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An Economic analysis of pearl millet production in Auraiya district of Uttar Pradesh

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Abstract
Pearl millet (Pennisetum glaucum L.), stands strong place where water runs short grown widely in India. In the Bhagyanagar block of Auraiya district, Uttar Pradesh, researchers looked into how much it costs to grow this crop, sorting farms by size. 100 farmers (80 marginal, 12 small, and 8 medium) were selected for study in year 2025–26. On average, each farm covered just 0.88 hectare. When adding up what these families put into their fields, the typical spending on equipment and resources reached Rs.3,45,745.93 per hectare. One hectare of pearl millet farming cost Rs.63,956.75 on average, bringing in Rs. 95,690.40 as total return, net profit of Rs. 31,733.65 after expenses. Though all sizes group of farm highest net income was found on marginal farms Rs. 35,236.18 above Cost C3, followed by small farms Rs.30,647.82, and medium farms Rs.26,917.65. Output relative to Cost C3 showed every rupee spent gave back Rs.1.57 on the marginal holdings, Rs.1.47 small farms, and ₹1.40 medium farms. Despite differences, each group made money growing this grain, especially those working less ground who used inputs more wisely. Rainy zone households depend on it not just for meals but feedstock too, lifting their stability through steady harvests even when rains falter.

Keywords: Economic analysis, gross income, net income, pearl millet

Introduction
Pearl millet (*Pennisetum glaucum* L.), commonly known as bajra, is one of the most important coarse cereal crops. The agricultural sector is an important aspect of the Indian economy, providing livelihood security and food and employment opportunities for the rural mass. Among cereals, pearl millet [Pennisetum glaucum L., known as bajra in the local context plays a significant role on account of its ability to grow well under adverse conditions and its good food value. It is one of the most drought tolerant crops with the ability to be grown under high temperature and low rainfall and soil fertility conditions. Therefore, pearl millet is considered a crop suitable for climate changes and contributes significantly to the sustainability and climate resilience. Pearl millet is grown widely in Asia and Africa and is an important food crop for million of the people apart from its used as fodder and feed for livestock and poultry. Among all the countries India produces maximum area of pearl millet and account for largest percentage of total area and production, where crop is predominantly grown in Rajasthan, Uttar Pradesh, Haryana, Gujarat and Maharashtra. Recently it has got importance for nutritive values and climate resilient properties for sustainable Agriculture. Among all the states, U.P. is a major producing state, in Auraiya district with favorable agro climatic situations the crop can be grown successfully.

Pearl millet is grown primarily during Kharif season under rain fed condition in Auraiya district and it covers substantial portion of the farming systems and serves as food and income generation crop besides fodder provision for Livestock. Bhagyanagar block in District Auraiya, which has agrarian economy dependent on monsoon agriculture and limited access to Irrigation facilities, is selected as an indicative pearl millet producing region. Even though, pearl millet is playing a vital role in farming economy, sufficient number of studies were lacking for cost, return and profitability at farmers level. Therefore, a farm economy analysis of production of pearl millet in terms of investment, cost, returns, profitability and input output ratio will have important implications for optimal resource use at the farming level among various farming category of farmer. The present study was conducted to analysis the farm size and investment structure, cost and return analysis and profitability and input – output relationship of production of Pearl millet in Auraiya district of Uttar Pradesh.

Keeping in view the above mentioned facts the present study entitled, **"**An Economic analysis of pearl millet production in Auraiya district of Uttar Pradesh" will be undertaken with following specific objectives:

a. To study the farm structure, and farm investment on different group of sample farms.
b. To work out the cost of cultivation, gross return in production of pearl millet crop on different group of farms.
c. To estimate the net return, cost of production and input-output relationship in production of pearl millet on different group of sample farms.

Materials and Method
The present study was undertaken with the aim to study the economics of production of Pearl millet in Auraiya district of Uttar Pradesh. The sampling design adopted for the investigation was simple randomization. Out of 07 blocks of Auraiya district, Bhagyanagar block was selected purposively for the study. List of villages having area under Pearl millet were collected from selected headquarters, out of which five villages having maximum area under Pearl millet were selected purposively.

A list of Pearl millet farmers along with their operational area for each of the selected villages were prepared on the basis of information obtained from village revenue office. The farmers were arranged in descending order on the basis of area under Pearl millet and further it was grouped in to three categories i.e. Marginal farmer (below 1ha), Small

farmer (1-2 ha), and Medium farmer (2-4 ha). Finally 100 farmers (80 marginal, 12 small and 08 medium) were selected for study. A specially designed schedule was used for getting information on aspects of land use pattern, costs, returns of Pearl millet cultivation was collected by personal interviews of Pearl millet farmers. The data was collected by survey method by conducting personal interviews of sample farmers with the help of schedule prepared for study purpose. Data was collected during the year 2025-26.

Result and Discussion

Result and discussion as incorporated objectives under the present study is explained as size of farms, farm investment on fixed capital, cost of cultivation and different types of farm income are given following.

Farm Structure and Investment Pattern

Average size of sample farms under different size of groups

Distribution of farm and their cultivated area under different size groups of farms are present in Table-1.

The distribution of sample farmers revealed that marginal farms dominated the study area, accounting for 80 percent of the total sample, followed by small farms (12 percent) and medium farms (8 percent). The average size of holding was estimated at 0.88 hectare, indicating the predominance of small-scale farming in the region. The average operational holding size was 0.58 hectare for marginal farms, 1.58 hectares for small farms, and 2.88 hectares for medium farms.

Table 1: Average size of holding on sample farms under different size group of farms

S. No.	Size of Farms	No. of farms	Net Cultivated Land (ha.)	Average size of holding (ha.)
1	Marginal (below 1ha)	80	46.33 (52.45)	0.58
2	Small (1-2ha)	12	18.99 (21.50)	1.58
3	Medium (2-4ha)	08	23.01 (26.05)	2.88
4	Overall	100	88.33 (100.00)	0.88

Note: Figures in parenthes is indicates percentage to the total

Per hectare investment on different size groups of farms

Per hectare investment on different size groups of farms as farm buildings, live stock, dead stock etc. are present in Table-2.

The table- 2 reveals that the overall average investment on farm assets was Rs.3,45,745.90. Major implements constituted the largest share of total investment (31.62%), followed by livestock (27.06%), farm buildings (26.22%), and irrigation structures (13.31%).

The higher investment in machinery indicates a gradual shift towards mechanization in agricultural operations. Marginal farmers invested relatively more in livestock and farm buildings, reflecting the importance of mixed farming and livestock rearing in sustaining household income. In contrast, small and medium farmers allocated a greater proportion of their investment towards machinery and irrigation facilities, suggesting increased adoption of modern production technologies.

Table 2: Per hectare average investment of assets on different size group of farms (in Rs.)

S. No.	Particulars	Size group of farms							
		Marginal	%	Small	%	Medium	%	Over all average	%
1	Farm Building	137531.43	29.15	51922.54	18.63	28243.33	19.19	90656.84	26.22
2	Live Stock	142502.54	30.20	52156.35	18.71	29133.25	19.79	93546.34	27.06
a	Buffalo	90970.71	19.28	32615.43	11.70	18267.97	12.41	59485.86	17.21
b	Cow	21381.78	04.53	8192.68	02.94	4689.92	03.19	14198.03	04.11
c	Others	30150.05	06.39	11348.24	04.07	6175.36	04.19	19862.45	05.74
3	Minor Implement	9495.27	02.01	3400.37	01.22	1910.47	01.30	6209.09	01.80
4	Major Implement	114949.49	24.36	142105.21	50.99	70882.27	48.15	109308.15	31.62
a	Tractor	44379.78	09.41	59807.06	21.46	31796.78	21.60	44418.60	12.85
b	Trolley	23852.73	05.06	30626.96	10.99	14740.11	10.01	22935.28	06.63
c	Harrow	8999.37	01.91	12433.91	04.46	5653.06	03.84	8866.05	02.56
d	Thresher	26570.26	05.63	35248.55	12.65	16639.98	11.30	25849.16	07.48
e	Other	11147.36	02.36	3988.73	01.43	2052.33	01.39	7239.07	02.09
5	Irrigation structure	67346.54	14.28	29124.60	10.45	17044.46	11.58	46025.51	13.31
a	Electric Motor	53816.15	11.41	23272.20	08.35	14356.63	09.75	36970.30	10.69
b	Pump Set	7412.39	01.57	3610.01	01.30	1393.96	00.95	5027.11	01.45
c	Other	6118.00	01.30	2242.39	00.80	1293.87	00.88	4028.10	01.17
	Total	471825.27	100.00	278709.07	100.00	147213.78	100.00	345745.93	100.00

Per hectare costs of cultivation of Pearl Millet

Per hectare costs incurred on the various input factor in the production of Pearl Millet was worked out and given in table-3

Average cost of cultivation of pearl millet was estimated at Rs. 63,956.75 per hectare. Per hectare cost of cultivation had been observed in increase with farm size and it was Rs. 62,201.42 on marginal farms, Rs. 64,980.18 on small farms and Rs. 67,056.74 on medium farms. Increase in the cost on medium farms is mainly due to more expenditure on hired labour, usage of tractor, Irrigation and some other items. The Human labour is a one of largest part of cost of cultivation of pearl Millet it was account for 16.03 percent and Marginal farmers spent more on small and medium size farms. Expenditures on manure and fertilizer were 12.80% followed by Rental value owned land (18.76 percent), Interest on working capital (9.88percent), tractors power (7.60percent), seed (6.92 percent).

Table 3: Per hectare costs of cultivation of Pearl Millet

S.No.	Particular	Size group of sample farms						Overall Average	%
		Marginal	%	Small	%	Medium	%		
1	Family Labour	6479.90	10.40	4316.90	06.60	4816.20	07.20	5622.20	08.80
2	Hired Labour	2777.19	04.46	6475.30	09.97	7224.54	10.77	4628.99	7.24
	Total Human Labour	9257.06	14.88	10792.21	16.61	12040.77	17.96	10251.17	16.03
3	Tractor Power	4154.46	06.68	5817.45	08.95	5638.16	08.41	4863.08	7.60
4	Seed Cost	4427.30	07.12	4567.29	07.03	4299.13	06.41	4426.11	06.92
5	Manure & Fertilizer	8232.09	13.23	7874.42	12.12	8365.22	12.47	8188.41	12.80
6	Irrigation Charges	2991.23	04.81	3278.05	05.04	3512.17	05.24	3177.17	04.97
7	Plant Protection	2205.17	03.55	2122.83	03.27	2177.29	03.25	2181.05	03.41
8	Other	2010.17	03.23	1784.41	02.75	1922.03	02.87	1941.21	03.04
9	Rental Value of Owned Land	12000.00	19.29	12000.00	18.47	12000.00	17.90	12000.00	18.76
10	Depreciation	2946.12	04.74	2773.22	04.27	2814.20	04.20	2877.82	04.50
11	Interest on Working Capital	6382.41	10.26	6239.63	09.60	6239.71	09.31	6317.89	09.88
12	Interest on Owned Fixed Capital	1940.74	03.12	1823.38	02.81	1951.98	02.91	1918.61	03.00
13	Sub total	56546.74	90.91	59072.89	90.91	60960.68	90.91	58142.50	90.91
14	Managerial cost @10% of sub total	5654.67	09.09	5907.29	09.09	6096.07	09.09	5814.25	09.09
	Total cost	62201.42	100.00	64980.18	100.00	67056.74	100.00	63956.75	100.00

Per hectare costs and income from production of Pearl Millet

Per hectare costs and income from production of Pearl Millet are given in table-4

TheTable-4 revealed that the table reveals that the cost of cultivation of pearl millet varied across different categories of farmers in the study area. Overall CostA1 / Cost A2, CostB2, CostC2and Cost C3 of cultivation per hectare were worked out to be 38,601.69, 52,520.30, 58,142.50 and 63,956.75 per hectare respectively. Average yield per hectare (30.67 quintals) had been also presented in the table. Marginal Farms recorded highest yield (31.23 quintals) while lowest yield was obtained in medium farms (30.12 quintals). Overall Gross Income was reported to be Rs.95,690.40/ha.

The gross income obtained from pearl millet Cultivation was estimated at Rs. 97,437.60, Rs. 95,628.00 and Rs. 93,974.40 per hectare on marginal, small and medium farms, respectively, with an overall average of Rs. 95,690.40 per hectare. The net income over Cost C3 was highest on marginal farms (Rs. 35,236.18 per hectare) followed by small farms (Rs. 30,647.82 per hectare) and medium farms (Rs. 26,917.65 per hectare). This indicates comparatively better economic efficiency of marginal farmers in utilization of available farm resources. Family labour income was estimated at Rs. 47,370.76, Rs. 40,872.01 and Rs. 37,829.92 per hectare on marginal, small and medium farms, respectively. Farm investment income and farm business income also showed a declining trend with increase in farm size, suggesting that marginal farmers managed available resources more efficiently than medium farmers.

Table 4: Per hectare costs and income from the production of Pearl Millet crop on various costs concept (in Rs.)

S. No.	Particulars	Size group of farms			Overall Average
		Marginal	Small	Medium	
1.	Cost A1/A2	36126.10	40932.61	42192.50	38601.69
2.	Cost B1	38066.84	42755.99	44144.48	40520.30
3.	Cost B2	50066.84	54755.99	56144.48	52520.30
4.	Cost C1	44546.74	47072.89	48960.68	46142.50
5.	Cost C2	56546.74	59072.89	60960.68	58142.50
6.	Cost C3	62201.42	64980.18	67056.75	63956.75
7.	Yield (q/ha)	31.23	30.65	30.12	30.67
8.	Yield (Byproduct)	59.53	60.45	61.43	60.10
9.	Gross Income	97437.60	95628.00	93974.40	95690.40
10.	Net Income	35236.18	30647.82	26917.65	31733.65
11.	Family Labour Income	47370.76	40872.01	37829.92	43170.10
12.	Farm Investment Income	49311.50	42695.39	39781.90	45088.71
13.	Farm Business Income	61311.57	54695.39	51781.90	57088.71
14.	Cost of Production (Rs/q)	1491.72	1519.91	1526.32	1504.66
15.	Input-Output Relationship				
I.	On the basis of C3	1:1.57	1:1.47	1:1.40	1:1.50
II.	On the basis of C2	1:1.72	1:1.62	1:1.54	1:1.65
III.	On the basis of C1	1:2.19	1:2.03	1:1.92	1:2.07
IV.	On the basis of B2	1:1.95	1:1.75	1:1.67	1:1.82
V.	On the basis of B1	1:2.56	1:2.24	1:2.13	1:2.36
VI.	On the basis of A1/A2	1:2.70	1:2.34	1:2.23	1:2.48

Cost of Production and Input-Output Relationship

Overall cost of production per quintal (Rs.1,504.66) was the lowest for marginal farms (Rs.1,491.72), whereas the highest for medium farms (Rs.1,526.32) as it has been shown in the Table 4. Input-Output ratio on CostC3 in the case of pearl millet for marginal, small and medium farmswere1: 1.57, 1: 1.47and 1:1.40.overallitwas 1: 1.50. Similarly, the input-output ratio on the basis of Cost A1/A2 was highest on marginal farms (1:2.70) followed by small farms (1:2.34) and medium farms (1:2.23). Same trend was observed at the case of other Costs Concepts. Since the Benefit – Cost ratio is greater than unity in all farm categories thus indicated that pearl millet cultivation is economically viable in the study area. The yield of pearl millet was recorded at 31.23, 30.65 and 30.12 quintals per hectare on marginal, small and medium farms, respectively. This clearly indicates that pearl millet cultivation was economically profitable on all categories of farms, although profitability was comparatively higher on marginal farms.

Conclusion

The study further explored that cultivation of pearl millet is a profitable and economical crop in the district of Auraiya, Uttar Pradesh. The total expenditure for cultivation per hectare was Rs.63,956.75, while gross return was Rs.95,690.40 and net return was Rs.31,733.65, with B/C ratio of 1:1.50. Marginal farmers achieved higher net returns and profits compared to small and medium farmers, because they efficiently used their available resources. As for investment was concern marginal farmers spent their maximum on livestocks and farm structures whereas, on an average spent of small farmers were on machinery, whereas medium farmers have investment in machinery. Hence, pearl millet provided with adequate net returns for all category of farmers. The study suggests that since grain and both dry and green fodder of pearl millet are used for various purpose in the village and this crop provides more nutritional value for the human being and lives tocks, hence improving its production through enhanced productivity, and other possible supports (institutional etc.) would generate more returns for the farming community. So, the crop is profitable as it sustainable the income of farmers.

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