2 = 0.526$ F = 20.747**

**- Significant at 0.01 level

It could be seen from the Table 20 that the independent variables namely farm power status (X_8), social participation (X_9) and mass media exposure (X_{10}) when considered in isolation from other independent variables explain 52.60 per cent of variation in the knowledge gaps. The difference in variation explained by the eliminated 14 variables was 8.30 per cent. This indicated that the unit increase in farm

power status, social participation and mass media exposure, *ceteris paribus*, would have decreased the knowledge gap by 0.074, 0.490 and 0.295 units respectively. So these independent variables could be considered as crucial ones for describing the knowledge gap of the respondents.

The increase in farm power status would increase the interest and would lead them to seek newer knowledge to increase the yield level which would in turn lower the knowledge gaps. Similarly social participation would lower the knowledge gap as it provides the respondents a chance to be member and office bearer of different organisations. More the mass media exposure, more would be information about better technology. Hence, the respondents would be more aware which will reduce the knowledge gaps.

4.4.1.3. Relationship and influence of the independent variables on technological gap of jute crop

To find out the relationship and influence, the independent variables were statistically analysed with the dependent variable i.e. technological gap on jute crop. The results of the work are presented as below.

Correlation analysis

It could be seen from Table 21 that out of the 17 independent variables namely education (X_2), farm power status (X_8), social participation (X_9), mass media exposure (X_{10}), innovativeness (X_{14}) scientific orientation (X_{16}) and progressiveness (X17) had a negative and significant relationship at one percent level of probability with the technological gap. Only three independent variables namely, farm size (X_6) extension agency contact (X_{11}) and economic motivation (X_{12}) had a significant and

Table 21. Relationship and influence of independent variables on technological gap of jute crop.

Vari-able No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	0.171^{NS}	0.0184	0.182	0.101^{NS}
X_2.	Educational status	-0.479**	-2.783	1.655	-1.681^{NS}
X_3.	Farming experience	0.112^{NS}	-0.166	3.408	-0.490^{NS}
X_4.	Annual income	-0.237^{NS}	1.357	2.522	0.538^{NS}
X_5.	Size of Family	0.133^{NS}	0.0707	0.317	0.223^{NS}
X_6.	Farm size	-0.261*	-1.041	3.343	-0.311^{NS}
X_7.	Material status	-0.400**	0.430	0.232	1.855^{NS}
X_8.	Farm power status	-0.473**	-0.537	0.222	-2.421*
X_9.	Social participation	-0.521**	-2.923	1.288	-2.270^{NS}
X_{10}.	Mass media Exposure	-0.534**	-1.166	0.701	-1.664^{NS}
X_{11}.	Extension agency contact	-0.257*	0.304	0.507	0.601^{NS}
X_{12}.	Economic motivation	-0.286*	0.217	1.192	0.182^{NS}
X_{13}.	Credit orientation	-0.136^{NS}	1.106	0.905	1.223^{NS}
X_{14}.	Innovativeness	-0.374**	4.362	2.787	-1.565^{NS}
X_{15}.	Risk orientation	-0.104^{NS}	-0.312	1.038	-0.301^{NS}
X_{16}.	Scientific orientation	-0.470**	-1.538	0.956	-1.609^{NS}
X_{17}.	Progressiveness	-0.586**	0.0280	1.446	0.019^{NS}

$R^2 = 0.587$ - F value = 3.511*

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

negative relationship at five percent level of probability with the technological gap of the respondents.

Multiple regression analysis

From Table 21 it could be seen that all the independent variables together contributed 58.70 per cent of variation to the knowledge gain. The 'F' value was found to be significant at five per cent level of probability.

Out of the 17 independent variables, only one variable namely, farm power status (X_8) had contributed significantly towards technological gaps. The remaining independent variables had no contribution towards technological gap among respondents.

This indicated that a unit decrease in farm power status (X_8), *ceteris paribus*, would decrease the technological gap by 0.537 units. More the farm power status, less would be their technological gaps. As more farm power status means that respondents can adopt more technologies without any constraints, for different activities with better efficiency which would lead to lessening the technological gap.

Stepwise regression analysis

The stepwise regression analysis of independent variables towards the technological gap was worked out and is presented in Table 23. This was done in order to eliminate those independent variables whose contribution to the variation in the dependent variables was considered to be very minimum.

Table 22. Stepwise regression analysis of independent variables with technological gap of jute crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_9	Social participation	-3.547	1.125	-3.155**
X_{17}	Progressiveness	-3.621	0.939	-3.854**

$R^2 = 0.422$ $F = 20.799$**

**- Significant at 0.01 level

It could be seen from the above Table 22 that the independent variables namely, social participation (X_9) and progressiveness (X_{17}) when considered in isolation from the other independent variables explains 42.22 per cent of variation in the knowledge gaps. The difference in variation explained by the eliminated 15 independent variable was 16.50 per cent. This indicated that the unit increase in social participation (X_9) and progressiveness (X_{17}), *ceteris paribus*, would have decreased the technological gap by 3.547 and 3.621 units respectively.

These independent variables could be considered as crucial ones for describing the technological gap of the respondents. It could be inferred that the social participation would make them meet resourceful people as being member or office bearer of organisation which may have helped them to adopt better technologies hence, reducing the technological gaps. Most of the respondents are progressive and up to date to adopt newer technologies which may lead to lower technological gaps.

4.4.2. Relationship and influence of the independent variables on yield gaps, knowledge gaps and technological gaps of paddy crop.

To find out the relationship and influence of the independent variables on the dependent variables, statistical analysis were done. This statistical analysis helped in interpreting and understanding the relationship between the variables with relation to paddy crop. The results and the interpretation of the statistical relationship worked out are presented with following subheadings.

4.4.2.4. Relationship and influence of the independent variables on yield gap of paddy crop

The 17 independent variables and the dependent variable yield gaps were statistically worked to find out the relationship and influence between the variables of crop cultivation. The results interpret the relationship and influence of the independent variables on yield gaps of paddy crop and are presented following pages.

Correlation analysis

Table 23 shows that out of the 17 variables *viz.*, education (X_2), material status (X_7), farm power status (X_8), social participation (X_9), mass media exposure (X_{10}), innovativeness (X_{14}), scientific orientation (X_{16}) and progressiveness (X_{17}) were found to have negatively significant relationship with the yield gaps at one per cent level of probability. The other variables namely, annual income (X_4), farm size (X_6), and extension agency contact (X_{11}) had negatively significant relationship with the yield gaps at five per cent level of probability. The other variables i.e., age (X_1), farming experience (X_3), annual income (X_4), size of family (X_5), economic motivation (X_{12}), credit orientation (X_{13}) and risk orientation (X_{15}) were found to have no significant relationship with the yield gaps of the respondents.

Table 23. Relationship and influence of independent variables on yield gap of paddy crop

Vari-able No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	0.146 ^{NS}	0.165	0.257	-0.064^{NS}
X_2.	Educational status	-0.390**	-0.925	2.337	-0.396 ^{NS}
X_3.	Farming experience	0.116^{NS}	3.041	4.812	0.632 ^{NS}
X_4.	Annual income	-0.291*	0.411	3.561	0.115 ^{NS}
X_5.	Size of Family	0.163^{NS}	0.160	0.447	0.357 ^{NS}
X_6.	Farm size	-0.810*	0.808	4.721	0.171 ^{NS}
X_7	Material status	-0.513**	-0.118	0.327	-0.360 ^{NS}
X_8.	Farm power status	-0.473**	-0.322	0.313	-1.027 ^{NS}
X_9.	Social participation	-0.496**	-3.561	1.818	-1.954 ^{NS}
X_{10}.	Mass media Exposure	-0.466**	0.331	0.984	0.335 ^{NS}
X_{11}.	Extension agency contact	-0.320*	-0.227	0.716	-0.317 ^{NS}
X_{12}.	Economic motivation	-0.243 ^{NS}	-0.932	1.683	-0.554 ^{NS}
X_{13}.	Credit orientation	-0.207 ^{NS}	0.663	1.227	0.519 ^{NS}
X_{14}.	Innovativeness	-0.469**	6.665	3.935	-1.694 ^{NS}
X_{15}.	Risk orientation	-0.037 ^{NS}	1.560	1.466	1.064 ^{NS}
X_{16}.	Scientific orientation	0.442**	1.615	1.350	-1.196 ^{NS}
X_{17}.	Progressiveness	0.562**	-0.840	2.042	-0.411 ^{NS}

R^2 = 0.524 F value = 2.720 ^{NS}

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

Multiple regression analysis

Table clearly shows that all the independent variables together contribute 52.40 per cent of variation to yield gaps. The 'F' value was found to be significant at five per cent level of probability.

Of the 17 independent variables calculated for multiple regression analysis, the independent variables had non-linear and functional influence on yield gaps of the respondents. Hence, it means that no variable was found to be significant.

Stepwise regression analysis

The stepwise regression analysis of the independent variables with yield gaps of the respondents was worked out which is presented in the Table below.

Table 24. Stepwise regression analysis of independent variables with yield gap of paddy crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_7	Material status	-0.372	0.173	-2.146*
X_9	Social participation	-3.364	1.524	-2.207*
X_{17}	Progressiveness	-3.876	1.298	-2.985**

$R^2 = 0.447$ $F = 15.090$**

**- Significant at 0.01 level

The above Table 24 shows that all the independent variables namely, material status (X_7), social participation (X_9) and progressiveness (X_{17}) when considered in isolation from the other independent variables explain 44.7 percent of variation in yield gaps. The difference in variation explained by the 14 variables eliminated was

7.7 per cent. This indicated that a unit increase in the material status (X_7), social participation (X_9) and progressiveness (X_{17}), *ceteris paribus*, would have decreased the yield gaps by 0.372, 3.364 and 3.876 units respectively. The increased material status would have lead the respondent to adopt newer technologies without any constraints which in turn would have reduced the yield gaps. The independent variable social participation would increased the accessibility of the respondents to resource persons as explained earlier and hence, better ideas would originate to adopt better technologies, which would have reduce the yield gaps.

4.4.2.2 Relationship and influence of the independent variables on knowledge gap of paddy crop

To find out the relationship and influence, the independent variables were statistically analysed with the dependent variable i.e. knowledge gap of paddy crop. The results of interpretation are presented as below.

Correlation analysis

Table 25 shows that education (X_2), annual income (X_4), material status (X_7), farm power status (X_8), social participation (X_9), mass media exposure (X_{10}), innovativeness (X_{14}), scientific orientation (X_{16}) and progressiveness (X_{17}) had significantly negative relationship with knowledge gap at one per cent level of probability. Farm size (X_6), extension agency contact (X_{11}), and credit orientation (X_{13}) had significantly negative association with knowledge gap at five per cent level of probability.

Table 25. Relationship and influence of independent variables on knowledge gap of paddy crop.

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	0.208 NS	0.0003	0.035	0.011 NS
X_2.	Educational status	-0.522**	-0.450	0.314	-1.434 NS
X_3.	Farming experience	0.191 NS	0.507	0.646	0 785 NS
X_4.	Annual income	-0.381 **	-0 475	0.478	-0.994 NS
X_5.	Size of Family	0.144 NS	0.0184	0.060	0.308 NS
X_6.	Farm size	-0.257*	0.850	0.634	1.342 NS
X_7.	Material status	-0.528**	0.232	0.044	0.529 NS
X_8.	Farm power status	-0.651**	-0.100	0.042	-2.382 NS
X_9.	Social participation	-0.531**	-0.476	0.244	-1.951 NS
X_{10}.	Mass media Exposure	-0.579**	-0.181	0.133	-1.359 NS
X_{11}.	Extension agency contact	-0.271*	0.3879	0.096	0.404 NS
X_{12}.	Economic motivation	-0.189 NS	0.242	0.226	1.072 NS
X_{13}.	Credit orientation	-0.255*	0.162	0.171	0.942 NS
X_{14}.	Innovativeness	0 397**	0.608	0 528	1.151 NS
X_{15}.	Risk orientation	0.070 NS	0.253	0.197	1.286 NS
X_{16}	Scientific orientation	-0.527**	-0 379	0.181	-2.089*
X_{17}	Progressiveness	-0.841**	-0.193	0.274	-0.703 NS

R^2 = 0.685 F value = 5.380*

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

Multiple regression analysis

Table 25 shows that the independent variables together contributed 68.5 per cent of variation to the knowledge gaps. The 'F' value was found to be significant at five per cent level of probability.

Scientific orientation (X_{15}) was found to be significant among the 17 variables. The other variables had no significant relationship with knowledge gaps. This means that scientific orientation would decrease the yield gaps by units 0.379, *ceteris paribus*. The need for more scientific orientation more information would have been the possible reason which influences the knowledge level of the respondents and decreases the knowledge gaps.

Stepwise regression analysis

The stepwise regression analysis of the independent variables towards the knowledge gain was worked out and is presented in the Table below.

Table 26. Stepwise regression analysis of independent variables with knowledge gap of paddy crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_8	Farm power status	-0.073	0.031	-2.387**
X_{10}	Mass media exposure	-0.291	0.102	-2.1861**
X_{17}	Progressiveness	-0.695	0.203	-3.423**

$R^2 = 0.552$ F = 22.965**

**- Significant at 0.01 level

Table 26 showed that the farm power status(X_8), mass media exposure(X_{10}) and progressiveness(X_{17}) when considered in isolation from other fourteen independent variables explain 55.20 per cent of variation in knowledge gain. The difference in variation explained that the eliminated eleven independent variables were 13.3 per cent. This indicated that a unit increase in farm power status (X_8), mass media exposure (X_{10}) and progressiveness (X_{17}), *ceteris paribus*, would decrease the knowledge gap by 0.073 units, 0.291 units and 0.695 units respectively. Hence, these independent variables should be considered while the knowledge gap studies are conducted.

4.2.2.3 Relationship and influence of the independent variables on technological gap of paddy crop

The independent variables and the dependent variable were statistically worked to find out the relationship and influence of the variables on paddy crop cultivation. The interpretations of the results are presented.

Correlation analysis

It could be seen from Table 27 that out of the 17 independent variables, education (X_2), material status (X_7), farm power status (X_8), social participation (X_9), mass media exposure (X_{10}), innovativeness (X_{14}) scientific orientation (X_{16}) and progressiveness (X_{17}) had a negative and significant relationship at one percent level of probability with the technological gap of the respondents. Only one variable *viz.*, size of family (X_5) was found to be positively significant at one per cent level. Only three variables namely, size of family (X_5) farm size (X_6) and extension agency

Table 27. Relationship and influence of independent variables on technological gap of paddy crop.

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	0.214^{NS}	0.0007	0.206	0.004^{NS}
X_2.	Educational status	-0.397**	0.0433	1.871	0.023^{NS}
X_3.	Farming experience	0.156^{NS}	4.078	3.852	1.059^{NS}
X_4.	Annual income	-0.243^{NS}	1.257	2.851	0.441^{NS}
X_5.	Size of Family	0.255*	0.391	0.358	1.092^{NS}
X_6.	Farm size	-0.325*	-0.909	3.779	0.241^{NS}
X_7.	Material status	-0.514**	-0.149	0.262	0.569^{NS}
X_8.	Farm power status	-0.466**	-0.209	0.251	0.832^{NS}
X_9.	Social participation	-0.424**	-1.667	1.456	1.145^{NS}
X_{10}.	Mass media Exposure	-0.515**	-0.345	0.792	0.435^{NS}
X_{11}.	Extension agency contact	-0.302*	-0.273	0.573	0.477^{NS}
X_{12}.	Economic motivation	-0.349^{NS}	-1.401	1.347	1.040^{NS}
X_{13}.	Credit orientation	-0.133^{NS}	1.393	1.023	1.363^{NS}
X_{14}.	Innovativeness	-0.398**	2.839	3.150	0.901^{NS}
X_{15}.	Risk orientation	-0.005^{NS}	0.806	1.174	0.686^{NS}
X_{16}.	Scientific orientation	-0.529**	-2.176	1.081	2.104*
X_{17}.	Progressiveness	-0.573^{NS}	-0.644	1.635	0.394^{NS}

$R^2 = 0.570$ F value = 3.271*

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

contact (X_{11}) had a significant and negative relationship at five percent level of probability with the technological gap of the respondents.

Multiple regression analysis

From Table 27 it could be seen that all the independent variables together contributed 57.00 per cent of variation to knowledge gain. The 'F' value was found to be significant at five per cent level of probability.

Among the 17 independent variables, only scientific orientation (X_{16}) had contributed negatively significant towards the technological gaps. The remaining variables had no contribution towards technological gap among respondents.

This indicated that a unit decrease in scientific orientation (X_{16}), *ceteris paribus* would decrease the technological gap by 2.176 units. More the scientific orientation (X_{16}), less would be the technological gap as more scientific orientation means more need to adopt the prescribed technology.

Stepwise regression analysis

The stepwise regression analysis of independent variables towards the technological gap was worked out and is presented in Table 29. This was done in order to eliminate those independent variables whose contribution to the variation in the dependent variables was considered to be low.

Table 28. Stepwise regression analysis of independent variables with technological gap of paddy crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_7	Material status	-0.399	0.143	-2.788**
X_{17}	Progressiveness	-4.036	1.080	-3.738**

$R^2 = 0.409$ $F = 19.725$**

**- Significant at 0.01 level

It could be seen from the above Table that the independent variables namely material status (X_7) and progressiveness (X_{17}) when considered in isolation from the other independent variables explain 40.9 per cent of variation in the knowledge gaps. The difference in variation explained by the elimination of 15 variables was 16.1 per cent. This indicated that a unit increase in material status (X_7) and progressiveness (X_{17}) *ceteris paribus*, would decrease the technological gap by 0.399 and 4.036 units respectively. So these independent variables could be considered as crucial ones for describing the technological gap of the respondents. It could be inferred that the material status would make them invest on more of the input so as to adopt numerous technologies. Hence, the reduction in the technological gap may be found. More the people are progressive they would try newer technologies to be ahead of the others which may lead to low technological gaps.

4.4.3. Relationship and influence of the independent variables on yield gaps, knowledge gap and technological gap of potato crop

The 17 independent variables and the dependent variable were statistically carried out to find the relationship and influence between the variables of potato crop

cultivation. The results interpret the relationship and influence of the independent variables on the dependent variable of paddy crop and are presented in the following lines.

4.4.3.1. Relationship and influence of the independent variables on yield gap of potato crop

All the 17 independent variables and yield gaps they were statistically worked out and the interpretation of the results are presented below.

Correlation analysis

The correlation analysis was worked out and was presented in Table 29. The Table reveals that the independent variables were found to be negatively significant at one per cent level of probability with the yield gaps was annual income (X_4), farm size (X_6), material status (X_7), mass media exposure (X_{10}), scientific orientation (X_{16}) and progressiveness (X_{17}) . Only two of the independent variables namely, education (X_2) and risk orientation (X_{15}) had a negatively significant and negative relationship at five percent level of probability with the yield gaps of the respondents.

Multiple regression analysis

From Table 29, it could be seen that all the independent variable put together contributed 74.3 per cent of variation to the yield gaps. The 'F' value was found to be insignificant hence, their occurred a functional and non-linear relationship between the independent variables and the yield gaps.

None of the 17 variable namely, age (X_1), education (X_2), farming experience (X_3), annual income (X_4), size of family (X_5), farm size (X_6), material status (X_7),

Table 29. Relationship and influence of independent variables yield gap on potato crop.

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1	Age	0.071 NS	0.01595	0.159	0.100 NS
X_2	Educational status	-0.314*	-0.617	1.848	-0.334 NS
X_3	Farming experience	-0.181 NS	-1.215	1.765	-0.688 NS
X_4	Annual income	-0.621**	-5.205	2.828	-1.840 NS
X_5	Size of Family	0.018 NS	-6.666	2.473	-2.695 NS
X_6	Farm size	-0.529**	-2.394	3.683	-0.650 NS
X_7	Material status	0.576**	-0.323	0.238	-1.355 NS
X_8	Farm power status	-0.458 NS	-0.253	0.276	-0.917 NS
X_9	Social participation	-0.219	0.212	2.388	0.089 NS
X_{10}	Mass media Exposure	-0.435**	0.0919	0.638	-0.144 NS
X_{11}	Extension agency contact	-0.219 NS	-1.357	0.786	-1.726 NS
X_{12}	Economic motivation	-0.133 NS	1.931	1.214	1.591 NS
X_{13}	Credit orientation	-0.301 NS	-0.436	0.928	-0.470 NS
X_{14}	Innovativeness	-0.017 NS	0.282	2.981	0.095 NS
X_{15}	Risk orientation	-0.289*	1.954	0.946	-2.065 NS
X_{16}	Scientific orientation	-0.477**	-0.588	0.807	-0.729 NS
X_{17}	Progressiveness	-0.679**	-4.299	1.380	3.114 NS

$R^2 = 0.743$ F value = 7.135**

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

farm power status (X_8), social participation (X_9), mass media exposure (X_{10}), extension agency contact (X_{11}), economic motivation (X_{12}), credit orientation (X_{13}), innovativeness (X_{14}), risk orientation (X_{15}), scientific orientation (X_{16}) and progressiveness (X_{17}) showed no contribution toward yield gaps of the respondents.

Stepwise regression analysis

The stepwise regression analysis was worked out and the results are presented in the Table 30.

Table 30. Stepwise regression analysis of independent variables with yield gap of potato crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_4	Annual income	-7.748	1.905	-4.068**
X_{15}	Risk orientation	-2.242	0.871	-2.573*
X_{17}	Progressiveness	-5.903	1.109	-5.324**

$R^2 = 0.625$ $F = 31.053$**

**- Significant at 0.01 level

It could be seen from the Table above, that the independent variables namely annual income (X_4), risk orientation (X_{15}) and progressiveness (X_{17}), when considered in isolation from the other 14 independent variables, explain 62.5 percent of the variation in yields gaps. The difference in the variation explained eliminated was 11.80 percent.

This indicated that a unit increase in annual income, risk orientation and progressiveness, *ceteris paribus*, would decrease the yield gaps by 7.748, 2.242 and 5.903 units respectively. The increase in annual income would allow the respondents to adopt better technologies and better ideas without any constraint which may in turn reduce the yield gaps. Also risk orientation of the respondents may lead to the reduction of the yield gaps. The respondent's nature of progressiveness may also lead to a reduction in yield gaps.

4.4.3.2. Relationship and influence of the independent variables on knowledge gap of potato crop

The independent variables were statistically worked out to find the relationship and influence of the independent variables on knowledge gap of paddy crop and the results are presented in the following lines.

Correlation analysis

It could be seen from Table 31 that out of the 17 variables, annual income (X_4), farm size (X_6), material status (X_7), farm power status (X_8), mass media exposure (X_{10}), scientific orientation (X_{16}) and progressiveness (X_{17}) had a significantly negative relationship at one percent level of probability with the knowledge gap of the respondents. Only two independent variables namely, education (X_2) and social participation (X9) had a significant relationship at five percent level of probability with the knowledge gap of the respondents.

Table 31. Relationship and influence of independent variables on knowledge gap of potato crop.

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1	Age	0.105^{NS}	-0.00105	0.22	-0.047^{NS}
X_2	Educational status	-0.273*	0.03502	0.259	0.133^{NS}
X_3	Farming experience	-0.145^{NS}	-0.0525	0.248	-0.212^{NS}
X_4	Annual income	-0.571**	-0.611	0.397	-1.540^{NS}
X_5	Size of Family	0.079^{NS}	-0.483	0.347	-1.391^{NS}
X_6	Farm size	-0.417**	0.373	0.517	0.722^{NS}
X_7	Material status	-0.561**	-0.0215	0.033	-0.644^{NS}
X_8	Farm power status	-0.420**	-0.0477	0.039	-1.232^{NS}
X_9	Social participation	-0.185	0.328	0.339	0.980^{NS}
X_{10}	Mass media Exposure	-0.462**	-0.137	0.090	-1.525^{NS}
X_{11}	Extension agency contact	-0.196^{NS}	0.0877	0.110	-0.795^{NS}
X_{12}	Economic motivation	-0.125^{NS}	0.262	0.170	-1.537^{NS}
X_{13}	Credit orientation	-0.253^{NS}	0.0317	0.130	-0.244^{NS}
X_{14}	Innovativeness	0.089^{NS}	0.04465	0.418	0.107^{NS}
X_{15}	Risk orientation	0.187^{NS}	0.114	0.133	0.801^{NS}
X_{16}	Scientific orientation	-0.510**	-0.176	0.113	-1.550^{NS}
X_{17}	Progressiveness	-0.699**	-0.651	0.194	-3.360**

$R^2 = 0.6830$ F value = 3.333**

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

Multiple regression analysis

From Table 31 it could be seen that all the independent variables together contributed 68.30 per cent of variation to the knowledge gap. The 'F' value was found to be significant at one per cent level of probability.

Amongst 17 independent variables, only one variable namely progressiveness (X_{17}) had contributed significantly towards knowledge gap. The remaining independent variables showed no contribution towards the knowledge gap among respondents.

This indicated that a unit increase in progressiveness (X_{17}), *ceteris paribus,* would decrease the knowledge gap by 0.651 units. A progressive respondent will have up-to-date knowledge of latest technologies which will urge him to get more information would decrease the knowledge gap. It could be inferred that because of more scientific orientation, the respondents may have more depth of information and hence, reduced knowledge gaps.

Stepwise regression analysis

The stepwise regression analysis of independent variables towards the knowledge gap was worked out and is presented in Table 32. This was done in order to eliminate those independent variables whose contribution to the variation in the dependent variables was considered to be very less.

Table 32. Stepwise regression analysis of independent variables with knowledge gap of potato crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_4	Annual income	-0.819	0.256	-3.196**
X_{17}	Progressiveness	-0.839	0.149	-5.616**

$R^2 = 0.566$ $F = 37.187^{**}$

**- Significant at 0.01 level

It could be seen from the above Table that the independent variables namely annual income (X_8) and progressiveness (X_9) when considered in isolation from the other independent variables, explain 56.60 per cent of variation in the knowledge gaps. The difference in variation explained by the eliminated 15 variables was 11.70 per cent.

This indicated that the unit increase in annual income and progressiveness *ceteris paribus*, would have decreased the knowledge gap by 0.819 and 0.839 units respectively. So these independent variables could be considered as crucial ones for describing the knowledge gap of the respondents. The increase in annual income would have helped the respondent to gain more information through different sources without constraints which may have been the reason for negative and significant relationship with regards to the knowledge gaps. It could be inferred that the possible reason for progressiveness may be due to the reason that they update themselves every now and then hence, reduced the knowledge gap.

4.4.3.2. Relationship and influence of the independent variables on technological gap of potato crop

The independent variables and the dependent variables were statistically analysed to find out the relationship and influence between the variables for crop cultivation. The relationship and influence of the independent variables on yield gaps of paddy crop were statistically worked out and are presented below.

Correlation

Correlation was carried out to check the influence of independent variables on potato crop. Table 33 indicates that the independent variables namely, annual income (X_4), farm size (X_6), material status (X_7), mass media exposure (X_{10}), and progressiveness (X_{17}) were found to be significant at one per cent level of probability. The other variables namely, education (X_2), credit orientation (X_{13}), risk orientation (X_{15}) and scientific orientation (X_{16}) were found to be significant at five per cent level of probability.

Multiple regression analysis

The Table 33 shows that all the independent variables together contributed 53.10 per cent of variation to the technological gap. The 'F' value was found to be significant at five percent level of probability. This means that there is a significant linear relationship with the technological gap.

The independent variable which was found to be significant after the multiple regression was worked out, revealed only one variable i.e. progressiveness (X_{17}). The

Table 33. Relationship and influence of independent variables on technological gap of potato crop.

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
X_1.	Age	-0.020 NS	-0.0295	0.139	-0.176 NS
X_2.	Educational status	-0.294*	-1.379	1.615	-0.854 NS
X_3.	Farming experience	-0.022 NS	1.640	1.543	1.063 NS
X_4.	Annual income	-0.513**	-3.209	2.471	-1.299 NS
X_5.	Size of Family	0.042 NS	-3.138	2.161	-1.452 NS
X_6.	Farm size	-0.427**	0.338	3.219	0.105 NS
X_7.	Material status	-0 444**	-0.0515	0.208	-0.248 NS
X_8.	Farm power status	-0.397 NS	-0.215	0.241	-0.891 NS
X_9.	Social participation	-0.178 NS	0.778	2.087	0.373 NS
X_{10}.	Mass media Exposure	-0.414**	-0.412	0.558	-0.739 NS
X_{11}.	Extension agency contact	-0.227 NS	-0.933	0.687	-1.358 NS
X_{12}.	Economic motivation	-0.194 NS	0.393	1.061	0.370 NS
X_{13}.	Credit orientation	-0.261*	-0.391	0.811	-0.482 NS
X_{14}.	Innovativeness	-0.069 NS	-1.449	2.605	-0.556 NS
X_{15}.	Risk orientation	0.302*	1.439	0.827	1.739 NS
X_{16}.	Scientific orientation	-0.313*	0.124	0.705	0.176 NS
X_{17}.	Progressiveness	-0.534	-2.500	1.206	-2.073*

$R^2 = 0.531$ F value = 2.800*

NS – Non-significant

* - Significant at 0.05 level

** - Significant at 0.01 level

other independent variables had no such significant relationship with the technological gap. This indicates that a unit increase in progressiveness, *ceteris paribus*, would decrease the technological gap by 2.500 units

Stepwise regression analysis

The stepwise regression analysis was worked out and the results are presented in the Table below.

Table 34. Stepwise regression analysis of independent variables with technological gap of potato crop.

Variable No.	Independent variable	Partial regression coefficient	Standard error	't' value
X_4	Annual income	-1.211	0.298	-2.613*
X_{15}	Risk orientation	-0.229	0.112	-1.501*
X_{17}	Progressiveness	-1.362	0.174	-6.200**

$R^2 = 0.410$ $F = 14.670$**

**- Significant at 0.01 level

It could be seen from the above Table 34 that the annual income (X_4), risk orientation (X_{15}) and progressiveness (X_{17}) when considered in isolation from the other fifteen independent variables explain 41.0 per cent of the variation in the technological gaps. The variable eliminated was 11.6 percent. These indicate that a unit decrease in the annual income, risk orientation and progressiveness, *ceteris paribus*, by 1.211, 0.229 and 1.362 units respectively would decrease the technological gap.

4.4.4. Relationship and influence of knowledge gap and technological gap on yield gap of selected crop

This section gives the contribution of knowledge gap and technological gap and yield gaps on selected crop *viz.*, jute, paddy and potato for studying the relationship simple correlation and multiple regression was followed. The different findings are given in the table below.

4.4.4.1. Relationship and influence of knowledge gap and technological gap on yield gap of jute crop

The relationship between the 17 selected independent variables with 3 dependent variables namely yield gaps, knowledge gaps and technological gaps has been studied and discussed in earlier pages. It has been already established by many researchers that knowledge gap influences technological gap and together these two variables influence yield gap. In order to have an understanding on the above premise, further analysis was done to know the relationship between the knowledge gap as well as technological gap with yield gap. The findings pertaining to this aspect are presented here under, for the three selected major crops separately.

Correlation analysis

The Table 35, below revealed that knowledge gap (Y_1) and technological gap (Y_2) were found to be positively significant at one per cent level of probability.

Table 35. Relationship and influence of knowledge gap and technological gap on yield gap of jute crop

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
Y_1.	Knowledge gap	0.866 **	2.808	0.428	6.561 **
Y_2.	Technological gap	0.824 **	0.305	0.067	4.580 **

$R^2 = 0.810$ F value = 127.026

** - Significant at 0.01 level

Multiple regression analysis

From the Table 35, it could be seen that knowledge gap (Y_1) and technological gap (Y_2) had a positively significant relationship with the yield gaps of jute crop. The knowledge gap and technological gap had put together contributed 81.00 per cent of variation while the 'F' value was found to be highly significant. Hence, there was a linear relationship between the knowledge gap (Y1) and the technological gap (Y2) with yield gaps.

The results revealed that a unit increase in knowledge gap (Y_1) and technological gap (Y_2) on the identified technologies, *ceteris paribus*, would result in the increase in the yield gap by 2.808 units and 0.305 units respectively.

The results proved that knowledge gap and technological gap on various technologies played significantly positive, relationship with yield gaps. Hence, knowledge and adoption should be given due importance to increase yield.

4.4.4.2. Relationship and influence of knowledge gap and technological gap on yield gap of paddy crop

To find out the relationship and influence of knowledge gap and technological gap on yield gaps of paddy crop were studied and statistical analysis was carried out. The results and interpretation are presented below.

Correlation analysis

The Table 36, revealed that knowledge gap (Y_1) and technological gap (Y_2) were found to be positively significant at one per cent level of probability.

Table 36. Relationship and influence of knowledge gap and technological gap on yield gap of paddy crop

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
Y_1.	Knowledge gap	0.842 **	2.157	0.450	4.793 **
Y_2.	Technological gap	0.868 **	0.454	0.074	6.113 **

$R^2 = 0.824$ F value = 133.467

** - Significant at 0.01 level

It was seen that knowledge gap (Y_1) and technological gap (Y_2) were found to be positive and significant contribution on the yield gaps of paddy crop.

The knowledge gap and technological gap had put together contributed 82.40 per cent of variation. While the 'F' value was found to be highly significant. Hence

there was a linear relationship between the knowledge gap (Y_1) and the technological gap (Y_2) with yield gaps of paddy crop.

The results revealed that a unit increase in knowledge gap (Y_1) and technological gap (Y_2) on the identified technologies, *ceteris paribus*, would result in the increase of yield gaps by 2.157 units and 0.454 units respectively.

Thus the finding proved that knowledge gap and technological gap of various identified technologies plays a significant role in influencing the level of yield gap. Hence more emphasis is needed to be given towards knowledge gap and technological gap.

4.4.4.3. Relationship and influence of knowledge gap and technological gap on yield gap of potato crop

To find out the relationship and influence of knowledge gap and technological gap on yield gaps of potato crop was studied and statistical analysis was carried out. The interpretation and the results are presented below.

Correlation analysis

The Table 37 below revealed that knowledge gap (Y_1) and technological gap (Y_2) were found to be positively significant at one per cent level of probability.

Table 37. Relationship and influence of knowledge gap and technological gap on yield gap of potato crop

Variable No.	Variable	'r' value	Regression analysis		
			Partial Regression coefficient	Standard error	't' value
Y_1.	Knowledge gap	0.772 **	2.163	0.097	2.732 **
Y_2.	Technological gap	0.770 **	0.266	0.769	2.812 **

$R^2 = 0.643$ 'F' value = 51.352

** - Significant at 0.01 level

It was seen that knowledge gap (Y_1) and technological gap (Y_2) were found to be positive and significant contribution on the yield gaps of potato crop.

The knowledge gap and technological gap had put together contributed 64.30 per cent of variation while the 'F' value was found to be highly significant. Hence there was a linear relationship between the knowledge gap (Y_1) and the technological gap (Y_2) with yield gaps.

The results revealed that a unit increase in knowledge gap (Y_1) and technological gap (Y_2) on the identified technologies, *ceteris paribus*, would result in the increase in the yield gap by 2.163 units and 0.266 units respectively.

Thus the finding prove that knowledge and adoption of various technologies play a significant role in influencing the level of yield produced in the cultivators plot. Hence, knowledge and adoption should be given due importance to increase yield.

The need of step wise regression was ruled out since the multiple regression analysis showed that knowledge gap and technological gap were significantly contributing to the yield gaps of potato crop.

Discussion

Analysis carried out to find the relationship and the influence of the selected 17 variables with knowledge gap, technological gap and yield gap are presented in Table 38.

Table 38. Relationship and influence of the various contributing variables with the dependent variables

Contributing variables	Knowledge gap			Technological gap			Yield gap		
	Jute	Paddy	Potato	Jute	Paddy	Potato	Jute	Paddy	Potato
Annual income						✓			✓
Material status					✓			✓	
Farm power status	✓	✓					✓		
Social participation	✓			✓			✓	✓	
Mass media exposure	✓	✓					✓		
Extension agency contact							✓		
Risk orientation						✓			✓
Progressiveness		✓	✓	✓	✓	✓		✓	✓
Knowledge gap							✓	✓	✓
Technological gap							✓	✓	✓

(✓- indicates highly contributing variables)

It could be revealed from the Table 38 that farm power status, social participation and mass media exposure were found to contribute more to the knowledge gap of jute crop. The variables namely farm power status and mass media exposure were found to be significantly related to the knowledge gap of paddy crop,

while only one dependent variable namely, progressiveness was found to have significantly contributed towards knowledge gap of paddy.

The most important independent variable contributing towards technological gap of jute crop were social participation and progressiveness. The independent variable which contributed significantly towards technological gap of paddy crop was progressiveness and material status, while the most significantly contributing independent variable on technological gap of potato crop were found to be risk orientation, annual income and progressiveness.

The independent variable which had significant relationship with yield gap of jute crop was farm power status, social participation, mass media exposure and extension agency contact. The important contributing variables on yield gap of paddy crop were social participation, progressiveness and material status. The independent variables namely progressiveness, annual income and risk orientation had a significant relationship with the yield gap of potato crop.

An analysis was also carried out to find the relationship of knowledge gap and technological gap with yield gap which revealed that they were having significant relationship with each other.

4.5 Constraints and suggestion of appropriate strategies for minimizing yield gaps

The different suggestions would be identified only when the constraints were studied. Hence the study to find out the different constraints faced by the cultivators

to cultivate the selected crop *viz.*, jute, paddy and potato. The different constraints found are given below.

4.5.1. The different constraints faced by the respondents

The different constraints faced by the jute-paddy cultivators and potato cultivators are given below.

4.5.1.1. Constraints faced by the jute-paddy cultivators

The constraints faced by the jute-paddy cultivators are represented in the Table 39. The major constraint identified by 96.67 per cent of the jute-paddy cultivators at recognized high cost of labour. 95.00 per cent of jute-paddy cultivators felt the high cost of input as a heavy burden. Higher pest incidence was faced by 91.67 per cent of the jute-paddy cultivators, 90.00 per cent of cultivators had experienced difficulty due to the occurrence of weeds and lack of technology for problem areas. Non-availability of improved varieties was reported as a constraint by 85.00 per cent of the jute-paddy cultivators. Adoption of specific fertilizer application and inadequate organic matter were ranked sixth (80.00%) and seventh (78.33%) respectively. Scattered land holding and indiscriminate use of fertilizers was reported by 75.00 per cent of jute-paddy cultivators. The other constraints reported by the jute-paddy cultivators in descending order are non-availability of credit/high rate of interest (65.00%), salinity and alkalinity of soil (63.33%), micro nutrient deficiency (58.33%), non-availability of farming implements (58.33%), lack of training facilities (58.33%), delayed land preparation (55.00%), poor quality seeds (53.33%), inadequate irrigation water (53.33%), improper harvesting (53.33%), absence of demonstration (50.00%), low population (40.00%), lack of transport facilities

Table 39. Constraints faced by jute-paddy cultivators

S. No.	Constraints	No	%	Rank
	Biophysical constraints			
1.	Availability of improved varieties	51	85.00	V
2.	Poor quality seed	32	53.33	XIII
3.	Adopting correct spacing	19	31.67	XVIII
4.	Adopting specific fertilizer application	48	80.00	VI
	Biological constraints			
1.	Inadequate irrigation water	32	53.33	XII
2.	Low population	24	40.00	XIV
3.	Occurrence of weeds	54	90.00	IV
4.	Higher pest incidence	55	91.67	III
5.	Lack of technology for problem areas	54	90.00	IV
	Physical constraints			
1.	Delayed land preparation	33	55.00	XII
2.	Micronutrient deficient	35	58.33	XI
3.	Indiscriminate use of fertilizers	45	75.00	VIII
4.	Saline and alkaline soil	38	63.33	IX
5.	Inadequate organic matter	47	78.33	VII
	Socio-economic constraints			
1.	High cost labour	58	96.67	I
2.	Non-availability of credit/high rate of interest	39	65.00	IX
3.	High cost of input	57	95.00	II
4.	Non-availability of soil testing centre	15	25.00	XIX
5.	Non-availability of farming implements	35	58.33	XII
6.	Improper harvesting	32	53.33	XIII
7.	Scattered land holding	45	75.00	VIII
8.	Lack of transport facilities	23	38.33	XVI
	Other constraints			
1.	Absence of demonstration	30	50.00	XIII
2.	Lack of training facilities	35	58.33	X
3.	Lack of union	20	33.33	XVII

(38.33%), lack of union (33.33%), adoption of correct spacing (31.67%), and non-availability of soil testing centres (25.00%).

The major biophysical constraint faced by the jute-paddy cultivators was the non-availability of improved varieties. Among the biological constraints, the major problem was higher pest incidence. In the physical and socio-economic constraints, inadequate organic matter and high cost of labour ranked first in the respective cases.

It can be thus inferred that higher pest incidence, high cost of labour and input were the major constraints faced by farmers cultivating the different crops.

4.5.1.2. Constraints faced by the potato cultivators

The constraints faced by the potato cultivators in cultivating potato crop were identified, ranked and tabulated in Table 40. The two major constraints faced by majority (98.33%) of the potato cultivators were higher pest incidence and lack of technology for problem areas. The second major constraint reported by 95.00 per cent of potato cultivators were high cost for labour and input. Inadequate organic matter and occurrence of weeds were the next major constraints reported by 91.67 per cent of the potato cultivators. 86.67 per cent of the potato cultivators complained of the non-availability of improved varieties. Lack of storage facility was reported by 78.33 per cent of potato cultivators. Heavy fertilizer requirement and specific fertilizer application were reported to 66.67 and 65.00 per cent of potato cultivators respectively. The other constraints reported, in descending rank order, were inadequate irrigation water, low population, acidic nature of soils, non-availability of farming implements and credit at cheaper rates, lack of training facilities, delayed

Table 40. Constraints faced by the potato cultivators

S. No.	Constraints	No	%	Rank
	Biophysical constraints			
1.	Availability of improved varieties	52	86.67	IV
2.	Poor quality seed	21	35.00	XVI
3.	Adopting correct spacing	23	38.33	XV
4.	Adopting specific fertilizer application	39	65.00	VII
	Biological constraints			
1.	Inadequate irrigation water	38	63.33	VIII
2.	Low population	36	60.00	IX
3.	Occurrence of weeds	55	91.67	III
4.	Higher pest incidence	59	98.33	I
5.	Lack of technology for problem areas	59	98.33	I
	Physical constraints			
1.	Delayed land preparation	27	45.00	XIII
2.	Micronutrient deficient	26	43.33	XIV
3.	Indiscriminate use of fertilizers	40	66.67	VI
4.	Saline and alkaline soil	34	56.67	X
5.	Inadequate organic matter	55	91.97	III
	Socio-economic constraints			
1.	High cost labour	57	95.00	II
2.	Non-availability of credit/high rate of interest	32	53.33	X
3.	High cost of input	57	95.00	II
4.	Non-availability of soil testing centre	10	16.67	XXI
5.	Non-availability of farming implements	32	53.33	XI
6.	Improper harvesting	17	28.33	XVII
7.	Scattered land holding	15	25.00	XVIII
8.	Lack of transport facilities	26	43.33	XIV
	Other constraints			
1.	Absence of demonstration	13	21.67	XVIII
2.	Lack of training facilities	29	48.33	XI
3.	Lack of union	11	18.33	XIX
4.	Lack of storage facilities	47	78.33	V

land preparation, micronutrient deficiency, lack of transport facilities, adoption of correct spacing, poor quality seeds, improper harvesting, scattered land holding, absence of demonstrations, lack of union and non-availability of soil-testing centres.

Discussion on the constraints faced by the cultivators

It was observed that higher pest incidence, high cost of labour and input were the major constraints faced by farmers cultivating the different crops i.e. jute and paddy.

For the potato crop cultivation, the different constraints faced by the potato cultivators was non-availability of improved varieties, higher pest incidence and lack of technology for problem areas. High cost of input and labour were the other major socio-economic constraints.

From the above lines it may be clear that the reason for variation of the yield was more due to the different constraints faced by the cultivators. As discussed earlier, it was found that the knowledge gap and technological gap was of medium level among the cultivators of different selected crops. The lack of labour availability may have deprived the potato cultivators to adopt the proper pest management and the other problems which may have lead to a wider gap.

4.5.2. Suggestion to minimize the yield gaps

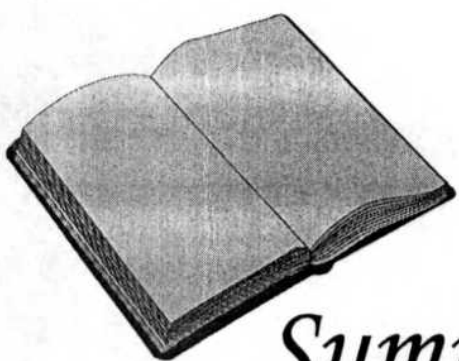
Based on the identified contributing variables and constraints, suggestions and strategies have been proposed to minimize the yield gap, knowledge gap, technological gap and constraints encountered by the cultivators.

Since the independent variables *viz.*, annual income, material status, farm power status, social participation, mass media exposure, extension agency contact, risk orientation and progressiveness were found to be influencing the yield gap, knowledge gap and technological gap, the characteristics of the cultivators should be given due to importance by the extension agency to minimize the different gaps. Methods like field demonstration, field visit, dissemination of knowledge through mass media should be given importance.

Non availability of improved varieties was mentioned as the most important problem by the jute-paddy cultivators, extension agents should provide informations to the cultivators regarding the arrival of improved variety, seed materials to the agricultural depots and their distribution should be followed appropriate time.

High cost of labour due to migration of labourers, from the villages, thus the demand for labourer resulted in higher wages. To overcome this problem labour saving implements at affordable prices should be developed by the researchers.

Since the potatc cultivators prioritized lack of storage facilities as the constraint, government should go for a strategy of establishing field level cold storage facilities.



Summary and Conclusion

SUMMARY AND CONCLUSION

Indian farmer with innovative agricultural technologies have made tremendous efforts in increasing the production of food and commercial crops to meet the needs of the growing population by transforming the traditional farming into a modern one. Problem lies in the lack of faster dissemination of these technology amongst farmers. It is common understanding that adoption of an improved technology to a large extent depends upon the farmer's ability to acquire knowledge and also his capacity to convert the knowledge gained into practice to reduce the technology gap. To understand the difference in the technological gap that existed due to the different constraints which led to the minimize the yield gaps.

The study was undertaken with the following specific objectives

1. To assess the yield gaps in jute, paddy and potato crops in Terai zone of West Bengal.
2. To assess the knowledge gap and technological gap in relation to jute, paddy and potato crops.
3. To study the socio-economic, personal and psychological characteristics of the farmers.
4. To examine the relationship between the socio-economic, personal and psychological characteristics with the yield gap, knowledge gap and technological gap.
5. To suggest appropriate strategies for minimizing yield gaps.

The study was conducted in the Terai zone of West Bengal. The sample size included 60 cultivators who cultivated jute as well as paddy (it is a common practice of

cropping system) and 60 cultivators were selected. Who cultivated potato crop in a single year. The cultivators were selected using proportionate random sampling method. The salient findings of the study are as follows.

5.1. Assessment of yield gap

The overall distribution of the respondents showed that most of them belonged to the groups which had medium level of yield gaps, followed by respondents who had high level of yield gaps and the rest (almost 30.00%) belonged to the category who had low yield gaps. For jute crop, 2 to 18 q/ha of yield gaps were seen. When compared to the best farmers yields, paddy production showed a yield gap of about 3 to 33 q/ha for the season crop. With regard to potato crop, yield gap of a 15 to 150 q/ha was found which was very high. Yield gap on jute crop varied between 6.25 to 75.00 per cent, paddy crop yield gaps studied revealed that a gap of 6.67 per cent to 73.33 per cent was found and the potato yield gap per cent varied between 8.34 to 50.00 per cent.

5.2. Assessment of knowledge gap and technological gap

Overall more than two-fifth (47.8%) of the cultivators had medium level of knowledge gap followed by high (30.83%) and low (26.67%) level of knowledge gaps.

It was found that (45.00%) of the cultivators had medium level of technological gap followed by 25.00 per cent of the cultivators, while 30.00 per cent of cultivators had low level of technological gap.

5.3 Socio-economic personal and psychological characteristics of the cultivators

Overall it was revealed that

- 42.50 per cent of the cultivators were young aged
- 35.00 per cent of them were educated upto middle school
- Majority (66.67%) of them had high level of farming experience
- More than half (53.33%) had lower medium level of annual income
- Most (40%) of them had nuclear family with members upto five
- Majority (66.70%) of the cultivators were medium sized farm.
- Majority (55.83%) of the cultivators belonged to lower category of material status
- 47.5 per cent had low level of farm power status
- More than half (55.83%) had medium level of social participation
- 46.67 per cent of the cultivators had medium level of exposure to mass media
- 38.33 per cent of them had high level of economic motivation
- More than one-half (55.83%) of the cultivators had medium level of credit orientation
- Half (50.00%) of the cultivators had medium level of innovativeness
- 36.67 per cent of them had medium level of risk orientation
- Majority (54.17%) had high level of scientific orientation
- More than two-fifth (42.5%) of the cultivators had high level of progressiveness

5.4. Relationship and influence of the independent variables with technological gap and yield gap of jute, paddy and potato

The zero order correlation, multiple regression analysis followed by stepwise regression were carried out to find relationship and influence on various dependent variables.

The various significant relationships mainly with knowledge gaps, technological gap are putforth.

5.4.1. Relationship and influence of the independent variables on yield gap of jute, paddy and potato crop

Zero order correlation revealed that only three variables namely, material status, mass media exposure and scientific orientation were found to have a negatively significant relationship with the yield gaps of jute, paddy and potato crop, while farm power status and social participation had a negatively significant relationship with the yield gaps of jute and paddy crop. Progressiveness was found to be negatively significant with the yield gaps of paddy and potato crops, while education and innovativeness on technological gap on paddy and annual income and farm size were found to be negatively significant with that of potato crop. All the above variables were found to be significant at one per cent level.

At five per cent level of probability, correlation analysis revealed that education was negatively significant on yield gaps of both jute and potato crop. Annual income was found to be negatively significant at five per cent of probability level on yield gaps of jute and potato crops. While Farm power status, economic motivation on yield gaps of paddy crop and risk orientation on yield gaps of potato crop were found to have a negatively significant relationship at five per cent level of probability.

Multiple regression was carried out which revealed that farm power status was found to be negatively significant on yield gaps of jute crops, while no independent variable was found to have a significant relationship with the yield gaps of paddy and potato crop studied.

To eliminate independent variables which had made minimum contribution, stepwise regression analysis was followed. The analysis revealed that social participation was found to have a negatively significant relationship on the yield gaps of jute and paddy crops. Progressiveness had a negatively significant relationship with the yield gaps of paddy and potato crops, while farm power status, mass media exposure and extension agency contact on the yield gaps of jute crop was found to have negatively significant relationship, while Annual income, risk orientation on yield gaps of potato crop and material status on yield gaps of paddy crop had a negatively significant relationship.

5.4.2. Relationship and influence of the independent variables on knowledge gap of jute, paddy and potato crop

Correlation analysis of the independent variables revealed that material status, farm power status, mass media exposure, scientific orientation and progressiveness were negatively significant at one per cent level with the knowledge gap of all the crops which included jute, paddy and potato. Education, social participation and scientific orientation was negatively significant with knowledge gap of jute and paddy crop. Annual income was found to have a negatively significant relationship with the knowledge gap on both paddy and potato crop. Farm size showed negatively significant relationship on knowledge gap of paddy crop. All the above relationship were found to be significant at one per cent level of probability.

At five per cent level of probability, independent variable namely extension agency contact had negatively significant relationship on knowledge gap of jute and paddy crop. While innovativeness had negatively significant relationship with knowledge gap of jute. Farm size and credit orientation on knowledge gap of paddy crop. Educational status of

the potato cultivators on knowledge gap were found to be negatively significant at five per cent level of probability.

Multiple regression revealed that scientific orientation was found to have negatively significant relationship with knowledge gap of both paddy and jute crop while progressiveness was found to have a negatively significant relationship with the knowledge gap of potato crop.

Stepwise regression was worked out and results showed that farm power status and mass media exposure were found to have negatively significant relationship with knowledge gaps of jute and paddy crop. While progressiveness was found to have a negatively significant relationship with knowledge gap of paddy and potato crops. Other variables namely social participation and annual income was found to be negatively significant on knowledge gap of jute and potato crop respectively.

5.4.3. Relationship and influence of the independent variables on technological gap of jute, paddy and potato crop

The correlation analysis at one per cent level revealed that only mass media exposure, progressiveness were found to have a negatively significant relationship on technological gap for all the three crops *viz.*, jute, paddy and potato. The variables namely, education, farm power status, social participation, innovativeness and scientific orientation were found to be negatively significant on technological gap for both jute and paddy crop while for the potato crop, the variables namely, annual income, farm size and material status were negatively significant on technological gap. All the above stated independent variables were found to be significant at one per cent level of probability.

The correlation analysis which was worked out, revealed that the independent variable namely, farm size, extension agency contact and economic motivation were found to be negatively significant on technological gap of jute crop. Size of farm was found to have a negatively significant relationship with the technological gap of paddy crop, while education, credit orientation and scientific orientation were found to be negatively significant with technological gap of potato crop. The above variables were found to be negatively significant at five per cent level of probability.

Correlation was followed by multiple regression analysis which revealed that only one variable each namely, farm power status, scientific orientation and progressiveness were found to be negatively significant on technological gap for jute, paddy and potato crop respectively.

Stepwise regression analysis was carried out which eliminated the variables whose contribution was minimum. The stepwise regression revealed that only one variable namely, progressiveness was found to have a significant relationship with technological gap of jute, paddy and potato crop. Annual income and risk orientation had negatively significant relationship with technological gap of potato crop, while social participation had negatively significant relationship on technological gap of jute crop. The independent variable namely, material status had negatively significant relationship on technological gap of paddy crop.

5.4.4. Relationship and influence of knowledge gap, technological gap on yield gap are jute, paddy and potato crop

To find out association and influence of knowledge and technological gap on yield gap, statistical analysis involving simple correlation and multiple regression were carried out. The results revealed that knowledge gap and technological gap had a highly

significant positive relationship with the yield gaps of the selected crops *viz.*, jute, paddy and potato.

5.5. Constraints faced by the respondents

With regards to paddy and jute cultivating respondents, majority (96.67%) of the respondents identified major constraints as adoption of technology and reducing the yield gaps. The least problematic factor cited by one-fourth (25%) of the respondents was the non-availability of soil testing centre.

In case of potato cultivating respondents, majority (8.33%) of cited higher pest incidence and lack of technology as constraints reducing yield in the problem areas. The least constraints cited were by scattered land holdings, absence of demonstrations, lack of union and non-availability of soil testing centres.

5.6. Implication of the study

1. The study revealed that majority of the respondents had medium level of productivity. It was found that there existed a wide gap between the reported best farmer yield and that of average farmer. Hence, various steps have to be taken to disseminate proper technologies as well as remove the constraints cited by the respondents, to avoid wide variation of gap that between the farmers.
2. A perusal of the characteristics of the respondents revealed that majority (40 to 70%) of them belonged to medium and high level of social participation, mass media, extension agency contact, credit orientation, innovativeness, risk orientation, scientific orientation and progressiveness. This revealed that

farmers by and large were receptive to the various technologies but did not adopt the recommendation. A leverage in all the extension and research efforts would be sufficient enough to achieve any desired results in future.

3. A scrutiny of the characteristics revealed that 40 – 70 per cent of the farmers belonged to low level of annual income, material status, farm power status and social participation. To increase the annual income, material status etc, the extension agency should advise the farmer to increase the annual income, Extension agency should also advise the farmers to increase the production. This could be only achieved by providing knowledge to increase the yield.
4. Assessment of knowledge gap, adoption level and technological gap also showed a wide gap in the knowledge level and adoption level for the recommended practice adopted and knowledge about the practice
5. The crucial variables which were found to have significant relationship with the knowledge gap could be given priority while taking up further research.
6. Conduct of correspondence course and farm schools on AIR preparation of audio and video lessons along with the existing field visits, workshop and demonstration should go a long way in solving the constraints faced by the farmers.
7. Exhibition on agriculture, projecting role model in production, best farmers award with regard to productivity could act as a motivation for the farmers to emulate one among themselves.

Pointers for future research

1. This study confines to a particular agro-climatic zones in the state of West Bengal similarly other agro-climatic zones in the state could be selected for further studies.

2. This study had focused only on major crops of West Bengal. Similar studies may also be taken up for other crops.
3. This study confirms to finding the difference in the yield gaps between the best farmer yield and the average farmer yield. Further studies can be done on yield gaps to compare the gap that exist between the research station yield and the farmers yield.
4. A study on information need and communication behaviour of jute, paddy and potato crop is suggested.
5. Though the variables selected in the study explained significant variation some other variables may also be studied to find out the influencing factors.

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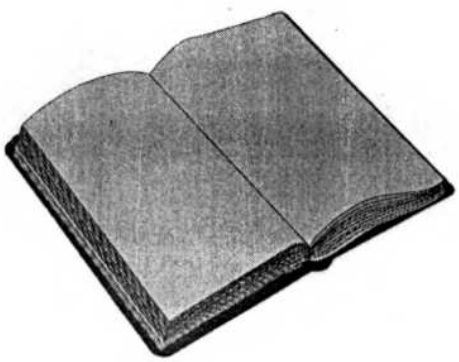

Appendices

APPENDIX I

Districts and blocks under Terai zone of West Bengal

Name of the Districts	No. of blocks	Blocks under the Terai zone		Geographical area (sq-km)
		No	Name	
Coochbeehar	12	12	Coochbeehar – I, Coochbeehar – II Tufanganj –I, Tufanganj –II Dinhata-I Dinhata-II , Sitai, Mathabhanga-I, Mathabhanga-II Sitaikuchi , Mekhliganj , Haldibari	3345 (2353)
Jalpaiguri	13	13	Jalpaiguri , Rajganj , Maynaguri, Dhupguri , Mal , Matelli , Nagrakata Falakata, Madarihat, Kalchini, Alipurduar-I, Alipurduar – II, Kumaragram	6140 (2303)
Darjeeling	10	2	Siliguri – Naxalbari, Kharibari – Phansidewa	838 (298)
West Dinajpur	16	5	Chopra, Islampur, Goalpokhar – I, Goalpokhar – II, Karandighi	1692 (1303)
Total	**51**	**32**		**12015 (6257)**

* Figure in the parenthesis indicates the respective area available for cultivation.

Source: Annual plan on agriculture, Coochbeehar, Jalpaiguri, Darjeeling and West Dinajpur district.

APPENDIX II

List of crop acreage under different blocks

Sl.No.	Blocks	Rice	Jute	Potato	District
1	Haldibari	11390	3930	70	Coochbeehar
2	Mekhliganj	17000	6370	1500	Coochbeehar
3	Mathabhanga-I	23110	10600	270	Coochbeehar
4	Mathabhanga-II	21110	10160	1090	Coochbeehar
5	Sitalkuchi	20420	9240	110	Coochbeehar
6	Coochbeehar-I	26720	12000	1650	Coochbeehar
7	Coochbeehar-II	**27680**	**12610**	3000	Coochbeehar
8	Tufanganj-I	17000	6670	1280	Coochbeehar
9	Tufanganj-II	12230	2960	560	Coochbeehar
10	Dinhata-I	20270	7920	2910	Coochbeehar
11	Dinhata-II	19730	11920	1420	Coochbeehar
12	Sitai	10340	3840	190	Coochbeehar
13	Jalpaiguri	26100	9525	2100	Jalpaiguri
14	Rajganj	24062	3598	850	Jalpaiguri
15	Mayanaguri	26650	12250	1875	Jalpaiguri
16	Dhupguri	14362	5200	**3500**	Jalpaiguri
17	Mal	14240	1900	1015	Jalpaiguri
18	Matiali	3275	275	215	Jalpaiguri
19	Nagraratta	4550	177	110	Jalpaiguri
20	Falakata	16000	2400	3200	Jalpaiguri
21	Madarihat	4665	250	135	Jalpaiguri
22	Kalchini	4250	940	300	Jalpaiguri
23	Alipurduar-I	14700	1800	2500	Jalpaiguri
24	Alipurduar-II	22900	1550	3050	Jalpaiguri
25	Kumargram	10400	1460	1450	Jalpaiguri

Contd...

26	Siliguri-Naxalbari	6525	233	240	Darjeeling
27	Kharibari-Phansidewa	17415	1782	713	Darjeeling
28	Chopra	19136	7300	790	Raiganj
29	Islampur	21366	6523	1680	Raiganj
30	Goalpukhar-I	24160	7500	890	Raiganj
31	Goalpukhar-II	20760	8750	890	Raiganj
32	Karandhigi	2750	6250	2205	Raiganj

Source: Annual plan on agriculture, Coochbehar, Jalpaiguri, Darjeeling and West Dinajpur district.

APPENDIX III

DEPARTMENT OF AGRICULTURAL EXTENSION & RURAL SOCIOLOGY
TAMIL NADU AGRICULTURAL UNIVERSITY
COIMBATORE- 3

INTERVIEW SCHEDULE

YIELD GAPS ANALYSIS OF MAJOR CROPS IN TERAI ZONE OF WEST BENGAL

PART I

1. **Respondent No.** :
2. **Name** :
3. **Village** :
4. **Block** :
5. **Age** :
6. **Education** : Illiterate / Primary school / Middle school / High school / Higher secondary / Collegiate
7. **Farming experience** :
8. **Annual income** :
9. **Size of family** :
   a) No. of members upto 5 / more than 5
   b) Type of family Nuclear / Joint

10. Farm size

Sl. No.	Particulars	Garden land	Dry land	Total
a)	Owned (in bighas)			
b)	Leased (in bighas)			
c)	Leased out (in bighas)			
	TOTAL			

11. Material status

Items.	No.	Items.	No.
Wall clock		T.V.	
Battery operated transistor		Two wheelers (Scooter / Motor cycle / Moped)	
Radio		VCP / VCR	
Fan		Telephone	
Tape recorder		Automobile	
Biogas plant			

12. Farm power status

Items.	No.	Items.	No.
Country plough		Power sprayers	
Iron plough		Oil engine	
Working animals		Bullock cart	
Milch animals			

13. Social participation

Sl. No.	Particulars	Members	Office bearer
1.	Village panchayat		
2.	Panchayat union		
3.	Co-operative societies		
4.	Land Development Bank		
5.	FDG		
6.	Youth club		
7.	Political organisation		

14. Mass media exposure

Sl. No.	Particulars	Regularly	Occasio-nally	Rarely	Never
a)	How often do you hear radio programmes?				
b)	How often do you read (or) hear to other reading newspaper?				
c)	How often do you watch television?				
d)	How often do you read (or) hear to other reading leaflets / folders				

Sl.No.	Particulars	In Numbers
e)	Last year, yow many agricultural films have you seen?	
f)	In how many field days (or) Agricultural festivals have you participated last year?	
g)	How many agricultural exhibitions have you visited last year?	

15. Extension Agency Contact

Sl. No.	Designation	Frequency of contact					Purpose of contact	
		Very frequently	Frequently	Some-time	Rarely	Very rarely	Agrl.	Non-Agrl.
1.	AAO							
2.	AO							
3.	ADA							
4.	JDA							
5.	Scientists							
6.	Others (specify)							

16. Economic motivation

Sl.No.	Statements	A	UD	DA
1.	A farmer should work towards larger yields and economic profits			
2.	The most successful farmer is the one who makes the minimum profit			
3.	A farmer should try any new forming idea which may earn him more money			
4.	a farmer should grow cash crop for home consumption			
5.	It is difficult for farmers children to make good start unless he provides them with economic assistance			
6.	A farmer must earn his living but most important thing in life cannot be defined in economic terms			

17. Credit orientation

Sl.No.	Questions	Response
1.	Do you think that a farmer like you should borrow money for agriculture purpose	Yes / No
2.	Do you think that getting credit for agricultural purpose will be difficult one	Yes / No
3.	How a farmer is treated when he approaches the official concerned for securing credit	Fairly / Badly
4.	There is nothing wrong in taking credit from institutional sources for increasing farm production	Agree / Disagree
5.	Have you availed credit facilities of institutionalised source, in the last two years for agriculture and allied enterprise	Yes / No

18. Innovativeness

What would you prefer to adopt an improved agricultural practice.

a) As soon as it is brought to your notice?

b) After you have seen other farmers have treated it successfully in their farm.

c) You prefer to wait and take your own time.

19. **Risk orientation**

Sl. No.	Statements	A	UD	DA
a)	A farmer should grow large number of crops to avoid greater risks involved in the crop alone			
b)	A farmer should take rather more of a chance in taking big profit than to be a content with a small but less risky			
c)	It is good for farmer to take risk when he knows his chance of success is fairly high			
d)	A farmer who is willing to take greater risks than the average farmer usually does better financially			
e)	It is better for a farmer not to try new farming methods, unless most others have used it with success			
f)	Trying new cultivation by a farmer involves risks, but it is worth			

20. Scientific orientation

Sl. No.	Statements	A	UD	DA
1)	New method of farming gives better results to a farmer than the old method			
2)	The way a farmer's forefather farmed is still the best way to farm today			
3)	Even a farmer with lots of experience should use new method of farming			
4)	Though it takes time for a farmer to learn new methods in farming, it is worth the efforts			
5)	A good farmer experiment with new ideas in farming			
6)	Traditional methods of farming have to be changed in order to raise the level of a farmer			

21. Progressiveness

1.	A progressive farmer should be upto date in knowledge of latest technology. Do you keep yourself upto date knowledge of latest technology?	Yes / No
2.	A progressive farmer should be receptive to change resulting in better income. Are you changing to new varieties as and when they are recommended?	Yes / No
3.	A progressive farmer should be helpful to other farmer in adopting improvement. Did you tell others about the benefit of adoption of improved technology?	Yes / No
4.	A progressive farmer should be an innovator or early adopter. Are you the first to adopt any improved practices?	Yes / No
5.	A progressive farmer should have more contact with extension agency. Do you meet extension worker (AAO, AO etc.) for advice?	Yes / No
6.	A progressive farmer should use improved (or) HYV. Did you grow any improved (or) HYV last year?	Yes / No
7.	A progressive farmer should be an adopter of plant protection measures in full. Did you use plant protection measures in full?	Yes / No

PART II

CONSTRAINTS

Sl. No.	CONSTRAINTS	Yes	No
	Biophysical constraints		
a	Availability of improved varieties		
b	Adopting correct spacing		
c	Adopting specific fertilizer application		
	Biological constraints		
a	Inadequate irrigation water		
b	Low population		
c	Occurrence of weeds		
d	Higher pest incidence		
e	Lack of technology for problem areas		
	Physical constraints		
a	Delayed land preparation		
b	Micronutrient deficiency		
c	Saline and alkaline soil		
d	Inadequate organic matter		
	Socio-economic constraints		
a	High cost labour		
b	Non-availability of credit / high rate of interest		
c	High cost of input		
d	Non-availability of farming implements		
e	Improper harvesting		
f	Lack of transport facilities		

Any other constraints, please specify.

PART III

KNOWLEDGE TEST AND ADOPTION BEHAVIOUR FOR JUTE GROWERS

Sl. No.	TECHNOLOGIES	KNOWLEDGE		ADOTPION	
		C	IC	A	NA
1.	Recommended varieties for *Corchorus olitorius* jute Ans:				
2.	Seed rate Ans:				
3.	Land preparation Ans:				
4.	Sowing method Ans:				
5.	Spacing Ans:				
6.	Manures and fertilizers Ans:				
7.	Irrigation Ans:				
8.	Thinning operations Ans:				
9.	Insect pest / jute apion Ans:				
10.	Insect pest / Hairy caterpillar Ans:				
11.	Red spider mite Management:				
12.	Hand weeding Ans:				
13.	Chemical weedicides Ans:				

14.	Major diseases / root rot Management:				
15.	Major insect pest /stem rot Management:				
16.	Stage of harvesting Ans:				
17.	Materials for submergence Ans:				
18.	Timely submergence Ans:				
19.	Bundle submergence Ans:				
20.	Determination retting stage Ans:				

C = Correct; IC = Incorrect; A = Adopted; NA = Not Adopted

PART IV

KNOWLEDGE TEST AND ADOPTION BEHAVIOUR FOR PADDY GROWERS

Sl. No.	TECHNOLOGIES	KNOWLEDGE		ADOTPION	
		C	IC	A	NA
1.	Recommended varieties for *aman* season paddy crop Ans:				
2.	Seed treatment Ans:				
3.	Seed rate Ans:				
4.	Improved nursery technique Ans:				
5.	Manures and fertilizers in nursery stage Ans:				
6.	Age of transplanting Ans:				
7.	Transplanting methods Ans:				
8.	Spacing Ans:				
9.	Manures and fertilizers / FYM Basal / Top Dressing/ Foliar Ans:				
10.	Irrigation Ans:				
11.	Gap filling Ans:				
12.	Drainage Ans:				
13.	Major disease / Leaf blast Management:				

14.	Major disease / brown spot Management:				
15.	Major insect pest /stem borer Management:				
16.	Major insect pest / rice bug Management:				
17.	Rice tungro virus Ans:				
18.	Weed control Ans:				
19.	Rat control Management:				
20.	Stage of harvest Ans:				

C = Correct; IC = Incorrect; A = Adopted; NA = Not Adopted

PART V

KNOWLEDGE TEST AND ADOPTION BEHAVIOUR FOR POTATO GROWERS

Sl. No.	TECHNOLOGIES	KNOWLEDGE		ADOTPION	
		C	IC	A	NA
1.	Recommended varieties for potato Ans:				
2.	Seed treatment Ans:				
3.	Seed rate Ans:				
4.	Seedling size/weight Ans:				
5.	Soil treatment Ans:				
6.	Sowing method Ans:				
7.	Spacing Ans:				
8.	Manure and fertilizers FYM/NPK/Micronutrient Ans:				
9.	Earthing up Ans:				
10.	Irrigation Ans:				
11.	Insect pest/Cut worms Management:				
12.	Insect pest/White grub Management :				
13.	Nematode Management:				

14.	Chemical weedicides Ans:				
15.	Major disease/Early blight Management:				
16.	Major Disease/Late blight Management :				
17.	Rat control Management:				
18.	Harvesting stage Ans:				
19.	Harvesting implements Ans:				
20.	Shade drying Ans:				

C = Correct; IC = Incorrect; A = Adopted; NA = Not Adopted