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# Study on Adoption of Chinnor Rice Production Technology and Constraints Faced by Farmers of Balaghat District, Madhya Pradesh

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***Data Availability Statement:*** Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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## Abstract

The Study was conducted during 2019–20 to find out the adoption of Chinnor rice production technology by farming communities of the Balaghat district, Madhya Pradesh, India. Farmers of an area were aware about technology invented by scientists of College of Agriculture, Balaghat. Adoption of interventions involved in given technology varied from 64–100%. Majority of the respondents respond to mixing of vermi-compost and other cakes in soil (77.72%), seed rate @ 20–25 kg $ha^{-1}$ (69.40%), 2–3 times of ploughing (64.51%), recommended plant spacing (75.00%), organic manures for nutrient management (88.47%), mechanical method of weed control (94.96%), try biological control insect-pest (96.33%), manual harvesting as well as bagging method of storage (98.00%). Data indicates that the lodging of the crop due to height was the major constraint in their adoption and it ranks $I^{st}$ as 68.33% respondents reported the problem of lodging. Long duration required for maturity of the Chinnor than other rice varieties was another limiting factor, ranked $II^{nd}$ with 61.67% farmers' response, whereas less availability and high cost of pure seed of variety ranked $III^{rd}$ with 54.33% farmers' response. Majority of respondents (36.33%) communicate with the scientists of the college and other institutions. With some improvements in qualitative parameters of the crop, adoption by farmers and yield of the crop will increase.

***Keywords:*** Adoption, chinnor, lodging, socio-personal attributes

## 1. Introduction

Balaghat is the tribal district of Madhya Pradesh, situated in Chhattisgarh plain Agro-climatic Zone (ACZ), which is not remain untouched by the vagaries of climate change (Nema et al., 2016). The farmers of Balaghat district are resource poor and form vulnerable class of people, which are prone to threats of livelihood insecurity (Shirisha, 2019). The cropping system of Balaghat district is Rice–Fallow–Fallow/ Rice–Rice–Fallow. It has also played a major role in pushing the farmers towards the threatening situation, which calls for remedial situation urgently. Balaghat is major rice growing district of the Madhya Pradesh, where rice is grown in 251.60 thousand hectares (Bhoi et al., 2021; Khan et al., 2012; Meshram and Swarnakar, 2019) with total annual production of 336370 tones and an average yield of 1426 Kg $ha^{-1}$. Chinnor is the oldest and most popular variety of scented rice among the farmers as well as consumers of Madhya Pradesh, Chhattisgarh and adjoining district of Maharashtra (Ahuja et al., 2019). However, productivity of such scented rice (*Dubraj-deshi Dubraj-bouna Vishnubhog*) is generally low due to traditional cultivation

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method and increasing erosion of genetic diversity (Ahuja et al., 2019). The aroma and softness its digestibility are the major traits, which attracts the consumers ( Dumitrascu et al., 2021). Scented rice varieties are most popular among the economically wealthy societies and intellectuals due to its aroma (Wakte et al., 2017). It is considered as a religious food, because of its kheer is always used as a food of God Krishna "known as Mohan Bhog" hence, religiously it has more importance in the Hindu community (Roy et al., 2016; Mahato et al., 2017). Looking to its popularities and palatability among the consumer, crop improvement programme was initiated at Research Farm (Murjhad Farm) during 2007 than it become College of Agriculture Balaghat in 2012. The objective of this programme was to select the desirable crop for plant height, maturity period, yield potential, oil content in bran and aroma of the grain.

Prior to development of Chinnor variety, its production was limited to some villages of the Balaghat district and few farmers used to grow because of unavailability of genetically pure seed of Chinnor. The quality and pure seeds of improved variety produces at College of Agriculture Balagaht, JNKVV Jabalpur (MP) and it was made available to the farmers. A crop-based module entitled, "Seed multiplication and marketing of locally cultivated scented variety of rice (Chinnor)" is running in Farmer First Project at College of Agriculture, Balaghat, a constituent college of Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur Center, and also promote through various programmes i.e. Paramparagat Krishi Vikas Yojana run under the ATMA, Department of the Farmers Welfare and Agriculture Development, Balaghat. With such efforts, area under increased cultivation and covered 4875 ha in the Lalburra, Waraseoni, Khairlanji, Katangi and Balaghat Developmental Blocks of the district Balaghat during the year of 2019-20 as well as the production of this variety has touched the 10930 t.

Therefore, the study was conducted to analyze the socio-personal, psychological and communicational attributes, adoption level production technology and constraints in adoption of Chinnor.

## 2. Materials and Methods

### *2.1. Study site*

Present study was conducted during 2019–20 in tribal district Balaghat of Madhya Pradesh. The district is bounded by 21° 19' to 22° 24' N Latitude and 73°31' to 81° 30' E Longitude with an Altitude of 330 m above sea level (masl). The district is bounded by the Mandla district of Madhya Pradesh in North, Rajnandgaon & Durg districts of Chhattisgarh in the East and South, and Seoni district of Madhya Pradesh in the west. One fourth of the district's total population is occupied by tribals such as Baiga, Gond and Korku etc. (Jain et al., 2011; Chakma et al., 2014).

Soils of the district is black cotton, sandy loam & lateritic type. Canals and dug wells, tube wells and ponds are the main source of irrigation in the district. Climate of the district is sub-tropical characterized by a hot summer and general dryness except during the southwest monsoon season. The normal annual rainfall of Balaghat district is 1294.5 mm. Despite of that irrigation water is not available sufficiently in *rabi* and *summer* season. Maximum temperature (43°C) recorded during the month of May and minimum (8°C) during the month of December.

Although there are ten developmental blocks (Balaghat, Lalburra, Waraseoni, Khairlanji, Katangi, Baihar, Birsa, Paraswada, Kirnapur and Lanji) in Balaghat district, the study was carried out in five blocks i.e. Lalburra, Waraseoni, Khairlanji, Katangi and Balaghat. These blocks were selected purposefully because of their suitability for growing of Chinnor. Three villages from each block and 20 respondents from each village were selected randomly for the study (Table 1).

Table 1: Information of selected villages from the five Developmental Blocks of the district Balaghat

| Sl. No. | Name of block | Name of villages | No. of respondents (20 respondents form each village) n |
|---|---|---|---|
| 1. | Lalburra | Adopted Cluster of villages Koppe, Chillod and Lendejhari | 60 |
| 2. | Waraseoni | Kaydi, Ekodi and Koste | 60 |
| 3. | Khairlanji | Fogaltola, Khursipar and Bhandarbodi | 60 |
| 4. | Katangi | Singodi, Lohmara and Selva | 60 |
| 5. | Balaghat | Aaolajhari, Kannadgawn and Parswada | 60 |
| Total | | | 300 |

There were total three hundred respondents selected form fifteen villages of five developmental blocks of Balaghat district. Randomly selected farmers benefited with required inputs for growing Chinnor rice as per the recommended technology (as inputs listed in Table 5).

### *2.2. Data collection and analysis*

The primary data were collected personally with the help of an interview schedule; the interviews were conducted on farmer's field or in their homes through face-to-face contact (Bayarta and Bonnel, 2015) as well as from base line survey of the project. Standard questionnaire was prepared for conduction of survey on 30 variables to study the socio-personal, psychological and communicational attributes,

adoption level production technology and constraints in adoption of Chinnor. Interview of the household head on scheduled questionnaire was conducted for the study. The collected data was analyzed by using SPSS software (Verma, 2013).

## 3. Results and Discussion

### *3.1. Socio-personal attributes*

The socio-personal attributes were mainly concerned with the social, economic, and political aspects of respondents in the farming communities. Generally, the socio-personal attributes focused to recognize the adaptive aptitude of individuals based on their internal characteristics such as age, education, size of land holding, social participation, farm power, and material possession. Differences of these factors are responsible for the variations in these characteristics of the respondents.

The data presented in Table 2 showed that the 41.67% of respondents were from middle age group (36–55 years), followed by 30.00% of old age group (above 55 years). While, only 28.33% were belonging to the young age group (18–35 years). These age groups are much more responsible for the current adoption rate of the scented rice cultivation in the area. Similar results were reported by Jamal et al. (2014) and Khan et al. (2012).

As the education helps the farmers to select the profitable production technology, the study of relation of education on adoption of Chinnor cultivation had its importance. Out of the total respondents, 43.67% has passed higher secondary and above level of formal education. Whereas, 31.67% respondents from the farming communities passed middle school and 20.00% passed primary level of education. Where, 4.67% respondents were not attained any formal education. Adoption of any new technology always affected by the education level of the farming communities (Adesina and Chianu, 2002; Waris et al., 2019). Devi and Ponnarasi (2009) studied adoption of SRI technology of rice cultivation and reported that the higher percentage of SRI paddy growers were having education up to higher secondary level.

Majority of respondents 38.33% owned medium size of land holdings (6–10 acres), followed by 31.67% small size (up to 5 acres) and 30.00% respondents of large size (above 10 acres) land holding. Decision on the adoption of new technology also affected by the availability of resources such as land, water etc. As the farmer have sufficient resources, they can think on the new technologies of the growing rice crop (McGinty et al., 2008; Adesina and Chianu, 2002). Khan et al. (2012) also found that majority of the resource poor respondents had medium to small size of land holdings.

The data regarding social participation indicate that, 46.67% of respondents possessed high level of social participation. Whereas, 35.33% and 18.00% respondents had medium and low level of social participation (Table 2). Similar studies were found by Sarawgi et al. (2004).

Table 2: Distribution of the socio-personal attributes of the respondents

| Sl. No. | Categories of attributes | Frequency (n = 300) | Percentage |
|---|---|---|---|
| 1 | Age | | |
| | Young (18–35 years) | 85 | 28.33 |
| | Middle (36–55) | 125 | 41.67 |
| | Old (above 55 years) | 90 | 30.00 |
| 2 | Education | | |
| | Illiterate | 14 | 4.67 |
| | Primary passed | 60 | 20.00 |
| | Middle passed | 95 | 31.67 |
| | High school passed and above | 131 | 43.67 |
| 3 | Size of land holdings | | |
| | Small (up to 5 acres) | 95 | 31.67 |
| | Medium (6–10 acres) | 115 | 38.33 |
| | Large (above 10 acres) | 90 | 30.00 |
| 4 | Social participation | | |
| | Low (3–6) | 54 | 18.00 |
| | Medium (7–10) | 106 | 35.33 |
| | High (11–14) | 140 | 46.67 |
| 5 | Farm power | | |
| | Low (up to 5) | 83 | 27.67 |
| | Medium (6 – 8) | 114 | 38.00 |
| | High (above 8) | 103 | 34.33 |
| 6 | Material possession | | |
| | Low (up to 12) | 55 | 18.33 |
| | Medium (13–16) | 125 | 41.67 |
| | High (above 16) | 120 | 40.00 |

In case of farm power, data reveal that out of total respondents 38.00% and 34.33% had medium to high level of farm power respectively. The 27.67% of them had low level of farm power. Khan (2012) also reported that the majority of the basmati growers has low to medium level of farm assets.

It is clear from the data that, 41.67% respondents possessed medium level of material possession followed by 40.00% belong to high material possession and only 18.33% had low level of material possession. Similar results were reported by Khan et al. (2012).

### *3.2. Psychological attributes*

Psychological attributes of the respondent's economic motivation, scientific orientation and innovation proneness were studied to know their attitude towards adoption of the cultivation technology of Chinnor rice. The data about

the psychological attributes of the respondents are given in Table 3.

It is evident from the Table 3 that, 37.67% of the respondents showed high level of economic motivation followed by medium 36.33% and 26.00% low, respectively. Khan (2012) reported comparable results.

It is clear from the data shown in Table 3 about the scientific orientation of the respondents that, 37.33% and 34.33% of respondents had medium and high level of scientific orientation followed by 28.33% had low level of scientific orientation. Tyagi et al. (2003) reported that all the small, medium, and big paddy farmers had medium scientific attitudes.

Empirical data revealed that, 41.67% of the respondents had medium level of innovative proneness followed by 34.00% high and 24.33% low, accordingly. Similar results were reported by Khan et al. (2012).

Table 3: Distribution of the psychological attributes of the respondents

| Sl. No. | Categories of attributes | Frequency (n= 300) | Percentage |
|---|---|---|---|
| 1. | Economic motivation | | |
| | Low (24–30) | 78 | 26.00 |
| | Medium (31–36) | 109 | 36.33 |
| | High (37–42) | 113 | 37.67 |
| 2. | Scientific orientation | | |
| | Low (24–30) | 85 | 28.33 |
| | Medium (31–36) | 112 | 37.33 |
| | High (37–42) | 103 | 34.33 |
| 3. | Innovation proneness | | |
| | Low (up to 5) | 73 | 24.33 |
| | Medium (6–9) | 125 | 41.67 |
| | High (above 9) | 102 | 34.00 |

### *3.3. Communicational attributers*

In the study of communicational attributers, mass media exposer and contact with development agencies were studied due to time-to-time contact and providing need based trainings to the farmers by the scientists of the college. Data related to the communicational attributers is represented in Table 4.

It is conspicuous from the empirical data presented in Table 4 that, 34.00% of respondents had high level of mass media exposure followed by 33.33% medium and 32.67% low, respectively. Corroborative results were reported by Tyagi et al. (2003).

The majority of respondents (36.33%) had high level of contact with the development agencies and 32.67 and 31.00% respondents belonged to medium and low level of contact with development agencies. Khan et al. (2012), Samarpitha et al. (2016) also reported that the majority of the respondents had maintained the contact with extension agencies.

Table 4: Distribution of the Communicational attributes of the Chinnor rice growers

| Sl. No. | Categories of attributes | Frequency (n=300) | Percentage (%) |
|---|---|---|---|
| 1. | Mass media exposure | | |
| | Low (up to 7), | 98 | 32.67 |
| | Medium (8–11) | 100 | 33.33 |
| | High (above 11) | 102 | 34.00 |
| 2. | Contact development agencies | | |
| | Low (up to 6), | 93 | 31.00 |
| | Medium (7–10) | 98 | 32.67 |
| | High (above 10) | 109 | 36.33 |

### *3.4. Adoption of Chinnor rice production technology*

Data given in Table 5 showed that identified stages of adoption of Chinnor rice production technologies by respondents. When respondents were aware about these improved technologies, then they decided to try the improved technologies on a small scale to test suitability of the technologies in their own field situation after that they decided to adopt or reject these technologies. The study revealed that the majority of the respondents were aware about of the Chinnor rice production technologies. This determined that sufficient level of awareness has been mounted and the sources of information could be effective among the respondents. Majority of the respondents cultivated Chinnor rice as production technology developed by college i.e. mixing of vermi-compost and other cakes in soil (77.72%), seed rate @ 20–25 kg $ha^{-1}$ (69.40%), 2–3 times of plowing (64.51%), recommended plant spacing (75.00%), organic manures for nutrient management (88.47%), mechanical method of weed control (94.96%), try biological control insect-pest (96.33%), manual harvesting as well as bagging method of storage (98.00%). So that the significant level of cultivation of Chinnor was accomplished by the farmers.. Farmers finally adopted Chinnor rice production technology which included; mixing of vermi-compost and other cakes at the time of nursery raising (84.34%), seed rate @ 20–25 kg $ha^{-1}$ (97.44%), 2–3 times plowing with MB plough (84.23%), mix 20–25 days old green manuring crop in the field (89.80%). Organics manners for nutrient management (88.12%), mechanical method of weed control (76.89%), biological control of insect-pest (81.31%), manual harvesting (97.62%) and bagging method of storage (100%) were also adopted by the respondents. Similar results were reported by Meena et al. (2012).

Table 5: Adoption of the Chinnor rice production technology (n=300)

| Sl. No. | Chinnor rice production technologies | Farmers awareness on Chinnor rice cultivation (%) | Farmers cultivated Chinnor rice (% of aware farmers) | Farmers adopted (% of Chinnor rice Cultivated) |
|---|---|---|---|---|
| 1. | Nursery management practices | | | |
| | a. Make raised beds | 61.33 | 41.71 | 68.53 |
| | b. Mixing of 50 kg vermi compost and other cakes @ 10 kg. | 66.33 | 77.72 | 84.34 |
| 2. | Seed and seed treatment | | | |
| | a. Seed rate @ 20–25 kg $ha^{-1}$ | 93.67 | 69.40 | 97.44 |
| | b. Seed treatment with pseudomonas 2–5 ml $kg^{-1}$ and 1500 ppm neem oil 5 ml $kg^{-1}$ of seed | 60.00 | 51.11 | 47.83 |
| 3. | Field preparation | | | |
| | a. 2–3 times ploughing with MB plough | 97.67 | 64.51 | 95.24 |
| | b. Mixed well 20–25 days old green manuring crop in the field | 61.33 | 53.26 | 89.80 |
| 4. | Transplanting | | | |
| | c. 12–15 days old rice nursery plants should be transplanted. | 88.67 | 45.11 | 62.50 |
| | d. Transplanting should be done in 20×15 or 20×10 cm. row to row and plant to plant spacing | 98.67 | 75.00 | 84.23 |
| 5. | Manures and fertilizer management | | | |
| | a. Application of Mahua or Neem or karanj cake mix with @ 5 to 7.5 q $ha^{-1}$ FYM or wermi compost | 98.33 | 88.47 | 88.12 |
| | b. Mycorrhiza @ 10 kg $ha^{-1}$, PSB @ 5 kg $ha^{-1}$ and @ BGA 10 kg $ha^{-1}$ | 89.00 | 63.67 | 65.88 |
| 6. | Weed management | | | |
| | Mechanical methods | 92.67 | 94.96 | 76.89 |
| 7. | Plant protection | | | |
| | *Trichoderma Viridi* @ 5 kg $ha^{-1}$, (*Beauveria bassiana* @ 2 l $ha^{-1}$. and Pseudomonas @ 5 l $ha^{-1}$) 2 times application in standing crop and at for BPH Neem 2500 ppm Neem oil @ 2.5 l $ha^{-1}$ | 98.67 | 96.33 | 81.31 |
| 8. | Harvesting Techniques | | | |
| | a. Manual harvesting | 100.00 | 98.00 | 97.62 |
| | b. Mechanical harvesting | 98.00 | 11.90 | 42.86 |
| 9. | Improved storage methods | | | |
| | a. Silos | 78.00 | 17.09 | 2.50 |
| | b. Bags | 100.00 | 98.00 | 100.00 |
| | c. Rhombus | 36.00 | 10 | 0.00 |

*3.5. Constraints in adoption of technology*

Table 6 indicates data of constraints faced by the respondents in adoption of Chinnor rice production technology as respondents practices technology once. Respondents reported the constraints such as crop lodging due to height & longer duration of the Chinnor than other rice varieties were the major hurdles in adoption and ranks $I^{st}$ with 68.33%, followed by lack of risk bearing and decision making ability ranked $II^{nd}$ with 61.67%. Less availability and high cost of pure seed of variety ranked $III^{rd}$ with 54.33%. Tyagi et al. (2003) reported similar results. Less availability of labor ranked $IV^{th}$ with 52.67%, attack of insect, pests and diseases ranked $V^{th}$ with 47.67% Sachan et al. (2005) reported that the most responsible factors for non–adoption of plant protection were lack of knowledge about advantages of seed treatment and plant protection measures., non-availability of technical knowledge ranked $VI^{th}$ with 43.33%. Ranikumar et al., (2004) and Kapur (2018) reported similar results. It was followed

Table 6: Constraints faced by the respondents in adoption of Chinnor rice production technology

| Sl. No. | Constraints | Frequency n = 300 | Percentage | Rank |
|---|---|---|---|---|
| 1. | Lack of risk bearing and decision making ability | 185 | 61.67 | II |
| 2. | Lack of transportation facilities | 118 | 39.33 | VII |
| 3. | Less–availability of labors | 158 | 52.67 | IV |
| 4. | Non–availability of technical knowledge | 130 | 43.33 | VI |
| 5. | Logging due to height & Longer duration of the Chinnor than other rice varieties | 205 | 68.33 | I |
| 6. | Less–availability and high cost of pure seed of variety | 163 | 54.33 | III |
| 7. | Lack of irrigation water | 98 | 32.67 | VIII |
| 8. | Attack of insect, pests and diseases | 143 | 47.67 | V |
| 9. | Lack of suitable communication source | 86 | 28.66 | IX |
| 10. | Poor contract of extension worker | 74 | 24.67 | X |

by lack of transportation facilities ranked VII$^{th}$ with 39.33%, lack of irrigation water ranked VIII$^{th}$ with 32.67%, as well as lack of suitable communication source ranked IX$^{th}$ with 28.66%, and poor contact with extension worker ranked X$^{th}$ with 24.67%. It was determined though the data that communication sources and work of extension worker quite good if respondents get the solution about lodging, attack of insect pest and diseases, short duration and sort height of Chinnor like other rice varieties as well as pure seed in cheap rates and proper technical knowledge of Chinnor production then adoption would increase. As far as resource, poor farmers are concerned they faced most important constraints like lack of risk bearing ability, lack of transportation facility, higher cost of technology.

## 4. Conclusion

Problems with traditional production technologies for Chinnor rice i.e. lodging and long duration to mature declined the interest of farmers towards growing of Chinnor rice. Low risk bearing and decision-making ability, less availability and high cost of pure seed, less availability of labor etc. were the other factors restricts increasing acreage under Chinnor. Dissemination of Chinnor rice production technology developed by the college has urgent need to increase area under Chinnor rice cultivation and improve its productivity.

## 6. Acknowledgement

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