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Technology adoption in paddy farming-a methodical study among the paddy farmers of Kashmir region

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Abstract
To analyze the level of technology adoption across different farm sizes of paddy growers in Kashmir region the study was conducted in 2016-17 with a sample of 150 farmers selected by multistage random sampling method, using specially designed pre-tested schedules and questionnaires through personal interview of the respondents. Among the respondents 47.00 percent had medium level of adoption and only 24.00 percent had high level of technological adoption. Majority of farmers followed the recommendations and management practices right from selection of varieties, fertilizer management, spacing and weedicide application along with scientific water and disease management strategies. The correlation results revealed that variables *viz*; age, education, family type, income, farming experience, attitude towards high yielding varieties, contact with extension personnel and social participation had positive and significant relationship with adoption of recommended package of practices.

Keywords: Adoption, technology and paddy

Introduction
Increasing agricultural productivity is critical to meeting the continues rising demand for food. Agricultural technologies play immense role in increasing food productivity. As a result, it is useful to examine the adoption of technologies among farmers. Agricultural technologies are said to include all kinds of improved techniques and practices which affect the growth of agricultural output (Jain, Arora, & Raju, 2009) [4]. According to Loevinsohn, Sumberg, Diagne, and Whitfield (2013) [8] the most common areas of technology development and promotion for crops include new varieties and management regimes; soil as well as soil fertility management; weed and pest management; irrigation and water management. A study by Kariyasa and Dewi (2013) [7] indicate that the adoption of improved technologies increase productivity, which later results in socio-economic development. Adoption of improved agricultural technologies has been associated with higher earnings and a reduction in rural poverty among farm households; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers. Adoption of improved technologies is believed to be a major factor in the success of the green revolution experienced by Asian countries (Chen & Ravallion, 2004) [2].
Available information about the new technology influences its adoption. It enables farmers to know much about its existence as well as the effective use of technology and this facilitates its adoption. Farmers will only adopt the technology they are aware of or have heard about it. It is therefore important to ensure that information is reliable, consistent, and accurate. Farmers need to know the existence of technology, its beneficial, and its usage for them to adopt it. Technology adoption among farmers is higher when extension services are made available. Through extension services, farmers get to know the benefits of new technology through extension agents. Extension agent acts as a link between the innovators (Researchers) of the technology and users of that technology. This helps to reduce transaction cost incurred when passing the information on the new technology to a large heterogeneous population of farmers (Genius, Koundouri, Nauges, & Tzouvelekas, 2013) [3].
Foodgrain production is the major activity covering about 65 percent of the cropped area in India and provides the main staple source of food of major chunk of population. Over the years with increased production the country achieved the status of food surplus from food scarcity. The substantial increases in production have been made possible due to technological innovations in terms of varieties, enhanced irrigation capabilities, farm mechanization and better infrastructure (Kareemulla *et al.*, 2002) [6].

Paddy production in the Jammu and Kashmir is predominantly a mono cropped activity with a very high consumption and most important stable food than other states of India. In Kashmir region paddy plays an important role in the livelihood of the people, although the area under the crop is very small as compared to other states of the India with only 0.27 million ha, but at the same time plays an important role in the states' economy. (Kaloo *et al.*, 2015) [5]. The total area under paddy in Kashmir region is 135.77 thousand ha and its production is 5082.5 thousand quintals (Anonymous, 2017) [1]. Decrease in the area under food grains especially paddy due to continuous land diversion to other commercial and horticultural purposes, at the same time decrease in production with problems of dry and dismal picture, owing to lack of rain and non-availability of water for irrigation (Mysir *et al.,* 2015) [9], hence, necessitates immediate attention for technological interventions to enhance productivity potential in paddy through adoption of recommended scientific technologies in production that has evolved and accumulated through research over the years by scientists that assumes greater significance in attaining potential output at the farm level.

Methodology

Based on maximum area under paddy two districts *viz.* Anantnag and Budgam were selected purposively. Out of the two districts selected, three blocks from each district were randomly selected thus making 6 blocks for the study. Out of the 6 blocks, a village cluster from each block in consultation with Agriculture department was selected randomly. A total of 150 respondents were randomly selected for the study.

Adoption is the decision of making full use of new ideas as the best course of action available. The technological adoption of package of practice issued by SKUAST-Kashmir was ascertained by drawing items in the form of questions for each given recommendation and after the finalization of the questions the responses were divided into three categories, 'full', 'partial' and 'no' adoption elicited from the farmers and quantified by giving scores of 2, 1 and 0 to full, partial and no response respectively. Adoption of recommended crop production technology was measured by means of adoption index formula.

$$\text{Adoption index} = \frac{\text{Respondents total score}}{\text{Total possible score}} \times 100$$

Finally respondents were divided into three categories using mean and standard deviation.

Results and Discussion

The extent of application scientific recommendations was low due to the disadvantages as its complexity leading to difficulty to be applied by farmers. It comprises of many measures, which are not well acquired by farmers' educational limitation. The conditions, which are necessary for farmers to adopt a technology is 0understanding its usefulness by witness of demonstration fields. Training farmers on seed technologies and dissemination of information on advantages of using certified and recommended seeds varieties are necessary conditions to increase production. Farmers often kept certain seed amount from the rice harvest for the next rice planting season. They mostly did not care about certified seeds. They self-produced or bought seeds from the neighboring farmers with lower cost than the cost of certified seeds. In fact, the certified seeds in seed markets were not sufficient to supply as demand. Some farmers spent for transportation to buy certified seeds from seed centers or research institutions because there was no place selling seeds at their local area. The transportation may increase cost of rice inputs, thus they were unwilling to go far to buy seeds. Farmer group for seed multiplication should be strengthen to produce sufficient certified seed amount for local farmers under the supervision of technical staff. The results also revealed that they did not use low seed rate because of bird, rat attack and bad weather of previous years. Not all farmers adopt recommended fertilizer and pesticide application because this comprised of many measures that required highly producing knowledge farmers to follow. Some of farmers only followed some components reducing seed rate and nitrogen fertilizer only. Other fertilizer kinds were not scientifically used. Moreover pesticide using was influenced by the advertisement of pesticide companies. Farmers got some material inputs from the fertilizer and pesticide selling agents by buying on credit. In some areas, farmers only reduced fertilizers and insecticide but not seed rate. The levels of fertilizer were not specific for certain rice varieties, seasons and areas.

For effective management of disease and insect pest there is need of collective effort of the farming community. The pesticide use is an integration of different methods including proper dosage and timing. Seed and seedling treatments are essential prophylactic measures to mitigate disease and insect pest, but due to lack of knowledge among the farmers these treatments had negligible adoption among farmers. The water management along with weedicide application had better adoption levels due to proper canal system of irrigation in the paddy growing areas. The farmers used chemical weedicides more than cultural management practices because manual weed management through labour and mechanization was perceived as costly and time consuming.

Adoption of scientific recommendations in paddy

S. No	Statement	Full		Partial		No	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
1	Recommended variety	118	78.7	0	0.0	32	21.3
2	No of ploughings	119	79.3	28	18.7	3	2.0
3	Fertilizer use: Urea	34	22.7	104	69.3	12	8.0
4	DAP	35	23.3	98	65.3	17	11.3
5	MOP	35	23.3	63	42.0	52	34.7
6	Seed Rate	42	28.0	97	64.7	11	7.3
7	Seed treatment	16	10.7	13	8.7	121	80.7
8	Pre-sowing seed treatment	33	22.0	8	5.3	109	72.7
9	Water level maintained	65	43.3	69	46.0	16	10.7
10	FYM (Quantity)	33	22.0	112	74.7	5	3.3
11	Urea (As basal application)	99	66.0	51	34.0	0	0.0

12	DAP	111	74.0	39	26.0	0	0.0
13	MOP	100	66.7	39	26.0	11	7.3
14	As top dose in 1st split (urea) (early tillering stage 15-18 DAT)	61	40.7	66	44.0	23	15.3
15	As top dose in 2nd split (urea) (panicle initiation stage 38-42 DAT)	62	41.3	35	23.3	53	35.3
16	Seedling treatment	0	0	0	0.0	150	100
17	Age of seedlings	127	84.7	21	14.0	2	1.3
18	No of seedlings used per hill	89	59.3	27	18.0	34	22.7
19	Spacing	83	55.3	28	18.7	39	26.0
20	Recommended weedicide used if any	139	92.7	2	1.3	9	6.0
21	Dose and Time of application (DAT) of weedicide	139	92.7	2	1.3	9	6.0
22	Level of water maintained after weedicide application	142	94.7	6	4.0	2	1.3
23	Water management at Mid-tillering stage (18-22 DAT)	99	66.0	28	18.7	23	15.3
24	Water management at Panicle initiation (35-40 DAT)	82	54.7	35	23.3	33	22.0
25	Water management at Pre-heading stage (50-55 DAT)	90	60.0	29	19.3	31	20.7
26	Water management at Flowering to milk Stage	53	35.3	66	44.0	31	20.7
27	Water management at Semi dough to maturity	30	20.0	4	2.7	116	77.3
28	Pesticide used	27	18.0	10	6.7	113	75.3
29	Dose of Pesticide	27	18.0	10	6.7	113	75.3
30	Time of application of the pesticide	27	18.0	10	6.7	113	75.3

Among paddy respondents 47.00 percent of the respondents had medium level of adoption, 29.00 percent had low level of adoption and 24.00 percent of the respondents had high level of adoption index.

Table 1: Level of respondent's adoption on paddy cultivation (N = 150)

Levels of adoption	Percentage (%)
Low	29.00
Medium	47.00
High	24.00

Correlation analysis of independent variables with adoption of recommended package of practice for paddy.

Correlation analysis between independent variables and adoption of recommended technology was worked out using statistical package for social sciences (SPSS). A cursory look at the correlation results revealed that independent variables *viz*; age, education, income, farming experience, attitude towards high yielding varieties, contact with extension personnel and social participation had positive and significant relationship with adoption of recommended package of practices.

Correlation coefficients of adoption and independent variables in paddy

	Coefficient	*p*(≤0.05)
(Constant)	-19.898	0.002
Age	4.162	**0.000
Education	1.641	**0.000
Family type	2.294	*0.040
Occupation	0.618	0.436
Annual Income	1.148	*0.040
Farming Experience	2.186	*0.035
Land Holding	0.041	0.685
Area Under Food grain	0.078	0.501
Attitude towards HYV	0.967	*0.000
Innovative Proneness	0.204	0.380
Economic Motivation	0.037	0.090
Risk Orientation	0.301	0.330
Mass Media Use	0.125	0.851
Contact with Extension Personnel	1.698	*0.001
Social Participation	1.868	*0.010

* Significant at 0.05 level of probability

Although young farmers are seen to have higher rate of adoption than conservative old men but experience gained over years of farming in older farmers have significant association with adoption of technology as best course of action available. Farmers with high education had better recognition of advantages of new technologies and acquirement the technical knowledge and information. Farmers should obtain certain education level and well associate with rice farming to be enthusiastic in learning new technology. Training, information from mass media and good irrigation system inside the fields are necessary to increase adoption. The low capacity of the extension staff was not able to convince farmers to adopt. Farmers who were afraid of low rice production due to small land holdings hesitated adoption. Small farmers did not care about new technologies. Small land holdings prevented the mechanization of harvesting. Poor farmers could not afford for the technologies required more capital inputs as seeds and new rice varieties and costly chemical inputs and labour, moreover they do not have time to pursue the innovation which requires more labors. Farmers did their old practices and hesitated to adopt the innovation because they worried the yield loss when applied new technologies that they had not known well. The contact with extension staff and social participations are important factors for changing attitudes and orientation of farmers to stimulate the adoption of technologies but the extension staff capacity to convince farmer was low. The site, timing, and participant selection for training was not always rational. There is the need of strengthening manpower and equipment's for extension. The well-organized mass media and people associations play important role in farmers' adoption of technologies. The extension staff's knowledge and updated knowledge can increase adoption. The extension staff at ground level should know well farmer cultivation schedule to arrange suitable timing for training. The staff should teach scientific practices by the stages of paddy plant and let farmers discuss themselves. The staffs do practices together with farmers. The training also should be organized in the remote villages to have chance for remote rural farmers to attend. The materials distributed to farmers should be easy to understand by farmers. The main reasons of non-adoption included lack of positive attitude and low education of farmers, weak teaching capacity and limited knowledge of extension staff, not-well organization and management of extension programs.

Conclusion
Main factors affecting farmers' adoption of technologies were their perceptions of technologies, knowledge level of extension staff, methods of organization and management of the extension program and local conditions. Low education, low perception, lack of capital, small land holdings and limited capacity of extension staff led to low technology adoption. Extension program for farmers in remote area and information transmitted orally among trained farmers were not enough to increase adoption. Technologies with complicated components or required more time and labors were difficult for farmers to apply. To increase the adoption farmers should be increased their knowledge about the benefit and economic efficiency of this technology. Thus, mass media should reach all farmers, especially in the remote areas. Enhancing capacity on the extension and management of the extension staff, increasing fund for extension activities, and merging the small farms are needed for wider adoption.

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