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Economic analysis of pigeon pea seed production in Akola District

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Abstract
The study on pigeon pea seed production in Akola district during 2024-25 estimated the cost and returns associated with its cultivation. The analysis revealed the total per hectare cost of cultivation (Cost C3) averaged Rs. 100,865.23, with small farmers incurring the highest cost of Rs. 101,371.7. Despite these costs, pigeon pea seed production was profitable, demonstrating an overall input-output ratio of 1.22 at Cost C3. This indicates an encouraging economic return for farmers engaged in pigeon pea seed production. The study used the standard cost concept for cost and returns analysis, ensuring a comprehensive assessment of various cost components and returns. These findings align with similar research in Maharashtra, where the cost of cultivation ranged from about Rs. 50,000 to Rs. 55,000 per hectare for pigeon pea, with a favorable cost-benefit ratio and net profit recorded. Hence, pigeon pea seed production in the Akola district is a viable and profitable agricultural activity under prevailing conditions.

Keywords: Pigeon pea seed, cost of cultivation, profitability

1. Introduction

1.1 General Background

Pigeon pea (*Cajanus Cajan*), a vital pulse crop of India, holds significant nutritional and economic importance due to its high protein content and adaptability to semi-arid regions. It serves as a major source of dietary protein for millions and plays an essential role in crop diversification and soil fertility improvement through symbiotic nitrogen fixation. India, being the leading producer, accounts for nearly 80% of the global pigeon pea area and production, making it an indispensable crop in Indian agriculture.

The production of pigeon pea seed is critical for sustaining productivity and improving crop yields. High-quality seed production ensures genetic vigour, better germination rates, and enhanced crop performance compared to farm-saved seeds. Given the growing demand for quality seed, a detailed study on the economics of pigeon pea seed production is vital for informing farmers, policymakers, and extension agencies.

1.2 Significance of the study

Understanding the cost and returns structure in pigeon pea seed production is crucial for improving its profitability and resource allocation efficiency. The profitability of seed production activities directly influences farmers' willingness to adopt improved technologies and expand the area under cultivation. Moreover, documenting production costs and economic returns helps in establishing price policies, promoting quality seed adoption, and addressing input management issues to optimize output.

1.3 Objective

Study focuses specifically on estimating the cost and returns of pigeon pea seed production in Akola district to provide empirical evidence on its economic viability and to assist stakeholders in decision-making processes related to production technology and marketing strategies.

2. Materials and Methods

The study on the cost and returns of pigeon pea seed production was conducted in Akola district during the agricultural year 2024-25, employing a structured approach for data collection and economic analysis.

- **Data Source and Sampling:** Primary data were collected from 100 randomly selected pigeon pea seed growers across seven tahsils in Akola district. The farmers were categorized into small (< 2 ha), medium (2.01-4 ha), and large (> 4 ha) landholding groups for analysis. The sampling list was obtained from the Maharashtra State Seed Corporation (MAHABEEJ).
- **Data Collection:** Data were collected through survey using a pre-tested structured questionnaire. Information gathered included the quantities and costs of inputs (labour, seed, fertilizers, pesticides, machinery), cultivation practices, yields, and marketing returns.
- **Cost Concepts:** The cost of pigeon pea seed production was estimated using standard cost concepts widely adopted in Indian agricultural economics. These include:
  - **Cost A1:** All paid-out expenses (hired labour, purchased inputs, land revenue, depreciation, interest on working capital).
  - **Cost A2:** Cost A1 + rent paid for leased-in land.
  - **Cost B1:** Cost A1 + imputed interest on owned fixed capital assets (excluding land).
  - **Cost B2:** Cost B1 + rental value of owned land (net of land revenue).
  - **Cost C1:** Cost B1 +imputed value of family labour.
  - **Cost C2:** Cost B2 + imputed value of family labour.
  - **Cost C3:** Cost C2 + 10% of Cost C2 as imputed managerial cost.

Each cost component was calculated by valuing inputs at prevailing local rates (e.g., wages for labour, market price for seed). Depreciation on implements and machinery was computed using the straight-line method.

- **Returns Estimation**

Gross returns were computed from the total revenue obtained from the sale of pigeon pea seed. Net returns were derived by subtracting the various cost levels (A1 through C3) from the gross returns. The benefit-cost ratio was also calculated at each cost level to assess economic viability.

- **Data Analysis**

The data were tabulated and analyzed using descriptive statistics to estimate the per hectare cost of cultivation, returns, net returns, and profitability indices. The results provide insights into the economic feasibility and resource allocation efficiency in pigeon pea seed production.

3. Results

The cost of cultivation is helpful for crop planning therefore in order to know the cost and profitability, the cost of cultivation of pigeon pea seed for small, medium and large farmer was workout.

Table 1: Per hectare input utilization pattern of selected pigeon pea seed growers

Particulars	Unit	Small	Medium	Large	Overall
		Quantity	Quantity	Quantity	Quantity
Seed	Qtl.	15.24	14.19	10.08	13.17
Manure	ton	4.75	3.19	3.55	3.82
Fertilizer					
N	kg	27.83	21.17	24.95	24.65
P	kg	63.92	42.67	57.15	54.58
K	kg	16.14	23.79	19.89	19.94
Hired Human Labour					
Male	Days	26.5	22.14	18.38	22.46
Female	Days	36.92	31.33	28.08	32.11
Sub Total	Days	63.42	53.47	46.46	54.57
Family Labour					
Male	Days	36.04	31.69	24.91	30.88
Female	Days	17.24	14.46	14.78	15.16
Sub Total	Days	53.28	46.15	39.69	46.04
Bullock labour	Days	5.71	4.02	4.31	4.68
Machine Labour	Hrs.	42.67	58.41	46.82	49.3

Table 2: Per hectare cost of pigeon pea seed growers

Sr. No.	Item	Small		Medium		Large		Overall	
		Cost	Percentage	Cost	Percentage	Cost	Percentage	Cost	Percentage
1	Hired Human Labour								
	Male	9981.76	9.85	7562.80	7.66	8981.94	9.42	9035.96	8.96
	Female	7822.98	7.72	8508.60	8.62	7353.03	7.71	7977.52	7.91
	Subtotal	17804.74	17.57	16071.40	16.28	16334.97	17.13		16.87
2	Bullock Labour	4814.84	4.75	3212.94	3.25	3383.74	3.55	3786.99	3.75
3	Machine charges	10141.81	10.00	13434.88	13.61	7826.90	8.21	10432.87	10.34
4	Seed	3326.59	3.28	1967.86	1.99	1991.10	2.09	2434.21	2.41
5	Manures	941.74	0.93	460.253	0.47	718.59	0.75	695.70	0.69
6	Fertilizer								
	N	923.40	0.91	905.44	0.92	1018.46	1.07	959.46	0.95
	P	3899.76	3.85	2383.54	2.41	2811.21	2.95	3021.18	3.00
	K	477.26	0.47	527.66	0.53	639.26	0.67	557.59	0.55

7	Bio-fertilizers	18.22	0.02	13.83	0.01	19.60	0.02	17.22	0.02
	Micronutrients	513.20	0.51	348.47	0.35	417.27	0.44	426.31	0.42
	Irrigation charges	341.19	0.34	32.56	0.03	38.98	0.04	35.24	0.03
8	Plant Protection	4197.56	4.14	4511.13	4.57	4165.94	4.37	4024.88	3.99
9	Incidental charges	2048.83	2.02	2512.53	2.55	3809.60	3.99	3123.65	3.10
10	Repairing Charges	824.74	0.81	1268.13	1.28	1118.09	1.17	1070.32	1.06
11	Working Capital (1 to 10)	50273.86	49.59	47650.65	48.27	44293.71	46.44	47599.10	47.19
12	Interest on working Capital	3016.43	2.98	2859.03	2.90	2657.62	2.79	2855.95	2.83
13	Depreciation	2917.05	2.88	3293.44	3.34	3127.60	3.28	4112.70	4.08
14	Land Revenue	43.72	0.04	37.72	0.04	33.69	0.04	38.38	0.04
15	COST "A1" (Items 11 to 14)	56251.07	55.49	53840.85	54.55	50112.62	52.54	54606.13	54.14
16	Rental Value Leased in land	0	0.00	0	0.00	0.00	0.00	0.00	0.00
17	COST "A2" (Items 15 to 16)	56251.07	55.49	53840.85	54.55	50112.62	52.54	54606.13	54.14
18	Int. on Fix.Cap. @ 10%	9690.7	9.56	12932.51	13.10	13752.77	14.42	12125.33	12.02
19	COST "B1" (Items 15+ 18)	65941.77	65.05	66773.36	67.65	63865.39	66.97	66731.46	66.16
20	Rental Value of Land	13836.76	13.65	14942.3	15.14	13389.99	14.04	15056.35	14.93
21	COST "B2" (Items 19 to 20)	79778.53	78.70	81715.66	82.79	77255.38	81.01	81787.81	81.09
22	Family Human Labour								
	Male	9940.19	9.81	6258.46	6.34	6685.59	7.01	7634.46	7.57
	Female	2437.39	2.40	1760.65	1.78	2760.02	2.89	2273.39	2.25
	Subtotal	12377.58	12.21	8019.11	8.12	9445.61	9.90		9.82
23	Cost " C1 " (Items 19+23)	78319.35	77.26	74792.47	75.77	73311.00	76.87	76639.31	75.98
24	Cost " C2 " (Items 21+23)	92156.11	90.91	89734.77	90.91	86700.99	90.91	91695.66	90.91
25	Cost " C2 " (Items 24)	92156.11	90.91	89734.77	90.91	86700.99	90.91	91695.66	90.91
26	10% Cost C2	9215.611	9.09	8973.47	9.09	8670.10	9.09	9169.57	9.09
27	Cost " C3 " (Items 25+ 26)	101371.7	100.00	98708.25	100.00	95371.09	100.00	100865.23	100.00

Table 3: Economics of pigeon pea seed production (Rs/ha)

Sr. No.	Particulars	Small	Medium	Large	Overall
1	Yield per hectare				
	Main	121265.80	116985.70	113069.00	117130.89
	By	2560.89	2752.15	2531.40	2614.53
2	Main Produce +By produce	123826.70	119737.80	115600.40	119745.42
3	Per quintal cost of Prod.	7988.31	8070.33	7538.03	8053.76
4	Value of Main Produce	121265.75	116985.70	113069.00	117106.80
5	Value of By Produce	2560.90	2752.20	2531.40	2614.82
6	Gross Returns	123826.65	119737.81	115600.40	119721.62
7	Cost at				
a	Cost "A1"	56251.07	53840.85	50112.62	53401.51
b	Cost "A2"	56251.07	53840.85	50112.62	53401.51
c	Cost "B1"	65941.77	66773.36	63865.39	65526.84
d	Cost "B2"	79778.53	81715.66	77255.38	79583.19
e	Cost "C1"	78319.35	74792.47	73311.00	75474.27
f	Cost "C2"	92156.11	89734.77	86700.99	89530.62
g	Cost "C3"	101371.72	98708.24	95371.09	98483.69
8	Return at				
a	Cost "A1"	67575.59	65896.96	65487.78	66320.11
b	Cost "A2"	67575.59	65896.96	65487.78	66320.11
c	Cost "B1"	57884.89	52964.45	51735.01	54194.78
d	Cost "B2"	44048.13	38022.15	38345.02	40138.43
e	Cost "C1"	45507.30	44945.34	42289.39	44247.34
f	Cost "C2"	31670.54	30003.04	28899.40	30190.99
g	Cost "C3"	22454.93	21029.56	20229.30	21237.93
9	Output input ratio at				
a	Cost "A1"	2.20	2.22	2.31	2.24
b	Cost "A2"	2.20	2.22	2.31	2.24
c	Cost "B1"	1.88	1.79	1.81	1.83
d	Cost "B2"	1.55	1.47	1.50	1.50
e	Cost "C1"	1.58	1.60	1.58	1.59
f	Cost "C2"	1.34	1.33	1.33	1.34
g	Cost "C3"	1.22	1.21	1.21	1.22

4. Discussion

The economic analysis of pigeon pea seed cultivation across different farm sizes demonstrates its profitability, albeit with notable variations in costs and returns. Small farmers achieved the highest per hectare net return (Rs. 22,454.93) and gross return (Rs.123,826.65), despite incurring the greatest Cost C3 (Rs.101,371.70 per hectare). In comparison, medium and large farmers reported lower net returns (Rs. 21,029.56 and Rs. 20,229.30, respectively) and gross returns (Rs.119,737.81 and Rs.115,600.40 per

hectare), alongside reduced cultivation costs. The per quintal cost of production was highest for medium farmers (Rs. 8,070.33), followed by the overall average (Rs. 8,053.76), small farmers (Rs. 7,988.32), and was lowest for large farmers (Rs. 7,538.03). The input-output ratio at Cost C3 remained favorable across all groups (1.21–1.22), underscoring consistent profitability in pigeon pea seed cultivation at all farm sizes.

5. Conclusion

The cultivation of pigeon pea seed is economically profitable with an overall cost per hectare 100865.2 rupees, gross returns of 119721.62 rupees, net returns of 21237.93 rupees and input-output ratio of 1.22.

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