Original Research Article

An Insight into the Level of Technology Adoption of farmers of Jhelum Rice Variety in Kashmir Valley

ABSTRACT

This work is centered around the adoption level of Jhelum rice variety among the farmers in Kashmir Valley. The data collected from 120 respondents from four Jhelum growing districts (Badgam, Kulgam, Pulwama and Anantnag) has been subjected to Technology Adoption Index (TAI) to analyze the adoption level, and Multivariate Linear Regression Model to analyze its determinants. It has been found that farmers used excess seed material by 207.67 per cent, DAP and Urea by 28.00 and 10.82 per cent respectively. MOP use was recorded 3.69 per cent less than the recommended level, which stands one of the contributing factors of blast incidences in some farms. Incremental yield of 20.92 per cent was observed over the expected, which could be attributed mostly due to increased crop density rather than efficient production resulting from optimally dense farms. Regression analysis results have indicated that education level, experience and family labor of the respondents, coefficients of which were reported at 10.76, 0.56 and o.34 respectively, had a significant positive influence on TAI. Based on the results obtained, extension activities directed towards educating progressive farmers about Jhelum's package of practices is suggested.

Keywords: Jhelum, Rice, Kashmir, TAI, Regression

1. INTRODUCTION

The farmers of Kashmir, a region of the temperate Himalayan, bear a great advantage over the rest of those in India from the standpoint of horticultural production, for the region's climate is much suited for orchards and forest produce. Yet, it is necessary for them to cultivate food grains such as rice, which remains their staple crop, and the populace's main source of carbohydrate intake(Husainiet *al.,* 2018). The state of Jammu and Kashmir produces about 5.5 lakh tonnes per annum, which is 50 per cent of its annual requirement (Najeeb *et al*., 2016), and the supply gap is met by imports from the neighboring states.
It remains a fact that an increase in production of commodities is a requirement in face of ever-increasing population, which could be the same justification for Kashmir's intended self-sufficiency of Rice. During the decade of 2008-09 to 2017-18, Kashmir realized an average annual production of 462.33 thousand tons from an area averaging 140.56 thousand hectares (DES, 2021). The productivity stood at 32.96 quintals per hectare during the same period. Although the production and productivity recorded an increase in this period, area allotted for paddy has declined by 3.41 per cent by its end, owing to allocation of land towards much remunerative horticultural crops by the farmers.

Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K), in its efforts to boost rice production in the valley, has released a variety in 1996 by the name ‘Jhelum’. Greater cold tolerance, moderate resistance to blast and better cooking quality have been its defining attributes. Also, this variety had found its use in breeding programmes, and had been instrumental to the creation of new rice varieties like SKUA-408.The State Government’s latest efforts in the form of seed multiplication programmes to spread Jhelum has popularized it among the farming community.
Release of a new varietyto the farmers comes with information about its package of practices leading to optimum output. However, farmers are often known to deviate from the suggested practices, either due to theirfarm nutrient and meteorological status or due to their ignorance. This may result in sub-optimal or super-optimal yields in real time. In this regard, there is a need to understand the extent of deviancy from the recommended practices and its determinants, which is the central focus of this work.

2. METHODOLOGY

2.1 Study Area

Four of the valley’s districts that witnessed greater areas under Jhelum variety have been chosen, namely Badgam, Kulgam, Pulwama and Anantnag districts (Fig.1). Badgam, where Jhelum cultivation has been on an upswing in recent times, represented Central Kashmir, while the remaining three districts were chosen from South Kashmir. A total of 25 villages were surveyed.

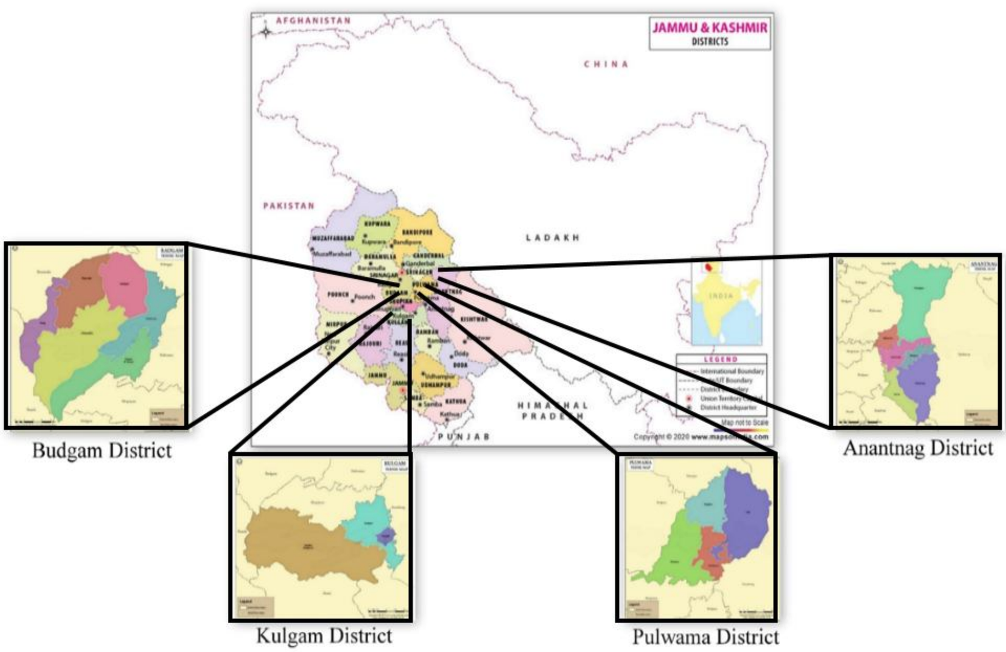

Fig.1. Map of the study area

2.2 Sampling

A total of 120 cultivators were selected for study. The field staff of the State’s Department of Agriculture helped in identification of respondents across the villages included in the sample. A mix of purposive sampling and simple random sampling was used to identify the respondents with area and adoption as the key factors.

2.3Data Collection

The data was collected by administering the thoroughly structured interview schedule to the respondents. The questions were asked both in Urdu and the local language (Kashmiri). Several experts/scientists from the Division of Agricultural Economics, Rajiv Gandhi Chair in Contemporary Studies on Livelihood and Food Security in SKUAST-Kashmir and Krishi Vignan Kendra in Pombay, Kulgam District aided in structuring the schedule.

2.4Analytical Tools

2.4.1 Technology Adoption Index

The extent to which a respondent has adopted the recommended set of packages is determined by the Technology Adoption Index (TAI). It is calculated by adding up the adoption quotient of each practice and dividing it by number of adopted practices of each respondent. The adoption quotient of each practice is calculated by taking the ratio of actual rate of practice adopted to the recommended rate of practice. TAI is calculated according to the formula stated below:

$$TAI = \frac{1}{n}\left[\sum_{X=1}^{n}\frac{X_A}{X_R}\right] * 100$$

Where,

TAI = Technology Adoption Index
n = Total number of input technologies to be evaluated
X_A = Expression of actual practice
X_R = Expression of recommended practice

TAI was later regressed with certain variables pertaining to the respondent to assess the personal disposition of the respondent to follow the recommended practices, after observing the similar analysis in the work on Shalimar Rice 1 (SR1) by Wani *et al.* (*2013*).

2.4.2 Multivariate Linear Regression Analysis

To assess the linear relationship of the select socio-economic parameters on TAI, Multivariate Linear Regression Analysis has been used. The coefficient associated with each independent variable gives the measure of its influence on the dependent variable. Ordinary Least Squares (OLS) model is most commonly used, which is used for the determination of not only linear, but also polynomial relationships. Residuals are computed in the model, which are used to determine Residual Sum of Squares and the Goodness of Fit (R^2).
The following form of Linear Regression Model was used in the study:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots \ldots + \beta_i X_i + \varepsilon$$

Where,

Y = Dependent Variable
α = Intercept
β_1, β_2, ….. β_i = Estimated Regression Coefficients
X_1, X_2, ….. X_i = Independent Variables
ε = Error Term

A similar regression model was employed by Bhatta *et al.* (2009) to estimate the determinants of farmers' willingness to pay for organic agriculture inputs

3. RESULTS AND DISCUSSION

3.1 Level of adoption of technology

Observation of Table 1 shows that the adopters use 207.67 per cent more seed than the recommended seed rate per ha, which indicate that seed quantities used by the farmers exceeded the optimum capacity of the nursery area. This led to unnecessary wastage of seed material, though it has contributed to an increase in the overall farm output to an extent. Excess seed use in a unit of nursery area puts a strain on space and nutrients required per seedling, which may restrict the seedlings in reaching their maximum potential, hasten the spread of diseases among the seedlings or lead to seedling mortality. But the farmers have reported that they were using excess seed to provide paddy seedlings to their neighboring relatives or friends. The average level of urea application was 10.82 per cent more than the recommended rate per ha, which stands a reasonable cause as to why several adopter farms had greater vegetative growth than the normal level. Adopters, on an average, used 28.00 per cent more DAP than the recommended level, but the use of potassium fertilizers (MOP) was 3.69 per cent below the recommended rate per ha. It is well known that potassium is the element responsible for disease and pest resistance, which is why the reduced application of MOP could be cited as one of the causes for increase in the incidences of Blast Disease in Jhelum rice fields.This statement could be supported by the work of Perrenoud (2013), wherein he clearly stated the importance of Potassium in resulting decline in fungal diseases in plants by 70 percent.Also, this could be worsened in the face of excess vegetative growth induced by the extra application of Nitrogen fertilizers. From the work of Li *et al.* (2021), which concluded with increase in numbers of white-backed planthopper, we can understand that insect vector population might increase with excess nitrogen application.Despite these deviations from the recommended input levels, the adopters realized 20.92 per cent more grain yield than the expected grain yield of 65 Quintals/ha. The average TAI for adopters stood at 160.71 percent.
The work on technology adoption in dry land crops of Andhra Pradesh by Suseela*et al.* (2018) witnessed three levels of adoption, the lowest being 0 per cent and the highest being 100 per cent of TAI. No farmer in their work used more than recommended levels of inputs. This was quite different from the situation in Kashmir, where paddy farmers used more than recommended dosages of inputs, which is why the average TAI recorded more than 100 percent.

Table 1.Determinants of adoption of Jhelum rice variety based on Probit regression model

S.No.	Input Particulars (Averages)	Observed [O] *(in kg ha^{-1})*	Recommended [R] *(in kg ha^{-1})*	Deviation (%) $\frac{O-R}{R} x\ 100$
1.	**Inputs**			
a)	Seed	184.60	60.00	207.67
b)	Urea	88.66	80.00	10.82
c)	DAP	166.4	130.00	28.00
d)	MOP	52.97	55.00	-3.69
2.	**Outputs**	**Observed**	**Expected**	**Deviation**
	Grain Yield	78.6 Quintals	65 Quintals	20.92 percent
3.	**Average TAI**	160.71 percent		

3.2<u>Determinants of Level of Technology Adoption</u>

Table 2 shows the determinants of level of technology adoption of the adopters. Eight variables have been selected, which were thought to have a direct or indirect impact on technology adoption, and were regressed with the TAI values of the adopters. Before the description of regression analysis with TAI, it is necessary to observe the relationship between residual errors and fitted values. The mean of residuals remains zero, but the observation of their distribution is necessary to find out whether the assumptions of linear regression are fulfilled. Fig. 2 shows the random distribution of residuals in relation to the reference line at zero value on the y-axis, indicating that there is no discernable non-linear trend to the residuals, and no indication of non-constant variance, thus fulfilling the major assumptions of linear regression analysis. The coefficient of the farmers' education level was found to be positive (10.76) and significant, indicating that educated farmers have positive impact on the levels of technological adoption than those farmers with low education. Family labor has a significant positive coefficient (0.34), indicating that adopters from families with greater percentage of agricultural participants have the tendency for greater technological adoption than those with less family labor. Farming experience of adopters, which reported a positive coefficient of 0.56, was observed to contribute significantly to the level of technology adoption. Education level of the families and paddy holding size of the respondents positively influenced the level of technological adoption, though their contribution to it was insignificant.Mariano *et al.*, (2012), in a similar study in Philippines, observed the importance of education on the adoption of improved rice technologies. Similarly, the contribution of variables like age of the adopters and family size was negligible, despite their negative coefficients, since the tabulated t-values of these variables were higher than their calculated t-values.

Regression of variables related to the farmer with a representative index wasn't an entirely new concept. Previous research on diversification of Punjab agriculture by Singh *et al.* (*1985*) regressed variables pertaining to farmers with their respective Herfindahl indices, which measure crop diversification, to identify the determinants of crop diversification. This formed the basis of regression analysis with TAI in the current study.Similarly, Mondal *et al.*, (2016) studied the level of technology adoption of major food grain crops in West Bengal. Yet, unlike this study, they studied the determinants of yield gap through regression analysis, rather than those of the adoption level.

Table 2.Determinants of adoption of Jhelum rice variety based on Probit regression model

Variable	Regression Coefficient	Standard Error	P >$\|t\|$
Constant	126.27***	12.23	0.00
Age	-0.50	0.39	0.20
Experience	0.56*	0.33	0.097
Education	10.76***	1.09	0.00
Family Size	-0.47	0.65	0.48
Family Education	0.04	0.09	0.71
Family Labor	0.34***	0.09	0.00
Paddy Holding Size	0.20	0.18	0.25
R^2	**0.6141**		
Adjusted R^2	**0.5863**		

**** At 1% level of significance** At 5% level of significance* At 10% level of significance*

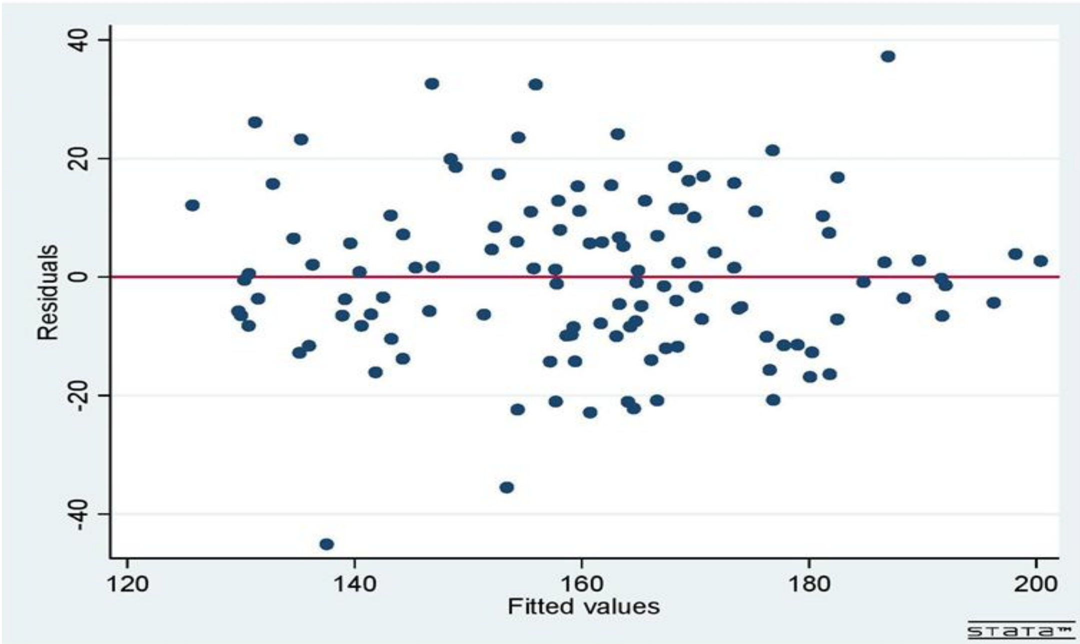

Fig. 2. Scatter Plot of Residuals and Fitted Values of TAI Regression

4. CONCLUSION

The crux of this work is that the farmers of Jhelum rice variety in Kashmir valley recorded sub-optimal use of resources. The incremental yield observed in comparison to the expected one could possibly be by the virtue of using excess seed material. However, such usage could be deemed inefficient. Insufficient use of MOP coupled with increased crop density could favor spread of blast disease. A significant positive influence of the respondents' experience, education and family labor on TAI brings about an understanding that educating experienced, well-educated farmers about the package of practices and efficient use of inputs might yield fruitful results. Progressive farmers might be the primary target of such a programme.

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