Agricultural Economics Research Review 2018, 31 (1), 95-104
DOI: 10.5958/0974-0279.2018.00009.5

Post-adoption experience of hybrid rice in India: farmers' satisfaction and willingness to grow

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Abstract Through this study we try to understand the post-adoption experiences of hybrid rice technology of the Indian farmers and its influences on their level of satisfaction, as well as their willingness to continue with the use of this technology. We find a number of factors, such as agronomic potential, agro-economic potential, effective demand, distribution, location, geography and cropping pattern impacting farmers' levels of satisfaction as well as their willingness to continue with cultivation of hybrid rice. Farmers in the predominantly rainfed regions, characterized by low crop yields, are more satisfied than others and they are also willing more to grow hybrid rice in future. From policy perspective, the results indicate the need for appropriate targeting of the technology while ensuring adequate supply of seeds and other inputs.

Keywords Hybrid rice, Farmer satisfaction, Willingness to grow, India

JEL classification Q13, Q16, Q18

1 Introduction

Rice is a staple food for majority of the Indians and is widely cultivated in different agro-ecologies. It accounts for 35% of the total area and 41.5% of the total production of food grains. While, the demand for rice has been increasing continuously, scope for enhancing production through area expansion is limited owing to fixed supply of arable land. Hence, there is a need to shift yield frontiers *via* research and extension of new technologies, such as hybrid seeds that are high-yielding, and are also tolerant to biotic and abiotic stresses. Hybrid rice cultivation has been a success in China (Longping 2014), Vietnam (Tri Hoan 2012), Bangladesh and the Philippines (Sana et al. 2001; Regalado 2012). However, it has not met much success in India.

Concentrated research efforts to develop hybrid rice in India began in 1989; and since then about 60 hybrids, both from public and the private sectors, have been released for cultivation. Yet, their acceptance has remained unexpectedly low. Area under hybrid rice though increased from 0.5 million ha in 1996 to 2.5 million ha in 2014, as proportion of the total rice area it is just 6%. Table 1 presents state wise area under hybrid rice.

At the time of introduction of hybrid rice technology, farmers of states like Punjab, Haryana, Tamil Nadu, Karnataka and Andhra Pradesh, where rice crop is fertilized, irrigated and transplanted, were expected to adopt it more. But, contrary to the expectations, its adoption level is much higher in rainfed states like Jharkhand, Chhattisgarh, Uttar Pradesh and Bihar. Several studies have identified factors for the limited adoption of hybrid rice technology. The important ones include: marginal yield gains (Spielman et al. 2012), low profit (Nirmala 2012) and poor resistance to insect-pests and diseases (Pandey & Bhandari 2009). In addition to the technological characteristics, several socio-economic and instituional factors too have been restrictive to wider adoption of hybrid rice technology.

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Table 1. State wise area under hybrid rice 2011

States	Area under hybrid rice* ('000 hectares)	% of the total rice area in the state #	% of the total area under hybrid rice in the country
Uttar Pradesh	770	12.9	38.88
Bihar	328	9.9	16.56
Chhattisgarh	207	5.5	10.45
Jharkhand	202	13.8	10.20
Haryana	99	8.0	5.00
Madhya Pradesh	83	5.0	4.19
Gujarat	80	9.6	4.04
Odisha	53	1.3	2.67
Others	158	–	7.98
Total	1980	–	–

Source: Siddiq (2012) *Estimated based on the F1 seeds sold; # calculated based on data from Ministry ofAgriculture, Government of India

Farmers' economic status has been found to have a negative (Sarkar and Ghosh 2013) as well as a positive (Spielman et al. 2012) influence on hybrid rice adoption. Further, their lack of knowledge about the recommended package of practices (Singh et al. 2009), low level of education (Hossain et al. 2003) and poor aceces to institutional credit (Pandey & Bhandari 2009), irrigation (Janaiah & Hossain 2003) and quality seeds (Singh et al. 2013; Spielman et al. 2012) have been identified as the main deterrants to its adoption. These studies, however, have failed to capture framers' post-adoption experience with hybrid seed technology and its potential for adoption in the future. These studies also have not considered the impact of farmers' disconfirmed beliefs (perceptions) on their satisfaction, and willingness to continue using the technology in future as well.

The process of adoption of agricultural technology is complex, involving interactions among several agro-ecological, social, institutional and policy factors. In general, farmers have to undergo a five-stage adoption process, encompassing awareness, interest, evaluation, trial and adoption (Rogers 1962). Once the technology has been adopted, its performance may lead either to satisfaction or dissatisfaction among adopters, and accordingly their decisions to continue or discontinue its use. According to the Expectation Confirmation Theory (Oliver 1980), the post-adoption satisfaction is a function of the expectations, perceived performance and disconfirmed beliefs (positive or negative). The resultant level of satisfaction translates into its potential adoption in future.

This paper attempts to address these gaps. Using farm-level data, we examine determinants of farmers' satisfaction with the use of hybrid rice technology, and their willingness to continue its use in future. We hypothesize that farmers' disconfirmed beliefs i.e., their perceptions after they have adopted the technology (Oliver 1980), related to yield advantage, profit, demand, supply and distribution along with socio-economic factors, such as age, education and land size, influence farmers' level of satisfaction from adoption of hybrid rice, and also their willingness to continue its adoption. The evidences on these can provide useful feedback to researchers and policymakers in targeting efforts and investments for promotion of hybrid rice technology.

In the next section, we discuss in brief the conceptual framework utilized to understand the impact of post-adoption experiences on farmers' level of satisfaction and willing to continue with the use of technology. Section 3 discusses data and descriptive statistics, and is followed by a discussion on the method used to achieve the objectives. Results are presented in section 5. Concluding remarks are made in the final section.

2 Conceptual framework

Assessing the adoption of a new technology in a developing-country context as India needs a

comprehensive framework encompassing price and non-price factors (Hodgdon and Singh 1966). Such a conceptual framework was developed by Desai & Stone (1987) and Gandhi & Desai (1992) for fertilizer use, and later it was extended by Gandhi & Patel (2001) to other inputs. In this paper, we adapt this framework to examine farmers' level of satisfaction with the adoption of hybrid rice technology and their willingness to continue its use in future. The main elements of this framework are described in figure 1.

Agronomic potential: It is the 'maximum amount of an input that can generate a beneficial physical effect (Gandhi & Patel 2001). The effect can be either absolute increase in production or reduction in losses at the same level of input use. It is reflected in yield advantage, resource use efficiency, and resistance to biotic and abiotic stresses.

Agro-economic potential: It refers to the economic advantage of a new technology determined by the price of output vis-à-vis cost of inputs, the quality and

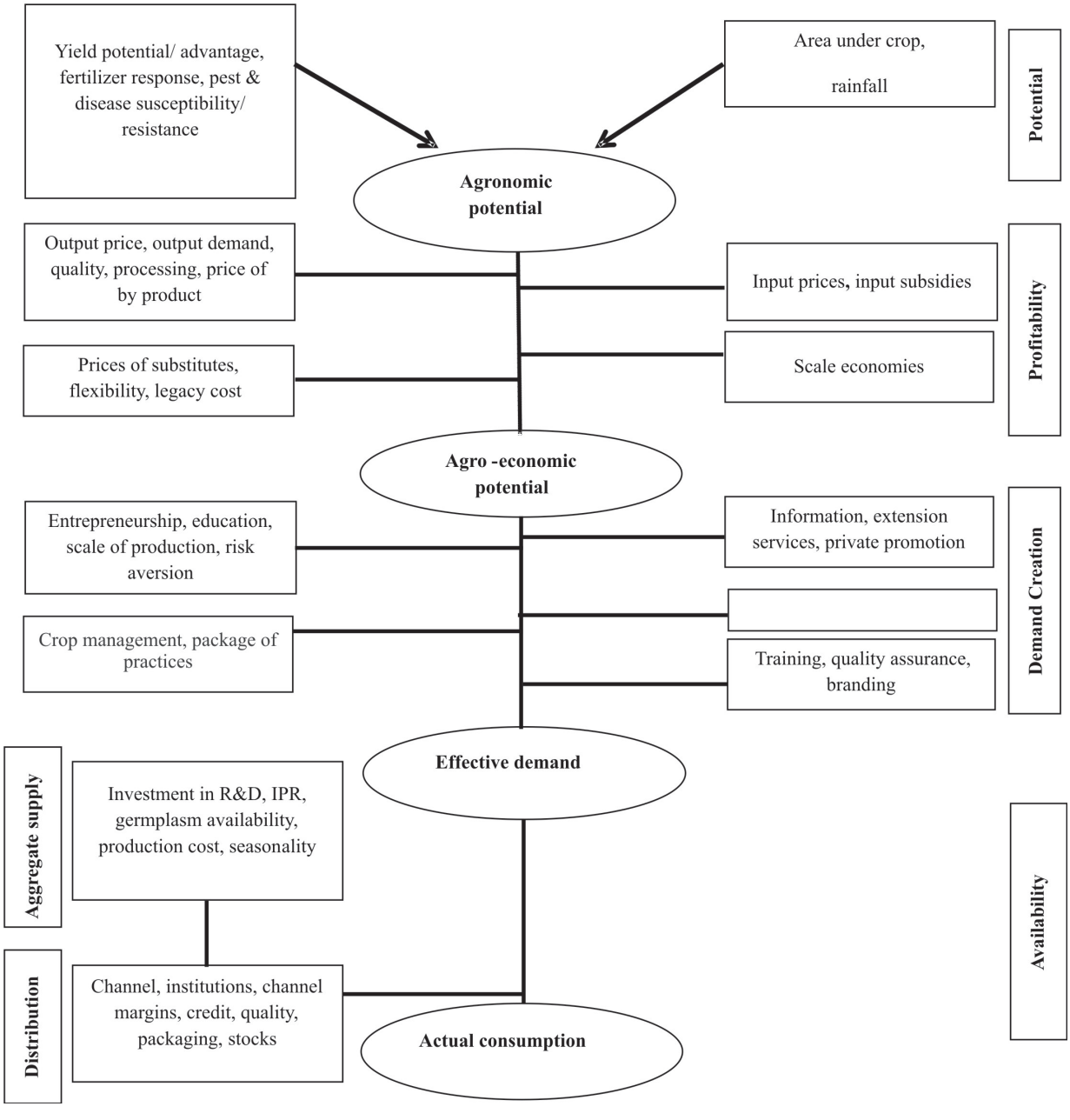

Figure 1. Conceptual framework

demand for output, and government interventions in input and output markets (e.g., input subsidies, price support, etc.).

Effective demand: It involves processes that induce farmers to adopt new technology fully from a situation of its no adoption (Desai & Stone 1987). Demand for a technology is determined by the availability of information, extension services and credit, ease of management and farmers' characteristcs, such as age, education, gender and experience.

Supply and distribution: In a developing country with huge number of dispersed small farmers the actual use of technology, even there exists a demand for it, can be limited by poor access to seeds, credit, information, etc.

3 Data and descriptive statistics

This study is based on survey data collected from 439 hybrid rice-growing farmers of 18 districts across the states of Uttar Pradesh, Chhattisgarh and Gujarat. Using a questionnaire, developed based on the conceptual framework described in the previous section and inputs from rice experts, a survey was conducted during December 2012 to February 2013. Multistage stratified sampling design, taking into considerations rice cropped area, share of hybrid rice in the total rice area, production and yield of rice, agro-climatic conditions, extent of dependence of crop on rains and size of landholding was followed to select the ultimate sample of farmers. From each district, 2-3 villages and from each village, 12-15 farmers were selected to get the required information.

Table 2 shows salient characteristics of the selected states. Uttar Pradesh accounts for 39% of the total area under hybrid rice cultivated in the country; and as such the hybrid rice occupies about 13% of the total rice area in the state. Chhattisgarh shares 10.5% of the total area under hybrid rice in the country, but only 5.5% of the state's total rice cropped area. Gujarat though shares only 4% of the country's total area under hybrid rice, the share of hybrid rice in the rice cropped area in the state is approximately 10%.

Table 3 shows demographic and other details of sample farmers. Farmers of Chhattisgarh are relatively younger. However, in terms of schooling, farmers of Uttar Pradesh have an edge over farmers of other states, but the inter-state difference are not significant. Farmers of Uttar Pradesh also have a higher ownership of cattle, while that of Gujarat dominate in the ownership of machines. The farmers of Uttar Pradesh are more experienced in cultivation of hybrid rice compared to farmers of other two states.

Average landholding size is larger in Chhattisgarh (3.50 ha) than in Gujarat (2.16 ha) and Uttar Pradesh (2.09 ha). Rice is the main crop on sample farms, and farmers allocate a sizeable area to hybrid rice; 60-68%. The test of difference in the means indicates that there are significant differences in the landholding size, rice cropped area and area allocated to hybrid rice across the selected states.

The post-adoption experience of farmers regarding hybrid rice cultivation on its various aspects related to agronomic potential, agro-economic potential, effective demand and supply and distribution was captured through farmers' response to statements: '*Hybrid rice yields more than the OPVs of rice'*, and '*Hybrid rice fetches more price than the OPVs'* on a 5-point Likert scale, ranging from strongly disagree to strongly agree. Each of the five constructs of the conceptual framework was operationalized through a set of items (table 4), and the mean scores were used as explanatory variables in the regression analysis. Yield advantage, availability

Table 2. Distinct characteristics of the sample states

	Uttar Pradesh	Chhattisgarh	Gujarat	Overall
No. of districts	7	6	5	18
No. of farmers sampled	156	149	134	439
Rice yield (kg/hectare) †	2239	1630	1997	-
% share in total area under hybrid rice area‡	38.88%	10.45%	4.04%	53.37%
% share of hybrid rice in total rice area ‡	12.9%	5.5%	9.6%	-

Source: †Average yield of 2010-11 and 2011-12 (Indiastat.com), ‡ Siddiq (2012).

Table 3. Features of the sampled farmers by states

	Uttar Pradesh	Chhattisgarh	Gujarat	Overall	ANOVA
Average age (in years)	43.6 (12.02)	41.3 (11.71)	46.9 (12.36)	43.8 (12.21)	7.76 (0.0005)
Average education (in years)	9.9 (5.16)	8.7 (4.93)	9.0 (4.11)	9.2 (4.80)	2.45 (0.0871)
Average distance from city (km)	14.4 (14.37)	13.2 (8.37)	9.5 (5.22)	12.6 (10.55)	7.62 (0.0006)
Cattle ownership (%)	96.8 (17.67)	89.3 (31.06)	85.1 (35.76)	90.7 (29.13)	-
Machinery ownership (%)	38.5 (48.81)	30.2 (46.07)	51.5 (50.16)	39.6 (48.97)	-
Experience of hybrid rice cultivation (years)	6.3 (2.95)	4.8 (3.03)	5.1 (2.77)	5.43 (2.99)	10.98 (0.0000)
Average land owned (ha)	2.09 (2.49)	3.50 (4.61)	2.16 (2.11)	2.59 (3.34)	8.68 (0.0002)
Rice cropped area (ha)	1.56 (2.29)	3.29 (3.51)	2.04 (2.42)	2.30 (2.89)	15.36 (0.0000)
Area allocated to hybrid rice (ha)	0.99 (1.04)	2.04 (2.66)	1.39 (1.56)	1.47 (1.93)	12.27 (0.000)

Source: Field Survey.
Figures in parenthesis in the first 4 columns are the standard deviations, and last column presents F-statistic for ANOVA with p-values in parenthesis.

of water, importance of rice, availability of hybrid seeds and guidance from input dealers are the important aspects indicated by the adopters in their decisions to cultivate hybrid rice.

The measures of farmers' attitude towards hybrid rice are: (i) satisfaction level in the use of hybrid rice technology, and (ii) willingness to continue with the cultivation of hybrid rice in future. These variables were also captured on a 5-point Likert scales, ranging from strongly disagree to strongly agree as a response to two statements: (i) *You are completely satisfied with hybrid rice technology,* and (ii) *You will continue to grow hybrid rice in future* as well.

4 Methodology

To identify determinants of farmers' level of satisfaction with the use of hybrid rice technology, and their willingness to continue its use in future, we use ordinal logistic regressions because of the nature of dependent variables. The model can be written as:

$$y_i^* = \beta' x_i + \varepsilon_i$$

where, y_i^* represents the unobserved value of the dependent variable, x_i is the set of observable explanatory variables, and ε_i is the error term normally distributed with zero mean and constant variance. The model assumes that true value of the dependent variable (y_i^*) cannot be observed. While we cannot observe y_i^*, the category of response y_i is observable for the ordered logit model that we employ.

$$\text{If } y_i^* \leq 0, \text{ then } y_i = 0$$

$$\text{If } 0 < y_i^* \leq \lambda_1, \text{ then } y_i = 1$$

$$\text{If } \lambda_1 < y_i^* \leq \lambda_2, \text{ then } y_i = 2, \text{ and so on.}$$

$\lambda_1 \ldots \lambda_n$ are unknown or unobserved utility threshold parameters which are to be estimated along with β. The model is estimated using maximum likelihood method. The coefficient β indicates change in the highest and lowest ranked categories of y_i for a change in x_i. Thus, a positive sign on β means that with an increase in the corresponding x_i the likelihood that $y = 0$ decreases and the likelihood that $y = 5$ increases.

Table 4. Perception of farmers regarding hybrid rice cultivation

	Strongly disagree	Disagree agree/ disagree	Neither	Agree agree	Strongly	Mean
Agronomic potential						
There is adequate water available for rice crop	2.1	8.7	16.2	28.7	44.4	4.05
Hybrid rice gives better yield than non-hybrids	0.0	2.3	7.1	46.9	43.7	4.32
Hybrid rice responds well to the fertilizer	1.1	10.3	17.6	53.4	17.6	3.76
Hybrid rice is resistant to pests and diseases	3.2	15.9	18.5	47.2	15.3	3.55
Hybrid rice is resistant to lodging	2.1	15.0	22.6	45.1	15.3	3.56
Hybrid rice is tolerant to abiotic stresses	8.5	28.2	20.9	29.4	13.1	3.10
Agro-economic potential						
There is good demand of hybrid rice in market	2.7	21.9	15.5	41.5	18.5	3.51
Hybrid rice fetches a good price in market	4.6	28.5	34.9	25.3	6.6	3.01
Government buys hybrid rice output	31.0	11.7	11.0	26.8	19.5	2.92
Subsidized hybrid rice seeds are available	61.0	22.6	8.3	6.2	1.8	1.65
Cost of production of hybrid rice is not more than non-hybrids	4.1	30.6	33.6	25.3	6.4	2.99
Hybrid rice has good milling quality	2.5	22.4	29.3	41.4	4.4	3.23
Hybrid rice is suitable for making puffed rice etc.	22.0	16.4	15.5	30.9	15.2	3.01
Effective demand						
Willing to take the risk and try new technologies	2.7	10.9	19.1	46.2	21.0	3.72
Opinion leader and actively participate in village activities	6.2	15.8	24.9	36.5	16.7	3.42
Well aware of the correct package of practice to follow	0.2	4.8	21.5	50.2	23.3	3.92
Easy to manage and you know how to do it	0.0	3.7	19.9	46.5	30.0	4.03
Getting adequate credit is not a problem	6.4	19.4	23.3	34.0	16.9	3.36
Rice is very important crop for your family income	1.6	7.6	10.3	46.3	34.2	4.04
Aggregate supply						
Hybrid rice seeds are easily available when required	0.0	0.9	3.0	32.2	63.9	4.59
Large number of companies supplying hybrid rice seeds	0.0	0.9	6.9	52.9	39.4	4.31
Distribution						
Many outlets selling hybrid rice seeds located nearby	0.0	0.9	2.7	51.8	44.5	4.41
Hybrid rice seed is available through government/cooperatives	58.4	24.2	7.5	7.5	2.3	1.71
Dealers charge reasonably for hybrid rice seed	0.7	13.9	15.3	33.3	36.8	3.92
Hybrid rice seeds are of good quality	0.2	5.2	16.9	55.8	21.9	3.94
Dealers help with other requirements like credit	15.2	28.9	20.3	19.2	16.4	2.93
Dealers provide proper guidance	0.5	8.2	6.8	52.6	31.9	4.07

5 Results and discussion

5.1 Satisfaction level

Table 5 shows means and standard deviations of the dependent and independent variables. The mean scores of different explanatory variables suggest that aggregate supply, effective demand and agronomic potential are the strongest aspects of hybrid rice cultivation. At the same time, perceived agro-economic potential of hybrid rice does not appear as a good determinant.

The result of the ordinal logistic model with '*Complete satisfaction'* as dependent variable is shown in table 6. The chi-square is 93 and is significant. The coefficients on agronomic potential, agro economic potential, effective demand and distribution have significant and positive effects on the log odds of farmers being at a higher level of satisfaction with the adoption of hybrid

Table 5. Definitions of the variables used in the empirical model

	Description	Mean	Standard deviation	Minimum	Maximum
Dependent variables					
Complete_satisfaction	Satisfaction level	4.11	0.794	1	5
Future_use	Willingness to grow in future	4.38	0.829	1	5
Independent variables					
AP	Agronomic potential	3.72	0.509	2.33	5.00
AEP	Agro economic potential	2.90	0.516	1.33	4.71
ED	Effective demand	3.74	0.523	1.83	5.00
AS	Aggregate Supply	4.45	0.519	2.00	5.00
D	Distribution	3.50	0.471	2.17	4.83
Age	Age of the farmer (years)	43.85	12.20	18	79
Education	Education of the farmer (years)	9.22	4.803	0	18
Landholding	Landholding size (hectares)	2.59	3.340	0	40.5
Kharif_crop	Number of kharif crops	1.48	0.500	1	2
City_distance	Distance of village from city (km)	12.58	10.55	0	72
Cattle_dummy	Dummy for cattle ownership			0	1
Machine_dummy	Dummy for machinery ownership			0	1
States	Dummy for states				

rice technology. At the same time, the coefficient on the distance is negative indicating that farmers who stay close to the cities and towns are more satisfied with the use of hybrid rice technology than those staying far way from these. The coefficients on the growing season dummy (kharif) is negative indicating that a lower level of satisfaction if they grow only one crop in the season. The state dummies for Uttar Pradesh and Chhattisgarh carry positive and significant signs implying that the log odds of farmers in these states being at a higher level of satisfaction compared to farmers of Gujarat. Other variables such as aggregate supply, age, education, landholding, and ownership of cattle and machinery do not have any significant effect on farmers' satisfaction with hybrid rice cultivation. Table 6 also reports marginal effects of the explanatory variables for two highest levels of dependent variable that is, agree and strongly agree.

5.2 Willingness to continue hybrid rice cultivation

The estimated coefficients with respect to future use of hybrid rice technology as dependent variable are presented in table 7. The results suggest that log odds of farmers continuing with hybrid rice technology improve with increase in agronomic potential, agro-economic potential and effective demand. The coefficient for dummy for kharif crops is negative and significant, implying farmers' less willingness to use hybrid rice for cultivation in future if there they cultivate only one crop in the season. On the other hand, coefficient on dummy for states indicates willingness to use hybrid rice is significantly higher among farmers of Chhattisgarh relative to farmers of Gujarat.

Overall, estimates suggest that farmers' satisfaction with hybrid rice technology is determined by their post-adoption perceptions regarding the relative physical advantage, profitability, demand creating factors and availability of technology. The estimates also indicate that satisfaction is affected by cropping pattern, remoteness of the region as well as the state to which a farmer belongs to. In the same way, the decision to continue using hybrid rice technology is significantly influenced by the relative physical advantage, profitability and demand creating factors. It is also found to depend on the number of kharif crops grown or cropping pattern, and geographical location of the farmers. Past studies have taken adoption as the dependent variable. We rather consider satisfaction and willingness to grow as dependent variables that provide for the future prospects of application of technology conditional upon several price and non-price factors. Janaiah & Xie (2010) and Spielman et al. (2012)

Table 6. Estimated logistic regression for complete satisfaction

	Coefficient	Odds ratio	X	Marginal effect	
				Agree	Strongly agree
Agronomic potential	0.684***	1.982***	3.737	-0.070**	0.141***
	(0.236)	(0.468)			
Agro-economic potential	1.076***	2.933***	2.895	-0.110***	0.223***
	(0.237)	(0.697)			
Effective demand	0.405*	1.499*	3.750	-0.041*	0.083*
	(0.224)	(0.335)			
Aggregate supply	-0.092	0.912	4.448	0.009	-0.019
	(0.214)	(0.196)			
Distribution	0.671***	1.956***	3.492	-0.069**	0.139***
	(0.238)	(0.466)			
Age	-0.009	0.990	43.94	0.001	-0.002
	(0.009)	(0.008)			
Education	-0.004	0.996	9.263	0.000	-0.001
	(0.024)	(0.024)			
Landholding	-0.035	0.966	2.641	0.003	-0.007
	(0.034)	(0.033)			
Kharif crops	-0.771***	0.462***	0.511	.0782***	-0.159***
	(0.224)	(0.103)			
City_distance	-0.027***	0.973***	12.60	0.003**	-0.006***
	(0.010)	(0.010)			
Uttar Pradesh	0.801**	2.227**	0.364	-0.093**	0.172**
	(0.318)	(0.708)			
Chhattisgarh	0.848***	2.336***	0.344	-0.102**	0.183***
	(0.279)	(0.653)			
Cattle_dummy	0.098	1.103	0.086	-0.011	0.021
	(0.364)	(0.401)			
Machinery_dummy	-0.031	0.969	0.602	0.003	-0.006
	(0.234)	(0.033)			
N			403		
LR chi^2			93.00		
Prob> chi^2			0.000		
Pseudo R^2			0.1052		

identify yield advantage an important factor in the adoption of hybrid rice technology, while Nirmala (2012) and Ward et al. (2013) find its adoption being more influenced by its profitability. Pandey & Bhandari (2009), Sarkar & Ghosh (2013), and Mottaleb et al. (2014) indicate seed delivery system having positive and significant impact on its adoption.

This study is one of the first attempts to understand and explain the post-adoption satisfaction of farmers with regard to hybrid rice technology in India in a framework that considers agronomic and agro-economic potential, demand and supply as important factors in the process of adoption of technology. The results regarding both farmers' satisfaction with technology and their willingness to continue with its use suggests a higher potential in rainfed regions. It is, however, contrary to the expectations that hybrid rice might be adopted more and perform better in irrigated environments (Mottaleb et al. 2014). To an extent it can be explained by the fact that marginal returns to adoption of hybrid rice, where yields of the conventional varieties are low, are higher, making

Table 7. Ordered logistic regression for future use

	Coefficient	Odds ratio	X	Marginal effect	
				Agree	Strongly agree
Agronomic potential	0.842***	2.323***	3.738	-0.151***	0.208***
	(0.243)	(0.564)			
Agro-economic potential	0.697***	2.008***	2.896	-0.125***	0.172***
	(0.239)	(0.481)			
Effective demand	0.568**	1.766**	3.750	-0.102**	0.140**
	(0.231)	(0.408)			
Aggregate supply	0.052	1.053	4.448	-0.009	0.013
	((0.213)	(0.225)			
Distribution	0.328	1.388	3.492	-0.059	0.081
	(0.241)	(0.335)			
Age	-0.011	0.989	43.94	0.002	-0.003
	(0.009)	(0.009)			
Education	-0.111	0.989	9.263	0.002	-0.003
	(0.025)	(0.025)			
Landholding	-0.011	0.989	2.642	0.002	-0.003
	(0.034)	(0.034)			
Kharif crops	-0.690***	0.501***	0.511	0.121***	-0.169***
	(0.228)	(0.114)			
City_distance	-0.002	0.997	12.60	0.000	-0.001
	(0.010)	(0.010)			
Uttar Pradesh	0.507	1.661	0.365	-0.091	0.124
	(0.323)	(0.537)			
Chhattisgarh	0.962***	2.617***	0.345	-0.169***	0.229***
	(0.288)	(0.755)			
Cattle_dummy	-0.193	0.825	0.087	0.034	-0.048
	(0.363)	(0.299)			
Machinery_dummy	0.009	1.009	0.603	-0.002	0.002
	(0.241)	(0.244)			
N			403		
LR chi^2			70.40		
Prob> chi^2			0.000		
Pseudo R^2			0.0869		

farmers satisfied with its agro-economic potential. On the other hand, in states like Uttar Pradesh and Gujarat, where yields of existing varieties are high, the adoption of hybrid rice technology does not seem to be as remunerative.

6 Conclusions

This study explains farmers' post-adoption satisfaction with the use of hybrid rice technology and their willingness to continue with it as a function of their disconfirmed beliefs and expectations regarding the technology. We find that the physical and economic benefits of hybrid rice as well as availability of seeds stand out as the important factors shaping farmers' attitude. Improving its yield advantage, ensuring higher prices, reducing cost of cultivation, and making seeds available at affordable prices are likely to improve farmers' satisfaction and their willingness to continue hybrid rice technology. Higher satisfaction levels and willingness to use the technology in future among those closer to the cities and towns implies the importance of infrastructure, markets and information in the

adoption of new technologies. Interestingly, higher level of satisfaction and willingness to grow in existing rainfed and low productivity regions suggests the need for targeting hybrid rice production to these regions.

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Received: 23 October 2016; Accepted: 31 December 2017