**Comparative Analysis of Technological Gaps in Rice Cultivation between Raipur District of Chhattisgarh and Imphal East of Manipur, India**

**ABSTRACT**

The aim of the study was to determine the extent of technological gap in recommended rice production technology by the farmers of Chhattisgarh and Manipur and to analyse the difference among the States. The study was conducted in Raipur District of Chhattisgarh and Imphal East District of Manipur during the year of 2021 to 2023. A total of four blocks namely Arang and Abhanpur blocks from Raipur while Keirao and Khsetrigao blocks from Imphal East were chosen randomly. 10 farmers each from randomly chosen five villages belonging to each selected block were chosen randomly in both the States. An ex-post facto research design was adopted involving 100 randomly chosen rice growing farmers from each State so as to make a total of 200 respondents. The data were collected through personal interview, compiled and tabulated. Statistical tools like frequency, percentage and arithmetic mean were used for measurement to derive appropriate answer for the specific objective of the study. The technological gap of each major practice was measured by using formula of Technological Gap Index developed by Biradar (2012). The study found that 97.00 % and 99.00% of respondents of Chhattisgarh and Manipur were found to have technological gap in seed treatment and the highest technological gap index was observed in bio-fertilizer application and seed treatment. The average technological gap index shown by the respondents of Chhattisgarh was 47.76 % and 50.41 % shown by the respondents of Manipur resulting in the difference of -5.54 % between the States. But both the States had medium level in extent technological gap with a difference of -7.44 % in terms of extent of technological gap. It can be concluded that these gaps may be due to lack of complete knowledge and information about recommended package of practices in rice cultivation in both the States.

***Keywords:*** *Adoption, Rice Farming, Technological Gap, Production Technology*

1. **INTRODUCTION**

Rice is the staple food crop of more than 60 % of the world’s population. About 90 % of all rice grown in the world is produced and consumed in Asian region. Rice is the principal crop in the State and the central plains of Chhattisgarh are known as “Rice bowl of central India”. About 80 % of the population in the State is engaged in agriculture and 43 % of the entire arable land is under cultivation. In terms of production of rice, Chhattisgarh comes in seventh position in India with 9.81 million tonnes growing in the area of 3.77 million ha and its productivity was 2602 kg/ha during 2022-23. Rice is also the staple food crop of NE region. Manipur, one of the seven sisters of the north eastern region of India resembling most of the northern states of India, the economy of State primarily depends on agriculture and allied activities. Though the total land under agriculture in Manipur is only 6.74 % of the total geographical area, it provides livelihood of more than 52 % of the total population of the State. In the State of Manipur, the area under rice crop is about 219.10 thousand ha, with the productivity of 2940 kg/ha with total production of 643.30 thousand tonnes. The growth in agriculture in the country has been quite uneven resulting in inequitable distribution of benefits in the recent years. High cost technologies with liberal use of inputs have resulted increase in production and productivity in agricultural endowed environment. However, in the State like Chhattisgarh and Manipur where majority of farmers are medium, small and marginal in constrained environment have benefited only marginally. Therefore, it is high time to pay attention to such farming through systematic studies about their occupational growth and examine whether these farming communities have responded as per expectation with regard to the acceptance and application to the scientific production technologies and techniques in their farming systems.

Various technologies are evolved by scientists including high yielding varieties for increasing productivity level and share profits to cultivators but still due to non-adoption of certain technologies, the productivity level is low. So, there still exists large and exploitable rice yield gap in India. This may be due to lack of technical know-how and either no or poor adoption of recommended technologies by the growers. Apart from this, personal, economic, psychological characteristics and situational and communication attributes of the growers may affect yield level. Thus, there may be technological gap between recommended package of practices and actual adoption of the recommended rice production technology by rice growers. Productivity level of farmers may be increased by finding technological gap in adoption of recommended rice production technology.

1. **METHODOLOGY**

The methodology covers the research design for investigation. The technique of study which entails data collecting, association, inquiry, and ultimately outcome presentation, was planned in this manner. Hence, it gives information about scientific procedure adopted for the present investigation to draw rational, logical and meaningful conclusions. An ex-post facto research design was used for the study. The present study was carried out in the States of Chhattisgarh and Manipur during the year of 2021-22 and 2022-23.

Raipur district and Imphal East district were chosen randomly from Chhattisgarh and Manipur, respectively. Out of four blocks of Raipur district, two blocks namely Arang and Abhanpur blocks were chosen for the study in the State of Chhattisgarh. Similarly, out of four blocks in Imphal East district of Manipur two blocks namely Keirao and Khsetrigao blocks were chosen for data collection. Five villages belonging to each selected block had been chosen randomly to complete the proposed study so as to make a total of 20 villages (10 from Chhattisgarh and 10 from Manipur). 10 rice growing farmers had been chosen randomly from each of the selected villages for collection of data. In this way, the total number of respondents were 200 rice growers (100 from Chhattisgarh and 100 from Manipur) for the current investigation.

Table 1: Selection of districts, blocks, villages and number of respondents

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Chhattisgarh** | | | | **Manipur** | | | |
| **Raipur District** | | | | **Imphal East District** | | | |
| Selected  Block | Selected  Villages | No. of respondents | | Selected  Block | Selected  Villages | No. of respondents | |
| Arang | Rasni  Arang  Bhilai  Baihar  Bothali | | 10  10  10  10  10 | Keirao | Andro  Angtha  Makting  Langdum  Chanam-Sandrok | | 10  10  10  10  10 |
| Abhanpur | Jhanki  Bendri  Baktara  Abhanpur  Thelka-Bandha | | 10  10  10  10  10 | Khsetrigao | Keikhu  Naharup  Porompat  Loumanbi  Thambalkhong | | 10  10  10  10  10 |
| 2 | 10 | | 100 | 2 | 10 | | 100 |

The data were collected by personal interview with the help of well prepared, structured and pretested interview schedule. Collected data were tabulated and processed by using appropriate statistical methods.

**2.1 Measurement of Technological gap** **in rice production technology**

In the present study, technological gap was calculated by assigning scores to the technologies adopted by the respondents as “non-adoption”, “partially adopted” and “completely adopted” with the score of 0, 1 and 2, respectively.

The per cent technological gap for each major practice and for the whole package, were worked out with the help of following formula which was developed by Biradar (2012) with slight modification:

Where, R = No. of recommended technology

A = No. of practices adopted by the farmers

Average technological gap index for each practice was calculated:

Where,

A.T.G. = Average Technological Gap

GIp = Gap index for pth practice

r = Total number of respondents

Technological gap was taken as the dependent variable. Package of practices recommended by the Indira Gandhi Krishi Vishwavidyalaya, Raipur and Central Agricultural University, Imphal for the State of Chhattisgarh and Manipur, respectively was considered as standard calculating gaps. Based on the technological gap index of each practices, the score obtained by the respondents was also worked out and ranked. The respondents were also categorized as low (33.33 %), medium (33.34%) and high level (66.66 %).

**2.2 Statistical Analysis**

**2.2.1 Frequency and percentage**: The frequency distribution of the respondents was worked out and expressed in terms of percentages. Simple comparisons were made on the basis of frequency and percentage.

**2.2.2 Arithmetic mean**: The arithmetic mean is the result of sum of the entire items in a series, divided by number of items. Arithmetic mean was used to classify the respondents into different categories.



Where,  = Arithmetic mean

∑Xi = Total score

n = Number of respondents

**3. RESULTS AND DISCUSSION**

**3.1 Distribution of respondents according to their technological Gap**

The findings regarding percentage distribution of respondents according to their technological gap is considered in Table 2. The data introduce that the majority (97.00 %) respondents of Chhattisgarh was found to have technological gap in seed treatment followed by 96.00 % respondents in bio-fertilizer application, followed by 85.00 %, 81.00 % and 80.00 % respondents were having technological gap in SRI method, selection of rice variety, seed rate and disease management, respectively.

70.00 % respondents were found to have technological gap both in insect and pest management and harvesting which is also followed by 63.00 % respondent both in line sowing and chemical fertilizer application. Further, the technological gap was also found in weed management (61.00 %), farm yard manure application (52.00 %). 49.00 % respondents were found to have technological gap both in weed management and post-harvest management, followed by 25.00 % and 20.00 % in transplanting and broadcasting, respectively.

Similarly, the findings also disclose regarding the respondents of Manipur in which almost all (99.00%) and 96.00 % respondents were seen to have technological gap in seed treatment and seed rate followed by 90.00 %, 86.00 per cent and 79.00 % respondents in bio-fertilizer application, SRI method and selection of rice variety, respectively. It was also found that 77.00 % and 73.00 % respondents were having the technological gap in both chemical fertilizer application and disease management as well as in both irrigation drainage and insect and pest management, respectively followed by 72.00 %, 64.00 %, 61.00 %, 53.00 % and 47.00 % in weed management, harvesting, farm yard manure application, line sowing and transplanting, respectively. The data reveal that 26.00 % of respondents had technological gap both in seedling transplanting and post-harvest management. Further, technological gap was found in broadcasting by 21.00 % respondents.

The average number of respondents who had technological gap was 61.70 % in Chhattisgarh while it was 66.47 % respondents in Manipur. The difference between Chhattisgarh and Manipur was found to be -7.73 % which meant that the respondents of Chhattisgarh were having seven times lesser technological gap than that of Manipur.

The findings indicate the difference between recommended package of practices and actual field-level adoption, highlighting the technological gap in both the States. These disparities may be caused due to lack of complete knowledge and information about recommended package practices in rice cultivation. Factors contributing to these gaps include limited access to timely and comprehensible information, as well as constraints like low income and limited exposure to agricultural extension services reflecting slow adoption of recommended package of practices.

Table 2: Percentage distribution of respondents according to their technological gap

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Practices** | **Chhattisgarh (n=100)** | | | | **Manipur (n=100)** | | | |
| **Complete** | **Partial** | **Nil** | **Total Gap** | **Complete** | **Partial** | **Nil** | **Total Gap** |
| 1. | Selection of rice variety | 40.00 | 41.00 | 19.00 | 81.00 | 43.00 | 36.00 | 21.00 | 79.00 |
| 2. | Seed rate | 60.0 | 21.00 | 19.00 | 81.00 | 74.00 | 22.00 | 4.00 | 96.00 |
| 3. | Seed treatment | 86.00 | 11.00 | 3.00 | 97.00 | 80.00 | 19.00 | 1.00 | 99.00 |
| 4. | Transplanting | 2.00 | 23.00 | 75.00 | 25.00 | 3.00 | 44.00 | 53.00 | 47.00 |
| 5. | Broadcasting | 4.00 | 16.00 | 80.00 | 20.00 | 0.00 | 21.00 | 79.00 | 21.00 |
| 6. | SRI method | 66.00 | 19.00 | 15.00 | 85.00 | 64.00 | 22.00 | 14.00 | 86.00 |
| 7. | Line Sowing | 24.00 | 39.00 | 37.00 | 63.00 | 3.00 | 50.00 | 47.00 | 53.00 |
| 8. | Seedling transplanting | 6.00 | 5.00 | 89.00 | 11.00 | 0.00 | 26.00 | 74.00 | 26.00 |
| 9. | Farm yard manure application | 25.00 | 27.00 | 48.00 | 52.00 | 16.00 | 45.00 | 39.00 | 61.00 |
| 10. | Chemical fertilizer application | 38.00 | 25.00 | 37.00 | 63.00 | 58.00 | 19.00 | 23.00 | 77.00 |
| 11. | Bio-fertilizer application | 81.00 | 15.00 | 4.00 | 96.00 | 69.00 | 21.00 | 10.00 | 90.00 |
| 12. | Irrigation drainage | 42.00 | 19.00 | 39.00 | 61.00 | 38.00 | 35.00 | 27.00 | 73.00 |
| 13. | Weed management | 4.00 | 45.00 | 51.00 | 49.00 | 30.00 | 42.00 | 28.00 | 72.00 |
| 14. | Insect and pest management | 44.00 | 26.00 | 30.00 | 70.00 | 45.00 | 28.00 | 27.00 | 73.00 |
| 15. | Disease management | 46.00 | 26.00 | 28.00 | 72.00 | 50.00 | 27.00 | 23.00 | 77.00 |
| 16. | Harvesting | 7.00 | 55.00 | 30.00 | 70.00 | 11.00 | 53.00 | 36.00 | 64.00 |
| 17. | Post-harvest management | 4.00 | 45.00 | 51.00 | 49.00 | 0.00 | 26.00 | 74.00 | 26.00 |
|  | Average number of respondents |  |  |  | 61.70 |  |  |  | 66.47 |
|  | Difference between Chhattisgarh and Manipur | | |  |  | -7.73 % | |  |  |

**3.2 Technological gap index in recommended rice production technology**

The data regarding technological gap index is presented below in Table 3. From the study, it was found that in the State of Chhattisgarh, among all the cultivation practices of rice the highest technological gap index was found in bio-fertilizer application (92.50 %), followed by seed treatment (91.50 %), SRI method (75.50 %) and seed rate (70.50 %). Further, the technological gap index in selection of rice variety, disease management, insect and pest management, chemical fertilizer application, line sowing, farm yard manure application, harvesting and weed management were found to be 60.50 %, 59.00 %, 57.00 %, 51.50 %, 50.50 %, 43.50 %, 38.50 %, and 34.50 %, respectively. The technological index of 26.50 % was found both in irrigation drainage and post-harvest management. Thus, the lowest technological gap index was found in transplanting (13.50 %), broadcasting (12.00 %) and seedling transplanting (8.50 %).

Similarly, as per the responses of respondent farmers of Manipur, the highest technological gap index was reported in seed treatment (89.50 %), seed rate (85.00 %), bio-fertilizer application (84.50 %) and SRI method (75.00 %). Moreover, the technological gap index in chemical fertilizer application, disease control measures, selection of rice variety, pest control measures, irrigation drainage, inter-cultural practices, farm yard manure application and harvesting accounted to be 67.50, 63.50, 61.00, 59.00, 55.50, 51.00, 38.50 and 37.50 %, respectively. The lowest technological gap index was observed in line sowing (28.00 %), transplanting (25.00 %), seedling transplanting (13.00 %) and post-harvest management (13.00 %) and broadcasting (10.50 %).

Table 3: Technological Gap Index in recommended rice production technology by the respondents

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Practices** | **Technological Gap Index** | | | |
| **Chhattisgarh**  **(n=100)** | | **Manipur**  **(n=100)** | |
|  |  | % | Rank | % | Rank |
| 1. | Selection of rice variety | 60.50 | V | 61.00 | VII |
| 2. | Seed rate | 70.50 | IV | 85.00 | II |
| 3. | Seed treatment | 91.50 | II | 89.50 | I |
| 4. | Transplanting | 13.50 | XIV | 25.00 | XIV |
| 5. | Broadcasting | 12.00 | XV | 10.50 | XVI |
| 6. | SRI method | 75.50 | III | 75.00 | IV |
| 7. | Line Sowing | 43.50 | X | 28.00 | XIII |
| 8. | Seedling transplanting | 8.50 | XVI | 13.00 | XV |
| 9. | Farm yard manure application | 38.50 | XI | 38.50 | XI |
| 10 | Chemical fertilizer application | 50.50 | IX | 67.50 | V |
| 11. | Bio-fertilizer application | 92.50 | I | 84.50 | III |
| 12. | Irrigation drainage | 51.50 | VIII | 55.50 | IX |
| 13. | Weed management | 26.50 | XIII | 51.00 | X |
| 14. | Insect and pest management | 57.00 | VII | 59.00 | VIII |
| 15. | Disease management | 59.00 | VI | 63.50 | VI |
| 16. | Harvesting | 34.50 | XII | 37.50 | XII |
| 17. | Post-harvest management | 26.50 | VIII | 13.00 | XV |
|  | Average Technological Gap Index | 47.76 |  | 50.41 |  |
|  | Difference between Chhattisgarh and Manipur -5.54 % | | | | |

%= Percentage

The study reveals that the average technological gap shown by the respondents of Chhattisgarh was 47.76 % and 50.41 per cent which was shown by the respondents of Manipur. So, the difference between Chhattisgarh and Manipur in terms of technological gap index was endowed to be -5.54 % which means technological gap index observed in respondents of Chhattisgarh was five times lesser than that of Manipur.

**3.3 Extent of technological gap in recommended rice production technology**

The findings regarding the percentage distribution of respondents according to the extent of technological gap is presented below in Table 4. The data reveal that 54.00 %, 32.00 % and 14.00 % of respondents of Chhattisgarh signified medium level, high level and low level of extent of technology, respectively. Similarly, the data also discloses that 49.00 %, 43.00 % and 8.00 % respondents of Manipur had medium level, high level and low level of extent of technological gap, respectively.

Table 4: Percentage distribution of respondents according to their extent of technological gap

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Extent of Technological Gap** | **Chhattisgarh (n=100)** | | **Manipur (n=100)** |
| 1. | Low level (Up to 33.33%) | 14.00 | | 8.00 |
| 2. | Medium level (33.34 to 66.66%) | 54.00 | | 49.00 |
| 3. | High level (Above 66.66%) | 32.00 | | 43.00 |
|  | Average level of technological gap | 49.09 | | 52.75 |
|  | Difference between Chhattisgarh and Manipur | | -7.44 % | |

%= Percentage

Furthermore, the study also perceived that the average level of technological gap as per indicated by the respondents of Chhattisgarh and Manipur were 49.09 % and 52.75 %, respectively. As a result, the difference between Chhattisgarh and Manipur discovered from the study was -7.44 %.

Several socioeconomic, topographical, and agricultural variables contribute to greater adoption of recommended methods for rice farming in Manipur than in Chhattisgarh, even though the state is slightly better in some areas.

1. **CONCLUSION**

The study concludes that the majority (97.00 %) respondents of Chhattisgarh was found to have technological gap in seed treatment while it was 99.00 % in ManipurIn terms of technological gap index, the highest technological gap index was found in bio-fertilizer application (92.50 %) in Chhattisgarh while it was in seed treatment with 89.50 % in Manipur. The study reveals that the average number of respondents who had technological gap was 61.70 % as compared to 66.47 % respondents who had technological gap in various cultivation practices of recommended package of practices for rice cultivation in Chhattisgarh and Manipur, respectively. Furthermore, the study also perceived that the average level of technological gap as per indicated by the respondents of Chhattisgarh and Manipur were 49.09 % and 52.75 %, respectively. The study attributed these gaps to a lack of complete knowledge and information about recommended package practices in rice cultivation. In Chhattisgarh it has been working to modernize its agricultural sector, but gaps still exist due to limited mechanization, lack of irrigation facilities, and dependency on traditional farming methods. In Manipur it may be due to geographic constraints, poor connectivity and market access, limited access to quality seeds, fertilizers, and mechanization and inadequate extension services for farmers.

Consent

As per international standards or university standards, respondents’ written consent has been collected and preserved by the author(s).

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1. **REFERENCES**

Agriculture Statistics at A Glance, (2023). Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics, Statistics & Evaluation Division.

Annual report (2022-23), Department of Agriculture and Farmers Welfare, GOI Krishi Bhawan, New Delhi.

Biradar, G., Sidramaiyya, S. and Goudappa, S. (2012). A study on technological Gap in chilli cultivation practices by the farmers of N-E districts of Karnataka state. *Raj. J. Extn. Edu. 20*: 171-174.

Konjengbam, M.D., Singh, D., Yadav, R.N., Singh, D.K., Singh, L.B., Kumar, M. and Muarya, D.S.R.K., (2023). Socio-economic and psychological characteristics of the organic farmers in Manipur. *The Pharma Innovation Journal, 12(9):*1349-1353.

Kumar, R., Devi, M. T., Boruah, M., Kumar, B., & Baruah, A. (2024). Impact of pulses on technological gap and socio-economic status of farmers in North Eastern India. *Journal of Food Legumes*, *37*(2), 215-223.

Kumar, S. (2021). A study on technological gap in adoption of improved wheat production technology among the farmers of Mungeli district of Chhattisgarh. M.Sc. (Ag.) Thesis, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.).

Mandal, K. G., Thakur, A. K., & Ambast, S. K. (2019). Current rice farming, water resources and micro- irrigation. *Current Science*, *116*(4), 568-576.

Obianefo, C. A., Ng’ombe, J. N., Mzyece, A., Masasi, B., Obiekwe, N. J., & Anumudu, O. O. (2021). Technical efficiency and technological gaps of rice production in Anambra State, Nigeria. *Agriculture*, *11*(12), 1240.

Parikh, A. H., Soni, N. V., & Chaudhari, J. K. (2015). Technological gap in adoption of improved cultivation practices by soybean growers. *Guj. J. Ext. Edu*, *26*(2), 192-194.

Puppala, H., Peddinti, P. R., Tamvada, J. P., Ahuja, J., & Kim, B. (2023). Barriers to the adoption of new technologies in rural areas: The case of unmanned aerial vehicles for precision agriculture in India. *Technology in Society*, *74*, 102335.

Sekhar, M., Rastogi, M., Rajesh, C. M., Saikanth, D. R. K., Rout, S., Kumar, S., & Patel, A. K. (2024). Exploring traditional agricultural techniques integrated with modern farming for a sustainable future: A review. *Journal of Scientific Research and Reports*, *30*(3), 185-198.

Sharma, K., Dhaliwal, N. S., & Kumar, A. (2015). Analysis of adoption and constraints perceived by small paddy growers in rice production technologies in Muktsar district of Punjab state, India. *Age*, *20*, 16-67.

Singh, D. P., & Yadav, S. K. (2014). Knowledge and adoption gap of tribal farmers of Bastar towards rice production technology. *American International Journal of Research in Humanities, Arts and Social Sciences*, *5*(1), 54-56.

Singh, R. K. (2014). Adoption of improved agricultural practices by farmers. *The Journal of Rural and Agricultural Research*, 14(2):35-36.

Sumon, M. S. M. M., Shovon, S. C., Mahjuba, A., Mehraj, H., & Jamal Uddin, A. F. M. (2014). Adoption of Improved Rice Cultivation Practices by Farmers in Relation to Their Characteristics. *International Journal of Business, Social and Scientific Research*, *2*(1), 13-19.

Tengli, M. B. and Sharma, O. P. (2017). Technological gap in adoption of improved paddy cultivation practices. *Int. J. Current Microbiology of Applied Sciences, 6(11):*1224-1229.

Thangjam, B. and Jha, K. K. (2020). Paddy Cultivation in Imphal, West Manipur: Status of Information Sources Utilization. *Plant Archives,* *20(1):*1229-1234.

Yambem, T., Singh, A. T. and Leihaothabam, N. S. (2020). Technological Gap in Relation to Hybrid Rice Production Practices. *Int. J. Curr. Microbiol. App. Sci, 9(3):*860-870.