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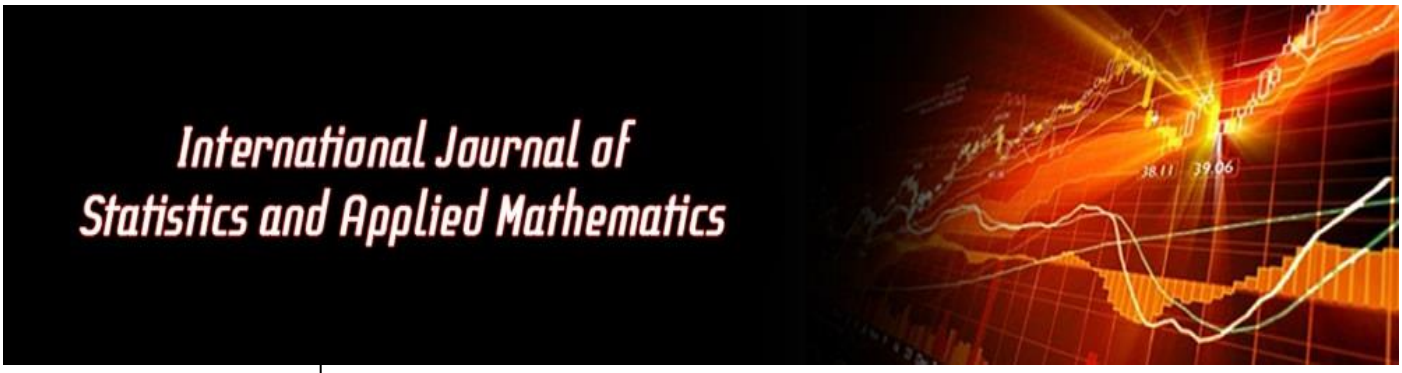


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# An analysis on farmers' preference for rice varietal traits in Godavari districts of Andhra Pradesh

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**Abstract**
This research aims to investigate the preferential traits of the farmers in the selection of rice variety using Conjoint Analysis. The present study was conducted in two purposively selected districts i.e, East and West Godavari of Andhra Pradesh during Kharif 2022-23. From each district three mandals, from each mandal three villages and from each village 15 respondents were selected. Thus, a total of 270 farmers who actively involved in paddy farming were randomly selected for the current study. The findings revealed that the most preferred trait of paddy farmers in East and West Godavari districts is pest tolerance (31.443%). The second most important trait disease resistance (22.634%). The third important trait is Non-lodging (19.072%). The fourth important trait considered by farmers' is grain type (14.011%), grain type that farmers preferred to grow is slender grains. The fifth importance value is crop duration (7.685%), it shows that farmers are preferring to grow short duration paddy variety. Further, the last consideration of the preference was plant height (5.155%), which indicates that paddy farmers in Godavari districts preferred to grow paddy variety that is short in height.

**Keywords:** Conjoint analysis, paddy, preference, trait, variety

## Introduction
The origin of rice (*Oryza sativa* L.) is South East Asia (Indo Burma). It is globally an important staple food consumed by 50.00 per cent of world population as well as main source of income, cultivated in an area of 162.06 million hectares with annual production of 497.69 million tonnes during 2019-2020 (Statista.com). It is cultivated in tropical and subtropical countries in the world. Rice provides 27% of dietary energy supply and 20% of dietary protein intake. Asia produces and consumes more than 90% of the world's paddy, and its 2 billion inhabitants get 60–70% of their energy from rice and rice related products.

In India, rice is one of the prominent cereals crops, which accounts for 23.88 per cent of the global rice production. Being the world's second largest producer of rice, India occupies an important position among the global rice supplier's area and production of rice. It has managed to secure its position by adopting improved rice production technologies such as high-yielding varieties/hybrids, expansion of irrigation potential, and use of chemical fertilizer, which kept the supply of rice in the country in pace with the increase in demand (Mahajan *et al.* 2017) [4]. India has 439.03 lakh hectares of area with a production of 1158.9 lakh tonnes and with a productivity of 2647 kg $ha^{-1}$ (Triennium Ending 2019-20). 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 nation's rice growing area (Shagun, 2022) [7].

Andhra Pradesh which is referred as the "Rice bowl of India", occupying 8th position in area (2.21 million ha), 4th position in production (8.25 million tons) and 2nd position in rice productivity (3.73 t/ha) and contributes 7.08% of country's rice requirement (Agricultural Statistics at a Glance 2019-20). In fact, West Godavari and East Godavari which comes under Godavari zone are the two most important rice producing districts not only of Andhra Pradesh but of the whole of India and these two districts considered as rice bowl of Andhra Pradesh.

In the Godavari zone rice is grown in 7.81 lakh hectares with a production of 51.17 lakh tonnes with a productivity of 6552 kg $ha^{-1}$ (Triennium Ending 2019-20).

Since, in this region agriculture is dominated by more number of marginal farmers and smallholders with different levels of skills, knowledge, capital and resources. Hence, understanding the farmers' preferences for paddy varietal traits and incentives to cultivate improved varieties are crucial to the success of another green revolution in the study area. Hence, this study is undertaken to analyze the farmers' preference for rice varietal traits in Godavari districts of Andhra Pradesh which would help to understand the incentives that farmers need in making the choice of technology adoption, identification of farmers' needs and also forms a basis for formulating research strategies for improvement of rice varieties and scaling up of suitable varieties.

## Material and Methods

The main goal of this study is to determine the preferential traits of the farmers in the selection of rice varieties in Godavari districts of Andhra Pradesh. For this purpose, a study was undertaken in the major rice growing tracts of East and West Godavari districts of Andhra Pradesh during Kharif 2022-23. The multistage sampling design was adopted for the selection of sample at different levels of district, Mandal and village for the present study. Andhra Pradesh has 22.61 lakh hectares of area under rice with a production of 129.18 lakh tonnes and with a productivity of 5711 kg $ha^{-1}$ (Triennium Ending 2019-20). Godavari Zone was selected for the study, as it has 7.81 lakh hectares of area under rice with a production of 51.17 lakh tonnes and productivity 6552 kg $ha^{-1}$ under rice cultivation (Triennium Ending 2019-20).

Godavari zone consists of East and West Godavari districts, from East Godavari district Pithapuram, Tuni and Samalkot mandals were selected and from West Godavari district, Tadepalligudem, Nidadavole and Pentapadu mandals were selected as these Mandals having a large area under rice cultivation. In each mandal, top three villages were selected based on the maximum area of rice distribution. Thus, a total of 18 villages and 270 respondents (15 respondents from each selected village) from Godavari districts, were selected for the present study. A well-structured and pretested interview schedule was used to collect data from respondents and the collected details were analyzed by using Conjoint Analysis Technique.

## Conjoint Analysis

Conjoint analysis is a technique used in assessing respondents value judgments. Hence, in the present study, it was used to measure the farmers' preference for the rice attributes. Of late, conjoint analysis is finding increasing application in the field of market research and wider management decision-making.

One of the important requirements for conjoint analysis is the identification of critical attributes to describe the preferences for rice and the specific and feasible levels of these attributes. On the basis of the objective attributes and then respective levels with orthogonal variables 18 cards were developed. The respondent is first asked to rank the set of profiles, or cards according to his or her preference. On each of these profiles, all factors of interest are represented and a different combination of factor levels appears. The task of respondents is to rank each profile from the most to the least preferred. From these rankings or scores, conjoint analysis derives utility scores for each factor level. These utility scores, analogous to regression coefficients are called part-worths and can be used to find the relative importance of each factor. What rice attribute is important or unimportant to the farmers? What level of rice attributes are the most or least desirable in the farmer's mind? Answer to these questions of crucial importance in the purchase and utilization of rice variety were analyzed using conjoint analysis technique.

The virtue of conjoint analysis is that it asks the respondent to make choices in the same fashion as the respondent presumably does- by trading off features, one against another. The full concept method is adopted to collect the data for conjoint analysis as it is considered as a more realistic because all factors are considered at the same time. These attributes and levels resulted in 18 profile solutions. Since, the number of all possible combinations of these 6 attributes was too large for evaluation, a computer software package, 'SPSS' (Statistical Package for Social Sciences) was employed to select a subset of 18 rice profiles which represent the most likely ones. Each profile was described on a separate card called plan cards. Each respondent was shown a randomly mixed set of 18 plan cards and was asked to rank them accordingly to their own perception. The ranks provided by them through these 18 cards were noted down. For each attribute/respondent, part-worth as well as relative importance of each attribute was estimated using conjoint analysis.

The additive conjoint model was used in this study. The model has been formulated as:

$$Y = \sum_{i=1}^{n} \sum_{j=1}^{m} V_{ij} X_{ij}$$

Where,

Y = Consumers' overall evaluation of the rice.

Vij = Part worth associated with 'j' (1,2,3, ……m) of attributes, 'i' (1,2, ……, n)

Xij = Dummy variable representing the preference of the jth level of ith attribute.

For this study, profile describing alternatives was constructed by combining levels of six attributes. The attributes and their levels were identified through discussions with the rice farmers during the survey and also on consultation with marketing specialists and presented in Table-1.

**Table 1:** Attributes and attribute levels of rice considered for conjoint analysis

| SI. No. | Attribute | Attributes Level |
|---|---|---|
| 1 | Plant Height | Short |
| | | Tall |
| 2 | Crop Duration | Short |
| | | Long |
| 3 | Pest Tolerance | Yellow Stem Borer |
| | | Brown Plant Hopper |
| 4 | Disease Resistance | Sheath Blight |
| | | Bacterial Leaf Blight |
| 5 | Non-Lodging | Non-lodging |
| | | Lodging |
| 6 | Grain Type | Bold |
| | | Slender |

## Results and Discussion

### Pattern of attributes of Paddy determining Producer

In this study, conjoint analysis was employed to quantify the important traits of rice those determining farmers' preferences in the selection of paddy variety in Godavari districts. The

important attributes considered in this study were plant height, crop duration, pest tolerance, disease resistant, Non-lodging and grain size. OLS regression analysis was used to estimate the part-worths for each respondent. The additive model fit the individual data well.

Correlation test comes next in this analysis for determining the conjoint analysis result aggregate's validity in predicting respondents' preferences using the correlation value (Table 2). At a 5% level, Kendall's tau correlation value of 0.422 and Pearson's rank correlation value of 0.782 were both found to be statistically significant. It inferred relatively strong correlation between the anticipated preference and actual preference or it comprises precise prediction in the conjoint process. Consequently, the preferences of farmers for rice varieties, analyzed by different attributes – plant height, crop duration, pest tolerance, disease resistant, Non-lodging and grain size – have a significant correlation in determining the preferences of farmers for rice varieties in Godavari districts.

**Table 2:** Correlation Values

| Correlations | Value | Sig. |
|---|---|---|
| Pearson's R | .782 | .004 |
| Kendall's tau | .422 | .045 |

The individual utility values and relative importance of the traits were given in Table-3 & 4 respectively. Overall, it was clear that farmers preferred shorter plants when it came to plant height. It indicated a positive utility estimate value (0.110) compared to tall plant which showed a negative utility estimate value (-0.110). Thus, the farmers' preference level for plant height attribute was short plant. The possible reason for preferring the short plant by the farmers is that short plants are resistant to lodging compared to tall plants. Since in the study area lodging is a major problem especially during kharif season, so as to overcome the problem of lodging, farmers are considering the short plant while growing paddy.

The results also show that, farmers prefer short duration paddy variety which is with a positive utility estimate value (0.164) compared to long duration variety which showed a negative result (-0.164), since, the short-duration varieties, besides offering a sufficient window for paddy residue management for next season, also save irrigation water and input cost. In this investigation, farmers showed preference on pest tolerance trait i.e., brown plant hopper tolerance with a positive utility estimate value of 0.671 than yellow stem borer which resulted in negative utility estimate value of -0.671. On the disease resistant trait, overall, farmers' preference is for resistant to bacterial leaf blight with a positive utility estimate value (0.483) as compared to the sheath blight resistance that yielded a negative utility estimate value (-0.483).

In this investigation, farmers showed preference to Non-lodging which is indicated by positive utility estimate value of 0.407 compared to lodging which showed a negative utility estimate value (-0.407). One of the most chronic constraints to crop production is the grain yield reduction due to lodging at the stage of harvest. Since this is more prevalent in cereal crops, particularly in rice, farmers are considering resistant to lodging as an important trait in the varietal selection. Based on Table-3, paddy grain type attribute levels are bold (-0.299) and slender (0.299), it implies that farmers tended to select paddy variety with slender grains, since this is one of the most crucial factors that affects the produce's price on the market.

Based on this research, preferred combination of paddy variety that had an impact on farmers' purchasing decision is short plant, containing short duration, with Non-lodging nature and, slender grain type which is tolerant to yellow stem borer and resistant to bacterial leaf blight.

**Table 3:** The Utility Estimate Values of Rice Attribute Levels

| SI. No. | Attribute | Attributes Level | Utility Estimate |
|---|---|---|---|
| 1 | Plant Height | Short | .110 |
| | | Tall | -.110 |
| 2 | Crop Duration | Short | .164 |
| | | Long | -.164 |
| 3 | Pest Tolerance | Yellow Stem Borer | -.671 |
| | | Brown Plant Hopper | .671 |
| 4 | Disease Resistance | Sheath Blight | -.483 |
| | | Bacterial Leaf Blight | .483 |
| 5 | Non-Lodging | Non-lodging | .407 |
| | | Lodging | -.407 |
| 6 | Grain Type | Bold | -.299 |
| | | Slender | .299 |

In order to arrive at the relative importance of each trait, the part worth functions relative importance was compared across different traits within segments. The relative importance values of the attributes for Godavari districts are presented in below Table-4. and figure.

This relative importance values represents the degree of importance to the traits (in percent). Among all the traits of paddy studied in Godavari districts, pest resistance was discovered to be the farmers' primary concern and their top priority, accounting for 31.443% of relative importance. After pest tolerance, disease resistance had a considerable impact on farmers' preferences, accounting for 22.634% of the relative importance. The third most significant component, with a relative value of 19.072%, was non-lodging. Grain type formed the fourth important factor with a relative value of 14.011%. Plant height and crop duration had the least relative values of 5.155% and 7.685% respectively. Ravindera and Singh (2022) [5], Sharma et al., (2017) [6], Asante et al., (2013) [1] and Hossain (2021) [3] were also revealed such attributes as the most preferred attributes by the rice cultivating farmers while choosing rice variety.

**Table 4:** Relative importance values of paddy traits

| SI. No | Attribute | Relative importance (%) |
|---|---|---|
| 1 | Plant Height | 5.155 |
| 2 | Crop Duration | 7.685 |
| 3 | Pest Tolerance | 31.443 |
| 4 | Disease Resistance | 22.634 |
| 5 | Non-Lodging | 19.072 |
| 6 | Grain Type | 14.011 |
| Total | | 100.000 |

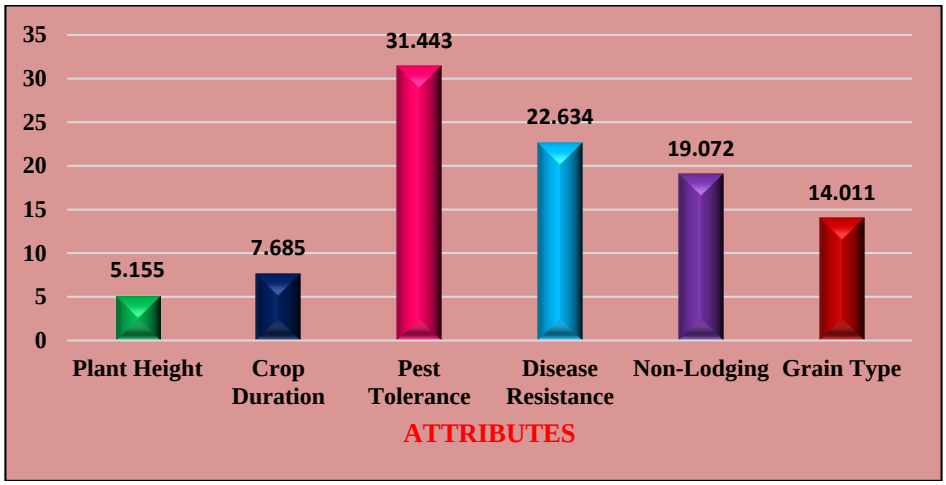


**Fig:** Relative importance values of paddy preference by east and west Godavari farmers

## Conclusion

In accordance with the findings of the conjoint analysis used in this study, it was found that Pearson's correlation and Kendall's correlation values for farmers' preference of paddy was significant at 5% level confirming that the farmers' preferences for paddy varieties, analyzed by different attributes – plant height, crop duration, pest tolerance, disease resistant, Non-lodging and grain size – have a significant correlation in determining the preferences of farmers for rice varieties in Godavari districts.

The results show that the most desired trait of paddy farmers in Godavari districts consider is pest tolerance (31.443%), it indicates that the variety with the brown plant hopper tolerance is the most important factor in farmers' variety purchasing decision. The second highest importance value is disease resistance (22.634%) inferring that the variety with bacterial leaf blight resistance is most preferred by paddy farmers. The third highest importance value is Non-lodging (19.072%), it shows that paddy farmers in Godavari districts preferred paddy variety that is resistant to lodging. The fourth highest importance value grain type (14.011%), grain type that farmers preferred to grow is slender grains. The fifth importance value is crop duration (7.685%), it shows that farmers are preferring to grow short duration paddy varieties. Furthermore, the last consideration of farmers' preferences is plant height (5.155%), which indicates that paddy farmers in Godavari districts preferred to grow paddy variety that is short in height.

Finally, study revealed that the preferred combination of paddy variety that had an impact on farmers' purchasing decision is short plant, containing short duration, with Non-lodging nature and, slender grain type which is tolerant to yellow stem borer and resistant to bacterial leaf blight.

Therefore, it is suggested to all the scientists as well as Agricultural universities to consider these preferred traits and combination by also taking into account high yield while producing new varieties for create good market to the developed variety and as to ensure higher returns to the farmers, which in turn brings about the farmers' satisfaction.

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