CHAPTER-II

REVIEW OF LITERATURE
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We need a review of literature while conducting any research, because a review of literature helps the researcher to get acquainted with the subject matter and efforts should be made towards the desirable direction. An attempt has been made to review the literature, which are meaningful and have direct relevance to this study. For the sake of convenience it is presented under the following heads:

2.1 Socio-personal and socio-economic characteristics of the respondents
2.2 Socio-psychological and communicational characteristics of the respondents
2.3 Knowledge level of recommended technology
2.4 Adoption level of recommended technology
2.5 Production and productivity of selected rice crops
2.6 Constraints and suggestions in relation to adoption of recommended technology

2.1 Socio-personal and socio-economic characteristics of the respondents

An attempt has been made to present the related literature on some of the socio personal, socio economic characteristics of the adopter viz. age, education, type and size of family, social participation, socio economic status, types and number of houses possessed, occupation, material possession, migration habit.
2.1.1 Age

Singh and Isael (1989) concluded that contact farmers had significantly higher socio-economic status, favorable attitude toward T and V system and higher adoption as compared to non-contact farmers. Bhatt (1990) stated that majority of the respondents (80.00%) were found to be of middle age group i.e. 31 to 55 years, followed by 18.00 per cent in old age group i.e. above 55 years, while only 2.00 % were found to be young age group. On the basis of the literature reviewed most of the investigation revealed that majority of the tribal farmers belonged to middle age group.

Sharma (1995) revealed that age and cast were negatively associated with the adoption of recommended paddy practices. Khan (1996) revealed that age of the respondents had significant and negative association with the adoption of selected agriculture technology. Rangnath (1997) found that there is a non-significant relationship between age and adoption of organic farming practices of rice-crop. Shivakumar (1997) revealed non-significant relationship between age and adoption of IPM practices on rice crop. Singh and Patel (1998) reported that the chi-square value was not significant for contact farmers. It proves that there was no relationship between age of contact farmers and their extent of adoption. It is probably because the management of farming is joint responsibility of all the members of family.
Choudhary *et al.* (2001) stated that there is a non-significant relationship between age and adoption of improved rice technology. Sengar (2003) found that the highest percentage of respondents (46.00%) were belonged to middle age, and 32.50 per cent in old age group. Prakash *et al.* (2004) depicted that the majority of rice growers (58%) were from middle age group, followed by 23 per cent in young age group.

### 2.1.2 Education

Reddy and Reddy (1988) found that education was negatively and significantly related with adoption of improved practices of paddy cultivation. Bhatt (1990) concluded that majority of the tribal respondents (72.00%) were found to be in the illiterate group. The respondents who can read and write were found to be 20.00 per cent, while 8.00 per cent were having education upto primary and above level. It can be concluded that majority of tribal farmers had low level of education.

Dubey and Swarnkar (1992) investigated that the adoption behaviour of marginal and small farmers in relation to paddy production technology was having a significant relationship with their education. Rai *et al.* (1992) pointed out that the extent of adoption of improved seeds, fertilizers and pesticides were found to be negatively correlated with their level of education. Sharma (1993) revealed that the literacy level of tribal is very low and female literacy was extremely low.
Caffey and Kazmierczak (1994) used the multinational logic model to analyze the impact of various producer characteristics on the adoption of flow through and recirculating technologies. The results suggest that increased adoption might be fostered by targeting education programme towards full time, family operated businesses in non-traditional production regions. However, development of effective education programme may be hindered by the lack of a significant relationship between producer adoption decisions and the information provided by university or extension personnel.

Sharma (1995) revealed that education of farmers were highly significantly associated with adoption level of farmers. Shivakumar (1997) revealed that there is a non-significant relationship between education and adoption of IPM practices on rice cultivation. Sengar (2003) reported that out of the total respondents 64.00 per cent were illiterate and 18.50 per cent had primary education.

2.1.3 Family type and size

Choudhary et al. (1988) found that family type was significantly associated with the level of adoption. Singh (1991) reported a significant and positive relationship between extension contact and adoption behaviour of respondents. Rai et al. (1992) observed that the family size of non-tribal and tribal farmers had no significant relationship with the extent of their adoption behavior. Khare et al. (1998) reported that majority of the respondents belonged to nuclear family, followed by those who were from joint family.
Pandey (2000) observed that family type was associated with adoption of rice production technology. Choudhary et al. (2001) observed that the size of family had non-significant but positive relationship with the adoption of improved rice technology. Sengar (2003) found that the majority of respondents belonged to medium and small size of family group. Rajput (2003) investigated that majority of the respondents belonged to nuclear type of family.

Prakash et al. (2004) reported that majority of the respondents (90.00%) were observed in the medium category of size of family, followed by large (9.00%) and small (1.00%), respectively. Khan et al. (2004) reported that most of the tribal farmers had nuclear type of family and size of family was medium (5-7 members).

2.1.4 Material possession

Menon et al. (1995) reported that utilization pattern of farm information sources, significantly influenced by the variables such as educational status, extent of social participation, material possession, extent of cosmopoliteness, extent of mass media utilization and level of adoption. Kirar (2003) revealed that the contact farmers had significant progressiveness over the non-contact farmers in terms of all the connected variables of the study i.e. favourableness of attitude, source of information, diffusion activity performed, assets and material possession and extent of adoption of the improved technology.
2.1.5  Migration habit

Sinha (1980) stated that the migration is responsible for abnormal sex ratio, which greatly affect family structure. Premi (1981) concluded that rural to urban migration would be a very strong factor in the urbanization process.

Bhattacharya (2000) revealed that for migration for purpose other than marriage, the scheduled caste status is seen to have an effect independent of its direct effects on poverty. Ton et al. (2000) emphasized that second migration can be beneficial for poor peasants even without strong Government interference. Further, they stated that seasonal migration could provide an incentive for endogenous agricultural development. Conceptualizing it as mechanism for favouring and investment for even the poorest section for the peasantry.

2.1.6  Social participation

Bhatol (1987) stated that majority of the respondent (64.67%) were member of more than one social organization followed by member of one social organization (19.33%) and 6.67 per cent were having no membership, whereas only 9.33 per cent respondents were position holders. Singh and Patel (1990) concluded that the chi-square value was significant for contact farmers while non significant for non-contact farmers. It indicated that there was significant relationship between social participation of contact
farmers and their extent of adoption. While, there is no relationship between social participation of non-contact farmers and their extent of adoption.

Balavatti and Sunderswami (1990) concluded that extension participation will help to acquire more knowledge about improved agricultural technology. Bhatt (1990) reported that out of 150 tribal respondents 86.66 per cent were having no membership in any of the village organisation. Only 12.66 per cent respondents were members in one organization followed by singular respondents (0.67%) having membership in more than one organization. It can be inferred in general that tribal farmers have got inclination towards social participation.

Agrawal et al. (1993) realized the importance of conservation, development and utilization of natural resources in an area for increasing productivity and upliftment of socio-economic conditions of people. Study conducted at Akola Centre of Advance Training in Dry Land Agriculture Technology revealed that watershed planning and management, resource analysis, soil and water conservation practices, alternate land use pattern and transfer of technology were based on the needs of the participants and would be more useful to the participants in performing their job. Rao (2004) investigated that most of the respondents belonged to low participation category of social participation, followed by no participation category.
2.1.7 Size of land holding

Veigas (1987) studied the causes and process of land alienation among tribal people on the basis of a survey in 12 blocks in four districts in the tribal regions of Orissa. He noticed that by different means non-tribals, by virtue of their social, economic and political advantage, exercise their power and control over the poor tribals by acquiring their lands, thereby depriving them of their source of livelihood/income.

Patel (1988) stated that majority (74.29%) of the respondents from tribal area had small size of land holding i.e. upto 5 acres, followed by 20.00 and 5.71 per cent of respondents had medium size i.e. 5.1 to 10 acres of land and large size i.e. above 10 acres of land, respectively. Singh and Patel (1990) concluded that the Chi-square value was non significant for contact farmers and significant for non-contact farmers. It proves that there was no relationship between size of land holding of contact farmers and their adoption of improved wheat practices. While, there was relationship between size of land holding of non-contact farmers and their extent of adoption.

Bhatt (1990) stated that half of the tribal farmers (51.33 %) were having small size land holding (i.e. upto 2 acres) followed by more than one third tribal farmers (38.00%) belonged to medium size of land holding (i.e. 2.1 to 5.0 acres) whereas, only 10.67 per cent tribal farmers had large size (above 5.00 acres) of land holding. Jaiswal et al. (1990) reported that the cultivated land of Surguja district is distributed in upland, unbunded (29%).
upland bunded (24.86%), bunded (14.23%), badi (7.73%) and rest of the cultivable land is under hilly area (1.91%). The low land bunded and badi land are better in productivity as compared to all other categories of upland

Das Gupta (1993) reported that the tribals of Sankargarh block of Surguja district owned only 1 to 3 acre of poor quality land. Sharma (1998) found that the majority of the farmers belonged to small land holding group (46%). Gupta et al. (1998) found that 44 per cent of contact farmers possessed medium size of land holding, while 29 per cent of respondents had large size of land holding.

Gogoi and Phukan (2000) revealed that a high degree of association was found between size of land holding and extent of adoption in improved rice cultivation. Sengar (2003) reported that only 51.00 per cent respondents were in small land holding group, followed by 25.00 per cent to medium land holding group. Prakash et al. (2004) stated that majority (35%) of the respondents had small size of land holding followed by 25.00 per cent of respondents had medium size of land holding, respectively.

2.1.8 Occupation

Patel (1988) stated that tribal farmers were dependent on farming and labour work. Bhatt (1990) concluded that two third (68.67%) respondents were dependent on farming with labour work for their livelihood, whereas only 18.00 per cent tribal farmers were fully dependent on
agriculture. Further only 10.66 per cent respondents were having farming with some kind of small business and only 2.67 per cent respondents had service along with agriculture work. So, it can be said in nutshell that majority of the tribal farmers had farming as their main occupation.

Raje (1991) found that the majority of respondents had the occupation of farming alone in each area of study. Das Gupta (1993) stated that the tribals of Surguja district (M.P.) were living by collecting fruit and other minor products of forest and by selling them in the local market and all agriculturist of the area used the tribals as labour. Khan (1996) reported that majority of the respondents were engaged in animal husbandry and in collecting and selling of forest products, liquor preparation, extraction of tadi etc.

Pandey (2000) found that majority of the respondents (43.75%) were practicing only one occupation similarly about 37.5 per cent were engaged in two occupations and only limited i.e 18.75 per cent respondents were doing more than two occupations. Mishra et al. (2001) observed that sustainable management and optimum utilization practices, particularly associated with a limited natural resource base, had been marked by the age old interplay between man and nature in the mountains of Uttaranchal. Therefore, the changes in status of natural resources had significantly affected the occupational structure in the study area, finally leading to the process of economic transition. Sengar (2003) reported that higher (87%) percentage of
respondents belonged to 2-4 occupations, and 11.00 per cent in one occupation.

2.1.9 Annual income

Patel (1988) stated that majority of the respondents (72.38%) in tribal area had an annual income upto Rs. 10000. This was followed by 25.72 per cent tribals who had income between Rs. 10000 to Rs. 20000. Only 1.90 per cent of respondents had annual income above Rs. 20000. Singh (1989) found that the annual income established significant association with extent of adoption among all categories of farmers i.e. big, small and marginal farmers. Bhatt (1990) stated that two third of the respondent (66.00%) from tribal area belonged to the category of low annual income of Rs. 3000 (low annual income group) followed by the category of Rs. 3001 to Rs. 5000 (i.e. medium annual income group) with 23.34 per cent respondents, while only 8.00 per cent (i.e. high annual income group) respondents had annual income of Rs. 5000 and above. Thus, it may be stated that generally tribal farmers were of low income group.

Patel and Sengle (1993) revealed that level of techno-economic change of respondent were significantly related with their annual income. Sharma (1993) reported that higher percentage of the respondents belonged to low income group, followed by medium income group. Singh et al. (1995) studied that the improved agronomic practices led to 46.25 to 91.82 per cent increase in the gross return from agricultural crops. Due to increased cropped
area the per capita income has gone up by Rs.598 to Rs.1739. Shrivastava et al. (1996) found that use of high yielding varieties of paddy depend mainly on size of land and income. Age and education has no association with adopters and non-adopters of the programme and use of fertilizer has significant association with both adopters and non-adopters while education had no relationship. Kalaskar et al. (1999) found that majority of the respondents belonged to low level of annual income group.

Gogoi and Phukan (2000) stated that income showed significant association ($x^2 = 29.79$) with extent of adoption. The highest percentage of non-adopter belonged to middle and low-income group, respectively. Choudhary et al. (2001) found that annual income had highly significant and positive correlation with extent of adoption. Chauhan (2003) reported that a higher percentage of tribal respondents (52.50%) belonged to low income group, followed by respondents of medium income group.

2.1.10 Availability of irrigation

Thakre (1993) reported that the non-significant relationship between the availability of irrigation and the adoption behaviour of paddy growers. Khan (1996) found that majority (83.13%) the respondents had no irrigation facility, 12.15 and 2.80 per cent respondents had irrigation facility only for up to rabi and kharif season, respectively.
Joshi and Rudraradhya (1997) revealed that rice-cowpea and rice-maize sequences gave comparable net returns comparable to that of rice-rice sequence. However, these sequences gave a net saving of 35-37 cm of irrigation water per ha. Sharma (1998) found that the majority of the respondents (70%) were devoid of irrigation, while 22 per cent farmers were having irrigation up 10 per cent area.

Pandey (2000) found that the highest coverage of area under irrigation was due to tube wells (25%) followed by pump (23%), well (20%) and canal (19%). However, ponds contributed only 13 per cent area that level of irrigation had highly positive and significantly correlated with the adoption of rice production technology. Pandey (2002) revealed that the 54.16 per cent respondents had no irrigation facility, whereas, 36.66 per cent respondents had irrigation availability upto partial level and 9.16 per cent respondents had irrigation availability up to sufficient level.

2.1.11 Credit facility

Sharma (1993) found that most of the mustard growers (70.83%) availed the credit facility from institutional sources in Tikamgarh district of Madhya Pradesh. Sharma (2003) investigated that most of the respondents (72.50%) borrowed loan from institutional sources as compared to 27.50 per cent of the respondents borrowing loan from non institutional sources.
2.1.12 Socio-economic status

Singh and Patel (1990) concluded that socio-economic status of contact as well as non-contact farmers was associated with their knowledge of improved practices of wheat crop. Nandini (1996) studied that adoption of soil and water conversion practices in general resulted in a lot of socio-economical, psychological and ecological consequences. The proportion of the respondents reporting these consequence also varied among the IRDP beneficiaries and the government beneficiaries as is evident from the Omega test value. Rao and Rao (1996) revealed that socio-economic status was positively and significant associated with extent of adoption of rice production in technology among the tribal farmers of Mandal district (A.P.)

Sharma (1998) found that the majority (75%) of the farmers was residing under-medium socio-economic status and only 13.3 per cent farmers belonged to high status group among the tribal farmers of Surguja region. Further he was also found that the socio-economic status had a significant and positive correlation with the adoption of recommended modern agriculture technology for rice cultivation. Singh and Patel (1998) revealed that there was a relationship between socio-economic status of contact and non-contact farmers and their extent of adoption of improved wheat practices.

Singh and Prasad (2000) reported that IRDP programme contributed in improving the standard of living (72.5%), increase in dietary standard (66.5%) and consciousness about education of children (61.5%).
However, the changes perceived by the respondents above 25 per cent emerged as, status in caste and community have improved (44%), able to maintain social relation (30%) and habit of small savings developed (29%).

Rai and Srivastava (2001) concluded that majority of respondents (56.25%) had medium status, whereas only 18.75 per cent of the respondents had high socio-economic status. Further, houses possessed by respondents was found to have no significant association with awareness level of respondent, whereas good co-efficient of associations were found with six socio-economic independent variables viz. caste, size of land holding, irrigation area, irrigation facilities, institution, credit facilities and social participation. Thus, it means that variables that are found to be associated significantly have contributed towards generating the awareness level of the respondents. It can be concluded that socio-economic status plays an imperative role on level of awareness regarding watershed programme.

Bandgar et al. (2002) reported that the majority of the respondents belonged to medium socio-economic status group. Pandey (2002) reported that majority of the respondents had middle class category of socio-economic status followed by lower middle class category. Prakash et al. (2004) found that majority of the respondents (68%) had medium level of the socio economic status, followed by high level of socio economic status of rice growers respondents.
2.2 Socio-psychological and communicational characteristics of the respondents

2.2.1 Socio-psychological characteristics

2.2.1.1 Attitude

Singh and Isael (1989) concluded that contact farmers had significant higher socio-economic status, favourable attitude towards T & V system and higher adoption as compared to non-contact farmers. Ganorkar and Shirke (1992) stated a significant relationship between the attitude of farmers towards high yielding varieties of paddy and yield per hectare. Veeraswami et al. (1994) concluded that the farmers were enthusiastic and visit block office to get new farm information. The extension officer should devote more time for farm and home visits since all farmers can not afford to visit block office to get farm information. Among the group contact methods, demonstration continued to be the most popularly used method followed by training meetings. Out of the mass contact methods, distribution of literature was the most popular one. Khan (1996) investigated that most of the tribal farmers had the medium attitude towards selected agricultural technologies, followed by high attitude. Sengar (2003) reported that majority respondents (74.50%) had the medium attitude towards NWDPRA, followed by low attitude towards NWDPRA.

2.2.1.2 Cosmopoliteness

Parbhu and Chandrakandan (1990) reported that cosmopoliteness had positive and significant association with knowledge of
soil conservation practices. Farooqui et al. (1993) found that cosmopoliteness of the respondents had positive and significant relationship with adoption of water management practices. Patel et al. (1995) studied the farmers of Sehore district of Madhya Pradesh and found a significant positive relationship between adoption and cosmopoliteness of farmers.

Khan (1996) found that most of the respondents had low cosmopoliteness, followed by medium consmopoliteness. Kushwaha and Pande (1998) investigated that majority of the respondents had medium level of cosmopoliteness, followed by low level of cosmopoliteness. Chauhan and Singh (2001) revealed that the respondents used personal localite and personal cosmopolite sources of information. Mass media were used least. Tribal leaders were used by vast majority of respondents followed by progressive farmers and neighbours. Among officials, gram sevaks and cooperative personnel were used most. Radio was the most popular among the tribal dairy farmers. The first preference on the basis of influence of the source was expressed by the majority in favour of tribal leaders and progressive farmers.

2.2.1.3 Risk preference

Deshmukh et al. (1994) studied in Maharashtra state and found that risk orientation has highly significant association with adoption having 0.936 ‘r’ value. Fernandez et al. (1994) studied the factors influencing the adoption of integrated pest management (IPM) techniques in Florida, Michigan and Texas and found that farmers who adopt IPM tend to be less
risk averse and use more managerial time on farm activities than non adopters. Pogar and Kulkarni (1996) found positive and significant relationship between risk preference of respondents and their adoption behaviour. Gupta et al. (1998) reported that the majority of respondents had medium level of risk preference, followed by the respondents of low level of risk preference.

Gogoi et al. (2000) concluded that the higher percentage of respondents of paddy growers had medium risk preference, followed by low level of risk preference. Sengar (2003) reported that majority of the respondents (73.00%) had medium level of risk orientation, followed by high level of risk orientation group. Prakash et al. (2004) observed that the majority of respondents had medium risk preference, followed by the respondents of low level of risk preference.

2.2.2 Communicational characteristics

The review of literature on the sources of information used in transfer of technology has been grouped in the different heads viz. source of information, extension contact and exchange of information.

2.2.2.1 Sources of information

Bhatt (1990) revealed that formal and informal sources which tribal farmers mainly utilized were village level worker, friends & neighbours. Mishra (1991) mentioned that there is specific need for
upgrading the professional competence of subject matter specialists (SMS) particularly at district and sub-divisional levels. A systematic approach is to train extension personnel through more practical and need based training for better serving their clients in rainfed agriculture.

Ganeshan et al. (1992) concluded that the small rice growers needed training in the major areas of plant protection measure, manuring and seed sowing. If the peripatetic training programme was organized for four days during April-May through demonstration, group discussion and field trips, no doubt, it will be most effective than any other training programmes. Girase et al. (1992) stated that among the various farm information sources and channels availed by tribal contact farmers, the personal cosmopolite sources of information, VLW was found to be vital and dominating. Prasad and Mrutyunjayam (1992) found that the training need of tribal farmers with regard to skill clearly highlighted the importance of training in various areas related to high yielding varieties of paddy cultivation.

Girase and Desai (1993) found that among various extension agents and information sources, village extension workers (T & V system) was observed most credible and referred source which was utilized by 70 per cent of the respondents. Jagdale and Nimbalkar (1993) found a significant association between source of information and level of knowledge about recommended dry farming practices.
Patel et al. (1995) found that the most credible source of information was radio followed by T.V., Rural Agricultural Extension Officer (RAEO), Progressive farmers, Newspapers, Magazines and local leaders in the progressive villages. In less progressive village, the most credible source was found RAEO, followed by progressive farmers, local leaders, T.V., radio, newspapers and magazines. Mohanty and Sahu (1997) observed that Krishi Vigyan Kendra (58%) and Block Development Officer (42%) were the major source of information in adoption of improved agricultural practices for tribal farmers in adopted village while in non-adopted village, state department of agriculture and village development officer were the major sources of information.

Gupta (1998) concluded that significant difference was found in beneficiaries and non-beneficiaries respondents in the use of selected communication sources namely communication media and contact with extension agent. Amongst the various communication sources; village institutions, RAEO played major role for disseminating agricultural information to beneficiary farmers, whereas in case of non-beneficiary farmers neighbours, friends and relatives were used as the important sources. Hanumarangaih et al. (1998) found that contact with development agency had significant to highly significantly association with the productivity of paddy crop. Mishra and Verma (1998) indicated that the newspaper can focus attention of the farmers towards modern farm technology by transferring
information from research institutes, agricultural universities and scientists to
the farmers. In this study, they found the percentage of space allotted to
agricultural news was very low (1.52 %). On the whole, the agricultural news
is poorly attended practically by all the categories of Indian newspapers. The
Indian newspapers are therefore cautioned by the findings of this study that
they have to revise their policies pertaining to farm sector. Government
should put pressure on the Indian press for more coverage of agricultural
news. Research, education and extension were most appreciated and covered
in almost all categories of Indian dailies. At the same time, coverage of other
categories of agricultural news like crop production, agro-climatic conditions,
animal husbandry, dairying and allied etc. was extremely meager in almost all
the Indian dailies.

Sharma (1998) revealed that source of information were
positively and signification correlated with the adoption of modern agriculture
technology for rice cultivation among the tribal farmers of Surguja district.
Waghdhare et al. (1998) concluded that the Village Extension Workers found
most credible source of information followed by progressive farmers/local
leaders. Small farmers gave negligible preference to the agricultural meetings
and demonstrations. Swarnkar and Agrawal (1999) reported that utilization
pattern of information sources showed that RAEOs, progressive farmers,
agril-scientists and friends were most popular sources among the farmers.
Television and radio were most effective channel. RAEO was the most
credible source to the farmers. Demonstration was the most credible channel to the farmers. All the selected socio-economic characteristics had significantly association with utilization of information sources and channels as well as adoption of new farm technology.

Choudhary et al. (2001) found that information source utilization pattern had highly significant and positive correlation with extent of adoption of rice technology in Faizabad. Mukhopadhyay and Ramudurai (2001) stated that all the categories of farmers extension agents: AAOs and AOs (ranked first and second) were found to be the most trusted information channel for receiving the farm information followed by cooperatives, input dealers, cane officers (ranked third). Radio was the most popular among the respondents whereas newspaper and television were recorded first and last rank, respectively.

Kadian and Kumar (2002) studied that the majority of the farmers preserved the information in their memory. The evaluation of perceived information was done by discussing with friends, relatives and progressive farmers (87.22 %) as well as considering the feasibility and profitability of the innovation. Due consideration must be given to educate the farmers so that they may maintain subject matter file to preserve the useful information. Manohari (2002) concluded that majority of the respondents were using friends, neighbours and local leader as the main
source of information for adoption better practices in agriculture and allied field which ultimately leads to enchange the crop-yields and better living.

Gupta et al. (2003) indicated that electronic media like television and radio are mostly used and preferred for seeking information on agriculture and development. Hai et al. (2003) revealed that interpersonal communication sources like neighbours, relatives and radio among mass communication channels were being utilized by the majority of respondents. Group Discussion followed by Kisan Mela, Farm Visit and Cattle Show were being frequently used by the extension workers for dissemination of improved livestock production technologies. Singh et al. (2003) concluded that the extension personnel made maximum use of personal contact methods like farm and home visit followed by group contact method like group meetings, demonstrations, crop competitions etc. while least used sources were mass contact methods/media such as TV, radio educational films, publications and exhibitions. The most frequently utilized modes by the farmers for acquisition of farm technology were progressive farmers, friends, neighbours, relatives, and fellow farmers and sources such as seed/fertilizer, market and commercial agencies of insecticides and pesticides.

2.2.2.2 Contact with extension agent

Singh (1990) stated that the contact with the extension agencies played a major role in influencing knowledge, attitude and adoption behaviour of farmers. Ansari (1992) reported that the analysis shows
correlation and regression coefficient of age, education, size of land holding, credit source and use, source of information knowledge, credit agency, marketing agency and input agency on adoption of recommended farm technology and level of extension contact were significant and concluded that these characteristics of farmers have high contribution in adoption of recommended farm technology. Sharma and Sharma (1994) revealed that under institutionalized sources village extension workers was an important source of information at all the stages of adoption followed by information through agriculture college, youth club demonstration, neighbours etc.

Jassi et al. (1998) reported that majority of the trainees were low contact with the development agency. Bhosle et al. (2002) concluded that maximum number (53.33%) of the respondents had medium extension contact, while 25.34 per cent and 21.33 per cent of the respondents had low and high extension contact, respectively regarding information programmes. Sengar (2003) reported that higher percentage of the respondents belonged to low contact with extension agent, followed by medium level of contact with extension agent.

**2.2.2.3 Exchange of information**

Kanungo et al. (1994) observed that majority of contact farmers belonged to medium communication behaviour (72 %) and only a few (15 %) were in the category of high communication behaviour. Reason might be socio-economic factors which plays an important role in information seeking.
and information dissemination behaviour of contact farmers. It was further observed that respondents also disseminated these information to follow farmers by personal contacts, group discussions and conducted demonstrations in their own fields. The contact farmers require sufficient information and exposure to different low-cost farm implements and its uses.

2.3 Knowledge level of recommended technology

Patel (1988) stated that majority of the tribal farmers were belonged to low and medium level of knowledge category, whereas majority of the non-tribal farmers were belonged to high level of knowledge category. Singh (1989) stated that the knowledge had significantly associated with adoption of recommended rice production technology and complete knowledge leads to complete adoption among the farmers.

Bhatt (1990) revealed that more than half (58.00%) of the respondents from tribals had medium level of knowledge, while nearly equal members i.e 32.00 and 30.00 per cent respondents had low and high level of knowledge, respectively. Patel (1990) presented the information about the knowledge of general farmers regarding paddy technology. He confirmed that two-third of the respondents (66.00%) were in medium knowledge group, followed by 20.67 and 13.33 per cent of respondents from high and low level of knowledge groups, respectively. Singh (1990) reported that the below average knowledge and slightly favourable attitude of farmers indicated a need to develop proper extension teaching methods to impart useful
agricultural knowledge to the farmers. He further observed that the knowledge of rainfed technology of farmers had no impact on their adoption behaviour.

Sulina et al. (1991) observed that most of the marginal and small farmers possessed only medium level of knowledge about IPM practices. More than half of the big farmers possessed high level of knowledge and the higher adoption behaviour of the big farmers than the small and marginal farmers. The extent of adoption was found to be positive and significant associated with variables. Dubey and Swarnkar (1992) observed that education and information sources were significantly associated with knowledge among small and marginal farmers. Whereas non-significant association was observed with respect of annual income.

Thakker (1993) stated that majority of the paddy growers possessed medium to high level of knowledge about recommended paddy technology. Bora (1994) reported that productivity in farming had related with knowledge of the farmers of modern agriculture technology like yielding varieties of seed, use of fertilizer and plant protection of rice cultivation contributed significantly with the level of rice productivity.

Hanumarangaih et al. (1998) found that knowledge of paddy cultivation contributed significantly with level of rice productivity. Vedpathak (2001) revealed that the highest percentage of marginal (42.64%)
and small (63.46%) farmers had medium and high knowledge, respectively about high yielding varieties.

Rathore and Kalla (2002) stated that majority of beneficiaries had medium knowledge level, comparatively the big farmers had (37.5%) higher knowledge level as compared to marginal farmers (2.5%). There was significant difference between and within the beneficiaries and non-beneficiaries about various selected knowledge components. Pandey (2002) reported that greater emphasis should be given to educate the farmers about package of practice mainly seed treatment, use of weedicides, insecticides and use of fungicides. He investigated also that majority of the respondents had medium level of knowledge about paddy production technology, followed by low level.

Singh (2005) investigated that maximum gap was found in plant protection measure followed by skill gap observed in seed rate and spacing. Water management, varieties, fertilizer management, selection of soil type and land preparation, inter-culture operation and plant management, inter-culture operation and plant protection of paddy crops. For maximizing the paddy production potential training programme for the farmers should be introduced.

### 2.3.1 Knowledge gap

Khan (1996) investigated that maximum knowledge gap was found in plant-protection measures, followed by proper dose of fertilizers and
manures. Prakash et al. (2004) reported that the majority in widening the technological gap in rice production technology such as (1) Improved seeds (2) Plant protection measure (3) Nursery sowing and raising and (4) Fertilizer application were felt by almost all the members of the rice growers.

2.4 Adoption level of recommended technology

Bhatt (1990) observed that education had non-significant association with the adoption of paddy crop. Patel (1990) found that there was no relationship between age of summer paddy growers and their extent of adoption. Bhoite and Girase (1991) revealed that social participation of respondent farmers was not significantly associated with their adoption behaviour. Dubey and Swarnkar (1992) stated that the small and marginal farmers had very poor knowledge regarding herbicides. Soil testing use of pesticides, spacing, irrigation, method of fertilizer application, seed treatments and use of insecticides things ultimately result in poor adoption of the recommended rice production technology.

Thakker (1993) stated that education of paddy farmers had positive and significant relationship with their extent of adoption of recommended paddy technology. Adesina and Zinnah (1993) studied the 124 rice farmers for adoption of improved mangrove swamp rice varieties. A Tobit model was used and found that the farmers’ perceptions of the technology-specific attributes of the varieties are the major factors
determinants traditionally used in adoption—diffusing studies were found not be important in driving adoption decisions.

Chandra and Kaul (1994) studied that independent variables viz. material possession, social participation, credit behaviour, attitude towards artificial insemination, level of aspiration, source utilization, number of crossbred cows, average milk yield and percentage of wet animals were positively and significantly associated with adoption index. Khan (1996) found that the economic motivation is positively and significantly correlated with the adoption of selected paddy production technology.

Singh and Patel (1998) concluded that the majority of contact farmers belonged to high level of adoption while majority of non-contact farmers belonged to medium level of adoption. It is also proved that there was relationship between education, social participation and socio-economic status of contact farmers and their extent of adoption of improved wheat practices. Hanumarangaih et al. (1998) found that adoption of paddy cultivation contributed significantly with the level of rice productivity. Tiwari et al. (1998) revealed that paddy and maize, arhar, soybean and sesamum crop increased productivity and net profit due to adoption of improved practices. Gajbhiye (1998) revealed that majority of the rice growers were having low adoption (46.66%) regarding recommended rice production technology. This might be because of lack of capital, moderate knowledge of rice production technology, economic motivation, scientific orientation, source of information
used and no social participation and low degree of contact with extension personnel. Malek et al. (1998) revealed that 95.6 per cent of the rice production needed to training in biological control. It is concluded that the less difference between the number of trained farmers and target groups, the more efficient the extension projects. Ladebo (1999) indicate that adoption level among rice farmers is moderately high. Adoption levels of improved seeds, seed rate and recommended spacing and not significantly different from each other.

Thyagarajan and Kumar (2000) suggested that some of the characteristics of farmers were found to be associated with adoption, these characteristics need to be taken into account while formulating extension strategies. In addition, conducting demonstrations at village level, campaigns, field visits, intensive training programmes and group discussions are some of the techniques suggested for increasing the extent of adoption at farm level. Shriram and Chauhan (2000) found that majority of wheat growers were found to have medium level of adoption in both tribal and non-tribal categories of farmers among all the major cultivation practices of wheat crop. It was also found that there was significant difference in the adoption gap of improved technology of wheat cultivation between tribal and non tribal wheat growers.

Nagabhushanam and Nanjaiyan (2002) studied that educational status, land holding, annual income, social participation, socio-economic
status, training undergone, risk orientation, innovative proneness and perception on eco-friendly practices were found having significant relationship with dependent variables. Age and participation in transfer of technology were also found significantly related. Further, farming experience and decision making were found to have high significant relationship with dependent variable. Jaishwal and Sharma (2003) revealed that maximum percent of respondents belonged to middle age group, scheduled tribe, primary level of education, individual type of family system with medium size of family, medium level of annual family income. They had medium level of economic motivation, risk orientation, average level of fatalism and conservative nature. Maximum participation of respondents was observed under plantation work. The association between extent of programme participation level and socio-economic, psychological characteristics of respondents was positive and significant relationship was observed except size and type of family. Kirar (2003) concluded that the contact farmers had significant superiority over non-contact farmers. The Psycho-socio characteristics of the contact and non-contact farmers had played an important role in the adoption of innovation. The contact farmers worked better in diffusion of agriculture innovation, better level of knowledge, attitude and adoption as compared to non-contact farmers.
2.4.1 Relationship between different characteristics of the farmers and their extent of adoption

Gogoi and Gogoi (1989) found that knowledge level had positive and significant contribution in variation of extent of adoption of recommended plant protection practices in adsali rice. Patel (1990) inferred that there was a significant relationship between level of knowledge and level of adoption of recommended summer paddy cultivation technology. He stated that there was moderate association between land holding and extent of adoption of recommended summer paddy cultivation technology. There was no association between annual income and extent of adoption of paddy crop by the farmers. He also found that there was significant relationship of occupation with the extent of adoption of recommended paddy cultivation technology. A fairly association between annual income of summer paddy growers and adoption of summer paddy cultivation was also observed. Bhatt (1990) found that there had been a positive influence on the extent of adoption of social participation of tribal farmers and acceptance of new technology. He concluded also that the extent of adoption of paddy crop had negative association with land holding and non significant association with annual income.

Jullana et al. (1991) revealed that there was no significant association between social participation and their adoption level. Raje (1991) related that the hardly 23 per cent of paddy farmers used recommended
varieties and more than 90 per cent of the farmers did not treat seed before sowing. Thakker (1993) revealed that the occupation of paddy farmers were found to have no significant correlation with their extent of adoption of recommended paddy technology. He indicated that the knowledge level of the paddy growers about recommended paddy technology was found to be positive and significantly associated with their extent of adoption.

Kulkarni et al. (1994) reported that the highest majority of cotton growers (84.67%), possessed medium level of adoption of recommended cotton production technology. They further reported that an overwhelming majority of cotton growers adopted the recommended practices like soil type, crop rotation and spacing to a fullest extent by more than half of the respondents (56%). Khan (1996) found that the majority of the respondents (78.45%) had low level of adoption, 9.35 per cent had nil and only 1.87 per cent respondent had high level of adoption. Khan et al. (1997) found that use of fertilizer, transplanting method of sowing, irrigation management, use of insecticides and improved varieties of paddy were adopted by more than half of the respondents respectively.

Mahapatra et al. (1997) observed that big farmers exhibited higher acquisits of knowledge, favourable attitude and better adoption than small and marginal farmers, regarding adoption of packages of rice cultivation practices. The farmers had better knowledge, attitude and adoption towards practices like HYV seeds balanced fertilizer application and plant
protection measure than other aspects. Sharma et al. (1997) revealed that majority of cotton growers belonged to medium adoption category in cotton production technology. Maraty and Reddy (1998) revealed that the majority of the respondents had medium adoption (61.6%) of paddy production practices, followed by low (21.7%) and high (16.7%) adoption.

More and Jadhav (2000) observed that majority of farmers (57.86%) belonged to medium adoption of cotton production practices. Kareem and Manohari (2001) concluded that 50 per cent of the tribal farmers are using high yielding varieties of paddy and nitrogenous fertilizer either full or partial. Nil adoption of ‘P’, ‘K’ and ‘Zn’ was observed with all the farmers even though the soil test results are indicating that the soil are low with these nutrients. Forty per cent adoption was observed for plant protection and 100% partial adoption with inter cultivation operation.

Korram (2002) revealed that practice like seed treatment, linesowing methods, use of weedicides, plant protection by chemicals were not adopted by cent per cent respondents. Raghuprasad et al. (2002) observed that majority of the respondents were not adopting farm yard manure to the paddy field. Further, use of overdoses of inorganic fertilizers and plant protection chemicals aggravated the problem of profitability of the crop. Hence, a suitable extension activity like frequent contact by extension functionaries, organised discussion, meetings, establishing demonstration, organising field visits to research stations and successful farmers field to
show the method and impact of recommended practices are required to educate and train the farmers on different production practices to make the enterprise lucrative to the farmers.

Chauhan (2003) concluded that higher percentage of tribal cotton growers had medium extent of adoption of recommended cotton production technology, followed by low adoption. Dandotia et al. (2004) concluded that there was a significant impact of special rice production programme on knowledge and adoption of recommended rice technology by small and marginal farmers in the project area. The extent of knowledge and extent of adoption of recommended rice technology were observed significantly associated among the respondents. This resulted that the complete knowledge leads to complete adoption among the farmers using recommended rice production practices.

2.4.2 Adoption gap

Patil (1995) concluded that mean technological gap was highest in respect of application of chemical fertilizer to nursery (88.0%), while in case of seed treatment and use of chemical fertilizer were found 81.75 and 57.58 per cent, respectively among the rice growers of Konkan region (MH). Hedau (2000) revealed that the maximum adoption gap (99.10%) was noticed in use of weedicides, followed by line sowing and use of fungicides (98.2%), seed treatment (90.9%) with second and third rank, minimum adoption gap was found in adoption of improved varieties and overall adoption gap
regarding selected practices of paddy production technology was observed
63.6 per cent.

Pandey (2002) observed 99.50 per cent adoption gap in the seed
treatment practice with first rank, whereas, 99.00 per cent adoption gap was
noticed in line sowing with rank second.

2.5 Production and productivity of selected crops

Singh and Singh (1993) observed that lentil in optimum till age
after transplanted rice in kharif gave 11.9 and 23.7 per cent more grain yield
than both zero tillage treatment (T₂ and T₃). However cost/ benefit ratio was
more by 8.9 per cent and 19.3 per cent under paraquat sprayed treatment (T₂)
than optimum tillage (T₁) and stubbles cut tilling treatment (T₃), respectively.
Lentil fertilizer @ 20 kg N+40 kg P₂O₅ ha⁻¹ increased the grain yield, net
profit and cost/ benefit ratio.

Rao and Rao (1994) found that tribal farmers grow rice and ragi
as pure crops some portion of their land particularly undulated and uplands
were used for pulses and cereals mixture in accordance with their family
requirements. Desai et al. (1997a) evaluated that there was significant positive
change in cropping pattern, creating and constructing rainfall utilization
structures, afforestation, proper land use, tapping irrigation potentials and
increasing cropping intensity. They further revealed a shift in cropping pattern
in favour of commercial crops. Tiwari et al. (1998) found that paddy crop can be grown profitable by using improved practices.

Hedau (2000) reported that the extension workers have to play an important role in motivating the farmers by regular visits and disseminating the latest rice production technologies by conducting demonstrations on the farmers by regular visits and disseminating the latest rice production technologies by conducting demonstrations on the farmers’ field. They not only improved the farmers’ knowledge and skill but also help them to expose their ideas, views and entrepreneurial abilities and increase their income. Dhaka and Sharma (2002) found that average size of operational holdings net cropped area, gross cropped area, cropping intensity and irrigation intensity was moderately higher of beneficiaries than those of non-beneficiaries. The study indicated that watershed project have helped significantly in raising the underground water level in the study area. A shift in area under low productive crops to high productive crops and more remunerative crop was observed in case of beneficiaries. The average productivity of almost all the crops was found to be higher side for beneficiaries than non-beneficiaries.

Rathore et al. (2003) reported that in rainfed rice-chickpea cropping system, dry seeding of rice and sowing of chickpea just after or 3 days after harvest of rice are the economical options for assurance of economical double cropping in low land rice fields under rainfed condition of
the Chhattisgarh region. Sengar (2003) observed that majority of the respondents (83.00%) had the low level of productivity, followed by medium level of productivity. The average productivity of almost all the crops was found to be higher side for beneficiaries than non-beneficiaries.

2.6 Constraints and suggestion in relation to adoption of recommended technology

Tantray and Nanda (1991) observed that majority of the rice growers suggestion that introducing of low cost production technology and ensuring timely supply of inputs are bound to help in increasing rice yields at farmers fields to a large extent. Dubey and Sawarkar (1992) reported that the small and marginal farmers were unable to adopt recommended rice production technology because their financial condition was not appropriate to invest money on the cost of inputs and therefore these factors were limiting factors for adoption. Ganorkar and Shirke (1992) found that message regarding paddy cultivation received by farmers was poor because message were not in local language and farmers try to obtain more information and translate the message in their own language. Singh et al. (1992) found that high cost of pesticides, insecticides and fertilizers, lack of their availability timely and lack of knowledge were reported as the most important constraint for low and non adoption of fertilizer and plant protection measures by the farmers. In case of high yielding rice varieties, lack of seeds suitable for top sequence of lands, lack of seeds availability in time, high cost and lack of
irrigation was found as important factors for low & non adoption of high yielding rice varieties.

Deshumkh and Boruklar (1993) observed that farmers were not able to adopt the recommendation of the state department of agriculture for increasing production due to lack of economic difficulties. Thakker (1993) pointed out that supply of inputs at reasonable price, fixing, reasonable wages of labour in scarcity, giving subsidy in purchasing costly inputs and regular power supply for irrigation were the major suggestion pointed out by the paddy growers. Sharma (1994) noted that constraints regarding various aspect of KVK were poor transport and communication facilities, poor input supply, overloading of information, high cost of advocated technology, unsuitable venue of training, poor use of audio – visual aids and more emphasis on theoretical aspects.

Desai et al. (1997b) found the major constraints in adoption of new technology by the contact farmers were non-availability of improved seeds in time improved implements, chemical and bacterial fertilizers, pesticides, plant protection appliances, benefiting soil type to the advocated crops and timely guidance from village extension workers. Das and Talukdar (1998) revealed the constraints related to the different aspects of rice cultivation and found that irrigation was the most important constraints for the farmers. This was followed by constraints related to seeds, pesticides, fertilizers, extension contact and credit in order of their seriousness. Thakur et al. (1998) reported
that the non-availability of labour, low price of produce and lack of improved implements were the major constraints for both the categories of big and small paddy growers.

Patil et al. (2000) investigated that maximum proportion of the farmers were trying to switch over to plant Hyvs. Farmers of the kal irrigation project area used more seed rate than recommended dose. Farmers’ still transplant seedlings per hill and do not follow tine transplanting. Per hectare fertilizer used in kharif season was lower than recommended dose. Some beneficiary farmers were aware of the use of butachlor weedicide but they did not use it because spray pumps were not available at proper time, high cost of butachlor weedicide and dangerous to handle. Gogoi and Phukan (2000) concluded that relatively lesser percentage of tribal farmers were convinced about the utility of improved practices, in Jorhat district of Assam. Low level of adoption of respondents about improved rice cultivation practices may be due to non-availability of village level extension worker and lack of practical oriented agriculture training programme and demonstration. Gogoi et al. (2000) concluded that the level of knowledge and extent of adoption of trained farmers on recommended rice production practices were significantly higher than the untrained farmers. This can be attributed to the impact of training programme. Lack of availability of certified seed, sali rice, fertilizer plant protection chemical and their high cost, inadequate supply of irrigation
water and lack extension contact were the major problems in adoption the recommended practices.

Lal and Mandape (2000) reported that duration of training was less than four days. Patel (2000) found that most of the farmers wanted two or three days trainings crops. He found also that the size of training group for the training upto 20 given first rank by farmers. The methods preferred by farmers in their training programme were demonstration followed by farmers fair, exhibition group discussion and audiovisual aids. Vichare (2000) reported that development of agriculture may be hamper through the proper training strategy to the farmers in complex issued to the technology.

Rao et al. (2001) observed in his studies in A. P. that majority (80. 80%) of 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. Total other suggestions were arranging fields visits to the farmers that have been practicing sustainable agriculture and bringing out periodical publication on rice-farming with latest cultivation practices. Pandey (2002) indicates that the non-availability of adequate irrigation was a major constraints among tribals and non-tribals,
followed by non-availability of seeds at proper time, respectively. He observed that majority of the tribal and non tribal farmers (78.33 and 66.66%) suggested that adequate irrigation facility should be available, followed by 38.33 and 65.00 per cent tribal and non tribal respondents respectively suggested that improved seeds should be available in time and is sufficient quantity.

Sengar (2003) reported that the most serious constraints faced by the respondents in relation to recommended agricultural technologies were small size of land holding, grazing problem, lack of credit facilities, fatalistic attitude, lack of irrigation facility, lack of training programme, erratic rainfall and high incidence of insect pest and diseases. The important suggestions as perceived by the respondents were sufficient facility of irrigation, construction of stopdam or small dam in seasonal nalas, availability of inputs viz. seed, fertilizer, insecticide in proper time and at low cost, timely technical guidance, improvement in marketing facility, checking of grazing problem and removal of naxalite problem.