P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 6; June 2024; Page No. 459-463

Received: 13-04-2024
Accepted: 16-05-2024

Indexed Journal
Peer Reviewed Journal

Adoption of production technologies by minor millets growers in central dry zone of Karnataka

[1]Amrutha Basavaraju, [2]MH Shankara, [3]R Vinay Kumar, [4]AS Shashi Kiran and [5]TL Mohan Kumar

[1]M.Sc.Scholar, Department of Agricultural Extension, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

[2]Assistant Professor and Head, Department of Agricultural Extension, College of Agriculture Hassan, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

[3]Assistant Professor, Department of Agricultural Extension, Office of Vice Chancellor, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

[4]Assistant Professor, Department of Agricultural Economics, College of Agriculture Hassan, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

[5]Assistant Professor, Department of Agricultural Statistics, College of Agriculture Hassan, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

DOI: https://doi.org/10.33545/26180723.2024.v7.i6f.752

Corresponding Author: Amrutha Basavaraju

Abstract
Small-seeded cereals in the Poaceae family include little millets, which are referred to as nutri cereals. The most widely grown types of these include finger millet, foxtail millet, proso millet, barnyard millet, kodo millet, and little millet. There are about 35 grass species from 20 genera that are categorized as small millets. Minor millets are also abundant in critical micronutrients such fiber, B vitamins, tryptophan, phosphorus, magnesium, calcium, and manganese, which the body uses as antioxidants. Notably, minor millets demonstrate a remarkable potential to tolerate extreme climatic conditions and thrive in settings of limited water supply. It is crucial to create new, high-yielding strategies and put them into practice to extend the cultivation of these crops in order to improve nutritional security and to adopt new technologies and maintain rainfed agriculture.

Keywords: Minor millets, adoption

Introduction

Millets are the ancient crops of the mankind and has history of 5000 years.Millets were the first crops to be domesticated by the mankind in Asia and Africa which later spread across the globe as critical food sources to the evolving civilizations these are rainfed crops and are grown in regions with low rainfall areas. The word millet is derived from the French word “mille” which means that a handful of millet contains thousands of seed grains. Millets have gained increasing recognition worldwide due to their significant contributions to nutritional security and sustainable agriculture. These ancient grains have been an integral part of traditional diets in many regions, providing essential nutrients and fostering food diversity. In recognition of their importance, the United Nations declared 2023 as the International Year of Millets, aiming to raise awareness about their nutritional value and potential in achieving global food security. They are currently attracting interest on a global scale due to their potential to address current agricultural and nutritional concerns. Millets are a lifesaver in areas vulnerable to unpredictable rainfall and environmental pressures since they thrive in a variety of agro-climatic settings. The excellent nutritional value of millets, such as barnyard millet, which has calcium content 10 times higher than that of rice or wheat, is what truly sets them apart. Millets include important micronutrient antioxidants such magnesium, calcium, manganese, phosphorus, and B vitamins. Additionally, despite climate change, they are environmentally sustainable due to their resilience and low water needs. Nevertheless, despite these advantages, millets have not yet been widely adopted because to things like a lack of knowledge about their nutritional benefits, restricted access to improved varieties, and the predominance of rice and other grains. Despite the numerous benefits millets offer, their production has faced challenges, particularly among small and marginal farmers. Adoption of modern technologies is vital to enhance millet cultivation and improve agricultural practices. Promoting the adoption of modern technologies among farmers is crucial to unlock the full potential of millets for nutritional security and sustainable agriculture. Empowering farmers with the necessary knowledge and resources can enhance millet cultivation, improve crop yields, and contribute to a more resilient and food-secure future. To fully realize the

potential of these "smart grains" for a more robust and nutrient-dense future, comprehensive plans and policies that cover awareness campaigns, increased access to high-quality millet seeds, and market linkages with high adoption of modern technologies are urgently required.

Objective

To study the adoption of production technologies by minor millets growers

Methodology

The study focuses on minor millets cultivation in the Central Dry Zone of Karnataka and involved data collection from villages in the top two potential districts, namely Tumakuru and Chitradurga Districts respectively. Chicknayakanahalli and Hosdurga taluks were selected, and six villages were chosen from each taluk. Employing a simple random sampling technique, a total of 120 respondents, comprising 30 small farmers and 30 marginal farmers from each taluk, were selected for the study.

Results and Discussion

Adoption of production technologies by minor millet growers

The information in Table 01 emphasizes notable variations in the rates of production technology adoption between small and marginal farmers in the context of minor millet cultivation, with an emphasis on little millet and foxtail millet. The table contains 13 statements about various elements of the production technologies employed in millet cultivation. While observing the table, it is clear that many small farmers have fully adopted a number of production technologies like spacing (60.00%), seed rate (51.66%), time of planting (55.00%), FYM application (48.34%) and harvesting (60.00%). While in case of marginal farmers, they have adopted spacing technologies (78.33%), time of planting (55.00%) and harvesting (66.67%) were completely adopted.

The main reasons for full adoption could be majority of the small and marginal farmers had awareness about technical skills in sowing and spacing and timely sowing which could be more beneficial for them in gaining higher yields and avoid disease and pest attack incidence.

It is observed from the table that partial adoption of various production technologies was observed among both small and marginal farmers. Notably, small farmers show partial adoption in areas such as varieties (40.00%), seed treatment (70.00%), nutrient management (50.00%), intercropping (60.00%), weed management (56.66%), sorting, grading, and value-addition practices (66.66%), and storage facilities (48.33%). In contrast, marginal farmers exhibit partial adoption in seed rate (65.00%), FYM application (50.00%), nutrient management (56.66%), intercropping (45.00%), weed management (61.66%) and storage facilities (48.34%). The reasons behind this partial adoption trend appear to be a lack of knowledge about improved varieties, with concerns about high input costs and yield uncertainty. These factors collectively influence farmers to cautiously adopt specific technologies, indicating a need for targeted education and support to optimize adoption and enhance overall agricultural practices.

The percentage of small and marginal farmers who adopted important agricultural technologies is low. Approximately 45.00 per cent of small farmers have not adopted integrated pest and disease management practices While 55.00 per cent of marginal farmers have not adopted integrated pest and disease management practices, While 60.00 per cent have not adopted improved varieties, 50.00 per cent not adopted seed treatment technology, 65.00 per cent have not adopted sorting, grading, and value addition techniques respectively by marginal farmers.

These low adoption rates can be attributed to a number of things, including limited understanding, the lack of necessary inputs, resource limitations, conventional habits, and difficulties entering lucrative industries. To enable small and marginal farmers to adopt these advantageous methods, a complete strategy is required, comprising education and training, enhanced input accessibility, improved market links, supporting legislation, and strengthened extension services.

Small and marginal farmers are less likely to adopt modern agricultural practices due to a variety of reasons, such as lack of knowledge and awareness, financial constraints, insufficient access to quality inputs, attachment to traditional methods, risk aversion, poor rural infrastructure, market constraints, policy challenges, climate variability, and social and cultural influences. To overcome these obstacles, a comprehensive strategy is needed that includes offering specialized education and training, enhancing access to affordable and trustworthy.

Overall Adoption of Production Technologies by Minor Millet Growers

In accordance to the examination of Table 02, which includes responses from 120 respondents, farmers have fully adopted several production practices, such as spacing (69.16%) planting time (55.00%) and harvesting (63.33%). Significant proportion of farmers have however only partially adopted techniques like seed rate (56.66%), seed treatment (53.33%), FYM application (46.66%), nutrient management (53.33%), intercropping (52.50%), weed management (59.16%), sorting, grading, and value-addition practices (50.83%), and storage facilities (48.33%). While 40.83 per cent of farmers have non adopted improved varieties and 50.00 per cent have not adopted integrated pest and disease management practices respectively. This partial adoption and non adoption among farmers may be attributed to factors such as small and marginal farmers' insufficient land holdings, financial constraints, yield uncertainties, insufficiently remunerative prices discouraging millet cultivation, challenges resulting from the lack of suitable processing inputs, inadequate infrastructure, limited access to credit, knowledge gaps, market uncertainty, labour intensiveness, high initial costs in processing technology set up, conventional thinking, and restricted access to pertinent information. It is essential to address this broad range of issues in order to encourage farmers to adopt new production technologies, increase agricultural productivity, and improve farmer livelihood.

Table 1: Adoption Level of Production Technologies by Minor Millet Growers

(n =120)

Sl. No	Technologies	Adoption Level											
		Small Farmers (n_1=60)						Marginal Farmers (n_2=60)					
		Full adoption		Partial adoption		Non adoption		Full adoption		Partial adoption		Non adoption	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Varieties	23	38.33	24	40.00	13	21.67	05	08.34	19	31.66	36	60.00
2	Spacing	36	60.00	24	40.00	00	00.00	47	78.33	13	21.67	00	00.00
3	Seed rate	31	51.66	29	48.34	00	00.00	21	35.00	39	65.00	00	00.00
4	Time of planting	33	55.00	27	45.00	00	00.00	33	55.00	27	45.00	00	00.00
5	Seed treatment	05	08.34	42	70.00	13	21.66	08	13.34	22	36.66	30	50.00
6	FYM application	29	48.33	26	43.33	05	08.34	07	11.66	30	50.00	23	38.34
7	Nutrient Management	26	43.33	30	50.00	04	06.67	15	25.00	34	56.66	11	18.34
8	Inter cropping	10	16.66	36	60.00	14	23.34	01	01.67	27	45.00	32	53.33
9	Weed Management	11	18.34	34	56.66	15	25.00	09	15.00	37	61.66	14	23.34
10	Integrated pest and disease management practices	08	13.34	25	41.66	27	45.00	03	05.00	24	40.00	33	55.00
11	Sorting, grading & value addition practices	11	18.34	40	66.66	09	15.00	00	00.00	21	35.00	39	65.00
12	Harvesting	36	60.00	24	40.00	00	00.00	40	66.67	20	33.3	00	00.00
13	Storage facilities	17	28.33	29	48.33	14	23.34	13	21.66	29	48.34	18	30.00

Table 2: Overall Adoption Level of Production Technologies by Minor Millet Growers

(n=120)

Sl. No.	Technologies	Adoption Level					
		Full Adoption		Partial Adoption		Non-Adoption	
		No.	%	No.	%	No.	%
1	Varieties	28	23.33	43	35.83	49	40.83
2	Spacing	83	69.16	37	30.83	00	00.00
3	Seed rate	52	43.33	68	56.66	00	00.00
4	Time of planting	66	55.00	54	45.00	00	00.00
5	Seed treatment	13	10.33	64	53.33	43	35.83
6	FYM application	36	30.00	56	46.66	28	24.16
7	Nutrient Management	41	34.16	64	53.33	15	12.50
8	Inter cropping	11	09.16	63	52.50	46	38.33
9	Weed Management	20	16.66	71	59.16	29	24.16
10	Integrated pest and disease management practices	11	09.16	49	44.16	60	50.00
11	Sorting, grading & value addition practices	11	09.16	61	50.83	48	40.00
12	Harvesting	76	63.33	44	36.66	00	00.00
13	Storage facilities	30	25.00	58	48.33	32	26.66

Adoption Level of Production Technologies by Minor Millet Growers

The analysis presented in Table 03 highlights the ranking and mean scores assigned to recommended production technologies for different categories of farmers. Among 13 suggested production technologies, spacing emerged as the top choice, securing the 1st rank with a mean score of 1.60 for small farmers, 1.78 for marginal farmers, and 3.38 for the overall farmer group. Following closely, time of planting secured the 2nd rank with mean scores of 1.55 for small and marginal farmers, and 3.10 for overall farmers. Seed rate secured the 3rd position among small and marginal farmers, with mean scores of 1.51 and 1.35, respectively. For overall farmers, harvesting shared the 3rd rank with a mean score of 2.95. FYM application earned the 4th rank with a mean score of 1.40 for small farmers, and among marginal farmers, harvesting took the 4th spot with a mean score of 1.33. Seed rate was also ranked 4th for overall farmers, with a mean score of 2.86. Nutrient management stood at the 5th rank for all farmer categories, with mean scores of 1.36, 1.06, and 2.43 for small farmers, marginal farmers, and overall farmers, respectively. Notably, integrated disease and pest management received the lowest ranking of 11th among small farmers, accompanied by a mean score of 0.66. Similarly, sorting, value addition, and grading practices shared the 11th rank, each with a mean score of 0.35. Among all these technologies, integrated disease and pest management received the lowest rank of 13th for overall farmers, with a mean score of 1.18. This thorough assessment offers insight on the preferences and perceived usefulness of various agricultural technologies among various kinds of farmers.

Table 3: Adoption Level of Production Technologies by Minor Millet Growers

(n=120)

Sl. No.	Recommended Technologies	Adoption Level					
		Small Farmers (n_1=60)		Marginal Farmers (n_2=60)		Overall (n=120)	
		Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
1	Varieties	1.16	VI	0.48	X	1.65	IX
2	Spacing	1.60	I	1.78	I	3.38	I
3	Seed rate	1.51	III	1.35	III	2.86	IV
4	Time of planting	1.55	II	1.55	II	3.10	II
5	Seed treatment	0.86	X	0.63	VIII	1.50	X
6	FYM application	1.40	IV	0.73	VII	2.11	VI
7	Nutrient Management	1.36	V	1.06	V	2.43	V
8	Inter cropping	0.93	IX	0.48	X	1.41	XI
9	Weed Management	0.93	1X	0.91	V1	1.83	VIII
10	Integrated pest and disease management practices	0.66	XI	0.50	IX	1.18	XIII
11	Sorting, grading & value addition practices	1.03	VIII	0.35	XI	1.40	XII
12	Harvesting	1.60	I	1.33	IV	2.95	III
13	Storage facilities	1.05	VII	0.91	VI	1.95	VII

Overall Adoption Level of Production Technologies by Growers

From Table 04 it is observable in small millet growers that nearly half of them belonged to medium level of adoption category (50.00%), followed by high adoption rate (43.34%) and low adoption (06.66%).Whereas in case of marginal farmers, more than half of the farmers had low adoption rates (61.66%) followed by medium level (33.34%) and high level (05.00%). When it comes to the pooled data of 120 members, it was evident that two fifth of the millet growers (41.66%) belonged to medium level of adoption followed by low adoption (34.16%) and high adoption rates (24.18%). With chi square value of 13.93 showed that adoption level of production technologies was significant at 1%. One of the main reasons for the varying adoption levels appears to be the lack of awareness among the growers about the importance of millets and the potential benefits of adopting modern production technologies. Addressing these barriers requires a comprehensive approach that involves providing targeted education and training, improving access to affordable and reliable inputs, creating better market opportunities, implementing, and supporting policies, and developing resilient and context-specific farming practices, ultimately empowering small and marginal farmers to embrace more effective and sustainable agricultural methods.

Table 4: Categorization of Overall Adoption Level of Production Technologies by Minor Millet Growers

Sl. No	Category	Small Farmers (n_1=60)		Marginal Farmers (n_2=60)		Total (n=120)	
		No.	%	No.	%	No.	%
1	Low (<12.50)	04	06.66	37	61.66	41	34.16
2	Medium (12.50 to 15.28)	30	50.00	20	33.34	50	41.66
3	High (>15.28)	26	43.34	03	05.00	29	24.18
	Mean= 13.89 ½ SD =2.78						
	Chi Square = 13.93**	** Significant at 1% level of significance					

Comparative Analysis of Adoption Level of Production Technologies by Growers

It is noticed from Table 05 that small farmers had better adopted the minor millets production technologies than marginal farmers with the mean rank of 83.62 in case of small farmers, when compared to marginal farmers (37.38) with Z value 7.32 at 5% level of significance.

Table 5: Comparative Analysis of Adoption of Production Technologies among Minor Millet Growers

Category	Mean Rank	(Mann-Whitney U) Z Value
Small Farmers	83.62	7.32*
Marginal Farmers	37.38	

* Significant at 5% level of significant

Conclusion

Overall, among the growers surveyed, it was found that 41.66% belong to the medium adoption level, 34.16% to the low adoption level, and 24.16% to the high adoption level. One of the main reasons for the varying adoption levels appears to be the lack of awareness among the growers about the importance of millets and the potential benefits of adopting modern production technologies. Addressing these barriers requires a comprehensive approach that involves providing targeted education and training, improving access to affordable and reliable inputs, creating better market opportunities, implementing and supporting policies, and developing resilient and context-specific farming practices, ultimately empowering small and marginal farmers to embrace more effective and sustainable agricultural methods

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