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A study on varietal penetration and buying behavior of key purchase determinants and purchase intentions of rice seed in Kanker District of Chhattisgarh

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Abstract
The study titled "A study on varietal penetration and buying behavior of key purchase determinants and Purchase intentions of rice seed in Kanker District of Chhattisgarh" for two critical aspects: rice seed adoption (varietal penetration) and farmers' purchasing behavior in the Kanker district of Chhattisgarh, India. The research aims to gain comprehensive insights into the prevalent rice seed dynamics and agricultural practices in this specific region. The geographic focus on the Kanker district, located within the Bastar plateau, was based on its reputation for maximum rice production compared to other zones in Chhattisgarh. The district consists of seven blocks, with Charama and Kanker blocks selected for sampling due to their significant rice seed area and production. The study included 100 farmers, categorized by their total landholding into marginal, small, medium, and large farmers. Data revealed that medium farmers constituted the largest group, covering nearly half of the total land area surveyed. One of the essential aspects of the study was to identify the distribution of rice seed varieties by different companies and institutes operating in the Kanker district. ANGRAU emerged as the largest distributor, with two varieties, MARUTERU MTU-1010 and MTU-1001, being prominent. IRRI held the second-largest market share, offering IR-64 and IR-36 rice seed varieties. Regarding farmers' purchasing decisions, the study highlighted that quality was the most critical factor, influencing a majority of farmers surveyed, followed by price. Insights into these determinants can aid policymakers and seed companies in developing targeted strategies to meet farmers' preferences and needs. Furthermore, the study examined farmers' intentions when purchasing rice seeds. Higher yield, good germination, and resistance to pests and diseases emerged as the most significant factors influencing farmers' decisions. the study analyzed the current market share of rice seed companies in the study area. ANGRAU and IRRI dominated the market, while other companies and institutes held smaller shares.

Keywords: buying behavior, varietal penetration, rice seed, Maruteru MTU-1010, IR-64 and IR-36

1. Introduction
Rice contributes 43 percent of total food grain production. Among the rice growing countries, India has largest area of 45.1 million hectares and an average productivity of 2.9 t/ha. India accounts for 15 percent of total rice production of the world. Efforts to develop and use of hybrid rice technology in India was initiated during 1970. But the research works were systematized and infested since 1989 with a mission mode project. With the concerned research work, the country developed half a dozen rice hybrids each from public and private sectors. (Agri Stat Glance, 2018a) [1].

Most outstanding states in India for the production of rice were West Bengal (13.91%), Andhra Pradesh (6.85%), Uttar Pradesh (11.53%), Punjab (10.53%), Odisha (7.87%), Tamil Nadu (5.43%), Chhattisgarh (5.99%), Bihar (6.02%), Karnataka (3.36%) and Haryana (3.80%) (Anonymous, 2016, Das and Kumar 2019). The area under rice was found to be 45.1 million hectares in 2020-21 crop year occupying about 24 percent of total cropped area of the country. (Anonymous, 2021) [3].

Chhattisgarh is also known as bowl of rice due to intensive cultivation of rice in the state. Rice constitutes the major part of the food basket of people of Chhattisgarh. There is a significant improvement in production and productivity of rice in Chhattisgarh. This increase in rice production in state is due to adoption of hybrid rice. The cultivation of hybrid rice in the state changed tremendously after 2010 (Agricultural Statistics at a Glance 2015b) [2]. Annual population growth rate of the country is nearly 1.8% and if per capita consumption of rice is expected to be 400 gm of rice per day then the demand for rice in 2025 will be 130 million tones. In Chhattisgarh, rice occupies average of 3.6 million ha.

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With productivity of the state is ranging between 1.2 to 1.6 t/ha depending upon the rainfall. (Anonymous, 2021) [3].

The study examines rice seed adoption (varietal penetration) and farmers' purchasing behavior in Kanker district, Chhattisgarh, India, to understand popular varieties, factors influencing choices, and seed procurement patterns. Valuable insights can aid policymakers and seed companies in enhancing seed distribution strategies and agricultural development.

2. Materials and Methods

The study employed a mixed-methods approach, combining quantitative surveys and qualitative interviews. A representative sample of rice farmers in Kanker district was selected, and data was collected on their seed adoption patterns, purchasing behavior, and factors influencing their choices. The survey data was analyzed using statistical techniques, while the qualitative data was subjected to thematic analysis to identify key themes and patterns.

Chhattisgarh state consist three well known zones i.e., Chhattisgarh Plains, Northern hills and Bastar plateau. Out of these three zones namely Bastar plateau was undertaken on the basis of the maximum production of rice than that of other zones of Chhattisgarh. Kanker districts of Bastar plateau have also observed that, the higher production of rice than other districts of Baster plateau. Chhattisgarh state consists 33 districts out of which Kanker district have been selected purposively. Kanker district is comprised of 7 blocks *viz*; Antagarh, Bhanupratappur, Charama, Durgkondal, Kanker, Narharpur and Pakhanjur. Among them Charama, and Kanker, blocks will be sampled on the basis of the maximum area and production of rice seed.

2.1 Selection of the villages

10 villages was identified randomly for study. Five villages from each block will be selected randomly except of village was selected. (Table 1).

2.2 Selection of respondents

From each village 10 rice seed cultivating farmers was selected by using stratified random sampling method. Therefore, a total of 100 farmers formed the basis of the study. Thus, the sample consisted of farmers holding different farm sizes.

2.3 Selection of dealers

From each block 3 dealers was randomly selected. Therefore, a total of 6 dealers from 2 block will be selected to form the basis for study. Overall, 100 farmers and 6 dealers formed the sample for the study.

2.4 Analytical tools
Frequency and per centages

Frequency and per centage were used in descriptive analysis for making simple comparison for calculating per centage; the frequency of particular cell was multiplied by 100 and divided by total number of respondents in that particular category to which cell they belong.

Percentage = (Value/Total Value) × 100

Mean

It is defined as the sum of all values of the observations divided by the total number of observations (n), symbolically it is presented as:

$$\bar{x} = \frac{\sum xi}{n}$$

Where,
xi = is the observation and
n = is the number of observations.

3. Results
3.1 Total land holding of farmers (in ha)

The table 1 and Fig 1 shows the total land holding of farmers (in ha) and the corresponding number of farmers and their percentage for a study on the key purchase determinants and purchase intentions of rice seed. The study includes a sample of 100 farmers. The farmers are categorized based on their total land holding. The categories are marginal farmers (less than 1 ha), small farmers (1-2 ha), medium farmers (2-4 ha), and large farmers (4-10 ha). Out of the 100 farmers surveyed, 16 are marginal farmers, with a total land area of 11.50 ha, which covered in 5.16% of the total land area. 40 farmers are small farmers, with a total land area of 64.00 ha, which covered in 28.74% of the total land area. 38 farmers are medium farmers, with a total land area of 110.20 ha, which covered in 49.48% of the total land area. Finally, 6 farmers are large farmers, with a total land area of 37.00 ha, which covered in 16.61% of the total land area. Overall, the total land area of all the farmers surveyed is 222.70 ha, which represents 100% of the land area. These findings provide insights into the land holdings of farmers and their potential impact on the purchase determinants and purchase intentions of rice seed. These outcomes are consistent with findings of Takele (2017) [8].

Table 1: Total land holding of farmers (in ha)

S. No.	Total Land Area (in ha) (n=100)	Number of Farmers	Area (in ha)	Percentage
1.	Marginal Farmers (Less than 1 ha)	16	11.50	5.16
2.	Small Farmers (1-2 ha)	40	64.00	28.74
3.	Medium Farmers (2-4 ha)	38	110.20	49.48
4.	Large Farmer (4-10 ha)	6	37.00	16.61
	Total	100	222.70	100.00
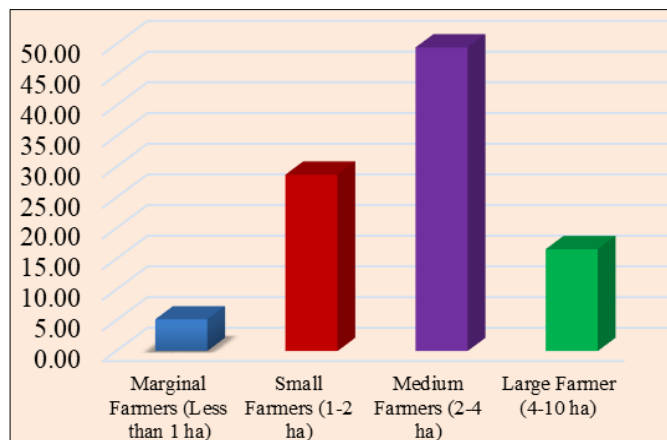
Fig 1: Total land holding of farmers (in ha)

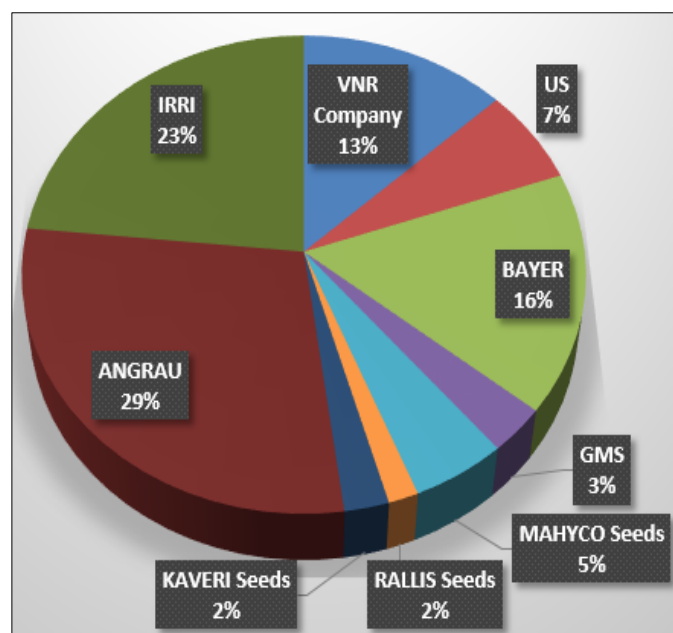### 3.2 Distributor of rice seeds in Kanker district

The table 2 and Fig 2 shows the distribution of rice seed varieties by different companies and institutes in Kanker district. The table provides information on the estimated area

covered by a distributor on the basis of variety, the total area covered by the company, and the percentage of the total area covered by each company. The data includes for nine different companies and institutes that distribute rice seeds in Kanker district. The companies and institutes are ANGRAU, IRRI, BAYER, VNR Company, US, Mahyco, GMS, KAVERI, and RALLIS. The table shows that ANGRAU is the largest distributor of rice seeds in Kanker district, covering a total area of 16,600.50 ha, which found in 28.68% of the total area. ANGRAU distributes two varieties of rice seeds, MARUTERU MTU-1010 and MTU-1001, with estimated areas covered by distributors of 12,118.37 ha and 4,482.14 ha, respectively. The second-largest distributor is IRRI, covering a total area of 13,550.50 ha, which found in

23.41% of the total area. IRRI distributes two varieties of rice seeds, IR-64 and IR-36, with estimated areas covered by distributors of 11,111.41 ha and 2,439.09 ha, respectively. The other companies and institutes in the data are BAYER, VNR Company, US, Mahyco, GMS, KAVERI, and RALLIS. These companies cover smaller areas, ranging from 922 ha to 9,400 ha, and found in smaller percentages of the total area covered. Overall, the Table 2 provides useful information on the distribution of rice seed varieties by different companies and institutes in Kanker district. This information could be important for farmers and policymakers who are interested in the availability and distribution of rice seeds in the district. The finding of present study is in accordance with those of Hadimartono et al. (2017) [4].

Table 2: Distributor of rice seeds in Kanker district

S. N.	Name of company/ institute	Variety	Est. area covered by a distributer on the basic of variety (in ha)	Total Area Covered by Company (in ha)	Percent (%)
1.	Angrau	Maruteru MTU-1010	12118.37	16600.50	28.68
		MTU-1001	4482.14		
2.	Irri	IR-64	11111.41	13550.50	23.41
		IR-36	2439.09		
3.	Bayer Crop Science	Arize 6444 Gold	7520.00	9400.00	16.24
		Arize Az 8433 DT	1880.00		
4.	Vnr Seeds Pvt Ltd	VNR-2228	3020.00	7550.00	13.04
		BHIM-115	4530.00		
5.	Us Agritech Pvt Ltd	US 312	950.00	3800.00	6.56
		US 362	2850.00		
6.	Mahyco Pvt ltd	MRP-5222 Jaladhi	1218.00	2900.00	5.01
		MRP-5222 Jaladhi 2.0	1682.00		
7.	Gms Agritech Pvt Ltd	GMS- 2499	810.00	1800.00	3.11
		GSM- 2434	990.00		
8.	Kaveri seeds	KAVARI- 468	503.20	1360.00	2.35
		475	856.80		
9.	Rallis seeds	DRH-775	571.64	922.00	1.59
		DRH-748	350.36		
	Total		57883.00	57883.00	100.00

Fig 2: Est. Area covered by a distributer (in ha)

3.3 Major determinants of purchase of rice seed by farmers: The Table 3 shows the major determinants of the purchase of rice seed by farmers, based on a study that examined the purchase intentions of rice seed. The data includes two factors that were identified as major determinants of purchasing decisions: quality and price. According to the data, quality is the most important factor that influences farmers' decisions to purchase rice seed. Quality received a mean score of 78.39, with a total score of 7761, and was 1st ranked as the top factor by 73 out of the 100 farmers surveyed. Price was identified as the second most important factor, with a mean score of 62.33 and a total score of 6233. It was 2nd ranked as the top factor by 35 out of the 100 farmers surveyed. Overall, the table provides valuable insights into the factors that influence farmers' purchasing decisions for rice seed. The findings suggest that quality is the most important factor, followed by price, and that other factors may also play a role in purchasing decisions. This information could be useful for seed companies and policymakers who are interested in developing marketing strategies for rice seed. These outcomes are consistent with findings of Win et al. (2019) [9].

Table 3: Major determinants of purchase of rice seed by farmers

| S. N.	Factors	Rank			Total no of farmers	Total Scores	Mean Score	Ranking
		1	2	3				
1.	Quality	73	12	15	100	7761	78.39	I
2.	Price	35	37	28	100	6233	62.33	II

3.4 Intention of farmers to purchase the rice seed.

The Table 4 and Fig 3 shows the intention of farmers to purchase rice seed based on a study that examined purchase intentions. The table includes 6 factors that were identified as important to farmers when making a decision to purchase rice seed. According to the data, the most important factor for farmers when deciding to purchase rice seed is higher yield, which was 1st ranked as the top factor by 65 out of the 100 farmers surveyed. Higher yield received a total score of 7789 and a mean score of 77.89. The second most important factor is good germination, which was 2nd ranked as the top factor by 60 out of the 100 farmers surveyed. Good germination received a total score of 7498 and a mean score of 74.98. The third most important factor is resistance to pest and disease, which was 3rd ranked as the top factor by 56 out of the 100 farmers surveyed. Resistance to pest and disease received a total score of 7297 and a mean score of 72.97. Other factors that were identified as important to farmers when making a decision to purchase rice seed include brand, neighbor's/family opinion, and dealers' guidance. These factors received mean scores ranging from 46.59 to 67.15. Overall, the data provides valuable insights into the factors that influence farmers' intentions to purchase rice seed. The findings suggest that yield, good germination, and resistance to pest and disease are the most important factors to farmers. This information could be useful for seed companies and policymakers who are interested in understanding the needs and preferences of farmers when developing and marketing rice seed. Also, similar results were reported by Sukrat *et al.* (2015) [6].

Table 4: Intention of farmers to purchase the rice seed.

S. No.	Factors	Rank			Total no of farmers	Total Scores	Mean Score	Ranking
		1	2	3				
1.	Higher yield	65	30	5	100	7789	77.89	I
2.	Good germination	60	34	6	100	7498	74.98	II
3.	Resistance for pest disease	56	30	14	100	7297	72.97	III
4.	Brand	45	35	20	100	6715	67.15	IV
5.	Neighbor's/ family opinion	42	39	19	100	6691	66.91	V
6.	Dealers' guidance	18	40	42	100	4659	46.59	VI
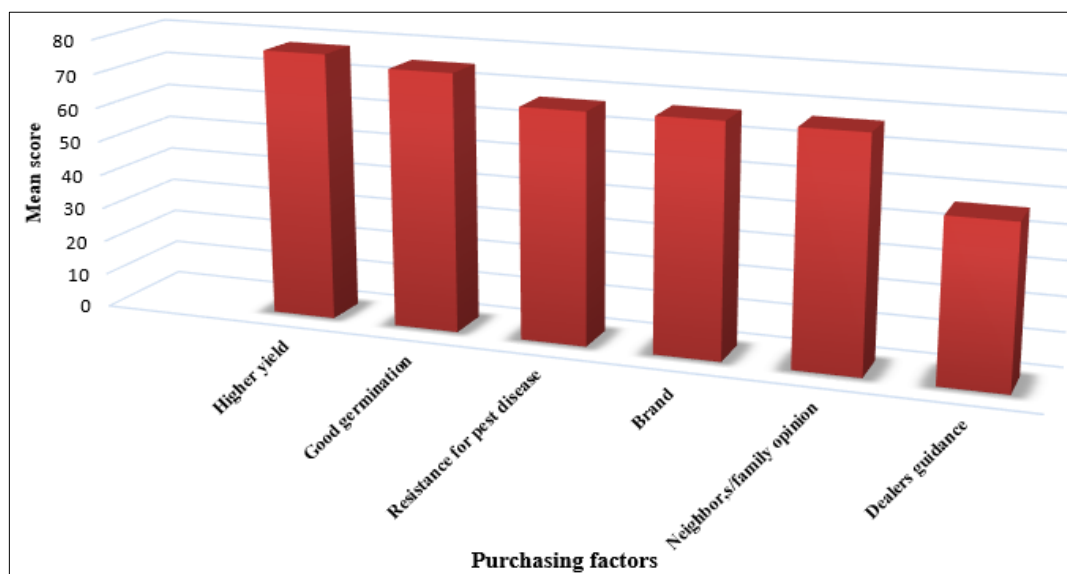
Fig 3: Intention of farmer to purchase rice seeds

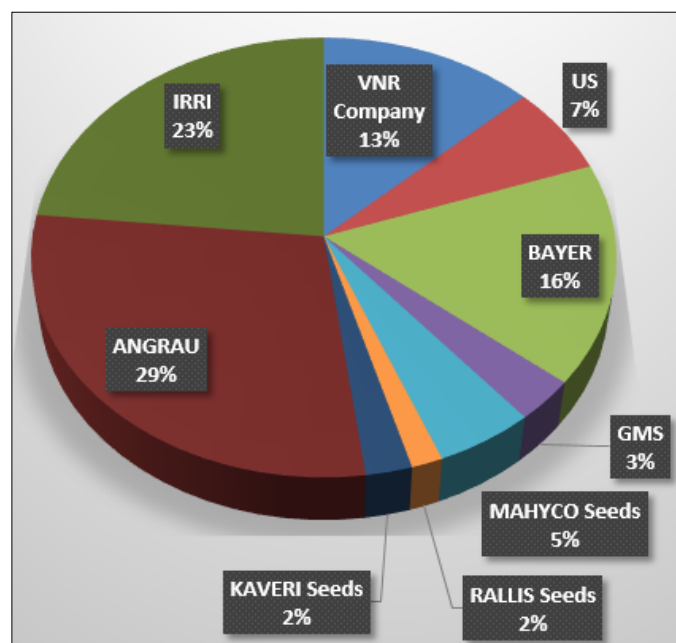### 3.5 Current market share of rice seed companies under study area

The Table 5 and Fig 4 shows the current market share of rice seed companies in the study area, based on estimated sales of rice seed varieties. The table includes data for 9 different companies and institutes that sell rice seed in the study area. According to the data, ANGRAU has the largest market share, with estimated sales of 415,012.50 kg, which found in 28.68% of the total sales of all companies. ANGRAU sells two varieties of rice seed, MARUTERU MTU-1010 and MTU-1001, with estimated sales of 302,959.13 kg and 112,053.38 kg, respectively. The second-largest market share is held by IRRI, with estimated sales of 338,762.50 kg, which found in 23.41% of the total sales of all companies. IRRI sells two varieties of rice seed, IR-64 and IR-36, with estimated sales of 277,785.25 kg and 60,977.25 kg, respectively. The other companies and institutes in the data are BAYER, VNR Company, US, Mahyco, GMS, KAVERI, and RALLIS. These companies have smaller market shares, ranging from 1.59% to 16.24%, and sell smaller volumes of rice seed, ranging from 23,050 kg to 235,000 kg. Overall, the data provides valuable information on the market share of different companies and institutes that sell rice seed in the study area. This information could be useful for seed companies and policymakers who are interested in understanding the competitive landscape and market opportunities for rice seed in the study area. The finding of present study is in accordance with those of Sahu (2011) [7].

Table 5: Current market share of rice seed companies under study area

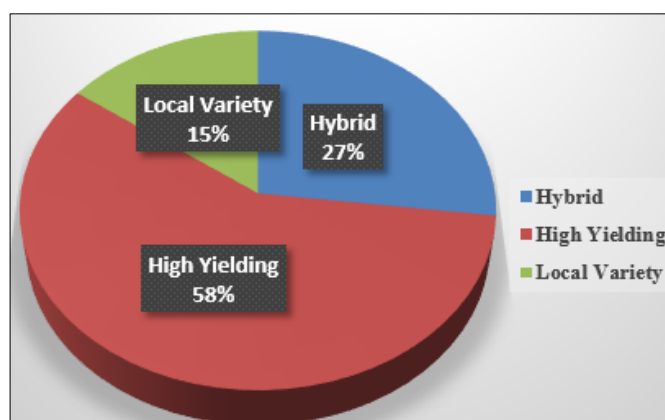| S. N.	Name of company/institute	Variety	Est. Sales on the basic of variety (kg)	Total Est. Sales (kg)	Total Sale (Rs)	Percent
1.	Angrau	MARUTERU MTU-1010	302959.13	415012.50	33201000.00	28.68
		MTU-1001	112053.38			
2.	IRRI	IR-64	277785.25	338762.50	27101000.00	23.41
		IR-36	60977.25			
3.	Bayer Crop Science	Arize 6444 Gold	188000.00	235000.00	18800000.00	16.24
		Arize Az 8433 DT	47000.00			
4.	Vnr Seeds Pvt Ltd	VNR-2228	75500.00	188750.00	15100000.00	13.04
		BHIM-115	113250.00			
5.	US Agritech Pvt Ltd	US-312	23750.00	95000.00	7600000.00	6.56
		US-362	71250.00			
6.	Mahyco Pvt Ltd	MRP-5222 Jaladhi	30450.00	72500.00	5800000.00	5.01
		MRP-5222 Jaladhi 2.0	42050.00			
7.	Gms Agritech Pvt ltd	GMS-2499	20250.00	45000.00	3600000.00	3.11
		GMS-2434	24750.00			
8.	Kaveri Seeds	KAVERI-468	12580.00	34000.00	2720000.00	2.35
		KAVERI-475	21420.00			
9.	Rallis Seeds	DRH-775	14291.00	23050.00	1844000.00	1.59
		DRH-748	8759.00			
	Total			1447075.0	115766000.0	100.00

Fig 4: Current market share of rice seed companies under study area

Table 6: Seed type used by the farmers in the study area

S. No.	Seed type	Kanker	Area Under Cover in ha	Rank
1.	High Yielding	58.15	42798.4	I
2.	Hybrid	26.98	19857.28	II
3.	Local Variety	14.87	10944.32	III
	TOTAL	100	73600.00	

Fig 5: Seed type used by the farmers in the study area

3.6 Seed type used by the farmers in the study area
According to the data Table 6 and Fig 5, farmers in the study area predominantly use three different seed types. The majority of farmers, accounting for 58.15% of the total, utilize high-yielding seeds, covering an area of 42,798.4 hectares. This seed type holds the 1st rank in terms of area under cover. The second most common seed type is hybrid, which is used by 26.98% of farmers in the study area. The total area under cover for hybrid seeds is 19,857.28 hectares, found in the 2nd rank. Local variety seeds are employed by 14.87% of farmers, covering an area of 10,944.32 hectares. This seed type ranks 3rd in terms of area under cover. In total, considering all the seed types, the study area has a cumulative area of 73,600.00 hectares under cultivation. The table data provides a comprehensive overview of the seed types utilized by farmers in the study area, highlighting the area under cover for each seed type and their respective ranks based on usage. The results obtained in the present study are supported by the works of Joshi and Bauer (2006) [5].

4. Conclusion
The study concludes that medium farmers with substantial landholdings are likely to have the most significant impact on rice seed purchase decisions in Kanker district, Chhattisgarh. ANGRAU and IRRI dominate the market, with quality being the most crucial determinant for farmers' purchasing choices. Higher yield, good germination, and resistance to pests and diseases are the primary factors influencing farmers' purchase intentions. Promoting high-yielding seed varieties is vital for enhancing agricultural productivity. The findings offer valuable insights for seed companies to align their offerings with farmers' preferences, ultimately contributing to sustainable agricultural development in the region.

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