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Lina R Budhe
PG Scholar, Master of Business Administration in Agri Business Management, School of Agri Business Management, Nagpur, Maharashtra, India

Dr. NT Bagde
Assistant Professor, Agricultural Economics and Statistics, College of Agriculture, Nagpur, Maharashtra, India

Dr. NV Shende
Head, Department of Agricultural Economics and Statistics, Dr. PDKV, Akola, Maharashtra, India

Dr. SV Warade
Professor (CAS), School of School of Agribusiness Management, Nagpur, Maharashtra, India

Corresponding Author:
Lina R Budhe
PG Scholar, Master of Business Administration in Agri Business Management, School of Agri Business Management, Nagpur, Maharashtra, India

Business analysis of government biological pest control laboratory, Seloo, District Wardha

Lina R Budhe, NT Bagde, NV Shende and SV Warade

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Abstract
The study focused on detailed economic and operational assessment of the Government Biological Pest Control Laboratory (BPCL), Seloo, functioning under the Department of Agriculture, Government of Maharashtra. The study covers the fiscal year 2024-25 and focuses on key aspects such as capital investment, cost and return structure, break-even analysis, marketing expenditure, and production constraints. The total capital investment in the unit was ₹91.00 lakhs, with major allocations to infrastructure (38.46%) and machinery (37.57%). Fixed costs totalled ₹14.69 lakhs, and variable costs stood at ₹24.30 lakhs, primarily due to raw materials and labour charges. The unit achieved a total production cost of ₹44.93 lakhs against gross returns of ₹50.10 lakhs, yielding net returns of ₹5.16 lakhs. Among the four biofertilizer products produced Azotobacter and Rhizobium (for Soybean, Tur, and Gram) Rhizobium (Tur) was found to be the most financially efficient, with the lowest break-even quantity (302.36 L) and highest margin of safety (77.20%). Marketing was conducted through a direct channel, with transportation being the major expense. Despite challenges like inadequate infrastructure and skilled labour shortages, the unit operated at a high capacity utilization rate of 91.31%. The benefit-cost ratios of all products were above 1, confirming profitability. The study concludes that the BPCL Seloo unit is economically sustainable and has strong potential for future expansion with targeted improvements.

Keywords: Biofertilizer, cost analysis, break-even point, economic viability, benefit-cost ratio

Introduction

In recent years, biofertilizers have gained significant relevance in sustainable agriculture, especially in response to the adverse effects of long-term chemical fertilizer use. These inputs, based on beneficial microorganisms, play a crucial role in restoring soil health and supporting eco-friendly farming practices. These eco-friendly inputs contain living microorganisms that improve nutrient availability by fixing atmospheric nitrogen, solubilizing phosphorus, and decomposing organic matter in the soil (Subba Rao, 1982). Their use supports sustainable agriculture by improving soil fertility, crop productivity, and environmental health.

The continuous use of chemical fertilizers has led to severe problems including decreased soil productivity, water pollution, and loss of microbial biodiversity. In contrast, biofertilizers such as *Azotobacter* and *Rhizobium* not only reduce chemical input dependency but also restore natural soil activity. As per the Ministry of Agriculture and Farmers Welfare, the promotion of bio-inputs is a key strategy under national programs like Paramparagat Krishi Vikas Yojana (PKVY) and National Mission on Sustainable Agriculture (NMSA).

The Government Biological Pest Control Laboratory (BPCL), located in Seloo, Wardha district, is an initiative under the Department of Agriculture, Government of Maharashtra. It produces various liquid biofertilizers including:

- *Azotobacter* for enhancing nitrogen fixation in cereals and vegetables,
- *Rhizobium* (Soybean) for soybean cultivation,
- *Rhizobium* (Tur) for pigeon pea,
- *Rhizobium* (Gram) for chickpea and other pulses.

These products are used by farmers to improve yields and promote eco-friendly farming.

The BPCL Seloo not only supports sustainable agriculture but also contributes to rural employment and skill development by involving technical staff and local labour in production and distribution activities.

This research aims to study the economic performance of the laboratory by assessing its capital investment, cost of production, break-even analysis, marketing structure, and production constraints. The findings are intended to provide practical insights to policymakers, academicians, agro-entrepreneurs, and rural development planners.

Biofertilizers offer a range of agronomic and environmental benefits that make them a sustainable alternative to chemical fertilizers. Their key benefits include:

- **Improved soil fertility:** They enhance the biological activity of soil by fixing atmospheric nitrogen and solubilizing essential nutrients.
- **Cost-effectiveness:** Biofertilizers reduce the dependence on costly chemical fertilizers, lowering input costs for farmers.
- **Eco-friendliness:** Being natural and non-toxic, they promote long-term soil health and reduce environmental pollution.
- **Sustainability:** Regular use supports sustainable farming by maintaining soil microbial balance and improving crop productivity.

Company Profile

Sr. No.	Particulars	
1	Name of processing unit	Government Biological Pest Control Laboratory Seloo
2	Ownership	Department of Agriculture, Government of Maharashtra
3	Responsible Person	Nilesh Ughavekar
4	Establishment Year	2004
5	Business Type	Manufacturer
6	Legal Status (type of ownership)	Government
7	Registered With	Government of Maharashtra
8	License No.	LCFD10010701
9	Annual Turnover	88.82 Lakh
10	Business Address	Near the Research and Demonstration Plot, Vikas Square, Nagpur Road, Seloo, Wardha-442104.
11	E-mail Address	bpclseloo@gmail.com

Objectives of study

- To estimate the cost and returns of biofertilizer products.
- To analyze the break-even point of biofertilizer products.

Methodology area of study

The present study was conducted at Government Biological Pest Control Laboratory Seloo.

Period of study

The data was collected for FY 2024-2025 i.e., from April 2024 to March 2025.

Source of Data

Primary data was collected by pretested schedule from concern person, officials of selected firm by personal interview method regarding the production of Biofertilizer.

Analytical Tools

Cost and Returns of Biofertilizer Production

The collected data related to required cost and returns from Biofertilizer were analysed, tabulated on the following different aspects *viz*.

Fixed Cost

The fixed cost includes the data regarding the cost of machinery, building, furniture, and wages of payment employed labours, salary of staff. These information was collected from Government Biological Pest Control Laboratory Seloo.

Variable Cost

The variable cost consists of expenditure on purchase of raw material, wages of casual labours, repair and maintenance of machinery, electricity and stationary charges, etc.

Total Cost

Total cost was comprised of the total fixed cost and total variable cost calculated by adding both costs together.

Total cost = Fixed cost + Variable cost

Gross Returns

The gross returns for production of Biofertilizer was calculated by adding together value of main product received after production of biofertilizer. The gross returns defined as the total rate of return on an investment before the deduction of any expenses.

Gross returns = Quantity of product X Price per unit

Net Returns

The net returns refer to returns after deducting all expenses from the gross return generated by the investment.

Net returns = Gross returns-Total cost

B:C ratio

The benefit cost ratio compares the present value of all benefits with that of the cost and investment of the project.

B:C ratio = Gross returns / Total cost.

Breakeven Point Analysis

The point at which the two curves i.e. total cost curve and total revenue curve intersect is called as breakeven point, which indicates the level of production at which neither losses money nor makes profit.

Computation in physical quantity,

$$\mathbf{B}\boldsymbol{EP} = \boldsymbol{F} / (\boldsymbol{P} - \boldsymbol{V})$$

Computation in monetary value, $\mathrm{B}\boldsymbol{EP} = \boldsymbol{F} / [\mathbf{1} - (\mathrm{V/P})]$

Where,
F = Annual fixed cost in Rs.
P = Selling price per unit in Rs.
V = Variable cost per unit in Rs.

Results and Discussion

- **Cost and returns of selected unit**

To fulfil the first objectives of the study in respect of organizational study of Biofertilizer production the results has been obtained on cost required, returns obtained from the unit are given as under

Table 1: Capital investment for Biofertilizer Production

Sr. No.	Particulars	Value in (Rs)	Percentage Share
1	Machinery	3419030.41	37.57
2	Land	600000.00	6.59
3	Building	3500000.00	38.46
4	Furniture	304899.00	3.35
5	Fixture	534608.23	5.87
6	Appliances	741707.96	8.10
	Total	9100246.59	100.00

Table 1. Shows that, the total investment in capital asset in Biofertilizer production project was Rs. 91.00 lakhs. The investment on building and machinery was the major investment which is 35 lakhs and 34.19 lakhs respectively.

Fixed cost for Biofertilizer Production: The fixed cost for an Biofertilizer production project includes several essential components, such as the purchase of machinery, buildings, furniture, and electrical appliances. Additionally, it covers permanent labours in the project. These costs are crucial for establishing and maintaining the infrastructure necessary for successful Biofertilizer production operations.

Table 2: Fixed cost for Biofertilizer Production

Sr. No.	particulars	Value in (Rs/year)	Value in (Rs/lit)	Percentage share
1	Depreciation on machinery @10%	373736.54	10.51	25.45
2	Building @ 5%	309866.86	8.71	21.10
3	Depreciation on furniture @10%	54236.17	2.93	3.70
4	Depreciation on fixture @10%	71376.72	0.60	4.85
5	Depreciation on Appliances @15%	109814.12	3.09	7.40
6	Permanent Employee Salary	550000.00	17.42	37.50
7	Total fixed cost	14,69,030.41	73.13	100.00
8	Azotobacter	321570.75	16.01	21.89
	Rhizobium for Soybean	394434.67	19.64	26.86
	Rhizobium for Tur	96956.00	4.83	6.6
	Rhizobium for Gram	656068.99	32.66	44.64

Table 2 shows that total fixed cost requirement for Biofertilizer production project was Rs. 14.69 lakhs. It is observed that Permanent Employee Salary and depreciation on machinery was major which constituted 55 lakhs and 37.37 lakhs.

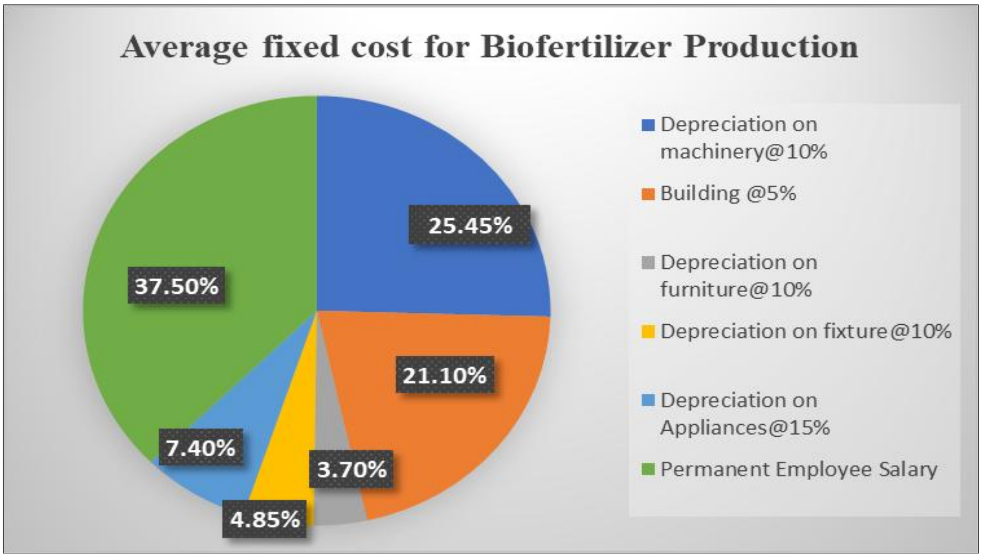

Fig 1: Per cent share of fixed cost for biofertilizer production

Variable cost required for Biofertilizer Production: The variable cost consists of expenditure on purchase of raw material, wages of casual labour, repair and maintenance of machinery, electricity charges, postage, and stationery etc.

Table 3: Variable cost for Azotobacter production, (4397.3 lit)

Sr. No.	Particulars	Quantity	Cost (Rs/L)	Cost (Rs / year)	Percentage Share
1	Raw Material	4453.1Lit	188.32	838926.00	82.81
	Male Labour 500Rs/day (working days 65)	130	15.46	68000.00	
	Female Labour 300Rs/day	130	9.28	40800.00	
2	Total Labour	260	24.74	108800.00	10.74
3	Repair & Maintenance		1.20	5255.79	0.52
4	Packaging		4.09	17968.23	1.77
5	Energy		3.49	15329.29	1.51
6	Postage & Stationery		6.10	26833.00	2.65
	Total Variable Cost		227.94	1013112.31	100.00

Table 3 reveals that the variable cost for Azotobacter production worked out to Rs. 10.13 lakhs. The composition of variable cost revealed that the cost of raw materials was major i.e., 8.38 lakhs.

Table 4: Variable cost of rhizobium production for soybean, (5396.25 lit)

Sr. No.	Particulars	Quantity	Cost (Rs/L)	Cost (Rs/year)	Percentage Share
1	Raw Material	5464.69Lit	175.84	948888.77	81.60
	Male Labour 500Rs/day (working days 73)	146	₹ 13.53	73000.00	
	Female Labour 300Rs/day	219	12.23	66020.00	
2	Total Labour	365	25.76	139020.00	11.95
3	Repair & Maintenance		1.12	6048.17	0.52
4	Packaging		17.57	23296.59	2.00
5	Energy		3.11	16777.53	1.44
6	Postage & Stationery		5.35	28886.07	2.48
	Total Variable Cost		228.75	1162917.13	100.00

Table 4. Reveals that the variable cost of Rhizobium production for soybean worked out to Rs. 11.62 lakhs. The composition of variable cost revealed that the cost of raw materials was major i.e., 9.48 lakhs.

Table 5: Variable cost of Rhizobium Production for Tur (1326 lit)

Sr. No.	Particulars	Quantity	Cost (Rs/L)	Cost (Rs)	Percentage Share
1	Raw Material	1342.83 lit	147.73	195892.04	80.58
	Male Labour 500Rs/day (working day 20)	20	7.54	10000.00	
	Female Labour 300Rs/day	40	9.05	12000	
2	Total Labour	60	16.59	22000.00	9.05
3	Repair & Maintenance		2.02	2672.51	1.10
4	Packaging		7.63	10116.44	4.16
5	Energy		6.23	8258.44	3.40
6	Postage & Stationery		3.13	4153.67	1.71
	Total Variable Cost		183.33	243093.10	100.00

Table 5 Reveals that the variable cost of Rhizobium production for Tur worked out to Rs. 2.4 lakhs. The composition of variable cost revealed that the cost of raw materials was major i.e., 1.95 lakhs.

Table 6: Variable cost of Rhizobium Production for Gram (8967.25 Lit)

Sr. No.	Particulars	Quantity	Cost (Rs/L)	Cost (Rs)	Percentage Share
1	Raw Material	9081.02 Lit	189.17	1696334.54	82.56
	Male Labour 500 Rs/day (working day 82)	164	9.14	82000.00	
	Female Labour 300Rs/day	328	10.97	98400.00	
2	Total Labour	492	20.12	180400.00	8.78
3	Repair & Maintenance		1.70	15231.28	0.74
4	Packaging		6.57	58889.68	2.87
5	Energy		5.07	45435.97	2.21
6	Postage & Stationery		6.50	58287.34	2.84
	Total Variable Cost		229.13	2054578.81	100.00

Table 6 Reveals that the variable cost of Rhizobium production for Gram worked out to Rs. 20.54 lakhs. The composition of variable cost revealed that the cost of raw materials was major i.e., 16.96 lakhs.

Total cost incurred by producer for production of Biofertilizer

Total cost incurred by producer for production of Biofertilizer is the sum of fixed cost and variable cost incurred by producer

Table 7: Total cost incurred by producer for production of Biofertilizer

Sr. No.	Name of Product	Variable cost	Variable cost(Rs/lit)	Fixed cost	Fixed cost (Rs/lit)	Total cost	Total cost (Rs/lit)
1	Azotobacter	1013112.31	227.94	321570.75	73.13	1334683.06	301.07
2	Rhizobium for Soybean	1162917.13	228.75	394434.67	73.09	1557351.8	301.84
3	Rhizobium for Tur	243093.1	183.33	96956.00	73.12	340049.1	256.45
4	Rhizobium for Gram	2054578.81	229.13	656068.99	73.16	2710647.8	302.29

Table 7. Reveals that, the total cost incurred by producer was estimated for Azotobacter Rs. 13.34 lakhs, for Rhizobium for soybean 15.57 lakhs, rhizobium for tur 3.40 lakhs and rhizobium for gram 27.10 lakhs.

Economics of production of Biofertilizer

It explores the financial aspects of Biofertilizer production, focusing on production costs, revenue, and profitability. By evaluating these economic factors, it provides insights into the financial viability and sustainability of Biofertilizer production as a business by calculating the benefit cost ratio.

Table 8: Economics of production of Biofertilizer

Sr. No.	Particulars	Azotobacter	Rhizobium for Soybean	Rhizobium for Tur	Rhizobium for Gram
1	Production in Lit	4397.3	5396.25	1326	8967.25
2	Value of final product(Rs)	1944735.77	2384323.56	586275.36	3966625.00
3	Gross return (Rs)	1944735.77	2384323.56	586275.36	3966625.00
4	Total cost incurred by producer (Rs)	1334683.06	1557351.80	340049.10	2710647.80
5	Net returns (Rs)	610052.71	826971.76	246226.26	1255977.20
6	Benefit cost ratio	1.46	1.53	1.72	1.46

Table 8 shows that, the value of product i.e., Gross return from the Azotobacter is 19.44 lakhs, Rhizobium for soybean is 23.84 lakhs, Rhizobium for tur is 5.86 lakhs, Rhizobium for gram is 39.66 lakhs. Calculated by multiplying quantity of product with price per liter with total cost of 13.34 lakhs, lakhs, 8.26 lakhs, 2.46 lakhs, 12.55 lakhs, among all products, Rhizobium for Tur not only achieved the highest benefit-cost ratio (1.72) but also demonstrated efficient resource use relative to its scale of production.

II. Break-even point analysis: The break-even point is the number of Biofertilizer produced to cover all costs associated with the production process, including both fixed and variable expenses. It is the level at which the total revenue from sell of Biofertilizer matches the total costs incurred, meaning that no profit or loss is achieved.

Table 9: Break-even point analysis of selected firm

Sr. No	Particulars	Azotobacter	Rhizobium (soybean)	Rhizobium (Tur)	Rhizobium (Gram)
1	Actual quantity processed per year lit	4397.3 Lit	5396.25 Lit	1326Lit	8967.25 Lit
2	Annual fixed cost (Rs) F	321570.75	394434.67	96956	656068.99
3	Selling price per lit (Rs) P	442.23	442.23	442.23	442.23
4	Variable cost per lit(Rs) V	227.94	228.75	183.33	229.13
5	Breakeven point (physical quantity) lit	1432.26	1832.31	302.36	2936.43
6	Breakeven point (monetary value) Rs	633313.38	810305.66	133741.09	1298551.86
7	Margin of Safety (physical quantity) lit	2965.04	3563.94	1023.64	6030.82
8	Margin of Safety (monetary value) Rs	1310737.20	1575252.33	452630.14	2666860.27
9	Percentage of Margin of Safety (physical quantity) lit	67.43	66.04	77.20	67.23
10	Percentage of Margin of Safety (monetary value) Rs	67.43	66.04	77.20	67.23

Table 9. Reveals that, the biological pest control laboratory have to produce at least 1432.26 lit of Azotobacter, 1832.31lit of rhizobium for soybean, 302.36 lit of rhizobium for tur and 2936.43 lit of rhizobium for gram that will recover their fixed cost and variable cost i.e., zero profit for running the unit. In monetary terms, breakeven point analyzed was Rs.633313.38 of Azotobacter, Rs. 810305.66 rhizobium for soybean, Rs. 133741.09 of rhizobium for tur, Rs. 1298551.86 rhizobium for gram Percentage of margin of safety was 67.43, 66.04, 77.20, 67.23 respectively.

Conclusion

- The total capital investment in the laboratory shows that building infrastructure (50.26%) and machinery (27.79%) are the major components of fixed capital. This reflects a substantial fixed cost requirement for setting up and running the unit. The total fixed cost was ₹14,69,030.41 annually, with land alone contributing 40.84% of that cost.
- All four Biofertilizer types Azotobacter, Rhizobium (Soybean, Tur, Gram) yielded positive net returns, proving the profitability of the enterprise.
- Rhizobium for Gram had the highest net return (₹12,55,977.20), while Tur had the lowest (₹2,46,226.26). Raw materials were the dominant cost in variable expenditure (over 80% for all). The Benefit-Cost Ratios for all products were greater than 1 (ranging 1.46 to 1.72), indicating economic feasibility of production.
- The break-even analysis showed that only a small percentage of total production was required to cover costs. All products had a high margin of safety (>66%), which reflects a low financial risk and strong economic sustainability of the production unit.

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