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A study on cost of cultivation and various income measures of pea in Jhansi district of Bundelkhand region of Uttar Pradesh

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Abstract

The study reveal that the expenditure of pea cultivation was most pronounced on medium farms (Rs. 51,584.96) with small (Rs. 42,135.24) and marginal farms (Rs. 41,420.09) following yielding an average of Rs. 42,362.006. Notably cost of cultivation diminished as farm size escalated. The predominant cost component was human labor, comprising 32.23%, succeeded by rental value of land (16.52%), tractor charges (15.71%), seeds (9.23%), irrigation (4.8%) and manure/fertilizers (4.60%). The agriculture cost framework demonstrated a systematic increase, from, Cost A1/A2 at Rs. 23,564.54 to Cost C3 at Rs. 42,362.50. Marginal farms achieved the zenith of gross income (Rs. 88,050.80) and net returns (Rs. 46,630.26), while medium farms exhibited the lowest performance metrics. The mean income from family labor was Rs. 48,900.19, and production costs per quintal were calculated at Rs. 2,040.83. Input-output ratios ranged from 1:3.7 (Cost A1/A2) to 1:2.06 (Cost C3), revealing that larger agricultural enterprises faced diminishing returns as escalating input costs surpassed yield increments, resulting in a contraction of net income per hectare.

Keywords: Cost of cultivation, cost concept, input-output ratio, profit measures

Introduction

Peas (*Pisum* spp.), classified within the Leguminosae family, represent a pivotal pulse crop in India, with a cultivation history that dates back to antiquity in regions including Italy, southwestern Asia, and northern India, extending eastward beyond the formidable Himalayas. These legumes are lauded for their high nutritional value, comprising substantial quantities of digestible protein, carbohydrates, minerals, and vitamins. A comprehensive analysis reveals that 100 grams of dried peas typically contain approximately 11 grams of moisture, 22.5 grams of protein, alongside essential nutrients such as calcium and iron, thus underscoring their dietary significance. By 2022, China ascended to the status of the preeminent global producer of green peas, yielding an impressive 11.57 million tonnes—accounting for 55.22% of total worldwide production—while India followed as the second-largest contributor, generating 6.18 million tonnes (29.52%). Notably, Albania distinguished itself with the highest yield per hectare, whereas Mauritius recorded a mere 1 tonne, the lowest globally. In the Indian context, field peas hold considerable importance as a rabi pulse crop, cultivated across approximately 0.64 million hectares, with an annual production of 0.88 million tonnes in the 2020-21 season. Uttar Pradesh stands out as the foremost state in this agricultural domain, contributing approximately 48.33% of national production. In Jhansi district, the area dedicated to pea cultivation reached 76,772 hectares in 2021-22, yielding 123,863 metric tonnes at a productivity rate of 14.22 quintals per hectare. Despite the crop's economic significance, there remains a pressing need for rigorous studies assessing its viability and potential for advancement within the region.

Methods and Materials

Sampling Technique

A purposive random sampling methodology was employed to select the district, block, villages, and respondents, systematically organized into distinct stages:

1. **Selection of District**: Jhansi district in Uttar Pradesh was strategically chosen to mitigate operational challenges for the investigator.
2. **Selection of Block**: A comprehensive list of the eight blocks in Jhansi was ranked by field pea acreage. The block "Moth," exhibiting the highest cultivation area, was selected.
3. **Selection of Village**: From a list of villages within the selected block, five were randomly chosen, ensuring equitable representation.
4. **Selection of Farmers**: A stratified list of field pea

growers was compiled, categorizing them by holding size:

- Marginal: Below 1 ha
- Small: 1 to 2 ha
- Medium: 2 to 4 ha

A total of 100 respondents were selected proportionately: 74 marginal, 18 small, and 8

Cost Concepts

- **Cost A1**: Total working capital plus interest on working capital.
- **Cost A2**: Cost A1 plus rent paid for leased land.
- **Cost B1**: Cost A1/A2 plus interest on fixed capital.
- **Cost B2**: Cost B1 plus the rental value of land.
- **Cost C1**: Cost B1 plus family labor.
- **Cost C2**: Cost B2 plus family labor.
- **Cost C3**: Cost C2 plus 10% of managerial costs.

Profit Measures

- **Gross Income**: Yield in quintals multiplied by price per tonne.
- **Net Income**: Gross Income minus Cost C3.
- **Farm Business Income**: Gross Income minus Cost A2 (or Net Income plus imputed value of family labor).
- **Family Labor Income**: Gross Income minus Cost C2.
- **Farm Investment Income**: Net Income plus rental value of owned land plus interest on fixed capital.
- **Benefit-Cost Ratio**: Cost C divided by Gross Income.

Cultivation Costs

The "cost of cultivation" refers to the total expenses incurred by farmers in the process of growing crops or raising livestock, encompassing all costs from land preparation to harvest. This includes expenditures on seeds, fertilizers, pesticides, labor, machinery, irrigation, and land-related costs.

- **Fixed Costs**: Expenses that remain unchanged regardless of production levels.
- **Variable Costs**: Expenses that vary in direct relation to production levels.

Cost of cultivation = fixed cost + variable cost

Results and Discussion

The per-hectare expenditures for pea cultivation are elucidated in Table 1. Medium farms incurred the apex cost of Rs. 51,584.96, followed by small and marginal farms at Rs. 42,135.24 and Rs. 41,420.09, respectively. The average cost across sampled farms was Rs. 42,362.006, indicating a decline in expenses with increasing farm size. Human labor emerged as the predominant cost component (32.28%), trailed by land rental (16.52%), tractor charges (15.71%), and other inputs. The positive correlation between per-hectare costs and farm size underscores the intricate economic dynamics inherent in agricultural practices.

The analysis of Table 2 elucidates average costs across various categories: Cost A1/A2 at Rs. 23,564.54, Cost B1 at Rs. 24,445.74, Cost B2 at Rs. 31,445.74, Cost C1 at Rs. 31,511.41, Cost C2 at Rs. 38,511.41, and Cost C3 at Rs. 42,362.50. The average gross income was Rs. 87,411.61, juxtaposed with a net income of Rs. 45,049.10. Among farm sizes, marginal farms achieved the highest gross income at Rs. 88,050.80, followed by small farms at Rs. 85,816.20, while medium farms reported the least at Rs. 85,088.80. Net income mirrored this trend, peaking at Rs. 46,630.26 for marginal farms. Average family labor income and farm business income were recorded at Rs. 48,900.19 and Rs. 70,912.73, respectively. The cost of production per quintal was Rs. 2,040.83, with yields averaging 18.69 quintals per hectare. Notably, while cultivation costs escalate with farm size, net returns per hectare diminish, primarily due to insufficient yield increases relative to rising input costs.

Table 1: Per hectare costs of different inputs used in Pea production (Rs.)

S. No.	Particulars	Size group of farms			Overall average
		Marginal	Small	Medium	
1.	Human labour	15,008.62 (36.23)	9,556.21 (22.67)	10,650.79 (20.64)	13,678.55 (32.28)
a.	Family	8,857.77 (21.38)	2,016.25 (4.78)	1,850.00 (3.58)	7,065.67 (16.67)
b.	Hired	6,150.85 (14.84)	7,591.67 (17.89)	8,800.79 (17.06)	6,612.88 (15.61)
2.	Tractor charges	6,080.85 (14.68)	7,591.67 (18.01)	9,910.00 (19.21)	6,659.12 (15.71)
3.	seed	3,464.86 (8.36)	4,933.33 (11.70)	5,775.00 (11.19)	3,913.99 (9.23)
4.	Fertilizers	1,648.57 (3.98)	2,431.06 (5.76)	3,650.00 (7.07)	1,949.53 (4.60)
5.	Irrigation	1,754.27 (4.23)	2,568.06 (6.09)	3,879.00 (7.51)	2,070.73 (4.8)
6.	Intercultural and plant protection	1,262.97 (3.04)	1,894.12 (4.49)	2205.15 (4.27)	1,451.95 (3.42)
7.	Total working capital	20,362.37 (49.16)	26,958.20 (63.98)	34,219.94 (66.33)	22,658.22 (53.48)
8.	Interest on working capital	814.49 (1.96)	1,078.32 (2.55)	1,368.80 (2.65)	906.32 (2.13)
9.	Rental value of land	7,000 (16.90)	7,000 (16.61)	7,000 (13.56)	7,000 (16.52)
10.	Interest on fixed capital	620.45 (1.49)	1,252.93 (2.97)	2,456.68 (4.76)	881.19 (2.08)
11.	Sub total	37,654.63 (90.90)	38,304.77 (90.90)	46,895.42 (90.90)	38510.91 (90.90)
12.	Managerial cost @10% of sub total	3,765.46 (9.09)	3,830.47 (9.09)	4,689.54 (9.09)	3851.08 (9.09)
Grand total		41,420.09 (100)	42,135.24 (100)	51,584.96 (100)	42362.00 (100)

Table 2: Per hectare costs and income measures from pea production on various costs concept (Rs.)

S. No.	Particulars	Size group of farms			Overall average
		Marginal	Small	Medium	
1.	Cost A1/A2	21,176.86	28,036.52	35,588.74	23,564.54
2.	Cost B1	21,797.31	29,289.45	38,045.42	24,445.74
3.	Cost B2	28,797.31	36,289.45	45,045.42	31,445.74
4.	Cost C1	30,655.08	31,305.70	39,895.42	31,511.41
5.	Cost C2	37,655.08	38.305.70	46,895.42	38,511.41
6.	Cost C3	41,420.54	42,136.17	51,584.96	42,362.50
7.	**Yield q/ha**				
a.	Main - product	18.89	18.21	18.04	18.69
b.	By product	22.72	23.98	23.92	23.04
8.	Gross income	88,050.80	85,816.20	85,088.80	87,411.61
a.	Main product	77,826.80	75,025.20	74,324.80	77,042.35
b.	By product	10,224	10,791	10,764	10,369.26
9.	Net return	46,630.26	43,680.03	33,503.84	45,049.10
10.	Family income	50,395.72	47,510.50	38,193.38	48,900.19
11.	Farm business income	75,731.71	59,795.93	51,350.06	70,912.73
12.	Farm investment income	54,250.71	51,932.96	42,960.52	52,930.29
13.	Cost of production	1,986.98	2,062.15	2,491.06	2,040.83
14.	**Input - output ratio**				
a.	On the basis of cost A1	1: 4.15	1: 3.06	1: 2.39	1: 3.7
b.	On the basis of cost B1	1: 4.03	1: 2.9	1: 2.23	1: 3.57
c.	On the basis of cost B2	1: 3.05	1: 2.3	1: 1.8	1: 2.7
d.	On the basis of cost C1	1: 2.87	1: 2.74	1: 2.13	1: 2.77
e.	On the basis of cost C2	1: 2.33	1: 2.24	1: 1.81	1: 2.26
f.	On the basis of cost C3	1: 2.12	1: 2.03	1: 1.64	1: 2.06

Conclusion

In conclusion, field pea cultivation in Jhansi district, Uttar Pradesh, highlights both its nutritional importance and economic potential. Our analysis reveals that while larger farms incur higher costs, they do not achieve proportionate net returns, with marginal farms yielding the highest income. Human labor remains the largest expense, indicating a need for better labor management and possible mechanization. To enhance profitability, further research on improving yields and sustainable practices is crucial. Targeted support for smaller farmers could optimize production strategies and boost livelihoods, reinforcing the significance of peas in India's agricultural landscape.

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