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FARMER'S PERCEPTION OF MILLETS, PRODUCTION, CONSTRAINTS, VARIETAL PREFERENCE AND THEIR MANAGEMENT

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ABSTRACT

*This study investigates the demographic characteristics, cropping patterns, and economic viability of small millet cultivation, specifically focusing on Ragi and Kodo, in Chhattisgarh state, with particular attention to Jashpur district It also examines "**farmer's perception of millets, production, constraints, varietal preference and their management"**. A survey of 100 households revealed a diverse mix of farm sizes, including 15 marginal, 34 small, 40 medium, and 11 large farms. The male population slightly outnumbered the female population (58.51% vs 41.49%), with the majority (71%) belonging to Scheduled Tribes. Family size varied, with large farms having an average of 9 members, while small farms had an average of 5.29 members. The study found that during the kharif season, cropping intensity was highest on marginal farms (179.01%), while large farms showed the lowest (150.33%). Small millet production in Chhattisgarh displayed fluctuating trends: from 119,000 hectares in 2014-15, the area decreased to 44,000 hectares by 2022-23, although productivity improved from 232 kg/ha in 2014-15 to 492 kg/ha in 2022-23. The Compound Growth Rate (CGR) for area showed a decline of -9.62%, but the growth rate for productivity was positive at 9.92%. Economic analysis of Ragi cultivation revealed that the average cost of cultivation per hectare was Rs. 28,049.52, with human labor and bullock/machinery costs being the largest expenses. The income over different cost categories (A1, A2, B1, C1, etc.) showed that larger farms had higher returns, with income over Cost A1 and A2 averaging Rs. 35,091.86 per hectare. Similarly, Kodo cultivation required an average cost of Rs. 19,333.51 per hectare, with human labor as the primary expense. The income per hectare from Kodo cultivation varied from Rs. 34,544.64 (Cost A1) to Rs. 12,666.89 (Cost C3), demonstrating the profitability benefits of larger farms. Farmers faced significant challenges in both cultivation and marketing, including lack of irrigation, high-yielding seeds, and poor market access, particularly in terms of small marketable surplus and low producer share in the consumer price. The study emphasizes the need for targeted interventions to enhance resource availability, technical knowledge, and market infrastructure to improve the sustainability and profitability of small millet farming in the region.*

Keywords: Rice, Variety, Economic, Farmer, Market

INTRODUCTION

Millets represent one of the earliest domesticated cereal crops, possessing considerable historical and agricultural relevance. Their cultivation dates back to ancient civilizations, particularly in tropical regions of Asia and Africa. Among the global

producers, India holds a dominant position, accounting for approximately 41% of the world's millet production. According to data from the Indian Institute of Millets Research (IIMR, Hyderabad, 2021–2022), the country produced 15.53 million metric tons from 12.45 million hectares, reflecting a productivity of 1247 kg per hectare. Small millets form a significant subset within this production, comprising 12.46 million metric tons from 8.87 million hectares. India's leadership in millet cultivation is particularly evident in the production of barnyard millet and finger millet, contributing 99.90% and 53.30% to global output respectively. Recognizing their nutritional and agronomic potential, the Government of India declared 2018 as the 'National Year of Millets' to promote their cultivation and integrate them into strategies addressing food and nutritional security. Further, the United Nations General Assembly designated 2023 as the 'International Year of Millets', a resolution aimed at enhancing global awareness regarding the health benefits and environmental adaptability of these grains. Millets, classified under the Poaceae family, are commonly referred to as 'Nutri-cereals' or 'dryland cereals' due to their high nutritional value and resilience in arid environments. They encompass a variety of species such as sorghum (jowar), pearl millet (bajra), finger millet (ragi), and small millets including proso, barnyard, Kodo, and foxtail millets. These crops are nutritionally superior to many conventional cereals, being gluten-free, easily digestible, and rich in essential micronutrients such as iron, magnesium, phosphorus, and potassium. Notably, finger millet is recognized for its exceptional calcium content, which is approximately ten times higher than that of rice or wheat (Joseph and Shanmugam, 2013). Millets are predominantly cultivated in dry land and rain-fed ecosystems that require minimal irrigation and lower input costs. Their ability to thrive in low-fertility soils and challenging agro-climatic conditions makes them a suitable option for sustainable agriculture, especially in regions such as Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Karnataka, and Tamil Nadu. Promoting millet cultivation in such areas enhances agricultural sustainability, supports climate-resilient cropping systems, and contributes to rural economic development. In terms of global sorghum cultivation, approximately 41.31 million hectares were under production in 2018–2019, yielding 59.83 million metric tonnes (www.indiastal.com). India accounted for 16% of this production. Domestically, sorghum occupied 40.9 million hectares, producing 3.48 million tonnes at an average productivity of 849 kg per hectare during the same period. It is cultivated in both Kharif and Rabi seasons, with major production in Maharashtra, Karnataka, Gujarat, Madhya Pradesh, and Andhra Pradesh. In Andhra Pradesh, the Kurnool district emerged as a major sorghum-producing region, with a total production of 60,252 tonnes and a productivity of 935 kg per hectare in 2018–19 (Directorate of Economics and Statistics, 2019). Finger millet, with a cultivation area of 1.19 million hectares and production of 1.98 million tonnes (average productivity: 1661 kg/ha), is another key millet crop in India. Karnataka dominates both in terms of area (56.21%) and production (59.52%), followed by Tamil Nadu, Uttarakhand, and Maharashtra. Beyond India, finger millet is cultivated in regions such as Sri Lanka, Nepal, Uganda, Madagascar, Malaysia, and Japan *(http://agritech.tnau.ac.in).*

MATERIALS AND METHODS

For the purpose of this study, the Sarguja Division in Chhattisgarh was intentionally chosen due to its significant role in small millet cultivation. This division comprises five districts: Sarguja, Surajpur, Jashpur, Balrampur-Ramanujganj, and Manendragarh. From these, Jashpur District was specifically selected based on its prominence in millet production. Within Jashpur District, which includes eight administrative blocks—Jashpur, Kunkuri, Bagicha, Duldula, Kansabel, Manora, Pathalgaon, and Pharsabahar—three blocks were selected purposively: Bagicha, Kunkuri, and Jashpur. The selection was based on their relatively higher cultivation area and production levels of small millets. From the Bagicha Block, the villages of Runi, Mudhi, and Chhichhali were identified for the study. In the Jashpur Block, Aara, Ghoraghat, Jashpur, and Kanmora were chosen, while Bander Chunwa, Ghuitangar, and Behrakhar were selected from the Kunkuri Block. The villages were chosen specifically for their high production levels and area under small millet cultivation. The Probability Proportionate to Size (PPS) sampling method was utilized to select respondents for data collection. A total of 100 respondents were surveyed, and both primary and secondary data were collected to ensure the robustness of the study.

RESULTS AND DISCUSSIONS

1. To examine the growth rate of area, production & productivity of small millets in Jashpur district and Chhattisgarh state

Table No.1 Area, production, and productivity of small millets in Chhattisgarh

S. No.	Year	Area (in 000 ha)	Production (in 000 tonnes)	Productivity (Kg/ ha)
1.	2014-15	119.00	27.60	232.00
2.	2015-16	94.80	15.00	158.00
3.	2016-17	89.80	25.40	285.00
4.	2017-18	89.47	21.13	236.00
5.	2018-19	86.25	28.61	332.00
6.	2019-20	63.37	19.04	300.00
7.	2020-21	84.62	21.83	258.00
8.	2021-22	52.35	26.23	501.00
9.	2022-23	44.00	22.00	492.00
10.	2023-24	48.00	19.00	390.00
	CGR	-9.62	-0.50	9.92
	LGR	-8.62	0.68	10.50
	Significant	NS	NS	NS

Note: NS Significant at 5 % of probability

(Source of Directorate of Economics and Statistics 2022-2023)

Table 1 presents the data on the area, production, and productivity of small millets in the Chhattisgarh district for 2014–2024. The analysis reveals fluctuations in both the cultivated area and production levels, alongside variations in productivity over the years. In 2014-15, the area under cultivation was 119.00 hectares, with a total production of 27.60 thousand tonnes, resulting in a productivity of 232 kg per hectare. By 2015-

16, the area dropped to 94.80 hectares, and production decreased to 15.00 thousand tonnes, leading to a reduced productivity of 158 kg per hectare. Over the subsequent years, area and production saw moderate variations, with the highest production recorded in 2018-19 at 28.61 thousand tonnes, accompanied by a productivity of 332 kg per hectare. However, after 2019-20, the area under small millet cultivation started to decline more sharply, reaching just 44.00 hectares in 2022-23, with a productivity of 492 kg per hectare. In the most recent year, 2023-24, a slight recovery in area was observed, rising to 48.00 hectares, but production decreased to 19.00 thousand tonnes, with a corresponding productivity of 390 kg per hectare. The Compound Growth Rate (CGR) for area indicates a negative trend of -9.62%, reflecting a consistent reduction in the area under cultivation over the years. Conversely, the growth rate for production (LGR) is positive at 0.68%, suggesting a modest recovery in production despite the decline in cultivated area. Notably, the productivity growth rate stands at a higher 9.92%, highlighting a significant improvement in yield per hectare over the period. However, despite these observed trends, statistical analysis reveals that none of the changes in area, production, or productivity were statistically significant.

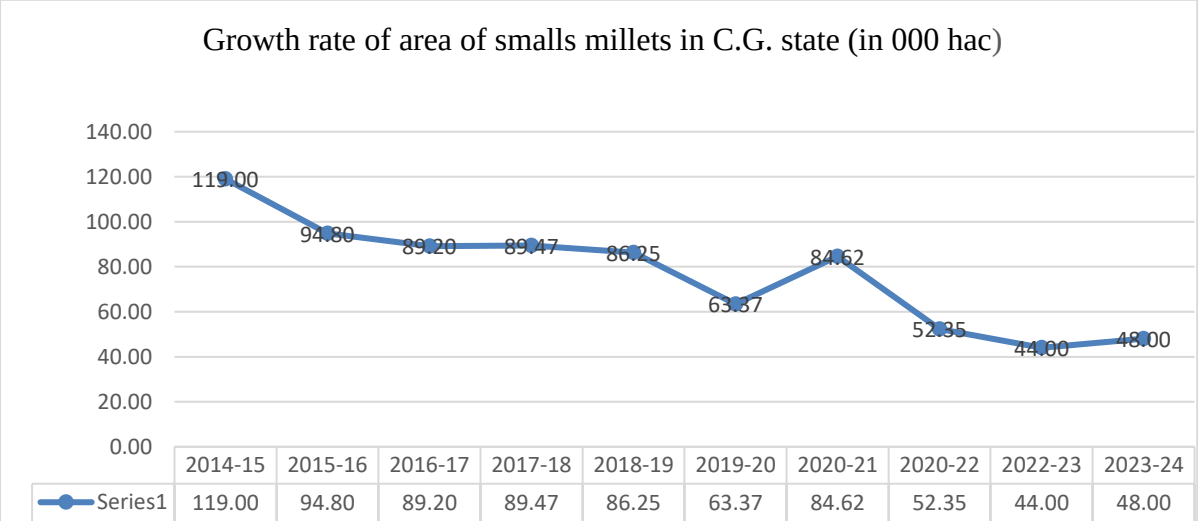

Fig 1 Growth rate of area of small millets in C.G. state (in 000 hac)

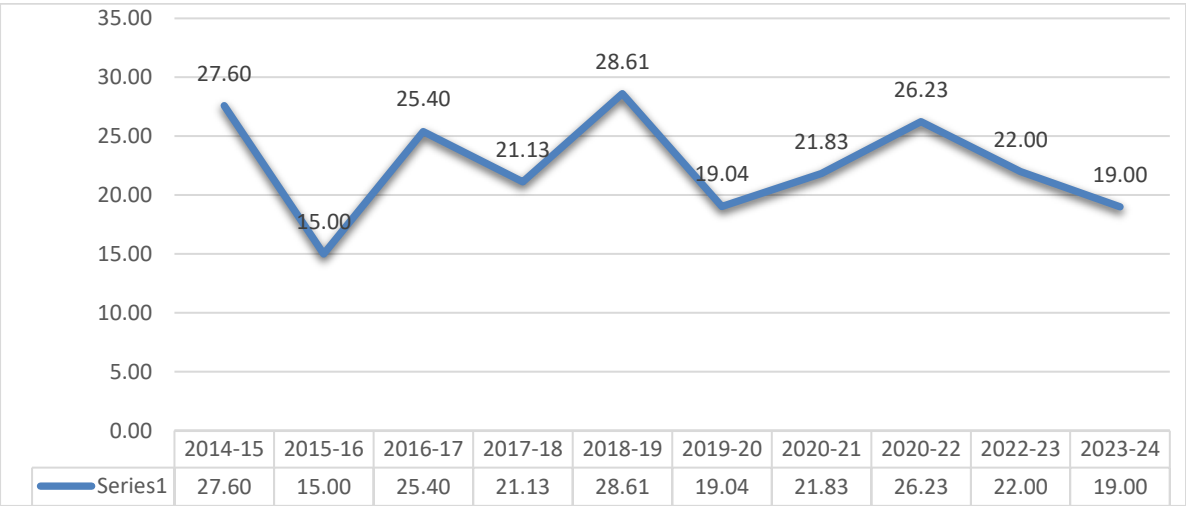

Fig 2 Growth rate of production of small millets in C.G. state (in 000 tonnes)

Table No. 2 Area, Production, and Productivity of small millets in Jashpur district

S. No.	Year	Area (hac)	Production (tonne)	Productivity (Kg/ha)
1.	2014-15	3325	952	286
2.	2015-16	3113	733	235
3.	2016-17	3037	1112	366
4.	2017-18	1820	820	451
5.	2018-19	2758	1113	407
6.	2019-20	2618	955	365
7.	2020-21	2627	899	341
8.	2021-22	2513	659	262
9.	2022-23	3795	1463	386
10.	2023-24	4679	1513	323
	CGR	-95.2	-94.9	-99.7
	LGR	1854.2	5.9	-0.16
	Significant	NS	NS	NS

Note: Ns significant at 5 % of probability

(Source of Rural Agriculture Extension Officer 2014-2024)

Table 2 provides a decade-long overview (2014–2024) of the area, production, and productivity of small millets in Jashpur district. Over the years, the area under cultivation has exhibited inconsistency, with a notable increase observed in 2023–24, reaching 4,679 hectares, compared to 3,325 hectares in 2014–15. Production figures followed a similar trend, peaking at 1,513 tonnes in 2023–24, up from 952 tonnes recorded in 2014–15. Productivity levels also fluctuated during this period. The highest productivity was recorded in 2017–18 at 451 kg per hectare, although this declined to 323 kg per hectare by 2023–24. An analysis of the Compound Growth Rate (CGR) indicates a downward trajectory across all three parameters. The CGR for area was calculated at -95.17%, while production saw a similar negative rate of -94.90%. Productivity, too, declined sharply with a CGR of -99.72%, suggesting an overall regression in small millet performance over the studied period. Despite some yearly increases, statistical testing revealed that these variations were not significant (NS) at the 5% level. This indicates that the observed changes lack sufficient consistency or strength to be considered statistically meaningful. The findings suggest that while fluctuations exist, they are not supported by significant trends, highlighting the need for further research into the factors influencing small millet cultivation in the region.

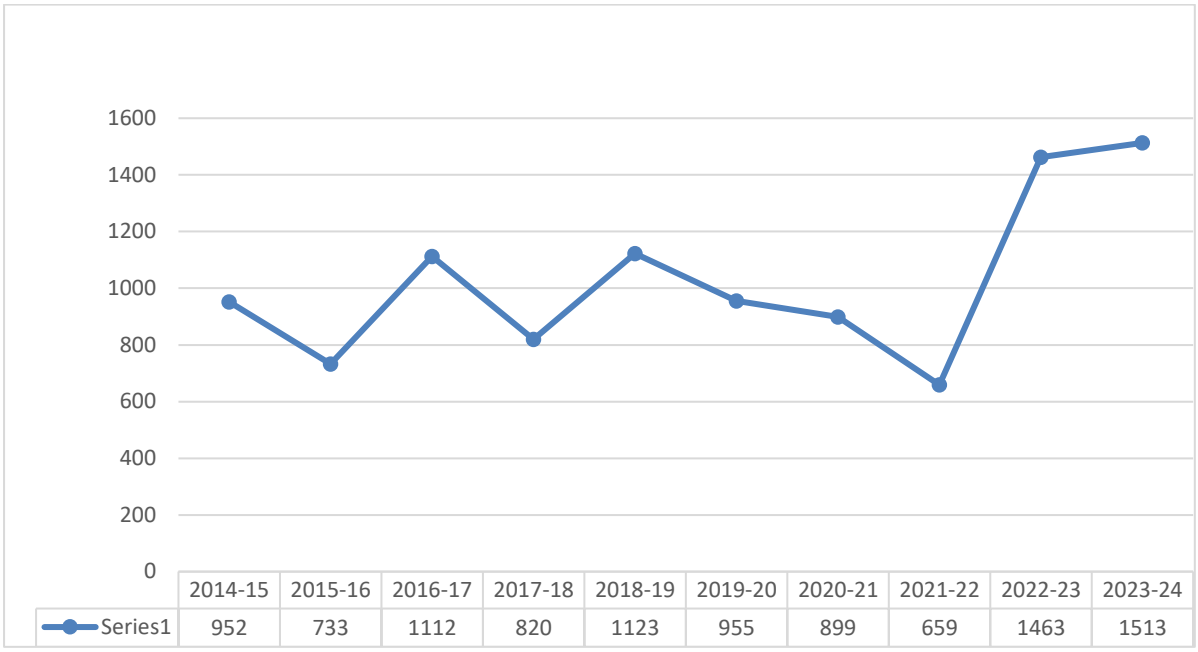

Fig 3. Growth rate of production of small millets in Jashpur (tonne)

2. To find the cost returns in the production and marketing of small millets in the study area

Table 3. Cost of cultivation of Kodo

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
A.	**Variable Cost**					
B.						
1.	**Human labour**					
a.	Family labour	7712.36	6832.18	5323.81	4758.31	6131.66
		(25.05)	(36.10)	(26.67)	(21.47)	(31.72)
b.	Hired labour	3677.61	6130.34	7964.94	10260.55	7000.86
		(22.07)	(18.36)	(20.66)	(24.95)	(22.71)
	Total labour	11389.96	12962.52	13188.75	15018.86	13140.02
		(37.00)	(38.82)	(34.21)	(36.52)	(42.58)
	2. Bullock and machinery power					
a.	Bullock	535.71	647.70	885.32	1321.32	847.51
		(1.74)	(1.94)	(2.30)	(3.21)	(2.75)
b.	Machinery	1187.26	1632.61	17772.00	1946.72	1634.65
		(3.86)	(4.89)	(4.60)	(4.73)	(5.30)
	Total	1722.97	2280.31	2657.33	3268.04	2482.16
		(5.60)	(6.83)	(6.89)	(7.95)	8.04)
3.	Seed	460.00	460.00	460.00	460.00	460.00
		(1.49)	(1.38)	(1.19)	(1.12)	(1.49)

4.	Manure and fertilizer	1720.00	1720.00	1720.00	1720.00	1720.00
		(5.59)	(5.15)	(4.46)	(4.18)	(5.57)
5.	Plant protection	174.91	210.82	216.05	223.22	206.25
		(0.57)	(0.63)	(0.56)	(0.54)	(0.67)
6.	Irrigation charges	243.64	245.61	269.73	283.05	260.51
		(0.79)	(0.74)	(0.70)	(0.69)	(0.84)
7 .	Miscellaneous cost	312.03	316.77	321.47	333.62	320.97
		(1.01)	(0.95)	(0.83)	(0.81)	(1.04)
8.	Interest (4%) on working capital	640.04	727.50	753.33	852.27	743.60
		(2.08)	(2.18)	(1.95)	(2.07)	(2.41)
	Total variable cost	16664.46	18923.86	19586.67	22159.06	19333.51
	C. Fixed cost					
9.	Land revenue	10.00	10.00	10.00	10.00	10.00
		(0.03)	(0.03)	(0.03)	0.02)	(0.03)
10.	Depreciation (10%)	118.73	163.26	177.20	194.67	163.46
		(0.39)	(0.49)	(0.46)	(0.47)	(0.53)
11.	Interest (6%) on fixed capital	537.13	725.50	861.77	1044.04	792.11
		(1.74)	(2.17)	(2.24)	(2.54)	(2.57)
12.	Rental value of owned land	13456.00	13567.00	13678.00	13768.00	10560.00
		(43.71)	(4063)	(35.48)	(33.48)	(34.22)
	Total Fixed cost	14121.85	14465.76	18970.00	18970.00	11525.58
		(45.87)	(43.32)	(49.20)	(46.12)	(37.35)
C	Total cost (A+B)	30786.31	33389.63	38556.67	41129.06	30859.09
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Table 3 presents the detailed cost structure of kodo millet cultivation per hectare, indicating that higher costs are associated with farms adopting modern agricultural practices. The elevated expenditure observed on such farms is primarily attributed to the greater use of improved inputs such as certified seeds, chemical fertilizers, irrigation facilities, and hired labour. These farms typically benefit from better access to credit and more favorable economic conditions, which enable them to invest more extensively in production. Consequently, higher input use on these farms translates into increased yields and improved returns compared to farms with lower investment capacities. The average cost of cultivation per hectare for kodo was calculated at Rs. 19,333.51, with variations ranging from Rs. 16,664.46 on marginal farms to Rs. 22,159.06 on large farms. Among the various input categories, human labour constituted the most significant component of total costs, encompassing both family and hired labour. The mean labour cost stood at Rs. 13,140.02 per hectare, varying from Rs. 11,389.96 on marginal farms to Rs. 15,018.86 on large farms. The second-largest cost component was associated with animal power and machinery, with an average expenditure of Rs. 2,482.16 per hectare, increasing by farm size. Seed costs remained constant at Rs. 460.00 per hectare across all farm categories, suggesting standardized pricing or uniform usage rates. Expenditure on manure and fertilizers averaged Rs. 1,720.00 per hectare, with no significant variation across farm sizes. Additional cost components included interest on working capital (Rs. 743.60; 2.41%), miscellaneous expenses (Rs. 320.97; 1.04%), irrigation charges (Rs. 260.51; 0.84%), and plant protection and depreciation (Rs. 206.25; 0.67% each). Furthermore, interest on owned fixed capital was calculated at Rs. 743.60, mirroring the rate applied to working capital. An important economic cost included in the analysis was the imputed rental value of owned land, estimated at Rs. 13,456.00 per hectare for a single crop season. This reflects the opportunity cost of land use in the absence of tenancy arrangements and provides a more comprehensive view of total cultivation expenses.

Table No.4. Break–up of total cost, cost concept-wise income over different costs of Kodo (Rs. / Ha)

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
	A. Break–up of cost					
1.	Cost A1	23192.68	26789.13	34579.10	39071.62	25855.44
2.	Cost A2	23192.68	26789.13	34579.10	39071.62	25855.44
3.	Cost B1	23729.81	27518.51	35505.02	40266.04	26702.14
4.	Cost B2	37185.81	41085.51	49183.02	50826.04	37262.14
5.	A2+FL	30905.04	33621.31	39802.91	43829.93	31987.10
6.	Cost C1	31442.16	34350.69	40728.82	45024.35	32833.81
7.	Cost C2	44898.16	47917.69	54406.82	55584.35	43393.81
8.	Cost C3	49387.98	52709.45	59847.51	61142.78	47733.19
	Gross income from different crops					

1.	Income over cost A1	28711.32	28809.27	30622.66	31184.54	34544.64
2.	Income over cost A2	28711.32	28809.27	30622.66	31184.54	34544.64
3.	Income over cost B1	28174.19	28079.89	29696.74	29990.12	33697.94
4.	Income over cost B2	14718.19	14512.89	16018.74	19430.12	23137.94
5.	Income over cost C1	20461.84	21247.71	24472.94	25231.81	27566.27
6.	Income over cost C2	7005.84	7680.71	10794.94	14671.81	17006.27
7.	Income cost C3	2516.02	2888.95	5354.25	9113.38	12666.89

Table 4 shows the average income per hectare over cost A1, cost A2, cost B1, cost B2, cost C1, cost C2, and income over cost C3 were worked out to Rs.34544.64, Rs. 34544.64, Rs. 33697.94, Rs. 23137.94, Rs. 27566.27, Rs. 17006.27, and Rs. 12666.89, respectively. The income from different costs was increasing with the increase in farm size, which indicates the scale to economy was operating in the kodo cultivation.

Table 5. Yield and benefit of kodo at sample farm (Rs. / ha)

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
1.	Main yield (qt / ha)	10.00	10.00	10.00	10.00	10.00
2.	Price/qt (MSP)	3300.00	3300.00	3300.00	3300.00	3300.00
3.	Gross returns (Rs / ha)	51904.00	55598.40	65201.76	70756.16	60400.08
4.	Cost cultivation (Rs. / ha)	44898.16	4784.39	53273.64	56135.78	42374.66
5.	Net returns (Rs. / ha)	7005.84	7753.01	11928.12	14120.38	18025.42
6.	Cost of production (Rs. / qt)	4489.82	4349.58	4129.74	4038.55	3546.00
	Input–output ratio	1.16	1.16	1.22	1.25	1.20

Table 5 presents the values for net income, family labor income, and farm business income per hectare on the sample farms across various size groups, as shown in Table 5 and Figure 6. According to the data, the average net income per hectare amounted to Rs. 18,025.42, while the average family labor income was Rs. 6,131.66. Moreover, the average input-output ratio for kodo millet cultivation on the sampled farms was 1.20:1, signifying that for every unit of input, the output yielded 1.20 units. This indicates a moderate return on investment, with input resources generating slightly more output, reflecting an efficient use of inputs in kodo millet farming.

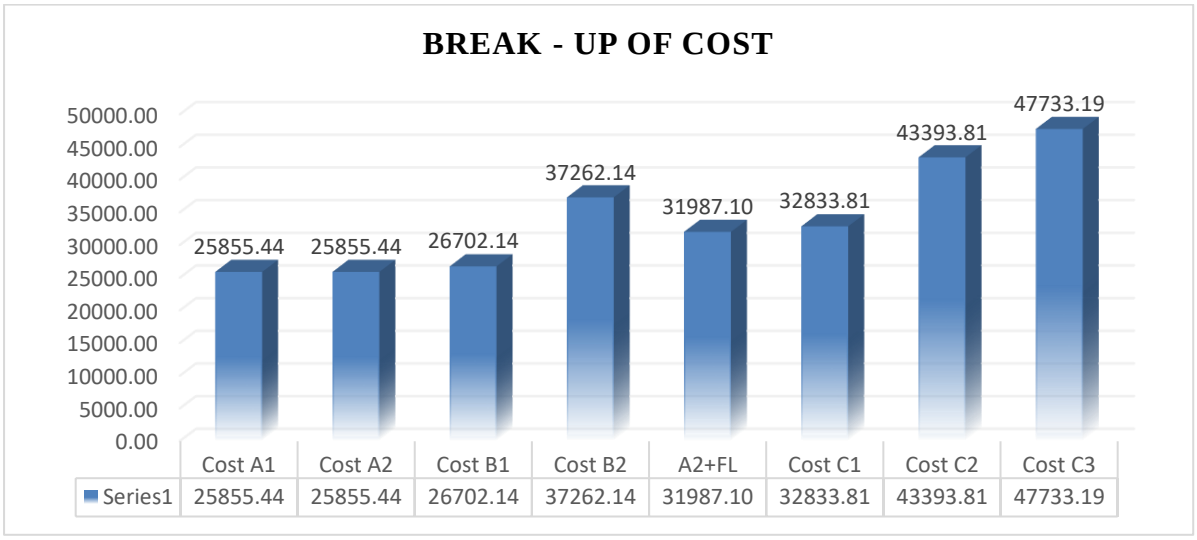

Fig 4. Cost and returns based on the cost concept of kodo (Rs. / ha)

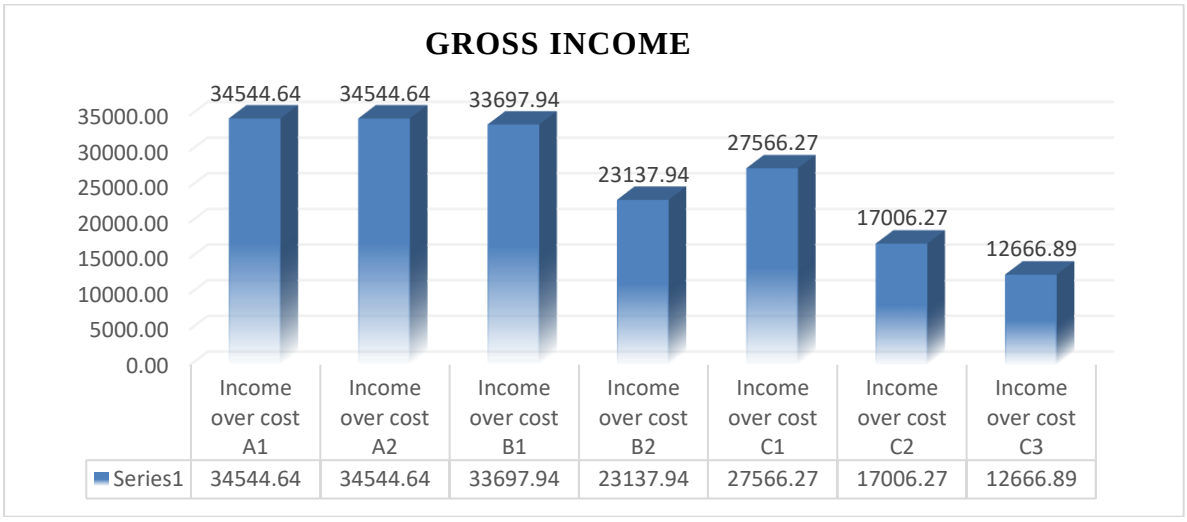

Fig 5. Income over different costs of kodo (Rs. / ha)

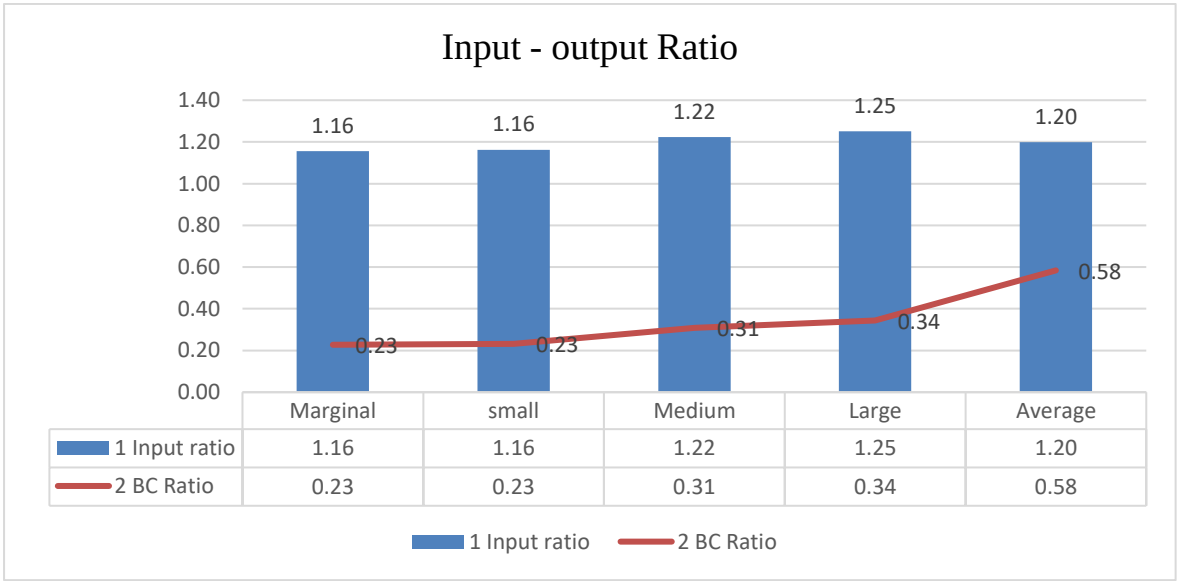

Fig 6. Benefit-cost ratio of different sample farms

CONCLUSION

The present study investigates the demographic attributes, production patterns of small millets, and the economic feasibility of Kodo millet cultivation in Jashpur district, with a focus on smallholder agriculture in this predominantly tribal region. The demographic analysis of 100 sample households revealed significant variation in farm sizes, with an average landholding of 0.34 hectares, ranging from marginal to large-scale farms. This disparity underscores the need for policy interventions tailored to farm size to mitigate resource inequities and promote inclusive agricultural development. The decadal analysis (2014-2024) of small millet cultivation highlighted considerable fluctuations in area, production, and productivity. Despite observable peaks in area (4,679 hectares) and production (1,513 tonnes) in 2023–24, the overall Compound Growth Rates (CGR) for area (-95.17%), production (-94.90%), and productivity (-99.72%) demonstrated a consistent decline over the period. This suggests that although temporary growth occurred, it lacks sustainability, likely due to factors such as inconsistent agricultural practices, insufficient access to inputs, and potential climatic variability. These findings support the hypothesis that small millet cultivation faces challenges in achieving long-term growth, which may be due to structural and environmental factors. In contrast, the economic assessment of Kodo millet cultivation revealed that it is a labor-intensive yet economically viable activity, particularly for medium and large-scale farmers. The average cost of cultivation per hectare was calculated to be Rs. 19,333.51, with labor costs being the dominant expenditure. Profitability across various cost categories (Cost-A, Cost-B, and Cost-C) was consistently positive, with net returns of Rs. 34,544.64, Rs. 33,697.94, and Rs. 27,566.27 per hectare, respectively. Additionally, an input-output ratio of 1.20:1 reinforces the economic viability of Kodo millet as a profitable venture in the region. The study further demonstrated that economies of scale are evident in Kodo cultivation, with larger farms benefiting from better access to quality inputs, mechanization, and credit facilities, which collectively lead to higher profitability. Conversely, marginal farms exhibit lower returns due to structural constraints, including limited investment capacity and resource access, which affects their productivity and profitability. In conclusion, while the production trends of small millets in the district reveal signs of instability, the cultivation of Kodo millet offers a promising and sustainable livelihood with significant potential for increased profitability. To address the challenges and enhance the sustainability of millet cultivation, it is crucial to implement the following strategies:

- *Improving access to institutional credit and quality agricultural inputs for small and marginal farmers.*
- *Enhancing agricultural extension services to promote improved agronomic practices.*
- *Strengthening market linkages for Kodo millet and other small millets to ensure better market access and prices.*
- *Supporting millet-based cropping systems, which can improve nutritional outcomes and enhance climate resilience.*

By adopting these interventions, millet cultivation can be revitalized, contributing to sustainable agricultural practices, improved farm incomes, and enhanced food security in tribal and ecologically vulnerable areas such as Jashpur district.

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