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ADOPTION OF HYBRID RICE PRODUCTION TECHNOLOGY BY THE TRIBAL FARMERS OF SURAJPUR DISTRICT OF CHHATTISGARH CONSIDERING SOIL FERTILITY

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Abstract

Rice (Oryza sativa L.) is a member of the grass family, Gramineae. India holds the largest rice acreage, covering 43.97 million hectares, with a production of 104.32 million tonnes and a yield of 2372 kg/ha (Government of India, 2012). In 2010, hybrid rice was cultivated across 1.3 million hectares, contributing an additional 1.5 to 2.5 million tonnes to the national food production. The study focused on Surajpur district in Chhattisgarh, specifically the Surajpur and Pratapur blocks, with a total sample size of 120. A comprehensive analysis of farmers' socio-personal characteristics revealed that the majority were middle-aged, with education up to middle school, living in nuclear families, and predominantly engaged in agriculture. Most respondents had moderate farming experience, and their land holdings were mainly small. Survey results indicated that 56.67% of respondents possessed a moderate level of knowledge, while 38.33% had a high level, and 5.00% had a low level. Adoption levels showed that 55.83% had a medium level, 40.00% had a high level, and 4.17% had a low level. Factors such as education, occupation, extension contact, source of irrigation, information-seeking behavior, and mass media exposure were found to be significantly associated with both knowledge and adoption levels. The primary reasons for cultivating hybrid rice were the availability of seeds and the high productivity achieved.

Keywords: Hybrid rice, Adoption levels, Socio-personal characteristics, Knowledge

Introduction:

Rice (*Oryza sativa* L.) is a member of the grass family, Gramineae, and approximately 90% of the global rice cultivation occurs in Asia. It serves as the primary food staple in many regions of India, emphasizing the imperative to boost rice production and enhance land productivity dedicated to rice cultivation. India holds the largest rice acreage, covering 43.97 million hectares, yielding 104.32 million tons with a production density of 2372 kg/ha (Government of India, 2012). Rice contributes significantly to dietary energy (27%) and protein (20%) intake in the developing world, necessitating improvements in rice crop productivity for a robust agricultural system.

In the Surajpur district, which encompasses a total area of 4,99,826 hectares, the cultivation area for hybrid rice is 11,153 hectares. Central India states, hosting 75% of the total tribal population (8% of India's population, i.e., 0.84 million), face the challenge of ensuring food security. Chhattisgarh, with a predominantly rural and tribal population of 76.76% out of a total of 2,55,45,198, has a specific focus on Surajpur district, where the population stands at 6,60,280 according to the 2011 census, including 74,148 schedule tribes.

To sustain self-sufficiency, there is a pressing need to increase rice production by nearly 2 million tons annually, despite the backdrop of dwindling natural resources. Hybrid rice technology emerges as the most viable option, as demonstrated in China, with India making significant strides in research and development since the 1990s. A total of 46 hybrid varieties, comprising 29 from the public domain and 17 from the private sector, have been authorized for commercial planting.In 2010, 1.3 million hectares were dedicated to hybrid rice, contributing an additional 1.5 to 2.5 million tons to the food supply. This transformation signifies a shift from conventional to conservation agriculture, emphasizing minimal soil disturbance, efficient crop residue management, and innovative cropping systems within the rice-wheat cultivation paradigm.

Acknowledging the potential of hybrid rice technology to boost production and productivity, the key challenge lies in successfully transferring this technology from research farms to the fields of farmers.Agencies need to actively participate in creating awareness among farmers about the benefits of cultivating hybrid rice, employing various innovative approaches.

Methodology:

Chhattisgarh, often referred to as the "Rice bowl" of India, is renowned for its predominant cultivation of paddy. The Surajpur district, located 520 km away from SHIATS Allahabad, holds significant importance as one of the leading hybrid rice cultivation areas in Chhattisgarh. The research, carried out in Surajpur district in the year 2014-15, is centered on understanding the awareness and uptake of hybrid rice production technology.

Employing a descriptive research design, the study aims to outline the characteristics of individuals or groups without intervening in concomitant variations of independent and dependent variables. Surajpur district was purposively chosen for its prominence in hybrid rice cultivation. Two blocks, Surajpur and Pratapur, were selectively included due to their status as the highest hybrid rice growing blocks. The study encompassed 121 and 116 villages in Surajpur and Pratapur, respectively. Ten villages were specifically chosen based on their significant cultivation area. Proportionate random sampling was applied to select twelve hybrid rice-growing farmers from each village, resulting in a total sample size of 120 farmers. Personal interviews were utilized as the most suitable method for data collection to ensure authenticity.

The study investigated various variables, categorizing them into independent and dependent categories. Independent variables encompassed factors such as age, education, family size, occupation, farming experience, landholding, type of house, annual income, social participation, extension contact, source of irrigation, information-seeking behavior, and mass media exposure. Dependent variables included knowledge and adoption of hybrid rice production technology. To conduct the analysis, participants were classified according to various factors, including age, education, family size, occupation, farming experience, landholding, type of residence, social involvement, extension contact, source of irrigation, information-seeking habits, and exposure to mass media. Knowledge was assessed through a structured schedule, and adoption was measured based on respondents' acceptance and application of recommended practices for hybrid rice cultivation.

The study explored various dimensions of respondents' characteristics. Age was self-reported in completed years, and education levels ranged from Illiterate to Graduation and above, with scores assigned from 1 to 7. Family size was categorized into small, medium, and big groups based on the number of members living together. Farming experience was classified as low, medium, and high,

utilizing mean and standard deviation. Land holding was assessed in hectares and categorized as marginal, small, and big. The type of house was determined by construction materials, scored from 1 to 3. Socio-participation, extension contact, and information-seeking behavior were assessed and categorized as low, medium, and high based on a scoring range. Variables such as the source of irrigation and mass media exposure were also considered in the study. Knowledge level was evaluated through a structured schedule, and a Knowledge test comprising questions on hybrid rice production technology practices was developed. Respondents' knowledge was categorized as low, medium, or high based on their scores. The evaluation of hybrid rice growers' adherence to recommended production technologies was gauged through a systematic questionnaire. Respondents were categorized as adopters, partial adopters, or non-adopters for each prescribed practice. The total adoption score was computed, and respondents were grouped into Low, Medium, and High levelsofAdoption using mean and standard deviation.Statistical techniques, including percentages, arithmetic mean, standard deviation, frequency, and Pearson's correlation coefficient, were utilized to analyze the data and assess the formulated hypotheses.

Results:

The majority of respondents were middle-aged (57.50%), followed by old (21.67%) and young (20.83%) age categories. The predominant age group of hybrid rice cultivators appeared to be middle-aged, possibly due to young farmers engaging in non-agricultural activities and old farmers adhering to traditional practices. The findings of the study are in confirmation with Narayanaswamy and Ramachandra (1998), Obaiah (2004), Nrusimha Kalyan *et al*. (2012).

In terms of education, a significant proportion (25.83%) were functionally literate, while others had various levels of formal education. The presence of more functionally literate and primary/middle-educated respondents could be attributed to a lack of formal education institutions in the area. The same results were presented by Obaiah (2004), Vanetha(2005). Regarding family size, most respondents had medium-sized families (55.00%), potentially influenced by rural-to-urban migration and the fragmentation of joint families into nuclear ones.

Agriculture combined with labor (30.00%) was the most common occupation, indicating diversification due to the high cost of living. Medium farming experience (65.00%) was prevalent,

aligning with the majority falling into the middle-aged category. The findings of the study are in confirmation with Mahale et al (1991), Pandey et al. (2004).

Small farmers constituted the majority (51.67%), with land fragmentation possibly leading big farmers to become small or marginal ones. Housing patterns showed a prevalence of semi-cemented and cemented houses, reflecting a middle economic status. This aligns with the conclusions drawn from the research on farming experience conducted by Venkatakumar and Nanjaiyan (1999) as well as Dhamodaran and Vasanthakumar (2001).

More than half of the respondents had medium annual income (55.83%), with variations attributed to factors like landholding size and dependence on agriculture. A substantial portion (35.83%) were not members of any organization, indicating limited community involvement. The findings of the study are in conformity with singha (1995), meena et al . (2012), choudary et al (2013).

The majority had frequent contact with agricultural technology modules (ATM) (80.00%) compared to other extension services. Extension contact levels were predominantly medium (77.50%), with lower and higher levels also reported. The findings of the study are in conformity with Deshmukh *et al*. (2007), Ganesh Kumar *et al.* (2013).For irrigation, the majority utilized tube wells (80.83%), followed by ponds (43.33%), wells (29.17%), canals (16.67%), and rivers (15.83%).

Table 1. The respondents were categorized based on their information-seeking behavior, and the distribution is as follows (n=120).

Information seeking behavior	Always		Some		Never	
	F	P	F	P	F	P
Neighbour	103	85.83	17	14.17	-	-
progressive farmer	99	82.50	15	12.50	2	1.67
Village extension officer	32	26.67	79	65.83	9	7.50
NGO officer	20	16.67	84	70.00	16	13.33
Radio	106	88.33	14	11.67	-	-
Television	109	90.83	11	9.17	-	-
Newspaper	40	33.33	569	57.50	11	9.17
Training	13	10.83	87	72.50	20	16.67

F = frequency P = Percentage

Table 1 indicates that television is the most frequently utilized source, followed by radio and interactions with neighbors.The least frequency of utilization is with training followed by NGO officer. This clearly depicts that most of the present information obtained by the farmers is from the government sources.

Table 2. Category of the respondents according to their Information seeking behaviour

n=120

Sl.No.	Information seeking behavior	Frequency	Percentage
i.	Low (below 11.9)	18	15.00
ii. .	Medium (11.9 – 14.9)	88	73.33
iii.	High (above 14.9)	14	11.67
	Total	120	100.00
Mean = 13.40		SD = 1.50	

A perusal from the table 2 that majority of the respondents have medium level of information seeking behaviour (73.33%) followed by low level (15.00%) and High level (11.67%) of information seeking behaviour. The findings of the study are conformity Rani and Reddy (2005) and Samatha (2011).

Table 3. Distribution of respondents according to their Mass media exposure (n=120)

	Always		**Some**		**Never**	
Mass media	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Radio	76	63.33	33	27.50	11	9.17
Newspaper	89	74.17	23	19.17	8	6.67
TV	83	69.17	21	17.50	16	13.33
Farm magazine	20	16.67	89	74.17	11	9.17
Internet	-	-	16	13.33	104	86.67
Farm publication	14	11.67	71	59.17	35	29.17
Mobile	86	71.67	26	21.67	8	6.67

It is evident from the table 3 that newspaper, mobile and television are the major mass media utilized by the respondents. Whereas, Internet followed by farm publication are least utilized mass media sources for obtaining the information.

Table 4. Category of respondents according to their Mass media exposure (n=120)

Sl.No.	Mass media exposure	Frequency	Percentage
i.	Low (below 5.47)	23	19.17
ii. .	Medium (5.47 – 8.13)	85	70.83
iii.	High (above 8.13)	12	10.00
	Total	120	100.00
Mean = 6.80			SD = 1.33

It is evident from the table 4.4 that majority of the respondents have medium level of mass media exposure (70.83%) followed by low level (19.17%) and High level (10.00%) of information seeking behaviour.

Table 5. Distribution of the respondents according to their Level of knowledge

S.No.	Technological practices of hybrid rice cultivation	Level of knowledge					
		Low		Medium		High	
		F	P%	F	P%	F	P%
1.	Selection and preparation of land	17	14.17	59	49.17	44	36.67
2.	Seed treatment	69	57.50	46	38.33	5	4.17
3.	Preparation of nursery	27	22.50	54	45.00	39	32.50
4.	Sowing method and seed rate	-	-	4	3.33	116	96.67
5.	Row to Row distance and transplanting	34	28.33	58	48.33	28	23.33
6.	Irrigation method	2	1.67	69	57.50	49	40.83
7.	Knowledge of hybrid varieties	-	-	57	47.50	63	52.50
8.	Soil fertility test	59	49.17	43	35.83	18	15.00
9.	Knowledge of manure and fertilizer and its dosage	9	7.50	71	59.17	40	33.33
10.	Weed control	32	26.67	45	37.50	43	35.83
11.	Insect control	2	1.67	67	55.83	51	42.50
12.	Disease control	4	3.33	62	51.67	54	45.00
13.	Time and method of harvesting	24	20.00	54	45.00	42	35.00
14.	Method of storage	19	15.83	39	32.50	62	51.67
Note: F = frequency, P = Percentage							

Results furnished in the table 5 are depicted that the respondents has low knowledge level in the decreasing percentage rank order of the knowledge of Hybrid rice production technology by

respondents: Seed treatment (57.50%), Soil fertility test (49.17%), Row to Row distance and transplanting (28.33%), Weed control (26.67%), Preparation of nursery (22.50%), Time and method of harvesting (20.00%), Method of storage(15.83%), Selection and preparation of land (14.17%), Knowledge of manure and fertilizer and its dosage (7.50%), Disease control (3.33%), Irrigation method (1.67%), Insect control (1.67%).

Medium level of knowledge of the Hybrid rice production technology by the respondents is lucidly depicted in the table; presented below as the percentage rank order of their decreasing importance as follows: Knowledge of manure and fertilizer and its dosage (59.17%), Irrigation method (57.50%), Disease control (51.67%), Insect control (55.83%), Selection and preparation of land (49.17%), Row to Row distance and transplanting (48.33%), Knowledge of hybrid varieties (47.50%), Time and method of harvesting (45.00%), Preparation of nursery (45.00%), Seed treatment (38.33%), Weed control (37.50%), Soil fertility test(35.83%), Method of storage (32.50%), Sowing method and seed rate (3.33%).

High level of knowledge of the Hybrid rice production technology by the respondents is lucidly depicted in the table; presented below as the percentage rank order of their decreasing importance as follows: Knowledge of hybrid varieties (52.50%),Method of storage (51.67%), Disease control (45.00%), Insect control (42.50%), Irrigation method (40.83%), Sowing method and seed rate (36.67%), Weed control(35.83%), Time and method of harvesting (35.00%), Knowledge of manure and fertilizer and its dosage (33.33%), Preparation of nursery (32.50%), Row to Row distance and transplanting (23.33%), Seed treatment (4.17%)

Table 6. Category wise distribution of respondents according to their Level of knowledge

S. No.	Category	Frequency	Percentage (%)
1.	Low knowledge (below 16.22)	6	5.00
2.	Medium knowledge (16.22 – 23.52)	68	56.67
3.	High knowledge (above 23.52)	46	38.33
Total		120	100
		Mean = 19.87, S.D = 3.65	

Based on the information presented in Table 6, it is clear that the majority of respondents (56.67%) possessed a moderate level of knowledge, followed by high (38.33%) and low (5.00%). The data presented in the above table suggests that the majority of respondents exhibited a high

level of knowledge, followed by medium and low levels, respectively. This outcome may be attributed to the perceived high profitability, as well as the abundance of information from sources such as friends, relatives, and extension contacts from both private and government agencies. These findings align with the research conducted by Subhash Chander and Singh (2004), Sravan Kumar et al. (2013), and Ashok Kumar et al. (2014).

Table 7. Distribution of respondents according to their extent of adoption

S.No.	Technological practices of hybrid rice cultivation	Level of Adoption					
		Low		Medium		High	
		F	P%	F	P%	F	P%
1.	Selection and preparation of land	21	17.50	56	46.67	43	35.83
2.	Seed treatment	87	72.50	29	24.17	4	3.33
3.	Preparation of nursery	27	22.50	53	44.17	40	33.33
4.	Sowing method and seed rate	-	-	4	3.33	116	96.67
5.	Row to Row distance and transplanting	46	38.33	55	45.83	19	15.83
6.	Irrigation method	8	6.67	59	49.17	53	44.17
7.	Soil fertility test	69	57.50	49	40.83	2	1.67
8.	Dosage of manure and fertilizer	10	8.33	39	32.50	71	59.17
9.	Weed control	54	45.00	63	52.50	3	2.50
10.	Insect control	5	4.17	72	60.00	43	35.83
11.	Disease control	7	5.83	63	52.50	50	41.67
12.	Time and method of harvesting	34	28.33	59	49.17	27	22.50

Note: F = frequency, P = Percentage

Results furnished in the table 7 are depicted that the respondents has low knowledge level in the decreasing percentage rank order of the knowledge of Hybrid rice production technology by respondents: Seed treatment (72.50%), Soil fertility test (57.50%), Weed control (45.00%), Row to Row distance and transplanting (38.33%), Preparation of nursery (22.50%), Time and method of harvesting (28.33%), Selection and preparation of land (17.50%), Irrigation method (6.67%). Disease control (5.83%), Insect control (4.17%).

Medium level of knowledge of the Hybrid rice production technology by the respondents is lucidly depicted in the table; presented below as the percentage rank order of their decreasing importance

as follows: Insect control (60.00%),Disease control (52.50%), Weed control (52.50%) Time and method of harvesting (49.17%), Irrigation method (49.17%), Selection and preparation of land (46.67%), Row to Row distance and transplanting (45.83%), Preparation of nursery (44.17%), Soil fertility test (40.83%), Dosage of manure and fertilizer (32.50%), Seed treatment (24.17%), Sowing method and seed rate (3.33%).

High level of knowledge of the Hybrid rice production technology by the respondents is depicted in the table; presented below as the percentage rank order of their decreasing importance as follows: Sowing method and seed rate (96.67%), Dosage of manure and fertilizer (59.17%), Irrigation method (44.17%), Insect control (35.83%), Selection and preparation of land (35.83%), Preparation of nursery (33.33%), Disease control (41.67%), Time and method of harvesting (22.50%), Row to Row distance and transplanting (15.83%), Seed treatment (3.33%), Weed control (2.50%), Soil fertility test(1.67%).

Table 8. Category wise distribution of respondents according to their Level of adoption

S. No.	**Category**	**Frequency**	**Percentage (%)**
1.	Low adoption (below 13.91)	5	4.17
2.	Medium adoption (13.91 – 19.87)	67	55.83
3.	High adoption (above 19.87)	48	40.00
Total		120	100
Mean = 16.89		S.D = 2.98	

As per the findings presented in Table 8, it is apparent that the majority of respondents (55.83%) demonstrated a medium level of adoption, followed by high (40.00%) and low (4.17%) levels.

The results from the table suggest that most respondents exhibited a medium level of adoption, followed by high and low levels, respectively. This trend may be attributed to their moderate knowledge levels, influenced by the availability of information from sources such as friends, relatives, and extension contacts from both private and government agencies.The findings of the study are supported by Thyagarajan and Subhashini (1999), Pandya and Thumar (2000),

Singh and Singh (2002)

An effort has been undertaken to investigate whether there is a correlation between the independent variables (profile characteristics of respondents), including age, education, family size, occupation, farming experience, landholding, type of house, annual income, social participation, extension contact, source of irrigation, information-seeking behavior, mass media exposure, and the level of knowledge and extent of adoption of hybrid rice production technologies among the respondents.

Table 9 Correlation coefficient of selected profile characteristics of respondents with their Level of Knowledge

S. No.	Characteristics	Correlation coefficient (r)
1.	Age	0.0232 NS
2.	Education	0.249**
3.	Family size	0.099 NS
4.	Occupation	0.151**
5.	Farming experience	0.0542 NS
6.	Land holding	0.0521 NS
7.	Type of house	0.0152 NS
8.	Annual income	0.1028 NS
9.	Social participation	0.204*
10.	Extension contact	0.354**
11	Sources of irrigation	0.103**
12	Information seeking behaviour	0.165 **
13	Mass media exposure	0.267**
Note: * Significant at 0.05 level of probability ** Significant at 0.01 level of probability, NS –Non Significant		

Table 9 indicates significant relationships at the 1% probability level for variables such as education, occupation, extension contact, sources of irrigation, information seeking behavior, and mass media exposure. Social participation and annual income exhibit significance at the 5% probability level. Conversely, age, family size, farming experience, landholding, type of house, and annual income show no significant relationship with knowledge of hybrid rice production

technology.

The data suggests a lack of significant association between respondents' age and their knowledge level. Unlike younger and middle-aged respondents, older individuals may have lower education levels, potentially influencing their knowledge. However, age itself does not determine knowledge acquisition, leading to a non-significant relationship.

Results further indicate a positive and significant link between education and overall knowledge level. Higher education facilitates broader interaction and better interpretation. Training contributes to knowledge and skill acquisition in farming, explaining this relationship.

Family size shows a non-significant relationship with knowledge, possibly because knowledge is primarily linked to education, information-seeking behavior, and related factors rather than family size. Occupation exhibits a positive and significant relationship with knowledge, likely driven by the need for increased crop productivity and income, necessitating knowledge of production technology. Farm experience shows a non-significant relationship with knowledge, potentially attributed to experienced farmers feeling knowledgeable and less inclined to adopt new technologies.

Similarly, landholding and type of house exhibit a non-significant relationship with knowledge, likely influenced by farm size and interest in farming activities.

Annual income, social participation, extension contact, sources of irrigation, information-seeking behavior, and mass media exposure reveal positive and significant relationships with knowledge. Frequent social participation, extension contacts, reliable sources of information, and exposure to mass media contribute to advanced knowledge in production technologies.

Table 10 Correlation coefficient of selected profile characteristics of respondents with their Level of adoption

S. No.	Characteristics	Correlation coefficient (r)
1.	Age	0.1736 NS
2.	Education	0.292**
3.	Family size	0.044 NS
4.	Occupation	0.206**
5.	Farming experience	0.0329 NS
6.	Land holding	0.126 NS

7.	Type of house	0.0192 NS
8.	Annual income	0.286**
9.	Social participation	0.1023*
10.	Extension contact	0.354**
11	Sources of irrigation	0.104**
12	Information seeking behaviour	0.325**
13	Mass media exposure	0.426**

Note: * Significant at 0.05 level of probability,** Significant at 0.01 level of probability, NS –Non Significant

Table 10 indicates significant 'r' values for education, occupation, annual income, extension contact, irrigation sources, information seeking behavior, and mass media exposure at a 1% probability level. Social participation and annual income show significance at a 5% probability level. However, variables such as age, family size, farming experience, land holding, and type of house do not exhibit a significant relationship with hybrid rice production technology knowledge. The table implies a non-significant relationship between adoption level and respondents' age. Unlike younger and middle-aged respondents, older respondents with lower education levels may exhibit lower adoption rates. Age, however, is not a criterion for technology adoption, resulting in a non-significant relationship. The results suggest a positive and significant association between education and overall adoption level. Higher education widens interaction, aiding interpretation. Training enhances farming knowledge and skills, contributing to increased adoption. Family size shows a non-significant relationship with adoption, possibly because adoption is primarily linked to education, information seeking behavior, and annual income, not family size.

Occupation exhibits a positive and significant relationship with adoption, likely due to the necessity to increase crop productivity for higher income, driving the need for production technology adoption. Farm experience, land holding, and type of house do not show significant relationships with adoption, possibly because experienced farmers may resist trying new technologies, larger farm sizes may enhance technology adoption capacity, and housing type may not influence adoption. Annual income demonstrates a positive and significant relationship with adoption. Increased income may boost the capacity for risk-taking and motivation, contributing to higher adoption levels.

Social participation and extension contact reveal positive and significant relationships with adoption, as frequent interactions with communities and extension agencies increase positive attitudes and knowledge, respectively. Source of irrigation shows a positive and significant relationship with adoption, suggesting that increased irrigation facilities enhance cropping intensity and adoption levels. Information seeking behavior and mass media exposure display positive and highly significant relationships with adoption. Utilizing various information sources and having substantial mass media exposure contribute to advanced knowledge and increased adoption of production technologies.

Table 11 Reasons for growing the hybrid rice by the tribal farmers

S. No.	Reasons	Frequency	Percentage
1.	High production in comparison to improved varieties.	116	96.67
2.	Minimum seed rate of hybrid rice per acre.	111	92.50
3.	Easy availability of hybrid rice seeds.	117	97.50
4.	Fewer number of cultural practices are required.	101	84.17
5.	Early and extra - early rice hybrid variety availability which is suitable for doublecropping apply under rainfed condition.	99	82.50
6.	Hybrid rice high yielding potential.	112	93.33
7.	Good price in market.	111	92.50
8.	Early maturity, heavy grains, high grain quality of hybrid rice variety.	109	90.83
9.	Hybrid rice is grown the farmer in Surajpurbecause they found that hybrid rice is subsistencefor their livelihood better than other improverrice varieties.	97	80.83
10.	Hybrid seed are resistant to diseases and pest.	94	78.33

From the table 11 it can be interpreted that the respondents reasons for adopting the hybrid rice production technology in the decreasing percentage rank order is as follows: Easy availability of hybrid rice seeds (97.50%), High production in comparison to improved varieties (96.67%),Hybrid rice high yielding potential (93.33%),Minimum seed rate of hybrid rice per acre (92.50%), Good

price in market (92.50%),Early maturity, heavy grains, high grain quality of hybrid rice variety (90.83%),Fewer number of cultural practice are required (84.17%),Early and extra - early rice hybrid variety availability which is suitable for doublecropping apply under rainfed condition (82.50%),Hybrid rice is grown the farmer in Surajpurbecause they found that hybrid rice is subsistencefor their livelihood better than other improverrice varieties (80.33%),Hybrid seed are resistant to diseases and pest (78.33%).

Table 12 Rank wise distribution of constraints faced by respondents in adoption of hybrid rice production technology.

Sl. No.	Constraint	Frequenc	Percentag	Rank
1.	Lack of technical knowledge	92	76.67	XI
2.	Lack of knowledge about identification and control of insects –pests and disease	99	82.50	IX
3.	Lack of proper resources and capital	100	83.33	VIII
4.	Lack of credit facility at time	95	79.17	X
5.	Lack of proper market facilities	105	87.50	VII
6.	Lack of proper information at time	111	92.50	III
7.	Lack of training programme related with improved practices	103	85.83	VI
8.	Selling of expired hybrid seed by shopkeepers	91	75.83	XII
9.	Mixing of the hybrid seeds with other inferior seeds	110	91.67	IV
10.	Poor education status of farmers	116	96.67	I
11.	Transportation problem	104	86.67	V
12.	Costly critical inputs	115	95.83	II
13.	Unavailability of electricity	90	75.00	XIII

As indicated by the results presented in Table 12, the study identified various constraints in the context of hybrid rice production technology adoption. The primary challenges include the poor education status of farmers (I rank), indicating a need for educational interventions. The high cost of critical inputs emerged as the second-ranking constraint (II rank), highlighting economic barriers. Additionally, the lack of timely and adequate information (III rank) poses a significant hurdle. The mixing of hybrid seeds with inferior ones (IV rank) and transportation issues (V rank) were also notable concerns. Furthermore, the study underscored challenges such as the absence of

proper training programs (VI rank), insufficient market facilities (VII rank), limited resources and capital (VIII rank), and inadequate knowledge about identifying and controlling pests and diseases (IX rank). Other obstacles include a lack of timely credit facilities (X rank), insufficient technical knowledge (XI rank), the sale of expired hybrid seeds by shopkeepers (XII rank), and the unavailability of electricity (XIII rank). These findings shed light on critical areas that warrant attention for the successful adoption of hybrid rice production technology.

Table 13 Rank wise suggestions as given by respondent's in increase the adoption of hybrid rice production technology.

S no.	Suggestions	F	P%	Rank
1	Information should be provided on proper time	110	91.67	II
2	Compensation for the crop failure	97	80.83	VII
3	Input should be made available at proper	102	85	IV
4	Subsides should be provided for the crop cultivation	107	89.17	III
5	Result demonstration should be conducted in farmers field	99	82.5	VI
6	Irrigation facilities should be provided	111	92.5	I
7	Adulteration of the seed, pesticides, insecticides etc,. Should be checked	101	84.17	V
8	Timely information should be available should be provided through mass media, government sources	95	79.17	VIII
9	Training should be provided to the farmers	84	70	IX

F = frequency P = Percentage

From the above table 13 following suggestions rank wise is as follows: Irrigation facilities should be provided (I rank), Information should be provided on proper time (II rank), Subsides should be provided for the crop cultivation (III rank), Input should be made available at proper (IV rank), Adulteration of the seed, pesticides, insecticides etc,. Should be checked (V rank), Result demonstration should be conducted in farmers field (VI rank), Compensation for the crop failure (VII rank), Lack of proper resources and capital (VIII rank), Training should be provided to the

farmers (IX rank).

Summary and Conclusions:

The research offers insights into the profile characteristics, information-seeking behavior, mass media exposure, level of knowledge, and adoption of hybrid rice production technology among the surveyed participants.Most respondents were middle-aged (57.50%), followed by old (21.67%) and young (20.83%) farmers. A significant proportion (25.83%) had functional literacy, and medium-sized families (55.00%) were prevalent. Agriculture combined with labor (30.00%) was the most common occupation, and small farmers constituted the majority (51.67%). Medium farming experience (65.00%) was prevalent, aligning with the majority falling into the middle-aged category. Agriculture combined with labor (30.00%) was the most common occupation, indicating diversification due to the high cost of living. Small farmers constituted the majority (51.67%). More than half of the respondents had medium annual income (55.83%), and a substantial portion (35.83%) were not members of any organization, indicating limited community involvement. The majority had frequent contact with agricultural technology modules (ATM) (80.00%) compared to other extension services. Television had the highest frequency of utilization, followed by radio and neighbors. Training and NGO officers had the least frequency of utilization. The majority of respondents exhibited a moderate level of knowledge (73.33%) and adoption (55.83%) of hybrid rice production technology. Positive and significant relationships were observed with education, occupation, annual income, extension contact, sources of irrigation, information-seeking behavior, and mass media exposure in relation to both knowledge and adoption.

The major constraints faced by respondents included poor education status of farmers, costly critical inputs, lack of proper information, and issues related to seed quality. Key suggestions from respondents included providing timely information, compensating for crop failure, ensuring availability of inputs, providing subsidies, conducting result demonstrations, improving irrigation facilities, and checking adulteration of seeds and agrochemicals.

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