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Adoption status and determinants of direct seeded rice technology in Telangana

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Abstract

Rice (*Oryza sativa* L.) serves as the staple food for more than half of the global population and plays a crucial role in ensuring India's food security. However, the conventional method of puddled transplanting is becoming less viable due to rising labour costs, water scarcity, and declining availability of manpower. The study was conducted during in Khammam and Peddapalli districts of Telangana to assess the adoption status and determinants of Dry Converted to Wet (DCW) and Wet DSR. An ex-post facto design was employed with 180 farmers (n=60 DCW, n=60 Wet DSR, n=60 conventional) from four mandals and three villages from each mandal with a total of twelve villages. Data was collected using pre-tested interview schedule and analysed through frequency, percentage, correlation, and multiple regression. Results indicated that most respondents in both DCW and Wet DSR categories had medium adoption levels, reflecting gradual transition from conventional methods. Correlation analysis showed significant positive relationships between adoption and profile characteristics such as age, education, landholding, farming experience, media use, and extension contact. Regression analysis identified age, education, farming experience, media use, and extension as key predictors, with high explanatory power ($R^2 = 0.852$ for DCW; 0.881 for Wet DSR). The study concludes that farmer education, reliable information access, and participatory extension services are critical to enhance adoption of DSR for sustainable rice cultivation.

Keywords: Direct seeded rice, adoption, determinants, dry converted to Wet DSR, Wet DSR, regression analysis

Introduction

Agriculture forms the backbone of rural livelihood and national food security, providing employment and sustenance to a large share of the population. It continues to play a vital role in driving economic growth and ensuring nutritional needs. Rice (*Oryza sativa* L.) is staple food for more than 60 per cent of the global population (Bista, 2018; Ashraf *et al.*, 2006) ^[2, 1]. India is the second largest producer of rice in the world being superseded only by China in the gross annual output (Dhillon *et al.*, 2010) ^[3].

Rice is a prominent global crop, serving as the primary staple food for over half of the world's population. The transplanting method remains the most widely practiced approach among farmers, however, in the face of mounting challenges such as population growth, climate change, resource scarcity, and labour shortages, the need for sustainable agricultural practices have become increasingly urgent.

Among the innovative solutions that have emerged, direct-seeded rice (DSR) stands out as a promising approach with significant sustainability potential. DSR refers to the process of establishing rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery (Mahajan

et al., 2017) ^[6]. Direct-seeded rice is a possible alternative to conventional puddled transplanted rice, where rice crop was sown through direct seeding in non-puddled fields, these fields were suitable approaches for water saving and labour (Singh *et al.*, 2009) ^[9].

Direct seeded rice (DSR) refers to the process of establishing rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery (Farooq *et al.*, 2011) ^[4]. Three principal methods of establishing the direct seeded rice commonly known are; dry seeding (sowing dry seeds into dry soil), wet seeding (sowing pre germinated seeds on wet soil), and water seeding (seeds sown into standing water) (Joshi *et al.*, 2013) ^[5]. Globally, 23 per cent of rice cultivation is under direct seeded rice and about 29 million hectares in Asia, which is approximately 21 per cent of the total rice area in the region (Rao *et al.*, 2007; Pandey and Velasco, 2002) ^[8, 7]. In Southeast Asia, DSR is mostly adopted in the dry season than in the wet season possibly because of better water management strategies.

Thus, the present study was planned to analyse the adoption status of Dry converted Wet DSR and Wet DSR in Khammam and Peddapalli district of Telangana.

Materials and Methods

The study was conducted in Khammam and Peddapalli Districts of Telangana state. An ex-post facto research design was used for the study. The two districts with highest acreage and lowest acreage of cultivation under Direct Seeded Rice were selected purposively for the study. From these two districts, twelve villages were selected simple randomly. From each village, five Dry converted to Wet direct seeded rice, five Wet direct seeded rice and five conventional respondents resulting in a total sample of 180 respondents (60 DCW DSR, 60 WET DSR and 60 Conventional) were selected for the study. The data was collected from the farmers through personal interview with the help of well-designed pre-tested schedule.

The data was analysed using frequency and percentage to know the adoption status of the respondents, correlation was used to analyse the relationship between independent variables and adoption status of the respondents and multiple regression was used to analyse the Determinants influencing the Adoption status of Direct Seeded Rice.

Results and Discussion

The results from the table 1. indicated that, majority of the Dry Converted Wet Direct Seeded Rice respondents having medium level of adoption of practices (40.00%) followed by very high (20.00%) high (16.67%) low (15.00%) and very low (8.33%). As for the Wet direct seeded rice, majority of the respondents having medium level of adoption (33.23%) followed by very high (26.77%), high (21.66%), low (11.67%) and very low (6.67%), whereas for the conventional method, majority of the respondents having medium (38.33%) level of adoption followed by high (26.67%), very high (20.00%), low (8.33%) and very low (6.67%) respectively.

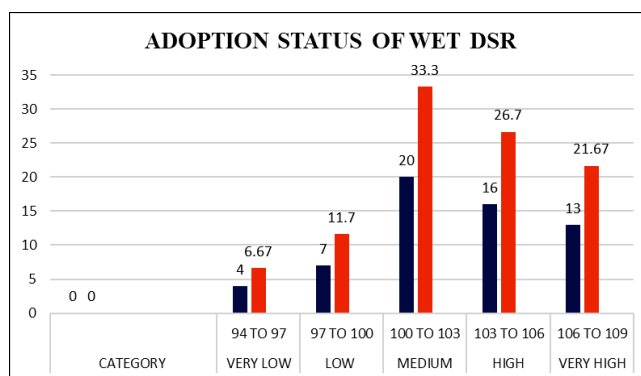
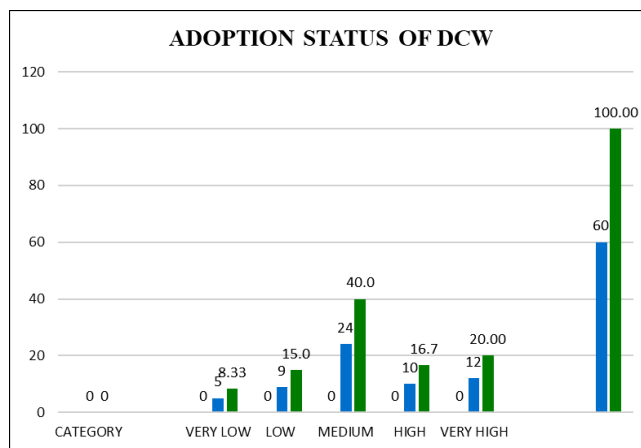
The observed variation in adoption levels across the three methods can be attributed to differences in farmers' experience, awareness, and risk perception. In the case of Dry Converted Wet DSR, a large proportion of farmers reported a medium level of adoption, as this practice is relatively new and farmers are still in the process of understanding and adjusting to its requirements. Only a few have moved to very high adoption due to confidence in the technology and better resource access, while some remain at low adoption due to uncertainties regarding weed control and water management.

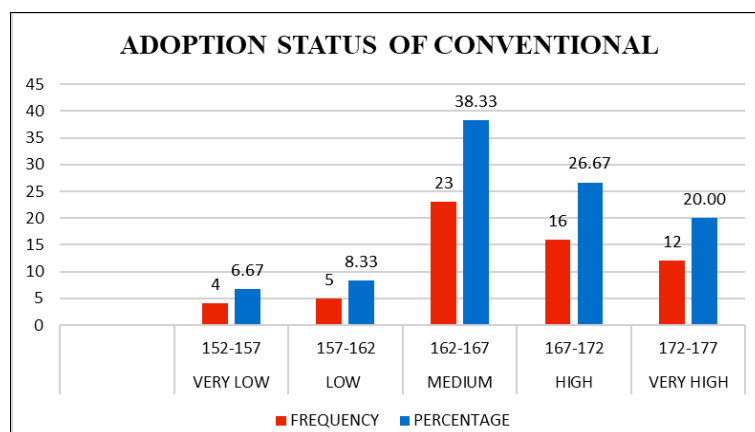
For the Wet DSR method, adoption is slightly higher at the "very high" and "high" levels compared to DCW, since farmers find it relatively closer to their conventional practice and it offers better control over germination and establishment. Still, a significant share stays at the medium level as constraints like weed management and technical knowledge limit complete adoption.

In the case of the conventional method, adoption also centers around the medium level, but relatively more farmers reach higher adoption levels because of familiarity, traditional knowledge, and lower perceived risk. However, limitations such as high labor and water requirements prevent very high adoption levels from being universal.

Table 1: Distribution of respondents based on their Adoption status (n=180)

S. No	Category	DCW (60)		WET (60)		Conventional (60)	
		f	%	f	%	f	%
1.	Very low	5	8.33	4	6.67	4	6.67
2.	Low	9	15.00	7	11.67	5	8.33
3.	Medium	24	40.00	20	33.23	23	38.33
4.	High	10	16.67	16	26.77	16	26.67
5.	Very high	12	20.00	13	21.66	12	20.00





Relationship between profile characteristics and adoption status of Direct Seeded Rice

To analyse the relationship between the profile characteristics of the respondents and the determinants influencing the adoption of Direct Seeded Rice, correlation coefficient (r) was computed, and the findings are presented accordingly.

Table 2: Relationship between profile characteristics and adoption status of Direct Seeded Rice. (n=120)

S. No	Independent Variables	'r' value (DCW)	'r' (Wet DSR)
1.	Age	0.898**	0.920**
2.	Education	0.913**	0.923**
3.	Land Holding	0.969**	0.917**
4.	Farming Experience	0.961**	0.969**
5.	Masa Media Utilisation	0.930**	0.932**
6.	Extension contacts	0.914**	0.897**
7.	Social Participation	0.890**	0.883**
8.	Innovativeness	0.932**	0.934**
9.	Decision Making Ability	0.920**	0.949**
10.	Economic Motivation	0.950**	0.963**
11.	Achievement Motivation	0.910**	0.934**
12.	Risk Orientation	0.931**	0.943**

**Correlation significant level at 0.01

The correlation analysis presented in the table highlights the relationship between selected socio-economic, psychological, and communication variables with the adoption of Direct Seeded Rice under Dry Converted Wet (DCW) and Wet DSR methods. The results clearly indicate that all the independent variables exhibited highly significant and positive correlations with both DCW and Wet DSR adoption.

Among the variables, land holding ($r = 0.969^{**}$ for DCW and $r = 0.917^{**}$ for Wet DSR) and farming experience ($r = 0.961^{**}$ for DCW and $r = 0.969^{**}$ for Wet DSR) recorded the strongest associations, implying that farmers with larger landholdings and greater experience are more likely to accept and adopt DSR practices. Similarly, economic motivation ($r = 0.950^{**}$ for DCW and $r = 0.963^{**}$ for Wet DSR) and decision-making ability ($r = 0.920^{**}$ for DCW and $r = 0.949^{**}$ for Wet DSR) also showed strong positive relationships, suggesting that economically driven and proactive farmers tend to favour innovative rice cultivation methods.

Psychological variables such as innovativeness ($r = 0.932^{**}$ and $r = 0.934^{**}$), risk orientation ($r = 0.931^{**}$ and $r = 0.943^{**}$), and achievement motivation ($r = 0.910^{**}$ and $r =$

0.934^{**}) were also positively correlated, highlighting the role of farmer attitude and willingness to experiment in adopting DSR. Furthermore, like mass media utilization ($r = 0.930^{**}$ and $r = 0.932^{**}$) and extension contacts ($r = 0.914^{**}$ and $r = 0.897^{**}$) exhibited a substantial influence, indicating that access to information and advisory services significantly enhances adoption.

Multiple Linear Regression Analysis of profile characteristics of DCW and WET DSR Farmers

The results from the table 3. illustrates the functional relationship between the independent variables determining the adoption status of Dry converted to Wet Direct Seeded Rice. The regression analysis provides clear evidence that adoption is not determined by a single factor, but rather by the combined influence of socio-economic, psychological, and communication characteristics of farmers.

Table 3: Determinants influencing the Adoption status of Dry converted to WetDirect Seeded Rice (DCW)

S. No	Independent Variables	"b" Value	Standard error	't' value	Sig.
1	Age	0.94	0.28	3.369	0.001
2	Education	0.762	0.247	3.078	0.003
3	Land holding	0.343	0.404	0.850	0.399
4	Farming experience	0.109	0.051	2.132	0.038
5	Mass media utilisation	0.389	0.172	2.167	0.028
6	Extension Contact	0.429	0.185	2.315	0.025
7	Social participation	-0.534	0.156	-3.429	0.001
8	Innovativeness	0.272	0.257	1.059	0.295
9	Decision making ability	0.313	0.238	1.313	0.195
10	Achievement motivation	-0.382	0.208	-1.837	0.072
11	Risk orientation	-0.324	0.192	-1.688	0.098
12	Economic motivation	0.016	0.145	0.056	0.854
		$R^2 = 0.852$		Adjusted, $R^2 = 0.835$	

**Significant at 1%level of significant, * significant at 5% level of significant, NS- Non-significant

The multiple linear regression analysis explains the combined influence of various socio-economic, psychological, and communication characteristics of farmers on the adoption of Direct Seeded Rice under Dry Converted Wet conditions. The model recorded a high coefficient of determination ($R^2 = 0.852$; Adjusted $R^2 = 0.835$), indicating that about 85% of the variation in adoption was explained by the selected independent variables.

The results reveal that age ($b = 0.94$, $t = 3.369$, $p < 0.01$)

and education ($b = 0.762$, $t = 3.078$, $p < 0.01$) were highly significant and positive predictors, implying that younger and better-educated farmers were more inclined towards adoption of DCW DSR. Farming experience ($b = 0.109$, $t = 2.132$, $p < 0.05$), mass media utilization ($b = 0.389$, $t = 2.167$, $p < 0.05$), and extension contact ($b = 0.429$, $t = 2.315$, $p < 0.05$) also had significant positive effects, suggesting that experienced farmers with greater access to information and advisory services are more likely to adopt. Interestingly, social participation showed a significant negative influence ($b = -0.534$, $t = -3.429$, $p < 0.01$), indicating that highly socially engaged farmers may face constraints in allocating time or resources to new practices such as DCW DSR. Other variables like innovativeness, decision-making ability, achievement motivation, risk orientation, and economic motivation, though positive in direction for some, did not exhibit statistical significance at the 5% level, suggesting their comparatively weaker role in influencing adoption decisions.

Table 4: Determinants influencing the Adoption status of Wet Direct Seeded Rice

S. No	Independent Variables	"b" Value	Standard error	't' value	Sig.
1	Age	0.92	0.18	3.384	0.001
2	Education	0.303	0.211	1.432	0.003
3	Land holding	-0.049	0.109	-0.447	0.399
4	Farming experience	0.106	0.025	2.850	0.038
5	Mass media utilisation	0.430	0.241	2.368	0.028
6	Extension Contact	0.378	0.138	-3.595	0.025
7	Social participation	-0.450	0.185	0.469	0.001
8	Innovativeness	0.066	0.186	1.450	0.295
9	Decision making ability	0.403	0.276	0.530	0.195
10	Achievement motivation	-0.223	0.189	-1.176	0.072
11	Risk orientation	0.216	0.132	1.787	0.098
12	Economic motivation	0.012	0.177	0.085	0.932
R ² = 0.881		Adjusted, R ² = 0.862			

**Significant at 1% level of significant, * significant at 5% level of significant, NS- Non-significant

The multiple linear regression analysis presented in Table 4, explains the influence of farmers socio-economic, psychological, and communication characteristics on the adoption of Wet Direct Seeded Rice (DSR). The model showed a high explanatory power with $R^2 = 0.881$ and Adjusted $R^2 = 0.862$, indicating that nearly 88% of the variation in adoption behaviour was accounted for by the independent variables considered in the study.

The results reveal that age ($b = 0.92$, $t = 3.384$, $p < 0.01$) was a highly significant and positive predictor, implying that relatively younger and middle-aged farmers are more inclined to adopt Wet DSR practices. Farming experience ($b = 0.106$, $t = 2.850$, $p < 0.05$), mass media utilization ($b = 0.430$, $t = 2.368$, $p < 0.05$), and extension contact ($b = 0.378$, $t = 3.595$, $p < 0.05$) also exhibited significant positive effects, suggesting that experienced farmers with better exposure to mass media and stronger interaction with extension personnel are more likely to accept and adopt Wet DSR technology.

On the other hand, social participation recorded a significant negative influence ($b = -0.450$, $t = -2.469$, $p < 0.01$), indicating that farmers with greater social involvement may be more cautious or face constraints in adopting new

practices. Other variables such as education, innovativeness, decision-making ability, achievement motivation, risk orientation, and economic motivation, though positive in direction for some, did not reach statistical significance at the 5% level, suggesting a relatively weaker or indirect role in influencing adoption.

Conclusion

The present study demonstrates that adoption of Direct Seeded Rice (DSR) technology, whether Dry Converted to Wet (DCW) or Wet DSR, is significantly shaped by the socio-economic and psychological characteristics of farmers. Across both methods, majority of respondents reported to be under medium adoption category, reflecting a transitional stage from conventional practices towards improved and sustainable methods. The correlation study revealed that, variables such as age, education, landholding, farming experience, mass media utilization, extension contacts, social participation, innovativeness, decision-making ability, economic motivation, achievement motivation, and risk orientation had a strong and positive association with adoption levels.

Further, the regression analysis revealed that age, education, farming experience, mass media exposure, and extension contact were the most influential predictors of adoption in both DCW and Wet DSR. On the other hand, factors such as social participation, achievement motivation, and risk orientation showed either negative or non-significant contributions, indicating the need for targeted interventions in these areas. The high R^2 and adjusted R^2 values indicate that these variables explain a substantial proportion of variation in adoption behaviour.

Overall, the findings highlight that farmer's education, improving access to reliable information, encouraging participatory extension services, and fostering innovative practices are essential for accelerating the adoption of Direct Seeded Rice (DSR). To achieve wider dissemination of this sustainable and resource-efficient cultivation method, policymakers and extension agencies should prioritize capacity building, awareness creation, and strategies that address farmers' motivational and risk-taking constraints.

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