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A Study on Adoption Rate of Hybrid Rice in Jammu District, India

Rashika Mahajan[1*], Yudhishther Singh Bagal[2] and Lakshmi Kant Sharma[3]

[1]*Division of Agricultural Extension Education, SKUAST- Jammu, J&K, India*
[2]*RIMT University, Mandi- Gobindgarh, Punjab, India*

*Corresponding author

ABSTRACT

All potential adopters of a new product do not adopt the new product at the same time. Consequently, on the basis of the degree to which an individual is relatively earlier in adopting the new product, adopters can be classified into adopter categories. Development of adopter categories requires determination of the number of adopter categories, the percentage of adopters to include in each category, and a method to define categories. To find out the adopter categories of hybrid rice, a study was conducted in randomly selected one block of Jammu district. Based on the random number sampling, total sample of 70 respondents were interviewed using a semi-structured interview schedule. Majority of the farmers were of middle age and studied up to matriculation. The average land holding of farmers was 1.92±2.61 ha. In the study area, adoption of hybrid rice was started in 2005 and maximum adoption was in 2012. Majority (80%) of the farmers growhybrid-6444 variety of hybrid rice in their first year, with an average yield of 61.37 q/ha. There are many comparative benefits of hybrid rice reported by the farmers but along with it many constraints were also faced by the farmers in its cultivation. The time variable allows us to classify the respondents into adopter categories. Both curves of the adoption of hybrid rice over time by the farmers and s-shaped curve on cumulative basis were plotted. The percentages of adopter category found in the study area were approximately similar to that of Rogers in adopter categories, i.e., 2.86 percent innovators,17.14% early adopters, 25.71% early majority, 37.14% late majority and 17.14% laggards. It is suggested that extension agencies have to provide information and remain in contact with farmers for early adoption of innovations.

Introduction

Rice (*Oryza sativa* L.) is a self-pollinated plant belonging to family Graminae (Poaceae). Rice is a staple food of more than 60% of the world's population. Rice crop has great importance, as it constitutes about 44% of total food grain production and about 49% of total cereal production (Bisht and Pandey, 2005). At least 90% of the world's rice farmers and consumers are in Asia, where rice provides up to 75% of dietary energy and protein for 2.5 billion people (Juliano, 1985).

In India, rice is the most important and extensively grown food crop, occupying 44.14 million hectares of land in 2013-14, 44.11 million hectares in 2014-15 and 43.39 million hectares in 2015-16 with a production of 106.65 million tonnes, 105.48 million tonnes and 104.32 million tonnes respectively (DES, 2016).

Hybrid rice is grown from hybrid rice seed which is produced by growing an inbred rice variety having sterile pollen which is cross pollinated with normal pollen with adjacent rice plants of different inbred variety. Hybrid rice, therefore, has two genetically different parents (Wikipedia, 2018). Hybrid rice is a landmark technology development in china. Professor Yuvan Long Ping, the father of hybrid rice revolution in china, developed the first hybrid rice (Balasubramaniyan and Palaniappan, 2011).

Hybrid rice cultivation has helped china to increase rice production by nearly 200 million tonne from 1976 to 1991, and has also enabled china to improve rice yields by 15-20% over the commercial rice varieties. International Rice Research Institute, Philippines, started work on hybrid rice in the 1980s. The other countries such as India, Indonesia, Korea, Thailand and Veitnam have also joined in this pursuit. To increase the productivity and production of rice in the country in 1989, Government of India initiated a goal-oriented, time-bound project entitled, "The Development and Use of Hybrid Rice Technology" (Balasubramaniyan and Palaniappan, 2011).

The rigorous efforts of hybrid rice research and development in India since 1990s has resulted in release of 46 hybrids, 29 from public sector and 17 from private sector for commercial cultivation. During the year 2010, hybrid rice was planted in an area of 1.3 million hectares and additional rice production of 1.5 to 2.5 million tonne was added to Indian food basket through this technology (Hari Prasad *et al.,* 2011).

Average yield of hybrid rice is more when compared to high yielding varieties and cultivation of hybrid rice is economically viable if management level is above 60 percent. All this can be made possible only by the adoption of hybrid rice. But not all the farmers adopt at once. The number of adopter will increases as the information is generated over time. Rogers, 1962 in his book "Diffusion of Innovation", mentioned five adopter categories according to their *innovativeness*, the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system.

Over the years, as the production of hybrid rice is increasing, at the same time, there are various constraints associated with its cultivation as reported in various research studies (Jaiswal and Sharma 1990, Samuel 1993, Kumar and Jha 2001, Narayana *et al.,* 2014, Singh *et al.,* 2014, Nirmala and Suhasini 2013, Mustapha *et al.,* 2012). Therefore, present study on adoption rate of hybrid rice was conducted in Jammu district to analyze the innovativeness in adoption of hybrid rice and to find the constraints perceived by the respondents during its cultivation.

Materials and Methods

Multi-stage sampling technique was employed for the selection of ultimate sampling. The present study was conducted in Jammu district of Jammu and Kashmir state. There are ten blocks in Jammu district, out of which one blocks was randomly selected. Five villages were selected randomly from the selected blocks.

A list of hybrid rice growers was prepared from each selected village with the help of local people. Out of the prepared list 14 hybrid rice growers from each selected village were selected. Thus a total of 70 hybrid rice growers were taken as respondents for the present study. A semi-structured interview schedule was developed for the data collection. Data was collected from the

farmers either at their home or at their farms. Formula employed to find the adopter category

$$Adopter\ category = \frac{number\ of\ farmers\ in\ that\ category}{n} X\ 100$$

Results and Discussion

Socio- economic profile of the respondents mentioned in table 1. The results of the study revealed that, the mean age of the respondents was 49.37 years. Majority of the respondent fall in the category of the middle age (54%). The mean education of the respondents was 9.17 years i.e. studies upto 9th class standard and a very little percent of respondent were illiterate. This may due to maximum respondents were of middle age. The education was further categorized into seven parts, majority of the respondents fall under matriculate (29%), followed by 10+2 (17%), middle (12%) and primary (4%).

The mean farmers experience for cultivating the crops was 29.92 years. It could be attributed due to the fact that the selected respondents were mostly from agriculture back ground and they engage in agriculture from their early childhood. With regards to family size, the average family was having 7 members. It was categorizes into nuclear and joint family, majority of the respondents lived in joint family (54%). With regards to distance, the average distances of the respondents home from the nearest seed store and fertilizer store was 1.05 km followed by nearest market (3.47 km) and nearest office of the department of agriculture (3.75 km).

The mean operational farm size of the respondents was 1.92 ha. The mean irrigated land holding was 1.82 ha and the mean unirrigated land holding was 0.09 ha. Further farm size is categorized as per MOA 2011 into five parts, majority of the respondents fall under small category i.e. one to two

hectare (56%), followed by small category (30%), semi medium category (26%), medium category (7%) and one percent in the category of large farm size (>10 ha) (Table 2).

With respect to the variety of hybrid rice cultivated by the farmers in the first year, it was found that 83 percent of the farmers grow Hybrid 6444 with average yield of 61.37 q/ha, followed by PHB- 71 by 11 percent farmers with an average yield of 76.43 q/ha, 2355 by four percent of the farmers with an average yield of 94.33 q/ha (Table 3).

Many benefits of hybrid rice were reported by the farmers like more production (82%), no lodging problem (3%), early maturity (3%), good quality of seed grains (2%), less disease and insect pest attack (2%) and less water requirement (4%). Besides benefits, many constraints were also faced by the respondents in cultivation of hybrid rice. More disease and insect pest attack (22%), difficult in harvesting and threshing (23%), comparatively less selling price (10%) and fodder not good for animals (4%) were reported by the hybrid rice growers (Table 4).

With regards to various varieties of rice grown by the farmers during the year 2017, average area under basmati- 370 was 0.44 ha with average productivity of 29.76 q/ha and sold at the average rate of Rs 3283.33/q. The average area under hybrid- 6444 was 0.95 ha with average productivity of 61.96 q/ha and sold at the average rate of Rs 1500/q. Similarly, Pusa-1121 was cultivated in an average area of 0.44 ha, with the average productivity of 51.76 q/ha and sold at the average rate of Rs 2004.6/q. In case of PHB-71, cultivated in an average area of 0.68 ha with an average productivity of 65.60 q/ha and sold at an average price of Rs 1423/q by the farmers (Table 5). As far as adopter categories are concerned, it was found that none of the farmer was fall under the category

of innovators, while twenty percent were fall under early adopter category followed by 26 percent of the farmers in early majority category, 17 percent were fall in late majority category and a total of 17 percent farmers were fall under laggard category. All these percentages were similar to normal adopter distribution percentages of adopter categories found by Rogers, 1983 (Table 6, Figure 1).

Figure 2, showed the adoption of hybrid rice by the farmers over time. The s-shaped adopter distribution rises slowly at first when there are few adopters in each time period. It then accelerates to a maximum until half of the individuals in the system have adopted. It then increases at a gradually slower rate as the few remaining individuals finally adopt.

Table.1 Descriptive statistics regarding socio- economic status of the farmers

Parameter	Total (n=70)
Mean age (years)	49.37±13.37
Young (18-43 years)[1] (%farmers)	23 (33)
Middle age (44-63 years)	38 (54)
Old age (64-80 years)	9 (13)
Mean education (Formal number of schooling years completed)	9.17±3.48
Education level (%farmers)	
Illiterate	7 (10)
Below primary	0
Primary	3 (4)
Middle	8 (12)
Matriculate	38(54)
10+2	12 (17)
Graduation and above	2 (3)
Average farming experience	29.92±15.18
Type of family (%households)	
Nuclear	32 (46)
Joint	38 (54)
Average family size	7±3.95
Average distance of village from (km)	
Nearest market	3.47±2.15
Seed store	1.05±0.73
Fertilizer store	1.05±0.73
Nearest department of agriculture	3.75±2.06

Figures in parentheses are percentages and rounded upto the nearest whole number
[1]Categorization was done through Singh cube root method

Table.2 Distribution of wheat growers on the basis of their farm size

Parameter	Total (n=70)
Average land holding (ha)	1.92±2.61
Categorization of farm size (No.)[1]	
Marginal (<1ha)	21 (30)
Small (1-2ha)	25 (36)
Semi- medium (2-4ha)	18 (26)
Medium (4-10ha)	5 (7)
Large (>10ha)	1 (1)
Farmers with fragmented land holding	67 (96)
Mean fragments (No.)	5.82±6.67
Average irrigated area (ha)	1.82±2.40
Average unirrigated area (ha)	0.09±0.29
Irrigation availability (No.)	
Canal	60 (86)
Shallow pump (Bambi)	28 (40)
Bore well	1 (1)

Figures in parentheses are percentages
[1]Categorization of farm size as per MOA (2011)

Table.3 Status of hybrid rice varieties when first time cultivated

Variety (n=70)	% farmers (n= 70)	Yield (q/ha)
Hybrid 6444	58 (83)	61.37±12.49
NVR 2355	3 (4)	94.33±56.97
Hybrid 5152	1(2)	78
PHB-71	8 (11)	76.43±11.34
Source of seed (No.)		
Department of Agriculture	45 (64)	
Input dealer	24 (34)	
Neighbour	1 (2)	
Source of information (No.)		
Department of Agriculture	26 (37)	
Input dealer	19 (27)	
Neighbour	16 (23)	
Private company	1 (2)	
Mass media	1 (1)	

Figures in parentheses are percentages

Table.4 Benefits and constraints in cultivation of hybrid rice reported by the farmers

Parameter	Total (n= 10)
Benefits (No.)	
More production	57 (82)
No lodging	2 (3)
Early maturity	2 (3)
Good quality	1 (2)
Less disease and insect pest attack	1 (2)
Less water requirement	3 (4)
Constraints (No.)	
More disease and insect pest attack	15 (22)
Harvesting and threshing problem	16 (23)
Less selling price	7 (10)
Fodder not good	3 (4)

Figures in parentheses are percentages

Table.5 Distribution of farmers on the basis of their field crop cultivation

Variety	Area (ha)	Productivity (q/ha)	Selling Price (Rs)
Pusa-1121	0.44±0.36	51.76±19.68	2004.6±1138.47
NVR- 2355	1.04±0.633	59.75±3.86	1433±115.47
Hybrid 5152	0.80	60	1250
Hybrid 6444	0.95±0.74	61.96±21.91	1500±401.31
Basmati- 370	0.86±0.66	29.76±10.45	3283.33±772.16
Basmati-30	0.5±0.17	38±2.65	3750±636.39
Gold	0.4	70	1600
PHB-71	0.68±0.44	65.6±9.38	1423.63±152.39

Table.6 Distribution of farmers on the basis of adopter category

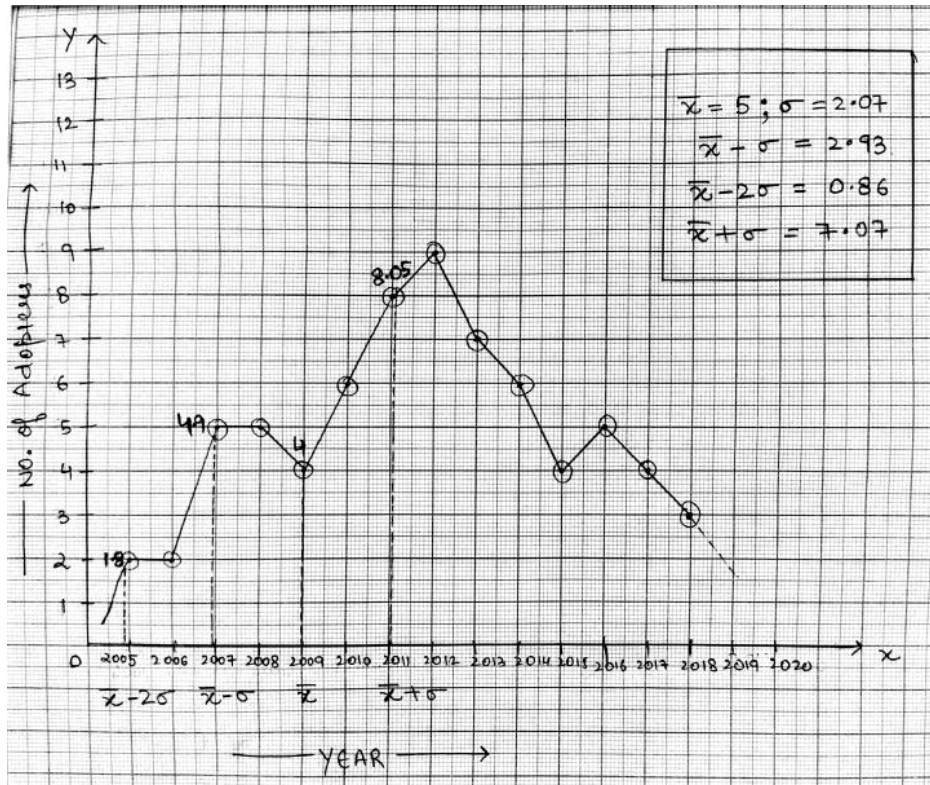| Adopter category	Normal adopter distribution (%)	Result % (n= 70)	Area covered under normal curve	Difference
Innovators	2.5	2.86	Beyond $\bar{x}-2\sigma$	0
Early adopters	13.5	17.14	Between $\bar{x}-\sigma$ to $\bar{x}-2\sigma$	6.5
Early majority	34.0	25.71	Between $\bar{x}$ to $\bar{x}-\sigma$	28
Late majority	34.0	37.14	Between $\bar{x}$ to $\bar{x}+2\sigma$	23
Laggards	16.0	17.14	Beyond $\bar{x}+\sigma$	57

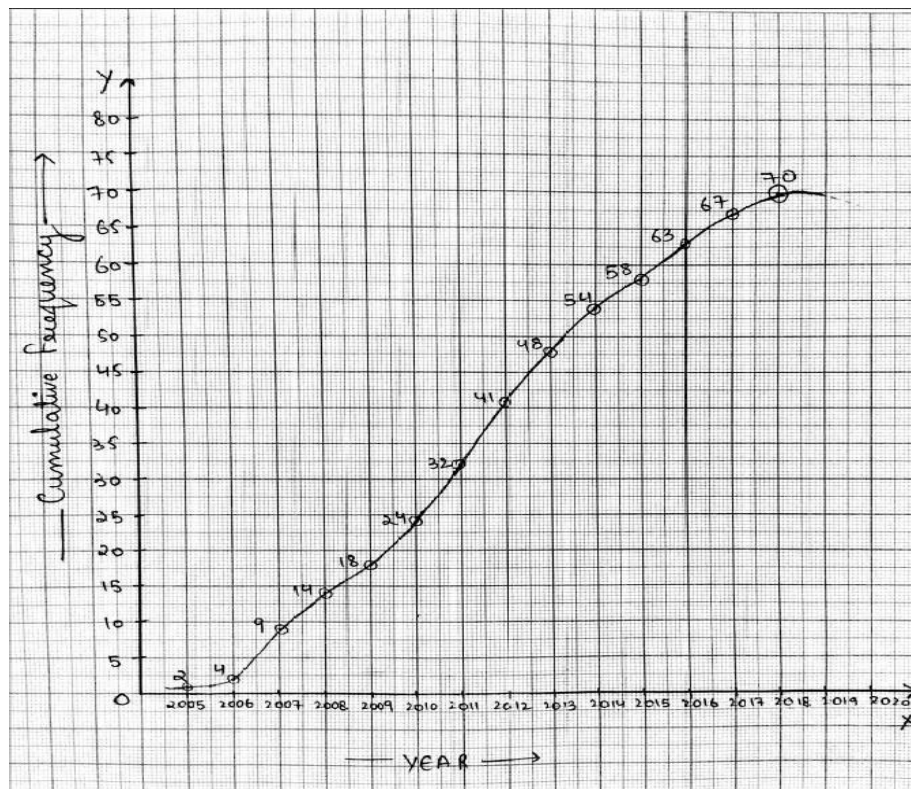**Figure.1** Adopter categories on the basis of the innovativeness

Figure.2 S- shaped cumulative curve for an adopter distribution

Rice is the lifeline for Asians because it is not only a dominant food crop but also an important crop in their national economy. It accounts for a major share of cereal consumption. Rice contributes 30–76% to total daily calorie intake (Hossain and Pingali, 1998). Therefore, boosting the rice production is always at the top priority for national governments for economic growth, social security, and political stability on the continent. From this study we found that adoption of hybrid rice was not uniform, this may be due to lack of information regarding hybrid rice. Extension agencies have to play a significant role in not only diffusion of hybrid rice varieties but also make the farmers to adopt it.

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