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Varietal distribution, farm-level yield and seed sources among rice-growing households in Chhattisgarh, India

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Abstract
Rice (*Oryza sativa* L.) is a major food and livelihood crop in Chhattisgarh, where varietal distribution and seed availability are important aspects of rice-based farming systems. The present study documented rice varieties cultivated by sampled farm households, examined their distribution across farm-size categories, compared reported average area and yield, and identified the principal sources of seed. Primary data were collected through personal interviews using a structured questionnaire from 100 rice-growing households in 10 villages across two blocks of a purposively selected rice-growing plain region of Chhattisgarh. Respondents were classified as marginal, small, medium and large farmers. Descriptive statistical methods were used to analyse varietal distribution and seed sources. Six rice varieties were reported: Swarna (51%), MTU 1010 (26%), IR 64 (11%), Mahamaya (6%), HMT (4%) and MTU 1001 (2%). Swarna was the most frequently reported variety across all farm-size categories. The highest reported mean yield was recorded for Swarna (45.62 q ha^{-1}), followed by IR 64 (43.56 q ha^{-1}) and MTU 1010 (43.18 q ha^{-1}), whereas HMT recorded the lowest mean yield (30.02 q ha^{-1}). Regarding seed sources, 62% of respondents reported the Primary Agricultural Cooperative Society (PACS), while 38% relied on self-retained seed. PACS was the principal source for Swarna and MTU 1010, whereas self-retained seed was reported for the other four varieties. The findings indicate the predominance of Swarna in the sampled households and the coexistence of cooperative and farmer-managed seed channels. However, the observed yield differences are descriptive farm-level averages and cannot be attributed exclusively to varietal characteristics.

Keywords: *Oryza sativa*, Varietal distribution, Farm-level yield, Seed sources, PACS, Chhattisgarh

1. Introduction

Rice (*Oryza sativa* L.) is a major staple food crop in India, contributing significantly to food security and rural livelihoods. In Chhattisgarh, rice dominates the agricultural production system, covering approximately 3.82 million hectares with a production of 9.70 million tonnes and productivity of 2,539 kg ha^{-1} during 2023–24 (Department of Agriculture and Farmers Welfare, 2025) [1].

Rice varietal selection depends on several factors, including yield, grain characteristics, maturity duration, adaptability and seed availability. Farmers' varietal choices may also be influenced by socioeconomic conditions and risk preferences (Mehar *et al.*, 2017; Sharma *et al.*, 2017) [2, 3]. Similarly, access to quality seed through cooperative institutions and farmer-managed sources plays an important role in rice cultivation (Nayak *et al.*, 2022) [4].

Considering these aspects, the present study examines the distribution of rice varieties, reported farm-level area and yield, and major seed sources among rice-growing households in a selected region of Chhattisgarh.

Objectives

1. To document the rice varieties grown by sampled rice-farming households in the study area.
2. To compare the reported average area and yield associated with the varieties grown.
3. To identify the principal sources of seed for the varieties reported by sampled households.

2. Materials and Methods

2.1 Study area and sampling design

The study was conducted in a purposively selected rice-growing plain region of Chhattisgarh. Two blocks were selected randomly from the selected region, followed by the inclusion of 10 villages. A total of 100 rice-growing households were interviewed, with 10 respondents selected from each village. The study therefore covered 100 respondents from 10 villages.

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The original study records indicate that approximately 1–2% of villages in each block were selected. However, the district, block and village names were not available in the supplied dataset and should be incorporated into the final manuscript before submission.

2.2 Classification of farmers

The respondents were classified into four categories according to operational landholding size:

1. Marginal farmers: up to 1.00 ha
2. Small farmers: 1.01–2.00 ha
3. Medium farmers: 2.01–4.00 ha
4. Large farmers: above 4.00 ha

The sample consisted of **46** marginal, **26** small, **21** medium and **7** large farmers.

2.3 Data collection and analysis

Primary data were collected through personal interviews using a structured questionnaire/schedule. Secondary information was obtained from the Directorate of Agriculture and relevant government sources.

The collected information was analysed using descriptive statistical methods, including frequencies, percentages and arithmetic averages. The percentage distribution of varieties within each farm-size category was calculated using the corresponding category total as the denominator. Overall varietal percentages were calculated using the total sample of 100 respondents. Similarly, seed-source percentages were calculated within each variety.

The area under cultivation was expressed in hectares (ha), while yield was expressed in quintals per hectare (q ha^{-1}). Since the study relied on descriptive analysis, no inferential statistical tests or econometric models were employed.

3. Results and Discussion

3.1 Distribution of rice varieties across farm-size categories

Six rice varieties were reported among the 100 sampled rice-growing households. Swarna was the most widely reported variety, cultivated by 51% of respondents, followed by MTU 1010 (26%), IR 64 (11%), Mahamaya (6%), HMT (4%) and MTU 1001 (2%).

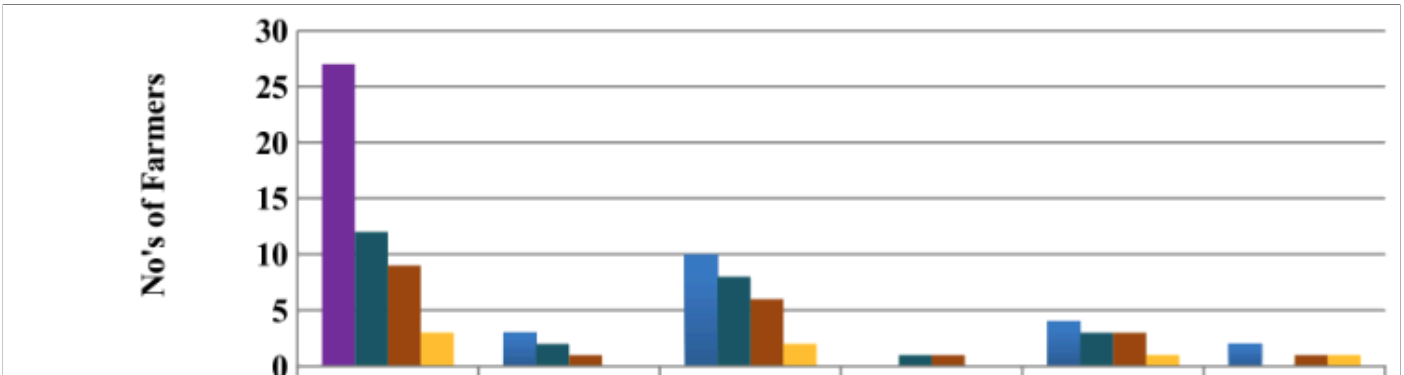
The distribution across farm-size categories revealed that Swarna was the leading variety among marginal, small, medium and large farmers. It was reported by 58.70% of marginal farmers, 46.15% of small farmers, 42.86% of medium farmers and 42.86% of large farmers. MTU 1010 occupied the second position across all four categories (Table 1).

In Fig 1. the results indicate that Swarna was widely cultivated across all farm-size categories in the surveyed area. Its consistent predominance suggests an established position within the sampled rice production system. The second most frequently reported variety, MTU 1010, also showed considerable representation across the different categories.

The observed distribution provides information about varieties currently cultivated by farmers; however, it does not establish the specific factors responsible for their selection. Previous studies have demonstrated that rice varietal selection may involve several considerations, including production-related attributes and farmers' socioeconomic characteristics (Mehar *et al.*, 2017; Sharma *et al.*, 2017) [2, 3]. Such factors were not individually examined in the present investigation.

3.2 Reported average area and yield of rice varieties

The reported variety-wise mean area and yield are presented in Table 2 and Fig 2. Swarna recorded the highest reported mean yield of 45.62 q ha^{-1}, followed by IR 64 (43.56 q ha^{-1}), MTU 1010 (43.18 q ha^{-1}), Mahamaya (41.39 q ha^{-1}) and MTU 1001 (40.15 q ha^{-1}). HMT recorded the lowest reported mean yield of 30.02 q ha^{-1}.



	Swarna	Mahamaya	MTU 1010	MTU 1001	IR 64	HMT
Marginal (n=46)	27	3	10	0	4	2
Small (n=26)	12	2	8	1	3	0
Medium (n=21)	9	1	6	1	3	1
Large (n=7)	3	0	2	0	1	1

Figure 1. Farmer Counts by Farm Size (n)

The difference between the highest and lowest reported mean yields was 15.60 q ha^{-1}. The reported mean area also varied across varieties, ranging from 1.32 ha for HMT to 2.71 ha for Swarna.

The higher reported mean yield of Swarna indicates that it recorded the highest average among the varieties included in the survey. However, these observations represent yields obtained under farmers' field conditions and should not be interpreted as the results of controlled varietal trials. Differences in soil fertility, irrigation availability, crop management, sowing time, input application and other environmental conditions may also influence the observed yield.

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Table 1. Distribution of rice varieties across farm-size categories

Rice variety	Marginal (n = 46)	Small (n = 26)	Medium (n = 21)	Large (n = 7)	Total	Share (%)
Swarna	27 (58.70)	12 (46.15)	9 (42.86)	3 (42.86)	51	51.00
Mahamaya	3 (6.52)	2 (7.69)	1 (4.76)	0	6	6.00
MTU 1010	10 (21.74)	8 (30.77)	6 (28.57)	2 (28.57)	26	26.00
MTU 1001	0	1 (3.85)	1 (4.76)	0	2	2.00
IR 64	4 (8.70)	3 (11.54)	3 (14.29)	1 (14.29)	11	11.00
HMT	2 (4.35)	0	1 (4.76)	1 (14.29)	4	4.00
Total	46 (100)	26 (100)	21 (100)	7 (100)	100	100.00

Note. Values in parentheses are percentages within the corresponding farm-size category.

Furthermore, the number of households reporting MTU 1001 (n = 2) and HMT (n = 4) was relatively small. Consequently, their reported average yields should be interpreted cautiously. Research on the adoption and economic impact of rice varieties has similarly highlighted the importance of evaluating farmer-level performance in the context of prevailing production conditions (Burman *et al.*, 2020) [5].

3.3 Sources of rice seed

The distribution of seed sources revealed that PACS was the principal reported source for 62% of sampled households, whereas 38% relied on self-retained seed.

In Fig 3, a variety-wise analysis showed that 82.35% of Swarna growers obtained seed through PACS, while 17.65% used self-retained seed. Similarly, 76.92% of MTU 1010 growers obtained seed from PACS and 23.08% relied on self-retained seed.

Table 2. Reported average area and yield of rice varieties

Rice variety	Households (n)	Mean area (ha)	Mean yield (q ha^{-1})
Swarna	51	2.71	45.62
Mahamaya	6	2.02	41.39
MTU 1010	26	2.24	43.18
MTU 1001	2	1.67	40.15
IR 64	11	2.13	43.56
HMT	4	1.32	30.02
Overall (reported)	100	2.01	40.65

Note. Values represent the reported mean area and yield for each rice variety.

In contrast, all sampled growers of Mahamaya, MTU 1001, IR 64 and HMT reported self-retained seed as their source. The detailed distribution is presented in Table 3.

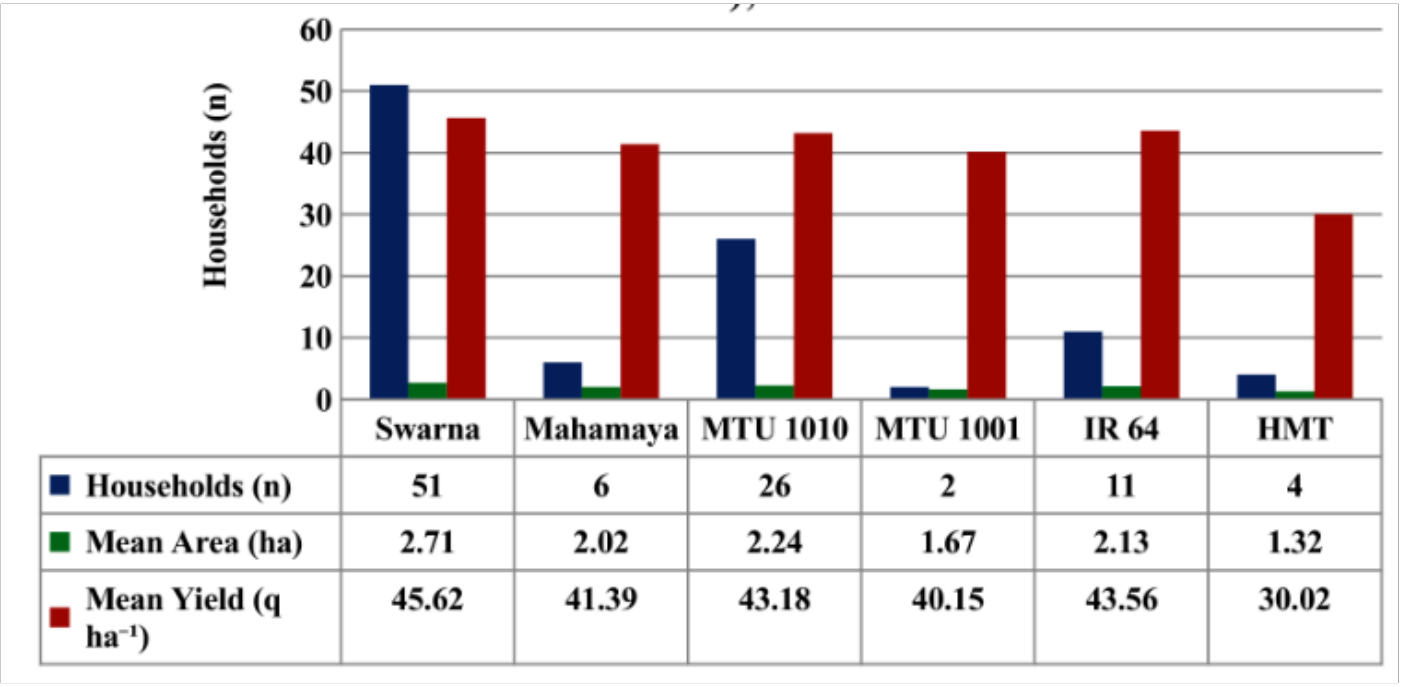
Table 3. Sources of seed for different rice varieties

Rice variety	Self-retained seed, n (%)	PACS, n (%)	Total (n)	Principal source
Swarna	9 (17.65)	42 (82.35)	51	PACS
Mahamaya	6 (100.00)	0 (0.00)	6	Self-retained
MTU 1010	6 (23.08)	20 (76.92)	26	PACS
MTU 1001	2 (100.00)	0 (0.00)	2	Self-retained
IR 64	11 (100.00)	0 (0.00)	11	Self-retained
HMT	4 (100.00)	0 (0.00)	4	Self-retained
Overall	38 (38.00)	62 (62.00)	100	PACS

Note. Percentages are calculated within each variety; overall percentages are based on the total sample (n = 100). PACS: Primary Agricultural Cooperative Society.

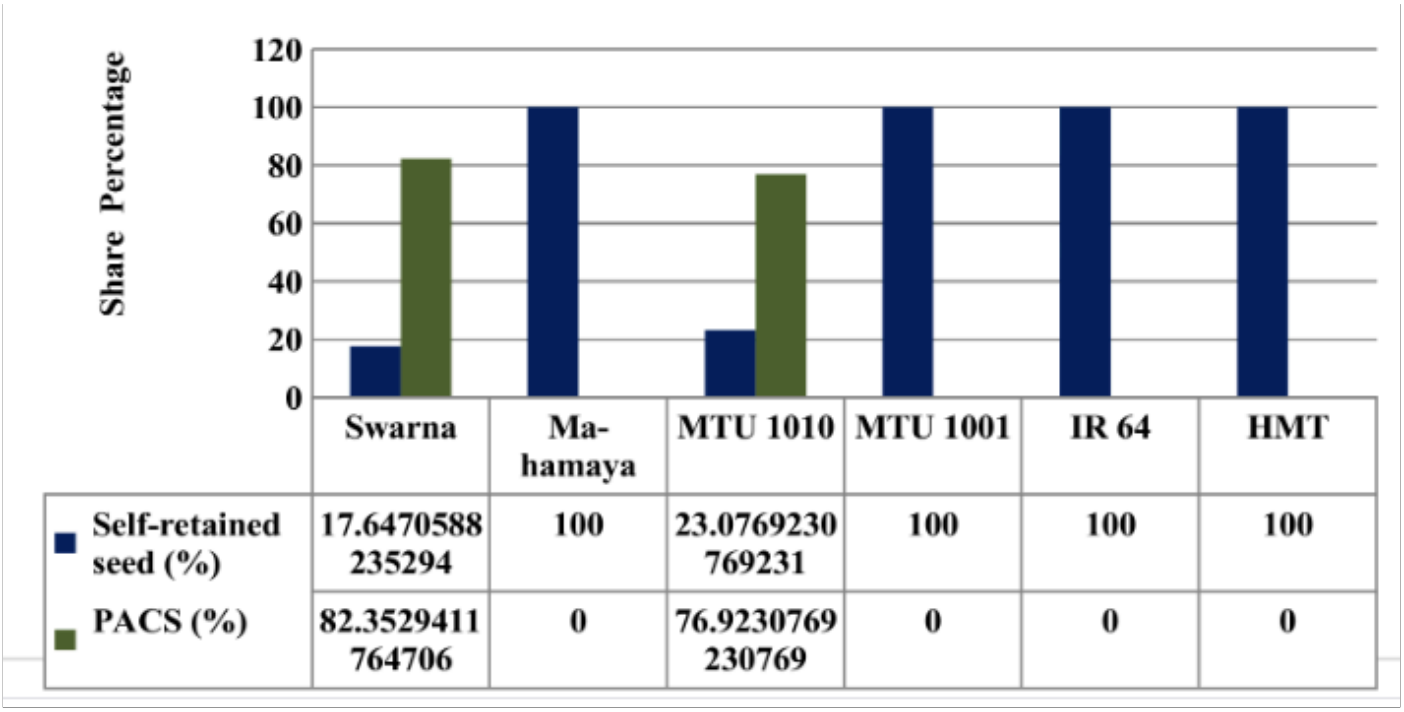
The findings demonstrate the contribution of both cooperative seed distribution and farmer-managed seed retention in the sampled area. PACS was the dominant source for Swarna and MTU 1010, whereas self-retained seed was the exclusive reported source for the remaining four varieties.

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	Swarna	Mahamaya	MTU 1010	MTU 1001	IR 64	HMT
Households (n)	51	6	26	2	11	4
Mean Area (ha)	2.71	2.02	2.24	1.67	2.13	1.32
Mean Yield (q ha^{-1})	45.62	41.39	43.18	40.15	43.56	30.02

Figure 2. Variety-wise cultivated area (ha), productivity (q ha^{-1}),



	Swarna	Ma-hamaya	MTU 1010	MTU 1001	IR 64	HMT
Self-retained seed (%)	17.6470588235294	100	23.0769230769231	100	100	100
PACS (%)	82.3529411764706	0	76.9230769230769	0	0	0

Figure 3. Seed Source Share Within Each Variety (%)

This variation indicates that seed procurement practices differed according to the variety cultivated. The findings are consistent with the broader observation that formal and farmer-managed seed channels can coexist within rice production systems (Nayak *et al.*, 2022) [4]. Nevertheless, the present study did not assess seed quality, varietal purity, germination percentage or storage practices.

4. Summary and conclusion

The present study documented the distribution of rice varieties, reported farm-level area and yield, and seed procurement practices among 100 rice-growing households in a selected plain region of Chhattisgarh. Six varieties were identified, of which Swarna was the most widely reported (51%), followed by MTU 1010 (26%), IR 64 (11%), Mahamaya (6%), HMT (4%) and MTU 1001 (2%). Swarna maintained its leading position across all four farm-size categories, indicating its widespread cultivation among the surveyed households.

Among the varieties studied, Swarna recorded the highest reported mean yield (45.62 q ha^{-1}), followed by IR 64 (43.56 q ha^{-1}) and MTU 1010 (43.18 q ha^{-1}). HMT recorded the lowest reported mean yield (30.02 q ha^{-1}). Regarding seed procurement, PACS accounted for 62% of the reported seed sources, while self-retained seed accounted for 38%. PACS was the principal source for Swarna and MTU 1010, whereas farmers growing Mahamaya, MTU 1001, IR 64 and HMT reported relying entirely on self-retained seed.

Overall, the findings highlight the predominance of Swarna and MTU 1010 in the sampled rice production system and demonstrate the contribution of cooperative institutions and farmer-managed seed sources to seed availability. The findings may assist local seed-demand assessment and planning by highlighting the varieties currently cultivated and the channels through which farmers obtain seed. However, the observed yield differences should not be interpreted as evidence of inherent varietal superiority because the study did not control for differences in agroecological conditions and crop-management prac

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tices. Further investigations involving plot-level observations, varietal performance trials and seed-quality assessment would provide a stronger basis for evaluating varietal performance and seed-system requirements.

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