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STUDY ON PRODUCTION AND UTILIZATION OF MINOR MILLETS IN ANDHRA PRADESH INDIA

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ABSTRACT

The study was conducted during October 2024 at Andhra Pradesh. The study focused on the production, consumption and utilization of minor millets, identified the challenges faced by the farmers, and gathered their recommendations for overcoming these issues. In India, 86% of farmers were small and marginal, facing significant financial challenges. Meanwhile, malnutrition and hidden hunger remained widespread among women and children. Furthermore, climate change threatened global agricultural productivity in the coming decades. To address these critical issues, millets, often referred to as a "smart food," played an essential role. India was the leading producer of millets in 2019, with a yield of 10.9 million tons (Das *et al*., 2019). Around one-fifth of the total millet production was used for self-consumption, while the rest was directed toward marketing, feed, and seed. Key challenges highlighted by farmers included the lack of processing units, inadequate remunerative prices, and changing dietary preferences. To overcome these barriers, farmers suggested improving prices, setting up more processing units, and enhancing capacity-building programs on millet production techniques. To increase demand and combat hidden hunger, especially among children, the government should integrate millets into the Public Distribution System and expand the mid-day meal program in schools. Furthermore, providing incentives and subsidies for new start-ups could encourage the production of millet-based value-added foods.

Keywords **:** Consumption, constraints and suggestions, millets, production.

Introduction

India is primarily an agrarian society, with 55% of its population reliant on agriculture. According to the 2015–16 Agriculture Census, 85% of Indian farmers are classified as small or marginal. The country's agricultural production is focused on key crops such as wheat, rice, and others. By the end of the 2022 fiscal year, India aimed to produce over 288 million metric tons of grains, utilizing 55% of its total cultivated land. On a global scale, India ranks as the third-largest producer of cereals, following the United States and China, with an 11% share of the global market. Technological innovations have significantly increased the productivity and yields of major crops like rice, wheat, and maize, outpacing the production of less prominent crops, such as minor millets. These crops have a long history of cultivation of more than 5000 years and grown in many states (Singh and Sharma, 2018). Das and Rakshit (2016) also reported droughts, pests, diseases, socio economic factors and diversion of lands to other remunerative crops as the reasons for reduction in millet area at global level. Traditional grains, particularly minor millets, hold immense potential in addressing these challenges due to their nutritional richness, climate resilience, and low resource requirements. However, despite their inherent advantages, minor millets have remained marginalized in agricultural systems and dietary patterns (Bhullar and Bhullar, 2019, DeFries and Herold, 2020). In an environment of changing climate and exhausting

resources, alternate crops suited to sustainable production systems may be given focus to ensure food and nutritional security. Also, the hidden hunger due to heavy reliance on two or three major staple grains affects people worldwide. Hence, diversifying the diet with underutilized crops such as small millet is a sustainable way to healthy living (Asha *et al*., 2024).

Millets were characterized by their remarkable ability to survive in less fertile soil, drought-resistant, resistance to pests and diseases, short growing season (Devi *et al*., 2014). Nutritional virtues, minor millets exhibit remarkable agronomic resilience, thriving in diverse agro-climatic conditions and requiring minimal inputs such as water and fertilizers. This inherent adaptability positions them as indispensable allies in the quest for climate-resilient agriculture (Sapna *et al*., 2024). Millets are less sensitive to climate variation than rice (Davis *et al*., 2019). Major millets in India include sorghum, bajra, and maize, while minor millets consist of finger millet, foxtail millet, barnyard millet, and kodo millet. (Sangappa *et al*., 2023). Minor millets, encompassing a diverse array of grains such as finger millet (ragi), foxtail millet, pearl millet, and others, represent a rich repository of nutrition, adaptability, and cultural heritage that remains largely untapped on a global scale (Anonymous, 2019, Sachan *et al*., 2024, Goron and Raizada, 2015). Millets have short growing season and can be very well fitted into multiple cropping systems both under irrigated as well as dry farming conditions. Millets are also unique due to their short growing season. Theses millets are ready to harvest in between 70-80 days. Millets are amazing in their nutrition content (Subramanian *et al*., 2010; Trivedi *et al*., 2015). Each of the millets is three to five times nutritionally superior to the widely promoted rice and wheat in terms of proteins, minerals and vitamins. They can provide nutritious grain and fodder in a short span of time. Their long storability under ordinary conditions has made them "famine reserves". The government has renamed jowar, bajra, ragi and other millets as “Nutri Cereals”, dispensing with the nomenclature “coarse cereals (Bhat *et al*., 2018). Behera (2017) studied “Assessment of the State of Millet Farming in India” and observed that millets are highly tolerant to high temperature, drought and floods because of effective root system. The cereal-centric diet based on rice, wheat, and maize seems unsustainable in the long run and poses a significant challenge in ensuring food and nutritional security worldwide. A total of 60% of the calorie intake is contributed by three crops-rice, wheat, and maize (Potaka *et al.*, 2021) whereas nearly half of the people suffering from hidden hunger lives in India (Ritchie *et al.,* 2018). The incorporation of minor millets into dietary patterns holds significant promise in combating malnutrition, addressing dietary deficiencies, and promoting overall health and wellbeing, particularly in regions where access to diverse and nutritious foods is limited. (Krishna and Vishnuvardhana, 2018).

Millets have considerable potential to generate livelihoods, increase farmers’ income and ensure food and nutritional security by addressing the SDGs (Muneer *et al*., 2023, Yadav *et al*., 2018, Borah and Basumatary, 2015; Roy *et al*., 2015). Farmer Producer Organizations (FPOs) focus on supporting small and marginal farmers throughout various stages of agricultural production. They help farmers by securing inputs, facilitating access to finance, connecting their produce to networks, ensuring processing and quality control, establishing market linkages, and offering training and technical guidance (Singh and Kumar, 2021). Rao and Tonapi (2022) stated that the processing of minor millets has improved over the years, but the lack of availability of de-hullers and separators with more than 80 per cent efficiency in primary processing is a concern as it determines the secondary processing and share of producers in consumers' rupee. A study was undertaken to explore the production, and utilization of minor millets in selected districts of Andhra Pradesh.

Materials and Methods

The study was conducted in 2024 at selected districts of Andhra Pradesh to assess the socio-economic status, production factors, challenges, and suggestions related to minor millet cultivation. As of 2021–22, Andhra Pradesh accounted for 5.00% of the country's area and 5.13% of its production of minor millets. Between 1970 and 2022, the state experienced annual decreases in area and production at rates of 5.01% and 3.39%, respectively. Seven districts with significant areas of minor millet cultivation were chosen for the study: Kurnool, Ananthapur, AlluriSitaramaraju, Nandyal, Prakasam, Parvathipuram Manyam, and Srisatyasai. The area shares of minor millets in these districts were 15.89%, 12.09%, 10.11%, 7.12%, 5.2%, 1.88%, and 0.52% respectively as of 2021–22. A total of 210 respondents were randomly selected, with 30 respondents from each district.

For this research, data on the area, production, and productivity of minor millets from 1950–2022 was sourced from Indiastat.com. The data was analyzed using tabular and percentage analysis to derive meaningful insights. The cost of cultivation was determined using the standard methodology established by the Directorate of Economics and Statistics,

Government of India. To identify and prioritize the constraints in millet cultivation, the Garret ranking method was applied. Statements for ranking were formulated through discussions with experts and were subsequently ranked according to the standard Garret ranking procedure. In this method, respondents were asked to rank the statements based on their perception and these ranks were converted into percent scores as:

$$\text{Percentage score} = 100\ (R_{ij}–0.5)/N_j$$

where R_{ij}, Rank given for i_{th} item by j_{th} individual, N_j, Number of items ranked by j_{th} individual. For each statement, the scores of individual respondents were added and divided by the total number of statements to rank. These mean scores for all the statements were ranked to identify the critical constraints. The respondents were asked to give their suggestions to overcome the constraints as perceived by them. An open-ended schedule was developed to measure the suggestions. They were measured using frequency and percentage. Finally, the suggestions were ranked from one to seven based on the descending order of frequencies obtained.

Results and Discussion

These findings indicated a growing consumer demand for delicious millet products and easy-to-follow recipes. Encouraging the use of millets in packaged or commercial foods could provide farmers with incentives to cultivate them, create new business opportunities, and enhance their quality of life. Millet processing was labour-intensive, but this could be alleviated through agricultural mechanization, particularly for smaller millets. The government should introduce incentive-driven programs to promote millet farming and develop policies specifically targeting both major and minor millet varieties. Examples of such policy initiatives included integrating millets into school meal programs, ensuring Minimum Support Prices (MSP) for all millets, facilitating fair millet procurement, and distributing them through the Public Distribution System (PDS). Between 1950–1951 and 2021–2022, India's minor millet production dropped significantly from 1,750 th t to 370 th t. Initially, between 1950 and 1960, millet production surged at an impressive rate of 15.71%. However, from 1950–51 to 2019–2020, there were substantial declines in minor millet production, with decreases of 9.27, 28.32, 17.03, 48.0, 34.92, and 16.06 % recorded. Despite this, the overall productivity of minor millets increased from 380 Kg ha^{-1} in 1950–51 to 789 Kg ha^{-1} in 2021–22, as depicted in Table 1. Notably, minor millet output fell by 4% in 1960 and 14% in 1980, but then experienced a growth of 21.97% between 1980 and 1990.

Table 1: Year wise Area, Production and Productivity of minor millets

Year	Area (in '000 ha)	Production (in '000 t)	Productivity (kg ha^{-1})
1950–1951	4605	1750	380
1951–1952	4764	1915	402
1952–1953	5044	1926	382
1953–1954	5677	2477	436
1954–1955	5630	2495	443
1955–1956	5335	2070	388
1956–1957	4976	1930	388
1957–1958	4870	1733	356
1958–1959	5159	2179	422
1959–1960	5148	2025	393
1960–1961	4955	1909	385
1961–1962	4868	2050	421
1962–1963	4772	1855	389
1963–1964	4621	2022	438
1964–1965	4558	1964	431
1965–1966	4564	1555	341
1966–1967	4584	1488	325
1967–1968	4857	1907	393
1968–1969	4746	1804	380
1968–1970	4733	1732	366
1970–1971	4783	1988	416
1971–1972	4477	1669	373
1972–1973	4265	1552	364
1973–1974	4567	1966	431
1974–1975	4466	1613	361

1975–1976	4672	1924	412
1976–1977	4680	1752	374
1977–1978	4574	2070	453
1978–1979	4397	1894	431
1979–1980	4002	1425	356
1980–1981	3976	1574	396
1981–1982	3787	1638	433
1982–1983	3500	1229	351
1983–1984	3638	1676	461
1984–1985	3214	1194	372
1985–1986	3155	1217	386
1986–1987	2975	1162	391
1987–1988	2901	1169	403
1988–1989	2743	1164	424
1989–1990	2703	1306	483
1990–1991	2447	1190	486
1991–1992	2088	882	423
1992–1993	1983	869	438
1993–1994	1888	917	486
1994–1995	1792	798	445
1995–1996	1662	779	469
1996–1997	1601	728	455
1997–1998	1529	645	422
1998–1999	1495	671	449
1999–2000	1411	618	438
2000–2001	1424	587	412
2001–2002	1311	577	440
2002–2003	1201	459	383
2003–2004	1191	564	473
2004–2005	1101	478	434
2005–2006	1064	472	443
2006–2007	1010	480	475
2007–2008	1039	551	530
2008–2009	905	445	491
2000–2010	831	382	460
2010–2011	800	442	553
2011–2012	798	452	565
2012–2013	754	436	578
2013–2014	682	430	630
2014–2015	590	386	654
2015–2016	650	391	602
2016–2017	619	442	714
2017–2018	546	439	804
2018–2019	454	333	734
2019–2020	458	371	809
2020–2021	444	347	781
2021–2022	440	370	789
Total	212149	87899	33195
Mean	2947	1221	461
Standard Deviation (S.D.)	1767.2	659.4	114.6

The graph indicated a recent decline in the cultivation area of minor millets over the past decade, whereas productivity had shown an upward trend. Production of minor millets decreased from 2010–2011 to 2015–2016, but then increased from 2015–2016 to 2017–2018, largely due to the increased productivity of minor millets during that period.

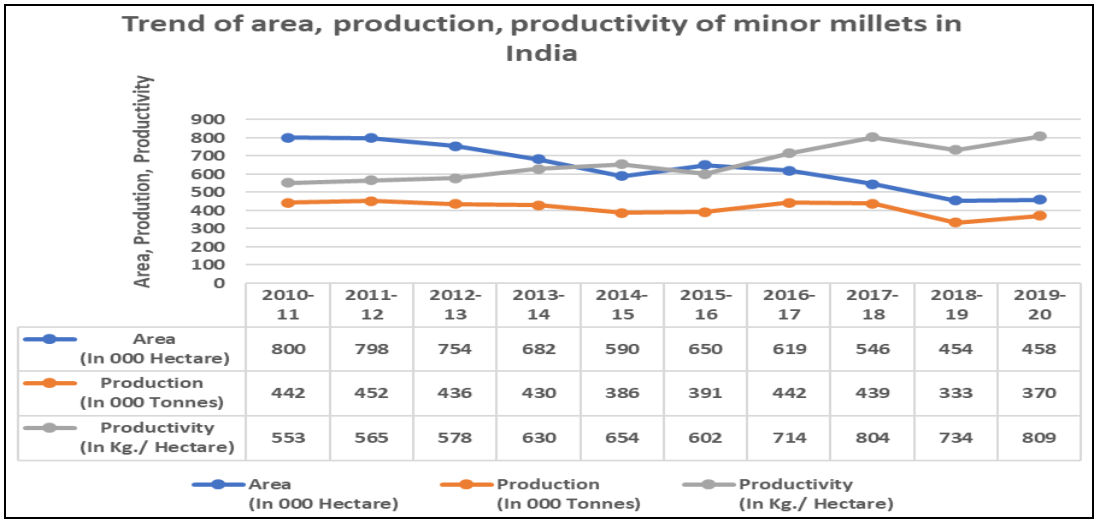

Fig. 1 : Trend of area, production, productivity of minor millets in India

Table 2 : Selected State-wise Area, Production and Productivity of minor millets in India (2021–2022)

State	Area (in '000 ha)	Production (in '000 t)	Productivity (in Kg-ha^{-1})
Andhra Pradesh	22.00	19.01	864
Arunachal Pradesh	26.82	27.62	1030
Assam	4.97	3.26	656
Bihar	2.17	1.64	753
Chhattisgarh	84.62	21.83	258
Dadra and Nagar Haveli	-	-	-
Goa	-	-	-
Gujarat	8.46	13.04	1541
Himachal Pradesh	2.41	2.34	972
Jammu and Kashmir	8.11	2.14	264
Jharkhand	-	-	-
Karnataka	26.00	20.23	778
Kerala	0.05	0.04	745
Madhya Pradesh	78.00	69.42	890
Maharashtra	37.00	16.72	452
Meghalaya	2.89	2.72	941
Nagaland	8.83	9.98	1130
Odisha	35.25	18.01	511
Puducherry	0.06	0.15	2375
Punjab	-	0.00	-
Rajasthan	6.50	4.29	660
Sikkim	2.05	2.13	1038
Tamil Nadu	24.47	30.51	11247
Telangana	-	-	-
Tripura	1.62	1.30	801
Uttar Pradesh	12.00	9.18	765
Uttarakhand	49.00	71.00	1449
West Bengal	0.76	0.38	502
India	440	370	789

In 2021, minor millet cultivation in India spanned 440 th ha, yielding 370 th t at a productivity rate of 789 kg ha^{-1}, as indicated in Table 2. During the 2021–22 period, the states of Chhattisgarh, Madhya Pradesh, and Uttarakhand led in millet cultivation, with areas of 84.62 th, 78.00 th, and 49.00 th ha, respectively.

Uttarakhand recorded the highest production at 71.00 th t, followed by Madhya Pradesh with 69.42 th t. Regarding productivity, Puducherry ranked first with 2375 kg ha^{-1}, followed by Gujarat at 1541 kg ha^{-1}, and Uttarakhand at 1449 kg ha^{-1}. Andhra Pradesh cultivated millets on 22.00 th ha, producing 19.01 th t at a productivity rate of 864 kg ha^{-1}.

State wise consumption trends of minor millets

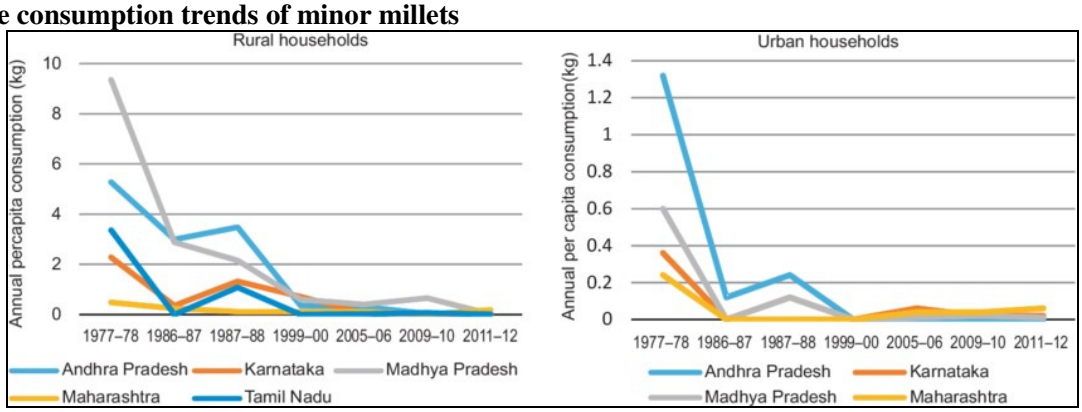

Fig. 2 : State wise annual percapita consumption of minor millets

According to Figure. 2, there has been a noticeable decrease in the consumption of minor millets across several states where consumption historically was higher. Per-capita consumption showed variability before the 2000s but had since declined to minimal levels. As of 2011–12, rural households were consumed between 0.01 to 0.18 kg annually person^{-1}, while urban households consumed between 0 to 0.06 kg. In Andhra Pradesh, rural areas previously averaged 5.86 kg person^{-1} annually, with urban areas consuming 1.3 kg, but current consumption has drastically dropped to just 20 g.

Cultivation aspects:

Based on the primary survey findings, farmers predominantly cultivated crops under rainfed conditions without employing fertilizers or irrigation, relying on local crop varieties. On average, each farmer owned 2 ha of land, with nearly 98.33% being owned and the remainder leased. Minor millets were typically grown during the *kharif* and *summer* seasons. A significant majority, over 70%, of the cultivated land relied on dry or rainfed conditions, while 23% had access to irrigation, although minor millets were exclusively rainfed crops. Table 3 detailed the input usage and economic aspects associated with minor millet cultivation in the study area. Despite owning 2 ha of land on average, farmers allocated only a third of it to millet cultivation, utilizing the remainder for other crops such as red gram, groundnut, and maize. Nearly 96% of the surveyed farmers opted for local varieties due to limited availability of high-quality seeds. Millets, especially minor ones, had received less research and development attention compared to staples like rice and wheat. The Government of India's 2014 report highlighted the release of only 114 varieties across different minor millets, including 21 varieties of kodo millet, 20 of little millet, 31 of foxtail millet, 18 of barnyard millet, and 24 of proso millet (Anonymous, 2014). Research efforts, both conventional breeding and biotechnological advancements, were limited, as noted by Pal *et al.* (2023). Genome sequencing has been completed for foxtail millet, and draft sequencing has been attempted for proso millet and barnyard millet, but not for little millet and kodo millet. Farmers surveyed identified the scarcity of quality seeds as a major constraint. Additionally, minor millets were typically cultivated under rainfed conditions without irrigation or fertilizers, indicating marginal cultivation practices in these regions. Economic feasibility assessments were conducted, calculating net returns over total costs, which amounted to Rs. 55,000 ha^{-1}, and net returns over cost A_2+ imputed value of family labor (FL), totalling Rs. 12,500 ha^{-1}.

Table 3 : Input use and economics of cultivation of minor millets

Particulars	**Values**
Land size (ha)	2
Per cent irrigated area	0
Fertilizer (kg ha^{-1})	0
Varieties (% of farmers):	
Local	97.33
High yielding varieties	2.67
Yield (q ha^{-1})	37.50
Cost Returns^{-1} (Rs. ha^{-1}):	
Gross income	67500
Cost A_2+ FL	55000
Total cost (Cost C_2)	12500
Net returns over total cost	55000
Net returns over cost A_2 + FL	12500

Utilization pattern:

Utilization and consumption were equally important as improving production when considering millets in general and minor millets in particular. The minor millets produced by farmers in the study area were utilized for their own consumption, feed for livestock and seed etc.

Table 4 : Utilization pattern of millets

Utilization	Quantity (Share)
Total production (q)	5.02 (100%)
Self-consumption (q)	1 (20%)
Feed (q)	0.18 (3%)
Seed (q)	0.03 (1%)
Marketed (q)	3.77 (76%)

Approximately one-fifth of the total production of minor millets was utilized for self-consumption, while the rest was divided for marketing (76%), feed (4%), and seed (1%) purposes, as detailed in Table 4. On average, each farmer yielded 5.02 q of minor millets, with 76% of this amount designated for sale in the market. Farmers typically sold their harvest through local merchants or commission agents at an average price of Rs. 4,080 q^{-1}. In the study area, nearly 60% of the total marketable surplus was sold, although prices varied significantly between districts, ranging from Rs. 1,500 to Rs. 4,500 q^{-1}. Unlike other millets, minor millets do not benefit from a Minimum Support Price (MSP). Implementing a stable pricing mechanism could incentivize more farmers to cultivate minor millets. According to Lokesh *et al*. (2022), integrating small-scale producers into the value chain through the establishment and strengthening of Farmer Producer Organizations (FPOs) could help alleviate some of the risks and challenges faced by farmers in this sector. Farmer Producer Organizations (FPOs) had the potential to strengthen collective efforts in seed production, procurement, access to credit, adoption of advanced technologies, reduction of transaction costs, facilitation of value addition, and fostering equitable partnerships with private entities. Survey respondents indicated that they primarily consume minor millets cooked similarly to rice. However, they displayed limited awareness of other value-added products derived from minor millets. In contrast, respondents from different districts were aware that millets could be processed into flour (atta), but none were familiar with products like rawa, puffs, flakes, etc. It was crucial to enhance awareness among farmers about the potential for various value-added products and provide training on different processing technologies. There was a growing demand for millet-based ready-to-eat foods owing to increasing awareness of their health benefits. Nonetheless, many surveyed farmers remained unaware of the potential to process millets into diverse products that could meet consumer demand and command higher prices. According to Asha *et al*. (2024), creating awareness, offering training, establishing village-level processing facilities, and developing the millet value chain were essential steps to encourage farmers to produce millet-based value-added products. While there were numerous state and central government programs aimed at promoting millet production, utilization, and consumption, more efforts were needed to integrate this crop into mainstream agricultural practices. Distribution of high-quality free millet seeds and training on millet cultivation practices for increasing the economic stability were the key factors for this improvement (Sangappa *et al*., 2024).

Constraints

Major constraints faced by the farmers were ranked based on the garret ranking technique and listed in Table 5.

In an environment of changing climate and exhausting resources, alternate crops suited to sustainable production systems might be given focus to ensure food and nutritional security. Also, the hidden hunger due to heavy reliance on two or three major staple grains affected people worldwide. Hence, diversifying the diet with underutilized crops such as minor millet was a sustainable way to healthy living. A study was undertaken to explore the production, consumption and utilization of minor millets in selected districts of Andhra Pradesh. The study revealed that lack of processing units (68.57) was the major constraint followed by lack of remunerative price (64.58), change in dietary habits (55.80), unavailability of high yielding varieties (51.75), lack of knowledge and adoption of improved varieties and technologies by the farmers (47.82), limited market opportunities (46.50), lack of public awareness about nutritional benefits of millets (44.02), low productivity of millets when compared to other crops (42.78), non availability of labour (32.79) and some millets require multiple processing (21.87) were the constraints expressed by the farmers in the study area. Sangappa *et al*. (2023) suggested that millet value chain could be revamped by the adoption of improved technologies, bettermarket linkages, and increased investment in infrastructure as in traditional supply chain, millet farmers were not getting remunerative prices to their production because of the existence of various actors or middle men in the chain. Das and Rakshit (2016) also reported that droughts, pests, diseases, socio

economic factors and diversion of lands to other remunerative crops as the reasons for reduction in millet area at global level.

Table 5 : Major production constraints faced by farmers in millets cultivation.

(n=210)

S. No.	Constraints	Mean Garrett score	Garrett rank
1	Lack of knowledge and adoption of improved varieties and technologies by the farmers	47.82	5
2	Limited market opportunities	46.50	6
3	Lack of public awareness about nutritional benefits of millets	44.02	7
4	Lack of processing units	68.57	1
5	Low productivity of millets when compared to other crops	42.78	8
6	Lack of remunerative price	64.58	2
7	Non availability of labour	32.79	9
8	Some millets require multiple processing	21.87	10
9	Change in dietary habits	55.80	3
10	Unavailability of high yielding varieties	51.75	4

Suggestions given by the farmers to overcome constraints in minor millets cultivation

Major suggestions given by the farmers were ranked based on the frequency and percentages were presented in Table 6. Finally, the suggestions were ranked from one to ten based on the descending order of frequencies obtained.

The study revealed that government should provide remunerative price (53.33%) followed by establishment of processing units (50.00%), conducting more number of capacity building programmes on millets production technology (46.66%), supply of quality seed (41.45%), availability of labour (33.80%), proper marketing channel should be provided (30.00%) and government should make provisions for incentives to encourage millets cultivation (24.76%) were the suggestions given by the farmers to overcome constraints in minor millets cultivation.

Table 6 : Suggestions given by the farmers to overcome constraints in minor millets cultivation. (n=210)

S. No.	Suggestions	Frequency	Percentage	Rank
1	Supply of quality seed	87	41.45	IV
2	conducting more number of capacity building programmes on millets production technology	98	46.66	III
3	Availability of labour	71	33.80	V
4	Government should provide remunerative price	112	53.33	I
5	Establishment of processing units	105	50.00	II
6	Proper marketing channel should be provided	63	30.00	VI
7	Government should make provisions for incentives to encourage millets cultivation.	52	24.76	VII

Conclusion

This three-decade study (1990–91 to 2019–20) on minor millets shows that despite declines in area and productivity, overall production has increased. Rising demand for millets and their health benefits offers long-term growth potential. However, taste remains key to consumer acceptance, highlighting the need for tasty millet-based products and easy recipes. Integrating millets into packaged foods can boost cultivation, create livelihoods, and open business opportunities. Mechanization is essential to reduce labor in millet processing. Policy support like MSPs, inclusion in PDS and midday meals, and fair procurement is crucial to promote both major and minor millet cultivation.

References

Anonymous, 2019. FAO, 2019. The State of Food Security and Nutrition in the World. Rome: Food and Agriculture Organization of the United Nations.

Anonymous (2014). Government of India (GoI). 2014. Status paper on coarse cereals (sorghum, pearl millet, finger millet, small millets, maize and barley). Directorate of millets development, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Asha, D., Anbukkani, P., Alka, S., Malhotra, S. K., Girish, K. J., Pradeep, P., 2024. Study on production and utilization of minor millets in Madhya Pradesh. *Indian Journal of Agricultural Sciences,* **94** (3), 303–307.

Behera, M.K. (2017). Assessment of the state of millets farming in India. *MOJ ecology & Environmental Sciences,* **2**(1), 16-20.

Bhat, S., Nandini, C., Tippeswamy, V., Prabhakar (2018). Significance of small millets in nutrition and health -A review. *Asian Journal* of *Dairy* and *Food Research,* **37**(1), 35-40.

Bhullar, G.S., Bhullar, N,K. (2019). Finger millet as a rich source of calcium: A review on processing, properties, and utilization. *Journal of Food Science Technology,* **56**(1), 1–10.

Borah, R., Basumatary, A. (2015). Agricultural diversification towards millet cultivation for sustainable livelihood in Assam. *Economic Affairs,* **60**(4), 659–666.

Das, Rakshit, S. (2016). Millets, their importance, and production constraints. *Biotic Stress Resistance in Millets*, 3–19.

Das, B., Satyapriya, S.P., Sangeetha, V., Bhowmik, A., Ray, P. (2019). Growth and Instability in Area, Production Productivity and Consumption of Millets in India: an Analysis. *Indian journal of Extension Education*, **55**(4), 158–161.

Davis, K. F., Chhatre, A., Rao, N. D., Singh, D., DeFries, R. (2019). Sensitivity of grain yields to historical climate variability in India. *Environmental Research Letters,* **14**(6), 064013.

DeFries, R.S., Herold, M. (2020). Land use change and emissions from food production: A brief overview. *Environmental Research Letters,* **15**(7), 071001.

Devi, P.B., Vijayabharathi, R., Sathyabama, S., Malleshi, N.G., Priyadarisini, V.B. (2014). Health benefits of finger millet (*Eleusine Coracana* L.) polyphenols and dietary fiber: a review. *Journal of Food Science and Technology*, **51**, 1021-1040.

Goron, T.L., Raizada, M.N. (2015). Genetic diversity and genomic resources available for the small millet crops to accelerate a New Green Revolution. *Frontiers in Plant Science,* **6**,157.

Lokesh, K., Chetan, R., Dudhagara, Ashish, B., Mahera, Sathish, K. M., Patel, H.D., (2022). Millets: The future smart food. *The Pharma Innovation Journal,* **11**(4), 75–84.

Potaka, J., Anitha, S., Tsusaka, T. W., Botha, R., Budumuru, M., Upadhyay, S., Kumar, P., Mallesh, K., Hunasgi, R., Jalagam, A.K., Nedumaran, S. (2021). Assessing millets and sorghum consumption behaviour in urban India: A large-scale survey. *Frontiers in Sustainable Food Systems* **5**, 680777.

Krishna, D., Vishnuvardhana, R. (2018). Role of minor millets in food and nutritional security: A review. *International Journal of Current Microbiology and Applied Sciences,* **7**(10), 3860–3865.

Pal, B., Mukhopadhyay, A., Kishore, A., Agarwal, A. K., Debangshi, U., Verma H.P., Sunil Jathar, G. (2023). Revitalizing the potential of minor millets: Agrarian constraints, possible solutions and future roadmap. *International Journal of Environment and Climate Change,* **13**(7), 328–338.

Muneer, S., Swamy, D.K., Lavanya, T., Supriya, K. (2023). COVID-19 pandemic: impact of agricultural labour migration on income levels of farmers in Telangana. *International Journal of Bio-resource and Stress Management,* **14**(1), 169–177.

Rao, B. D., Tonapi, V. (2022). Status of minor millets processing technologies in India: An overview. *Orphan Crops for Sustainable Food and Nutrition Security*, 281–292.

Ritchie, H., Reay, S. D., Higgins, P. (2018). Quantifying, projecting and addressing India's hidden hunger. *Frontiers in Sustainable Food Systems,* **2**: 11.

Roy, A., Singh, U., Dkhar, S. (2015). Food security in north east region of India: A State-wise Analysis. *Agricultural Economics Research Review,* **28**(1), 259–266.

Sachan, K., Saxena, A., Kumar, S., Mishra, A., Verma, A., Tiwari, D.D. (2024). Urban Soil Health Check and Strategies for Monitoring and Improvement. *Journal of diversity and gender studies,* **3**(1), 20–28.

Sangappa., Rafi, D., Chandini, K., Charishma, E., Meghana, G. (2024). Livelihood Security Index Assessment among Millet Farmers in North Eastern Hill (NEH) States of India. *International Journal of Bio-resource and Stress Management,* **15**(12), 01-07.

Sangappa., Rafi, D., Laxmi, B., Charishma, E., Srinivasa, B. K. (2023). Strengthening millet value chain through farmer producer organizations. *Indian Journal of Extension Education,* **59** (3), 26–31.

Sapna, Vijay Kumar, Kushal Sachan, Abhishek, S., (2024). IoT: Innovations Revolutionizing Agricultural Practices for Sustainability. *Journal of diversity and gender studies,* **3**(1), 29–36.

Singh, K., Kumar, P. (2021). Livelihood vulnerability assessment to climate variability and change: Insights from Indo-Gangetic plains of India. *Journal of Environmental Management,* **234**(3), 472–483.

Singh, T.S., Sharma, H.O. (2018). Trend and Growth of Small Millets Production in Madhya Pradesh as Compared to India. *International Journal of Agriculture Sciences,* **10**(1), 4983-4986.

Subramanian, A., Nirmalakumari, A., Veerabadhiran, P. (2010). Trait based selection of superior kodo millet (*Paspalum scrobiculatum* L.) genotypes. *Electronic Journal of Plant Breeding,* **1**, 852-855.

Trivedi, A.K., Arya, L., Verma, M., Verma, S.K., Tyagi, R.K., Hemantranjan (2015). Genetic variability in proso millet (*Panicum miliaceum*) germplasm of central Himalayan region based on morpho-physiological traits and molecular marhers. *Acta Physiologiae Plantarum,* **23**, 37-53.

Yadav, S., Das, A., Lal, R., Babu, S., Meena, S., Das, K. (2018). Conservation tillage and nutrient management practices for improving productivity and profitability of maize-millet cropping systems in the North Eastern Hill region of India. *Soil and Tillage Research,* **180**(1), 20–32.