STUDY ON DIFFUSION PATHWAY AND ADOPTION DIMENSIONS OF NEWLY RELEASED RICE VARIETIES IN CHHATTISGARH PLAINS

Ph.D. Thesis

by

Virendra Kumar Painkra

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE, RAIPUR
FACULTY OF AGRICULTURE
INDIRA GANDHI KRISHI VISHWAVIDYALAYA RAIPUR
(Chhattisgarh)
2018

STUDY ON DIFFUSION PATHWAY AND ADOPTION DIMENSIONS OF NEWLY RELEASED RICE VARIETIES IN CHHATTISGARH PLAINS

Thesis

Submitted to the

Indira Gandhi Krishi Vishwavidyalaya, Raipur

by

Virendra Kumar Painkra

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGRREE OF

Doctor of Philosophy

in

Agriculture

(Agricultural Extension)

Roll No. 130114006   UE ID No. 20141520509

July, 2018

CERTIFICATE-I

This is to certify that the thesis entitled **"Study on diffusion pathway and adoption dimensions of newly released rice varieties in Chhattisgarh plains"** submitted in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Agriculture** of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by **Virendra Kumar Painkra** under my/our guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma or certificate course. All the assistance and help received during the course of the investigations have been duly acknowledged.

Chairman

Date: 20.07.2018
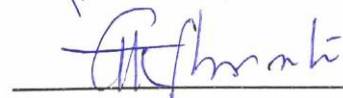
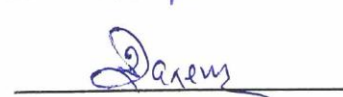THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE

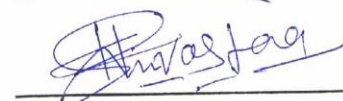|		
Chairman	(Dr. M.L. Sharma)	
Member	(Dr. M.A. Khan)	
Member	(Dr. (Major) G.K. Shrivastava)	
Member	(Dr. R.R. Saxena)	
Member	Head of the Department	

CERTIFICATE-II

This is to certify that the thesis entitled **"Study on diffusion pathway and adoption dimensions of newly released rice varieties in Chhattisgarh plains"** submitted by **Virendra Kumar Painkra** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Agriculture** in the Department of Agricultural Extension has been approved by the external examiner and Student's Advisory Committee after oral examination.

Signature External Examiner

(Dr. S.K. Acharya)

Date: 24.12.2018

Major Advisor

Head of the Department

Faculty Dean

Approved/Not approved

Director of Instructions

ACKNOWLEDGEMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF NOTATION/SYMBOL

%	Per cent
@	At the rate
et al.	and others/and co-workers
ha	Hectare
i.e.	That is
q.	Quintal
Kg	Kilogram
₹	Rupee
Viz.	Namely
$\overline{\mathrm{X}}$	mean

LIST OF ABBREVIATION

ADO	Agriculture Development officer
AS	Agriculture Scientist
BPH	Brown plant hopper
C.G. Govt.	Chhattisgarh Government
Ch	Channels
DR	Discontinued respondents
FAO	Food and Agricultural Organization of the United Nations
FIG.	Figure
F	Frequency
GDP	Gross domestic product
IGKV	Indira Gandhi Krishi Vishwavidyalaya
KVK	Krishi Vigyan Kendra
NGO	Non-Governmental Organization
NAR	Non adopted respondents
NS	Non-significant
OS	Obtained score
OBC	Other backward class
PW	Percentage weightage
RAEOs	Rural Agriculture Extension Officers
SMS	Subject matter specialist
SADOs	Senior Agriculture Development officers
ST	Scheduled tribes
SC	Scheduled caste
SD	Standard deviation
TV	Television
USA	United States of America

THESIS ABSTRACT

a)	Title of the thesis	:	Study on diffusion pathway and adoption dimensions of newly released rice varieties in Chhattisgarh plains
b)	Full name of the student	:	Virendra Kumar Painkra
c)	Major subject	:	Agricultural Extension
d)	Name and address of the major advisor	:	Dr. M.L. Sharma, Dean, College of Agriculture and Research Station, Kanker, Chhattisgarh
e)	Degree awarded	:	Ph.D. in Agriculture (Agricultural extension)

Signature of Major Advisor

Date: 20.7.2018

Signature of the student

Signature of Head of the Department

20/7/2018

ABSTRACT

The current study was carried out in Chhattisgarh plains during 2015-16 and 2016-17. Total four districts Raipur, Dhamtari, Rajnandgaon and Mahasamund were selected for the study, whereas 320 respondents were selected and pre-tested interview schedule were used for the data collection. Data were analyzed through appropriate statistical tools. Data reveals that respondents were educated and no anyone was illiterate. Mostly respondents were belonged to other backward castes (OBC). Maximum respondents had medium family size, majority of the respondents had 11 to 20 years, maximum land area was *Vertisols (Kanhar)* and maximum area was irrigated. More than 50 per cent of the respondents were medium farmer and hold 2.1 ha to 4 ha land. 97.81 per cent of the respondents were doing agriculture as main occupation. Further, results showed that 35.31 per cent respondents had ₹ 50001 to ₹ 100000 annual incomes where main source of annual income was agriculture. 94.38 per cent respondents observed neighbor's

demonstrated field and more than 50 per cent medium extension participation noted. The majority of the respondents collecting information regarding rice varieties from personal localite but highly believed in cosmopolitans sources and overall maximum contacting to RAEOs. Maximum respondents had medium decision-making ability. The majority of the respondents had moderately favorable attitude for imorved varieties and maximum respondents had medium management orientation. Average 38.52 per cent of the respondents were aware of 15 listed IGKV rice varieties, whereas average 96.75 per cent of the respondents were aware for other popular rice varieties. 85.26 per cent knowledge noted for other popular rice varieties whereas 34.88 per cent knowledge observed for IGKV rice varieties which was very low as compared to other than IGKV. Majority respondents cultivated Swarna, MTU-1010 and Mahamaya. Swarna was cultivated in the highest area followed by MTU-1010, whereas hybrid rice gives the highest productivity on respondents field. IGKV rice varieties cultivated only 25.30 per cent of the total rice cultivation area. MTU-1010 was highly cultivated in *Inceptisols (Matasi soil)* and *Alfisols (Dorsa soil),* but Swarna was highly cultivated in *Vertisols (Kanhar soil)*. IGKV rice varieties used different diffusion pathway where Agriculture Department and Agriculture University were noted major diffusion pathway for dissemination. Grain yield was core trait for selection of rice varieties in rainfed as well as in irrigated land. 26.00 per cent share noted of IGKV rice varieties in total annual income from rice. A powerful extension efforts needed for the speedy adoption of IGKV rice varieties. Education, social participation, land holding, occupation, extension participation, extent of contact, source of information about rice varieties, decision making ability, management orientation and innovativeness were significantly correlated with knowledge about IGKV rice varieties, whereas education, land holding, occupation, income, decision making ability, innovativeness, productivity and knowledge about IGKV rice varieties were significantly correlated with adoption area of IGKV rice varieties.

शोध सारांश

क)	शोध का शीर्षक	:	मैदानी छत्तीसगढ़ मे धान के नये विकसित किस्मों का फैलाव पथ और अंगीकरण आयामों का अध्ययन
ख)	छात्र का पुरा नाम	:	विरेन्द्र कुमार पैंकरा
ग)	प्रमुख विषय	:	कृषि विस्तार
घ)	प्रमुख सलाहकार का नाम एवं पता	:	डॉ. एम.एल. शर्मा, अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कांकेर, छत्तीसगढ़
ड.)	प्रदान की जाने वाली उपाधि	:	कृषि में डॉक्टर ऑफ फिलोसॉफी (कृषि विस्तार)

प्रमुख सलाहकार का हस्ताक्षर
दिनांक: 20.07.2018

छात्र का हस्ताक्षर

विभाग प्रमुख का हस्ताक्षर
20/7/2018

सारांश

वर्तमान अध्ययन, छत्तीसगढ़ के मैदानी भाग में 2015 से 2017 के मध्य किया गया था, जिसके लिए कुल चार जिला चुना गया, जो की रायपुर, धमतरी, राजनांदगाव और महासमुंद था। अध्ययन हेतु 320 उत्तरदाताओं को चुना गया और उनसे जानकारी प्राप्त करने के लिए पहले से परीक्षित साक्षत्कार अनुसूची का उपयोग किया गया और उनसे प्राप्त जानकारी का संश्लेषण उपयुक्त सांख्यिकी के माध्यम से किया गया था। उनसे प्राप्त जानकारी के संश्लेषण से पता चलता है की, लगभग सभी उत्तरदाता पढ़े–लिखे थे, कोई भी अशिक्षित नहीं था, अधिकतर उत्तरदाता अन्य पिछड़ा वर्ग के थे, उत्तरदाताओं का परिवार मध्यम आकार का था, उत्तरदाताओं के पास धान के खेती के लिए 11 से 20 वर्ष का अनुभव था। 50 से भी अधिक प्रतिशत उत्तरदाताओं के पास मध्यम आकार का भूमि 2.1 हे. से 4 हे. था, अधिकतर जमीन कन्हार वाले थे, कुल जमीन में अधिकतर जमीन सिंचित वाले थे 96.81 प्रतिशत उत्तरदाता कृषि को मुख्य व्यवसाय के रूप में करते थे और आग पता चलता है, की अधिकत्तर 35.31 प्रतिशत उत्तरदाताओं का वार्षिक आय रु. 50001 से रु.100000 के बिच में था, जहाँ की कृषि ही, वार्षिक आय का मुख्य सोत था, 98.38 प्रतिशत उत्तरदाताओं ने पडोसी के खेत में प्रदर्शन को देखा था और सभी उत्तरदाताओं का कुल रूप से विस्तार भागीदारी में मध्यम भागीदारी अंकित किया गया था। अधिकतर उत्तरदाता, स्थानीय स्रोत से धान के किस्म के बारे में जानकारी प्राप्त करते थे, लेकिन ये सबसे ज्यादा बाह्य स्रोत वालो पे विश्वास करते थे, अधिकत्तर ग्रामीण कृषि विस्तार अधिकारी से जानकारी के लिए संपर्क करते थे, सामान्यता उत्तरदातो के पास मध्यम,

निर्णय लेने की छमता थी और कई सारे उत्तरदाताओं के पास उन्नत किस्म के लिए मामूली अनुकूलन थी। अधिकत्तर के पास मध्यम प्रबंधन उन्मुखीकर था, औसतन केवल 38.52 प्रतिशत उत्तरदातओं ने 15 अनुसूचित इ.गा.कृ.वि. के धान के किस्मो को सुना था, जबकि 96.75 प्रतिशत उत्तरदाताओं ने इ.गा.कृ.वि. का धान के अलावा प्रचलित किस्मो को सुना था, केवल 34.88 प्रतिशत जानकारी इ.गा.कृ.वि. के धान के लिए उत्तरदाताओं के पास थे, जबकि 85.26 प्रतिशत जानकारी इसके अलावा दूसरे धान के लिए था। उत्तरदाता मुख्यतः स्वर्णा, एम.टी.यु.1010 और महामाया को लगाते थे। जिनका पूरा रकबा लगभग 71 प्रतिशत अंकित किया गया है, मटासी और डोरसा मृदा में अधिकत्तर एम.टी.यु.1010 को लगाते थे, जबकि कन्हार मृदा में स्वर्णा धान को सबसे अधिक लगाते थे, इ.गा.कृ.वि. के धान के किस्म के फैलाव के लिए विभिन्न पथ का उपयोग किया गया था, जिनमे से अबतक कृषि विभाग और कृषि विश्वविद्यालय ने अग्रणी भूमिका निभाया है. धान के किस्मो के चयन के लिए धान की किस्म का पैदावार प्रथम मुख्य गुण था, इसकी प्राथमिकता सिंचित और असिंचित दोनों में प्रथम था। इ.गा.कृ.वि. धान का वार्षिक आय , कुल धान के वार्षिक आय में केवल 26 प्रतिशत भागदारी अंकित किया गया था। इ.गा.कृ.वि. धान के फैलाव के लिए एक शक्ति शाली विस्तार की आवश्यकता है, शिक्षा, सामाजिक भागीदारी, भूमि रकबा, व्यवसाय, विस्तार भागीदारी, संपर्क, धान के किस्म के जानकारी का स्रोत, निर्णय लेने की छमता, प्रबंधन उन्मुखीकरण और नवाचार गुण महत्वपूर्ण रूप से इ.गा.कृ.वि. के धान के जानकारी से सम्बंधित है, जहाँ शिक्षा, भूमि रकबा, व्यवसाय, आय, निर्णय लेने की छमता, नवाचार गुण , उत्पादकता और इ.गा.कृ.वि. के धान के बारे में जानकारी, इ.गा.कृ.वि. के धान के क्षेत्र में अंगोकरण से महत्वपूर्ण सम्बंधित है।

CHAPTER-I
INTRODUCTION

Rice (*Oryza sativa* L. is the most important staple food in Asia. More than 90 per cent of the world's rice is grown and consumed in Asia, where 60 per cent of the world's population lives (Guyer *et al.,* 2013). It accounts for 73 per cent of the calorie intake in Bangladesh, 40 per cent in Nepal, and 30 per cent in India. South Asia has about 37 per cent of the world's total rice area and approximately 50 per cent of the rice-growing area in South Asia is rainfed. Rice is the only crop that grows well in large areas of wetlands in monsoon Asia. Most of these rainfed rice areas regularly suffer from various abiotic stresses such as droughts, floods and salinity. The productivity of rice in these stress-prone rainfed environments is less than 3.0 t ha^{-1}. Historical rice productivity trends in three countries of South Asia (India, Bangladesh and Nepal) show that growth in yield has been sluggish and unstable in rainfed areas due to the regular occurrence of abiotic and biotic stresses. Therefore, improving the productivity of rice through stress-tolerant technologies is a key entry point to enhance the income and livelihood of resource-poor farmers in these stress-prone environments (Behura *et al.,* 2012).

India is the second leading producer of rice in the entire world, preceded only by China. Rice is grown extensively in India in about 42.56 m ha area with an annual production of 95.33 million tonnes having an average yield of 2240 kg ha^{-1} (Anonymous, 2014). Annual consumption is around 85 million tons. In India, Rice is cultivated in both seasons - winter and summer. West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Orissa, Assam, Karnataka and Haryana are the major rice producing states. More than 50 per cent of total production comes from the first four states. Food Corporation of India purchases around 20 to 25 per cent of the total rice production in the country both under levy from the rice mills and directly in the form of paddy from the farmers at Minimum Support Prices announced by the Government.

Rice has shaped the culture, diets and economic of thousand of millions of peoples. For more than half of the humanity "rice is life". Considering its important position, the United Nation designated the year 2004 as the "International Year of rice. There is a lot of importance of rice such as rice is an important staple food crop for more than 60 per cent of the world people. In 2008, more than 430 million metric tons of rice was consumed worldwide. Ready to eat products e.g. popped and puffed rice, instant or rice flakes, canned rice and fermented products are produced. Rice straw is used as cattle feed, used for thatching roof and in cottage industry for preparation of hats, mats, ropes, sound absorbents, strawboard and used as litter material. Rice husk is used as animal feed, for paper making and as a fuel source. Rice bran is used in cattle and poultry feed. Defatted bran, which is rich in protein, can be used in the preparation of biscuits and as cattle feed. Rice bran oil is used in the soap industry. Refined oil can be used as a cooling medium like cottonseed oil/corn oil. Rice bran wax, a byproduct of rice bran oil is used in industries.

The immense diversity of rice germplasm is a rich source for many rice-based products and is also used for treating many health-related maladies such as indigestion, diabetes, arthritis, paralysis, epilepsy and give strength to pregnant and lactating mothers. Ancient Ayurvedic literature testifies the medicinal and curative properties of different types of rice grown in India. Medicinal rice varieties like Kanthi Banko (Chhattisgarh), Meher, Saraiphul & Danwar (Orissa), Atikaya and Kari Bhatta (Karnataka), are very common in India.

India has released a lot of rice varieties but only a few varieties are popular amongst farmers due to its characteristic. All released rice varieties are not completely disseminated amongst farmers (Anonymous, 2017).

Chhattisgarh, the 26th state of the Indian Union came into existence on 1 November 2000. The state is geographically situated between $17^0 46'N$ and $24^0 5$ North Latitude and $80^0 15'E$ and $84^0 20'$ East Longitude. The total geographical area is around 136 lakh ha of which cultivable land area is 58.81 lakh ha and forest land area is 60.76 lakh ha with more than 2.07 crore population. About 80 per cent of the population in the state is engaged in agriculture and 43 percent of the entire arable land is under cultivation. Paddy is the principal crop and the central plains

of Chhattisgarh are known as rice bowl of central India. Other major crops are coarse grains, wheat, maize, groundnut, pulses, and oilseeds.

Indira Gandhi Krishi Vishwavidyalaya is an autonomous non-profit, research and educational organization working for the uplifting of farmers livelihood of Chhattisgarh and it's headquarter is situated in Raipur.

Many rice varieties evolved from IGKV, Raipur. Mahamaya was evolved in 1996 from Asha x Kranti parentage, long bold grain with 45-55q ha^{-1} average yield. Further, year by year researches in rice increased and till 2015 about fifteen rice varieties were evolved *i.e.* Mahamaya, Poornima, Shyamla, Danteshwari, Indira Sugandhit Dhan-1, Bamleshwari, Samleshwari, Jaldubi, Chandrahasini, Indira sona, Indira barani dhan-1, Karma mahsuri, Maheshwari, Durgeshwari, Rajeshwari and Indira aerobic-1 (Sarawagi *et al.,* 2016)

There is a lot of rice varieties released for India as well as for Chhattisgarh also but only a few varieties have reached amongst the farmers. From IGKV also many rice varieties have been released but only a few varieties are well disseminated amongst the farmers and only few varieties are popular amongst farmers.

Keeping this in view, the present investigation entitled "Study on diffusion pathway and adoption dimensions of newly released rice varieties in Chhattisgarh plains" was carried out during the years 2015-16 to 2016-17 with the following specific objectives:-

1. To study the socio-economic profile of rice growers
2. To determine the diffusion pathway of different newly released rice varieties by IGKV, Raipur
3. To assess the extent of adoption of different popular rice varieties
4. To determine the preferential traits for selection of rice varieties
5. To determine the impact of different newly released rice varieties on annual income,
6. To obtain suggestions for speedy adoption.

Significance of the study

It is well-established fact that modern agricultural technologies can play a significant role in increasing production and productivity of the crop. The acceptance of high yielding rice varieties certainly leads to improving socio-economic status and living standard of the farming community. The findings of the study will not only be helpful to know the diffusion pathway and adoption status but also in deciding the solution and suggestions to overcome the constraints felt by farmers during the speedy adoption of newly released rice varieties from IGKV, Raipur. The findings of the study will also be able to provide basic planning strategy for new rice variety development on the basis of preferential traits for selection of rice varieties by the selected respondents.

Limitations of the Study

There may be factors associated with the need for adoption of newly released rice varieties by the farmers. It may be classified in different type *viz.* socio-economic, socio-psychological, technological etc. characteristics of the farmers. The inclusion of all such factors in this study was not possible for obvious limitations of inadequate money, time and other resources usually faced by a student. Limitation of time has set up a barrier for probing into more dimensions of the research. However, considerable care and thought have been exercised in selecting variables, so that all the objectives were well fulfilled.

The present investigation, therefore, has been carried out under a set of physical and functional limitations noted below:

1. The study largely relied on the responses of the farmers and their memory.
2. They were often reluctant to provide precise information, but they were tackled by establishing a thorough rapport with them.
3. The study was partly based on official statistics available from different publications of the Government. It is needless to refer to the time lag in the publication of official statistics. However, the available latest statistics have been utilized.
4. Some scales, measurements and test were used, but due to variations in the farmers, their living conditions and places, the administration of the scales etc.

had to be done with minor modifications to ensure more reliable and effective results.

Layout of the Study

The present study has been presented in five chapters. The first chapter is devoted to an introduction, which has been presented in brief. In the second chapter, a comprehensive review of the literature has been dealt with. The third chapter deals the materials and method used for the study along with its analysis and interpretation of data. The major findings and suitable discussion pertaining to the results have been incorporated in the fourth chapter. While in the fifth chapter summary and conclusion along with implications have been discussed. The relevant literatures consulted and cited in the body of the presentation have been enlisted in references just after the summary and conclusion. At the end of the dissertation, the structured interview schedule has been enclosed under the heading 'Appendices'.

REVIEW OF LITERATURE

One of the important aspects of research is the review of past literature. The researchers have to review the concerning literature at every stage. Through review, the researcher comes to know about the methods, procedures, and technique as well as results of past studies. It provides clues and guidance throughout the research process. Steady efforts were made to compile findings of the research studies possessing more or less similar characteristics. Research works conducted on rice varieties with extension purview are still scarce and sporadic; however, available researchers directly or indirectly related to the present investigation have been reviewed. The present chapter incorporates all the relevant literature developed in India and abroad, related to rice varieties, under following heads:

2.1   The socio-economic profile of rice growers

2.2   Diffusion pathway of different released rice varieties

2.3   Adoption of different popular rice varieties,

2.4   Knowledge about different released rice varieties

2.5   Preferential traits for selection of rice varieties

2.6   Impact of different released rice varieties on annual income,

2.7   Suggestion for speedy adoption.

2.1   Socio-economic profile of rice growers

2.1.1   Education

Saka *et al.* (2005) incorporated that the majority of the educated farmers (93.7%) were adopters, while the majority of the illiterate farmers (53.7%) were non-adopters. However, about 80.9 per cent of the respondents were literate.

Hossain (2006) depicted that the respondent's education level categorized in five categories *i.e.* no education (0), can sign only (0.5), primary education (1-5), secondary education (6-10), and above secondary education (>11). The indicated that a large proportion (33%) of the respondents fell into the category of secondary education compared to 28 per cent no education, 20 per cent can sign only, 11 per

cent having primary education and 8 per cent having above secondary education. As education can enlighten a family, it may contribute to the adoption of selected HYV rice.

Thammi *et al.* (2006) observed that level of education varied with the type of production system. Illiteracy was more predominant in a small animal production system, primary education in the large animal production system and higher education in a non livestock production system.

Verma (2009) found that the 43.33 per cent of the respondents were illiterately followed by 37.50 per cent respondents were found under the categories of up to primary school. Whereas, 12.50 per cent respondents were educated up to middle school and 3.33 per cent had education up to high school, about 01.67 per cent respondents had education up to higher secondary level and only 01.67 per cent respondents were educated up to college and above.

Naik *et al.* (2009) observed that education had a positive and significant correlation with knowledge of the respondents regarding the organic farming practices.

Karki (2010) revealed that the educational level of the farmers was significantly different at P<0.005. SRI adopters were younger and well educated compared to non-adopters. Sathish (2010) concluded that equal per cent (29.17%) of respondents studied up to middle level and high school. One fifth (20.08%) of the respondents studied up to primary school and followed by pre-university (15.83%).

Nguezet *et al.* (2010) revealed that the educational level of the household's head is significantly different between adopters and non-adopters. About 68 per cent of the respondents had at least a primary school level while for non-adopters; only 42.1 per cent had at least primary school level.

Lakra (2011) showed that the most (25.62%) of selected hybrid rice cultivators had a primary level of education, followed by 20.62 per cent of selected hybrid rice cultivators were high school passed and 16.89 per cent had passed middle school. However, 15.00 per cent had passed higher secondary, 11.25 per cent respondents were college passed and only 10.62 per cent respondents were illiterate.

Shori (2011) found that 33.13 per cent of the respondents were educated up to primary school level and 23.75 per cent were educated up to the middle school level, followed by 14.37 per cent of the respondents who were illiterate. Whereas 13.75 per cent respondents had education up to high school level, 11.25 per cent of the respondents were educated up to higher secondary level and only 3.75 per cent respondents had education up to college and above.

Meena and Punjabi (2012) indicated that on an average, 52.94 per cent heads of families were illiterate. On an average, 12.47 per cent of heads of families had education up to primary level and 32.24 per cent of heads of families had education up to senior secondary level. Those educated up to graduate and above level were observed only 2.35 per cent of total sample farmers in the project area.

Nirmala *et al*. (2013) found that 36 per cent of the farmers were illiterate, 28 per cent had primary education, 22 per cent possessed the secondary education and only 14 per cent of the sample farmers had college level of education.

Narbaria (2013) revealed that the most of selected SRI adopters (37.30%) had a middle class of education. However, 26.98 per cent of selected SRI adopters had a primary level of education, followed by 15.90 per cent were higher secondary passed, 11.90 per cent were high school passed, 3.96 per cent respondents had under graduation, 2.38 per cent respondents had post-graduation and only 1.58 per cent respondent were illiterate.

Pradhan (2014) revealed that most (31.25%) of selected scented rice growers had middle school level of education, followed by 23.61 per cent of selected scented rice-growing farmers were higher secondary school passed and 16.67 per cent had passed high school. However, 15.97 per cent had passed primary school, 9.72 per cent respondents were college passed and only 2.78 per cent respondents were illiterate.

Sharma *et al*. (2015) observed that 60 per cent of the respondents were having a medium level of education followed by 35 per cent with a low level of education. Only five per cent of the respondents were in a high level of education category. Farmers with higher and medium level of education can be easily motivated for the adoption of recommended practices.

Farid *et al*. (2015) found that the highest 37.2 percent of the respondents completed a secondary level of education and about 18 percent are illiterate.

2.1.2   Castes

Dhruw (2008) found that a maximum number of the respondents (68.33%) belonging to scheduled tribe's, followed by 15.93 per cent were under other backward caste, 13.34 per cent respondents were from general caste and only 2.50 per cent respondents belonged to scheduled caste.

Dey *et al.* (2014) reported that the majority (54.5%) of the respondents of Lumding were from Scheduled castes followed by 7.2% of other backward classes and 32.9% were from general castes. Panda (2014) stated that the 80 per cent of respondents belonged to scheduled caste category, however, 7.50 and 8.33 per cent of them belonged to general and scheduled tribe categories respectively.

Bunkar (2015) found that a maximum number of the respondents 56.88 per cent belonged to scheduled tribes, followed by 40.00 per cent who belonged to other backward class, 2.50 per cent of the respondents belonged to general category and only 0.62 per cent of the respondents belonged to the scheduled caste.

Pradhan (2017) noted that that majority (59.58%) of the respondents belonged to Scheduled Tribes, followed by Other Backward Class (37.51%). It was also found that only 2.08 per cent of the respondents belonged to Schedule Castes, while only few (0.83%) respondents were belongs to Other Caste or General category.

2.1.3   Size of family

Shrivastava (2005) found that 70.00 per cent of the respondents had medium size of the family (4 to 7 members) followed by 30.00 per cent of the respondents had large size of family (8 and above members) and there were not a single respondent having small size of family.

Kushwaha (2005) revealed that the majority of the farmers (70.00%) had a medium size of family, followed by small (10.00%) and big sized family (20.00%).

Raghuwanshi (2005) found that majority of the rice growers (50.63%) had medium size of family (6 to 10 members), followed by 26.87 per cent respondents

who had large size family (11 members and above). However, rest of 22.61 per cent respondents had small size of family (up to 5 members).

Manjunath (2010) reported that majority (57.14%) of the respondents belonged to the family, followed by medium family (31.42%) and remaining 11.40 per cent belonged to the large family.

Sathish (2010) concluded that more than half of the respondents (53.33%) belonged to big family (>4 members).

Rokonuzzaman (2012) depicted that average family size of the respondents was 4.92and most of them (68%) were in medium to a small category.

Lakra *et al.* (2012) revealed that the 59.38 per cent of the respondents were having medium size of family (6 to 10 members), followed by 22.50 per cent of respondents had big size of family (above 10 members) and only 18.12 per cent of the respondents had the small size of family (up to 5 members).

Khan *et al.* (2013) revealed that the highest proportion (52%) of the farmers had medium family size as compared to 36 per cent having small and 12 per cent large family size. Thus, an overwhelming majority (88%) of farmers were found to have small to medium families.

Torres *et al.* (2013) incorporated that a bigger percentage of respondents (40.60%) had only 1-3 children. Those with the bigger family size of 4-6 children accounted for lower percentage (35%). There were very few (14.70%) who had the proverbial big farm family size of 7 and more children. These data indicate that farm families engaged in biotech corn are decreasing in size.

Sharma *et al.* (2015) stated that more than 60 per cent (63.33%) of respondents were having small family size with less than five members and remaining were having large family size with more than five members.

2.1.4 Social participation

Shrivastava (2005) revealed that maximum number of respondents (43.12%) were having membership in two organization, followed by 24.38 per cent of the respondents having membership in one organization, whereas 18.75 per cent of the respondents who were having the membership in more than two organizations. Only 13.75 per cent of the respondents having no membership in any organization.

Ramesh and Santha (2008) revealed that positive and significant relationship was observed between social participation and extent of adoption of organic farming practices by the respondents.Lakra *et al.* (2012) incorporated that the higher of the respondents (40%) had no social participation, while only 28.76 per cent of the respondents were members of one organization, 23.12 per cent of the respondents" falls in the category of member of more than one organization and 8.12 per cent of the respondents were office bearer of organization.

Rokonuzzaman (2012) elaborated that majority (68%) had low to medium organizational participation.

Meena *et al.* (2012) depicted that that majority of farmers (67%) were not having membership in any social organization.

Kumar *et al.* (2013) revealed that more than four-fifths (81%) of the surveyed farmers had no membership in any organization, indicating very poor social participation, 16 per cent of the farmers had membership in one organization, while only 2 per cent and 1 per cent of them were office bearers/executive and had membership in two or more than two organization respectively.

Sharma *et al.* (2015) observed that 80 per cent of the respondents were having no membership of any social organization while 20 per cent were involved in membership with some organizations.

2.1.5   Occupation

Pandey *et al.* (2004) revealed that the majority of the respondents were in agriculture occupation with increasing of cosmopoliteness and family need, about 31.88 and 23.75 per cent respondents were engaged in forestry and animal husbandry, respectively.

Kushwaha (2005) indicated that almost all the respondents were involved in agriculture occupation. But with increasing cosmopolites and their family needs, the respondents were also practicing other occupations, which were suitable and available in their reach. About 19.16 per cent respondents were engaged in agriculture + animal husbandry. The farmer with small land holding also earned by working in other's field as labour, about 49.16 per cent farmer involved in agriculture + labour. In the study area, 20.00 per cent respondents were engaged in

agriculture + business for earning, whereas, 8.33 per cent farmers were doing service occupation and 9.16 per cent farmers were doing other occupation. They further revealed that majority of the rice growers (72.50%) were practicing two occupations. Similarly, about 10.83 per cent respondents were engaged in one occupation and only 16.67 per cent farmers were doing more than two occupations.

Singh *et al.* (2007) found that all the farmers were involved in agriculture as their main occupation in both the categories; a few had labour, service, and business as their secondary occupation in the adopter category whereas, in the non-adopter category, there were 13 per cent laborers. A trend was observed that those who had comparatively small holdings were having other subsidiary occupations to support their family.

Khan *et al.* (2007) found that the main occupation of the majority (64%) was the combination of agriculture and milk production followed by only agriculture (26%).

Kulshrestha *et al.* (2010) revealed that two to three subsidiary occupation along with farming, less possession of agricultural assets, favorable attitude towards watershed programme, availed irrigation and credit facilities, less to average innovative in nature and utilized medium to low communication sources.

Lakra (2011) observed that most of the respondents (28.76%) were involved in agriculture (hybrid rice cultivation) + labour, followed by agriculture (hybrid rice cultivation) 18.75 per cent, hybrid rice cultivation + animal husbandry 18.12 per cent, hybrid rice cultivation + business 16.25 per cent, Agriculture (hybrid rice cultivation) + Service 9.37 per cent and hybrid rice cultivation + others 8.75 per cent category, respectively as their main occupation.

Kumar *et al.* (2012) revealed that majority of them (58%) had agriculture + labour as their main occupation, 24 per cent of them had agriculture alone as their principal occupation, whereas, 10, 4, 3 and 1 per cent of them had Agriculture + business, Agriculture + Animal husbandry, Agriculture + Service and Agriculture + Other as their principal occupations respectively.

Meena *et al.* (2012) found that the majority (51.50%) of the farmers were engaged in agriculture only. Whereas, 35.50 and 13 per cent farmers were engaged

in agriculture along with business and agriculture along with services, respectively for their livelihood.

Mondal and Bandyopadhyay (2013) found that the beneficiary households are primarily waged laborers as 33 per cent of the total households contacted belong to this category.26 percent are engaged in farming activities. 17 percent of them work on others" fields as sharecroppers. 11 percent of them are servicemen, while 6 percent of them have their own businesses. 5 percent contacted work both as wage laborers as well as sharecroppers while 2 percent of them engaged in farming activities and work as wage laborers as well.

Pradhan (2014) reported that almost all of the respondents were involved in agriculture, followed by labor (72.92%) and animal husbandry (67.36%) involvement of farmers in other occupations like non timber forest products were reported by 18.06 per cent, whereas only 11.11 per cent and 4.17 per cent involved respectively, business and service.

2.1.6 Annual income

Prajapati (2006) observed that the majority of the respondents (51.66%) belonged to low income group, 34.17 per cent belonged to medium income group and remaining 14.17 per cent belonged to high income group.Sathish (2010) revealed that total 36.66 per cent of respondents belonged to high-income group followed by medium (31.66%); semi medium (27.5%) income groups, whereas only 4.16 per cent of them were in the low-income group.

Lakra (2011) observed that majority of farmers (50.62%) were having their annual income in range of Rs. 20,001 to Rs. 40,000, which considered to be medium income, followed by 21.25 per cent of the respondent come under the income range of upto Rs. 20, 000 which come under to low level of annual income, while 16.68 per cent of the respondent come under the range of Rs. 40, 001 to 60,000 come under to high level of annual income. It has been also observed that only 11.25 per cent respondent come under to the range of more than Rs. 60,000 which considerable very high level of annual income.

Narbaria (2013) noticed that the higher percentage of the respondents (52.39%) were having their income in the range of Rs. 1, 00001 to Rs. 2, 00000 followed by 20.63 per cent of respondents had their annual income in the range

between Rs. 2, 00001 to Rs. 4, 00000, while 15.08 per cent of the respondents had obtained income up to 1, 00000 and only 11.90 per cent of respondents had very high income above Rs.

400000.

Thatchinamoorthy and Selvin (2014) explained that more than half of the respondents (50.80%) belonged to a low level of income followed by middle (34.20%) and high level of income (15%). Cultivating SRI in less than 2.5 acres by most of the respondents contributed to the low and medium annual income.

Pradhan (2014) incorporated that majority of respondents (52.08%) were having an annual income in the range of Rs. 50001 to 100000, followed by 27.08 per cent of the respondents come under the income range of Rs. 100001 to 200000 (moderate level of annual income), while 11.81 per cent of the respondent come under a high level of annual income (above Rs. 200000 and only 9.03 per cent respondents come under a low level of annual income (up to Rs. 50000). Pradhan also found that Annual income had no statistically significant correlation with the productivity of scented rice varieties.

Wiredu *et al* (2014) observed that on the whole, the daily per capita income of the sampled rice producers was less than USD 1 for both adopters and non-adopters. Rice contributed nearly 55% of the total household income. This was followed by incomes from a production of other crops, livestock rearing, trading activities, craftsmanship and remittances in that order. With the exception of income from remittances, all income sources of the NERICA adopters were generally higher than those of non-adopters. There were variations in the contribution of the various sources to the total income. For instance, income from crop production constituted about 77% of the total income for the adopters and about 80% for the non-adopters. On the other hand, livestock income constituted nearly 16% of the total income for the adopters and 12% for the non-adopters.

2.1.7   Land-holding

Nagadev and Venkataramaiah (2007) reported that 39.33 per cent of respondents belonged to semi medium category, 20.00 per cent belonged to medium land holding, while 26.67 per cent possessed small land holding, 12.00 per

cent possessed marginal land holding and only meager number (2.00%) had large land holding.

Saka and Lawal (2009) found that average size of rice farm was 2.60 hectare and the results also showed that the decision on whether or not to cultivate improved rice varieties was significantly influenced by the size of rice farm.

Verma (2009) indicated that the maximum number of the respondents (43.33 %) had small size of land holding (1.1 to 2 ha), followed by 31.67 per cent who belonged under marginal land holders (up to 1 ha), whereas, 21.67 per cent of the respondents were having medium size of land holding (2.1 to 4 ha) and only 03.33 per cent respondents had large size of land holding (above 4.0 ha).

Narbaria (2013) indicated that of the total, 53.18 per cent of the selected SRI adopters had 1.1 to 2 ha of land holdings (Small farmers), followed by 23.01 per cent of the respondents had 2.1 to 4 ha of land holdings (Medium farmers), 12.70 per cent of the respondents had above 4 ha of land holdings (Big farmers), while only 11.11 per cent of the respondents were marginal farmers.

Soni *et al*. (2013) found that the majority of the subscribers (63.12%) were big farmers.

Asmelash (2014) incorporated that the average total land holding of the sample households was 2.28 hectare for adopters and 1.90 hectares for non-adopters. Statistical analysis illustrated that mean difference is statistically significant at 10% significance level that is (t-test=1.887, P-value=0.062). The results of the study occur with the past research finding of Yishak (2005).

Bruce *et al.* (2014) revealed that the mean size of 4.92 compares with the national average of 5 acres. The empirical result shows that adoption of improved rice variety had a positive effect on farm output and farm size had a significant and positive impact on output.

Onumadu and Osahon (2014) revealed that majority (55.3%) of the farmers had farm size of 1.0 to 2.0 ha, while 31.7% of them had 2.0 to 3.0 ha farm holding. The size of a farm is a strong determinant of the expected output yield.

Hegos and Zemedu (2015) revealed that land is a constraining factor of production. The total land holdings are positive and significant at 5 percent probability level and influence participation. The marginal effect indicates that if

land cultivated increases by 1 hectare, farmers' probability of participating in improved technology transfer would increase by 0.0571. This outcome is consistent with Henery *et al.* (2012) research done in Ethiopia.

Ghimire *et al.* (2015) depicted that the positive and significant sign of farm size indicated that as farm size increased, the likelihood of adopting rice varieties released by National Rice Research Institute, China increased. This result is consistent with Mendola (2007), Kassie *et al.* (2011), and Mariano *et al.* (2012).

Awotide (2015) evaluated in terms of land area (ha) allocated to NERICA rice production, there was a progressive increase in the proportion of land given to NERICA rice cultivation since 2004. This suggests that there is an increase in the adoption rate of NERICA varieties across states. Statistically, the analysis shows Farm size is positively and significantly determined NERICA rice adoption.

2.1.8 Farming experience

Singh (2011) indicated that farming experiences of farmers with the adoption of mungbean production technology were not significant.

Kumar and Rathod (2013) discussed that 62 per cent respondents found to have medium farm experience (8-13 year) followed by the respondents (25.33%) of high experience where found farm experience was significantly correlated with knowledge and adoption at 0.01 level of probability.

Pradhan (2014) indicated that about 56 per cent of the respondents were having 6 to 15 years of experience in the field of scented rice. Also, 20.14 per cent of the respondents reported to have above 20 years of such experience and 18.75 per cent of the respondents had 5 years of experience of scented rice cultivation, while only 5.55 per cent of the respondents had 16 to 20 years of experience in scented rice cultivation.

Adedoyin *et al.* (2016) incorporated that majority of the farmers had 21-30 years farming experience with averages of 26.87. This indicates that rice farmers have more than 20 years of sound experience in rice farming and this to an extent affects their managerial know-how and decision making. Besides, it influences the farmers' knowledge of any climatic and weather condition. The coefficient of farming experience was positive and significant at 1% which implies that adoption of improved high yielding varieties is higher among rice farmers with more rice

experience than less experienced rice farmers. This will help the farmers in any agricultural decision making. It will also affect their managerial know-how to a large extent and increases farmers' understanding of weather and climatic conditions (Okunade, 2006; and Tijani, 2007).

2.1.9 Extension participation

Jangid *et al.* (2010) revealed that the extension participation was positively and significantly associated with the training needs of pea growers about improved pea production technology. It means that the extension participation of pea growers exerts highly significant influence on their training needs of pea growers about improved pea production technology.

Singh and Singh (2011) revealed that extension participation has a significant association with level of knowledge and extent of adoption by the mothbean grower.

Pradhan (2014) reported that the majority of the respondents (97.22%) had participated in different extension meetings, followed by 93.75 per cent of respondents were in contact with extension personnel, 54.86 per cent of respondents participated in agriculture exhibition, 44.44 per cent of respondents saw demonstration in neighbours" fields, 39.58 per cent of respondents had participated in kisan mela, 17.36 per cent respondents observed demonstration in their own field. Only 1.39 per cent respondents made contact in Kisan Call Centre (1800- 180-1551).

Painkra (2014) found that majority (92.50%) of the respondents participated in discussion with extension agents, 49.17 per cent respondents were participated in farmers fare, 16.22 per cent of respondents use kisan call centre, 10.83 per cent of respondents participated in farm exhibition and only 1.67 per cent respondents observed neighbor demonstration fields.

2.1.10 Source of information

Singh and Kumar (2007) reported that the large numbers of respondents were using all the sources *i.e.* Press, T.V., Radio, other farmers, Agriculture Department and Research Institute to gather information. The trend was more or less similar in case of medium farmers too. The uses of press and T.V. were less amongst the small and marginal farmers. The farmers ranked fellow farmers first,

followed by Agriculture Department, Research Institutes, Television, Radio and Press.

Pathak *et al.* (2009) reported that all the respondents followed by pesticide dealers and traders (76%), personal experiences (70%), neighboring farmers (68%) and village level agricultural workers (64%), respectively. A percentage of the respondents (40%) got the information from mass media and only 36 % respondents from Agricultural Extension Officer.

Sharma and Sharma (2010) indicated that Television (80.71%) was the most preferred mass media for getting information about modern agricultural technologies followed by Radio (67.85%) and News Paper (55.00%). Similarly, regarding adoption of various agricultural technologies Television was the most preferred medium (mean percentage 45.47), followed by Radio (mean percentage 26.16) and then News paper (mean percentage 12.73).

Meena *et al.* (2012) revealed that 46.50 per cent of the total farmers were using information sources up to medium level. Only 32 per cent farmers were under low level of information source used and rest 21.50 per cent of them were using information source to a high extent.

Singh *et al.* (2012) revealed that source of information utilized of moth bean growers was found to be significantly associated with the level of knowledge and extent of adoption.

Ibrahim *et al.* (2012) incorporated that radio and television, (29%) as the respondents' sources of information on improved rice production technologies. About 14% of the respondents indicated that cooperative union and salesmen were their sources of information on improved rice production technology. Only 7.7% of the respondents claimed to have received their information on rice production technology from their relatives and neighbors. About 4% of the respondents received their information on rice production directly from Research Institutes.

Narbaria (2013) revealed that in the study area, majority of the respondents (75.39%) had found information regarding rice cultivation from Rural Agriculture Extension Officer (RAEO). The study also revealed that 60.31 per cent of the respondents had obtained the information from friends, followed by 48.41 per cent of respondents had obtained the information from T.V., 34.12 per cent had

obtained the information from progressive farmer, 31.74 per cent of respondents obtained the information from neighbor, while 28.57 per cent of the respondents had obtained the information regarding rice cultivation from relatives and farmer fair, 27.77 per cent of the respondents had obtained the information from agriculture store, followed by about 10.31 per cent of the respondents used ADO, news paper and Kisan mitra as source of information, 9.52 per cent exhibition, 8.73 per cent Agriculture scientist, 7.14 per cent Sarpanch, 5.55 per cent Radio and 4.76 per cent Agriculture Magazines. They further revealed that the majority of respondents (68.26%) were utilizing 3-4 information sources; followed by 23.01 per cent of the respondents were utilizing 1-2 sources of information and only 8.73 per cent of the respondents were utilizing more than 4 information sources.

Usman *et al* (2013) indicated that the main source of agricultural information among the farmers of the study area was through mass media (37.5%), 28.3 per cent of the farmers source of agricultural information was from the extension workers and 26.7 per cent of the farmers source of information was obtained from the neighbours while few (7.5%) of the farmers source of information was from the middlemen.

Borthakur *et al.* (2014) depicted that farmers residing in districts that do not have a RARS will probably get even less information and opportunities regarding new varieties released by AAU. So, AAU should try to improve the quality of extension work going on in districts that do not have a rice centric RARS to ensure a better bridge between the laboratory and the fields.

2.1.11 Extension contact

Bhosle *et al.* (2002) concluded that maximum number (53.33%) of the respondents had medium extension contact, while 25.30 per cent and 21.33 per cent of the respondents had low and high extension contact, respectively regarding information programme.

Suryawanshi (2009) reported that the maximum (58.67 %) number of the finger millet growers had medium level of contact with extension personnel. The farmers generally contacted with the R.A.E.O.s / Gramsevaks (extension personnel) weekly, for information and guidance about recommended finger millet production technology.

Lakra (2011) revealed that the distribution of respondents with respect to their frequency of contact with extension personnel separately. The majority (50.00%) of the respondents made contact with Rural Agricultural Extension Officer (RAEOs) regularly followed by 28.12 per cent respondents who often contacted RAEOs, 18.12 per cent respondents contacted rarely, while only 3.76 per cent of the respondents had never contacted them . With regards to Agricultural Development Officer (ADOs), the research findings shows that maximum 47.50 per cent respondents had contact with them rarely followed by 38.12 per cent respondents never contacted, 14.38 per cent respondents who often contacted ADOs and none of the respondents contacted with ADOs regularly.

Shori (2011) indicated that majority of the respondents (59.38%) had made contact 2-3 times in a year with Rural Agriculture Extension Officer, whereas most of the respondents (30.00%) had made no contact with Rural Agriculture Extension Officer, while 5.00 per cent, 3.75 per cent and 1.87 per cent respondents had made contact once in a moth, once in a week and daily with Rural Agriculture Extension Officer respectively for getting the information regarding control measure practices of various weeds of rice crop.

Kumar *et al.* (2012) recorded that the majority of the respondents (71%) had a medium level of overall contact with extension personnel, 19 per cent of them had a low level of overall contact with extension personnel while 10 per cent of them had a high level of overall contact with extension personnel.

Simtowe *et al.* (2012) indicated that the proxy variable for access to agricultural extension *i.e.* contact with government extension workers where information on improved varieties is access returned a significant and positive coefficient. The findings highlight the significant role of government as the source of variety information or as a provider of extension services, particularly for pigeon pea. Most pigeon pea varieties are disseminated through field days and participatory variety selection, and government extension workers play an important role in such activities.

Gouda *et al*. (2013) observed that half of the marginal farmers had medium extension contact, whereas 26.67 and 23.33 per cent of them had high and low extension contact respectively. In case of landless laborers, nearly half (48.33%)

had low extension contact, whereas 28.33 and 23.33 had medium and high extension contact.

Usman *et al.* (2013) indicated that most (50.8%) of the farmers had extension contact only once in a year, 30% had no extension contact at all, 10% of the farmers were visited by extension workers on monthly basis and few (9.2%) of the farmers had contact with extension workers on weekly basis. The findings imply that there were weak and or no extension coverage by the extension workers in the study area, which might have a negative implication on the acceptance and adoption of improved agricultural technology which repercussions leads low agricultural productivity by the farmers. This agricultural procurement and extension agencies need to work together in order to meet the needs and aspirations of farmers in the study area in order to promote food security. This enhances the development of confidence in the agriculture extension agents by the farmers (Uzonna and Qijie, 2013).

Sharma *et al*. (2015) reported that the extension contact of majority respondents (68.33%) was in medium category followed by about 18% of the respondents with low level of extension contact.

2.1.12 Decision-making ability

Nandapurkar (1981) indicated that it is the degree to which an individual justifies his selection of most efficient means from among the available alternatives on the basis of scientific criteria for achieving maximum economic profits.

Tiongco and Hossain (2009) indicated that educated farmers have the ability to decide which modern varieties to grow among a wide range of choices.

2.1.13 Management orientation

Uddin *et al.* (2014) reported that all inputs were available but, due to a lack of proper management capacity in relation to farm size, large farms fail to adapt efficiently. The scarcity of labor may also be an additional motive not to engage in adaptive strategy adoption

2.1.14 Attitude towards improved rice varieties

Hossain (2006) noted that the highest proportion (45%) of the farmers belonged to moderately favorable attitude towards HYV rice as compared to 31 per cent had slightly favorable attitude and 24 per cent had a highly favorable attitude.

This indicates that 76 per cent of respondent farmers had slightly to moderately favorable attitude towards HYV rice. Nearly hundred per cent of respondents had slightly favorable to moderately favorable attitude towards adoption of selected HYV rice by the farmers. Chowdhury (2003), Sarker (2002) and Sadat (2002) also were more or less in conformity with this finding.

Usman *et al.* (2013) found out that most (55.8%) of the rice farmers were aware of the availability of improved rice varieties in their localities while 44.2% of the farmers were not aware of the presence of improved rice varieties in their localities. This indicates that information on the presence of improved rice technology was disseminated to the farmers.

Asmelash (2014) noticed that there is a highly significant variation between adopters and non-adopters at less than 1 per cent significant level and attitude was found to be an influential factor on adoption of improved upland rice variety. This is conceded with the research result obtained by Tesfaya (2009).

Sahu (2015) indicated that the majority of the respondents (66.67%) had moderately favorable attitude, followed by 30.83 per cent of them had most favorable attitude and only 2.50 per cent of respondents had less favorable attitude.

2.1.15 Adopter categories

Khan *et al.* (2013) reported that area lying to the left of the mean time of adoption minus two standard deviations included 5 per cent of individuals who were towards the beginning to adopt Binasail rice. They could be known as innovators. The next 13 per cent of the individuals between the mean minus one standard deviation and the mean minus two standard deviations to adopt Binasail rice were called as early adopters, the next 35 per cent of the mean minus one standard deviation. Between the mean and the mean plus one standard deviation to the right of the mean are located in the next 37 per cent to adopt the innovation (Binasail) *i.e.* the late majority. The last12 per cent to the right of the mean plus one standard deviation the adopter categories of the farmers regarding Binasail rice in two selected villages. This study slightly deviated from the normal distribution. Due to existence of unequal proportions (early majority 35% and the late majority 37%), were considered the mean value of the two proportions (35% and 37%) as 36. After taking mean time of the adoption of Binasail rice, categorization on the

basis of innovativeness of the farmers regarding Binasail rice is very close to the idea of Roger's adopter categories model.

Imtiaz *et al.* (2015) revealed that in upper class 59.45 per cent, in middle class 14.60 per cent and in lower class 0 (Zero) per cent of the framers in area are the early adopters of technology. In upper class 40.54 per cent, in middle class 78.65 per cent and in lower class 79.72 per cent of the framers in area are the followers of early adopters of technology. In upper class 0 per cent, in middle class 16.21 per cent and in lower class 20.27 per cent of the framers in area are laggards in adoption of technology.

2.1.16 Innovativeness of farmers

Khan *et al.* (2013) revealed that about three-fourths (72%) of the farmers had medium innovativeness for Binasail rice as compared to 17 per cent having high innovativeness and 11 per cent having low innovativeness. A majority of the farmers in the study area possessed medium to high innovativeness for Binasail rice, there is a possibility exists to improve agricultural production of the farmers through awareness.

2.1.17 Productivity of rice varieties

Sivagnanam (2014) noticed that relationship between manure, seeds, human and mechanized labor and they are positively related to the productivity of hybrid rice cultivation.

Koshta and Choudhary (2015) recorded that the growth in production and yield of rice notice increased significantly after formation of the Chhattisgarh state. It gives the clear indication of the impact of adoption of modern varieties by the farmers.

Sahu (2015) productivity (yield q ha^{-1}) of sugarcane was 300 q ha^{-1}, followed by maize (40 q ha^{-1}), rice and wheat (25 q ha^{-1}) both, rapeseed and mustard (11 q ha^{-1}) both, soybean (10 q ha^{-1}), chickpea (9 q ha^{-1}), blackgram (8 q ha^{-1}), linseed (7 q ha^{-1}) and lentil (6 q ha^{-1}), respectively.

Gupta (2015) reported that among the rice growing respondents, 43.4 per cent were reported that they were managed to harvest 10 to 15 q ha^{-1} rice followed by 30.2 per cent of them were receiving less than 10 q ha^{-1} productivity of rice.

About 26 per cent respondents were reported that they were attaining rice yield more that 15 q ha^{-1}

2.2 Diffusion pathway of different released rice varieties

Diagne (2006) revealed that the NERICA probability of an adoption in the population is estimated to be 27%. Reflecting the presently very limited extent diffusion of the NERICA varieties in Core d'Ivoire, a very large downward bias is found to be 4%. Hence, if the diffusion of NERICA were complete in 2000, the NERICA adoption would have been 23% higher than the 4% sample adoption rate.

Charyulu *et al.* (2013) revealed that the rate of adoption improved sorghum cultivars in different states is presented based on 2006-08 mean crop estimates, the highest adoption was noticed because here diffusion in 2006-08 highest in case of Maharashtra followed Madhya Pradesh and Tamil Nadu.

Dandedjrohoun *et al.* (2014) depicted that diffusion and adoption rates increased from 2004-2008. The rise in the diffusion rate from 2.5% (in 2004) to 85% (in 2008) results from efforts at disseminating the technology during that period. Dassa commune, the highest diffusion rate (90%) observed in 2008 was in Savalou. All of the NGOs in charge of the diffusion of the improved parboiling technology in the surveyed zones intervened in Savalou. This suggests that the significant presence of NGOs in Savalou played a key role in improving the diffusion rate of technology in that commune.

2.3 Adoption of popular rice varieties

Saka *et al.* (2005) indicated that substantial proportion of land area grown to rice was cultivated with improved rice varieties with an adoption rate of 68.7% while the adoption rate for local varieties was estimated as 31.3%. The improved rice varieties grown by the farmers included ITA 150, WAB 189, ITA 235, WITA 4, ITA 315, ITA 321, ITA 128, ITA 360, WAB 450.P31, WAB 450-131 and WITA 1, while the local varieties consisted of Ofada, Eleefa, Ilesa, Ode-omi, Benue local, Akure local and Mokwa. ITA 150, WAB 189, ITA 235 and WITA 4 are the prominent improved rice varieties while Ofada, Eleefa, Ilesa and Ode-omi are the local varieties commonly grown by the farmers in order of importance.

Udoh and Omonona (2008) indicated that educational attainment, access to extension agents, access to credit, access to augmented inputs, farm size and crop yield were significant determinants of adoption of improved rice varieties.

Jirgi *et al.* (2009) noticed that 92 per cent of the respondents adopted improved rice varieties to obtain more yield and income, 21 per cent adopted because it matures early, while 10 per cent adopted in order to have long grain rice which is more marketable than short grain.

Dibba *et al.* (2012) indicated that adoption rates were 2 per cent in 2001, which increased gradually to 40 per cent in 2006. The highest sample adoption rate, in 2006, was observed in WR (54%) and the lowest in NBR (29%). With the exception of CRRs, the sample adoption rate was less than 40 per cent for the all remaining regions.

Usman *et al.* (2013) incorporated that most (60.8%) of the farmers did not adopt the introduced rice varieties while 39.2 per cent of the farmers adopted the varieties and the reasons for not adopting the improved rice varieties include Familiarity with the local varieties (67.5%), Susceptible to drought and pest attack (26.7%) and low yield (5.8%). The majority (75. 8%) of the farmers that accepted the introduced rice technology adopted the varieties during the dry season of the year while few (24.2%) adopted the varieties during the rainy season. As could be seen from the findings, the reasons for not adopting the technology by the farmers were not based on poor yield but sociocultural and psychological orientation.

Panda (2014) noted that the technologies viz. timely harvesting (98.33%), intercultural operation (97.50%) had more adoption by the farmers, followed by chemical control and line sowing with 91.67 and 85.00 per cent representation. Lesser adopted technologies were biological control and soil testing.

Koshta and Choudhary (2015) recorded that across the district level of Chhattisgarh, the area planted under MVs varied from minimum 40 to 90 per cent. The maximum percentage was planted in Dhamtari (98%) followed by Kanker (95%), Rajnandgaon (90%) and the minimum in Baster (40%), respectively. It is important to note that Baster and Surguja districts belong to Baster plateau and Northern hills agro-climatic zones of the state are so backward as compared to other districts of Chhattisgarh plains.

2.4 Knowledge about released rice varieties

Hossain (2006) indicated that the majority (75%) of the respondents had medium knowledge compared to 11 per cent fell in low knowledge and 14 per cent possesses high knowledge. It reveals that the majority 86 per cent of the farmers in the study area were under high knowledge to medium knowledge categories.

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

Lakra (2011) showed that the knowledge of selected practices of hybrid rice production technology. The maximum number of respondents (90.62%) had high level of knowledge of selection and preparation of land, followed by preparation of nursery 87.50 per cent, the knowledge of sowing method and seed rate 86.88 per cent, row to row distance and transplanting 57.50 per cent, method of storage 46.87 per cent, 38.76 per cent knowledge of manure and fertilizer, dose of manure and fertilizer 38.75 per cent, irrigation method 38.12 per cent, duration gap of irrigation 33.75 per cent, time and method of harvesting 31.25 per cent, soil fertility test 31.25 per cent, insect-pest control 30.63 per cent, seed treatment 25.63 per cent, disease control 25.00 per cent, Adoption of hybrid verities 24.37 per cent and weed control 16.25 per cent.

Shori (2011) indicated that the majority of respondents (78.12%) had medium level of knowledge regarding adoption of control measure practices of various weeds of rice crop, whereas, 14.37 and 7.51 per cent of the respondents were having low and high level of knowledge, respectively.

Narbaria (2013) revealed that the majority of the respondents (80.16%) had high level of overall knowledge, followed by 17.16 per cent of them had medium level of knowledge and only 2.38 per cent of them had low level of overall knowledge.

Umeh and Chukwu (2015) found out that majority (91.67 %) of the rice farmers are knowledgeable on availability and use of improved rice varieties; also, 87.50 per cent were aware of the use of agrochemicals in rice production while the knowledge of zero tillage was known by 85.42 per cent. Similarly, the use of fertilizer in rice cultivation was known by 83.33 per cent while proper spacing during transplanting was known by 77.08 per cent. Further analysis indicates that

improved nursery, timely transplanting, line planting and urea deep placement was known by 66.67 per cent, 64.58 per cent, 58.33 per cent and 53.75 per cent respectively. Most of the farmers (83.75%) were not aware of the use of modern rice milling, 78.33 per cent were not aware of improved processing techniques while fertilizer inculcation, optimum seed rate, and planting depth were not known by 63.75 per cent, 54.58 per cent, and 52.08 per cent respectively.

2.5   Preferential traits for selection of rice varieties

Asante *et al.* (2013) compiled that specific grain quality attributes such as grain length and shape, fragrance, cooking quality, grain color, and absence of foreign matter also positively influenced farmers' preference for varietal traits while chalkiness had a negative influence. Improving grain quality will increase consumer demand for locally produced rice and farmer preferences for improved rice varieties.

Borthakur *et al.* (2014) noticed that among 25 varietal attributes considered in the study, high yield got the highest mean score (9.60) for high yielding varieties (HYV) and was ranked one followed by low-cost benefit ratio (9.20) and fertilizer response (9.00). In case of traditional varieties 'resistance to insect and pests and pests' got the highest mean score (8.09) and ranked first followed by resistance to diseases (7.92) and high input costs (7.82). Farmers' preference towards attributes of recommended HYV had a positive and significant correlation with a number of family members engaged in farm activities and economic motivation.

Laborte *et al.* (2015) incorporated that farmers adopt MVs that are high yielding, mature faster, and have long and slender grains, high milling recovery, and intermediate amylase content. The amylase content of adopted varieties has been declining, suggesting value in developing softer rice. In addition, new MVs should have higher head rice recovery, less chalky grains, and better resistance to pests and disease.

2.6   Impact of different released rice varieties on annual income

Hossain *et al.* (2006) revealed that cultivation of MV reached 65per cent of the rice in 2001-02, 81 per cent for the dry season and 51 per cent for the wet season. The spread of MV has contributed to a growth in rice yield at 2.3 per cent

per year over the last three decades which has helped achieve a favorable food security situation despite the high growth of population and decline in Arabic land.

Udoh and Omonona (2008) noticed that the determinants of household poverty revealed that age, educational attainment, the extent of commercialization and probability of adoption negatively influenced household poverty, whereas household size exerted a positive impact on the household poverty levels. The negative impact of adoption of improved rice varieties on household poverty implicitly showed improvement in households' welfare that had adopted improved rice varieties. These results generally suggest the relevance of adoption of improved rice varieties in improving the welfare of rice farming households. It also suggests the relevance of human capital indices like education and extension services as drives of poverty alleviation and dissemination of new innovations to farming households.

Nguezet *et al.* (2011) concluded that positive and significant impact of NERICA variety adoption on farm household income and welfare measured by per capita expenditure and poverty reduction.

2.7   Constraints in speedy adoption

Kumar *et al.* (2010) revealed that the main constraints faced by pulse grower were non availability of improved variety seeds, manure and fertilizers in time, lack of knowledge regarding weed control and back of regulated market for sale.

Jalal-Ud-Din (2011) found that low literacy rate of the sample respondents was the major hurdle in the adoption of new agricultural technology, followed by small landholders, which was one of the major obstacles towards the adoption of new technology. It was also found that majority of the respondents were having low incomes, due to which they were unable to adopt new farm technology. Some respondents were having large families with great expenditure, which negatively affected the adoption of new agricultural technology.

Badhala and Bareth (2013) revealed that beneficiary and non-beneficiary farmers perceived more constraints for environments in adoption of improved mothbean production technology. Technical and miscellaneous constraints were

perceived least in adoption of mothbean production technology by the overall as well as non-beneficiary respondents.

Narbaria (2017) revealed that that in cereal based farming system resistance in adoption of new technology by neighboring farmers/relatives, attachment to the traditions (83.80%) and more attachment to social norms and culture (67.96%) were the major problem faced by the respondents under cereal based farming system. On other hand most of the respondents (45.42%) were also faced the problem of non adoption of society and lack of participation in socio-cultural activity (43.31%).

2.8   Suggestions for speedy adoption

Rao *et al.* (2001) observed in their studies in that majority of (80.80%) farmers suggested that in-service training should be provided to field extension workers on sustainable rice farming practices. As the field extension workers were lacking in knowledge regarding sustainable rice cultivation practices, in service training should be given to them to acquire the latest technology. Rice cultivation requires high input and intensive cultivation, so farmers must learn techniques from extension workers to reduce the pressure on production environment. The other suggestion were arranging field visits to the farmers that have been practicing sustainable agriculture and bringing out periodical publications on rice-farming with latest cultivation practices.

Chinchmalatpure and Mayani (2008) reported that the major suggestion were making available irrigation facilities, more off and on campus training programmes on new agriculture technology, more subsidy to purchase FYM / fertilizer / insecticide and timely availability of fodder.

Chhodavadia *et al.* (2013) revealed that the most important suggestion offered by 70 per cent and above respondents to overcome constraints in adoption of groundnut-pigeonpea relay cropping system were: remunerative price of the product should be made available (76.92%), farmers should be protected by crop insurance, if crops fail (73.08%), inputs should be made available at subsidized rate (72.12%), multiple resistant varieties should be developed (70.19%). The important suggestions as expressed below 70 per cent respondents were: village level workers should frequently contact the farmers to make them aware about new

farm technology (60.58%), demonstrations of new farm technology should be laid out on farmer's fields (56.73%), there must be regular electric supply at the time of critical irrigation (51.92%), training should be given to the farmers in relation to new farm technology (46.15%). It can be revealed that important suggestions offered by the majority (70.00%) respondents were: remunerative price of the product should be made available (Rank I) farmers should be protected by crop insurance, if crops fail (Rank II), inputs should be made available at subsidized rate (Rank III) and multiple resistance varieties should be developed (Rank IV). These findings are similar to Baidyavadra (1993), Chavda (1998) and Verma (2000).

Narbaria (2013) revealed that the majority of the respondents (61.11%) suggested that the trained labour should be available on low wage and the amount of subsidies on seed and fertilizers should be increased, 57.93 per cent of the respondents suggested that government should provide cono-weeder and marker, 47.61 per cent of them suggested that the price of hybrid rice should be low, 34.12 per cent of the respondents suggested that government should provided more knowledge about high yielding varieties, 23.80 per cent of the respondents suggested that government should provide subsidies on bio-fertilizers, 21.42 per cent of the respondents suggested that the trans planter should available on low price, 12.69 per cent of the respondents suggested that the Weedicides and pesticides should be available on low price, 9.52 per cent of the respondents suggested that Government should organize farmer's fair at village level, 8.74 per cent of the respondents suggested that government should provide knowledge about seedling management, 2.38 per cent of the respondents suggested that the timely availability of seeds and fertilizers should be maintained and Stem borer resistant variety should be available and 0.79 per cent of them suggested that the extension workers should visit one's in week.

CHAPTER-III
MATERIALS AND METHODS

The chapter covers precise method and procedure followed during the course of research work as well as preparation of the manuscript. The blueprint used in carrying out investigation has been outlined in this chapter. The bifurcation of research methodology adopted is given under following heads:

3.1   Location of the study area

3.2   Sample and sampling procedure

3.3   Variables of the study

3.3.1 Independent variables

3.3.2 Dependent variables

3.4   Operationalization of independent variables and their measurement

3.5   Operationalization of dependent variables and their measurement

3.6   Diffusion pathway of different newly released rice varieties

3.7   Preferential traits for selection of rice varieties

3.8   Impact of different newly released rice varieties on annual income

3.9   Constraints in speedy adoption

3.10   Suggestions for speedy adoption

3.11   Type of data

3.12   Developing the interview schedule

3.12.1 Validity

3.12.2 Reliability

3.13   Method of data collection

3.14   Statistical analysis

3.1   Location of the study area

Agro-climatic zones Chhattisgarh state, divided into three zones that are Chhattisgarh plains, Bastar plateau and Northern hills. The present study was carried out in Chhattisgarh plains zone. Total fifteen districts come under the plains zone. The soil of Chhattisgarh plains, so developed has been classified into four soil order, that is widely differ in their production potential and physical

characteristics. They are locally called, *bhata* (Entisols), *matasi* (Inceptisols), *dorsa* (Alfisols) and *kanhar* (Vertisols).

3.2 Sample and sampling procedure

3.2.1 Selection of districts

The study was conducted during the years 2015-16 and 2016-17 in the Chhattisgarh plains zone. There are total fifteen districts where four districts *i.e.* Raipur, Rajnandgaon, Dhamtari, Mahasamund (Fig 3.1) were purposively selected because in there, districts maximum newly released rice varieties were distributed.

3.2.2 Selection of blocks

Two blocks where maximum rice seed of newly released varieties was distributed were selected purposively from each selected district to make total eight blocks in the sample.

3.2.3 Selection of villages

Four villages where the maximum seed of newly released varieties was distributed were selected purposively from each selected block, thus total villages were thirty-two.

3.2.4 Selection of respondents

Ten respondents were selected randomly from each selected village, thus total respondents were three hundred twenty (32X10=320).

3.2.5 Selection of rice varieties

To determine the diffusion pathway, rice varieties released by the IGKV, Raipur during 2000-2015 were considered.

3.2.6 Data collection

The data were collected through well structured and pre-tested interview schedule.

3.2.7 Data analysis

The collected data were analyzed through appropriate statistical tools and methods.

3.3 Variables of the study
3.3.1 Independent variables
- Education
- Caste
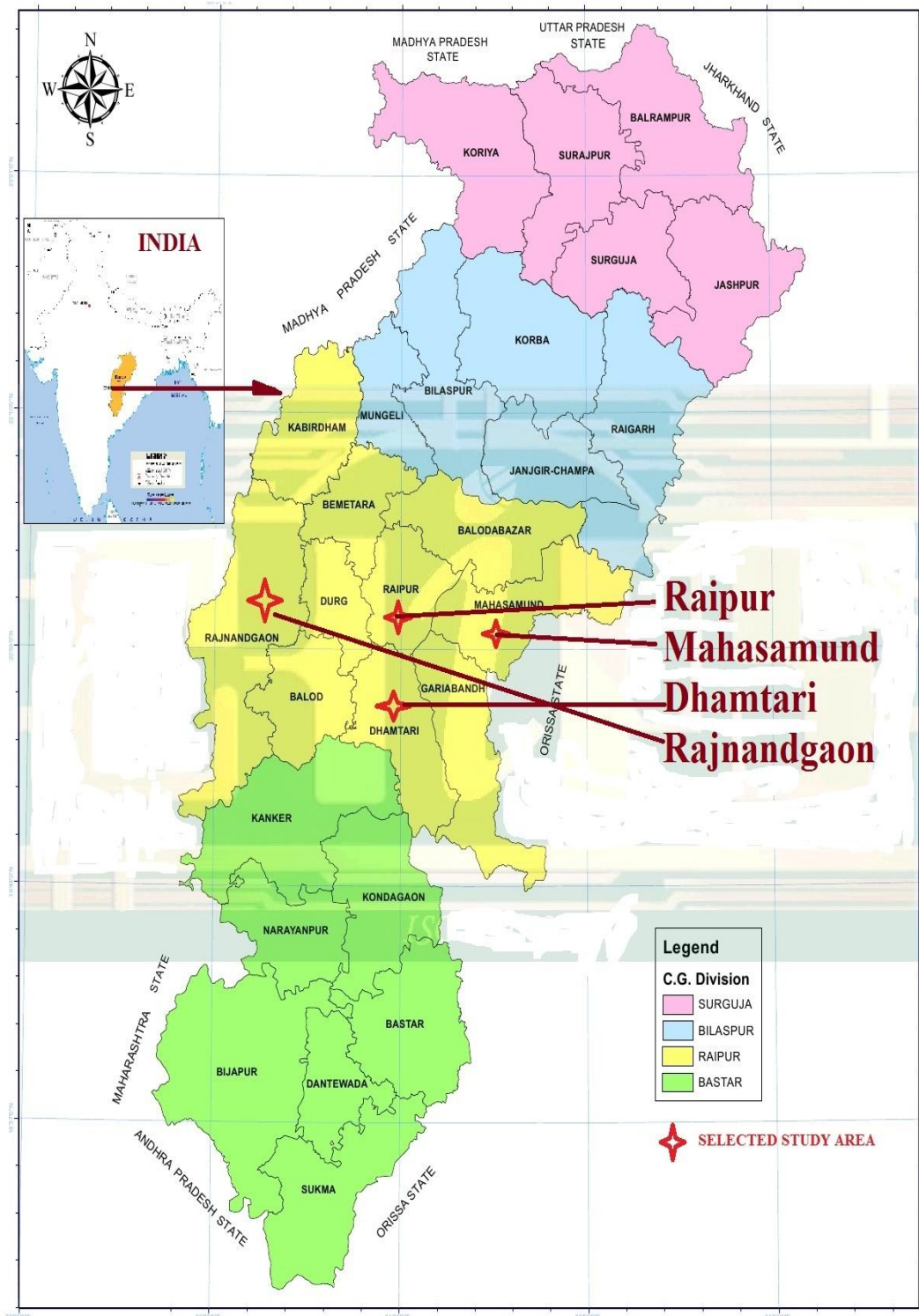
Fig 3.1: Map of the selected study area

- Size of family

- Social participation

- Farming experience

- Land holding

- Occupation

- Annual income

- Extension participation

- Source of information

- Credibility of information sources

- Extension contact

- Decision-making ability

- Attitude towards improved rice varieties

- Management orientation

- Adopters categories

- Innovativeness of farmers regarding IGKV rice varieties

- Productivity of rice varieties

3.3.2 Dependent Variables

- Knowledge about newly released rice varieties

- Extent of adoption of modern rice varieties

3.4 Operationalization of independent variables and their measurement

3.4.1 Education

The reading and writing capability acquired by the farmers was considered as their education status and it was categorized as followed by Painkra (2014):

Categories	Score
➢ Illiterate	0
➢ Primary school (1st to 5th class)	1
➢ Middle school (6th to 8th class)	2
➢ High school (9th to 10th class)	3
➢ Higher secondary (11th to 12th class)	4
➢ Graduation	5
➢ Post-graduation	6

3.4.2　Caste

Caste as an endogamous and hereditary subdivision of an ethnic unit occupying a position of superior rank or social esteem in comparison to other such division, In Chhattisgarh there are wide variability exists pertaining to sub caste of various caste. System in which an individual rank and it accompanying right and obligation is described on the basis of birth into particular groups as defined caste, The procedure followed by Raghuwanshi (2005) with partial modification and it was categorized as follows:

Categories	Score
➢　Scheduled Tribes (ST)	1
➢　Scheduled Caste (SC)	2
➢　Other backward class (OBC)	3
➢　General (GEN)	4

3.4.3 Size of family

On the basis of a number of members in the family of the respondents the following categories were made (Procedure followed by Khan *et al.* (2013) with partial modification:

Categories	Score
➢　Small family (1 to 4 members)	1
➢　Medium family (5 to 8 members)	2
➢　Large family (Above 8 members)	3

3.4.4 Social participation

The social participation of rice growers may influence their adoption behavior. Through social participation, respondents may get an opportunity for more learning/exposure towards new ideas and may be motivated for adoption. The term social participation in this study refers to the degree of involvement of the respondents in formal/informal organizations as a member or executive/office bearer or both. A social participation score was computed for each respondent on the basis of their membership (s) and position in various formal/informal organizations. The scoring was done in the following manner:

Categories	Score
➢ Participation in one organization	1
➢ Participation in two organizations	2
➢ Participation in more than two organization	3

3.4.5   Farming experience

The experiences of respondents were categorized on the basis of years spent in the rice cultivation. The respondents were categorized as follows:

Categories	Score
➢ Up to 10 years	1
➢ 11 years to 20 years	2
➢ 21 years to 30 years	3
➢ More than 30 years	4

3.4.6   Land-holding

3.4.6.1 Categories of farmers

The land holding of the respondent's family was considered as an important factor influencing the process of the adoption. It may be related to cropping pattern, annual income, social status and contacts with an extension agent. The measurement used which is followed by Bawajir and Nandapurkar (1985) in the following manner:

Categories	Score
➢ Marginal (Up to 1 ha)	1
➢ Small (1.01 ha to 2.0 ha)	2
➢ Medium (2.1 ha to 4 ha)	3
➢ Big (Above 4 ha)	4

3.4.6.2 Land parcels

It is an extended area of land or we can say piece of land, which is categorized in following manner:

Categories	Score
➢ Up to 5 land parcels	1
➢ 6-10 parcels	2
➢ 11 to 15 land parcels	3
➢ More than 15 land parcels	4

3.4.7 Occupation

The occupation held by the rice growers such as agriculture, agriculture labour, other labour, services Animal Husbandry, business and other (like: non-timber forest produces etc.) was included in the study. The kinds of the occupation practiced by the respondents were categorized for analysis in following manners:

Categories	Score
➢ One occupation	1
➢ Two occupations	2
➢ Three occupations	3
➢ More than three occupations	4

3.4.8 Annual income

In the study, total annual incomes from all the available sources of respondents were calculated and then the respondents were categorized in the following manner:

Categories	Score
➢ Up to ₹50,000	1
➢ ₹50,001 to ₹1,00,000	2
➢ ₹1,00,001 to ₹1,50,000	3
➢ ₹1,50,001 to ₹2,00,000	4
➢ More than ₹2,00,000	5

3.4.9 Extension participation

The extension participation of rice cultivars may influence their adoption behaviour. Through extension participation farmer may get the opportunity for more learning/exposure towards new ideas and may be motivated for adoption. The term extension participation in this study refers to the degree of involvement of the respondents in various extension activities. The total score of an individual respondent was sum of the items in which respondent had participated. The individual respondent score was obtained by summing up the scores of all the items. The overall scores of the respondent were obtained and according to their involvement in extension activities, they were categorized as follows

Categories	Score
➢ Low participation	1
➢ Medium participation	2
➢ High participation	3

3.4.10 Source of information

Source of information are supposed to directly associate with the adoption of any innovation. These information sources provide different information to the respondents regarding newly released rice varieties and production technology of rice. For assessing this variable, different sources of information were identified. To determine the extent of utilization of each information source, the responses of the farmers were recorded and presented in frequency and percentage.

Afterwards, the respondents were categorized for analysis on the basis of using number of sources as follows:

Categories	Score
➢ Up to 3 sources	0
➢ 4 to 6 sources	1
➢ 7 to 9 sources	2
➢ More than 9 sources	

3.4.11 Credibility of information sources

Credibility means trustworthiness or the quality of being believable and it is categorized in following manner:

Credibility of source	Score
➢ Nil	0
➢ Partial	1
➢ Full	2

Afterwards for the calculation of overall credibility of sources, following formula used:

$$CIi \quad = \quad \frac{Oi}{Si} \quad X \quad 100$$

Where,

Cl i = Credibility index for *i th* respondent

Oi = Total score obtained by *i th* respondent

S = Maximum obtainable score

3.4.12 Extension contact

This is operationally defined as the "frequency with which a respondent comes in contact with extension personnel i.e. RAEOs, SADOs, SMS, Agriculture scientists". The extent of contact was measured by four point continuum scale *viz*., never, sometimes, always and regularly with a score 0, 1, 2 and 3, respectively. On the basis of overall obtainable score, the respondents were grouped in four categories as following manners:

Categories	Score
➢ Low contact	1
➢ Medium contact	2
➢ High contact	3

3.4.13 Decision-making ability

It is the degree to which an individual justifies his selection of most efficient means from the available alternatives on the basis of scientific criteria for achieving maximum economic profits. This is measured with the help of partially modified scale developed by Nandapurkar (1981).

It consisted of 9 items each with 3 point response continuum namely agree, disagree and undecided with a score of 2, 1 and 0, respectively. Based on the total score obtained by the respondents, they were grouped into three categories namely, low, medium and high by considering mean score and standard deviation and the sum was used for analysis.

3.4.14 Attitude towards improved rice varieties

An attitude may be defined as a predisposition to act towards an object in a certain manner. The attitude of farmers towards HYV rice was used to refer to his

belief, feelings, and action towards the various aspects of modern agricultural technologies. It was measured with little modified scale followed by Hossain (2006), by constituting 9 statements. A statement was considered positive if it possessed an idea favorable towards HYV rice cultivation. On the other hand, a statement was considered negative if it was unfavorable towards HYV rice cultivation. The respondents were asked to express their opinion in the form of 'agree' or 'disagree' or' undecided'. A score of 2 was given to 'agree' 1 was given to 'disagree' and 0 was given to 'undecided' if the statement was positive. A reverse scoring method was followed in case of statement considered negative. Attitude score of respondent was determined by summing the scores obtained by him for all the items in the scale. Based on the total score obtained by the respondents, they were, grouped into three categories namely low, medium and high taking mean and standard deviation.

3.4.15 Management orientation

It is operationally defined as the degree to which a farmer is oriented towards scientific farm management comprising planning, production, and marketing function of the farm. This was measured with a partially modified scale developed by Samanta (1977).

The scale consisted, nine statements, three statements (each) for planning, production and marketing orientation. In each group, positive and negative statements were mixed. Each item is provided with three-point responses continuum. The positive statements were given a score of two for agree, one for disagree and 0 for undecided and vice-versa in case of a negative statement. The score for each individual on the management orientation scale is obtained by summation of the score awarded for each of the items included. Based on the total score obtained by the respondents, they were, grouped into three categories namely low, medium and high taking mean and standard.

3.4.16 Adopter categories

To analyze this variable procedure follow by Khan (2013) were following with slight modification on the basis of innovativeness of respondents (pertaining to taking years to adopt a variety after its release) was categorized under innovators, early adopters, early majority, late majority and laggards categories.

These categories were compared with the categories suggested by Rogers (1983) under ideal condition.

3.4.17 Innovativeness of farmers regarding IGKV rice varieties

Innovativeness referred to the degree to which a farmer was relatively earlier in adopting IGKV released rice varieties. As matter of fact, all the farmers included in the sample were IGKV rice varieties growers. Since IGKV rice varieties was first adopted in the study area in 1997, the highest adoption period for the farmer in respect to IGKV rice varieties was 20 years.

The possible innovativeness scores of the farmers regarding IGKV rice varieties could range from 1-20, while 1 indicated very low innovativeness and 20 indicating very high innovativeness. However, the observed innovativeness scores of the farmers regarding IGKV rice varieties were used for analysis (procedure followed by Khan *et al.* (2013) with partial modification). Obtained scores by respondents categorized on the basis of mean and standard deviation for presentation.

Basis of categorization	Categories of innovativeness
➢ Mean-SD	Low innovativeness (Less than 12.05 score)
➢ Mean+SD	Medium innovativeness (12.05 to 19.11 scores)
➢ Above Mean+SD	High innovativeness (More than 19.11 scores)

3.4.18 Productivity of rice varieties

Productivity that shows us how a specific crop variety performs on given area, which is calculated as follows and actual productivity of rice was used for analysis

$$\text{Productivity} = \frac{\text{Production (Q.)}}{\text{Area (ha.)}}$$

$$\text{Weighted average productivity of rice} = \frac{\sum \text{Area of rice variety X Productivity of rice variety}}{\text{Total rice cultivation area}}$$

3.5   Operationalization of dependent variables and their measurement

3.5.1   Knowledge

3.5.1.1 Awareness about various rice varieties:

Awareness is quality or state of being aware, knowledge and understanding that something is happening or exists. Data were presented as frequency and percentage.

3.5.1.2 Knowledge about newly released rice varieties

English and English (1961) defined knowledge, as a body of understandable information possessed by an individual or by culture.

Rogers (1983) stated that knowledge is of three types namely awareness knowledge, how to knowledge and principle knowledge. In the present study awareness knowledge was studied and the study is confined, to the newly released rice varieties by IGKV. Each respondent was asked to answer of questions about listed released rice varieties by IGKV, here these indicators of knowledge were selected *i.e.* developed year, developed by which institution, listen, maturity duration, productivity and last one is their major characteristic. Very small scores obtained by respondents for first two indicators that is developed year and developed by which institution, so these two indicators removed from the analysis. 3 indicators have taken for the determining the knowledge about IGKV rice varieties, 2 score was given for full knowledge, 1 score was given for partial knowledge and 0 score was given for no knowledge about given varieties. The summation of obtained score for IGKV rice varieties were calculated and used for analysis according to given formula:

$$KI_i = \frac{\sum O_i}{\sum S_i} \times 100$$

Where,

KI_i = Knowledge index for i^{th} respondent

$\sum O_i$ = Total score obtained by i^{th} respondent

$\sum S_i$ = Maximum obtainable score

3.5.2 Extent of adoption of modern rice varieties

It is mental process through which an individual passes from hearing about an innovation to final adoption (Rogers, 1995). For analysis purpose per cent rice area under IGKV rice varieties from total rice area of each respondent were calculated and applied.

3.6 Diffusion pathway of different newly released rice varieties

Diffusion can be defined as a process by which an innovation is communicated through certain channels over a certain period of time among the members of a social system. Diffusion pathway means spread of innovation through a route, formed by a chain.

Diffusion pathway measured as how much rice varieties (innovation) spread in which route or chain, among respondents farmer. Disseminated rice varieties was calculated and presented on the basis of frequency and percentage.

3.7 Preferential traits for selection of rice varieties

To determine the farmers' preference for rice varieties based on varietal attributes, a total 10 varietal attribute were selected and asked questions to answer, and give rank for each attribute 5 ranks for most preferential attribute and 1 rank for worst trait. Aggregate rank was calculated and presented on the basis of percentage.

Rank correlation also calculated between preferential traits for selection of rice varieties in rainfed and irrigated land situation, rank correlation calculated as following formula:

$$\text{Rank correlation} = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

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

3.8   **Impact (Share/contribution) of different newly released rice varieties on annual income**

Total annual income was calculated for each of respondent from different sources including agriculture as well as rice family. The shares of IGKV rice varieties was calculated and presented as percentage.

3.9   **Constraints in adoption of rice varieties**

Speedy means a process; event or action happens or is done very quickly. Respondents were report to the constraints faced by them in speedy adoption of newly released rice varieties. The constraints so obtained were summarized on the basis of number and percentage.

3.10   **Suggestions for speedy adoption**

Respondents were asked to give their valuable suggestions to overcome the constraints faced by them in a speedy adoption of newly released rice varieties and the suggestions offered were summarized on the basis of frequency and per cent of respondents.

3.11 Type of data

The following types of the data were obtained from the respondent in view of the objectives of the study:

1. Data pertaining to the socio-economic profile of rice growers,
2. Data regarding the diffusion pathway of different newly released rice varieties by IGKV, Raipur,
3. Data regarding the extent of adoption of different popular rice varieties,
4. Data regarding the preferential traits for selection of rice varieties,
5. Data regarding the impact of different newly released rice varieties on annual income,
6. Data regarding a suggestion for speedy adoption.

3.12   **Developing the interview schedule**

The interview schedule was designed on the basis of objectives and independents and dependent variables in the present investigation. To facilitate the respondents, the interview schedule was framed in "Hindi". Each question was thoroughly examined and discussed with the experts before finalizing the interview

schedule. Adequate precautions and care were taken into consideration to formulate the questions in a manner that they were well understood by the respondents and would find it easier to respond.

The prepared interview schedule was used in the study area for collecting the data. On the basis of experience gained in pre-testing, the necessary modifications and suggestions were incorporated before giving a final touch to interview schedule.

3.12.1 Validity

Validity refers to "the degree to which the data collection instruments measures what it is supposed to measure rather than something else". The validity of interview schedule used for this study was maximized by taking following steps:

1. The interview schedule was thoroughly discussed with the concerned scientists and member of the advisory committee and their suggestions were incorporated.
2. Pre-testing of interview schedule provided an additional check for improving the instrument.
3. The relevancy of each question in terms of objectives of the study, their logical order, and wordings of each question was checked carefully.

3.12.2 Reliability

Reliability of an interview schedule refers to "its consistency or stability in obtaining information from respondents".

The test-retest method of estimating the reliability of an interview schedule was followed in this study. Thirty respondents of the study area were randomly selected and interviewed and they were re-interviewed after 2 to 3 weeks by using the same interview schedule followed at the time of the first interview. Since same responses were observed, the reliability of the interview schedule was ensured.

3.13 Method of data collection

Respondents were interviewed through personal interview. Prior to the interview, respondents were taken into confidence by revealing the actual purpose of the study and also full care was taken to develop a good rapport with them. They were assured that the information given by them would be kept confidential. The

interview was conducted in the most formal and friendly atmosphere without any complications.

3.14 Statistical analysis

The data collected during the course of the investigation was tabulated into the coding sheet and then appropriate analysis of data was made according to objectives as suggested by Cochran and Cox (1957). The statistical techniques were applied in the form of frequency, percentage, mean, standard deviation, the coefficient of correlation, etc. the analysis done with help of computer application *i.e.* Analysis tool pack in word excel and SPSS software.

Fig 3.2: Photograph during the data collection

CHAPTER-IV
RESULTS AND DISCUSSION

This chapter deals with the results obtained on various aspects of the study and supported with a suitable discussion on each finding. The data were collected through pre-tested interview schedule on the basis of objectives of the study. The collected data were classified, tabulated, analyzed, presented, interpreted and discussed systematically.

The findings of the study are presented and discussed under the following heads:

4.1   Socio-personal characteristic of the respondents

4.2   Socio-economic characteristic of the respondents

4.3   Communicational characteristic of the respondents

4.4   Socio-psychological characteristics of the respondents

4.5   Awareness about various rice varieties

4.6   Knowledge of the respondents about released rice varieties

4.7   Adoption of rice varieties

4.8   Adopter's categories of adopters of IGKV rice varieties

4.9   Reasons for the adoption of rice varieties

4.10   Reasons for the non-adoption of IGKV rice varieties

4.11   Reason for discontinuation/reversion of the cultivation of IGKV released rice varieties

4.12   Innovativeness of the respondents for IGKV released rice variety

4.13   Diffusion pathway of rice varieties

4.14   Preferential traits for selection of rice varieties

4.15   Impact (share/contribution) of different released rice varieties on annual income

4.16   Constraints of the respondents in a speedy adoption of IGKV released rice varieties

4.17   Suggestions for a speedy adoption of IGKV released rice varieties

4.18   Correlation analysis of variables

4.19   Multiples regression analysis of variables

4.1 Socio-personal characteristic of the respondents

Education, caste, size of family, social participation, experience in rice cultivation a were considered as socio-personal characteristics of the respondents. These characteristics were analyzed and presented in Table 4.1.

4.1.1 Education

Education is the determinant of knowledge, which is associated with adoption and better learning about new technologies in agriculture and allied fields. Education of the respondents was categorized into 7 categories as given in Table 4.1, majority (50.31%) of the respondents were educated up to high school (9th to 10th class) followed by 18.31 per cent of the respondents had primary school level education (1st to 5th class), 16.25 per cent respondents were educated up to middle school (6th to 8th class), 10.63 per cent of the respondents were educated up to higher secondary school (11th to 12th class), 2.50 per cent respondents were educated up to graduation level, whereas only 2.19 per cent of the respondents had education up to post graduation level. Overall respondents were well educated and no one was illiterate. It may due to more number of schools (government & private sector), good education facilities *etc* in Chhattisgarh plains. Similarly, Saka *et al.* (2005) noted that 93.7 per cent of respondents were educated.

4.1.2 Caste

The date presented in Table 4.1 reveals that the highest (68.13%) respondents were Other Backward Class (OBC) followed by Scheduled Tribes (ST) (17.50%), and Scheduled Caste (SC) (8.75%). only 2.50 per cent respondents belonged to General caste category. Whereas, whole Chhattisgarh has the highest population of Scheduled Tribes (31.80%), followed by Other Backward Class (14.00%) and 12 per cent scheduled caste (Anonymous, 2001).

4.1.3 Size of family

Family size of the respondents were categorized in 3 groups (Table 4.1), where majority (56.56%) of the respondents belonged to medium family (5 to 8 members) followed by 21.88 per cent belonged to small family (1 to 4 members) and 21.56 per cent large family (more than 8 members). Probable reason for this may be that still small family norm is not accepted to large extent by rural people.

The other contributing reason might be agriculture which is the main occupation of the families of the respondents. It needs team work and requires more number of persons for its labour intensive work.

Table 4.1: Distribution of respondents according to their socio-personal characteristics

Particulars	Frequency	Percentage
• **Education**		
1 Illiterate	0	0.00
2 Primary school (1st to 5th class)	58	18.13
3 Middle school (6th to 8th class)	52	16.25
4 High school (9th to 10th class)	161	50.31
5 Higher secondary school (11th to 12th Class)	34	10.63
6 Graduation	8	2.50
7 Post-graduation	7	2.19
• **Caste**		
1 Scheduled Tribes	56	17.50
2 Scheduled Castes	28	8.75
3 OBC	218	68.13
4 General	8	2.50
• **Size of family**		
1 Small family (1 to 4 members)	70	21.88
2 Medium family (5 to 8 members)	181	56.56
3 Large family (more than 8 members)	69	21.56
• **Social participation**		
1 Participation in one organization	41	12.81
2 Participation in two organizations	227	70.94
3 Participation in more than two organizations	23	7.19
• **Experience in rice cultivation**		
1 Up to 10 years	3	0.94
2 11 to 20 years	185	57.81
3 21 to 30 years	89	27.81
4 More than 30 years	43	13.44

Whereas, Khan *et al* (2013) found that the highest proportion of the farmers had medium family size as compared to 36 per cent having small and 12 per cent large family size.

4.1.4 Social participation of the respondents

Social participation refers to individual's degree of participation in a community of society. With regards to social participation (Table 4.1), explicit majority (70.94%) of the respondents participated in two organizations followed by 12.81 per cent of the respondents participated in only one organization and 7.19 per cent of the respondents participated in more than two organizations. Whereas, Kumar *et al.* (2013) found that more than four-fifths of the surveyed had no membership in any organization, indicating very poor social participation.

4.1.5 Experience of the respondents in rice cultivation

Regarding experience of the respondents in rice cultivation (Table 4.1), majority (57.81%) of the respondents had 11 to 20 years experience of rice cultivation followed by 27.81 per cent respondents had 21 to 30 years, 13.44 per cent respondents had more than 30 years experience and only 0.94 per cent of the respondents had less experience (up to 10 years). An overall experience of rice cultivation was high, because rice is the major crop of Chhattisgarh and near about all the respondents totally depended on rice cultivation.

4.2 Socio-economic characteristic of the respondents

The independent variables i.e. land holding, occupation and annual income were considered as socio-economic characteristics of the respondents.

4.2.1 Land ownership, soil type and irrigation availability

Regarding ownership the data given in Table 4.2 reveals that the all 320 respondents had 1015.78 ha cultivable land out of which 85.99 per cent land owned by the respondents and 14.01 per cent land were under lease.

Chhattisgarh has different soil orders that widely differ in their production potential and physical characteristics. They are locally called *Bhata, Matasi, Dorsa* and *Kanhar* in Chhattisgarh plains. Regarding soil type in Chhattisgarh plains, the data given in Table 4.2 reveals that total 1015.78 ha land was cultivable, in which 44.71 per cent land was *Vertisols (Kanhar)*, 29.67 per cent land was *Inceptisols*

(Matasi), 14.96 per cent land was *Alfisols (Dorsa)* and 10.65 per cent land was *Entisols (Bhata).*

The data given in Table 4.2 reveals that out total 1015.78 ha cultivable land amongst 320 respondents, majority of the land (58%) was irrigated, whereas 42 per cent land was rainfed. Fig 4.1, lightened that out of total irrigated land (589.08 ha), more than 50 per cent was under *Vertisols (Kanhar)* followed by 26 per cent under *Inceptisols (Matasi)*, 14 per cent under *Alfisols (Dorsa)* and only 1 per cent under *Entisols (Bhata).* Fig 4.2, illustrated that out of total rainfed land (426.70 ha) the highest 34 per cent was under *Inceptisols (Matasi)*, 26 per cent under *Vertisols (Kanhar)* soils, 24 per cent under *Entisols (Bhata)* soils and only 16 per cent under *Alfisols (Dorsa).*

Table 4.2: Land ownership, soil type and irrigation availability

Particulars	Area (ha)	Percentage
• **Ownership of cultivable land**		
1 Total owned land	873.47	85.99
2 Total leased in land	142.31	14.01
Total cultivable land	1015.78	100
• **Soil type**		
1 *Entisols (Bhata)*	108.16	10.65
2 *Inceptisols (Matasi)*	301.42	29.67
3 *Alfisols (Dorsa)*	152.00	14.96
4 *Vertisols (Kanhar)*	454.20	44.71
Total land holding	1015.78 ha	
• **Area under irrigation**		
1 Rainfed land	426.70	42.00
2 Irrigated land	589.08	58.00

4.2.2 Categories of farmers according to land holding

With regards to categories of farmers according to land holding, Table 4.3, elaborated that farmers categorized in four categories according to their land holding, whereas, highest respondents were medium farmer (2.1 ha to 4 ha)

followed by 23.13 per cent of the respondents were small farmer who had land ranged from 1.01 ha to 2.0 ha, 16.88 per cent respondents were big farmer who had above 4 ha land and only 5.9 per cent respondents were marginal farmer who had up to 1 ha land. Overall results showed that nearly all the respondents had a good size of land for the different purpose.

Regarding range of land parcels the data given in Table 4.3, elaborated that majority (33.75%) respondents had up to 5 land parcels or land fragments, followed by 38.44 per cent of the respondents had 6 to 10 land parcels, 11.88 per cent respondents had 11 to 15 land parcels, though only 10.94 per cent respondents had more than 15 land parcels. After calculation of overall data regarding land parcels, data reveals that average number of parcels per family was 9 and their average size of per parcel was 0.35 ha.

Table 4.3: Distribution of the respondents according to their land holding

Particulars	Frequency	Percentage
• **Category of farmers**		
1 Marginal (Up to 1 ha)	19	5.94
2 Small (1.01 ha to 2.0 ha)	74	23.13
3 Medium (2.1 ha to 4 ha)	173	54.06
4 Big (Above 4 ha)	54	16.88
• **Availability of land parcels (Per family)**		
1 Up to 5 land parcels	124	38.75
2 6 to 10 land parcels	123	38.44
3 11 to 15 land parcels	38	11.88
4 More than 15 land parcels	35	10.94
Average number of parcels/family	9.14≈9	
Average size of parcel	0.35 ha	

4.2.3   Occupation

With respect to occupation, the data presented in Table 4.4 reveals that the highest (97.81%) respondents were doing agriculture as a major occupation, whereas, only 2.19 per cent of the respondents were doing agriculture as a
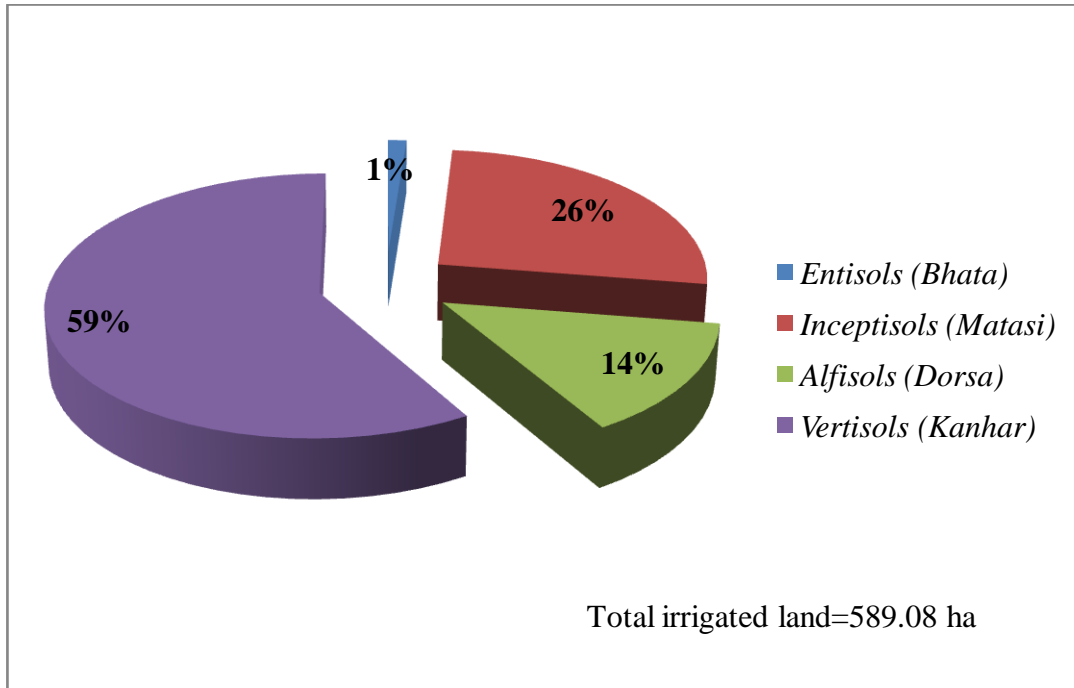
Fig 4.1: Availability of various soil types in irrigated land
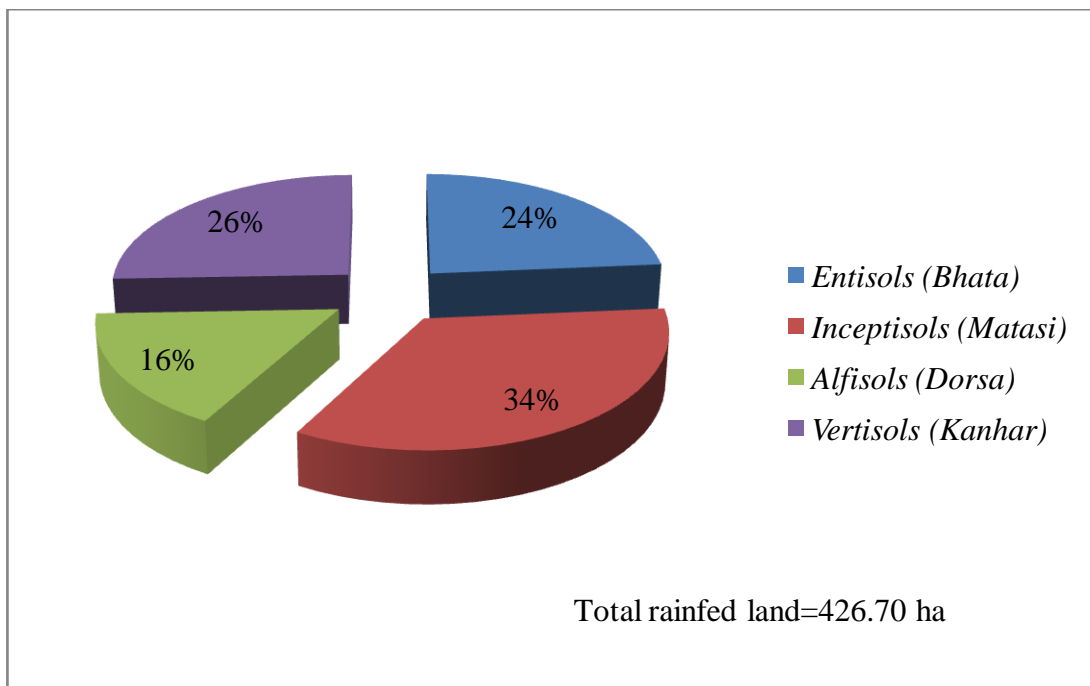
Fig 4.2: Availability of various soil types in rainfed land

subsidiary occupation. 66.25 per cent of the respondents worked as the subsidiary occupation of other labor *i.e.* home construction, road construction etc., 60.94 per cent of the respondents worked as agriculture labour *i.e.* sowing, transplanting etc. as a subsidiary occupation, 2.19 per cent of the respondents were doing the job as the main occupation, while 12.81 per cent of the respondents were doing the job as subsidiary occupation it means that respondents had a small job so that they did not completely dependents on the job. 29.69 per cent of the respondents doing business as a subsidiary occupation. 25.31 per cent of the respondents were doing animal husbandry as a subsidiary occupation. Results explained that majority of respondents completely depend on agriculture and doing some other work in off-season of agriculture farming. Almost similar finding were reported by Meena *et al.* (2012), who found that the majority of respondents were engaged in agriculture. It was also reported by Pradhan (2014) that almost all the respondents were involved in agriculture followed by labour and animal husbandry.

Table 4.4: Distribution of respondents according to their occupation

| Sl. No. | Occupation | Type of occupation | | | |
| | | Main occupation | | Subsidiary occupation | |
		F	%	F	%
1	Agriculture	313	97.81	7	2.19
2	Agriculture labour	0	0.00	195	60.94
3	Other labour	0	0.00	212	66.25
4	Job	7	2.19	41	12.81
5	Business	0	0.00	95	29.69
6	Animal husbandry	0	0.00	81	25.31

Note: Data are based on multiple responses, F=frequency

4.2.3.1 Involvement of respondents in occupation

The data presented in Table 4.5 and Fig 4.3 indicates that the majority (33.75%) of the respondents were involved in one occupation followed by 31.25 per cent of the respondents involved in three occupations, 29.69 per cent of the respondents were involved in more than three occupations, and only 5.31 per cent of the respondents were involved in two occupations.

Table 4.5: Distribution of the respondents according to their involvement in number of occupation

Sl. No.	Involvement	Frequency	Percentage
1	One occupation	108	33.75
2	Two occupations	17	5.31
3	Three occupations	100	31.25
4	More than three occupations	95	29.69

4.2.4 Annual income

Regarding annual income of the respondents, the data given in Table 4.6 reveals that 35.31 per cent of the respondents had annual income ₹ 50001 to ₹100000 followed by 33.75 per cent had annual income up to ₹ 50000, 18.13 per cent respondents had annual income ranged from ₹150001 to ₹ 200000, 5.63 per cent respondents had annual income ranged from ₹100001 to ₹150000 and only 7.81 per cent respondents had high annual income that was more than ₹200001.

Table 4.6: Distribution of the respondents according to their annual income

Sl. No.	Annual income	Frequency	Percentage
1	Up to ₹ 50000	108	33.75
2	₹ 50001 to ₹100000	113	35.31
3	₹100001 to ₹150000	25	7.81
4	₹150001 to ₹200000	58	18.13
5	More than ₹200001	16	5.00

Respondents had different sources of annual income (Fig 4.4), where 50 per cent annual income earned through agriculture followed by 28 per cent annual income got through business, 10 per cent annual income earned from other labour *i.e.* home construction, road construction etc. 5 per cent annual income comes from job, 4 per cent income comes from other labour *i.e.* sowing, transplanting etc. and only 4 per cent annual income comes from animal husbandry, which means respondents not well focused on animal husbandry for the collection of annual income.

Second large source of annual income was business; because the study area falls under Chhattisgarh plains zone, where most of the people were well educated and had well-transporting facilities. Agriculture labor contribution in annual income was poor because of most of the respondents' used machinery for agricultural practices.

4.3 Communicational characteristic of the respondents

In the process of transfer of technology, a large number of agencies are engaged such as of intermediary field functionaries and several other types of media. Some of these agencies or media are very effective as compared to others and have their own credit worthiness in communication of messages. The profile of respondents on the basis of their communicational characteristics is also considered. Under the category of communicational characteristics three variables i.e. extension participation, source of information regarding rice varieties and contact with extension personnel are discussed.

4.3.1 Extension participation of the respondents

Regarding extension participation of the respondents, the data presented in Table 4.7 reveals that that majority (94.38%) of the respondents had observed neighbor's demonstration field followed by 94.06 per cent of the respondents had discussed with extension agent, 72.81 per cent of the respondents had participated in extension meeting, 60.63 per cent of the respondents had participated in farmers fare, 58.13 per cent of the respondents had demonstration conducted on their own field, 35 per cent of the respondents had participated in farmer's day, 23.44 per cent of the respondents had read extension publication, 20.63 per cent of the respondents had visited agriculture college and research centre, while 18.13 per cent of the respondents had used the radio and television for the agricultural information.
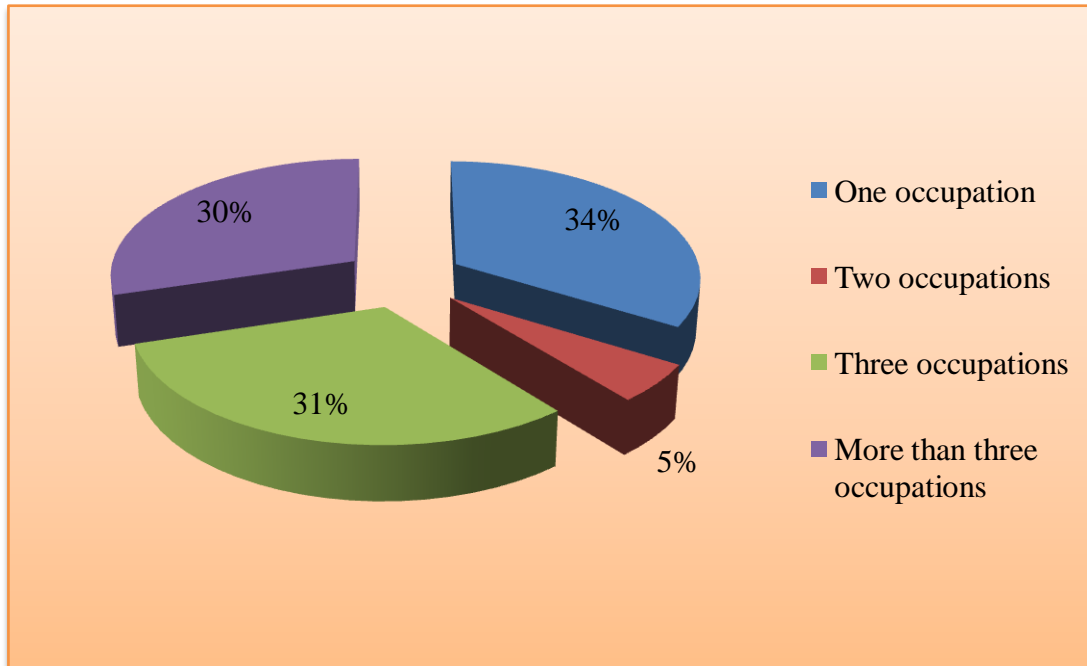
Fig 4.3: Involvement of respondents in occupation
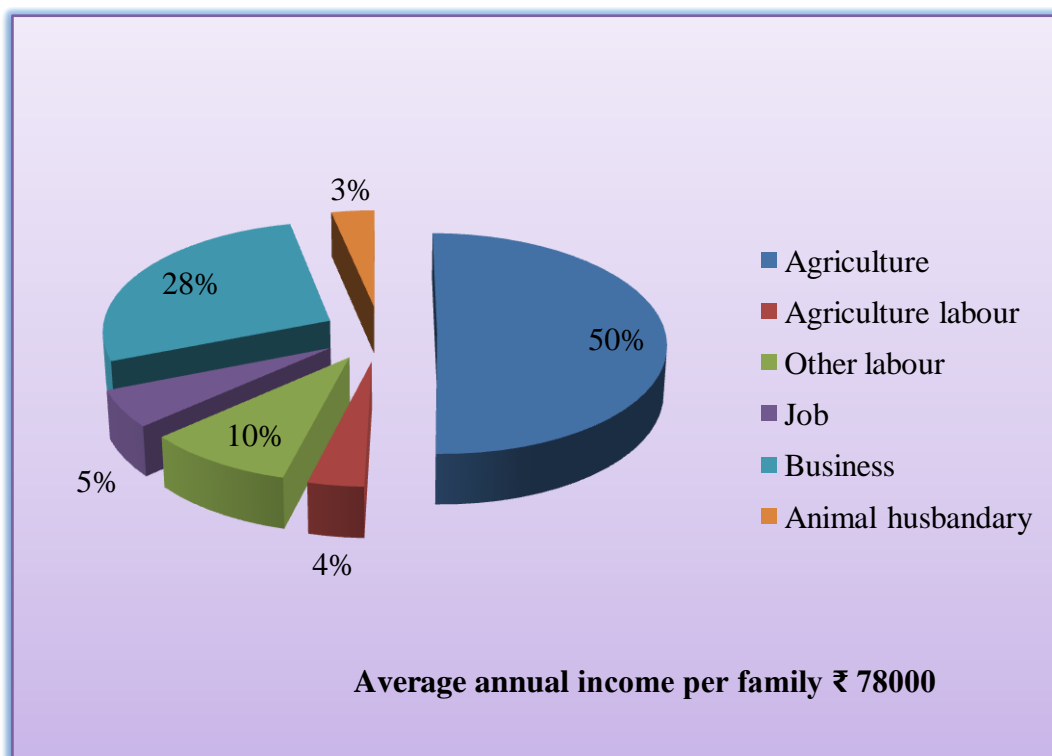
Fig 4.4: Annual income of respondents from different sources

Table 4.7: Distribution of respondents according to their participation in various activities

Sl. No.	Extension activities	Frequency	Percentage
1	Demonstration conducted on my field	186	58.13
2	Observed neighbor's demonstrated field	302	94.38
3	Discussion with extension agent	301	94.06
4	Participated in farmer's day	112	35.00
5	Participated in extension meeting	233	72.81
6	Participated in farmers' fare	194	60.63
7	Read extension publication	75	23.44
8	Used the radio & television for agricultural information	58	18.13
9	Visited agricultural institutions (KVK, Research centre etc.)	66	20.63

4.3.1.1 Overall extension participation

The data regarding overall extension participation are presented in Table 4.8 and Fig 4.5. The finding indicates that the maximum (55.31%) respondents had medium participation in different extension activities followed by 25.63 per cent respondents had low participation, whereas only 19.06 per cent of the respondents had high participation.

Table 4.8: Distribution of the respondents according to their overall extension participation

Sl. No.	Extension participation	Frequency	Percentage
1	Low participation (Up to 4.26 scores)	82	25.63
2	Medium participation (4.26 to 7.96 scores	177	55.31
3	High participation (More than 7.96 scores)	61	19.06

In above findings the sense of high participation indicates that the respondents had active and frequent participation in more than one extension activities. Similarly, Singh (2011) revealed that extension participation had a

significant association with level of knowledge and extent of adoption by the mothbean grower.

4.3.2   Sources of information regarding rice varieties

Source of information, mainly categorized into three categories *i.e.* personal localite, cosmopolitans and mass media

- **Personal localite source**

With regards to personal localite source, the data given in Table 4.9 reveals that under the personal localite information sources, 96.56 per cent of the respondents used a friend for the information in which majority (74.69%) of the respondents occasionally got information followed by 21.88 per cent of the respondents often collect information from this sources. Further, it was noted that 96.25 per cent of the respondents seek relatives as an information source, in which maximum (90%) respondents occasionally got information. 95.63 per cent of the respondents seeking information from their neighbor, in which majority (80%) respondents occasionally seeking information, whereas 15.65 per cent of the respondents often seeking information from this source. Only 82.81 per cent of the respondents gathered information from progressive farmers in which 67.81 per cent of the respondents got information occasionally, whereas only 15 per cent of the respondents often got information from this source.

- **Cosmopolitans' source**

Regarding cosmopolitans source, the data given in Table 4.9 indicates that majority (98.13%) of the respondents collected information from Rural Agriculture Extension Officers in which 78.13 per cent respondents occasionally gathered information regarding IGKV released rice varieties, whereas 20 per cent of the respondents often got information from this source. Further it was noted that 31.88 per cent of the respondents used Senior Agriculture Development Officers in which only 16.56 per cent respondents often got information and 15.31 per cent respondents occasionally got information from this source. Only 13.13 per cent of the respondents got information from Agriculture Scientist in which only 13.13 per cent respondents occasionally collected information from this source and remaining 86.88 per cent of the respondents not seeking information from this source. Whereas, maximum respondents not used cooperative society as an

information source, only 11.88 per cent of the respondents got information from this source in which respondents only occasionally used.

- **Mass media sources**

Regarding mass media source, the data presented in Table 4.9 reveals that only 23.75 per cent of the respondents used farm magazine for the information of IGKV released rice varieties in which all respondents only occasionally used and remaining 76.25 per cent of the respondents not used this source. 23.44 per cent of the respondents used television for the information in which 15 per cent of the respondents occasionally seeking information from television and 8.44 per cent of the respondents often seeking information and remaining 76.56 per cent of the respondents not used this source. 21.88 per cent of the respondents got information from radio in which 13.44 per cent of the respondents occasionally gathered information from radio and 8.44 per cent of the respondents often gathered information from the radio. Only 7.81 per cent of the respondents got information from the internet in which all respondents occasionally used this source and 92.19 per cent of the respondents not got information from this source. Whereas, only 1.56 per cent of the respondents seeking information from Kisan Call Centre and they were only occasionally used.

Similarly, Pathak *et al.* (2009) also reported that the respondents gathered information from pesticide dealers and traders, neighboring farmers (68%) and village level agricultural workers (64%). Around 40 per cent of the respondents got the information from mass media and only 36 per cent respondents from Agricultural Extension Officer.
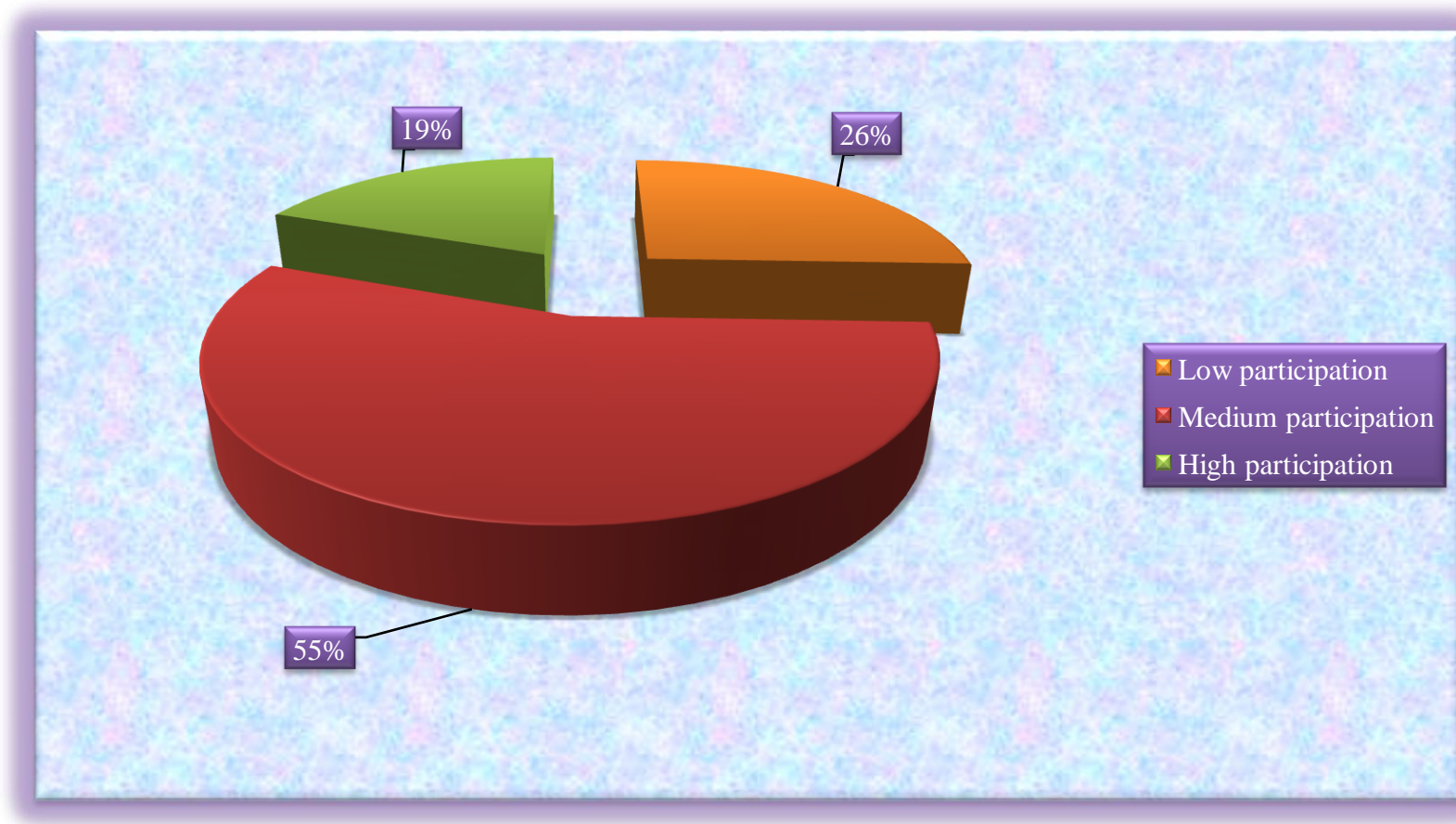
Fig 4.5: Overall extension participation of the respondents

4.3.2.1Credibility of information sources

Regarding credibility of information sources, the data given in Table 4.10 reveals that the highest (64.15%) credibility was recorded for progressive farmer followed by 10.31 per cent credibility recorded for a friend, 9.18 per cent credibility recorded for a neighbor and only 4.39 per cent credibility recorded for relatives. Regarding partial credibility, 95.61 per cent partial credibility recorded for relatives, followed by 90.82 per cent partial credibility recorded for a neighbor, 89.69 per cent partial credibility recorded for a friend. Under cosmopolitans, the highest (85.71%) full credibility was recorded for agriculture scientist followed by 84.08 per cent full credibility recorded for rural agriculture extension officers, 63.73 per cent full credibility recorded for senior agriculture development officers and 10.53 per cent full credibility was recorded for a cooperative society. However, the highest (89.47%) partial credibility was recorded for cooperative society followed by 36.27 per cent partial credibility recorded for senior agriculture development officers, 15.92 per cent partial credibility recorded for rural agriculture extension officers and 14.29 per cent partial credibility was recorded for agriculture scientist.

Under mass media, the highest (100%) full credibility was recorded for Kisan Call Center followed by 46.67 per cent full credibility recorded for television, 35.53 per cent full credibility recorded for farm magazine, while internet was not full credible for seeking information. Whereas, the highest (100%) partial credibility was recorded for internet followed by 77.14 per cent partial credibility recorded for radio, 64.47 per cent partial credibility recorded for farm magazine and 53.33 per cent partial credibility was noted for television.

Fig 4.6, explain the information seeking behavior along with their credibility. On the basis of overall finding regarding information seeking behavior and their credibility, it was found that the highest information regarding rice varieties was received from friends, neighbors and rural agriculture extension officers, but Kisan Call Centre was least used for information but their credibility was very high, However, the highest information seeking behavior and their maximum credibility was noted for rural agriculture extension officers.

Fig 4.6 elaborated that the highest information seeking behavior was recorded for personal localite, followed by cosmopolitans, whereas the highest credibility was recorded for cosmopolitans followed by personal localite and mass media. The most credible source should play the main role for new rice varieties dissemination.

Moreover, the finding illustrated through Fig 4.6 reveals that the respondents highly got information about IGKV rice varieties from a friend, neighbor, relatives and RAEOs, but their credibility was not equal for all information sources, most credible sources noted after data analysis, in the credible source list, most credible sources were RAEOs, Agriculture scientist and Kisan Call Centre. Respondents believed in all those information which was released by these credible sources.

Table 4.9: Distribution of respondents according to their information seeking behavior

Sources	Types of information seeking behavior						Overall information seeking		Rank
	Often		Occasional		Never				
	F	%	F	%	F	%	F	%	
A. Personal localite									
1 Friends	70	21.88	239	74.69	0	0	309	96.56	I
2 Neighbors	50	15.63	256	80.00	4	1.25	306	95.63	III
3 Relatives	20	6.25	288	90.00	1	0.31	308	96.25	II
4 Progressive farmers	48	15.00	217	67.81	55	17.19	265	82.81	V
B. Cosmopolitans									
1 RAEOs	64	20	250	78.13	6	1.88	314	98.13	IV
2 SADEOs	53	16.56	49	15.31	218	68.13	102	31.88	VI
3 Cooperative Societies	0	0	38	11.88	282	88.13	38	11.88	XI
4 Agriculture Scientists/KVK	0	0	42	13.13	278	86.88	42	13.13	X
C. Mass media									
1 Farm magazine	0	0	76	23.75	244	76.25	76	23.75	VII
2 Radio	27	8.44	43	13.44	250	78.13	70	21.88	IX
3 Television	27	8.44	48	15	245	76.56	75	23.44	VIII
4 Kisan Call Centre	0	0	5	1.56	315	98.44	5	1.56	XIII
5 Internet	0	0	25	7.81	295	92.19	25	7.81	XII

Note: Data are based on multiple responses, F= frequency, %= percentage

Table 4.10: Distribution of respondents according to credibility of information sources

Information sources	Level of credibility						Total obtained score	Maximum obtainable score	Overall credibility (%)	Rank
	Full		Partial		Nil					
	F	%	F	%	F	%				
A. Personal localite										
1 Friends	33	10.31	287	89.69	0	0.00	353	640	55.16	X
2 Neighbors	29	9.18	287	90.82	4	1.25	345	632	54.59	XI
3 Relatives	14	4.39	305	95.61	1	0.31	333	638	52.19	XII
4 Progressive Farmers	170	64.15	95	35.85	55	17.19	435	530	82.08	IV
B. Cosmopolitans										
1 RAEOs	264	84.08	50	15.92	6	1.88	578	628	92.04	III
2 SADEOs	65	63.73	37	36.27	218	68.13	167	204	81.86	V
3 Cooperative Societies	4	10.53	34	89.47	282	88.13	42	76	55.26	IX
4 Agriculture Scientists/KVK	36	85.71	6	14.29	278	86.88	78	84	92.86	II
C. Mass media										
1 Farm magazine	27	35.53	49	64.47	244	76.25	103	152	67.76	VII
2 Radio	16	22.86	54	77.14	250	78.13	86	140	61.43	VIII
3 Television	35	46.67	40	53.33	245	76.56	110	150	73.33	VI
4 Kisan Call Centre	5	100	0	0	315	98.44	10	10	100.00	I
5 Internet	0	0	25	100	295	92.19	25	50	50.00	XIII

Note: Data are based on multiple responses, F= frequency, %= percentage

4.3.2.2 Overall information seeking behavior along with overall credibility of information sources

Regarding the overall information seeking behavior and overall credibility of information sources, Table 4.11 illustrated that respondents had highest (95.31%) information seeking behavior for IGKV released rice varieties from personal localite followed by 38.75 per cent information seeking behavior recorded for cosmopolitans, whereas only 15.69 per cent information seeking behavior observed from mass media. Further, about overall credibility, highest credibility (87.2%) noted for cosmopolitans followed by mass media (66.53%) and 60.08 per cent credibility observed for personal localite.

Table 4.11: Overall information seeking behavior along with overall credibility of information sources

Information source group	Overall used information sources			Overall credibility of information sources		
	Obtained score	Obtainable score	%	Obtained score	Obtainable score	%
Personal localite	1188	1280	92.81	1466	2440	60.08
Cosmopolitans	496	1280	38.75	865	992	87.2
Mass media	251	1600	15.69	334	502	66.53

For increase in adoption area of IGKV released rice varieties need to spreading information through cosmopolitans group, because of it may increase the adoption rate. Singh *et al.* (2012) revealed that source of information utilized by mothbean growers was found to be significantly associated with the level of knowledge and extent of adoption. Borthakur *et al.* (2014) depicted that farmers residing in districts that do not have a RARS will probably get even less information and opportunities regarding new varieties released by AAU. So, AAU should try to improve the quality of extension work going on in districts that do not have a rice centric RARS to ensure a better bridge between the laboratory and the fields.
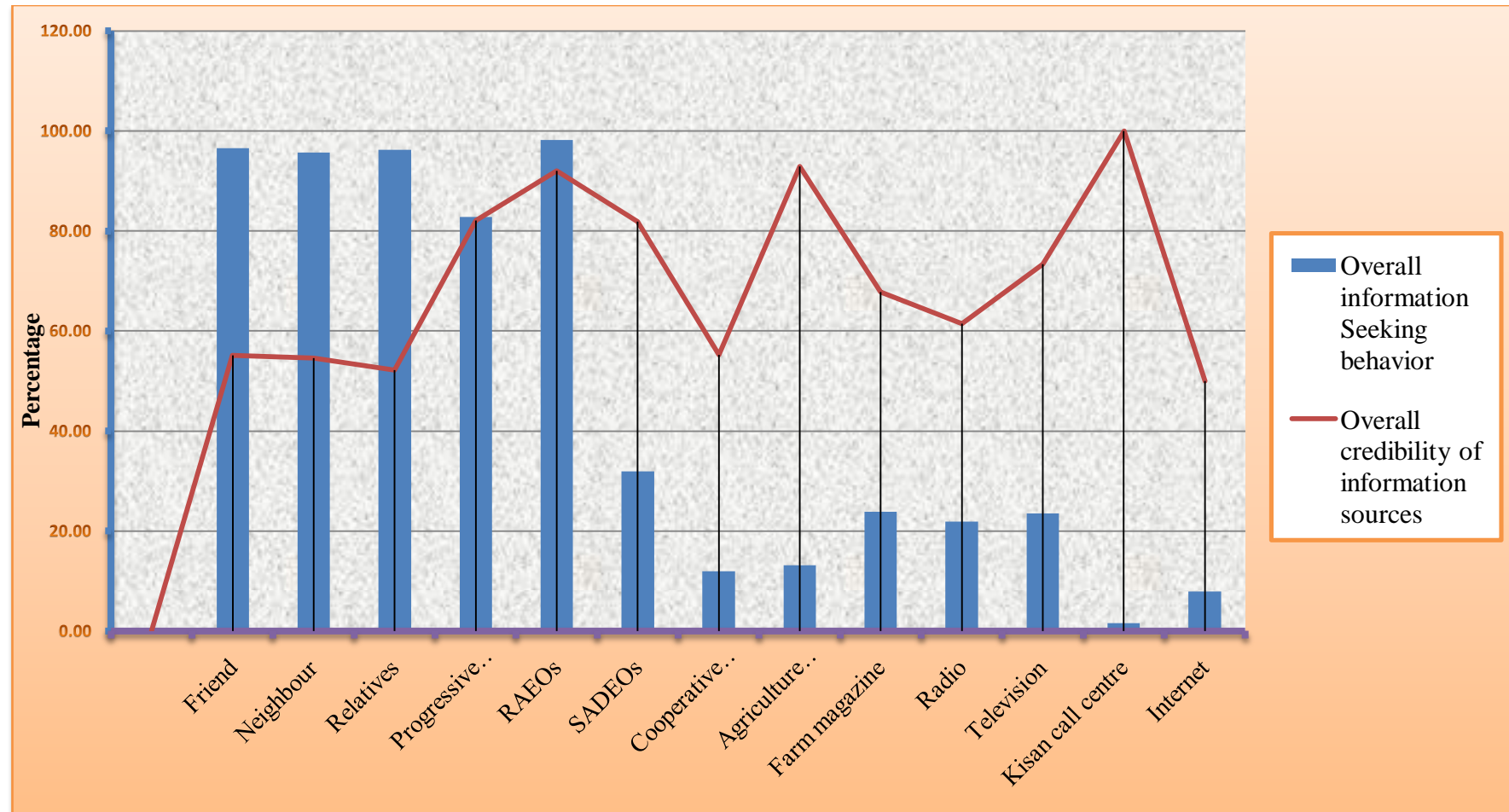
Fig 4.6: Information seeking behavior along with their credibility

4.3.3 Contact with extension personnel

Regarding contact of extension personnel of the respondents, Table, 4.12 revealed that highest (98.75%) respondents contacted with RAEOs in which 78.75 per cent of the respondents occasionally contacted to RAEOs and remaining 20 per cent of the respondents often contacted to RAEOs. 2nd highest (31.88%) respondents contacted to SADOs in which 16.56 per cent respondents often contacted and remaining 15.31 per cent of the respondents occasionally contacted to SADOs, moreover data incorporated that 24.69 per cent of the respondents contacted to SMS where in 24.69 per cent of the respondents contacted to and remaining 75.31 per cent of the respondents never contacted to SMS, whereas only 9.06 per cent of the respondents contacted to agriculture scientist (AS) wherein 9.06 per cent of the respondents occasionally contacted to agriculture scientist and remaining never contacted.

Fig 4.7.a, regarding contact with extension personnel, the data explains that the highest respondents contacted with rural agriculture extension officers followed by senior agriculture development officers, subject matter specialist and agriculture scientist. The reason behind the highest contact with rural agriculture extension officers, RAEOs working at village level might be that they visited the village time to time, so that good rapport builds between respondents and RAEOs. Similarly, Usman *et al.* (2013) indicated that most of the farmers had extension contact only once in a year and lower than 50 per cent respondents had no extension contact at all.

Table 4.12: Distribution of respondents according to their contact with extension personnel

Sl. No.	Extension personnel	Extent of contact							
		Never		Occasional		Often		OC	
		F	%	F	%	F	%	F	%
1	RAEOs	4	1.25	252	78.75	64	20.00	316	98.75
2	SADOs	134	41.88	49	15.31	53	16.56	102	31.88
3	SMS	241	75.31	79	24.69	0	0.00	79	24.69
4	AS	291	90.94	29	9.06	0	0.00	29	9.06

Note: Data are based on multiple responses, F= frequency, OC= overall contact, RAEOs= Rural Agriculture Extension Officers, SADOs= Senior Agriculture Development Officers, SMS= Subject Matter Specialist, AS= Agriculture Scientist

4.3.3.1   Overall extension contact with extension personnel

The data regarding overall extension contact with extension given in 4.12.1 reveals that it was categorized in three categories, in which highest (52.81%) respondents were medium contacted with extension personnel followed by 32.19 per cent of the respondents were low contacted with extension personnel and only 15 per cent of the respondents contacted with extension personnel.

It indicates that extension personnel working at village level and often and occasionally contacted regarding agriculture.

Table 4.12.1 Overall extension contact with extension personnel

Sl. No.	Categories	Frequency	Percentage
1	Low contact (Less than 2 scores)	103	32.19
2	Medium contact (2 to 3 scores)	169	52.81
3	High contact (More than 3 scores)	48	15.00

4.4   Socio-psychological characteristics of the respondent

Under the category of psychological characteristics, 3 variables namely decision-making ability, attitude towards improved variety and orientation towards farm management discussed here. Accordingly distribution of the respondents is presented in Table 4.13

4.4.1   Decision-making ability

Decision-making ability means the ability to the selection from alternatives. Regarding decision-making ability, the data given in Table 4.13 reveals that that highest (94.38%) respondent had medium decision-making ability followed by 3.75 per cent respondents had high decision-making ability, whereas only 1.88 per cent of the respondents had the low decision-making ability. Above discussed result shows that only a few respondents decide independently for selection of new varieties as well as new techniques etc. While, the majority of the respondents took a decision after discussion with their families, friends, relatives *etc*. Similarly, Tiongco and Hossain (2009) indicated that educated farmers had the ability to decide which modern varieties to grow among a wide range of choices.

4.4.2   Attitude towards improved variety

An attitude is the degree of positive or negative affect associated with some psychological object. Regarding attitude towards improved variety, the data given

in Table 4.13 elaborated that majority (40.94%) of the respondents had a moderately favorable attitude towards improved variety followed by 33.44 per cent of the respondents had favorable attitude, while 25.63 per cent respondents had an less favorable attitude towards improved variety. It is clear that majority of the respondents ready to cultivate improved variety, it was a good sign if we give opportunities for cultivation of improved variety they will try in small scale.

4.4.3 Orientation towards farm management

Regarding orientation towards farm management, the data given in Table 4.13 reveals that majority (96.56%) of the respondents had medium management orientation towards farm management followed by 2.19 per cent respondents had high management orientation whereas, only 1.25 per cent respondents had low management orientation towards farm management. It concluded that majority of the respondent had good farm management skill and they had planning, production

Contacted with extension personnel
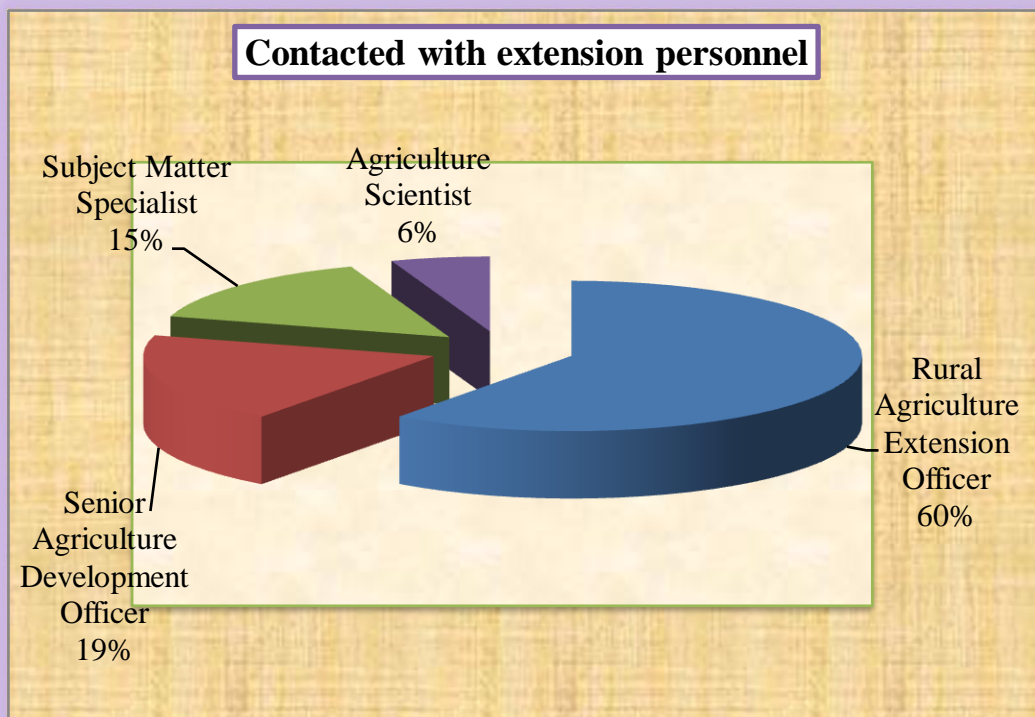
Fig 4.7.a: Distribution of respondents according to their overall contact with extension personnel

Overall extension contact
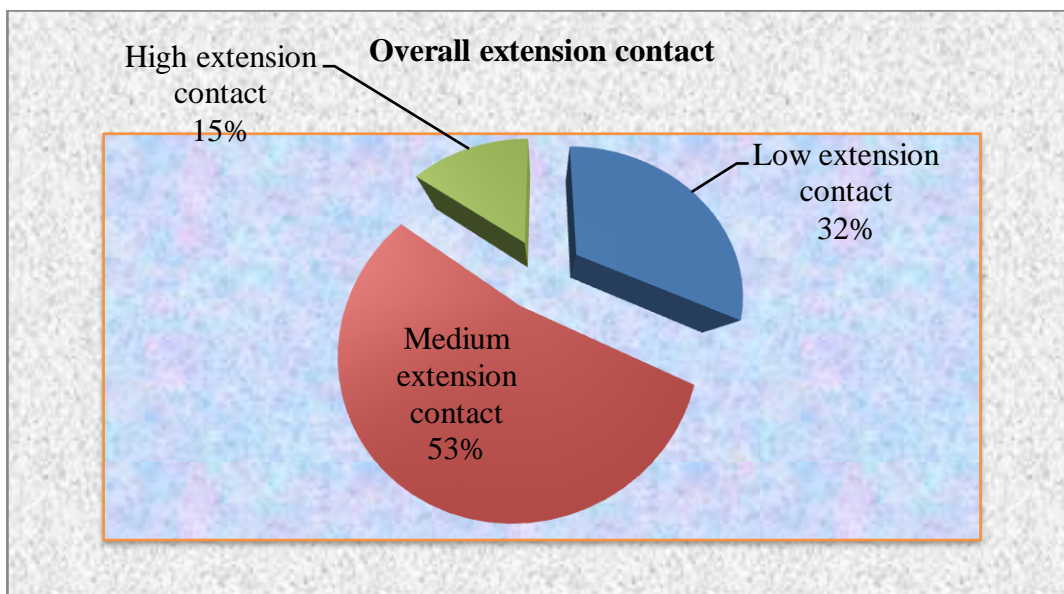
Fig 4.7.b Distribution of respondents according to their overall contact with extension personnel

and marketing skill. Whereas, another researcher Uddin *et al.* (2014) also noted that all inputs were available but, due to a lack of proper management capacity in relation to farm size, large farms fail to adapt efficiently. The scarcity of labor may also be an additional motive not to engage in adaptive strategy adoption.

Table 4.13: Distribution of respondents according to their socio-psychological characteristics

Sl. No.	Particulars	F	%	
• **Decision-making ability**				
1	Low (Less than 7 score)	6	1.88	$\overline{x}$ =11
2	Medium (8 to 15 Score)	302	94.38	SD=4
3	High (More than 15 scores)	12	3.75	
• **Attitude towards improved variety**				
1	Less favorable attitude (Less than 7.93 scores)	82	25.63	$\overline{x}$ =9.44
2	Moderately favorable attitude (7.93 to 10.95 scores)	131	40.94	SD=1.51
3	Favorable attitude (More than 10.95 scores)	107	33.44	
• **Orientation towards farm management**				
1	Low management orientation (Less than 14.93 scores)	4	1.25	$\overline{x}$ =15.92
2	Medium management orientation (14.93 to 16.91 scores)	309	96.56	SD=0.99
3	High management orientation (More than 16.91 scores)	7	2.19	

4.5   Awareness about various rice varieties

Regarding awareness about various rice varieties, the data given in Table 4.13 and Fig 4.8, explained that out of 15 IGKV released rice varieties cent per cent respondents were aware for Mahamaya rice variety, followed by 68.75 per

cent of the respondents aware for Rajeshwari, 59.38 per cent of the respondents aware for the Maheshwari and 59.06 per cent respondents aware for Durgeshwari.

Table 4.14: Awareness about various rice varieties

Sl.No.	Rice varieties	Aware		Not aware
		F	%	%
	IGKV released rice varieties			
1	Indira aerobic-1	25	7.81	92.19
2	Rajeshwari	220	68.75	31.25
3	Durgeshwari	189	59.06	40.94
4	Maheshwari	190	59.38	40.62
5	Karma mahsuri	71	22.19	77.81
6	Indira barani dhan-1	103	32.19	67.81
7	Indira sona	110	34.38	65.62
8	Chandrahasani	89	27.81	72.19
9	Jaldubi	45	14.06	85.94
10	Samleshwari	40	12.50	87.5
11	Bamleshwari	195	60.94	39.06
12	Indira sugandhit dhan-1	92	28.75	71.25
13	Danteshwari	90	28.13	71.87
14	Shyamla	70	21.88	78.12
15	Mahamaya	320	100	0.00
	Average		38.52	61.48
	Other popular rice varieties			
16	MTU-1010	320	100	0.00
17	MTU-1001	320	100	0.00
18	Swarna	320	100	0.00
19	IR-36/IR-64	300	93.75	6.25
	Average		98.44	1.56

Note=Data are based on multiple responses, F=frequency, %=percentage

21.88 to 34.38 per cent of the respondents were aware for Shyamla. Danteshwari, Indira Sugandhit dhan-1, Chandrahasani, Indira sona, Indira barani dhan-1, Karma mahsuri, 14.06 per cent of the respondents aware for Jaldubi, 12.50 per cent of the respondents aware for Samleshwari and only 7.81 per cent of the respondents aware for Indira aerobic-1. Average 38.52 per cent of the respondents aware and 61.48 per cent respondents not aware for IGKV rice varieties.

Mostly respondents were highly aware of popular rice varieties other than IGKV rice varieties, overall average 96.75 per cent of the respondents aware of these varieties. Overall data incorporated that respondents had high awareness for other popular rice varieties than IGKV rice varieties.

4.6   Knowledge of the respondents about released rice variety

4.6.1   Knowledge of the respondents about IGKV released rice variety

Regarding knowledge of the respondents about IGKV released rice variety, the data given in Table 4.15 and Fig 4.9 reveals that Mahamaya counted as an only one successful variety of IGKV, overall highest (98.28%) knowledge was also noted for this variety in which 99.69 per cent knowledge recorded for their other characteristic followed by 98.28 per cent knowledge observed for its productivity and 96.88 per cent knowledge observed for its duration in the between of the respondents. 2nd highest knowledge observed for Rajeshwari rice variety amongst respondents wherein 68.75 per cent knowledge noted for its other characteristics followed by 67.19 per cent knowledge for its duration and 66.41 per cent knowledge seen for its productivity. 3rd highest knowledge recorded for Bamleshwari rice variety wherein 61.09 per cent knowledge noted for its duration followed by 60.78 per cent knowledge observed for its other characteristics and 60.16 per cent knowledge noted for its productivity. Overall 58.85 per cent knowledge recorded for Maheshwari rice variety wherein 59.38 per cent knowledge noted for its productivity followed by 59.22 per cent known about its other characteristic and 57.97 per cent knowledge observed for its duration amongst respondents.

1st lowest knowledge noted for Indira Aerobic-1, overall 0.42 per cent knowledge noted amongst respondents, in which only 1.25 per cent knowledge noted for the duration while other knowledge attributes were null (other
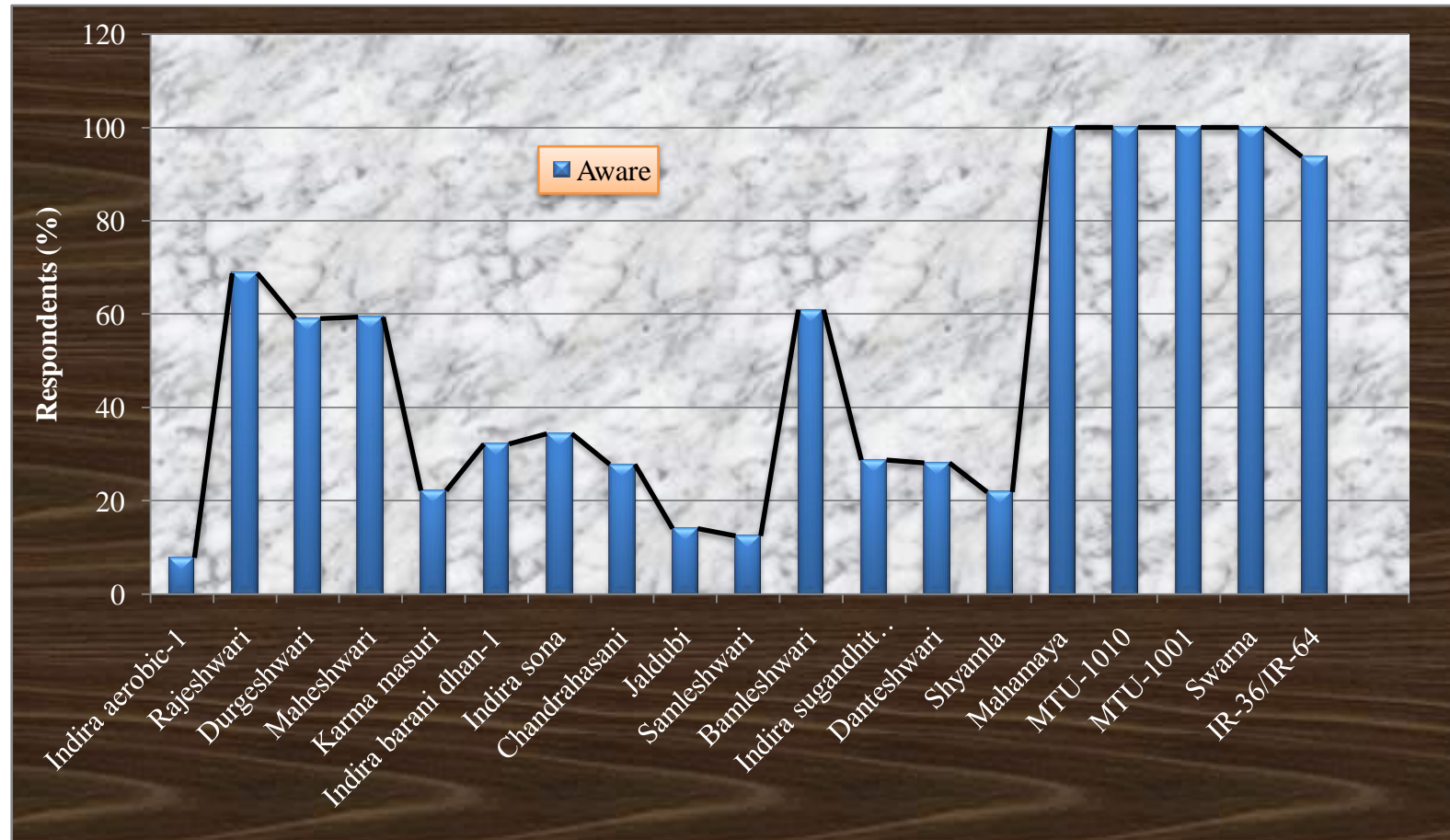
Fig 4.8: Awareness for various rice varieties

characteristic and productivity). 2nd lowest knowledge observed for Jaldubi in which 3.91 per cent knowledge noted for its other characteristic followed by 3.75 per cent knowledge observed for its productivity and 1.88 per cent knowledge noted for its duration amongst respondents. 3rd lowest knowledge recorded for Samleshwari rice variety in which 12.50 per cent knowledge for its productivity followed by 11.72 per cent knowledge observed for its other characteristic and 3.44 per cent knowledge noted for its productivity in the between of respondents.

Overall data showed that respondents were well familiar with Mahamaya, Rajeshwari and Bamleshwari due to its different characteristic and the highest lack of knowledge was noted for Indira aerobic-1 because it was not well disseminated amongst respondents.

Table 4.15 and Fig 4.10 revealed that overall 34.88 per cent knowledge noted for 15 listed IGKV rice varieties, wherein 33.32 per cent knowledge observed for other characteristics, 32.83 per cent knowledge noted for its productivity and 31.94 per cent knowledge observed for its duration. Less than 50 per cent knowledge seems for IGKV varieties in the midst of the respondents. It indicates that some efforts are needed for spreading the knowledge about IGKV rice varieties.

4.6.2   Knowledge gap of IGKV released rice varieties

Table 4.15 and Fig4.9 incorporated about knowledge gap of IGKV released rice varieties, further elaborated that highest (99.58%) knowledge gap noted for Indira aerobic-1 followed by Jaldubi and samleshwari (96.8%, 90.78% respectively), while lowest (1.72%) knowledge gap noted for Mahamaya rice variety followed by Rajeshwari (32.55%) and Bamleshwari (39.32%). The overall 65.12 per cent knowledge gap observed for 15 listed IGKV rice varieties.

4.6.3   Knowledge about other popular (non-IGKV) rice varieties

Table 4.15, Fig 4.9 incorporated that highest (99.06%) knowledge noted for Swarna rice variety, wherein respondents well familiar about its other characteristic (100%), duration (98.75%) and productivity (98.44%). 2nd highest (97.92%) knowledge noted for MTU-1010 wherein 98.75 per cent knowledge noted for its other characteristic, 98.44 per cent knowledge observed for its

Table 4.15: Knowledge of respondents about rice varieties

Sl. No.	Rice varieties	Knowledge attributes								R	Knowledge gap	R
		Duration		Other Characteristics		Productivity		Overall knowledge				
		OS	%	OS	%	OS	%	OS	%		%	
IGKV released rice varieties												
1	Indira aerobic-1	8	1.25	0	0	0	0	8	0.42	XV	99.58	I
2	Rajeshwari	430	67.19	440	68.75	425	66.41	1295	67.45	II	32.55	XIV
3	Durgeshwari	378	59.06	370	57.81	375	58.59	1123	58.49	V	41.51	XI
4	Maheshwari	371	57.97	379	59.22	380	59.38	1130	58.85	IV	41.15	XII
5	Karma masuri	138	21.56	140	21.88	139	21.72	417	21.72	X	78.28	VII
6	Indira barani dhan-1	198	30.94	206	32.19	200	31.25	604	31.46	VI	68.54	X
7	Indira sona	100	15.63	110	17.19	108	16.88	318	16.56	XII	83.44	IV
8	Chandrahasani	135	21.09	140	21.88	132	20.63	407	21.20	XI	78.80	V
9	Jaldubi	12	1.88	25	3.91	24	3.75	61	3.18	XIV	96.82	II
10	Samleshwari	22	3.44	75	11.72	80	12.50	177	9.22	XIII	90.78	III
11	Bamleshwari	391	61.09	389	60.78	385	60.16	1165	60.68	III	39.32	XIII
12	Indira sugandhit dhan-1	172	26.88	180	28.13	175	27.34	527	27.45	VII	72.55	IX
13	Danteshwari	169	26.41	180	28.13	175	27.34	524	27.29	IX	72.71	VIII
14	Shyamla	135	21.09	140	21.88	135	21.09	410	21.35	VIII	78.65	VI
15	Mahamaya	620	96.88	638	99.69	629	98.28	1887	98.28	I	1.72	XV
	Total	3271	31.94	3412	33.32	3362	32.83	10045	34.88		65.12	
Other popular rice varieties												
16	MTU-1010	618	96.56	632	98.75	630	98.44	1880	97.92	II	2.08	IV
17	MTU-1001	412	64.38	400	62.5	413	64.53	1225	63.80	V	36.20	I
18	Swarna	632	98.75	640	100	630	98.44	1902	99.06	I	0.94	V
19	IR-36/IR-64	526	82.19	600	93.75	525	82.03	1651	85.99	III	14.01	III
	Total	2188	85.47	2272	88.75	2198	85.86	6658	86.69		13.31	
	Overall (19 rice varieties)								49.97		50.03	

Note= Data are based on multiple responses, OC=Obtained score, R=Rank, %= percentage

productivity and 96.56 per cent knowledge noted for its duration in the midst of the respondents.

1st Lowest (63.80%) knowledge recorded for MTU-1001 wherein 64.53 per cent knowledge observed for its productivity followed by 64.38 per cent knowledge noted for its duration and 62.50 per cent knowledge observed for its other characteristic (Size, shape, taste etc.)

Table 4.15 and Fig 4.10 revealed that overall 86.69 per cent knowledge noted for 4 listed other popular rice varieties, wherein 88.75 per cent knowledge observed for their other characteristics followed by 85.86 per cent knowledge noted for their productivity and 85.47 per cent knowledge noted for their duration in the midst of the respondents.

4.6.4   Knowledge gap of other popular (non-IGKV) rice varieties

Table 4.15 and Fig 4.9 revealed that the highest (36.20%) knowledge gap was noted for MTU-1001 and 2nd highest (14.01%) knowledge gap was noted for IR-36/IR-64. Lowest (0.94%) knowledge gap was observed for Swarna rice variety and MTU-1010 (2.08%).

Table 4.15 and Fig 4.10 revealed that overall knowledge gap recorded only 13.31 per cent in the between of the respondents which was very lowest gap, comparison of knowledge gap of IGKV.

4.7   Adoption of rice varieties

4.7.1   Respondents according to the cultivation of rice varieties

Regarding cultivation of rice varieties in 2016, the data given in Table 4.16 and Fig 4.11 reveals that the maximum respondents (79.69%) adopted Swarna rice variety followed by MTU-1010 (54.69%) and Mahamaya rice variety (38.44%), about 17.19 per cent respondents adopted HMT, 16.56 per cent Arize 6444, 12.50 per cent Kaveri 888 and 10.94 per cent respondents adopted Rajeshwari. Similarly 7.81 per cent respondents adopted Durgeshwari and IR-64, 5.94 per cent respondents adopted Sadhna variety, whereas Maheshwari rice variety adopted by 4.69 per cent respondents. About 3.75 per cent of the respondents adopted Karma-Mahsuri, 3.44 per
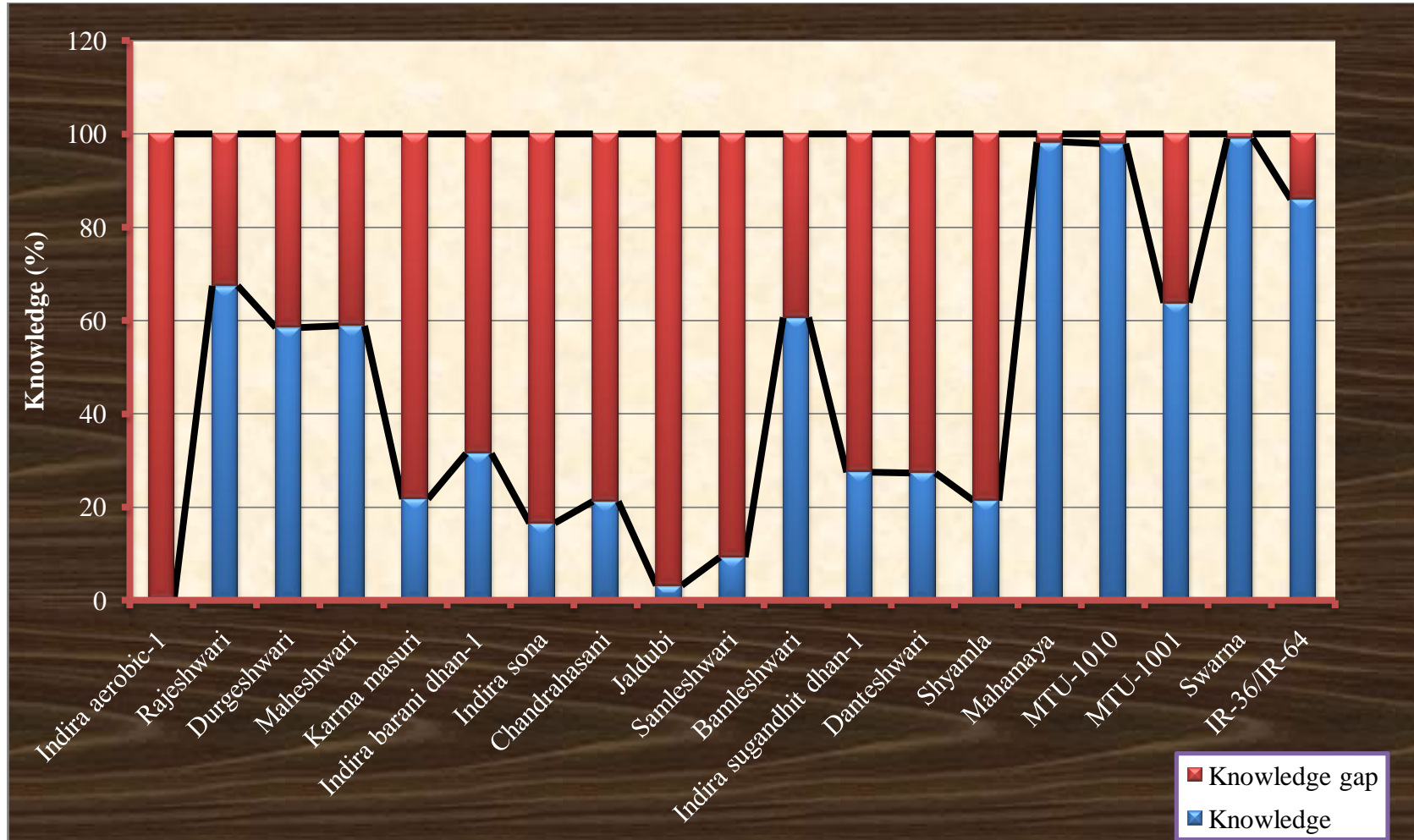
Fig 4.9: Variety wise overall knowledge and knowledge gap amongst the respondents

cent Sonam rice variety, 3.13 per cent respondents adopted Kirtman rice variety, while only a small per cent of respondents adopted other varieties *i.e.* Y-1011, MTU-1001, BPT-5355 etc. Total more than 30 rice varieties adopted in the midst of the respondents, they prefer variety according to the preferential trait of rice.

Table 4.16: Distribution of respondents according to cultivation of rice varieties

Sl. No.	Rice variety	Frequency	Percentage
1	Swarna	255	79.69
2	MTU-1010	175	54.69
3	Mahamaya	123	38.44
4	HMT	55	17.19
5	Arize 6444	53	16.56
6	Kaveri 888	40	12.50
7	Rajeshwari	35	10.94
8	Durgeshwari	25	7.81
9	IR-64	25	7.81
10	Sadhna	19	5.94
11	Maheshwari	15	4.69
12	Karma Mahsuri	12	3.75
13	Sonam	11	3.44
14	Kirtman	10	3.13
15	Y-1011	6	1.88
16	MTU-1001	5	1.56
17	BPT-5204 (Samba Mahsuri)	4	1.25
18	Jawful	4	1.25
19	VNR-2355 plus	4	1.25
20	IR-36	4	1.25
21	Safri	4	1.25
22	Vishnubhog	4	1.25
23	Poornima	4	1.25
24	Anjani	3	0.94
25	Bamleshwari	3	0.94
26	Ganga	2	0.63
27	Sarthi	2	0.63
28	Others (Danteshwari, Indira barani, Shyamla, Chandrahasani, Indira sugandhit dhan-1, RPN, Dubraj, Basmati, Vishnubhog, Mahalaxmi, Samleshwari, Rajbhog, Ratna, Culture etc.)	12	-
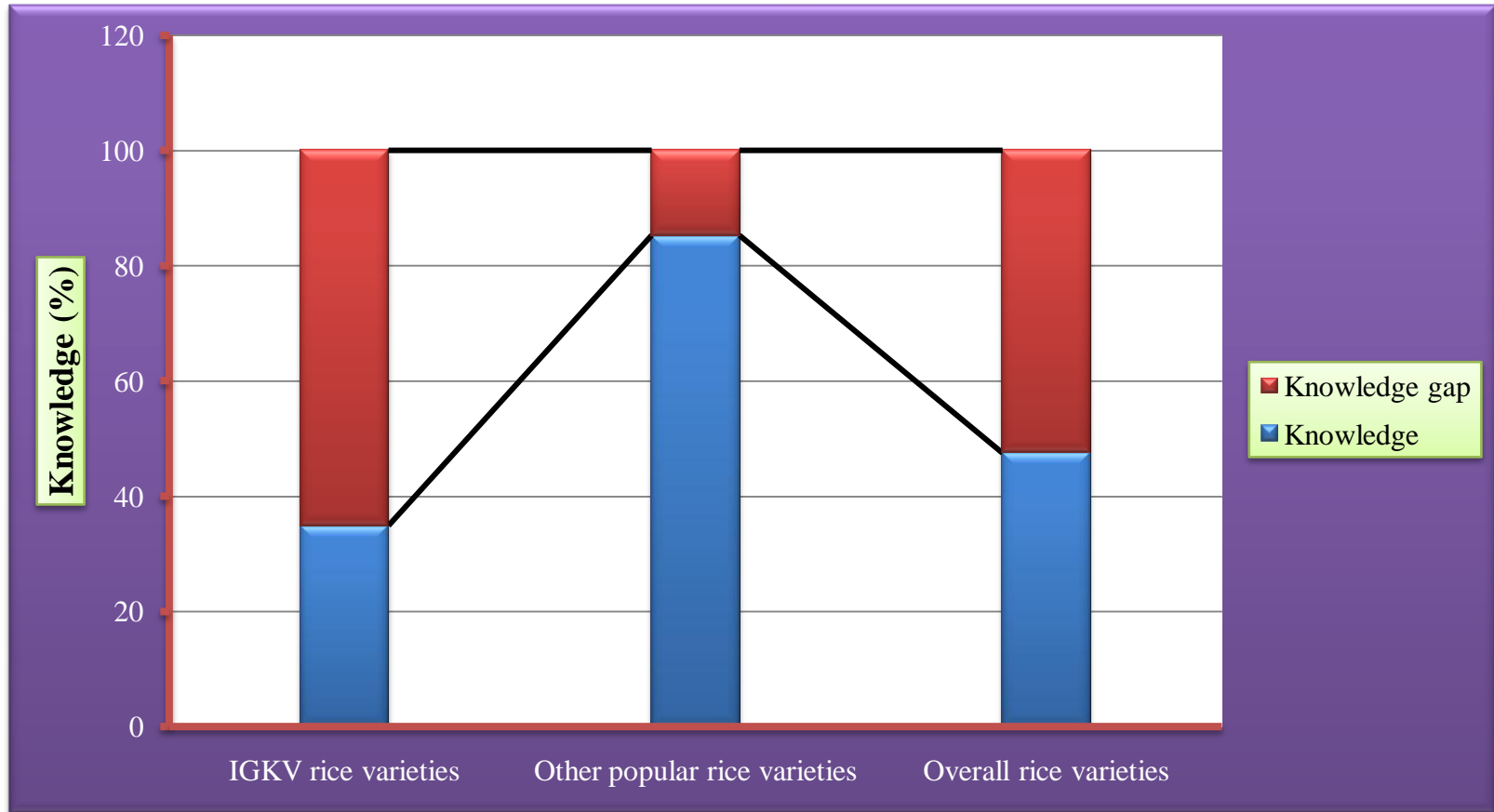
Fig 4.10: Overall knowledge and knowledge gap about rice varieties among the respondents (15 IGKV released+4 other popular rice varieties=19 Rice varieties)

Overall data showed that most of the respondents give preference to Swarna followed by MTU-1010 and Mahamaya rice varieties and these three varieties cultivated by about all respondents.

4.7.2 Area and productivity of various rice varieties cultivated by the respondents

Regarding area and productivity of various rice varieties cultivated by the respondents, the data given in Table 4.17 and Fig 4.11 reveals that rice cultivated in total 867.40 ha area, whereas Swarna was cultivated in the highest area (27.96%), followed by MTU-1010 cultivated in 25.52 per cent area of total rice cultivation and Mahamaya variety cultivated in 17.68 per cent of the rice cultivation area.

Swarna, MTU-1010 and Mahamaya rice varieties jointly cultivate in 71.16 per cent area of the total rice cultivation area, remaining 28.84 per cent area of rice, covered by other rice varieties *i.e.* Arize 6444, Rajeshwari, HMT *etc*

Similarly, Kostha and Choudhary (2015) noted that MTU 1010 ranked first position in the adoption pattern and was planted in more than 24 per cent of the area. Swarna was the next most important rice variety. The MTU-1001, Mahamaya and IR-64 were planted by farmers in 13, 10 and 8 per cent in area. This was different to present study.

4.7.3 Productivity of popular rice varieties

Table 4.17 incorporated regarding productivity of rice varieties, here 29 rice varieties listed for discussion of their productivity, generally hybrid variety of private sector given good performance on respondents field, highest productivity 49.50 q ha^{-1} noted of Arize 6444 on respondents field which was really much in comparison to others varieties, Kaveri 888, Kirtman VNR-2355 plus given good productivity ranged 40-42 q ha^{-1} after all hybrid varieties, good productivity noted for Rajeshwari 40.30 q ha^{-1}, Mahamaya 40.75 q ha^{-1} and Swarna 40.05 q ha^{-1}.

Some traditional and scented rice gives low productivity like Jawful 19 q ha^{-1}, Dubraj 18 q ha^{-1} etc. Poornima rice variety also gives low productivity 21.25 q ha^{-1}

which was released from IGKV, but due to its productivity not popular amongst respondents.

Table 4.17: Area and productivity of various rice varieties cultivated by the respondents

Sl. No.	Rice variety	Area (ha)	Area (%)	Productivity range (q ha^{-1})	Average productivity (q ha^{-1})
1	Swarna	242.54	27.96	35-53	40.05
2	MTU-1010	221.37	25.52	25-44	37.70
3	Mahamaya	153.35	17.68	32-55	40.75
4	Arize 6444	39.20	4.52	45-60	49.50
5	Rajeshwari	27.00	3.11	36-55	40.30
6	HMT	27.73	3.20	30-38	30.50
7	Kaveri 888	24.98	2.88	43-50	40.30
8	Sadhna	20.20	2.33	35-48	38.20
9	BPT-5204	11.53	1.33	38-42	36.00
10	Y- 1011	11.20	1.29	35-44	35.91
11	Sonam	12.96	1.49	38-43	38.61
12	Durgeshwari	11.00	1.27	32-44	37.00
13	Maheshwari	11.20	1.29	34-48	38.00
14	Karma Mahsuri	10.20	1.18	30-43	37.00
15	IR-64	10.12	1.17	35-41	37.28
16	Bamleshwari	4.61	0.53	35-38	36.50
17	MTU-1001	4.05	0.47	35-40	37.60
18	Kirtman	4.05	0.47	39-45	42.00
19	IR-36	3.24	0.37	32-38	35.75
20	Safri	3.24	0.37	15-25	23.00
21	Jawful	2.83	0.33	18-25	19.00
22	Poornima	2.10	0.24	20-29	24.25
23	Vishnubhog	2.02	0.23	20-28	21.25
24	Sarthi	1.82	0.21	39-45	42.00
25	VNR-2355 plus	1.62	0.19	40-55	41.25
26	RPN	1.42	0.16	40-41	40.10
27	Ganga	0.61	0.07	38-42	40.00
28	Anjani	0.80	0.09	30-40	32.33
29	Dubraj	0.40	0.05	18-20	18.00
	Total	867.40	100.00	15-63	39.14*

Note: *weighted average

Overall rice varieties give productivity ranged from 15 to 63 q ha^{-1} and weighted average of all 29 rice varieties was 39.14 q ha^{-1} and total rice cultivation land was 867.40 ha. Similarly, Koshta and Choudhary (2015) indicated that the growth in production and yield of rice notice increased significantly after formation of the Chhattisgarh state. It gives the clear indication of the impact of adoption of modern varieties by the farmers.

4.7.4   Cultivation of rice varieties, released by IGKV

Regarding cultivation of rice varieties released by IGKV, Table 4.18 illustrated that still, 16 rice varieties notified which are released from IGKV, Chhattisgarh. First IGKV released rice variety was Mahamaya that released in 1996.

Top most new notified variety is Indira aerobic-1 which was notified in 2015. Maximum (38.44%) respondents adopted Mahamaya rice variety followed by Rajeshwari rice variety which was cultivated by 10.94 per cent of the respondents, 7.81 per cent of the respondents adopted Durgeshwari 3.75 per cent adopted Karma Mahsuri, 1.25 per cent adopted Poornima and only 0.094 per cent of the respondents adopted Bamleshwari rice variety in 2016.

IGKV released rice varieties were cultivated in 219.46 ha in which Mahamaya cultivated in 17.68 per cent of IGKV rice cultivation area and take the 1st rank according to cultivation area followed by Rajeshwari (3.11%), 1.31 per cent area covered by Maheshwari, 1.29 per cent area covered by Durgeshwari and only 0.24 per cent area covered by Poornima, remaining 9 listed IGKV released rice varieties not cultivated in 2016 due to different reasons. Total rice cultivation area was 867.46 ha in which IGKV rice varieties contributed in 25.30 per cent area.
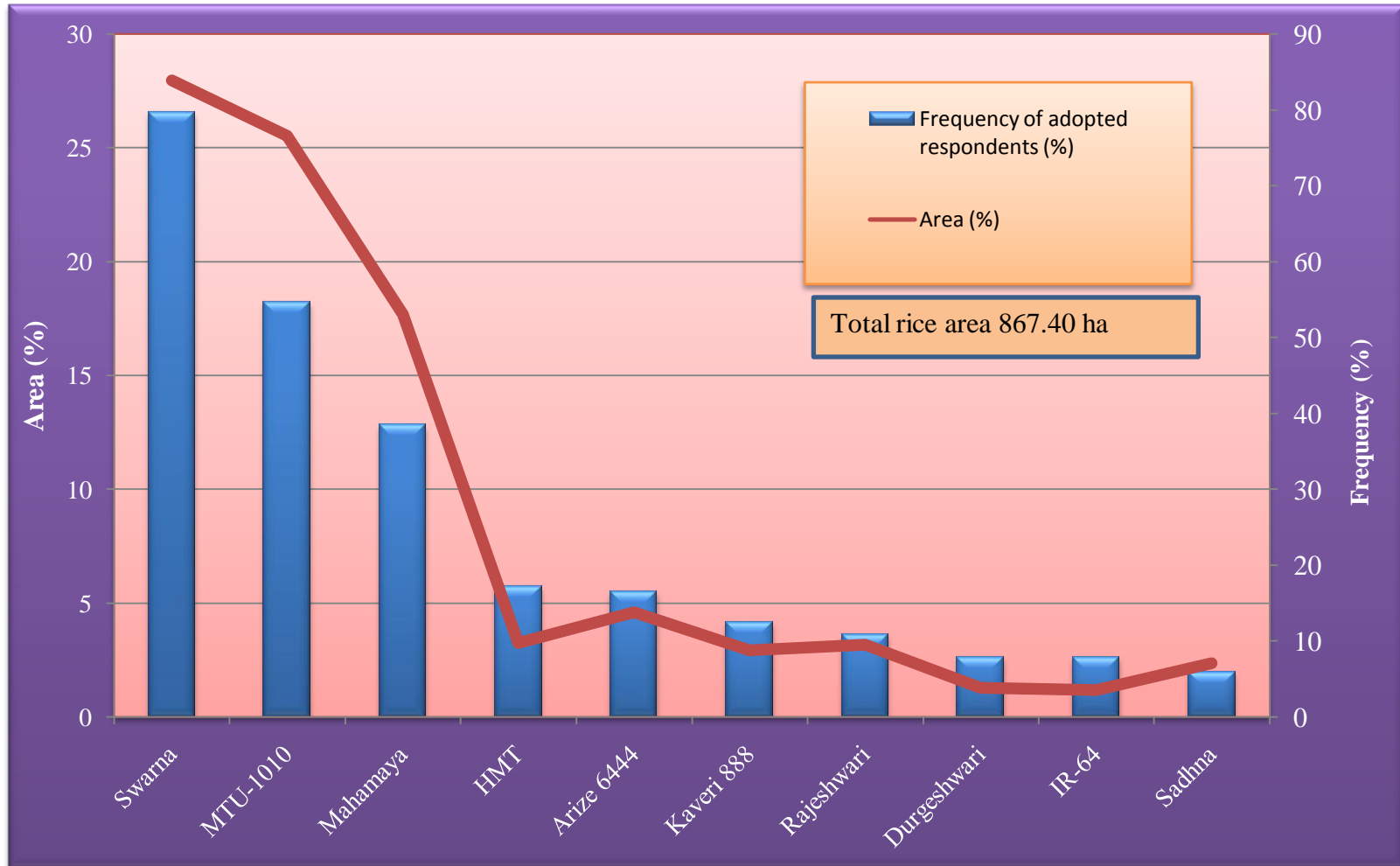
Fig 4.11: Adoption frequency and area of popular top10 rice varieties

Table 4.18: Distribution of respondents according to cultivation of rice varieties, released by IGKV

Sl. No.	Variety	Release year	Adoption of IGKV rice varieties		Area (ha)	% of total rice area	Rank
			F	%			
1	Mahamaya	1996	123	38.44	153.35	17.68	I
2	Poornima	1997	4	1.25	2.1	0.24	VII
3	Shyamla	1997	-	-	-	-	-
4	Danteshwari	2001	-	-	-	-	-
5	Bamleshwari	2001	3	0.94	4.61	0.53	VI
6	Indira sugandhit dhan-1	2005	-	-	-	-	-
7	Samleshwari	2007	-	-	-	-	-
8	Jaldubi	2007	-	-	-	-	-
9	Chandrahasini	2007	-	-	-	-	-
10	Indira sona	2007	-	-	-	-	-
11	Karma Mahsuri	2008	12	3.75	10.20	1.18	V
12	Rajeshwari	2011	35	10.94	27.00	3.11	II
13	Durgeshwari	2011	25	7.81	11.00	1.27	IV
14	Indira barani dhan-1	2012	-	-	-	-	-
15	Maheshwari	2012	15	4.69	11.20	1.29	III
16	Indira aerobic-1	2015	-	-	-	-	-
Total cultivated area under IGKV released rice varieties (ha)					219.46	25.30	
Total rice cultivation area (ha)					867.40		

4.7.5 Cultivation of popular rice varieties in different soil type (*Kharif* season)

- *Inceptisols (Matasi soil)*

Regarding adoption of rice varieties in *Matasi* soil, Table 4.19 illustrated that more than 7 rice varieties cultivated in 300.15 ha area in which maximum (46.88%) respondents cultivated MTU-1010 which was covered 53.23 per cent of the total rice cultivated in *Matasi* soil followed by 25 per cent respondents cultivated Mahamaya in 19.63 per cent area of *Matasi* soil, Swarna variety was cultivated by 15.00 per cent of the respondents and covered in only 4.72 per cent area of *Matasi* soil. Rajeshwari rice was cultivated by 9.38 per cent of the respondents in 5.16 per cent area of *Matasi*. Generally, *Matasi* soil was rainfed therefore respondents prefer short duration variety, like MTU-1010.

- *Alfisols (Dorsa soil)*

More than 8 varieties cultivated in 134.69 ha of *Dorsa* soil, in which MTU-1010 cultivated by 15.63 per cent of the respondents and which covered 36.19 per cent area of *Dorsa* soil followed by Mahamaya cultivated by 12.19 per cent of the respondents in 36.13 per cent area of *Dorsa* soil.

Swarna cultivated by 7.81 per cent of the respondents in 8.42 per cent area of *Dorsa* soil. Whereas, Durgeshwari and IR-36 were cultivated by 1.25 per cent of the respondents and jointly cultivated in 4.00 per cent area of *Dorsa* soil.

- *Vertisols (Kanhar soil)*

More than 14 varieties cultivated by respondents in 415.56 ha area of *Kanhar* soil in which Swarna was highest (58.75%) cultivated by the respondents in 51.36 per cent of the *Kanhar* soil, generally this soil was lowland type. So respondents mostly prefer long duration rice. Mahamaya rice also 2nd highest (18.13%) cultivated by respondents in 11.01 per cent area of *Kanhar* soil.

Arize 6444 was a hybrid variety, which was also cultivated by 16.56 per cent of the respondents which covered 9.43 per cent area of *Kanhar* soil. Whereas Bamleshwari rice variety cultivated in a small area (1.11%) by the 1.88 per cent of the respondents.

Table 4.19: Distribution of respondents according to the cultivation of popular rice
varieties in different soil type (*Kharif* season)

Sl. No.	Rice varieties	No. of respondents adopted		Area under rice varieties	
		F	%	Area (ha)	% in total of soil
Inceptisols (*Matasi* soil)					
1	MTU-1010	150	46.88	159.78	53.23
2	Mahamaya	80	25.00	58.93	19.63
3	Rajwshwari	30	9.38	15.50	5.16
4	Swarna	25	15.00	14.18	4.72
5	Durgeshwari	12	3.75	8.50	2.83
6	HMT	18	5.63	5.47	1.82
7	Others	-	-	37.79	12.59
	(Sonam, Y-1011, BPT-5204, Poornima *etc.*)				
	Total			300.15	100
Alfisols (*Dorsa* soil)					
1	MTU-1010	50	15.63	48.75	36.19
2	Mahamaya	39	12.19	48.66	36.13
3	Swarna	48	7.81	11.34	8.42
4	Rajeshwari	10	3.13	11.50	8.54
5	MTU-1001	5	1.56	4.05	3.01
6	Durgeshwari	4	1.25	2.50	1.86
7	IR-36	4	1.25	3.24	2.41
8	Other	-	-	4.65	3.45
	(Safri, Anjani, Ganga *etc.*)				
	Total			134.69	100
Vertisols (*Kanhar* soil)					
1	Swarna	188	58.75	217.00	51.36
2	Mahamaya	58	18.13	45.76	11.01
3	Arize 6444	53	16.56	39.20	9.43
4	Kaveri 888	40	12.50	24.98	6.01
5	HMT	55	17.19	22.27	5.36
6	IR-64	25	7.81	10.12	2.44
7	Bamleshwari	6	1.88	4.61	1.11
8	MTU-1010	12	3.75	2.84	0.67
9	Other	-	-	55.76	13.42
	(Sadhna, Maheshwari, Karma Mahsuri, Kirtman, RPN, Jawful, Vishnubhog, VNR-2355 plus, Sarthi, Dubraj *etc.*)				
	Total			415.56	100

4.8   Adopter categories of farmers growing IGKV rice varieties

Table 4.20, Fig 4.12 explained, more than 15 varieties notified but all varieties not adopted by the respondents, the recommendation of varieties also differ according to agro-climatic zone wise. IGKV start for releasing of rice varieties from 1996 and here categories of adopters of IGKV released rice varieties, respondents start adoption of IGKV rice from 1997 and that year only one variety available for the adoption and still year 16 varieties available for adoption (see appendix section). The finding showed that only 0.95 per cent respondents were innovators which were started to adopt within one year from start to release. 15.62 per cent were early adopters which start within 4 years from 1996, and 33.52 per cent respondents were early majority which was started adoption of IGKV rice varieties within 9 years, 26.48 per cent respondents were late majority, which was started to adopt IGKV rice varieties within the 14 years and 23.43 per cent respondents were laggards which were started to adopt IGKV rice varieties within 18 years from 1996.

Table 4.20: Adopter categories of farmers growing IGKV rice varieties

Categories	Adopted respondents (n=525)	
	Number	Percentage
Innovators (within 1 years)	5	0.95
Early adopters (1- 4 years)	82	15.62
Early majority (5- 9 years)	176	33.52
Late majority (10- 14 years)	139	26.48
Laggards (>14 years)	123	23.43
	525	100.00

Results showed that percentage of adopters categories partial differ from the established model of Roger's adopter categories in ideal condition. Similarly, Khan *et al.* (2013) found that 5 per cent respondents were innovators, 13 per cent respondents were early adopters, 35 per cent respondents were early majority, 37 per cent respondents were late majority and 12 per cent respondents were laggards.

Categorization on the basis of innovativeness of the farmers regarding Binsali rice is very close to the idea of Roger's adopter categories.

4.9 Reasons for the adoption of popular rice varieties

Table 4.21 illustrated, regarding reasons for the adoption of popular rice varieties, 79.69 per cent of the respondents adopted Swarna rice varieties due to many reasons, in which 100 per cent of the respondents adopted this variety due its high yield quality, followed by 78.00 per cent of the respondents adopted due to its high sustainability further 37.00 per cent of the respondents cultivated due to low risk to fail of this variety, while 20.00 per cent of the respondents adopted due to its good taste and quality also. Swarna rice variety released at 1982 but still majority respondents had cultivated this variety in their field due to its characteristic, they were more believed in this variety than other and I observed during group discussion amongst respondents that most of the respondents believed due to its yield quality and even it gave good yield in inferior condition also.

Table 4.21 showed that 38.44 per cent of the respondents adopted Mahamaya rice variety in which 98.00 per cent of the respondents adopted due to its high yield quality followed by 91.00 per cent of the respondents adopted due its drought and insect tolerance quality, 66.00 per cent of the respondents adopted due to its more grain weight further, 49.00 per cent of the respondents adopted due to its good for making by product quality, it was only one of the most popular rice variety of IGKV, Raipur, which was released in 1996 and fully diffused amongst respondents. It was 3rd most popular rice variety due to its good yield and grain weight.

Table 4.21 regarding MTU-1010, showed that 54.69 per cent of the respondents adopted this variety in which 99 per cent respondents adopted due to its good yield in mid-land, 63 per cent respondents adopted this variety due to its good market price followed by 49.00 per cent of the respondents adopted due to its early maturity, while 29.00 per cent of the respondents adopted due to tolerance to brown plant hopper (BPH), this variety was 2nd popular rice variety amongst respondents,
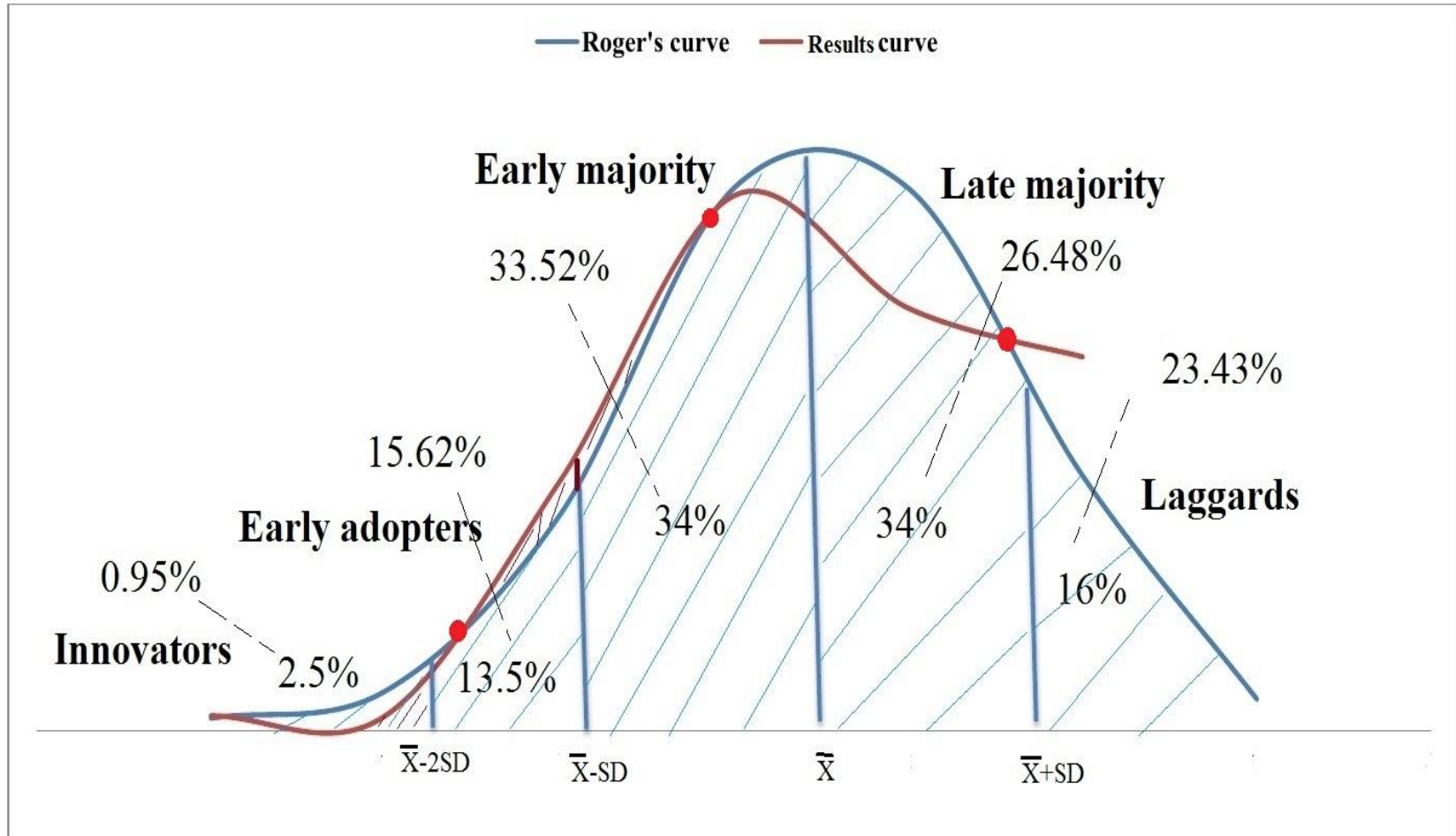
Fig 4.12: Difference between Roger's established model and adopters of IGKV rice varieties

which was released in 1999, but make 2nd position amongst respondents than Mahamaya rice variety, which was released at 1996.

Table 4.21: Distribution of respondents according to reasons for the adoption of popular rice varieties

Sl. No.	Variety	Adopters		Reasons for adoption	F	%
		F	%			
1	Swarna	255	79.69	• High yield	255	100
				• High sustainability	200	78
				• Low risk to fail	95	37
				• Good taste and quality	50	20
2	Mahamaya	123	38.44	• High yield	120	98
				• More grain weight	81	66
				• Drought and insect tolerance	112	91
				• Good for making by products	60	49
3	MTU-1010	175	54.69	• Good yield in mid-land	173	99
				• Good market price	110	63
				• Early maturity	85	49
				• Tolerance to BPH	50	29
4	Arize 6444	53	16.56	• High yield	53	100
				• High fertilizer response	35	66
				• Grain quality	22	42
				• Medium duration (135-140 days)	10	19
5	HMT	55	17.19	• Good eating quality	55	100
				• High market price	55	100
				• Growing for home consumption	40	73

Note: Data are based on multiple responses, F=frequency, %=percentage

Overall data showed that all the respondents adopted all those varieties who were able to give high yield and cultivated by them in previous years and observed good performance on their field. Best example is Swarna rice variety which was released at 1982, but its good performance credibility is major factor so it is still popular amongst respondents. Regarding Arize 6444, it was developed by private seed company 'bayer', and going to be the popular amongst respondents, moreover 16.56 per cent of the respondents adopted this variety owing to its characteristic, out of adopted respondents majority (100.00%) respondents adopted owing to its high yield quality followed by 66 per cent of the respondents adopted due to its high fertilizer responses. 42 per cent of the respondents adopted due to its grain quality.

Regarding HMT rice variety, the data reveals that 17.19 per cent of the respondents adopted this variety in which cent per cent respondents adopted due to its eating quality and same per cent of the respondents prefer due to its high market price.

4.10   Reasons for non adoption of IGKV released rice varieties

Table 4.22, regarding non-adoption of IGKV released rice variety, revealed that majority of the respondents did not adopt the listed IGKV rice varieties due to various reasons. Here 13, IGKV released rice varieties listed for the discussion. Cent per cent respondents did not adopt Indira aerobic rice variety due to 92.19 per cent respondents not aware about this variety but someone (7.81%) aware about this variety but not adopted because of unavailability of seed. Highest respondents do not aware perhaps it was released before one year and require more time for diffusion.

Indira barani dhan-1 also not adopted by 100 per cent of the respondents in which 67.81 per cent not adopted due to not aware and 45.61 per cent of the respondents not adopted due to unavailability of seed. Jaldubi rice variety not adopted by a cent per cent of the respondents wherein 85.94 per cent respondents not adopted, by reason of not aware about this variety and 14.06 per cent respondents not adopted as a result of non availability of seed. 100 per cent respondents not adopted Samleshwari where 87.50 per cent respondents not adopted as they were never aware and 12.50 per cent respondents not adopted caused by lack of seed availability. Cent per cent respondents not adopted Indira Sona rice variety which is only one hybrid rice

variety of IGKV in which 67.81 per cent respondents because of they had not aware about this variety and remaining 32.19 per cent respondents not adopted due to unavailability of seed. 99.38 per cent respondents not adopted Chandrahasani in which 78.62 per cent not adopted due to they had not aware of this variety and remaining 21.38 per cent respondents not adopted as a consequence of unavailability of seed. 96.56 per cent of the respondents not adopted Danteshwari rice variety wherein 90.29 per cent respondents did not adopt as they were not aware about this variety and 9.71 per cent respondents not adopted as a consequence of unavailability of seed. Indira sugandhit dhan-1 was not adopted by 90.94 per cent of the respondents wherein 78.35 per cent respondents not aware and 21.65 per cent respondents not adopted causes of lack of seed availability and 1.71 per cent not adopted due to good aroma but poor in taste. Karma mahsuri not adopted by 90.63 per cent of the respondents in which 85.86 per cent respondents not adopted due to not aware, 14.14 per cent respondents not adopted due to lack of seed availability. Maheshwari rice variety not adopted by 89.06 per cent of the respondents in which 45.61 per cent respondents not adopted due to not aware, 54.39 per cent respondents not adopted due to unavailability of seed. 86.25 per cent of the respondents not adopted Bamleshwari whereas 45.29 per cent respondents had never aware to this variety and 54.71 per cent not adopted due to lack of seed availability and 2.17 per cent respondents not adopted due to not uneven mature.

Rajeshwari not adopted by 84.38 per cent respondents in which 37.04 per cent respondents not adopted due to not aware and 62.96 per cent not adopted due lack of seed availability, 83.13 per cent respondents not adopted Durgeshwari rice variety, in which due to 49.25 per cent respondents not aware and 50.75 per cent respondents not adopted because of non-availability of seed. Indira aerobic, Indira barani dhan-1, Indira sona, Jaldubi and Samleshwari adopted by zero respondents due to different reasons like Jaldubi was not adopted because of it was recommended for northern hills.

Table 4.22: Distribution of respondents according to major reasons for non-adoption of IGKV released rice varieties

Sl. No.	IGKV rice varieties	NAR		Reasons for non adoption	F	%
		F	%			
1	Indira aerobic	320	100.00	• Not aware	295	92.19
				• Unavailability of seed	25	7.81
2	Indira barani dhan-1	320	100.00	• Not aware	217	67.81
				• Unavailability of seed	103	32.19
3	Jaldubi	320	100.00	• Not aware	275	85.94
				• Unavailability of seed	45	14.06
				• Lack of suitable land	2	0.65
4	Samleshwari	320	100.00	• Not aware	280	87.50
				• Unavailability of seed	40	12.50
5	Indira sona	320	100.00	• Not aware	217	67.81
				• Unavailability of seed	103	32.19
6	Chandrahasani	318	99.38	• Not aware	250	78.62
				• Unavailability of seed	68	21.38
7	Danteshwari	309	96.56	• Not aware	279	90.29
				• Unavailability of seed	30	9.71
8	Indira sugandhit dhan-1	291	90.94	• Not aware	228	78.35
				• Unavailability of seed	63	21.65
				• Good aroma but poor taste	5	1.71
9	Karma mahsuri	290	90.63	• Not aware	249	85.86
				• Unavailability of seed	41	14.14
10	Maheshwari	285	89.06	• Not aware	130	45.61
				• Unavailability of seed	155	54.39
11	Bamleshwari	276	86.25	• Not aware	125	45.29
				• Unavailability of seed	151	54.71
				• Uneven maturity	6	2.17
12	Rajeshwari	270	84.38	• Not aware	100	37.04
				• Unavailability of seed	170	62.96
13	Durgeshwari	266	83.13	• Not aware	131	49.25
				• Unavailability of seed	135	50.75

Note: Data are based on multiple responses, F=frequency, NAR=not adopted respondent, %= percentage

4.11 Major reasons for discontinuation from the cultivation of IGKV released rice varieties

Table 4.23 incorporated regarding major reasons for discontinuation from the cultivation of IGKV released rice varieties, here 7 rice variety of IGKV selected for the discussion. 6.25 per cent of the respondents discontinued Maheshwari rice variety wherein all respondents discontinued because of unavailability of seed and 60 per cent discontinued due to BPH & blight problem. Rajeshwari discontinued by 4.69 per cent of the respondents in which cent per cent respondents discontinued due to unavailability of seed and same per cent respondents discontinued due to lodging problem, 86.7 per cent respondents discontinued due to its blast susceptibility and 80 per cent of the respondents discontinued due to not suitable for low land. Durgeshwari rice variety also discontinued by 9.06 per cent of the respondents, 100 per cent of the respondents discontinued consequences of unavailability of seed followed by 69 per cent discontinued due to highly susceptible for brown plant hopper and 62 per cent respondents discontinued due to not suitable for low land. 5.63 per cent respondents discontinued Karma mahsuri rice due to different reasons such as 100.00 per cent of the respondents discontinued due to unavailability of seed followed by 83.33 per cent respondents discontinued because of its more chaffy grains in panicle and whereas 44.4 per cent of the respondents discontinued due to its uneven maturity. Indira sugandhit-1 also discontinued by the 9.06 per cent of the respondents wherein 100.0 per cent of the respondents discontinued due to lack of seed availability followed by 44.8 discontinued due to poor in taste and 41.4 per cent of the respondents discontinued due to susceptible to insect/disease and 31 per cent discontinued due to bold grain. 12.81 per cent of the respondents discontinued Bamleshwari rice due to different reasons wherein 95.1 per cent of the respondents discontinued due to unavailability of seed followed by 80.5 per cent discontinued reason of uneven maturity and while 43.9 per cent respondents discontinued due to distributed as long duration but matures in 120 days, therefore, face problem in lowland.

Table 4.23: Distribution of respondents according to major reasons for discontinuation of IGKV released rice varieties

Sl. No.	IGKV rice varieties	DR		Reasons for the discontinuation	F	%
		F	%			
1	Maheshwari	20	6.25	• Unavailability of seed	20	100.0
				• Problem of BPH & Blight	12	60.0
2	Rajeshwari	15	4.69	• Unavailability of seed	15	100.0
				• Lodging problem	15	100.0
				• Blast susceptible	13	86.7
				• Not suitable for low land	12	80.0
3	Durgeshwari	29	9.06	• Unavailability of seed	29	100.0
				• Susceptible to abiotic stress	21	72.4
				• Highly susceptible for brown planthopper	20	69.0
				• Not suitable for low land	18	62.0
4	Karma Mahsuri	18	5.63	• Unavailability of seed	18	100.0
				• More chaffy grains in panicle	15	83.3
				• Uneven maturity	8	44.4
5	Indira sugandhit -1	29	9.06	• Unavailability of seed	29	100.0
				• Poor in taste	13	44.8
				• Susceptible to insects/disease	12	41.4
				• Bold grain	9	31.0
6	Bamleshwari	41	12.81	• Unavailability of seed	39	95.1
				• Uneven maturity	33	80.5
				• Distributed as long duration but matures in 120 days	18	43.9
				• Low yield sustainability	15	36.6
				• More height	12	29.3
7	Danteshwari	11	3.44	• Unavailability of seed	11	100.0
				• Low productivity	10	90.9
				• Early maturity	8	72.7

Note: Data are based on multiple responses, DR=discontinued respondents, F=frequency, %= Percentage

3.44 per cent of the respondents discontinued Danteshwari rice variety in which 100.0 per cent of the respondents discontinued due to lack of seed availability and 90.9 per cent discontinued due to its low productivity in respondents field.

Results showed that all respondents discontinued different IGKV rice varieties due to different reasons where unavailability of seed was a major reason for discontinuation/reversion. Someone like to cultivate IGKV varieties but unable to cultivate due to uncommon maturity time in adjacent field, if surrounding field cultivate another maturity duration variety, then comes problem in mechanization *i.e.* harvesting through the machine, handling through tractor etc because no more space between two fields (size of bund) so that machinery unable to enters in the center field. Therefore respondents follow all those varieties that were cultivated in surrounding field.

4.12 Innovativeness of the respondents for IGKV released rice varieties

Here innovativeness means adoption of recommended rice varieties relatively earlier. Table 4.24 revealed, still total 16 rice varieties have notified of IGKV, in which described innovativeness of 8 rice varieties which was popular amongst respondents. 1st let's discuss innovativeness for Mahamaya rice variety, which was released in 1996. Table elaborated that majority (69.82%) respondents had medium innovativeness followed by 19.65 per cent respondents had low innovativeness while only 10.53 per cent respondents had high innovativeness.

Danteshwari rice variety released in the 2001 year, the same Table noted that majority (41.67%) respondents had high innovativeness followed by 33.33 per cent respondents had medium innovativeness, while only 25 per cent of the respondents had low innovativeness.

Bamleshwari rice variety released by IGKV in 2001, results nearly same to the innovativeness of Mahamaya, Highest (72.73%) respondents had medium innovativeness followed by 18.18 per cent respondents had low innovativeness and while only 9.09 per cent of the respondents had high innovativeness.

Indira sugandhit rice variety released in 2005 and maximum (66.67%) respondents had low innovativeness followed by 26.67 per cent respondents had

medium innovativeness, whereas 6.67 per cent respondents had high innovativeness.

Table 4.24: Distribution of respondents according to their innovativeness about IGKV released rice varieties

Sl. No.	Innovativeness	F	%
Mahamaya (n=285)			
1	Low innovativeness (Up to 10 scores)	56	19.65
2	Medium innovativeness (11 to 16 scores)	199	69.82
3	High innovativeness (More than 16 scores	30	10.53
Danteshwari (n=12)			
1	Low innovativeness (3 score)	3	25.00
2	Medium innovativeness (4 score)	4	33.33
3	High innovativeness (5 score)	5	41.67
Bamleshwari (n=44)			
1	Low innovativeness (Up to 2 score)	8	18.18
2	Medium innovativeness (3 to 7 score)	32	72.73
3	High innovativeness (More than 7 scores)	4	9.09
Indira sugandhit (n=15)			
1	Low innovativeness (3 score)	10	66.67
2	Medium innovativeness (4 score)	4	26.67
3	High innovativeness (5 score)	1	6.67
Karma Mahsuri (n=22)			
1	Low innovativeness (1 score)	4	18.18
2	Medium innovativeness (2 to 3 score)	12	54.55
3	High innovativeness (More than 3 scores)	6	27.27
Rajeshwari (n=41)			
1	Low innovativeness (1 score)	26	63.41
2	Medium innovativeness (2 to 3 score)	14	34.15
3	High innovativeness (More than 3 scores)	1	2.44
Durgeshwari (n=54)			
1	Low innovativeness (1 score)	25	46.30
2	Medium innovativeness (2 to 3 score)	28	51.85
3	High innovativeness (More than 3 scores)	1	1.85
Maheshwari (n=35)			
1	Low innovativeness (1 score)	20	57.14
2	Medium innovativeness (2 to 3 score)	11	31.43
3	High innovativeness (More than 3 scores)	4	11.43

n= Refers to cultivation of variety by the farmer anytime after its release

Karma Mahsuri rice variety released in 2008 and more than 50 per cent respondents had medium innovativeness followed by 27.27 per cent respondents had high innovativeness, while only 18.18 per cent respondents had low innovativeness.

Rajeshwari rice variety released in 2011, maximum (63.41%) respondents had low innovativeness followed by 34.15 per cent of the respondents had medium innovativeness and only 2.44 per cent of the respondents had high innovativeness.

Durgeshwari rice variety released in 2011 and more than 50 per cent of the respondents had medium innovativeness followed by 46.30 per cent respondents had low innovativeness and only 1.85 per cent of the respondents had high innovativeness.

Maheshwari rice variety released in 2012. The majority (57.14%) respondents had low innovativeness followed by 31.43 per cent respondents had medium innovativeness and 11.43 per cent of the respondents had high innovativeness.

Overall innovativeness of described rice varieties, Table showed that majority (74.69) respondents had medium innovativeness followed by 15.63 per cent of the respondents had high innovativeness and 9.69 per cent had low innovativeness.

Similarly, Khan *et al.* (2013) incorporated in their study that about three-fourths (72%) of the respondents had medium innovativeness for Binsali rice as compared to 17 per cent having high innovativeness and 11 per cent having low innovativeness. A majority of the farmers in the study area possessed medium to high innovativeness for Binsali rice, there is a possibility exists to improve agricultural production of the farmers through awareness.

Table 4.25: Overall innovativeness of farmers about IGKV rice varieties

Sl. No.	Innovativeness	Frequency	Percentage
1	Low innovativeness (less than 12.05 scores)	31	9.69
2	Medium innovativeness (12.05 to 19.11 scores)	239	74.69
3	High innovativeness (More than 19.11 scores)	50	15.63

$\bar{x}$ =15.59, SD=3.50

4.13   Diffusion pathway of rice varieties

4.13.1 Diffusion pathway of IGKV released rice varieties

Diffusion is a process by which innovations are communicated through appropriate channels in overtime among member a social system. Hence diffusion pathway means spreading of innovation through different path/route/channels in overtime amongst respondents.

The Table 4.26 illustrated regarding diffusion pathway of IGKV released rice varieties (Mahamaya and Danteshwari), Mahamaya rice variety released by IGKV and notified by Govt. of India at 1996, which was transferred amongst 1.56 per cent respondents in 1997-99 through agriculture department (60.00%) and Agriculture University (40.00%). Year after diffusion path changed in the 2010 year Mahamaya variety transferred amongst 3.44 per cent respondents through friends/relatives (54.55%), agriculture department (27.27%) and 18.18 per cent disseminated by a cooperative society.

Danteshwari variety released in 2001 was disseminated through agriculture department (66.67%), KVK (33.33%) in 2012 amongst 0.94 per cent respondents, whereas this variety diffused through farmers/relatives (14.29%), agriculture department (28.57%), KVK (14.29%), University (28.57%) and other (8.33%) in 2014 amongst 2.19 per cent respondents, while zero dissemination noted from 2001 to 2011 amongst respondents.

Table 4.27 regarding diffusion pathway of IGKV released rice varieties (Bamleshwari, Indira sugandhit and Karma mahsuri) revealed that Bamleshwari rice variety released in 2001 and started to diffusion at 2008 amongst 1.25 respondents in which 25 per cent of the respondents received seed through agriculture department and 75 per cent through KVK. Further, Table explained that Bamleshwari rice transferred through friends/relatives (20%), agriculture department (30%), Krishi Vigyan Kendra (20%), Agriculture University (10%) and other (20%) in 2014 amongst 3.13 per cent of the respondents.

Whereas, Indira sugandhit released in 2005 was disseminated through agriculture department (100%) in 2012 in the midst of 0.31 per cent of the respondents and it was transferred through another path also in 2014, *i.e.*

friends/relatives (10%), agriculture department (30%), KVK (30%), Agriculture University (20%) and other (10%) amongst 3.14 per cent of the respondents

Karma Mahsuri rice variety released at 2008 which was first disseminated amongst 1.88 per cent of the respondents through different pathway that was agriculture department (50%), KVK (33.33%) and Agriculture University (16.67%) in 2011 and it was transferred amongst 3.75 per cent of the respondents through different channels that was agriculture department (33.33%), KVK (25%), cooperative society (16.67%), Agriculture University (16.67%) and other (8.33%).

Table 4.28 regarding diffusion pathway of IGKV released rice varieties (Rajeshwari, Durgeshwari and Maheshwari) revealed that Rajeshwari rice variety released in 2011 was first diffused among 6.31 per cent of the respondents at 2012 through agriculture department (100%), whereas it was disseminated 3.13 per cent of the respondents through friends/relatives (20%), agriculture department (40%), Agriculture University (30%) and other (10%).

Durgeshwari released in 2011 was first disseminated amongst 6.31 per cent of the respondents through KVK (100%), whereas it was diffused through friends/relatives (13.64%), agriculture department (9.09%), KVK (40.91%), cooperative society (13.64), Agriculture University (13.64%) and other (9.09%) n 2011 amongst 6.88 per cent of the respondents.

Maheshwari rice released at 2012 was first transferred in 2013 through different pathway *i.e.* agriculture department (37.50%), KVK (37.50%), Agriculture University (12.50%) and other (12.50%) and it was disseminated through friends/relatives (16.67%), agriculture department (33.33%), KVK (16.67%), cooperative (8.33%), Agriculture University (8.33%) and other (16.67%) in 2014 amongst 3.75 per cent of the respondents.

Table 4.26: Diffusion pathway of IGKV released rice varieties (Mahamaya and Danteshwari)

Year	Respondents who adopt variety first time in year		Pathways /channels for diffusion of seed											
			Friends/relatives/ other farmers		Agriculture Department		Krishi Vigyan Kendra		Cooperative society		Agriculture University		Other	
	TF	%	F	%	F	%	F	%	F	%	F	%	F	%
1. Mahamaya (Released year, 1996)														
1997-99	5	1.56	0	0.00	3	60.00	0	0.00	0	0.00	2	40.00	0	0.00
2000	19	5.94	1	5.26	8	42.11	0	0.00	3	15.79	6	31.58	1	5.26
2001	25	7.81	8	32.00	6	24.00	0	0.00	5	20.00	6	24.00	0	0.00
2002	32	10	9	28.13	8	25.00	0	0.00	2	6.25	12	37.50	1	3.13
2003	30	9.38	10	33.33	8	26.67	0	0.00	7	23.33	5	16.67	0	0.00
2004	45	14.06	19	42.22	13	28.89	0	0.00	5	11.11	8	17.78	0	0.00
2005	48	15	12	25.00	20	41.67	0	0.00	14	29.17	2	4.17	0	0.00
2006	25	7.81	8	32.00	9	36.00	1	4.00	7	28.00	0	0.00	0	0.00
2007	20	6.21	1	5.00	2	10.00	3	15.00	11	55.00	2	10.00	1	5.00
2008	10	3.14	6	60.00	0	0.00	2	20.00	0	0.00	0	0.00	2	20.00
2009	15	4.69	3	20.00	3	20.00	4	26.67	4	26.67	0	0.00	1	6.67
2010	11	3.44	6	54.55	3	27.27	0	0.00	2	18.18	0	0.00	0	0.00
Total	**285**	**89.06**	**83**	**29.12**	**83**	**29.12**	**10**	**3.51**	**60**	**21.05**	**41**	**14.39**	**6**	**2.11**
2. Danteshwari (Released Year, 2001)														
2001-2011	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2012	3	0.94	0	0.00	2	66.67	1	33.33	0	0.00	0	0.00	0	0.00
2013	2	0.63	1	50.00	1	50.00	0	0.00	0	0.00	0	0.00	0	0.00
2014	7	2.14	1	14.29	2	28.57	1	14.29	0	0.00	2	28.57	1	14.29
Total	**12**	**3.75**	**2**	**16.67**	**5**	**41.67**	**2**	**16.67**	**0**	**0.00**	**2**	**16.67**	**1**	**8.33**

Note: Data are based on multiple responses, TF=total frequency, F=frequency, %= percentage

Table 4.27: Diffusion pathway of IGKV released rice varieties (Bamleshwari, Indira sugandhit and Karma Mahsuri)

Year	Respondents who adopt variety first time in year		Pathways /channels for diffusion of seed											
			Friends/relatives/ other farmers		Agriculture Department		Krishi Vigyan Kendra		Cooperative society		Agriculture University		Other	
	TF	%	F	%	F	%	F	%			F	%	F	%
3. Bamleshwari (Released year, 2001)														
2001-2007	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2008	4	1.25	0	0.00	1	25.00	3	75.00	0	0.00	0	0.00	0	0.00
2010	3	0.94	3	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2012	19	5.94	2	10.53	4	21.05	4	21.05	4	21.05	2	10.53	3	15.79
2014	10	3.13	2	20.00	3	30.00	2	20.00	0	0.00	1	10.00	2	20.00
2015	5	1.56	1	20.00	2	40.00	2	40.00	0	0.00	0	0.00	0	0.00
2016	3	0.94	0	0.00	3	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**44**	**13.75**	**8**	**18.18**	**13**	**29.55**	**11**	**25.00**	**4**	**9.09**	**3**	**6.82**	**5**	**11.36**
4. Indira sugandhit (Released year, 2005)														
2005-2011	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2012	1	0.31	0	0.00	1	100.00	0	0	0	0.00	0	0.00	0	0.00
2013	4	1.25	0	0.00	2	50.00	2	50	0	0.00	0	0.00	0	0.00
2014	10	3.14	1	10.00	3	30.00	3	30	0	0.00	2	20.00	1	10.00
Total	**15**	**4.69**	**1**	**6.67**	**6**	**40.00**	**5**	**33.33**	**0**	**0.00**	**2**	**13.33**	**1**	**6.67**
5. Karma Mahsuri (Released year, 2008)														
2008-2010	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2011	6	1.88	0	0.00	3	50.00	2	33.33	0	0.00	1	16.67	0	0.00
2014	12	3.75	0	0.00	4	33.33	3	25.00	2	16.67	2	16.67	1	8.33
2016	12	3.75	3	25.00	5	41.67	1	8.33	0	0.00	2	16.67	1	8.33
Total	**30**	**9.38**	**3**	**10.00**	**12**	**40.00**	**6**	**20.00**	**2**	**6.67**	**5**	**16.67**	**2**	**6.67**

Note: Data are based on multiple responses, TF=total frequency, F=frequency, %= percentage

Table 4.28: Diffusion pathway of IGKV released rice varieties (Rajeshwari, Durgeshwari and Maheshwari)

Year	Respondents who adopt variety first time in year		Pathways /channels for diffusion of seed									
			Friends/relatives/ other farmers		Agriculture Department		Krishi Vigyan Kendra		Cooperative society		Agriculture University		Other
	TF	%	F	%	F	%	F	%			F	%	F	%
6. Rajeshwari (Released year, 2011)														
2012	1	6.31	0	0.00	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00
2014	4	1.25	0	0.00	2	50.00	1	25.00	0	0.00	1	25.00	0	0.00
2015	10	3.13	2	20.00	4	40.00	0	0.00	0	0.00	3	30.00	1	10.00
2016	35	10.94	4	11.43	9	25.71	8	22.86	8	22.86	4	11.43	2	5.71
Total	**50**	**15.63**	**6**	**12.00**	**16**	**32.00**	**9**	**18.00**	**8**	**16.00**	**8**	**16.00**	**3**	**6.00**
7. Durgeshwari (Released year, 2011)														
2012	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
2013	1	0.31	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00	0	0.00
2014	6	1.88	0	0.00	2	33.33	2	33.33	0	0.00	2	33.33	0	0.00
2015	22	6.88	3	13.64	2	9.09	9	40.91	3	13.64	3	13.64	2	9.09
2016	25	7.81	5	20.00	5	20.00	4	16.00	6	24.00	2	8.00	3	12.00
Total	**54**	**16.88**	**8**	**14.81**	**9**	**16.67**	**16**	**29.63**	**9**	**16.67**	**7**	**12.96**	**5**	**9.26**
8. Maheshwari (Released year, 2012)														
2013	8	2.50	0	0.00	3	37.50	3	37.50	0	0.00	1	12.50	1	12.50
2014	12	3.75	2	16.67	4	33.33	2	16.67	1	8.33	1	8.33	2	16.67
2016	15	4.69	4	26.67	6	40.00	1	6.67	1	6.67	2	13.33	1	6.67
Total	**35**	**10.94**	**6**	**17.14**	**13**	**37.14**	**6**	**17.14**	**2**	**5.71**	**4**	**11.43**	**4**	**11.43**

Note: Data are based on multiple responses, TF=total frequency, F=frequency, %= percentage

4.13.2 Overall diffusion pathway of selected IGKV released rice varieties during the period (1996 to 2016)

Table 4.29 and Fig 4.13 and Fig 4.14, regarding overall diffusion pathway of selected IGKV released rice varieties during the period elaborated that Mahamaya rice variety disseminated through farmer to farmer (30%), agriculture department to farmer (29%), Krishi Vigyan Kendra to farmer (4%), cooperative society to farmer (21%), Agriculture University to farmer (15%) and Other channel (2%) in over 15 year from released year (1996) to 2010 amongst 89.06 per cent of the respondents. Till 2010 about all respondents 1 time adopted Mahamaya rice variety, farmer to farmer pathway was highly used for the diffusion of Mahamaya rice variety. Mahamaya was only one variety which was fully communicated in the middle of the respondents.

Danteshwari rice variety communicated through farmer to farmer (17%), agriculture department to farmer (42%), KVK to farmer (17%), Agriculture University to farmer (17%) and other path (8%) over 15 year from released year (2001) in the midst of the 3.75 per cent of the respondents. Results showed that agriculture to farmer path was highly used for the diffusion and variety diffused amongst little respondents over 15 years.

Bamleshwari rice variety communicated through farmer to farmer pathway (18%), agriculture department to farmer (30%), KVK to farmer (25%), cooperative society to farmer (9%), Agriculture University to farmer (7%) and other path (11%) over 15 year from released year (2001) amongst 13.75 per cent of the respondents. Agriculture department to farmer pathway highly used for the diffusion of Bamleshwari also. It as diffused amongst only more that 10 per cent of the respondents.

Indira sugandhit dhan disseminated through farmer to farmer path (7%), agriculture department to farmer (40%), KVK to farmer (33%), Agriculture University to farmer (13%) and other path to farmer (7%) over 11 year from released year (2005) in the middle of 4.69 per cent of the respondents. Results revealed that agriculture department plays a great role in the diffusion of Indira sugandhit rice variety; it was second lowest diffused rice variety of IGKV.

Karma Mahsuri rice of IGKV communicated through farmer to farmer (10%), agriculture department to farmer (40%), KVK to farmer (20%), cooperative society to farmer (7%), Agriculture University to farmer (17%) and other path (7%) over 8 year from released year (2008) in middle of the 9.38 per cent of the respondents.

Rajeshwari rice variety communicated through farmer to farmer path (12%), agriculture department to farmer (32%), KVK to farmer (18%), cooperative society to farmer (16%), Agriculture University to farmer (16%) and other channel (6%) in over 5 year from released year (2011) between 15.63 per cent of the respondents.

Durgeshwari rice transferred through farmer to farmer (15%), agriculture department (17%), KVK to farmer (30%), cooperative society to farmer (17%), Agriculture University (13%) and other path (9%) in over 5 year from its released year (2011) amongst 16.88 per cent of the respondents.

Maheshwari rice variety communicated through farmer to farmer channel (17%), agriculture department to farmer (37%), KVK to farmer (17%), cooperative society (6%), Agriculture University (11%) and other path (11%) in over 4 year from released year (2012) amongst 10.94 per cent of the respondents.

Results showed that IGKV rice varieties communicated through different channels where agriculture department to the farmer was highly (30.10%) used for the diffusion in over 1996 to 2016 amongst 20.51 per cent of the respondents. Mahamaya variety diffused amongst almost respondents but jointly (15 varieties of IGKV) rice varieties of IGKV only 20.51 per cent reached amongst respondents and 7 varieties of IGKV noted zero diffusion amongst respondents.

Table 4.29: Overall diffusion pathway of selected IGKV released rice varieties during period (1996 to 2016)

Sl. No.	Variety	Releasing year	Respondents who adopt rice varieties		Pathway/channels utilized for diffusion of seed											
					Ch-1		Ch-2		Ch-3		Ch-4		Ch-5		Ch-6	
			F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Mahamaya	1996	285	89.06	85	30	83	29	10	4	60	21	43	15	6	2
2	Danteshwari	2001	12	3.75	2	17	5	42	2	17	0	0	2	17	1	8
3	Bamleshwari	2001	44	13.75	8	18	13	30	11	25	4	9	3	7	5	11
4	Indira Sugandhit	2005	15	4.69	1	7	6	40	5	33	0	0	2	13	1	7
5	Karma Mahsuri	2008	30	9.38	3	10	12	40	6	20	2	7	5	17	2	7
6	Rajeshwari	2011	50	15.63	6	12	16	32	9	18	8	16	8	16	3	6
7	Durgeshwari	2011	54	16.88	8	15	9	17	16	30	9	17	7	13	5	9
8	Maheshwari	2012	35	10.94	6	17	13	37	6	17	2	6	4	11	4	11
	Total		**525**		**119**	**22**	**157**	**30**	**65**	**12**	**85**	**16**	**72**	**14**	**27**	**5**

Note: Data are based on multiple responses, F=Frequency, Ch-1= Farmer to farmer, Ch-2=Agriculture department to farmer, Ch-3=Krishi Vigyan Kendra to farmer, Ch-4=Cooperative society to farmer, Ch-5=Agriculture University to farmer, Ch-6= others (NGO *etc.)* to farmer
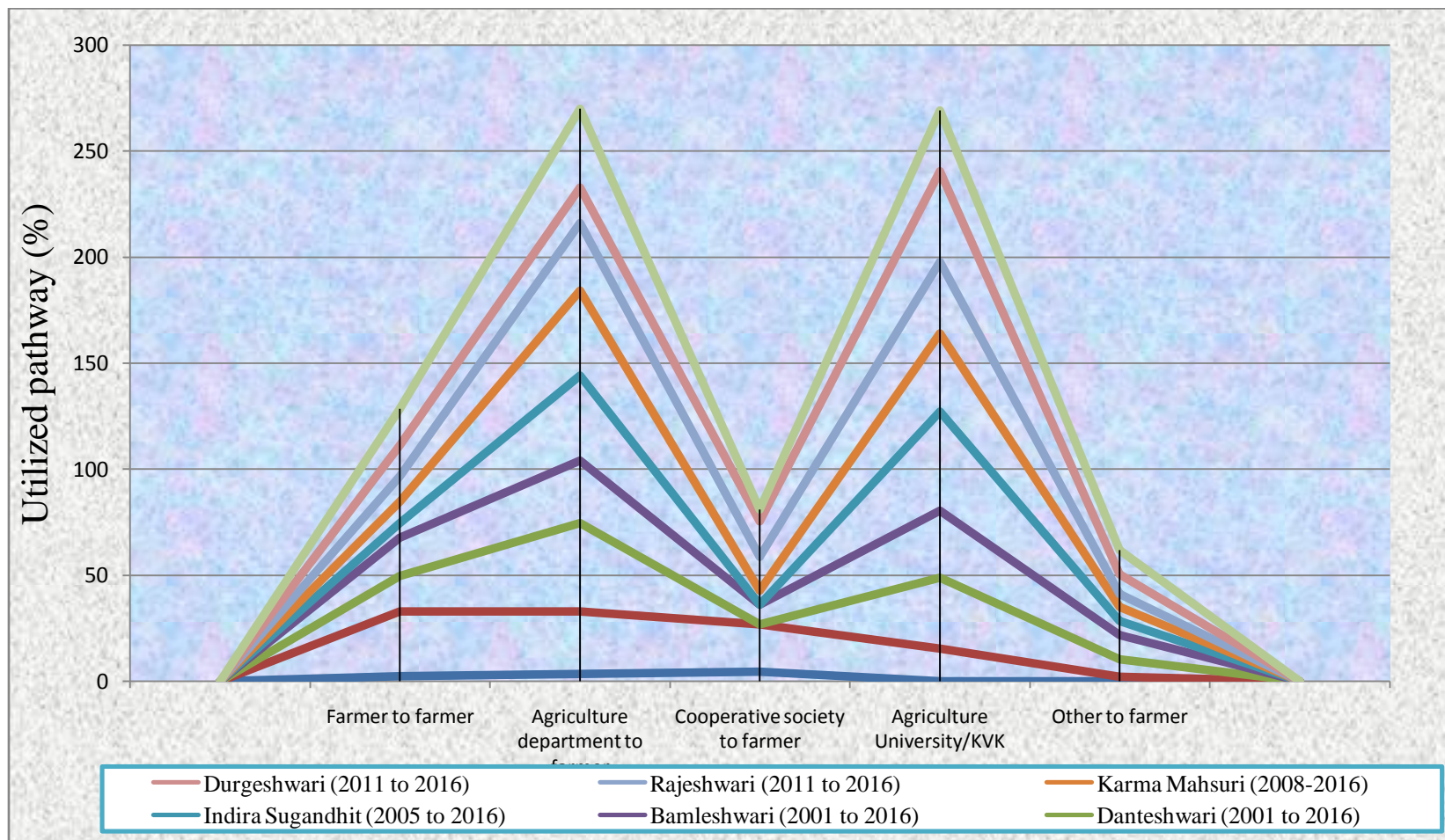
Fig 4.13: Variety wise utilized channels (diffusion pathway) for selected IGKV released rice varies

Channels/path , utilized by respondents during 1996 to 2016

Other
5%

Farmer to farmer
23%

Cooperative
society
16%

Agriculture
department
30%

Agriculture
University/KVK
26%
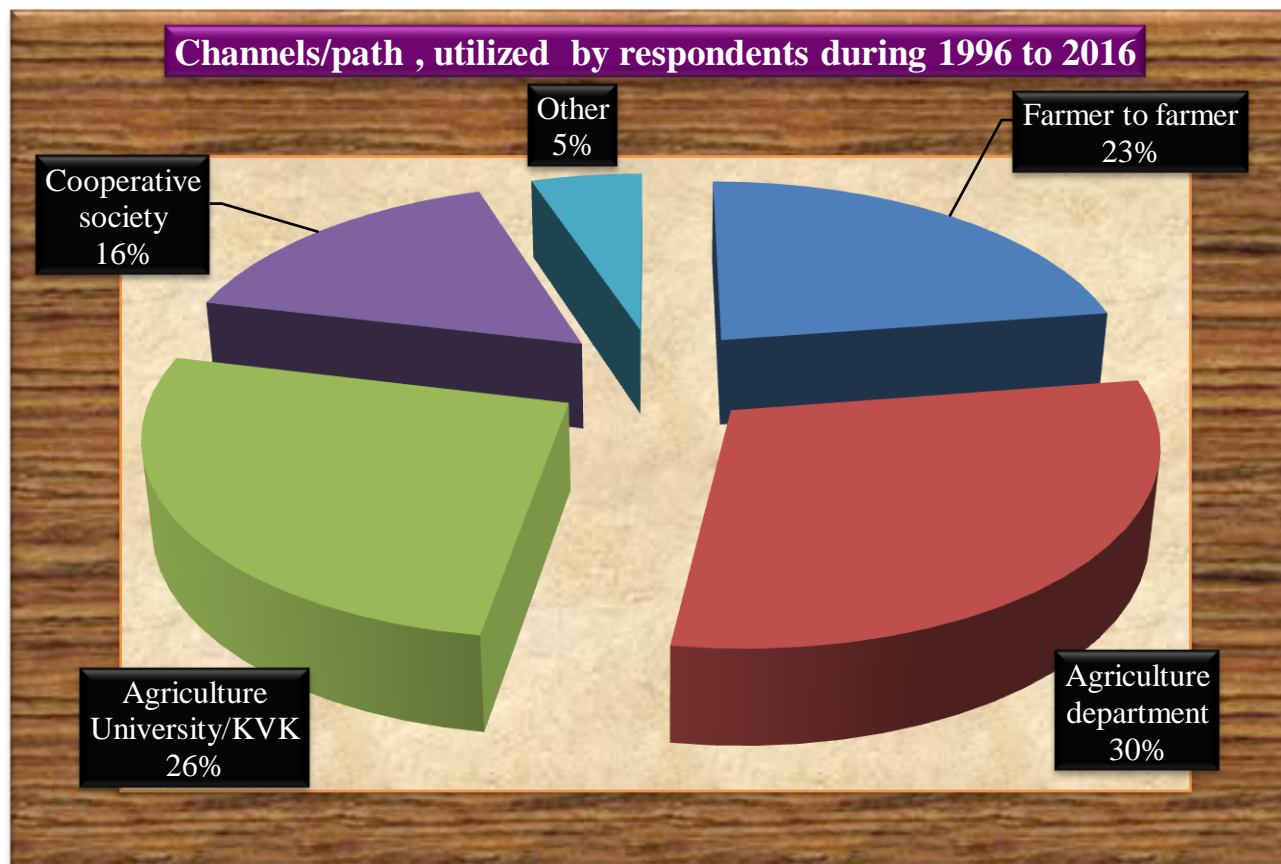
Fig 4.14: Overall utilized channels for diffusion of selected IGKV rice varieties
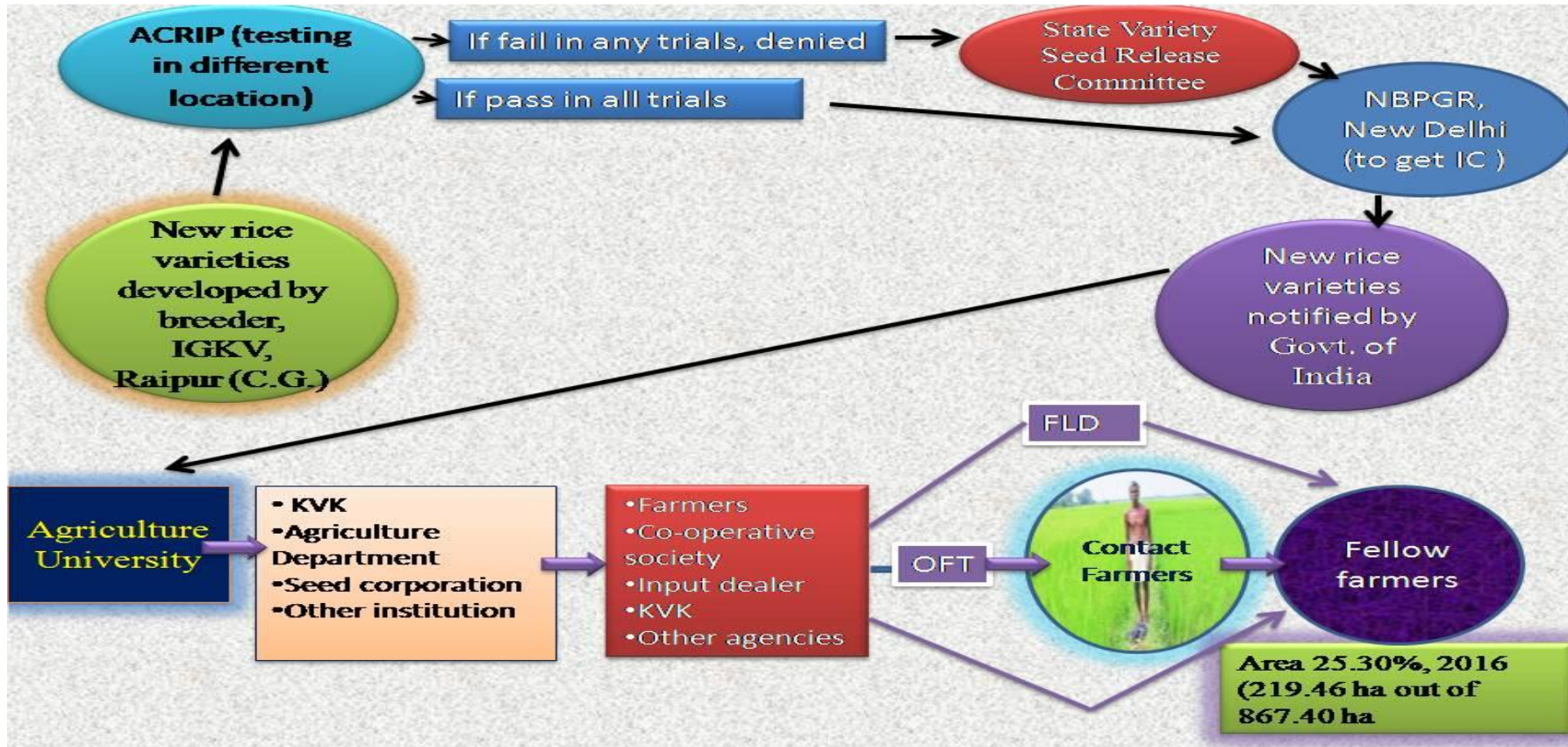
Fig 4.15: Diffusion pathway of IGKV released rice varieties

4.14 Preferential traits for selection of rice varieties

Regarding preferential traits for selection of rice varieties by the respondents, Table 4.30 and Fig 4.16 revealed that under mid-land of rainfed condition grain yield (40.48% weightage) was the major character for the selection of rice varieties followed by duration/maturity was 2nd ranked trait for the selection of varieties. Further, data elaborated that market price; size and shape of grain, height of plant, eating quality were also major characteristics for the selection of rice varieties in mid-land situation of rainfed. Whereas, grain yield was a major factor for the selection of rice varieties in the lowland of rainfed also followed by marker price, eating quality also main factors for the selection of rice varieties in lowland situation of rainfed land.

Respondents preferred grain yield for the selection of rice varieties in a mid-land situation of irrigated land followed by market price, size and shape of grain, duration/maturity, insect disease were foremost factors for the selection of rice varieties in a mid-land situation of irrigated land. Whereas, grain yield was the core factor for the selection of rice varieties in lowland situation of irrigated land followed by market price, eating quality, size and shape of grain and duration/maturity also chief points for the selection of rice varieties in lowland situation of irrigated land.

Results showed (Table 4.30, Fig 4.16) that grain yield was core factor for the section of rice varieties in the rainfed land as well as in irrigated land. 2nd most important trait was duration/maturity followed by market price; drought resistance and insect disease were main points for the selection of rice varieties in rainfed land, while 2nd chief aspect was market price followed by size and shape of grain, duration/maturity, and eating quality were major characteristic used for selection of rice varieties in irrigated land.

The rank correlation showed that significantly correlated, preferential traits for the selection of rice varieties. Statistics showed that grain yield highly used for the selection of rice varieties in rainfed as well as same results for the irrigated land.

Table 4.30: Percentage weightage on different traits as given by farmers for selection of a rice variety

| Sl. No. | Traits | Rainfed | | | | Overall rainfed | | Irrigated | | | | Overall irrigated | |
| | | Mid-land | | Lowland | | | | Mid-land | | Lowland | | | |
		PW	R	PW	R	PW	R	PW	R	PW	R	PW	R
1	Grain yield	40.48	I	42.67	I	41.58	I	41.77	I	43.06	I	42.42	I
2	Duration/maturity	11.53	II	5.27	VI	8.40	III	10.22	III	6.38	VI	8.30	IV
3	Height of plant	6.99	VI	5.20	VII	6.10	VII	5.95	VII	3.90	VIII	4.93	VII
4	Threshing quality	3.02	VIII	4.21	IX	3.62	IX	3.13	VIII	3.76	IX	3.45	IX
5	Size and shape of grain	2.92	IX	3.20	1X	3.06	X	6.32	VI	8.58	IV	7.45	VI
6	Eating quality (Taste)	6.61	VII	8.90	III	7.76	V	8.26	IV	9.00	III	8.63	III
7	Insect disease resistance	7.71	V	8.10	IV	7.91	IV	7.72	V	7.84	V	7.78	V
8	Drought resistance	8.10	IV	5.10	VIII	6.60	VI	2.88	X	1.64	X	2.26	X
9	Resistance to lodging	1.68	X	6.37	V	4.03	VIII	2.90	IX	4.87	VII	3.89	VIII
10	Market price	10.96	III	10.98	II	10.97	II	10.85	II	10.97	II	10.91	II
	Total	100.00		100.00		100.00		100.00		100.00		100.00	

Rank correlation $1-6\sum d^2/n\ (n^2-1) =0.77$, $t=r/\sqrt{1-r^2}/n-2=3.5$ (Table value =3.1)

Note: PW= Percentage weightage, R=Rank, Mid-land=*Matasi/Dorsa*, Lowland=*Kanhar*
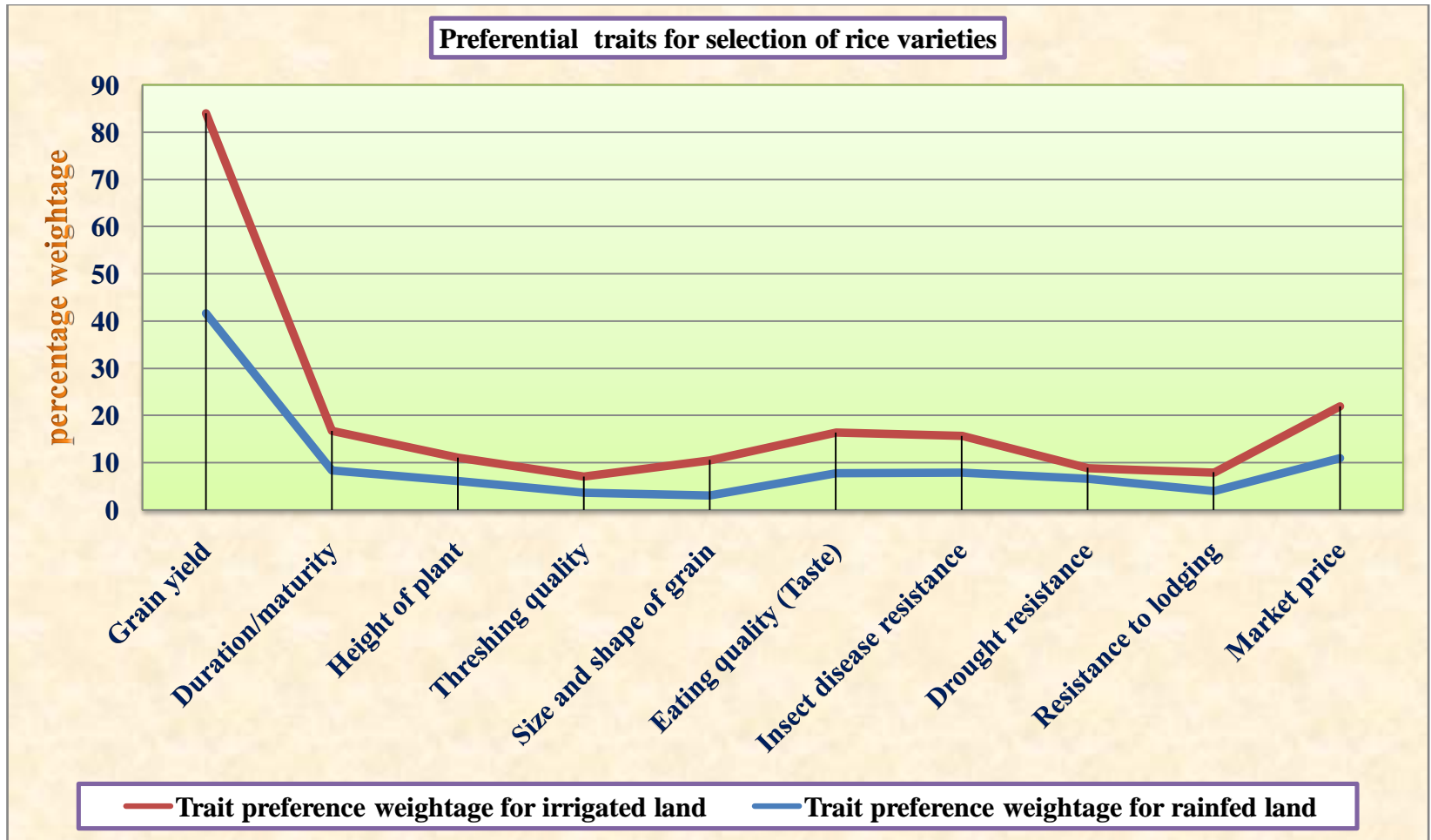
Fig 4.16: preferential traits for the selection of rice verities

Similarly, Laborte *et al.* (2015) also noted that farmers adopt MVs that are high yielding, mature faster and have long and slender grains, high milling recovery and intermediate amylase content. In addition, new MVs should have higher head rice recovery, less chalky grains and better resistance to pests and disease. Sharma *et al.* (1997) revealed that yield potential was the major character for the selection of rice varieties irrespective to land situation as reported by both the male and female respondents. Under upland condition eating quality, size & shape of grain and duration of maturity were the major factors used for selecting rice varieties.

4.15 Impact (share) of different released rice varieties on annual income

Table 4.31 incorporated that average total annual income was noted ₹ 78000 and average annual income from agriculture was ₹ 54414.06 and their percentage to total income was 69.76 per cent. If lack of knowledge of IGKV released rice varieties than how respondents adopt, for the adoption of anything, information is the first stage of adoption. According to North Central Rural Sociological society, adoption model has five stages: Awareness-Interest-Evaluation-trial-adoption (Singh and Singh, 2011), respondents got some information about varieties and further generate interest about varieties than last they adopt the variety. Some respondents want to adopt IGKV new varieties but they had feared to fail because they had limited land holding and they were totally depending on agriculture. Generally, large landholder respondents try to adopt but lack of seed availability failed to adopt of IGKV rice varieties. Seeing is believes principles work amongst farmers. If good production results were seen by respondents they definitely try to adopt in next year. Some respondent unable to adopt due to non cultivation of same variety in surrounding field, because of different maturity duration of rice variety, most of the respondents used harvester and thresher and they required space for a drive *etc.*

Average annual income from rice recorded was ₹ 40231 and percentage to total income from agriculture was 73.93 per cent. Further data showed that annual income non-rice was ₹ 14183.06 and percentage to total income from agriculture was 26.07 per cent. Average annual income from IGKV released rice varieties

recorded was ₹ 10460 and percentage to total annual income was 13.41 per cent, percentage to total income from agriculture was 19.22 per cent and percentage to total income from rice was 26.00 per cent. Further data lightened that average annual income other than IGKV released rice varieties was ₹ 29771 and percentage to total income from rice was 74.00 per cent.

Overall data showed that share of IGKV rice varieties on annual income was less than 30 per cent because of most of the released rice varieties not fully disseminated amongst respondents, only one rice variety Mahamaya of IGKV was popular in the midst of respondents. Similarly, Nguezet *et al.* (2011) observed in their research that positive and significant impact of NERICA variety adoption on farm household income and welfare measured by per capita expenditure and poverty reduction.

Table 4.31: Impact of different IGKV released rice varieties on annual income of respondents

Particulars (Per family)		
A	Average total annual income	₹ 78000
B	Average annual income from agriculture	₹ 54414.06
	• Percentage to total income	69.76%
C	Average annual income from rice	₹ 40231
	• Percentage to total income from agriculture	73.93%
D	Annual income from non-rice	₹ 14183.06
	• Percentage to total income from agriculture	26.07%
E	Average annual income from IGKV released rice varieties	₹ 10460
	• Percentage to total annual income	13.41%
	• Percentage to total income from agriculture	19.22%
	• Percentage to total income from rice	26.00%
F	Average annual income other than IGKV released rice varieties	₹ 29771
	• Percentage to total income from rice	74.00%

4.16   Constraints of the respondents in speedy adoption of IGKV released rice varieties

The finding given in Table 4.32 revealed that 71.88 per cent respondents said that lack of demonstration of IGKV released rice variety in farmer's field was barriers of speedy adoption because of farmers believe on varieties, after varietal production result.

Table 4.32: Distribution of respondents according to their constraints in speedy adoption of released rice varieties by IGKV

Sl. No.	Constraints	Frequency	Percentage
1	Lack of knowledge of IGKV released rice variety	195	60.93
2	Seed unavailability of IGKV released rice variety	121	37.81
3	Lack of demonstration of IGKV released rice variety on farmers field	230	71.88
4	Non-availability of IGKV rice varieties in required quantity inappropriate time.	150	46.88
5	Low land-holding	172	53.75
6	Demanded seed also not available in the market *i.e.* Rajeshwari	120	37.50
7	There is no difference in yield to adopt IGKV rice variety	180	56.25
8	Extension workers also not aware about the new IGKV rice varieties	50	56.25
9	IGKV rice varieties not cultivated in surrounded field	110	34.38

The majority (60.93%) of the respondents had lack of knowledge of IGKV released rice variety followed by 56.25 per cent of the respondents said that no difference in yield between IGKV varieties and non-IGKV rice varieties, so they adopted only those varieties, which was cultivated in the previous year. 53.75 per

cent of the respondents had low land holding so they were unable to try a new variety of IGKV, due to fear of fail of variety. 46.88 per cent of the respondents had constraints of nonavailability of IGKV rice varieties in required quantity in inappropriate time. 37.50 per cent of the respondents had constraints of demanded IGKV rice varieties also not available in the market. 34.38 per cent respondents had the problem of IGKV rice varieties not cultivated surrounding the field of other farmers. Whereas, 15.63 per cent respondents said that extension worker also not aware about the new IGKV rice varieties.

4.17 Suggestions for a speedy adoption of IGKV released rice varieties

The finding presented in Table 4.33, elaborated that 71.88 per cent of the respondents suggested conducting a demonstration of IGKV released rice varieties in villages because of most of the respondents believed in rice variety after their output. 60.93 per cent of the respondents suggested that required giving information of IGKV released rice varieties, followed by 56.25 per cent of the respondents suggested giving information related to yield of IGKV released rice varieties, 53.75 per cent of the respondents suggested that free crop insurance will be provided to the farmers for cultivation of IGKV released rice varieties especially for limited land holders, due to crop insurance some respondents may try to adopt of newly released rice variety of IGKV. 37.81 per cent of the respondents makes sure of seed availability of IGKV rice variety. 37.50 per cent of the respondents suggested that make seed availability of demanded seed of IGKV rice, 34.38 per cent respondents gave suggestion to motivate farmers group to cultivate IGKV rice variety in their field, whereas only 15.63 per cent of the respondents gave the suggestion that gives information to extension workers also of IGKV released rice varieties.

All suggestion are valuable to make speedy adoption of IGKV rice varieties, IGKV rice varieties adoption area was only 25.69 per cent which have discussed in previous, this adoption area of IGKV rice varieties is very poor its mean not poor characteristic of rice variety, many IGKV rice varieties have efficiency of better performance but due to above-discussed factors break the adoption rate.

Table 4.33 : Distribution of respondents according to their suggestion to overcome the given constraints in speedy adoption of released rice varieties by IGKV

Sl. No.	Suggestions	Frequency	Percentage
1	Providing information of released rice variety	192	60.93
2	Make seed availability of released rice variety by IGKV	121	37.81
3	Conduct demonstration in every village because villagers adopt new variety after seen production result.	230	71.88
4	Make availability of IGKV rice varieties in required quantity inappropriate time.	150	46.88
5	provide free crop insurance for new variety especially for low land-holders	172	53.75
6	Make seed availability of demanded seed of rice variety	120	37.50
7	Give information regarding yield of IGKV rice varieties	180	56.25
8	Give information regarding new released IGKV rice varieties to extension workers	50	15.63
9	Motivate to cultivate IGKV rice varieties surrounding the field	110	34.38

4.18 Correlation analysis of variables

Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate together. A positive correlation indicates the extent to which those variables increases or decreases in parallel, a negative correlation indicates the extent to which one variable increases as the other decreases.

Regarding correlation, the finding given in Table 4.34 reveals that two dependent variables taken for the analysis and all independent variables indicated some relationship on knowledge of IGKV rice varieties and adoption area of IGKV rice varieties.

4.18.1 Correlation of Knowledge about IGKV rice varieties with independent variables

Further Table 4.34 elaborated that relationship of knowledge about IGKV rice varieties with independent variables, where 9 variables such as education, social participation, land holding, extension participation, extension contact, source of information about rice varieties, decision-making ability, management orientation and innovativeness) were found positively significant correlated with knowledge about IGKV rice varieties at 0.01 level of probability, hence if education increases than knowledge also increase, the same direction followed by social participation, land holding, extension participation, extension contact, source of information about rice varieties, decision-making ability, management orientation and innovativeness.

Further results showed that only one variable that is occupation, which is negative significant correlated at 0.05 level of probability, which explained that if noumber of occupation increases than respondents focus on IGKV rice varieties decreases, they have not more interest in agriculture also, therefore knowledge decreases by increases of no. of occupation. While cast, family size, income, attitude towards improved rice variety and productivity were non-significantly correlated with knowledge about IGKV rice varieties.

4.18.2 Correlation of adoption area of IGKV rice varieties

Out of 16 variables, 7 variables *i.e.* education, land holding, income, decision-making ability, innovativeness, productivity and knowledge of IGKV rice varieties were found positively significant with adoption area of IGKV rice varieties at 0.01 level of probability, wherein occupation negative significant correlated with adoption area of IGKV rice varieties at 0.01 level of probability. Hence, adoption area of IGKV rice varieties increases by increases in education, land holding, income decision-making ability, innovativeness, productivity and knowledge.

Remaining 8 variables (cast, family size, social participation, extension participation, extension contact, the source of information, attitude towards improved rice variety and management orientation) not significantly correlated with adoption area of IGKV rice varieties.

Table 4.34: Correlation analysis of independent variables with dependent variables

Sl. No.	Variables/Factors	Knowledge about IGKV rice varieties	Adoption area of IGKV rice varieties
1	Education	0.36**	0.29**
2	Cast	-0.05	-0.05
3	Family size	-0.1	0.06
4	Social Participation	0.29**	-0.01
5	Land holding	0.22**	0.84**
6	Occupation	-0.12*	-0.17**
7	Income	-0.01	0.55**
8	Extension participation	0.52**	0.09
9	Extent of contact	0.45**	0.07
10	Source of information about rice varieties	0.29**	0.04
11	Decision making ability	0.35**	0.16**
12	Attitude towards improved rice variety	0.06	-0.03
13	Management orientation	0.27**	0.06
14	Innovativeness	0.19**	0.27**
15	Productivity	0.09	0.26**
16	Knowledge about IGKV rice varieties	-	0.25**

Note: * Significant at 0.05 level of probability, * *Significant at 0.01 level of probability

4.19 Multiple regression analysis

Correlation analysis only tells about the relation between two or more variables but not describe that how much correlated. Regression will tell about the contribution of factors on the dependent variable so that regression is the extent of predictability or could say it is used in calculating quantification relationship between two or more variables.

4.19.1 Multiple regression analysis of knowledge about IGKV rice varieties with   independent variables

The data given in Table 4.35 reveals that education, land holding, extension participation, source of information about rice varieties, decision-making ability,

attitude towards improved rice varieties, management orientation and innovativeness significantly contributed at 0.01 level of probability for knowledge about IGKV rice varieties, means these significant variables have ability to prediction for knowledge level of respondents about IGKV rice varieties, while occupation also significantly contributed to 0.05 level of probability. Remaining variables such as cast, family size, social participation, income, the extent of contact and productivity were non-significantly contributed for knowledge. It does not mean their zero contribution, but there factors affect but not to the level of significant factors.

R^2 found from statistical analysis, which also known as coefficient of determination, which is 0.62, which means 15 variables jointly contributed for knowledge of IGKV rice varieties, moreover elaborated that we can predict only for 62 per cent of knowledge another word we can control only 62 per cent of knowledge, we can increase to 62 per cent of knowledge as well decrease to 62 per cent. Whereas remaining 38 per cent level of knowledge we can't control or predict through these 15 factors and for finding that 38 per cent contribution we need to include more factors in these 15 factors. F-value interpreted that this regression is significantly associated with knowledge.

4.19.2 Multiple regression analysis of adoption area of IGKV rice varieties with independent variables

The data given in Table 4.35 reveals that 5 variables such as land holding, occupation, attitude towards improved rice varieties, productivity and knowledge were significantly contributed for adoption area of IGKV rice varieties at 0.01 level of probability while innovativeness showed that significant contribution for adoption area of IGKV at 0.05 level of probability, means all significations factors have ability to prediction for adoption area of IGKV rice varieties. Whereas education, cast, family size, social participation, income, extension participation, extension contact, the source of information about rice varieties, decision-making ability and management orientation showed no significant contribution for adoption area of IGKV rice varieties.

Where R^2 is 0.74, which mean 16 factors jointly effect till 74 per cent, we can control 74 per cent adoption area of IGKV rice varieties and need to add more

variable in these 16 variables to control of 26 per cent adoption area of IGKV rice varieties. F-value also showed that regression line is significant.

Table 4.35: Multiple regression analysis of independent variables with dependent variables

Sl. No.	Variables/Factors	Knowledge about IGKV rice varieties		Adoption area of IGKV rice varieties	
		b-value	t-value	b-value	t-value
1	Education	0.70	2.23*	-0.03	-0.30
2	Caste	-0.03	-0.27	-0.11	-0.56
3	Family size	0.00	-0.01	0.09	1.38
4	Social Participation	0.06	0.21	-0.12	-1.34
5	Land holding	0.15	3.38**	0.23	15.60**
6	Occupation	-1.18	-2.53*	0.44	2.73**
7	Income	0.08	-1.12	0.00	-0.95
8	Extension participation	1.70	8.24**	-0.06	-0.79
9	Extent of contact	0.62	1.84	-0.12	-1.00
10	Source of information about rice varieties	0.46	5.15**	-0.06	-1.86
11	Decision making ability	0.69	4.17**	0.01	0.26
12	Attitude towards improved rice variety	-0.93	-7.37**	0.16	3.48**
13	Management orientation	3.63	6.46**	0.12	0.61
14	Innovativeness	0.30	5.09**	-0.06	-2.60*
15	Productivity	0.00	-0.11	0.00	2.39**
16	Knowledge about IGKV rice varieties	-	-	0.05	2.65**
	R^2	0.62		0.74	
	F-value	33.03		57.80	

Note: * Significant at 0.05 level of probability, * *Significant at 0.01 level of probability

4.19.3 Step wise multiple regression analysis of independent variables for Knowledge about IGKV rice varieties

Table 4.36: Step wise multiple regression analysis of independent variables for Knowledge about IGKV rice varieties

Model	Variables under model	R^2
M_1	Extension participation	0.26
M_2	Extension participation, Education	0.36
M_3	Extension participation, Education, Decision making ability	0.41
M_4	Extension participation, Education, Decision making ability, Source of information about rice varieties	0.47
M_5	Extension participation, Education, Decision making ability, Source of information about rice varieties, Innovativeness	0.49
M_6	Extension participation, Education, Decision making ability, Source of information about rice varieties, Innovativeness, attitude towards improved rice varieties	0.52
M_7	Extension participation, Education, Decision making ability, Source of information about rice varieties, Innovativeness, attitude towards improved rice varieties, Occupation	0.58
M_8	Extension participation, Education, Decision making ability, Source of information about rice varieties, Innovativeness, attitude towards improved rice varieties, Occupation, Management orientation	0.61
M_9	Extension participation, Education, Decision making ability, Source of information about rice varieties, Innovativeness, attitude towards improved rice varieties, Occupation, Management orientation	0.62

R^2= coefficient of determinants

Different models were tested for finding their predicting ability and to determine best predictors for Knowledge about IGKV rice varieties (Table 4.36) every time one or more variables were added to find out the predictors. The findings revealed that model M_1 have predictability up to 26 per cent for the

knowledge, it mean model M_1 (Extension participation) highly affecting to knowledge about IGKV rice varieties, whereas model M_2 affect till 36 per cent, model M_3 affect 41 per cent and model M_5 affect up to 49 per cent its mean we can control 49 per cent knowledge about IGKV rice varieties by controlling of all variable which are under model M_5. Knowledge about IGKV affected up to 52 per cent by model M_6. Step wise step one model added and finally model M_9 have 9 variables (Extension participation, Education, Decision making ability, Source of information about rice varieties, Innovativeness, attitude towards improved rice varieties, Occupation, Management orientation) which can predict knowledge about IGKV rice varieties up to 62 per cent.

4.19.4 Step wise multiple regression analysis of independent variables for adoption area of IGKV rice varieties

Different models were tested for finding their predicting ability and to determine best predictors for adoption area of IGKV rice varieties, the data given in Table 4.37 reveals that a single variable of model 1 affected up to 69 per cent adoption area of IGKV rice varieties. Other all variables of M_2, M_3, M_4, M_5 and M_6 affect only 2-3 per cent. M_6 revealed that Land holding, Innovativeness, Productivity, Occupation, Attitude towards IGKV rice varieties, Knowledge about IGKV rice varieties jointly affect adoption area of IGKV rice varieties upto74 per cent.

Table 4.37: Step wise multiple regression analysis of independent variables for adoption area of IGKV rice varieties

Model	Variables under model	R^2
M_1	Land holding	0.699
M_2	Land holding, Innovativeness	0.706
M_3	Land holding, Innovativeness, Productivity	0.712
M_4	Land holding, Innovativeness, Productivity, Occupation	0.715
M_5	Land holding, Innovativeness, Productivity, Occupation, Attitude towards IGKV rice varieties	0.719
M_6	Land holding, Innovativeness, Productivity, Occupation, Attitude towards IGKV rice varieties, Knowledge about IGKV rice varieties	0.743

R^2= coefficient of determinants

CHAPTER-V
SUMMARY AND CONCLUSIONS

Chhattisgarh state is having 137.9 lakh ha geographical area, out of which about 46.77 lakh ha is under cultivation. Rice is the main crop of the state occupying about 37 lakh ha area. Indira Gandhi Krishi Vishwavidyalaya is an autonomous non-profit, research and educational organization working for the uplifting of farmers livelihood of Chhattisgarh and it's headquarter is situated in Raipur.

Many rice varieties evolved from IGKV, Raipur. First rice variety was Mahamaya which was evolved in 1996 from Asha x Kranti parentage, long bold grain with 45-55q ha^{-1} average yield. Further, year by year researches in rice increased and till 2015 about fifteen rice varieties were evolved *i.e.* Mahamaya, Poornima, Shyamla, Danteshwari, Indira Sugandhit Dhan-1, Bamleshwari, Samleshwari, Jaldubi, Chandrahasini, Indira sona, Indira barani dhan-1, Karma mahsuri, Maheshwari, Durgeshwari, Rajeshwari and Indira aerobic-1. There is a lot of rice varieties released for India as well as for Chhattisgarh also but only a few varieties have reached amongst the farmers. From IGKV also more than 15 rice varieties were released but only a small number of varieties reached in the field of farmers and out of 15 notified rice varieties of IGKV only one rice variety (Mahamaya) of IGKV popular in amongst the respondents due to its characteristics.

The present study entitled "Study on diffusion pathway and adoption dimensions of newly released rice varieties in Chhattisgarh plains" was conducted during 2015-16 to 2016-17 in Chhattisgarh plains zone with the following objectives:

1. The study the socio-economic profile of rice growers
2. To determine the diffusion pathway of different newly released rice varieties by IGKV, Raipur
3. To assess the extent of adoption on different popular rice varieties
4. To determine the preferential traits for selection of rice varieties

5. To determine the impact of different newly released rice varieties on annual income

6. To obtain suggestion for speedy adoption.

Chhattisgarh plains zone has total fifteen districts where four districts *i.e.* Raipur, Rajnandgaon, Dhamtari, Mahasamund were purposively selected because of here maximum newly released rice varieties distributed. Two blocks where maximum rice seed of newly released varieties was distributed was selected purposively from each selected district to make a total of eight blocks in the sample. Four villages where the maximum seed of newly released varieties was distributed were selected purposively from each selected block, thus total villages were thirty-two. Ten respondents were selected randomly from each selected village, thus total respondents were three hundred twenty. The data were collected through well structured and pre-tested interview schedule; an interview schedule consisting of various types of questions related to the objectives of the study was, therefore developed. Initially, the schedule was developed in English and was then translated to the local language *i.e.* Hindi.

5.1   Socio-personal characteristic of the respondents

Most of the respondents were educated up to middle school, jointly about all respondents had educated and they belonged to other backward classes (OBC), correlation and regression showed that cast no significant factor for the knowledge as well as adoption area of IGKV rice. More than fifty per cent of the respondents belong to the medium family and they had participated in at least two organizations as social participation, respondents well experienced in the cultivation of rice.

5.2   Land-holding and their type

Respondents had 1015.75 ha land for the cultivation wherein 44.71 per cent land was *Vertisol (Kanhar)*, 58 per cent cultivable land was irrigated and 42 per cent land was rainfed. More than 50 per cent of the respondents had medium land ranged from 2.1 ha to 4 ha wherein only 5.94 per cent respondents had marginal land.

5.3   Occupation of the respondents

Respondents mainly depend on agriculture but done some another occupation also. About 99 per cent of the respondents occupied agriculture as

major occupation and 66.25 per cent of the respondents worked subsidiary occupation of other labor like home construction etc. where a little respondent's done occupation of animal husbandry.

5.4 Annual income of the respondents

The annual income of respondents was good, majority respondents had income ranged from ₹50001 to ₹100000 followed by 33.75 per respondents had annual income ranged from up to ₹50000 where main annual income source was agriculture, and most of the respondents totally depend on agriculture.

5.5 Extension participation of the respondents

Maximum respondents had medium extension participation and majority respondents participated in demonstration programme followed by 94.06 per cent of the respondents discussed with extension agents. Where radio was least used by the respondents.

5.6 Source of information regarding rice varieties

Difference sources used for the information of rice varieties by the respondents, where the personal localite source was highly used for the information followed by cosmopolitans and media was low used, respondents more believed on cosmopolitans than personal localite and mass media.

5.7 Contact with extension personnel

Highest contacted with Rural Agriculture Extension Officers by the respondents followed by contacting with Senior Extension Officers, where most of the respondents regularly contacted with Rural Agriculture Extension Officers also.

5.8 Socio-psychological characteristic of the respondents

94.38 per cent of the respondents had medium decision-making ability and 40.94 per cent respondents had a moderately favorable attitude towards improved rice varieties, Majority (96.56%) respondents had medium management orientation towards farming management. Wherein decision-making ability and management orientation were positively significant correlated with knowledge about IGKV released rice varieties and decision-making ability positively correlated with adoption area of IGKV rice varieties also.

5.9   Awareness about various rice varieties

Mostly respondents highly aware for Mahamaya, Swarna, MTU-1010 and MTU-1001 in which Mahamaya was only one IGKV released rice varieties which were highly popular whereas respondents not aware of Indira aerobic-1 and average only 38.52 per cent of the respondents aware for 15 IGKV rice varieties.

5.10   Knowledge of the respondents about released rice varieties

Jointly only 34.88 per cent of the respondents listened about IGKV rice varieties. Respondents well known about Mahamaya rice varieties as well as Rajeshwari, Maheshwari of IGKV where well known about Swarna, MTU-1010 of non-IGKV released rice varieties, respondents more familiar with non-IGKV released rice varieties than IGKV released rice varieties.

5.11   Adoption of popular rice varieties by the respondents

Mainly 3 popular rice varieties found in the middle of respondents in which Swarna rice variety adopted by 79.69 per cent of the respondents followed by 54.69 per cent of the respondents adopted MTU-1010 and 38.44 per cent of the respondents adopted Mahamaya rice variety, Swarna cultivated in highest area followed by MTU-1010 whereas IGKV (15 rice varieties) released rice varieties in 25.30 per cent of area only out of 867.40 ha..

5.12   Adopter's categories of adopters of IGKV rice varieties

The early majority found 33.52 per cent was 26.48 per cent respondents were the late majority, while 23.43 per cent of the respondents were laggards, all percentage of adopters categories differ from Roger's adopter's categories.

5.13   Reasons for the adoption of rice varieties

Most of the respondents said that they adopt productive rice varieties along with their insect and disease resistance characteristic.

5.14   Reasons for the non-adoption of IGKV rice varieties

Not listen and lack of seed availability was main reasons for the non-adoption of IGKV released rice varieties.

5.15 The reason for discontinuation/reversion of the cultivation of IGKV released rice varieties

Respondents discontinued rice varieties which were not a good performance in the field of farmers and seed unavailability was also the reason for the discontinuation.

5.16 Innovativeness of the respondents for IGKV released rice varieties

More than 50 per cent of the respondents had medium innovativeness of IGKV rice varieties followed by 15.63 per cent of the respondents had high innovativeness.

5.17 Diffusion pathway of rice varieties

IGKV rice varieties communicated through different channels where agriculture department to the farmer was highly (30.10%) used for the diffusion in over 1996 to 2016 amongst 20.51 per cent of the respondents. Mahamaya variety diffused amongst almost respondents but jointly (15 varieties of IGKV) rice varieties of IGKV only 20.51 per cent reached amongst respondents and 7 varieties of IGKV noted zero diffusion amongst respondents.

5.18 Preferential traits for selection of rice varieties

That grain yield was core factor for the section of rice varieties in the rainfed land as well as in irrigated land. 2nd most important trait was duration/maturity followed by market price; drought resistance and insect disease were main points for the selection of rice varieties in rainfed land while 2nd chief aspect was market price followed by size and shape of grain, duration/maturity, eating quality were major characteristic used for selection of rice varieties in irrigated land

5.19 Impact of different released rice varieties on annual income

Contribution of annual income of IGKV rice varieties was not more than non-IGKV released rice varieties, because of cultivation area of IGKV released rice varieties also not more than non-IGKV released rice varieties, therefore need to increase area of IGKV released rice varieties, according to respondents IGKV rice varieties have efficiency to give higher yield but area of IGKV not increased because of lack seed availability

5.20 Constraints of the respondents in a speedy adoption of IGKV released rice varieties

The majority (99.69%) of the respondents had lack of knowledge about IGKV released rice varieties followed by 93.75 per cent respondents faced constraints of unavailability of IGKV released rice varieties exclude Mahamaya rice varieties. Lack of demonstration also recorded.

5.21 Suggestions for a speedy adoption of IGKV released rice varieties

Need to take a step toward increasing knowledge of IGKV released rice varieties and make the availability of seed according to demand of respondents. Need to a demonstration of IGKV released rice varieties so that they see the performance of rice varieties in a farmers field. Need to maintain seed quality also.

5.3 Proposed strategies for speedy adoption of IGKV rice varieties

Fig 5.1 elaborated about all proposed strategies for speedy adoption and how we can increase the adoption rate. We have found out adopter categories of IGKV rice growers *i.e.* Innovators (0.95%), early adopters (15.62%), early majority (33.52%), late majority (26.48%) and laggards (23.43), which were partial different from established model of Rogar. Laggards' percentage was 23.43 per cent so that we need to efforts for movement of laggards categories to late majority and late majority to early majority, early majority to early adopters and early adopters to innovators. There is need of different strategies for movement from one categories to another categories, and final move near innovators categories so that they may adopt IGKV rice varieties qFuickly. According to first strategies need to develop cosmopoliteness, innovativeness, decision making ability etc.and in the second stage need to create awareness amongst respondents about IGKV rice varieties, use different mass media so that all information regarding IGKV rice varieties reached to farmers. In the third stage need to create interest through group discussion, field demonstration etc. in the fourth stage need to give seed for trial so that they may cultivate in own field and know about its performance if varieties really gives good performance in farmer's field they defiantly adopt that variety.
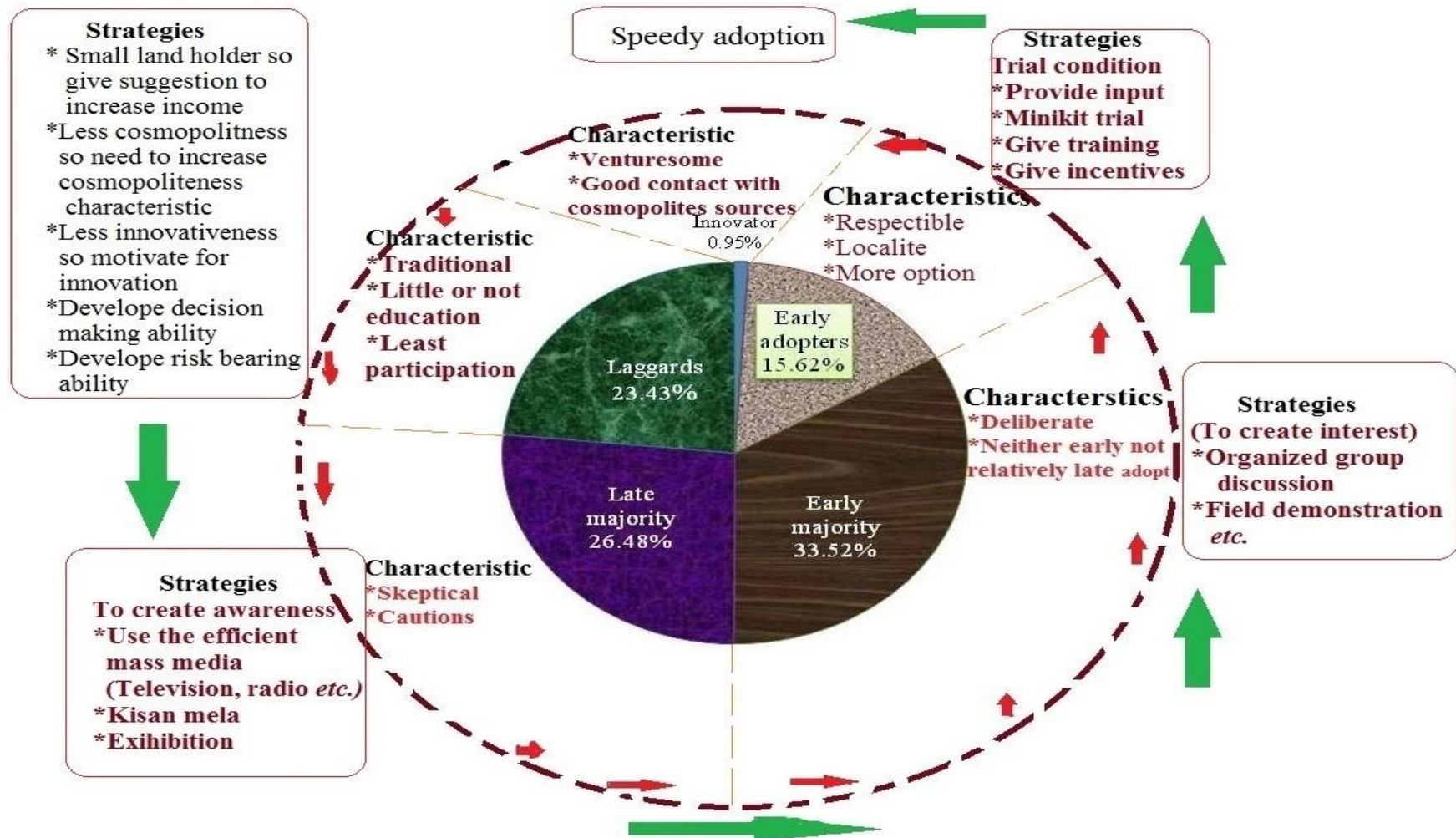
Fig 5.1 Proposed strategies for speedy adoption of IGKV rice varieties

CONCLUSION

This study concluded that all the respondents were educated, most of the respondents belonged to OBC and their family size was medium (6 to 10 members). Respondents social participation was also good and they had participated in two organizations with 11 to 20 years experience of rice cultivation. Total cultivable land noted 1015.78 ha in which majority of the land was *Alfisols* (*Kanhar*) and the maximum land was irrigated. Generally, most of the respondents were medium farmer and hold 2.1 to 4 ha land. The maximum respondents had 6 to 8 land parcels where the average number of the parcel was 9 per family and their average size of per parcel was 0.35 ha. The majority of respondents were mainly doing agriculture as the main occupation and maximum doing only one occupation. Most of the respondents had annual income ranged from ₹ 50001 to ₹ 100000 where maximum annual income collecting from the agriculture sector. Majority respondents had observed neighbor's demonstrated field and overall medium participation noted in extension participation. The majority of the respondents collecting information regarding rice varieties from personal localite but highly believed in cosmopolitans sources and overall maximum contacting to RAEOs. Maximum respondents had medium decision-making ability, had moderately favorable attitude and medium management orientation. Average 38.52 per cent of the respondents were aware of 15 listed IGKV rice varieties, whereas average 96.75 per cent of the respondents were aware for other popular rice varieties. Respondents were well known about Mahamaya rice variety which was released from IGKV and well knowledge noted for other popular (non-IGKV) rice varieties. Highest knowledge gap was recorded for Indira aerobic rice variety which was released from IGKV at 2015. Majority of the respondents cultivated swarna, MTU-1010 and Mahamaya. Swarna were cultivated in the highest area followed by MTU-1010 whereas hybrid rice gives the highest productivity on respondents field. IGKV rice varieties cultivated only 25.30 per cent of the total rice cultivation area. MTU-1010 was highly cultivated in *Inceptisols* (*Matasi* soil) and *Alfisols* (*Dorsa* soil) but Swarna was highly cultivated in *Alfisols* (*Kanhar* soil). Most of the respondents were an early majority which was started cultivation of IGKV rice varieties (within 9 years from releasing year). Mostly all rice

varieties adopted due to its high yield quality, most of the respondents not adopted IGKV rice varieties because of lack of awareness and lack of IGKV rice seed, some respondents discontinued IGKV rice varieties due to different factors whereas lack of seed was a major factor to discontinuation. Majority respondents had overall medium innovativeness of farmers about IGKV rice varieties. Results showed that IGKV rice varieties not well diffused due to different reasons, Agriculture Department and Agriculture University/KVK play a major role in the diffusion of IGKV rice varieties. Respondents prefer all those rice varieties who give high yield and same preference noted for irrigated and rainfed land. Percentage to total annual income of IGKV rice noted 13.41 per cent, percentage to total income from agriculture noted 19.22 per cent and percentage to total income from rice noted 26.00 per cent. Lack of demonstration of IGKV released rice varieties was a major constraint in a speedy adoption of IGKV rice and respondents suggests conducting a demonstration in per village wise so that respondents able to observed its productivity. Education, social participation, land holding, occupation, extension participation, extent of contact, source of information about rice varieties, decision making ability, management orientation and innovativeness were significantly correlated with knowledge about IGKV rice varieties, whereas education, land holding, occupation, income, decision making ability, innovativeness, productivity and knowledge about IGKV rice varieties was significantly correlated with adoption area of IGKV rice varieties.

SUGGESTIONS FOR FUTURE RESEARCH WORK AS WELL AS MAKING FOR STRATEGIES

All in all, from the results obtained from the research and the experience gained during and after the completion of the investigation, we can suggest the following points for future work as well as for making strategies-

1. It was really interesting and new topic for the study, but I think for the future study, select 2 or 3 varieties for the study of diffusion pathway of different varieties.

2. We will also study adopters' categories of different IGKV released varieties.

3. I feel that we can arrange a tape recorder for the group discussion, I think personal interview only not important, some time needs to make group discussion and sometimes need a personal interview.

4. Diffusion of IGKV released rice varieties was really very low, required powerful extension activities so that really all released varieties disseminate amongst the farmers.

5. IGKV have some really good rice varieties which can beat other popular rice varieties, like productivity of Rajeshwari is 60 q ha^{-1} and it gave a really good performance on farmers field but due to lack of seed they had discontinued, therefore need to making good seed channel.

6. Someone respondents discontinued varieties because of not maintains seed quality, therefore need seed quality.

7. Knowledge about IGKV rice varieties were affected by extension participation so there need to maximization of extension participation.

REFERENCES

Adedoyin, A.O., Shamsudin, M.N., Radam, A. and Abdlatif, I. 2016. Effect of improved high yielding rice variety on farmers' productivity in Mada, Malaysia. Int. J. Agril. Sc. And Vet. Med., 4(1): 38-52.

Anonymous, 2017. Seed net India Portal, http://seednet.gov.in

Anonymous. 2001. Primary census abstract: census of India.

Anonymous. 2014. Agricultural statistics, Directorate of Economic and Statistics, Department of Agriculture and Cooperation, Government of India, New Delhi, 1-2.

Asante, M.D., Asante, B.O., Acheampong, G.K., Wiredu, A.N., Offei, S.K., Gracen, V, Dapaah, H.A. and Danquah, E.Y. 2013. Grain quality and determinants of farmers' preference for rice varietal traits in three districts of Ghana: Implications for research and policy. J. of Dev. and Agril. Eco., 5(7): 284-294.

Asmelash, Y. 2014. Determinants of adoption of upland rice varieties in Fogera district, South Gondar, Ethiopia. J. of Agril. Ext. and Rural Dev., 8(12): 332-338.

Awotide, D.O. 2005. Farmers' evaluation of NRICA rice varieties and adoption determinants in Nigeria. J. of Agril. Sci. and Tech., 5(2015): 24-33.

Badhala, B.S. and Bareth, L.S. 2013. Constraints of Mothbean Production Technology in Arid Region of Rajasthan. Agriculture Update, 8(1&2):93- 97.

Baidiyavadra, D.A. 1993. Knowledge, technological gap and constraints of groundnut growers. M.Sc. (Ag.) Thesis, Gujarat Agricultural University, Sardarkrushinagar, Gujarat.

Bawajir, S.M. and Nandpurkar, G.G. 1985. Development and standardization of the socio-economic status scale to measure the socio-economic status of the farmers. MH. J. of Ext. Edu., 4: 89-97.

Behura, D., Koshta, A., Naik, D., Samal, P. and Malabayabas, M. 2012. Patterns of adoption of improved rice varieties and farm-level impacts in stress-prone rainfed areas in South Asia. Int. Rice Research Institute, 1-326.

Bhosle, P.B., Jondhale, S.G. and Patil, C.B. 2002. Effectiveness of farm broadcast as perceived by Listeners. Maharashtra Journal of Extension Education, 19(4): 28-32.

Borthakur, S., Mishra, P. and Bortamuly, D. 2014. Extent of adoption of rice varieties recommended by Assam Agricultural University (AAU), Jorhat. Agril. Update, 9(2): 181-185.

Bruce, A.K.K., Donkoh, S.A. and Ayamga, M. 2014. Improved rice variety adoption and its effects on farmers output in Ghana. J. of Dev. and Agril. Eco., 6(6): 242-248.

Bunkar, L. 2015. A study on adoption gap in recommended mustard production technology among the farmers of surguja district of chhattisgarh. M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Charyulu, D.K., Bantilan, M.C.S. and Rajlaxmi, A. 2013. Development and diffusion of sorghum improved cultivars in India: Impact on growth and variability in yield. Proceeding on 57th AARES Annual Conference, Sydney, New South Wales.

Chavda, V.N. 1998. Adoption of groundnut based inter/relay cropping system by the groundnut based inter/relay crop growers of Junagadh District. M.Sc. (Ag.) Thesis, Gujarat Agricultural University, Sardarkrushinagar, Gujarat.

Chhodavadia, H.C., Bariya, M.K. and Deshmukh, G.P. 2013. Constraints and suggestions in adopting groundnut-pigeonpea relay cropping system in Saurashtra region of Gujarat. Agril. Update, 8(4): 567-572.

Chinchmalatpure, U.R. and Mayani, V.V. 2008. Constraints and suggestions expressed by project affected farmers in adoption of modern agricultural technology. MANAGE Extension Research Review, pp 71-76.

Chowdhury, A.H. 2003. Farmers attitude towards crop diversification. M.Sc. (Ag.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Cochran and Cox. 1957. Experimental design. Second edition.

Dandedjrohoun, L., Diagne, A., Biaou, G, N'Cho, S. and Midingoyi, S.K. 2014. Daterminats of diffusion and adoption of improved technology for rice parboiling in Benin. Review of Agri.l and Env. Studies, 93(2): 171-191.

Deshmukh, P.R., Kadam, R.P. and Sindhe, V.N. 2007. Knowledge and adoption of agricultural technologies in Marathwada. Ind. J. of Extension Education 7(1): 40-42.

Dey, A., Goswami, A. and Mazumdare, D. 2014. Adoption behavior of livestock farmers in paschim Medinipore district of West Bengal, India. International Journal of Current Microbiology and Applied Science, 3(8): 666-672.

Dhruw, K.S. 2008. A study on adoption of recommended maize production technology among the farmers of Kanker district of Chhattisgarh State. M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Diagne, A. 2006. Diffusion and adoption of NERICA rice varieties in Cote D' Ivoire. The Dev. Eco., 44(2): 208-231.

Dibba, L., Diagne, A., Fialor, S.C. and Nimoh, F. 2012. Diffusion and adoption of new rice varieties for Africa (NERICA) in the Gambia. Afri. Crop Sci. J., 20(S1): 141-153.

English, H.B. and English, A.C. 1961. A Comprehensive Dictionary of Psychological and Psycholonalytical Terms. Longmans Green and Co., New York.

Farid, K.S., Tanny, N.Z. and Sarma, P.K. 2015. Factors affecting adoption of improved farm practices by the farmers of Northern Bangladesh. Journal of Bangladesh Agricultural University, 13(2): 291–298.

Ghimire, R., Wen-chi, H. and Shrestha, R.B. 2015. Factors affecting adoption of improved rice varieties among rural farm households in Central Nepal. Rice sci., 22(1): 35-43.

Gouda, S.K., Maraddi, G.N., Meti, S.K. and Hiremath, G.M. 2013. Analysis of existing livelihood systems of respondents in rainfed ecosystem of Koppal district in Karnataka. Karnataka J. of Agril. Sci., 26 (4): 519-523.

Gupta, N.K. 2015. A study on utilization pattern of leased forest land by the tribes of Bilaspur district of Chhattisgarh state. M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Guyer, D., Tuttle, A., Rouse, S., Volrath, S., Johnson, M., Potter, S., Gorlach, J., Goff, S., Crossland, L. and Ward, E. 2013. Activation of Latent Transgenes in Arabidopsis Using a Hybrid Transcription Factor. Genetics, 149: 633-639.

Hagos, A. and Zemedu, L. 2015. Determinants of improved rice varieties adoption in Fogera district of Ethopia. Sci. Technol. Arts Res. J., 4(1): 221-228.

Henry, K., Julius, M., Franklin, S., Kai, M. and Moses, S. 2012. Improved Legume Seed Demand Systems In Central Malawi. Proceeding of International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguacu, Brazil.

Hossain, K. 2006. Adoption of selected high yielding varieties of rice by the farmers of Rajpat union under kasiani upazila in Gopalgonj district. M.Sc. (Ag.) Thesis, Sher-e-Bangla Agricultural University, Dhaka.

Hossain, M., Bose, M.L. and Mustafi, B.A.A. 2006. Adoption and productivity impact of modern rice varieties in Bangladesh. The Dev. Eco., 64(2): 66-149.

Ibrahim, A.A., Ani, A.O. and Mustapha, S.B. 2012. The influence of sources of information on adoption of rice production technologies by farmers in Borno state, Nigeria. Int. J. of Inno. Res. Dev., 1(9): 224-236.

Imtiaz, S., Zeeshan, M. and Tahir, S. 2015. Advanced technology and agriculture production: a study of adoption technology, The Explorer Islamabad: Journal of Social Sciences, 1(7):232-236.

Jalal-Ud-Din, M. 2011. The socio-economic problems of small farmers in adopting new agricultural technology: A case study of three viallges in district Mardan. Sarhad Journal of Agriculture, 27(2):12-15.

Jangid, M.K., Lal, H., Jhajharia, A.K., Sharma, B.K. and Kumari, S. 2010. Association between Independent Variables and Training Needs of Farmers about Improved Pea Production Technology. Raj. J. of Ext. Edu., 17(18):140-143.

Jirgi, A., Abdulrahman and Ibrahim, F.D. 2009. Adoption of improved rice varieties among small-scale farmers in Katcha local government area of Niger state, Nigeria. J. of Agril. Ext., 13(1): 95:101.

Karki, S. 2010. An analysis of adoption and potential environmental benefits of system of rice intensification. M.Sc. (Ag.) Thesis, Norwegian University of Life Sciences, Norway.

Kassie, M., Shiferaw, B. and Muricho, G. 2011. Agriciltural technology crop income and poverty alleviation in Uganda. World Dev., 39(10): 1307-1317.

Khan, A.R., Dubey, M.K., Bisen, P.K. and Saxena, K.K. 2007. Constraints faced by farmers of Narsing Kheda village of Sihore district. Indian Res. J. Ext. Edu., 7 (1): 57-59.

Khan, M.A., Jeong, K.H., Karim, A.S.M.Z., Kim, E.J. and Rahman, M. 2013. Adopter categories in respect to a transplanted monsoon rice variety in two selected villages of Bangladesh. J. of Agril. Sci., 5(3): 200-216.

Koshta, A.K. and Choudhary, V.K. 2015. Adoption of released rice varieties in Chhattisgarh: Assessment through methodological approach of experts panel estimate. J. of Agril., 20(1&2): 41-48.

Kulshrestha, A., Kushwaha, T.S., Singh, Y.K. and Rai, D.P. 2010. Adoption of watershed technologies by the farmers in Morena district of Madhya Pradesh. Indian Journal of Extension Education, 10 (2):58-60

Kumar, A. and Rathod, M.K. 2013. Adoption behaviour of Farmers about Recommended Technology of Soybean. Agri. Upd. 8(1&2): 134-137.

Kumar, D., Shrivastava, K.K. and Shrivastava, P. 2013. Use of information sources by farmers of Raipur district of Chhattisgarh. J. of Pl. Development Sci., 5 (4): 423-429.

Kumar, D., Shrivastava, K.K., Shrivastava, P. and Shori, R.K. 2012. Profile of farmers and their attitude towards mass information sources. J. of Pl. Development S., 4(4): 605-611.

Kumar, D., Shrivastava, K.K., Shrivastava, P. and Shori, R.K. 2012. Profile of farmers and their attitude towards mass information sources. J. of Pl. Dev. Sci., 4(4): 605-611.

Kumar, P., Peshin R., Nain, M.S. and Manhas, J.S. 2010. Constraints in pulses cultivation as perceived by the farmers. Raj. J. of Ext. Edu., 17&18:33-36.

Kushwaha, D.P. 2005. Study on adoption pattern on rice cultivators among farmers in northern hill agro climatic zone of C.G. M.Sc. (Ag) Thesis, IGKV, Raipur (C.G.).

Laborte, A.G., Paguirigan, N.C, Moya, P.F, Nelson, A, Sparks, A.H. and Gregorio, G.B. 2015. Farmers' perefernce for rice traits: insight from farm survey in central Luzon, Philippines, 1966-2012, Open access available at the International Rice Research Institute: 1-18.

Lakra P.K., Chaturvedi, M.K., Yadaw, K.N. and Verma, L.R. 2012. Socio-economic status of hybrid rice growers in Surguja district of Chhattisgarh. J. of Pl. Dev. Sci., 4(4): 511-516.

Lakra, P.K. 2011. A study on extent of adoption of hybrid rice production technology by the tribal farmers of Surguja district of Chhattisgarh. M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Manjunath, T. 2010. A study on knowledge and adoption of plant protection measures by paddy growers of raichur district. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad.

Mariano, M.J., Villano, R. and Fleming, E. 2012. Factors influencing farmers adoption of modern rice technologies and good management practices in the Philippines. Agri. Sys., 110:41-53.

Meena, G.L. and Punjabi, N.K. 2012. Farmer's perception towards agriculture technology in tribal region of rajasthan. Rajasthan Journal of Extension Education, 20: 92-96.

Meena, S.L., Lakhera, J.P., Sharma, K.C. and Johri, S.K. 2012. Knowledge level and adoption pattern of rice production technology among farmers. Raj. J. of Ext. Edu., 20: 133-137.

Meena, S.L., Lakhera, J.P., Sharma, K.C. and Johri, S.K. 2012. Knowledge level and adoption pattern of rice production technology among farmers. Raj. J. of Ext. Edu. 20: 133-137.

Mendola, M. 2007. Agricultural technology adoption and poverty reduction: A prospective –score matching analysis for rural Bangladesh. Food policy, 32(3): 372-393.

Mondal, D. and Bandyopadhyay, A.K. 2013. Problems and prospects of national rural employment guarantee scheme in Jharkhand. J. of Prog. Agril., 4 (1): 91-95.

Nagadev, B. and Venkataramaiah, P. 2007. Characteristics of integrated pest management (IPM) trained dry paddy farmers. The Andhra Agriculture Journal 54(3&4): 240-242.

Naik, H.M., Srivastava, S.R., Godara, A.K. and Yadav, V.PS. 2009. Knowledge level about organic farming in Haryana. Ind. Res. J. of Extension Education, 9(1): 50-53.

Nandapurkar, G.G. 1981. A study of the entrepreneurial behavior of small farmers. Meteropolin Book, New Delhi.

Narbaria, S. 2013. A study on adoption level of System of Rice Intensification (SRI) technology among farmers in Dhamtari district of Chhattisgarh. M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.)

Narbaria, S. 2017. A study on identification, Characterization and adoption pattern of Farm practices in existing farming systems of northern hills of Chhattisgarh. Ph.D. (Ag.) Thesis, IGKV, Raipur (C.G.)

Nguezet, P.M.D., Diagne, A, Okoruwa, V.O. and Ojehomon, V. 2011. Impact of improved rice technology (NERICA varieties) on income and poverty among rice farming households in Nigeria: A local average treatment effect (LATE) approach. J. of Int. Agril., 50(3): 267-291.

Nguezet, P.M.D., Diagne, A. and Okoruwa, V.O. 2010. Estimation of actual and potential adoption rates and determinates of improved rice variety among rice variety among rice farmers in Nigeria: the case of NERICAs. Proceeding of 3rd African Association of Agricultural Economics and 48th Agricultural Economists Association of South Africa Conference, Cope Town, South Africa, 9-10.

Nirmala, B., Vasudev, N. and Suhasini, K. 2013. Farmer's perceptions on hybrid rice technology: A case study of Jharkhand. Indian Reseach Journal of Extension Education, 13 (3):103-105.

Okunade, E.O. 2006. Factor Influencing Adoption of Improved Farm Practices among Women Farmers in Osun State, Nigeria. J. of H. Eco., 19(1): 45-49.

Onumadu, F.N. and Osahon, E. E. 2014. Socio-economic determinants of adoption of improved rice technology by farmers in Ayamelum local government area of Anambra State, Nigeria. Int. J. of Science & Tech. Research, 3(1): 212-215.

Painkra, V.K. 2014. Assessment of technological gap in production of black gram among tribal farmers of Jashpur District (Chhattisgarh). M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Panda, C.K. 2014. Information sources and technology adoption by farmers: An empirical study in Mohanpur block west Tripura. International Journal of Extension Education, 10: 80-87.

Pandey, P. K., Suryawanshi, D.K. and Sarkar, J. D. 2004. Credit acquisition pattern of 96 rice grower in C.G. In: IRRI p. 270.

Pathak, M., Singh, R.K., Dubey, A.K., Dandapat, A., Kumari, C., Shekhar, S. and Singh, G.P. 2009. Knowledge empowerment through participatory trials in rainfed rice ecosystem. Ind. Res. J. of Ext. Edu., 9(1): 25-27.

Pradhan, S.K. 2014. Study on biotic factors affecting the Productivity of scented rice varieties amongst the Tribal farmers of Jashpur district (Chhattisgarh). M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Pradhan, S.K. 2017. Study on adoption of agricultural technologies in plateaux (pat areas) of northern hills agro-climatic zone of chhattisgarh state. Ph.D. (Ag.) Thesis, IGKV, Raipur (C.G.).

Prajapati, I.B. 2006. A study on socio-economic factors responsible for technological gap of recommended wheat technology among tribal farmers of Sidhi district (M.P.). M.Sc. (Ag.) Thesis, JNKVV, Jabalpur (M.P.).

R.L., Khatik, Bhimawat, B.S. and Upadhyay, B. 2012. Knowledge of Improved Rice Production Technology by the Farmers in Dungarpur District of Rajasthan. Raj. J. of Extn. Edu., 20: 97-101.

Raghuwanshi, H.S. 2005. Adoption behaviour of rice growers regarding control measures of various insect pests of rice crop in Dhamtari district of Chhattisgarh state. M.Sc. (Ag.) Thesis, IGKV, Raipur, (C.G.).

Ramesh, P. and Santha, G. 2008. Extent of adoption and relationship between the characteristics of organic farmers and their adoption level. Mysore J. Agric. Sci., 42(3): 526-529.

Rao, G. A., Gowda, N. S. and Geetha, K. 2001. Suggestions for farmers in achieving sustainability of rice farming and agricultural sustainability. Current Research, 30 (11-12): 171-174.

Rogers, E.M. 1983. Diffusion of innovations (3rd ed.). New York: Free Press.

Rogers, E.M. 1995. Diffusion of innovations (4th ed.). New York: Free Press.

Rokonuzzaman, M. 2012. Farmers' perception on environmental impact of rice monoculture in Bangladesh. Ind. Res. J. of Ext. Edu., 12 (2): 15-20.

Sadat, M.A. 2002. Framers attitude towards proshika: A cooperative study between proshika beneficiaries and non beneficiaries'. M.Sc. (Ag.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Sahu, G. 2015. A study on storage practices of food grains among the farmers of northern hills agroclimatic zone of Chhattisgarh state. M.Sc. (Ag.) Thesis, IGKV , Raipur (C.G.).

Sahu, L. 2015. Assessment of cropping systems followed by big farmers with reference to productivity in Balod district of Chhattisgarh state. M.Sc. (Ag.) Thesis, IGKV , Raipur (CG).

Saka, J.O. and Lawal, B.O. 2009. Determinants of adoption and productivity of improved rice varieties in Southwestern Nigeria. African J. of Biotech, 8(19): 4923-4932.

Saka, J.O., Okoruwa, V.O., Lawal, B.O. and Ajijola, S. 2005. Adoption of improved rice varieties among small-holder farmers in south-western Nigeria. World J. of Agril. Sci., 1(1): 42-49.

Samanta, R.K. 1977. A study of some agro-economic, socio-psychological and communication variables associated with repayment behavior of agricultural credit of nationalized bank. Ph.D. (Ag.) Thesis, Department of Agricultural Extension, Bidhan Chandra Krishi Vishwavidyalaya, West Bangal.

Sarawagi, A.K., Bhandarkar, S., Sharma, D., Sharma, B., Chandel, G. and Nair, S.K. 2016. Evolved improved rice varieties by Genetics and Plant breeding Department and its characteristic. Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

Sarker, M.R.A. 2002. Farmers Knowledge of and atiitude towards BRRI dhan variety of rice. M.Sc. Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Sathish, H.S. 2010. Farmers perception, preferences and utilization of SRI and traditional paddy straw for livestock. M.Sc. (Ag.) Thesis, University of Agriculture Sciences, Banglore.

Sharma, K., Dhaliwal, N.S. and Kumar, A. 2015. Analysis of adoption and constraints perceived by small paddy growers in rice production technologies in Muktsar district of Punjab State, India. Indian Research Journal of Extension Education, 15 (2): 20-23.

Sharma, K.C. and Sharma, A.K. 2010. Agricultural technology dissemination through mass media & its adoption by farmers. Rajasthan Journal of Extension Education 17 & 18 : 170-172.

Sharma, M.L., Thelma, P.R., Hossain, M., Sharma, P.N. and Taunk, S.K. 1997. Eliciting male and female farmers perception for rice cultivars in south eastern Madhya Pradesh, Project.

Shori, R., 2011. Attitude of farmers regarding of control mesearement practices of various weeds of rice crop in Dhamatri district of Chhattisgarh state. M.Sc. (Ag.) Thesis, IGKV, Raipur, (C.G.).

Shrivastava, R. 2005. Attitude of farmers regarding adoption of control measure practices of various diseases of rice crop in Dhamtari district of Chhattisgarh state. M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Simtowe, F., Muange, E., Munyua, B. and Diagene, A. 2012. Technology awareness and adoption: the case of improved pigeon pea varieties in Kenya. Proceeding of the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil.

Singh, B. 2011. Factors influencing the adoption of mung bean production technology in arid zone of Rajasthan. Raj. J. of Ext. Edu., 19:173-177.

Singh, D. and Singh, B.K. 2011. Agricultural Extension and Rural Development. Narendra Publishing House, New Delhi: 126-127.

Singh, I., Singh, K.K. and Gautam, U.S. 2012. Constraints in adoption of soybean production technology. Ind. Res. J. of Ext. Edu. Special issue, (2): 169-171.

Singh, R. and Kumar, A. 2007. Weed control strategies adopted by farmers in wheat crop. Agril. Extn. Review, July-Dec. pp 13-15.

Singh, R., Kumar, A. and Chand, R. 2007. Accelerating adoption of zero tillage technology. Ind. Res. J. of Ext. Edu., 7(1): 6-10.

Sivagnanam, K.J. 2014. Spread of new varieties of hybrid rice and its impact on the overall production and productivity in Tamil Nadu. Executive summary, Agro economic Research Centre University of Madras, Chennai.

Soni, N.V., Bhatt, P.M., Patel, M.R. and Kamani, K.C. 2013. Use of agricultural information by KRUSHIGOVIDYA subscriber's on their farming. Gujarat Journal of Extension Education, 24: 25-28.

Suryawanshi, R.K. 2009. A study on adoption of finger millet production technology by the tribal farmers of Bastar district. M.Sc. (Ag.) Thesis, IGKV, Raipur.

Tesfaye, A. 2009. Effectiveness of upland rice seed change farmer-to-farmer in Fogera district, south Gonder, Ethopia. M.Sc. (Ag.) Thesis, School of Graduate Studies of Alemaya University.

Thammi, R.D., Gnana, P.M., Viroji, R.S.T. and Srinivasa, R.M. 2006. Socioeconomic and livestock aspects of different production system. Livestock Research for Rural Development, 18(12)234-140.

Thatchinamoorthy, C. and Selvin, R. 2014. A study on profile of system of rice intensification (SRI) paddy growers in Tirunelveli district of Tamilnadu. Int. J. of Current Res., 6 (4): 6064-6066.

Tijani, B.A. 2007. Comparative economic analysis of weed control methods for selected crops in Marte local government area of Borno State, Nigeria. M.Sc. (Ag.) Dissertation, Department of Agricultural Economics and Extension, University of Maiduguri, Nigeria.

Tiongco, M. and Hossain, M. 2009. Adoption of modern varieties and rice varietal diversity on household farms in Bangladesh. Proceeding of the workshop "Adoption and Diffusion of Modern Rice Varieties in Bangladesh and Eastern India," held October 3-4, 2009, BRAC, Dhaka, Bangladesh.

Torres, C.S., Daya, R.A., Osalla, M.T.B. and Gopela, J.N. 2013. Adoption and uptake pathways of GM/Biotech crops by small-scale, resource-poor Filipino farmers. College of Development communication, International service for the Acquisition of Agri-biotech application, SEAsiaCenter, and SEAMEO Southeast Asian Regional Center for Graduate study and Research in Agriculture (SEARCA): 11-74.

Uddin, M.N., Bokelmann, W. and Entsminger, J.S. 2014. Factors affecting farmers' adaptation strategies to environmental degradation and climate change effects: A Farm Level Study in Bangladesh. Climate, 2: 223-241.

Udoh, E.J. and Omonona, B.T. 2008. Improved rice variety adoption and its welfare impact on rural farming households in Akwa Ibom state of Nigeria. J. of New Seed, 9(2): 156-173.

Umeh, G.N. and Chukwu, V.P. 2015. Determinants of adoption of improved rice production technologies in ebonyi state of nigeria. J. of Bio., Agril. and Healthcare, 5(7):170-176.

Usman, T., Ango, A.K. and Barau, A.A. 2013. Evaluation of adoption of improved rice varieties among small-scale farmers: a case of Goronyo local government area of Sokoto state, North-Western Nigeria. Int. J. Agril. Inno. And Res., 2(3): 1473-2319.

Uzonna,U.R. and Qijie, G. 2013. Effect of extension programs on adoption of improved farm practices by farmers in adana, Southern Turkey. Int. Inst. for Sci., Tech. and Edu., Bio. Agril and healthcare, 3(15): 120-138.

Verma, P.D. 2000. Yield gap and constraints analysis of groundnut production in South Suarastra Agro climatic zone of Gujarat state. Ph.D. (Ag.) Thesis, Gujarat Agricultural University, Sardarkrushinagar, Gujarat.

Verma, S.K. 2009. A study on knowledge and adoption of organic farming practices in paddy cultivation among the tribal farmers of Kanker district (C.G.). M.Sc. (Ag.) Thesis, IGKV, Raipur (C.G.).

Wiredu, A.N., Asante, B.O., Martey, E., Diagne, A. and Dogbe, W. 2014. Impact of NERICA adoption on incomes of rice-producing households in northern Ghana. J. of Sustainable Dev., 7(1): 167-178.

Yishak, G. 2005. Determinants of adoption of improved maize technology in Damote Gale Woreda, Wolaita, Ethiopia. M.Sc. (Ag.) Thesis, School of Graduate Study of Alemaya University.

APPENDIX-A

मदानी छत्तीसगढ़ मे धान के नये विकसित किस्मों का फैलाव पथ और अंगीकरण आयामों के अध्ययन हेतु
(Study on diffusion pathway and adoption dimensions of newly released rice varieties in Chhattisgarh plains)

साक्षत्कार अनुसूची
(Interview schedule)

क्र...............

शोधार्थी
विरेन्द्र कुमार पैंकरा
पी.एच.डी.
कृषि विस्तार विभाग
कृषि महाविद्यालय
इंदिरा गांधी कृषि विश्वविद्यालय
रायपुर, छत्तीसगढ़

1. कृषक का नाम : ....

2. ग्राम : ....

3. विकासखण्ड : ....

4. जिला : ....

5. ग्राम की दूरी : मुख्य मार्ग से .... शहर से ....

6. कृषक की उम्र : ....

7. शिक्षा का स्तर : ....

8. जाति : ....

9. आपके परिवार का आकार

अ. छोटा परिवार 1–5 सदस्य

ब. मध्यम परिवार 6–10 सदस्य

स. संयुक्त परिवार 10 से अधिक सदस्य

10. कृपया आप अपने ग्राम में कार्यरत संस्थाओं एवं उसमें अपनी सहभागिता के बारे में निम्न जानकारी दीजिए :

क्र. सं.	संस्थायें	भागीदारी का प्रकार			सदस्य	पदाधिकारी
		हमेशा	कभी-कभी	कभी नहीं		
1.	ग्राम पंचायत					
2.	सहकारी समिति					
3.	युवा मंडल					
4.	सांस्कृतिक मंच					
5.	स्कूलजनभागीदारी समिति					
6.	महिला मंडल					
7.	किसान क्लब					
8.	अन्य					

11. आपका व्यवसाय एवं विभिन्न स्रोतों से अनुमानित वार्षिक आय:

क्र.	स्रोत	व्यवसाय		वार्षिक आय (रूपये)
		मुख्य	सहायक	
1.	कृषि			
2.	कृषि मजदूरी			
3.	अन्य मजदूरी			
4.	नौकरी			
5.	व्यवसाय			
6.	पशुपालन			
7.	अन्य 1. .... 2. .... 3.			
	कूल आय			

12. आपके पास कृषि योग्य कुल कितनी भूमि है

1. स्वयं की भूमि.............................. 2. रेगहा पर दी गयी भूमि.....................

.... 3. रेगहा पर ली गयी भूमि..........................4. कुल कृषि भूमि...............

....

क्र.	भूमि के प्रकार	क्षेत्रफल	सिंचित क्षेत्रफल		असिंचित क्षेत्रफल	
			खरीफ	रबी	खरीफ	रबी
1.	भाटा					
2.	मटासी					
3.	डोरसा					
4.	कन्हार					

जोतो (खेतों) की संख्याः–

1. भाटा.................. 2. मटासी............... 3. डोरसा...............4. कन्हार............... **कूल**............

13. आप कितने वर्षों से धान की खेती कर रहे हैं...

14. आप अपनी विस्तार गतिविधियों में सहभागिता के सम्बंध में निम्न जानकारी दीजिएः–

क्र.	गतिविधियां	सहभागिता (✓ / ✗)
1	मेरे खेत में प्रदर्षन डाला गया	
2	अपने पडोसी का प्रदर्षन खेत देखा	
3	विस्तार कार्यकर्ता से चर्चा किया	
4	किसान के खेत पर कृषक दिवस में भाग लिया	
5	विस्तार बैठक में भाग लिया	
6	किसान मेला में भाग लिया	
7	विस्तार प्रकाषनों को पढ़ा	
8	कृषि आधारित कार्यक्रमों को रेडियो पर सुना या टी.वी. पर देखा	
9	कृषि महाविद्यालय या अनुसंधान केंद्र भ्रमण किया	

16. आपको धान की विभिन्न किस्मों से संबंधित जानकारी किन स्त्रोतों से प्राप्त होती है –

क्रं.	स्त्रोत	जानकारी			विश्वसनीयता का स्तर		
		अक्सर	कभी–कभी	कभी नहीं	पूर्ण	आंशिक	निरंक
अ.	व्यक्तीगत क्षेत्र से						
1.	मित्र						
2.	पड़ोसी						
3.	रिश्तेदार						
4.	उन्नत कृषक						
5.	ग्रामीण नेता						
ब.	व्यक्तीगत क्षेत्र से बांहर						
1.	ग्रा.कृ.वि.अ.						
2.	कृ.वि.अ						
3.	सहकारी समिति						
4.	कृषि वैज्ञानिक						
स.	मास मिडिया						
1.	कृषि पत्र–पत्रिकाए						
2.	रेडियो						
3.	टी.वी.						
4.	किसान कॉल सेंटर						
5.	इंटरनेट						

17. आप विस्तार विभागों से संपर्क के संबध मे निम्न जानकारी दीजिये :–

क्र.	विस्तार कार्यकर्ता	इनकी जानकारी	संपर्क का स्तर			
		(✓ / ✗)	कभी नहीं	कभी–कभी	ज्यादातर	नियमित
1	कृषि विस्तार अधिकारी					
2	वरिष्ठ कृषि विकास अधिकारी					
3	विषय वस्तु विशेषज्ञ					
4	कृषि वैज्ञानिक					

18. निचे दिये गये निर्णय संबंधी प्रश्नो के (✓ / ✗) मे उत्तर दीजिये

क्र.	निर्णय	बिना विचार किये निर्णय	परिवार / मित्रों आदि से विचार विमर्श के पश्चात्	स्वयं विचार कर
1.	नये किस्मो का चयन के लिये			
2.	कृषि ऋण लेने के लिये			
3.	कृषि यंत्र खरीदने के लिये			
4.	उर्वरक के प्रकार के उपयोग के लिये			
5.	कृषि संबंधी बैठक के लिये			
6.	कृषि संबंधी पत्र–पत्रिका मंगाने के लिये			
7.	कृषि मजदुर रखने के लिये			
8.	नये कृषि कार्य प्रणाली हेतु			
9.	नये फसल पध्दति हेतु			

19. धान के किस्मो के प्रति आपकी जानकारी के बारे मे बताइए (✓ / ✗)

क्र.	धान के किस्मो	जानकारी का स्तर					कुल अंक
		विकसित होने का वर्ष	विकसित करने वाली संस्था	पकने की अवधी	अनुशंसितउत्पादकता	प्रमुख लक्षण	
1.	इंदिरा ऐरोबिक–1						
2.	राजेश्वरी						
3.	दुर्गेश्वरी						
4.	महेश्वरी						
5.	कर्मा मासूरी						
6.	इंदिरा बरानी धान–1						
7.	इंदिरा सोना						
8.	चंद्रहासिनी						
9.	जलदुबी						
10.	समलेश्वरी						

11.	बमलेश्वरी					
12.	इंदिरा सुगंधित धान—1					
13.	दंतेश्वरी					
14.	श्यामला					
15.	पूर्णिमा					
16.	महामाया					
17.	छत्तीसगढ़ जिंक—1					
18.	बदशाह भोग सलेक्शन—1					
19.	दुबराज सलेक्शन—1					
20.	तरूण भोग सलेक्शन—1					
21.	विष्णु भोग सलेक्शन—1					
1.	एमटीयू—1010					
2.	एमटीयू—1001					

3.	स्वर्णा					
4.	सोना मासुरी					
5.	आई.आर. 36					

नोटः 1– आंशिक जानकारी स्तर , 2– पूर्ण जानकारी स्तर

20. धान के उन्नत किस्मों के प्रति अपना दृष्टिकोण बतावें (✓ / ✗)

क्र.	विचार	सहमत	असहमत	कुछ नही कह सकते
1.	धान के उन्नत किस्मो का पैदावर परंपरागत किस्मो की अपेक्षा अधिक होता है ।			
2.	धान के उन्नत किस्मो मे अधिक उर्वरको की आवश्यकता होता है ।			
3.	धान के उन्नत किस्मो का उत्पादन अधिक खर्चिला है।			
4.	धान के उन्नत किस्मो का किट से क्षति होने की संभावना कम होता है।			
5.	धान के उन्नत किस्मो मे बीज की कम मात्रा लगती है।			
6.	धान के उन्नत किस्मो का बाजार मूल्य कम होता है।			
7.	धान के उन्नत किस्म अधिक स्वादिष्ट होते है।			

21. कृषि प्रबंधन संबंधी जानकारी दीजियेः—

क्र.	विचार	सहमत	असहमत	कुछ नही कह सकते
	योजना संबंधी दृष्टिकोण			
1.	प्रत्येक वर्ष, सभी प्रकार की भुमि मे खेती की जाने वाली फसल के बारे मे विचार करना चाहिय।			
2.	लगायी जाने वाली किस्मो के बारे मे पहले से निर्णय लेने की आवश्यकता नही है।			
3.	फसल उत्पादन योजना के द्वारा पैदावार बढ़ाया जा सकता है।			
	उत्पादन संबंधी दृष्टिकोण			
1.	समय पर फसल रोपण से अच्छा पैदावार सुनिश्चित हो सकता है।			
2.	मृदा परीक्षण द्वारा, उर्वरक की मात्रा निर्धारित करने से पैसा बचता है।			
3.	वैज्ञानिक द्वारा अनुशंसित बीज मात्रा उपयोग करना चाहिये।			
	बाजार संबंधी दृष्टिकोण			
1.	बाजार संबंधी समाचार, किसानो के लिये उपयोगी नही है।			
2.	किसान अपने उत्पादन को ग्रेडींग करके अच्छी कीमत ले सकता है।			
3.	बाजार मे अधिक मांग वाले किस्मो को लगाना चाहिये ।			

22. धान के किस्म संबंधी फसल पध्दति बतावें:—

क्र.		धान का कौन सा किस्म	बीज कहॉ से प्राप्त हुआ	कितने क्षेत्र एकड़ मे लगाते है	कितना उत्पादन होता है, किलोग्राम मे	वर्तमान मे लगाने का कारण	पॉच वर्ष पहले धान के कौ सा किस्म लगाते थे, जिसे अब नही लगाते है	नही लगाने का क्या कारण है
	खरीफ							
	भाटा	....	....	....	....	....	....	....
	मटासी	....	....	....	....	....	....	....
	डोरसा	....	....	....	....	....	....	....
	कन्हार	....	....	....	....	....	....	....
	जायद							

(ग्रीष्मकालीन)							
भाटा	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
मटासी	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
डोरसा	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
कन्हार	....	....	....	....	....	....	....
	....	....	....	....	....	....	....
	....	....	....	....	....	....	....

23. आप धान के किस्मो फैलाव संबंधी जानकारी देवेः—

क्र.	धान के किस्म	किस्म की नोटी-फीकेशन वर्ष	कौन से वर्ष मे इस किस्म के बारे मे आपको जानकारी प्राप्त हुआ	किस वर्ष में प्रथम बार लगाये	प्रथम बार कितना क्षेत्र क्षेत्र मे लगाये (एकड़)	कितना उत्पादन प्राप्त हुआ	वर्तमान स्थिति		
							बोज कहा से प्राप्त किया	क्षेत्र (एकड़ मे)	उत्पादन कि.ग्रा.
1.	इंदिरा ऐरोबिक–1	2015							
2.	इंदिरा बरानी धान–1	2012							
3.	महेश्वरी	2012							
4.	राजेश्वरी	2011							
5.	दुर्गेश्वरी	2011							
6.	कर्मा मासूरी	2008							
7.	इंदिरा सोना	2007							
8.	च्व्रहासिनी	2007							
9.	ज्लदुबी	2007							
10.	समलेश्वरी	2007							
11.	इंदिरा सुगंधित धान–1	2005							
12.	बमलेश्वरी	2001							
13.	दंतेश्वरी	2001							

24. धान के प्रभाव संबंधी प्रश्नो के उत्तर देवें –

क्र.	धान के किस्म	किस्म की नोटी–फीकेशन वर्ष	इस किस्म के उपयोग के पहले आय रुपये में	इस किस्म के उपयोग के बाद आय रुपये में	आय मे परिवर्तन रुपये में
1.	इंदिरा ऐरोबिक–1	2015			
2.	महेश्वरी	2012			
3.	इंदिरा बरानी धान–1	2012			
4.	राजेश्वरी	2011			
5.	दुर्गेश्वरी	2011			
6.	कर्मा मासूरी	2008			
7.	इंदिरा सोना	2007			
8.	चंद्रहासिनी	2007			
9.	जलदुबी	2007			
10.	समलेश्वरी	2007			
11.	इंदिरा सुगंधित धान–1	2005			
12.	बमलेश्वरी	2001			
13.	दंतेश्वरी	2001			
1.	एमटीयू–1010	1999			
2.	सोना मासुरी	2005			
3.	नरेन्द्र–8002	2005			
4.	संपदा	2008			
5.	वी.एन.आर.–2245	2011			
6.	एराइज तेज	2012			
7.	सुजाला	2012			

25. आप धान के किस्मो मे कौन से गुण को महत्व देते है:—

क्र.	गुण	वरीयता का स्तर			
		बरानी क्षेत्र		सिंचित क्षेत्र	
		ऊपरी भूमि	निचली भूमि	ऊपरी भूमि	निचली भूमि
	शस्य विज्ञान के दृष्टिकोण से				
1.	अधिक पैदावर				
2.	कम परिपक्व अवधि				
3.	ज्यादा परिपक्व अवधि				
4.	अधिक पौध ऊँचाई				
5.	कम पौध ऊँचाई				
	अनाज के गुणवत्ता के अनुसार				
1.	मिसाई का गुण				
2.	लम्बा दाना				
3.	कम लम्बा दाना				
4.	दाना का आकार				
5.	सुफेद दाना				
6.	खाने मे स्वादिष्ट				
	पौध सुरक्षा गुण				
1.	कम खरपतवार लगना /				
2.	कीट व्याधि का कम प्रकोप / कीट प्रतिरोधी				
3.	कम रोग का प्रकोप / रोग प्रतिरोधी				
	बाजार भाव अधिक होना				

नोटः— वरीयता का स्तर अधिक से कम 5,4,3,2,1

बहुत अधिक वरीयता हाने पर 5 नं देवें, मध्यम हाने पर 4,3,2 नं देवें और कम वरीयता पर 1 नं देवें ।

26. धान के किस्मो का शीघ्र अंगीकरण में आने वाले बाधावों को बतावें :–

....

....

....

....

....

....

....

....

....

27. धान के किस्मो का शीघ्र अंगीकरण हेतु अपना अमूल्य सुझाव देवें:–

....

....

....

....

....

....

....

....

....

....

....

....

....धन्यवाद ....

APPENDIX-B

Table: total released rice varieties of India

(Total released rice variety till 2017, 1481)

Sl. No.	Year group	Popular/IGKV rice variety	No of released variety of rice	Percentage
1	Before 1978	Malina, Jagnnath, Kanchhi, Karishma, Padma, Palman	84	5.7
2	1978 to 1983	Kranti (R-2022), Swarna (MTU-7020), IR-34, IR-36	118	8.0
3	1984 to 1990	Shaktiman,Daya, Culture-1, Gauri, Gayatri, Anupama	156	10.5
4	1991 to 1997	IR-64, Mahamaya, Vijetha (MTU-1001), Purnima, Shyamla	130	8.8
5	1998 to 2004	MTU-1010, Danteshwari, Bamleshwari	145	9.8
6	2005 to 2011	Sona masuri (BPT-3291), Indira sona, Rajeshwari, Durgeshwari, Karma masuri, Chandrahasini, Indira sugandhit-1, Jaldubi, Samleshwari	260	17.6
7	2012 to 2012	Indira aerobic, Maheshwari, Indira barani dhan-1, Arize 6444	141	9.5
8	Unknown notification year	-	447	30.2
			1481	100

Note: Data are based on secondary data

Table: Distribution of rice varieties, released by IGKV, Chhattisgarh, according to year group (Total released rice variety, 16)

Sl. No.	Notification year group of rice varieties	Name of variety	No. of released variety	Percentage
1	1996 to 2000 Year	Mahamaya, Purnima, Shyamla	3	18.75
2	2001 to 2005 year	Danteshwari, Bamleshwari, Indira sugandhit dhan 1	3	18.75
3	2006 to 2010 year	Samleshwari, Jaldubi, Chandrahasani, Indira sona, Karma masuri	5	31.25
4	2011 to 2015 year	Indira barani dhan, Rajeshwari, Maheshwari, Durgeshwari, Indira aerobic	5	31.25

APPENDIX-C

Table: Distribution of the adopters of IGKV rice variety

Year after variety released	AY	Available IGKV rice varieties	Adopters of IGKV rice varieties	
			F	CF
1	1997-99	Mahamaya, Poornima, Shyamla	5	5
2	2000	Mahamaya, Poornima, Shyamla	25	30
3	2001	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari	25	55
4	2002	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari	32	87
5	2003	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari	24	111
6	2004	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari	45	156
7	2005	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1	48	204
8	2006	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1	25	229
9	2007	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona	20	249
10	2008	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri	14	263

11	2009	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri	15	278
12	2010	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri	14	292
13	2011	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri, Rajeshwari, durgeshwaru	36	328
14	2012	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri, Rajeshwari, durgeshwaru, Indira barani dhan-1, Maheshwari	25	353
15	2013	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri, Rajeshwari, durgeshwaru, Indira barani dhan-1, Maheshwari	49	402
16	2014	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri, Rajeshwari, durgeshwaru, Indira barani dhan-1, Maheshwari	54	456
17	2015	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri, Rajeshwari, durgeshwaru, Indira barani dhan-1, Maheshwari, Indira aerobic-	39	495

		1		
18	2016	Mahamaya, Poornima, Shyamla, Danteshwari, Bamleshwari, Indira Sugandhit Dhan-1, Samleshwari, jaldubi, Chandrahasani, Indira Sona, Karma Mahsuri, Rajeshwari, durgeshwaru, Indira barani dhan-1, Maheshwari, Indira aerobic-1	30	525
	total			525

Note: Data are based on multiple responses, AY=Adopted year, F=Frequency, CF=Cumulative frequency

इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर (छ.ग.) के द्वारा विकसित धान के किस्म

क.	धान के किस्म	किस्म की नोटी–फीकेशन वर्ष	फसल अवधि	औसत उपज
1.	इंदिरा ऐरोबिक–1	2015	115–120 दिन	40–45 क्विंटल / हेक्टेयर
2.	राजेश्वरी	2011	120–125 दिन	55–60 क्विंटल / हेक्टेयर
3.	दुर्गेश्वरी	2011	120–125 दिन	50–55 क्विंटल / हेक्टेयर
4.	महेश्वरी	2012	130–135 दिन	50–55 क्विंटल / हेक्टेयर
5.	कर्मा मासूरी	2008	125–130 दिन	45–50 क्विंटल / हेक्टेयर
6.	इंदिरा बरानी धान–1	2012	111–115 दिन	40–45 क्विंटल / हेक्टेयर
7.	इंदिरा सोना	2007	120–125 दिन	55–60 क्विंटल / हेक्टेयर
8.	चंद्रहासिनी	2007	120–125 दिन	40–45 क्विंटल / हेक्टेयर
9.	जलदुबी	2007	135–140 दिन	40–45 क्विंटल / हेक्टेयर
10.	समलेश्वरी	2007	105–112 दिन	30–35 क्विंटल / हेक्टेयर
11.	बमलेश्वरी	2001	130–135 दिन	45–55 क्विंटल / हेक्टेयर
12.	इंदिरा सुगंधित धान–1	2005	125–130 दिन	40–45 क्विंटल / हेक्टेयर
13.	दंतेश्वरी	2001	100–105 दिन	30–35 क्विंटल / हेक्टेयर
14.	श्यामला	1997	130–135 दिन	35–40 क्विंटल / हेक्टेयर
15.	पूर्णिमा	1997	100–105 दिन	30–35 क्विंटल / हेक्टेयर
16.	महामाया	1996	125–128 दिन	45–55 क्विंटल / हेक्टेयर
17.	छत्तीसगढ़ जिंक–1		110–115 दिन	40–45 क्विंटल / हेक्टेयर
18.	बदशाह भोग सलेक्शन–1			
19.	दुबराज सलेक्शन–1			

<u>RESUME</u>

Name	:	Virendra Kumar Painkra
Date of birth	:	12 May 1989
Present Address	:	Room no. 226, Wing- 'D', Sundaram Boys PG Hostel, IGKV, Krishak Nagar, Jora, Raipur (C.G.)
Phone number-		9303893380
Email id-		virupaikra@gmail.com
Permanent address	:	Village- Kuruwan, Post- Champa, Tehshil- Bagicha, Thana- Sanna, District- Jashpur (C.G.)
Academic qualification	:	

Degree	Year	University/Institute
B.Sc. (Ag.)	2012	IGKV, Raipur (C.G.)
M.Sc. (Ag.) Agricultural Extension	2014	IGKV, Raipur (C.G.)
ASRB-NET	2016	ASRB

Professional Experience	:	Rural Agricultural Work Experience (RAWE)
Membership of Professional Societies	:	Life time membership in Progressive Research-An International Journal
Awards/Recognitions	:	National Fellowship for higher education of ST students, Scientist associate award
Publications	:	More than 6 research paper published

Signature

RESUME

Name	:	Virendra Kumar Painkra
Date of birth	:	12 May 1989
Present Address	:	Room no. 226, Wing- 'D', Sundaram Boys PG Hostel, IGKV, Krishak Nagar, Jora, Raipur (C.G.)
Phone number-		9303893380
Email id-		virupaikra@gmail.com
Permanent address	:	Village- Kuruwan, Post- Champa, Tehshil-Bagicha, Thana- Sanna, District- Jashpur (C.G.)
Academic qualification	:	

Degree	Year	University/Institute
B.Sc. (Ag.)	2012	IGKV, Raipur (C.G.)
M.Sc. (Ag.) Agricultural Extension	2014	IGKV, Raipur (C.G.)

Professional Experience	:	Rural Agricultural Work Experience (RAWE)
Membership of Professional Societies	:	Life time membership in Progressive Research-An International Journal
Awards/Recognitions	:	National Fellowship for higher education of ST students, Scientist associate award
Publications	:	6

Signature