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Diffusion of Agricultural Innovations: The Case of Organic Farming in Uttarakhand State of India

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ABSTRACT

Organic agriculture is an innovation among the agricultural production systems having its own unique characteristics thus making it distinct from traditional as well as conventional agricultural production systems. From India, organic food products exports grew by 51 per cent to US$1040 million in 2020-21. The rapid spread of organic agriculture makes an interesting case for analysis particularly in the context of developing countries. This paper has attempted to discuss the diffusion of organic farming in Uttarakhand state of India where promotion of organic farming is taking place systematically through Uttarakhand Organic Commodity Board (UOCB). The various stages of innovation-decision in the process of adoption of organic farming i.e. from knowledge to confirmation by the registered organic farmers have been traced including the factors that played role at every stage. Characteristics like social participation, information access, training received, and experience in organic farming were found having significant association with adoption of organic farming.

INTRODUCTION

Growing awareness, increasing market demand, increasing inclination of farmers to go organic and growing institutional support have resulted in more than 200 per cent growth in the certified area during the recent years (Ramesh et al., 2010). Unlike Europe and USA, very few long-term organic farming experiments are available in India, however, there were farmers who have been cultivating land under organic farming conditions for the last two decades. India holds 5th position in terms of area (2.3 million hectare) under certified organic production (Willer et al., 2021) and currently exports across the globe a range of certified organic edibles and fiber to 58 countries. Organic food products exports grew by 51 per cent to US$1040 million in 2020-21 compared to US $689 Million in 2019-20, beating COVID-19 induced hiccups in the supply chain. The level of exports of organic agricultural produce gained momentum gradually and steep rise was seen which reveals that time is a very important factor in diffusion and adoption of any innovation. Early adopters are different from late adopters, and a longer time period is required for an innovation to spread amongst all potential adopters (Rogers, 1995) as the individual decision to adopt any innovation takes time. It was also reported by Singh et al., (2021) that from awareness to adoption average forty months were taken by the farmers to complete the five stages of adoption process.

Technology adoption is largely a function of communication between different groups, where knowledge and information play a large pivotal role. However, adoption issues reflect a variety of factors apart from socio-psychological values and beliefs of farmers in case of any innovation. Methodologies and approaches to support farmers' experiential learning to improve their technical and managerial capacities, is always advocated (Nain et al., 2020).

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Efforts to promote agricultural technologies must be adapted to suit local agricultural and cultural contexts as also stated by Ruzzante et al., (2021) in their study on the adoption of agriculture technology in the developing world. Hence a study on the factors that contributed towards adoption was organised through innovation-decision process model of Rogers (1995), which was also justified in a review study done by Padel (2001) that the model can be used to gain understanding of the diffusion processes of organic farming and the individual adoption or conversion decision.

METHODOLOGY

Uttarakhand (77° 34' and 81° 02'E longitude and 28° 43' to 31° 27' latitude), one of the Northern states of India was selected purposively where organic farming was being promoted systematically. Multistage sampling took place at the district, block and village levels and a total of 180 registered organic farmers were studied which consisted of 110 registered organic farmers from hill region and 70 farmers from *bhavar* (plain) parts. Details of information regarding farmers were collected from the official records as well as through interaction with the officials of UOCB. Data was collected personally from the respondents through structured interviews. 'Exploratory research design' was used. Analysis of the adoption of organic farming was carried out through innovation-decision process (Rogers, 1983) which comprises the following stages.

- Knowledge: Exposure to a technology and understanding its usage and benefits.
- Persuasion: Once the person is with needy information, then motivating him to think of its usage practically.
- Decision: Taking the final decision after proper perception.
- Implementation: Carrying out practically the technology on small-scale.
- Confirmation: Accepting or rejecting the technology basing on the outcome of the technology adoption.

RESULTS AND DISCUSSION

Profile of organic farmers

The respondents comprised of both the gender (62% male and 38% female) and were in the range of 21 to 66 years age group. Majority belong to higher castes and around 75.56 per cent of respondents have primary education and above. The average land holding of farmers was found to be 0.98 hectares, whereas, the land converted to organic farming on an average was 0.343 hectares accounting to 35 per cent of land under conversion. All the farmers received training on the importance of organic farming and around 61.67 per cent of farmers had medium level of innovativeness.

Factors leading to adoption of organic farming with roger's method of innovation-decision process

Farmers' basic level of knowledge plays a role in successful adoption and continuation of any innovation and hence, organic farmers were enquired about knowledge in different aspects of organic farming standards. Farmers were knowledgeable about different aspects of organic agriculture including the role and essentiality of animals in organic agriculture (Table 1). At the persuasion stage of the innovation-decision process, the individuals form a favorable or unfavorable attitude which play role in influencing the acceptance or rejection of any innovative idea.

Table 1. Farmers' awareness and knowledge about organic agriculture standards

Area	Frequency (%) of organic farmers		
	Hill (110)	Plain (70)	Total (180)
1. Organic Agriculture			
Organic agriculture is mixed farming	110 (100.00)	70 (100.00)	180 (100.00)
2. Compost making			
Aware	110 (100.00)	70 (100.00)	180 (100.00)
Types of compost	110 (100.00)	70 (100.00)	180 (100.00)
Preparation /*procedure*	110 (100.00)	70 (100.00)	180 (100.00)
Economic than direct *gober*	110 (100.00)	70 (100.00)	180 (100.00)
Enriches soil fertility	110 (100.00)	70 (100.00)	180 (100.00)
3. Crop rotation/Multiple cropping			
Aware	110 (100.00)	70 (100.00)	180 (100.00)
Protects soil fertility	73 (66.36)	51 (72.86)	124 (68.89)
Diversified production	55 (50.00)	34 (48.57)	89 (49.44)
Reduces risk & economic	43 (39.09)	32 (45.71)	75 (41.67)
Enhances local food security	00	08 (11.43)	08 (04.44)
4. Nature of organic farming			
Aware	110 (100.00)	70 (100.00)	180 (100.00)
Low external input intensive system	74 (67.27)	54 (77.12)	128 (71.11)
Conventional systems in organic production not allowed	110 (100.00)	70 (100.00)	180 (100.00)
Environmental pollution is less	61 (55.45)	53 (75.71)**	114 (63.33)
5. Animals in organic agriculture			
Aware	110 (100.00)	70 (100.00)	180 (100.00)
Essential	110 (100.00)	70 (100.00)	180 (100.00)
Recycling of nutrients	85 (77.27)	55 (78.57)	140(77.78)
Maintain bio-diversity	55 (50.00)	32 (45.71)	87 (48.33)
Duration of livestock conversion period - No idea	110 (100.00)	70 (100.00)	180 (100.00)
Less capital intensive	13 (11.82)	09 (12.86)	22 (12.22)

* Significant at 5% level; **Significant at 1% level

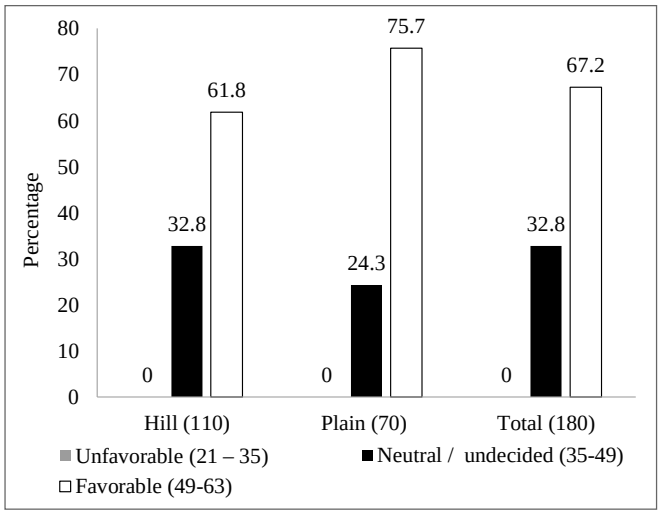

Figure 1. Attitude of farmers towards organic farming

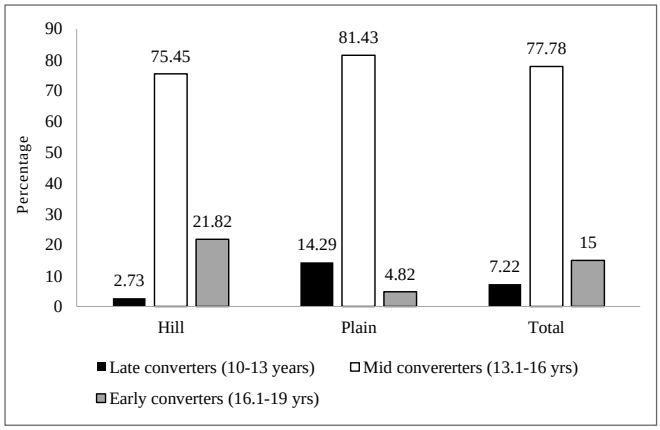

Figure 2. Categorization of organic farmers as per stage of conversion

It is quite clear (Figure 1), that no single farmer was with unfavorable attitude, an indication of farmers' affinity towards organic farming. The respondents being registered organic farmers of UOCB and moreover, their farming practices, values and beliefs might be in line with the principles of organic farming and hence the favorable attitude by majority. A study by Waghmode et al., (2018) also mentioned that more than three fifth of the mango growers were found to have favorable attitude towards global gap certification an innovative idea which is designed to maintain consumer confidence in food quality and safety as mentioned. Gills et al., (2021) mentioned that along with the ecological sustainability of the organic cultivation practices, farmers were more oriented to the economic and social sustainability of the organic way of cardamom production due to the social and cultural linkage which the crop possessed. Selective perception is important about the attributes of an innovation like its relative advantage, compatibility and complexity (Rogers, 2003) and here in case of organic farming, attributes like due recognition of age old practices of farmers, suitability to own agro-ecological situation, increasing demand and price premium for organic produce, philosophical views and the compatibility with the principles of organic farming might lead to favorable attitude among farmers towards organic farming. Though standards like certification process of farm and farm produce and raising of on-farm inputs necessary for farming appeared as complex to the farmers, the extension workers i.e. master trainers of UOCB could successfully pursue them by reducing the uncertainty of innovation through better orientation. All innovations carry some degree of uncertainty for an individual who is untypically sure of the innovation's functioning and thus seeks social reinforcement from others especially the *localite* personnel. The Master trainers and service providers of UOCB, who are the *localite* could successfully pursue the farmers towards better understanding of the concept of organic farming. Mass media, the *impersonal cosmopolite* channel further provided the specific kind of reinforcement and played greater role in making the farmers accessible to various developments.

In the study area organic farmers were being persuaded by the extension workers, could try the innovation on small-scale, and hence, out of the total land holding of 176.72 acres, about 61.67 acres of land is converted to organic i.e. 34.97 per cent of the total land. Farmers were very cautious in taking decisions about the innovation and the scattered land holdings of the respondents might further facilitated the farmers to try on small-scale. In adoption research it was discovered that farmers often experiment on small scale before they introduce a new technology on the whole farm (Ryan & Gross, 1943).

Organic farmers as innovators or early adopters

Farmers were categorized into early, mid and late converters basing on their entry into organic farming i.e. the period of time, since they started converting their farms. There was significant difference ($p<0.01$) between hill and plain area farmers with respect to number of farmers' experience in organic agriculture in the two categories i.e. late and early converters (Figure 2). The promoting agency might started motivating and registering the farmers in a phased way with a special focus on the opinion leaders of the farming community initially who act as key informants to the other members of the social system and leads to the effective diffusion of information.

Motivational factors and goals of organic farmers

Values of farming, sustainability of farm resources, reliable and stable income in organic farming were the major motivational factors as revealed by more than three fourth of the respondents. The decision to take up organic farming depends on the values and beliefs of farmers. Well planned awareness and educational programmes of organic agriculture promoting agencies could succeed in getting the farmers convinced to take up organic farming. Organic farming is offering a good prospect for securing their income as also found by Vaidya and Pratap (2007) that income security was a key motivating factor behind adoption of organic farming by small farmers in India.

Attributes of the technology viz. relative advantages, trialability, observability and compatibility have positive effects on the rate of adoption as also mentioned by Singh et al., (2021) in their study on adoption of happy seeder technology. Seth et al., (2014) in their study also revealed that due to desired innovation attributes like relative advantage, observability, cultural compatibility and trialability, there was faster rate of adoption of 'T&D pig'.

Table 2. Motivational factors and goals of organic farmers

S.No.	Motivating factor	Hill (110) F (%)	Plain (70) F (%)	Total (180) F (%)
1.	Role of organic agriculture promoting agencies	100 (90.90)	61 (87.14)	161 (89.44)
2.	Farmers personally convinced with the values of organic farming	95 (86.36)	62 (88.57)	157 (87.22)
3.	Sustainability of farm resources	86 (78.18)	61 (87.14)	147 (81.66)
4.	For stable and reliable income	84 (76.36)	55 (78.57)	139 (77.22)
Goal of taking up organic farming				
1.	To continue successfully traditional livestock farming practices which are given importance in organic production	101 (91.81)	58 (82.85)	159 (88.33)
2.	To have reliable and stable income	98 (89.09)	61 (87.14)	159 (88.33)
3.	To protect soil fertility through recycling of nutrients	80 (77.27)	63 (90.00)	148 (82.22)

Certain degree of uncertainty about the expected consequences of the innovation may exist at the implementation stage, wherein, technical assistance may help out in implementation of the innovation. In the present study, trainings and demonstrations by the *localite personnel* i.e. the co-operative net work of UOCB through its master trainers of the organic promoting agency could strengthen the farmers towards practical application and hence resulting in adoption of most of the practices as recommended (Table 3). The farmers selected for the study were at different stages of conversion and exposed to training at different phases in the various aspects of organic farming and hence adoption of practices were in different proportions (Table 3). Whereas, in case of organic livestock farming standards, very small number of farmers from both plain (2.86%) and hill area (1.82%) were following them indications about the need of technical expertise in organic livestock farming. Significant difference ($p<0.01$ and $p<0.05$) was found between the hill and plain area farmers. Through studies, it was assumed that when adoption has reached upto 15-20 per cent of the community, the process will continue on its own (Rogers, 1995), whereas, in the present study, the adoption rates were more than 15 to 20 per cent, thus, the successful continuation of the innovative farming. Naberia et al., (2015) mentioned in their report that psychological attributes of farmers significantly associate with the adoption of low cost technologies and organic practices being low cost production technologies and hence successful adoption and continuation of practices.

Table 3. Adoption of organic farming practices

S.No.	Area	Number (%) of organic farmers practicing	
		Hill F %	Plain F %
1.	Concept of organic farming	-	-
2.	Principles of organic farming	110 (100.00)	70 (100.00)
3.	Compost making	110 (100.00)	70 (100.00)
4.	Bio-pesticide making	40 (36.36)	35 (50.00)
5.	IPM	21 (19.09)	27***** (38.57)
6.	Crop rotation	110 (100.00)	70 (100.00)
7.	Record maintenance	110 (100.00)	70 (100.00)
8.	ICS	51 (46.36)	36 (51.43)
9.	Packaging and processing of products	25 (22.72)	43****** (61.43)
10.	Marketing channels		
	1. Export	00	45****** (64.29)
	2. Local/Domestic	60 (54.54)	70** (100.00)
11.	Organic livestock farming standards	02 (01.82)	02 (02.86)

Generally individuals seek reinforcement for an individual-decision already made, but may reverse the decision if exposed to conflicting messages. In the present study the systematic motivation of farmers through orientation and training in a phased way, the farmers could face no conflicting messages and hence resulted in successful carrying out of the practices. Moreover, the perceived usefulness of technology coupled with the ease in use of technology might encouraged farmers to continue the organic agriculture practices. Prajapathi & Shabyasachi (2019) also found that self efficacy, cooperative network and perceived usefulness of technology significantly associated with the adoption behaviour of farmers.

Relation of socio-personal characteristics with adoption of organic farmers

A relationship between socio-economic status, such as education, income level, farm size and commercial orientation and innovativeness was generalized from many adoption studies in the adoption model (Rogers, 1995). Several studies of conversion to organic farming have also looked at some aspects of the socio-economic status of organic farmers, such as caste, education farm size, farming background, social relationships and motivation to convert. And in the present study characteristics like social participation, information access, training received, experience in organic farming showed significant association with adoption of organic farming (Table 4). Extension activities, easy availability of technology and large operational land holding had a positive effect on the rate of adoption of Happy Seeder Technology as mentioned by Singh et al., (2021) in their study. Naberia et al., (2011) also reported that socio-personal attributes like social participation of

Table 4. Relation of socio-personal variables with adoption of organic farming

S.No.	Variable	Hill	Plain	Total
1.	Age	0.163	0.040	0.080
2.	Education	0.179	0.012	0.099
3.	Social participation	0.271**	0.186	0.079
4.	Information access	0.594**	0.707**	0.665*
5.	Training received	0.738**	0.832**	0.775**
6.	Land holding	0.059	0.075	0.053
7.	Organic land holding	0.030	0.276*	0.153*
8.	Organic farming experience	0.442**	0.158	0.147*
9.	Family education	0.290**	0.132	0.096

* Significant at 5 %; ** Significant at 1%

farmers significantly associate with the adoption of low cost technologies.

CONCLUSION

All types of innovations cannot be diffused successfully in a social system unless the innovation fits well into the multitude characteristics of society's psychological beliefs and values of individuals, wherein the adoption of organic farming in Uttarakhand state of India sets as an example. This study could analyze the factors to take up an innovation which can be taken as key factors to promote organic agriculture in the similar agro-ecological regions not only in India, but also elsewhere in the world. This study further supports the research on adoption of innovations, that innovations are more easily adopted if the practice is highly divisible, i.e. can be tried on a small-scale**,** so that the farmer gains some experience and confidence with the new techniques to adopt it on large scale successfully. A meta-analysis on the empirical literature, which has been further explained by this study that suitability of the organic farming to agro-ecological and cultural situation of farmers of Uttarakhand further facilitated the diffusion

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