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# Determinants of Adoption of Swarna (MTU-7029) Rice Variety in Godavari Zone of Andhra Pradesh

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**ABSTRACT**

Swarna (MTU-7029) rice variety alone occupies 51.65 % of the area in *kharif* season and grown in 1.85 lakh ha of total area under rice cultivation in Godavari zone of Andhra Pradesh. Determinants of adoption of Swarna (MTU-7029) rice variety was analysed by using binary logistic regression analysis. Multi stage sampling technique was employed to select 160 respondents and a well-structured questionnaire was used for data collection. The results of binary logistic regression model revealed that farmers' education, labour availability, average annual farm income and yield were positive and significant at 1% level of significance, whereas, access to information was positively significant at 5% level. The seed cost was negatively significant at 1% level of significance. On the contrary, farm size and distance to market for transportation were non-significant.

**Keywords:** *Adoption, Determinants, Godavari zone and Logit.*

Rice is the staple food for about 800 million people in India, which constitutes about 65 per cent of its population. Rice contributes to approximately 40 per cent of India's total food grain production (NRRI, 2020). India has 439.03 million hectares of area with a production of 1158.90 million tonnes and with a productivity of 2647 kg $ha^{-1}$ (TE 2019-2020). The major rice-growing states are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Orissa, Bihar, and Chhattisgarh, which collectively produce 75 per cent of India's rice and constituting 72 per cent of the nations' rice growing area (Shagun, 2022).

In India AP, stands at third position in rice with gross area of more than 22.61 lakh hectares with a production of 129.18 lakh tonnes and with a productivity of 5711 kg $ha^{-1}$ (TE 2019-2020). Godavari zone is considered as rice bowl of AP. In Godavari zone rice is grown in 7.81 lakh hectares with a production of 51.17 lakh tonnes with a productivity of 6552 kg $ha^{-1}$ (TE 2019-2020). About one-third of the rice varieties in India were A.N.G.R.A.U released rice varieties (Anonymous 2022). Till now in Andhra Pradesh A.N.G.R.A.U has successfully released 61 rice varieties each suited to diverse agro-ecological zones of the state. Among these, Swarna (MTU-7029), Badava Mahsuri (PLA-1100), Amara (MTU-1064), Indra (MTU-1061), Sridruthi (MTU-1121) and Samba Mahsuri (BPT-5204) are widely cultivated in *kharif* season in Godavari zone. Among the above mentioned varieties, Swarna (MTU-7029) rice variety alone occupies 51.65 % of the area in *kharif* season which constitutes 1.85 lakh ha.

The study was conducted with the objective to analyse the determinants of adoption of Swarna

(MTU-7029) rice variety in *Kharif* season in Godavari zone.

## DATA AND METHODOLOGY

A Multi-stage sampling technique procedure was adopted for the study. In Andhra Pradesh, Godavari zone is purposively selected for the study, because it is having 7.81 lakh hectares of area with a production of 51.17 tonnes and productivity of 6552 kg $ha^{-1}$ under rice cultivation (TE 2019-2020). Godavari zone consists of East and West Godavari districts. Two mandals from East Godavari and two mandals from West Godavari were selected based on the highest area under Swarna (MTU-7029) rice variety. From each mandal, two villages were selected based on the highest area under Swarna (MTU-7029) rice variety. From each village, 10 adopter and 10 non-adopter farmers were selected, making a total sample of 160 farmers comprising 80 adopters and 80 non-adopters. The data pertains to the year 2021-2022. The selected respondents were interviewed personally with the help of a well-structured interview schedule and the information collected was analysed using logistic regression model.

### Logistic Regression Model

Determinants of adoption of Swarna (MTU-7029) rice variety was analysed by using various parameters between adopters of Swarna (MTU-7029) rice variety and non-adopted farmers in *kharif* season. The logit model assumes that the random variable $Z_i$ predicts the probability of adoption. The basic model of the logit estimation (Gujarati, 2004) is as follows:

$$p_i = F(Z_i) = F(a+bX_i) = \frac{1}{(1+\exp Z_i)} \quad \ldots..(1)$$

Where,

*F* ($Z_i$) the standard normal density function for the possible values of the index $Z_i$

$p_i$ = the probability of adoption of Swarna (MTU-7029) rice variety

$X_i$ = set of explanatory variables

a = regression intercept, and

b= a vector of coefficient.

Where, i = 1, 2, 3, ....., n

Where $p_i$ is the probability of adoption of Swarna (MTU-7029) rice variety, given $X_i$ (the explanatory variables) and are parameters to be estimated. The log odds of the probability that an individual is willing to adopt Swarna (MTU-7029) rice variety is given by

$$Z_i = \log\left(\frac{Pi}{1-Pi}\right) = a + bX_i + \ldots bX_n + \mu_i \ldots.. (2)$$

Where:

*i* = 1, 2 …. N are observations

$Z_i$ = the natural logarithm of choice for the $i^{th}$ observation

$X_n$ = the nth explanatory observation

b = the nth vector of covariates

$\mu_i$ = the error or disturbance term.

For this study, the above equation is expressed implicitly as

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + u_i$$

where,

Y = Adoption of Swarna (MTU-7029) rice variety (1- adopter, 0-non-adopter)

$X_1$ = Age of the farmer (in years)

$X_2$ = Education (1=Illiterate, 2-Primary, 3-Secondary, 4-Intermediate, 5-Graduate Degree and 6-Post Graduate)

$X_3$ = Farm size (in ha)

$X_4$ = Access to membership (1-yes, 0-otherwise)

$X_5$ = Access to information (1-yes, 0-otherwise)

$X_6$ = Labour availability (1-yes, 0-otherwise)

$X_7$= Average annual farm income (in rupees)

$X_8$ = Distance to market for transportation (in kms)

$X_9$ = Seed cost (in rupees)

$X_{10}$ = Yield (q $ha^{-1}$)

$b_1$, $b_2$ . . . $b_{10}$ are parameters corresponding to estimated variables' coefficients.

$u_i$ is the error term and consists of unobservable random variables.

## RESULTS AND DISCUSSIONS

### Determinants of adoption of Swarna (MTU-7029) rice variety

In the present study logistic regression was used to analyse the determinants for the adoption of Swarna (MTU-7029) rice variety in *kharif* season, and the results were presented in Table 1. The Cox & Snell $R^2$ was 0.59 and Nagelkerke $R^2$ was 0.79 showed that the model's predictive capability explained 59 per cent and 79 per cent, respectively, of the farmer's decision to adopt Swarna (MTU-7029) rice variety. Hosmer and Lemeshow Chi-square stood at 0.70 which indicated that the efficiency of the data set on the final results.

### Age of the farmer

Age of the farmer showed negative relationship with adoption of Swarna (MTU-7029) rice variety and was found statistically significant at one per cent level. The negative coefficient indicated that age and the farmer's decision to adopt had a negative relationship. The marginal value of -0.027 for this variable indicated that the probability of adoption decreased by 2.7 per cent with one year increase in the age of the farmer. When compared to older farmers, younger farmers were more inclined to adopt Swarna (MTU-7029) rice variety. As the farmers grow older, there is an increase in risk aversion and a decreased interest in adoption of Swarna (MTU-7029) rice variety. It is known that younger farmers were more inventive and resourceful, which enables them to have better access to market knowledge. The results were similar with Abubakar *et al*. (2019) and Digal *et al*. (2020).

### Education of the farmer

Education of the respondents showed positive relationship with the adoption of Swarna (MTU-7029) rice variety and was found statistically significant at one per cent level. This indicated that positive relation between the education and adoption decision of farmer. The marginal value for this variable is 0.284 denotes that the probability of adoption increased by 28.4 percent with one year increase in the farmers' education. The farmers with higher level of education had higher capacity to adopt Swarna (MTU-7029) rice variety and the knowledge and skills accumulated over the years of formal education may give them eagle's eye for progressive pathway. This is consistent with Kadafur *et* al. (2020) and Feleke and Zegeye (2006).

### Access to membership in farmers' organisation:

Farmers membership in farmers' organisation showed positive and statistically significant relationship with the adoption of Swarna (MTU-7029) rice variety. It was positively significant at one per cent level of significance. This suggested a beneficial association between membership and the farmer's adoption decision. A marginal effect value of 0.274 for this variable indicated that the probability of adoption of Swarna (MTU-7029) rice variety increased by 27.4 percent. Farmers who belonged to certain social categories had access to A.N.G.R.A.U released rice varieties. The results were consistent with Ibn *et al.* (2018) and Mmbando and Baiyegunhi (2016).

**Table 1. Determinants for the adoption of Swarna (MTU-7029) rice variety in *Kharif* season**

| Variables | Co-efficients | Std. Error | P-Value | dy/dx |
|---|---|---|---|---|
| Age of the farmer | -0.108 | 0.056 | 0.053 | -0.027* |
| Education | 1.142 | 0.365 | 0.002 | 0.284*** |
| Farm size | 0.036 | 0.209 | 0.863 | 0.008 |
| Access to membership in farmers' organisation | 1.126 | 0.678 | 0.080 | 0.274* |
| Access to information | 1.502 | 0.673 | 0.014 | 0.355** |
| Labour availability | 2.308 | 0.907 | 0.002 | 0.520*** |
| Distance to market for transportation | -0.077 | 0.172 | 0.652 | -0.019 |
| Average annual farm income | 0.007 | 0.002 | 0.005 | 0.0018*** |
| Seed cost | -0.008 | 0.002 | 0.003 | -0.002*** |
| Yield | 0.203 | 0.057 | 0.000 | 0.050*** |
| Cox & Snell $R^2$ | 0.594 | | | |
| Nagelkerke $R^2$ | 0.792 | | | |
| Hosmer and Lemeshow test | 0.7 | | | |
| Pseudo $R^2$ | 0.69 | | | |
| Log likelihood | -34.204 | | | |
| Number of observations | 160 | | | |

Note: *** significant at 1 per cent level of significance, ** significant at 5 per cent level of significance and * significant at 10 percent level of significance.

**Access to information**

Access to information was found to have a statistically significant positive relationship with the adoption of Swarna (MTU-7029) rice variety at five per cent level of significance. This suggested a beneficial association between farmers' adoption decisions and the access to information. A marginal value of 0.355 for this variable denoted a 35.5 per cent increase in the likelihood of adoption. Swarna (MTU-7029) rice variety was more likely to be adopted by farmers who have access to information. Similar results were reported by Ibn *et al.* (2018) and Emongor and Uside (2019).

**Labour availability**

The adoption of the Swarna (MTU-7029) rice variety was positively correlated with the labour availability and significant at one per cent level. A marginal value of 0.52 implies that the probability of adoption increased by 52 per cent with the increase in the farmers' capacity to employ a unit of human labour. Similar findings were reported by Danso *et al.* (2017).

**Average annual farm income of the farmer**

The adoption of the Swarna (MTU-7029) rice variety was positively correlated with respondents' average annual farm income at one per cent level of significance, this showed a positive correlation between farmers' adoption decisions and their average annual farm revenue. This variable's marginal value of 0.0018 revealed a 0.18 per cent increase in the chance of adoption of Swarna (MTU-7029) rice variety with the increase in the average annual income. Farmers were more likely to adopt

Swarna (MTU-7029) rice variety because of higher yearly farm incomes due to the higher yield.

**Seed cost**

Cost of seed showed negative relationship with the adoption of Swarna (MTU-7029) rice variety. It was negatively and statistically significant at one per cent level of significance. This indicated that positive relationship between cost of seed and farmers adoption decision. This variable's marginal value of -0.002 represented 0.2 per cent reduced in the likelihood of adoption. Swarna (MTU-7029) rice variety was more likely to be adopted by farmers with decrease in seed cost. The results were consistent with Kanal and Maharjan (2013).

**Yield**

The yield of the farmer was found to have a positive and statistically significant relationship with the adoption of Swarna (MTU-7029) rice variety at one per cent level of significance. This indicated that positive relationship between the yield and farmers adoption decision. A marginal effect value of 0.050 for this variable indicated that the probability of adoption of Swarna (MTU-7029) rice variety increased by 5 percent. Swarna (MTU-7029) rice variety was more favourable to adopt by the farmers with increase in the yield. Crop variety that have high yielding stands to be adopted by farmers since high yield would raise output and subsequent income. The results were similar with Ademiluyi (2014).

**Farm Size**

The farm size of the farmer was positively influenced but not satistically significant. This implied that positive non-significant relationship between the farm size and the adoption decision. A marginal value of 0.008 indicated that the probability of adoption of Swarna (MTU-7029) rice variety increased by 0.8 per cent. This means that rice farmers whose farm size are large adopted Swarna (MTU-7029) variety unlike those without sufficient farm. This is true and conforms to the a priori expectations because sufficient farm size can be an advantage to innovation adoption. They can easily test the technologies on their farm when there is enough land for them to practice the technology. The results were similar with Digal (2020).

## CONCLUSION

From the above findings, it is concluded that education, access to membership of cooperative society, access to information, labour availability, average annual farm income and yield of the farmer were positively and significantly associated with the farmers adoption decision of Swarna (MTU-7029) rice variety. On the contrary, age and seed cost were negatively and significantly influencing the farmers adoption decision of Swarna (MTU-7029) rice variety. To improve the probability of adoption of Swarna (MTU-7029) rice variety, agriculture department should encourage the farmers to participate in farmers' organisation to increase the adoption and extent of adoption of Swarna (MTU-7029) rice variety. The extension networks of A.N.G.R.A.U should penetrate much deeper into the farming societies and increase the awareness on adoption of Swarna (MTU-7029) variety through high promotion at digital and print media.

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