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Role of Technology in Effective Crop Production; A Study on Paddy Farmers Perception towards adoption of technology in different stages of Paddy farming

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Abstract

The main intention of this research paper is to know the paddy farmers perceptions towards the adoption of technology in paddy farming. This study is focused to know the farmers perception in adopting the technology each state of the paddy farming such as, primary tillage, secondary tillage, plantation, inter-culture operations, harvesting and threshing. This study may enhance the added knowledge to the existing literature in the domain of technology adoption in paddy farming.

***Key Words*:**Paddy farming; Technology adoption; primary tillage; secondary tillage; plantation; inter-culture Operations; harvesting and threshing.

1 Introduction

Paddy is considered to be the second largest produced grain the world after maize. Scientifically paddy is known as the Oryza Sativa which gives the high calorific intake to the mankind. India stood in second place for the yielding of paddy as it is next to China with 22 percent of paddy production. Paddy is the main crop in many of the states and the states such as, West Bengal, Andhra Pradesh, Punjab, Uttar Pradesh, Tamil Nadu, Karnataka, Chattisgarh, Orissa etc. There are many factors contributing for the paddy farming in the country. The nation has the boon of appropriate rainfall, type of soil which is much suitable for the paddy farming, better irrigation conditions, availability of the unskilled and skilled labor, effective application of pesticides and fertilizers and credit availability through different financial bodies. These conditions made the country to yield the better paddy production in the country. The production trends of rice in India witnessed a disturbing trend, which reaches a stagnation stage during the current decade.

The CAGR in productivity declined from 3.19% to 1.61% since commencement of the new millennium. The extent of area under rice in 2015 is 45.54 million hectares, with a production of 99.18 million tonnes and productivity rate of 2178 kg/ha. Paddy yield during the early post-independence period is just 1013 kgs/ ha, which enhanced to 1336 kgs/ha in the post Green revolution era. Interestingly, the paddy productivity during the early 20th century is around 1600 kg/ha, which decreased to 1139 kg/ha during 1940-41. The exponential changes in yields in the post-independence period is mainly a result of introduction of new high yielding varieties coupled with better irrigation and increased use of chemical fertilizers and pesticides.

The state of Andhra Pradesh is considered to be the agriculturally developed state as almost 23.9 percent of the GSDP is pooling from this concerned sector and employing about 62.17 percent of the people in this sector. The statistics also revealed that, this sector is directly employing around 60 percent of the force and employing for 76 percent of the marginal work force. Hence, agriculture sector stood as the largest employment generating sector in Andhra Pradesh. There are 45.63 lakh hectares of land is using to cultivate the paddy i.e almost 45.24 percent of the total lands of

Andhra Pradesh. The average yield rate of paddy in the state of Andhra Pradesh is 2178 kgs per hectare which is higher than the nations production. But it is also noted that, the productivity rate compared to Punjab (4022 kgs/hectare) is very much low. This phenomenon stating that there is a huge scope for enhancing the paddy production in the state of Andhra Pradesh.

2 Stages in the Paddy Production:

Scientifically, the paddy cultivation consists of different stages such as, primary tillage, secondary tillage, plantation, inter-culture operations, harvesting and threshing. This section explains the mentioned stages clearly.

2.1 Primary Tillage:

Primary tillage is the basic soil tillage which take place after the last crop. This tillage usually conducted when the soil is wet enough to allow plowing and strong enough to give reasonable levels of traction. This can be immediately after the crop harvest or at the beginning of the next wet season. When there is sufficient power available some soil types are ploughed dry. The primary tillage holds some specific objectives and the objectives are mentioned below:

- ⋆ To accomplish a reasonable depth i.e 10-15 cm of soft soil with variable lump sizes;
- ⋆ To eradicate the weeds by entombing or cutting and exposing the roots
- ⋆ To cut and include crop residues in to the soil.

2.2 Secondary Tillage:

Secondary tillage takes place after the primary tillage is done and this phase has the following objectives:

- To down size the clod size,
- To control the weed in the field

- To incorporate the fertilizers,
- To operate the puddling
- To do the leveling of soil surface.

2.3 Plantation:

According to the dictionary meaning plantation is a large farm, especially in a hot part of the world, on which a particular type of crop is grown. For planting the paddy farmers usually select one of the methods from the following:

⋆ Broadcasting Method

⋆ Drilling Method

⋆ Transplantation Method

⋆ Japanese Method

2.4 Inter-Cultural Operations:

The inter-cultural operations in the paddy farming is aimed to make all the plant survive and to grow fast to yield the crops. To attain this objective the farmers will perform the following activities.

⋆**Gap filling**

It is carried out about to 10 days after transplanting. Take some healthy seedlings out of the nursery and plant them in the places where they have not grown successfully or died because of other reasons.

⋆ **Improved Biasi operation in dry sown rice**

In dry sown rice when first hoeing is done 20-2.5 days after sowing, the plant population remains only 100-125 per sq metre, whereas for optimum yield seedlings must be 300-400 per sq metre. For maintaining this population, three times more seed rate i.e. 30 gm/sq metre is used in field for sowing in about 1/20th area of cultivable land.

2.5 Weed Control

Weeds compete with rice plant for water and nutrients. They also act as alternative host plants for different insect pests. Therefore, destruction of weeds from rice crop is of paramount importance. Generally, the weed infestation is more serious in dry sown rice than in flooded or transplanted rice.

2.6 Harvesting and Threshing:

Usually farmers harvest rice crops at maturity to minimize field losses resulting from shedding of grains. Sometimes farmers are forced to delay harvesting mainly due to unfavorable weather and lack of labor, especially during critical period of harvesting i.e. October- November. The delay of harvesting beyond optimum date, increases shattering of grains and over drying results in poor milling recovery. In India, rice is harvested manually with the help of sickle. It takes about 170 to 200 man hours to harvest one hectare of crop. Due to high labour demand at the time of harvesting. the entire operation continues for weeks together resulting in over drying in the field itself. This will gradually cause 5 to 15% grain loss in subsequent operations. After harvesting, harvested stalks are either laid loosely on the ground for field drying or the crop is. left in the field for whole day and night. Later collect it in the bundles. The direct drying under the sun leads to an increased breakage of the grains during milling. Gradual drying in the shade is essential for better recovery in rice grains.

2.7 Research Problem:

Though India is the second largest country which yields the paddy, but the productivity levels of the country is very less. Even the small countries like Brazil and Israel are also far ahead comparing with India. When comparing to the extent they are farming and the productivity, this percentage seems very low in India. This phenomenon is caused due to rely on traditional practices of paddy farming. This situation also brought one question forward at what extent the adoption is possible in paddy farming in India and there is no a comprehensive study so far on to know the farmers perception towards the various stages of paddy farming for technology

adoption to determine the effective production. Hence, this study wants to test the mediating role of technology on different stages of paddy farming to determine the effective paddy production.

2.8 Conceptual Model of the Study:

Based on the above-mentioned procedures, past research findings and other theoretical aspects, the researcher framed a conceptual model to carry forward this study. The conceptual model is presented below figure 1.

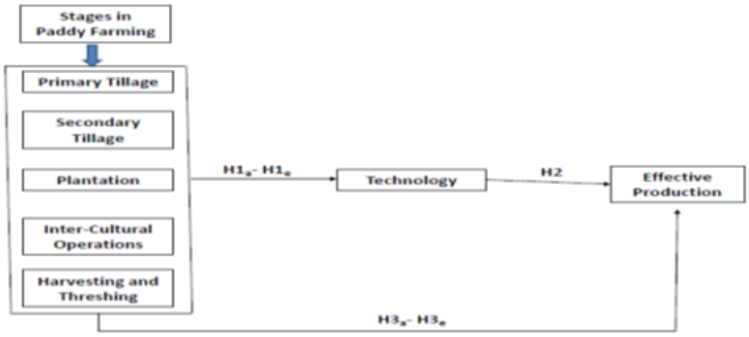

Fig 1 Conceptual Model of the Study

3 Research Methodology:

The data has been collected from 700 paddy farmers in Tenali revenue division. Researcher selected the farmers who are cultivating more than five acres of land and cultivating paddy since last two years as the samples of the study. Furthermore, the researcher also laid a condition who are well known about the technology upgradation in the paddy farming only considered as the samples of the study. Cluster sampling is adopted to select the location of the samples, where as time and convenience sampling technique is adopted to select the samples of the study. Proposed hypotheses of the study H1 is tested with multiple linear regression analysis, H2 is tested with simple linear regression and H3 is tested with multiple linear regression analysis.

4 Results:

For testing hypotheses H1a-H1e, stepwise multiple linear regression approach (MLRA) was used. The resulting regression models for dependent variable was shown in Table 1 and their significance including distinct predictors at varying levels.

Table 1: Regression model summaries for the affect of stages of paddy farming on Technology Adoption

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	ANOVA Results			
					df1	df2	F-value	Sig.
1	0.656(a)	0.431	0.430	0.797	1	699	414.127	0.000
2	0.694(b)	0.482	0.480	0.761	2	698	253.642	0.000
3	0.706©	0.493	0.495	0.750	3	697	180.029	0.000
4	0.709(d)	0.503	0.499	0.747	4	696	137.463	0.000
5	0.712 (e)	0.505	0.500	0.756	5	695	142.556	0.001

a. Predictors: (Constant), Primary Tillage
b. Predictors: (Constant), Primary Tillage, Secondary tillage
c. Predictors: (Constant), Primary Tillage, Secondary tillage, Plantation
d. Predictors: (Constant), Primary Tillage, Secondary tillage, Plantation, Inter-Cultural Operations
e. Predictors: (Constant), Primary Tillage, Secondary tillage, Plantation, Inter-Cultural Operations, Harvesting and Threshing
f. Dependent Variable: Technology

The five evolved regression models for technology adoption shown in Table - 1 contributed significantly and predicted 65.6 percent variation by model-1 with primary tillage and total 71.2 percent variation by model-5 with all independent variables. The five emerged regression models indicated that independent variables of Primary Tillage, Secondary tillage, Plantation, Inter-Cultural Operations, Harvesting and Threshing with their respective ANOVA values shown in Table 2 were significant (p=0.000). The coefficient summary for five evolved regression models revealed that all five models were the significant (p=0.000) predictors for technology adoption. The weights are standardised measures of the relative importance of independent variables in explaining the variation in the dependent variable, supporting an observation of β weights as a measure of relative importance. The positive sign of all beta estimates had shown that the greater the extent of attributes associated with stages in paddy farming, the more significant technology adoption will be. Therefore, the hypotheses $H1_a, H1_b, H1_c, H1_d$ and $H1_e$ were proved valid. The following regression models were emerged from the summary of unstandardized beta coefficients.

$Y = 2.123 + 0.626X_1$ ———- (1)

$Y = 0.569 + 0.478X_1 + 0.0.403X_2$ ——- (2)
$Y = 0.110 + 0.491X_1 + 0.0.325X_2 + 0.177X_3$—— (3)
$Y = 0.271 + 0.478X_1 + 0.0.2895X_2 + 0.120X_3 + 0.131X_4$ —— (3)
$Y = 0.755 + 0.514X_1 + 0.0.215X_2 + 0.230X_3 + 0.321X_4 + 0.366X_5$ —— (4)

Where, Y= Technology; X_1= Primary Tillage; X_2 = Secondary Tillage; X_3=Plantation; X_4=Inter-Cultural Operations; X_5=Harvesting and Threshing

The hypothesized relation between technology adoption and effective production are tested by using simple linear regression. The regression results shown in Table - 2 revealed that the predictor variables contribute significantly and had moderate impact on the brand loyalty (R^2 = 0.414). The corresponding ANOVA value (F = 385.972, p=0.000) for the regression models had indicated the validation with brand loyalty.

Table - 2 Regression Model Summaries for the Technology adoption on Effective Production

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	ANOVA Results		
				df1	df2	F-Value	Sig.
1	.643[a]	.414	.413	.80942	1	547	385.972	0.000
a. Predictors: (Constant), Effective Production							

The coefficient summary shown in Table 5.39 revealed that beta values of technology adoption (β=0.802, t=19.646, p=0.000) is significant with effective production. The results are implicit that predictor variable was related with dependent variable. Hence, null hypothesis was disproved and alternate hypothesis (H2) was accepted as their p-values were less than 0.05.

Here the following simple linear regression model

Effective Production (Y) = 0.693+ 0.802 (Technology Adoption) X

Table - 3: Predictor effects and Beta Estimates (Unstandardized) for technology adoption associated with effective production.

Model	Variable	Unstandardized Coefficients		Standardized Coefficients	t-Value	Sig.
		B	Std. Error	Beta		
1	(Constant)	.693	.238		2.914	.004
	Technology Adoption	.802	.041	.643	19.646	.000
a. Dependent Variable: Effective Production						

Table 4: Regression model summaries for the affect of stages of paddy farming on Effective Production

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	ANOVA Results			
					df1	df2	F-value	Sig.
1	0.568(a)	0.564	0.563	0.797	1	699	414.127	0.000
2	0.612(b)	0.599	0.598	0.761	2	698	253.642	0.000
3	0.624©	0.618	0.617	0.750	3	697	180.029	0.000
4	0.636(d)	0.628	0.627	0.747	4	696	137.463	0.000
5	0.640 (e)	0.636	0.635	0.756	5	695	142.556	0.001

a. Predictors: (Constant), Primary Tillage
b. Predictors: (Constant), Primary Tillage, Secondary tillage
c. Predictors: (Constant), Primary Tillage, Secondary tillage, Plantation
d. Predictors: (Constant), Primary Tillage, Secondary tillage, Plantation, Inter-Cultural Operations
e. Predictors: (Constant), Primary Tillage, Secondary tillage, Plantation, Inter-Cultural Operations, Harvesting and Threshing
f. Dependent Variable: Effective Production

The five evolved regression models for technology adoption shown in Table - 4 contributed significantly and predicted 56.8 percent variation by model-1 with primary tillage and total 64.0 percent variation by model-5 with all independent variables. The five emerged regression models indicated that independent variables of Primary Tillage, Secondary tillage, Plantation, Inter-Cultural Operations, Harvesting and Threshing with their respective ANOVA values shown in Table 2 were significant (p=0.000). The coefficient summary for five evolved regression models revealed that all five models were the significant (p=0.000) predictors for effective production. The weights are standardised measures of the relative importance of independent variables in explaining the variation in the dependent variable, supporting an observation of weights as a measure of relative importance. The positive sign of all beta estimates had shown that the greater the extent of attributes associated with stages in paddy farming, the more significant effective production will be. Therefore, the hypotheses H3a, H3b, Hec , Hed and H3e were proved valid. The following regression models were emerged from the summary of unstandardized beta coefficients.

$$Y = 1.916 + 0.546X_1 \text{ ———- } (1)$$

$Y = 0.889 + 0.372X_1 + 0.0.416X_2$ ——- (2)
$Y = 0.560 + 0.362X_1 + 0.0.225X_2 + 0.195X_3$— (3)
$Y = 0.445 + 0.356X_1 + 0.0.222X_2 + 0.187X_3 + 0.127X_4$ — (3)
$Y = 0.555 + 0.416X_1 + 0.0.218X_2 + 0.211X_3 + 0.111X_4 + 0.255X_5$ — (4)

Where, Y= Technology; X_1= Primary Tillage;X_2= Secondary Tillage; X_3=Plantation; X_4=Inter-Cultural Operations;X_5=Harvesting and Threshing

5 Conclusion

The study revealed that, the impact of technology is very high in the stages of primary tillage, secondary tillage and harvesting and threshing stages. The study also revealed that the impact of technology is valid but very much low in the stages of plantation and inter-cultural operations. The small extent of the lands is one of the major hurdle for the Indian farmers to adopt the technology in the paddy farming. This study also recognized that, the technology adoption importance is known by 60 percent of the farmers only. Hence, this study concludes that, there should be a need to give the appropriate orientation to the farmers on technology adaptation in the paddy farming.

References

[1] Birthal, P.S., A.K. Jha, M.M. Tiongco and C. Narrod (2008), Improving Farm to Market Linkages through contract farming: A Case Study of Small Holder Dairying in India, IFPRI discussion paper 00814. Washington, D.C.

[2] Birthal, P.S., PK Joshi and AV Narayanan (2011), Agricultural Diversification in India: Trends, contribution to growth and small farmer participation, ICRISAT, mimeo

[3] Chand, R., PA Lakshmi Prasanna and Aruna Singh (2011), Farm size and productivity: Understanding the strengths of smallholders and improving their livelihoods, Economic and Political Weekly, Vol.46, Nos. 26 and 27.

[4] Dev, Mahendra, S. Inclusive growth in India: Agriculture, poverty and human development. Oxford University Press; 2008.

[5] Sarthak, Gaurav and Srijit Mishra (2011), Size Class and returns to Cultivation in India: A Cold Case Reopened, IGIDR working paper No.WP2011-27, Mumbai

[6] Gulati, Ashok (2009), Emerging Trends in Indian Agriculture: What can we learn from these?

[7] 2nd Prof. Dayanath Jha Memorial Lecture, National Centre for Agricultural Economics and Policy Research, New Delhi

[8] Hazell, Peter (2011), Five Big Questions about Five Hundred Million Small Farms, paper presented at the Conference on new directions for small holder agriculture, 24-25 January 2011, Rome, IFAD.

[9] Joshi P K and A. Gulati (2003), From Plate to Plough: Agricultural Diversification in India, Paper presented at the Dragon and Elephant: A Comparative Study of Economic and Agricultural Reforms in China and India, New Delhi, India, March 25-26

[10] Lipton, M. (2006), Can Small Farmers Survive, Prosper, or be the Key Channel to cut Mass Poverty, Journal of Agricultural and Development Economics, Vol 3, No.1, 2006, pp58-85

[11] Madhur, Gautam (2011), "India: Accelerating Agricultural Productivity Growth- Policy and Investment Options", mimeo, World Bank, Washington, D.C.

[12] NCEUS (2008), A Special Programme for Marginal and Small Farmers, A Report prepared by the National Commission for Enterprises in the Unorganized Sector, NCEUS, New Delhi

[13] Rao, CH, Hanumatha (2005), Agriculture, Food security, Poverty and Environment Oxford University Press, New Delhi