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Adoption of minor millets (Kodo-kutki) production technology among the tribal farmers of Dindori district in Madhya Pradesh

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Abstract
The present study on adoption of minor millets (Kodo-kutki) production technology among the tribal farmers in Dindori district Madhya Pradesh was conducted during the year 2021-22 with the aim of understanding how tribal farmers of Dindori district (MP) are adopting minor millet (Kodo-kutki) production techniques. The research was focused on seven blocks within Dindori district namely Dindori, Shahpura, Bajag, Shamnapur, Amarpur, Karanjiya and Mehandwani. Among these, the Bajag block was intentionally selected due to its larger area and higher number of farmers engaged in minor millet cultivation. To gather primary data, a total of 120 respondents were selected using a proportionate random sampling method from five different villages i.e., Khapripani, Shitalpani, Shivri, Sunpuri and Khamhera. A well planned interview schedule was used and the investigator individually interviewed selected respondents to collect reliable data. The data analysis tools employed in this study included frequency, percentage, mean, standard deviation and correlation coefficient. The results revealed that 75.00% of respondents had fully adopted soil and land preparation, 63.33% of farmers had adopted seed and sowing management, 60.00% of them had adopted the practice of manure and fertilizer management, 58.33% of the respondents had adopted improved minor millet varieties. Additionally, 35.83 percent, 54.16% and 68.33% of respondents had adopted weed management, plant protection practices and harvesting management, respectively. Only 30.00% of respondents had adopted storage management practices for Kodo-kutki cultivation. The study also highlighted that a relatively low level of adoption of Kodo-kutki production technology was observed in 60.83% of respondents and a poor level of knowledge regarding these techniques was found in 71.66% of respondents.

Keywords: Adoption, minor millets, kodo-kutki, production technology, respondents, tribal farmers

Introduction
Minor millets often referred to as Nutri-cereals which are a group of small-seeded cereals belonging to the Poaceae family. Within this group, there are approximately 35 different species of grasses, encompassing 20 different genera, known as small millets. Among the cultivated species of small millets, the most important ones include finger millet, foxtail millet (Kagani), proso millet (Cheena), barnyard millet (Sawan), kodo millet (Kodo) and little millet (Kutki). Notably, barnyard millet is a type of minor millet stands out as an exceptionally rich source of calcium, containing about 10 times the calcium content of rice or wheat. Minor millets are also abundant in essential micronutrients such as magnesium, calcium, tryptophan, phosphorous, dietary fiber and various B vitamins (Amadou *et al.*, 2011; Izadi *et al.*, 2012) [1, 8]. These micronutrients function as antioxidants and play a crucial role in promoting human health (Saleh *et al.*, 2013; Muthamilarasana *et al.*, 2016) [13, 10]. Although, millets are often called "Orphan crops," or even "Lost crops" because they are stapled in the diets of the majority of the tribal communities who residing in the semi-arid, arid region, hilly and undulated areas of the world. These millets are considered as neglected crops but are significant in view of their contribution to maintain biodiversity and livelihood of the poor in various regions of the world (Belton and Taylor, 2004) [3]. Kodo (*Paspalum scrobiculatum*) and kutki (*Panicum sumatrense*) are the grains of millets species which are eaten like rice. Kodo and kutki grains contain 8.3 and 7.7 gm protein, respectively. The nutrients composition of Kodo-kutki millets contain protein (9.8 gm), carbohydrates (66.6 gm), crude fibre (9.0 gm) and Ash (3.3 gm) in hundred gm as of food it also contains calcium (35 gm), iron (1.7 gm), Thiamine (15 gm), Riboflavin (188 mg) and mineral matter (2.6 gm) in 100 gm of food and provided 353k/cal energy (Amadou *et al.*, 2011; Izadi *et al.*, 2012) [1, 8].

In India millets are cultivated in an area of 15.48 million ha producing 72.2 million tonnes with a productivity of 1111 kg per ha. Madhya Pradesh, Maharashtra, Rajasthan and Karnataka are the top most leading states of millets cultivation in India. Contribution of millets in total food grain production of India reduced from 22.17% to 6.94% over the last six decades from 1950-51 to 2011-12. Madhya Pradesh has highest area of small millets (32.4%) followed by Chhattisgarh (19.5%), Uttrakhand (8%), Maharashtra (7.8%), Gujarat (5.3%) and Tamil Nadu (3.9%). In Dindori district, Kodo-kutki crop is grown in 34.71 ha area with production of 32.11 tonnes and productivity of 925 kg per ha (Anonymous, 2020-2021) [2]. In Dindori district, they are cultivated by the tribals particularly Baiga and Gond community in most area in the slopes of the hills under the Tejaswini program of the district. Organic farming of Kodo and Kutki is being cultivated widely by women self-help groups.

Over the past two decades, there has been a significant decrease of more than 50% in the cultivation area of these cereals in the state, primarily because people have shifted their livelihoods towards wage labor and the purchase of subsidized rice and wheat. Farmers now tend to concentrate their limited time and land resources on cultivating paddy and maize. However, given the increasingly frequent drought conditions, they have come to realize that millets offer a more dependable option.

In Madhya Pradesh, the Dindori district stands out for having the largest area dedicated to the cultivation of Kodo-kutki. Particularly, the Bajag block within the Dindori district has gained recognition for its Kodo-kutki production, boosting the highest cultivation area in the district. It is widely acknowledged accepted that modern agricultural technology can significantly enhance crop production and productivity. The results of this study will not only aid in understanding the extent to which recommended Kodo-kutki production techniques are being adopted but also in identifying solutions and recommendations to address the challenges faced by Kodo-kutki growers during the adoption of these recommended cultivation practices. Additionally, the study's findings will serve as a foundation for developing a planting strategy aimed at increasing the adoption of the recommended Kodo-kutki production technology.

Materials and Methods

The study was conducted in the Dindori district of Madhya Pradesh state. The east central region comprises of seven blocks namely Dindori, Shamnapur, Mehandwani, Amarpur, Karanjiya, Bajag. Out of these, one block Bajag was selected purposively from the selected district because this block is having maximum tribal population among all other blocks of the district. From the selected block five villages namely, Khapripani, Shitalpani, Shivri, Sunpuri, Khamhera were selected through the random sampling method, thus, total 120 Kodo-kutki growers were selected purposively having large area under Kodo-kutki production technology.

For the purpose of the study, independent variables *viz*; age, education, farming experience, land holding, family income (Annual), marketing behaviour, innovativeness, social participation, achievement motivation, extension contact, no. of training attended and knowledge level were chosen to determine their relationship with the dependent variable i.e. adoption of minor millets production technology. Selection of variables included in the study were based on researcher adoption and extensive review of literature

Knowledge means refers to the acquisition of information relating to the recommended technology of Kodo-kutki crops by the respondents. It was on basis of scores to the answer of respondents to each selected question on Kodo-kutki production. The responses were recorded on 3-point continuum as complete, partial and nil knowledge and scores 3, 2 and 1 were assigned, to each statements.

Adoption level was operationalized as the extent to which an individual actually used the recommended components of Kodo- kutki production technology. The components of each selected practice were also made comprehensively with the constitution of agriculture scientists. The response of the Kodo-kutki growers were recorded on 3-point continuum as fully, partially and no adoption were score assigned to each question and were given of 3, 2 and 1 respectively. The data were statistically analysed by using mean, percentage, standard deviations and correlation coefficient.

Results and Discussion

Knowledge of respondents about Kodo-kutki production technology

The data regarding the respondents' knowledge of Kodo-kutki production technology is presented in Table 1. It is evident from Table 1 that 81.66% of the respondents possessed knowledge about soil and land preparation for Kodo-kutki crop cultivation. Additionally, 80.00% of the respondents were knowledgeable about seed and sowing management, while 66.66% of them had knowledge about manure and fertilizer management. Further observations from Table 1 revealed that 41.66%, 62.50%, and 65.83% of the respondents had knowledge about weed management, improved varieties and plant protection management of the Kodo-kutki crop, respectively. The majority of the respondents (75.83%) were well-informed about harvesting management, whereas only 35.00% of the respondents had knowledge about the storage management of Kodo-kutki crop.

Table 1: Distribution of respondents according to their knowledge about Kodo-kutki production technology

S. No.	Practices	Kodo-kutki growers N=120		Rank
		Frequency	Percentage	
1.	Soil and land preparation	98	81.66	I
2.	Seed and sowing management	96	80.00	II
3.	Manure and fertilizers management	80	66.66	IV
4.	Weed management	50	41.66	VII
5.	Improved varieties	75	62.50	VI
6.	Plant protection management	79	65.83	V
7.	Harvesting management	91	75.83	III
8.	Storage management	42	35.00	VIII

Overall knowledge level

From the Table 2, it was revealed that the majority of the respondents had a low level of knowledge (71.66%) followed by 22.50% and 5.84% of them having medium and high levels of knowledge about Kodo-kutki production technology, respectively. A similar finding was also reported by Ghuge (2015) [6].

Table 2: Distribution of respondents according to their level of overall knowledge about Kodo-kutki production technology

S. No.	Categories	Frequency	Percentage
1.	Low (up to 53 years)	86	71.66
2.	Medium (54 to 65 years)	27	22.50
3.	High (more than 65 years)	7	5.84
Total		120	100.00

Adoption of respondents about Kodo-kutki production technology

The data presented in Table 3 exhibited that 75.00% of the respondents had fully adopted with soil and land preparation practice for Kodo-kutki cultivation, whereas 63.33% of the farmers were adopted about seed and sowing management practices. Additionally, 60.00% of them embraced the practice of manure and fertilizer management. The data also showed that 58.33% of the respondents had adopted improved varieties of Kodo-kutki. When it comes to weed management and plant protection practices, only 35.83% and 54.16% of the respondents adopted them, respectively. Similarly, 68.33% of the respondents had implemented harvesting management, while only 30.00% of them adopted storage management practices. Similar results were also found by Sharma *et al.* (2005) [14] and Rajni, (2006) [12] on adoption of respondents for soybean and mushroom production technology, respectively. Significant relationship was observed between selected growers of groundnut and their adoption response by Nagaraj *et al.* (2000) [11] and size of land holding to be non-significant associated with adoption level of sustainable sugarcane cultivation practices by Maraddi *et al.* (2007) [9].

Table 3: Practice wise adoption of Kodo-kutki production technology by the respondents

S. No.	Practices	Kodo-kutki growers N=120		Rank
		Frequency	Percentage	
1.	Soil and land preparation	90	75.00	I
2.	Seed and showing management	76	63.33	III
3.	Manure and fertilizer management	72	60.00	IV
4.	Weed management	43	35.83	VII
5.	Improved varieties	70	58.33	V
6.	Plant protection	65	54.16	VI
7.	Harvesting management	82	68.33	II
8.	Storage management	36	30.00	VIII

Overall adoption level

The perusal of data present in Table 4 revealed that the majority of farmers had a low level of adoption (60.83%) followed by 28.34% and 10.83% of respondents who had a medium and high level of adoption of recommended practices for Kodo-kutki production technology. Present finding is corroborated with the research finding of Deshmukh (2014) [5]. Gyawali (2021) [7] reported that lack of domain-specific high yielding varieties, high preference towards major cereals and poor marketing in marginal areas are the constraints mainly considered for unexpected production of millet. Thorat (2013) [15] found that among the sunflower growers, extension contact had positive and significant relationship with adoption level of the respondents. Bondarwad (2009) [4] reported that significant percentage (54.17%) of the respondents were having medium level of social participation, followed by low level of social participation (40.83%) while, 5.00 per cent of the respondents were having higher level of social participation.

Table 4: Distribution of respondents according to their level of overall adoption of Kodo-kutki production technology

S. No.	Categories	Frequency	Percentage
1.	Low (Up to 52 years)	73	60.83
2.	Medium (53 to 64 years)	34	28.34
3.	High (More than 64 years)	13	10.83
Total		120	100.00

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