Financial Feasibility of Cucumber Cultivation in Polyhouse: A Case Study from Jaipur, Rajasthan, India

ABSTRACT

Cucumber (*Cucumis sativus L*.) is one of the popular vegetable crops grown broadly throughout the world. Cucumber crop grows successfully under conditions of high light, high humidity, high soil moisture, temperature, and fertilizers in the greenhouse.

Aim of the Study: The present study was carried out to evaluate financial matrix such as payback period or net present value benefit cost ratio and internal rate of return of polyhouse by cucumber cultivation financial metrics evaluated, for 2023-24.

Sampling Design: A multistage sampling design were used for the study of Cucumber cultivation in a polyhouse in the Jaipur district of Rajasthan for the 2023-24. Two tehsils were selected purposively based on the highest number of polyhouse from Jaipur district, namely Jhotwara and Jobner. A sample of 60 farmers were selected for the study from these two tehsils.

Results: The finding of the study revealed that the payback period of polyhouse by cucumber cultivation, for small farmers was favorable after covering the subsidy *i.e.* 0.75 years. The net present worth of polyhouse for small farmers was ₹ 14222249.12, for 20-year expected life at a 7.5 percent discount rate. It was ₹ 13406743.12 for large farmers and ₹ 11164102.12 for assumed non-subsidized farmers. The benefit-cost ratio for the subsidized small farmer was 10.41 and it was 6.76 for the subsidized large farmer. The benefit-cost ratio for the assumed non-subsidized farmer was 3.44 for the cucumber cultivation in polyhouse. The Internal Rate of Return was 133 percent, 84 percent, and 36 percent for the small, large, and non-subsidized cucumber-cultivating polyhouse farmers. Thus, result of the study in all three condition shows profitability of polyhouse by cucumber cultivation.

Keywords: Cucumber; polyhouse; payback period; NPW; BC ratio; IRR.

1. INTRODUCTION

Vegetables are generally grown in India using conventional agronomical practices in which the crops are cultivated in the open field under natural conditions [1,2]. Despite that, India is leading producer of several vegetable crops in the world. Interestingly, the small and marginal farmers are the most vulnerable among all farming classes, contribute largely to the production of high-value crops including vegetables [3,2]. Cucumber (*Cucumis sativus L*.) is one of the popular vegetable crops grown broadly throughout the world [4]. The cucumber is a thermophilic and frost-susceptible crop, growing best at a temperature above 20°C. Cucumber crop grows successfully under conditions of high light, high humidity, high soil moisture, temperature, and fertilizers in the greenhouse [5]. A polyhouse or greenhouse is a house or a structure made up of translucent materials like polyethylene or shade nets, where, the plants are grown under controlled climatic conditions, both considered as same. The size of the structure can differ from small shacks to big-size buildings as per the need. Polyhouse is a type of greenhouse or we can say that it is a

smaller version of greenhouse, where polyethylene is used as cover.

In India, the total area under horticultural crops is 28075 thousand ha with total production and productivity of 342329 thousand tonnes and 12.19 MT/ha respectively. The total area under vegetable production is 11348 thousand ha with total production and productivity of 204835 thousand tonnes and 18.05 MT/ha in the country. Total area under cucumber cultivation in India is 117 thousand hectare and the production and productivity is 1631 thousand tonnes and 13.94 MT/ha [6]. India has entered into an era of greenhouse vegetable cultivation more recently and the total area under protected vegetable production is not more than 10000 ha [7]. Rajasthan state have area under total vegetable cultivation is 190.22 thousand hectare and production is 232524 MT in the year 2021-22. In the year 2022-23, the area under vegetable cultivation in Rajasthan was 1927.12 thousand hectares and production was 2334884 MT. During the year 2022-23, Rajasthan state had 1149 hectares, of area under cucumber cultivation with 6873 MT production [8]. During the year 2022-23, Jaipur district had an area under total vegetable cultivation that was 41384 hectares and production was 257522 MT. In the same year, Jaipur district had the highest area under cucumber cultivation in Rajasthan which is 322 hectares and production is 624 MT [8].

2. METHODOLOGY

Sampling design: A multistage sampling design were used for the study of Cucumber cultivation in a polyhouse in the Jaipur district of Rajasthan for the 2023-24. Two tehsils were selected purposively based on the highest number of polyhouse from Jaipur district, namely Jhotwara and Jobner. A sample of 60 farmers were selected for the study from these two tehsils.

Research design: The economic feasibility of the production of cucumber in polyhouse was analyzed by using the Payback Period (PBP), Benefit Cost Ratio (BCR), Net Present Value (NPV), and Internal Rate of Returns (IRR). A discount rate of 7.5 percent has been fixed for the study, being the rate of interest for medium and long-term loans from commercial banks.

The four measures of capital productivity analysis were used in this study are:

1) Pay Back Period (PBP)
2) Benefit Cost Ratio (BCR)
3) Net Present Value (NPV)
4) Internal Rate of Return (IRR)

The cost of cultivation and returns obtained over the economic life of the polyhouse were used in the computation. Excepting PBP, all others are discounted measures of economic appraisal. For estimating these parameters costs and returns are discounted at 7.5 per cent rate of interest, being the rate at which medium term and long term credit could be obtained from commercial banks.

2.1 Pay Back Period (PBP)

PBP is an undiscounted measure of the worth of an endeavor, which measures the efficiency of cultivation by indicating the period within which the returns offset the investment. The payback period should be as minimal as possible

$$P = \frac{I}{R}$$

I = Initial investment (₹)
R= Annual net cash inflow (₹)

2.2 Benefit Cost Ratio

The benefit-cost ratio indicates the return on a rupee of investment. It is the ratio between the present worth of benefits and that of costs [9]. A project with benefit-cost ratio greater than unity is considered viable.

$$BCR = \frac{\text{Present Value of Bene it}}{\text{Present Value of Cost}}$$

$$BCR = \frac{\sum_{t=0}^{N} \frac{B_t}{(1+i_t)\text{^}t}}{\sum_{t=0}^{N} \frac{C_t}{(1+i_t)\text{^}t}}$$

Here, B_t is the benefit at time t, C_t is the cost at time t, N is the total number of periods, t is the period in which the cash flow occurs, and i is the discount rate or interest rate. BC ratio should be more than one for the financial feasibility of the polyhouse.

2.3 Net Present Value (NPV)

This is the most straightforward discounted cash flow measure of project worth. This is simply the present worth of the net cash flow stream [9], In other words, it is the difference between the present worth of benefits and the present worth of costs. The formal selection criteria for the NPV measure of project worth is to accept all projects with a positive net present value when discounted at the opportunity cost of capital.

$$NPV = \frac{\sum_{t=0}^{N}(B_t - C_t)^t}{(1 + i_t)^t}$$

Here, B_t is the benefit at time t, C_t is the cost at time t, t is the period in which the cash flow occurs, and i is the discount or interest rate. NPV should be more than zero for the feasibility of the polyhouse.

2.4 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is the discount rate that generates a zero net present value for a series of future cash flows. The SOLVER option is used in Excel to optimize the objective value (NPV) to zero by changing the discount rate value [2].

$$IRR = \frac{\sum_{t=0}^{N}(B_t - C_t)^t}{(1 + i_t)^t} = 0$$

Here, B_t is the benefit at time t, C_t is the cost at time t, t is the period in which the cash flow occurs, and i is the discount rate or interest rate. IRR should be more than the opportunity cost for the feasibility of the polyhouse.

3. RESULTS AND DISCUSSION

The financial feasibility of polyhouse cultivation in cucumber farming assesses the economic viability and profitability of using a polyhouse for growing cucumbers. This involves analyzing the costs of constructing and maintaining the polyhouse, the potential revenue from cucumber sales, and the impact of subsidies and financial support. Calculating metrics such as the payback period (PBP), net present worth (NPW), return on investment (B-C Ratio), and internal rate of returns (IRR) by farmers can determine whether investing in a polyhouse for cucumber cultivation is a financially sound decision or not.

Establishment cost of polyhouse of small and large farmers: Table 1 provides a detailed breakdown of the costs associated with establishing a polyhouse structure per unit area of 4000 m² and per square meter (m²). It includes the costs for different components and the impact of subsidies on the overall financial burden for both small and large farmers. Starting with the polyhouse structure costs, land leveling is priced at ₹ 250500 for 4000 m², translating to ₹62.62 per m². The major expense is the GI pipe assembly, costing ₹ 3306000 for the entire area, or ₹826.5 per m². Additional significant costs include the polythene sheet at ₹ 350500 (₹87.62 per m²) and the shade net at ₹ 125000 (₹31.25 per m²). The polyhouse structure installation costs ₹ 30,530 (₹7.63 per m²), with miscellaneous expenses totaling ₹ 15000 (₹3.75 per m²). This brings the subtotal for the polyhouse structure to ₹4077530, which amounts to ₹1019.37 per m² [10,11].

Moving on to the irrigation system and equipment, the irrigation system and fertigation unit cost ₹90500 (₹22.62 per m²). The microclimatic regulation system (foggers) is priced at ₹35400 (₹8.85 per m²), while other equipment costs ₹ 15600 (₹3.90 per m²). The subtotal for these components is ₹141500, translating to ₹35.37 per m². Consequently, the total establishment cost, which includes both the polyhouse structure and the irrigation system, comes to ₹4219030 or ₹1054.75 per m². Subsidies from the National Horticulture Mission (NHM) significantly reduce these costs. For small farmers, a subsidy covering 75 percent of the polyhouse structure cost amounts to ₹3058147.50 (₹764.52 per m²). For large farmers, a 55 percent subsidy provides ₹2242641.50 (₹560.66 per m²). After applying these subsidies, the total establishment cost for small farmers, including the subsidy, is reduced to ₹1160882.50 or ₹ 290.21 per m². For large farmers, the total establishment cost with the subsidy is ₹1834888.50 [2], which equates to ₹458.72 per m². This financial support provided by National Horticulture Mission subsidies makes polyhouse cultivation more accessible, and economically feasible for both small and large farmers [12-15].

Payback period of polyhouse: The payback period is a financial metric that measures the time it takes for an investment to generate an amount of income or cash equivalent to the cost of the investment. Essentially, it is the length of time required to recover the initial outlay of an investment [16-19].

Table 1. Cost of establishment of polyhouse for the unit area of 4000m²

S. No.	Particulars	Cost (in ₹/ Unit area)	
		Per 4000 m²	Per m²
A.	**Polyhouse structure cost**		
1.	Land leveling	250500	62.62
2.	GI Pipe assembly	3306000	826.5

3.	Polythene Sheet	350500	87.62
4.	Shade Net	125000	31.25
5.	Polyhouse structure installation cost	30530	7.63
6.	Miscellaneous	15000	3.75
7.	Subtotal (A)	4077530	1019.37
B.	**Irrigation System and equipment**		
1.	Irrigation System & fertigation unit	90500	22.62
2.	Microclimatic regulation system (Foggers)	35400	8.85
3.	Equipment's	15600	3.90
4.	Subtotal (B)	141500	35.37
C.	**Total establishment cost (A+B)**	4219030	1054.75
D.	Subsidy from NHM @ 75% of A (Small Farmer)	3058147.50	764.52
E.	Subsidy from NHM @ 55% of A (Large Farmer)	2242641.50	560.66
F.	Total establishment cost of the small farmer with Subsidy (B + 25% of A)	1160882.50	290.21
G.	Total establishment cost of the large farmer with Subsidy (B + 45% of A)	1834888.50	458.72

Table 2. Payback period of polyhouse over net return

S. No.	Particulars	Cost (₹)	Pay Back Period in Years
1	Polyhouse structure cost	4077530	2.64 (2 Years, 7 Months)
2	Total establishment cost (A+B)	4219030	2.73 (2 Years, 8 Months)
3	Subsidy from NHM @ 75% of A (Small Farmer)	3058148	1.98 (1 Year, 11 Months)
4	Subsidy from NHM @ 55% of A (Large Farmer)	2242642	1.45 (1 Year, 5 Months)
5	Total establishment cost with Subsidy (B + 25% of A) Small Farmer	1160883	0.75 (9 Months)
6	Total establishment cost with Subsidy (B + 45% of A)Large Farmer	1976389	1.19 (1 Year, 2 Months)

Note: - A = Polyhouse structure cost (₹ 4077530), B = Irrigation System and equipment (₹ 141500), Net Return = 1541087.32 ₹

Table 2 provides outlines the financial aspects of establishing a polyhouse for cucumber cultivation, detailing various costs, returns, and payback periods associated with different types of subsidies available to farmers. The polyhouse structure cost is listed at ₹ 4077530 with a payback period of 2.64 years, indicating the initial investment required for constructing the polyhouse. The total establishment cost, which includes the polyhouse structure and other related expenses, amounts to ₹ 4219030 with a slightly longer payback period of 2.73 years [20].

Subsidies play a significant role in reducing the financial burden on farmers. For small farmers, a substantial subsidy from the National Horticulture Mission (NHM) covers 75 percent of the polyhouse cost, amounting to ₹ 3058148. This subsidy reduces the payback period to 1.98 years, making the investment more effective. On the other hand, large farmers receive a 55 percent subsidy, totaling ₹ 2242642, which brings the payback period to 1.45 years. When considering the total establishment cost with subsidies, small farmers benefit significantly, with the cost reducing to ₹ 1160883 and a shortened payback period of 0.75 years. Large farmers, after accounting for their subsidy, face a total establishment cost of ₹ 1976389, with a payback period of 1.19 years. This data highlights the substantial financial support provided by subsidies, which significantly lowers the initial investment and enhances the feasibility of polyhouse cultivation for both small and large farmers.

Net present worth of polyhouse: Net Present Worth (NPW), also known as Net Present Value (NPV), is a financial metric used to evaluate the profitability of an investment in a polyhouse. It is the difference between the present value of cash inflows and the present value of cash outflows over a specified period. NPW is used to assess the profitability and viability of long-term projects by discounting future cash flows to their present value, taking into account the time value of money [21].

The net present worth of a subsidized polyhouse for small farmers, as outlined in Table 3, reveals a significant financial opportunity. The total cost to establish the polyhouse amounts to ₹ 4219030. However, the Government plays a crucial role in making this investment more accessible by providing a substantial subsidy of ₹ 3058147. As a result, the financial burden on the farmer is significantly reduced, with the net

cost of the polyhouse to the farmer being only ₹ 1160883.

This investment, though sizable, offers promising returns. The total economic profit generated from the polyhouse has been estimated at ₹ 1541087.32. Furthermore, when considering the expected lifespan of the polyhouse, which is projected to be 20 years, the financial benefits become even more apparent. At a discount rate of 7.5 percent, the net present worth of the polyhouse over this period is calculated to be ₹ 14222249.12. This substantial net present worth underscores the long-term value and profitability of investing in a polyhouse, especially with government support. For small farmers, this investment not only ensures economic viability but also promises significant returns over its operational life, making it a prudent and beneficial decision.

The net present worth of a subsidized polyhouse for large farmers, as shown in Table 4, highlights a significant investment opportunity. The total cost to construct the polyhouse is ₹ 4219030. However, in this case, the Government provides a subsidy of ₹ 2242642 to assist large farmers in making this investment more affordable. This generous subsidy reduces the financial burden on the farmer, bringing the net cost of the polyhouse down to ₹ 1976389. Despite the farmer bearing a larger share of the investment compared to smaller farmers, the economic returns remain impressive. The total economic profit generated from the polyhouse is estimated at ₹ 1541087.32, reflecting the potential for substantial earnings. Moreover, when accounting for the expected lifespan of the polyhouse, which is projected to be 20 years, the long-term financial benefits are further emphasized. Applying a 7.5 percent discount rate, the net present worth of the polyhouse over its operational life is calculated to be ₹ 13406743.12. This analysis demonstrates the long-term financial viability of investing in a polyhouse for large farmers. Even with a higher upfront cost, the substantial net present worth and the projected economic profit over two decades illustrate that polyhouse cultivation remains a valuable and profitable investment for large farmers, especially when supported by government subsidies.

The net present worth of a polyhouse without any government subsidy is outlined in Table 5, though it is important to note that such a practice is not common in the study area. The total cost of constructing the polyhouse in this scenario is ₹ 4219030, which represents a significant upfront investment entirely borne by the farmer, as no financial assistance is provided. Despite the higher initial cost, the polyhouse is still projected to generate a notable economic profit. The total economic profit from operating the polyhouse over its expected lifespan is estimated to be ₹ 1541087.32. When considering the long-term value of this investment, the net present worth of the polyhouse over a 20-year period, at a discount rate of 7.5 percent, is calculated to be ₹ 111 64102.12.

Benefit cost ratio of polyhouse: The benefit-cost ratio of polyhouse for small farmers was calculated from Table 3. The total cost polyhouse was found to be ₹ 4219030. The Government provided a subsidy of ₹ 3058147 out of the total cost. Hence, a farmer's net cost of a polyhouse was ₹ 1160883. The total cost of profit was found to be ₹ 1541087.32. Present worth of cash inflow and present worth of cash outflow were ₹ 15732960.45 and ₹ 1510711.00, respectively. The benefit-cost ratio was estimated to be 10.41. Since B-C ratio was greater than one so the establishment the polyhouse was considered to be economically feasible.

Table 3. Net present worth of polyhouse with the government subsidy of small farmers

Year	Cash outflow (₹)	Discount Factor (₹) @0.075	Present value of cash outflow (₹) @ 0.075	Cash Inflow (₹)	Present value of cash inflow (₹) @ 0.075	NPW (₹)
0	1160883	1	1160883	0	0	-1160883
1	34266.66	0.93	31867.99	1541087.32	1433211.20	1401343.21
2	34266.66	0.869	29777.73	1541087.32	1339204.88	1309427.15
3	34266.66	0.806	27618.93	1541087.32	1242116.38	1214497.45
4	34266.66	0.751	25734.26	1541087.32	1157356.57	1131622.31
5	34266.66	0.699	23952.4	1541087.32	1077220.03	1053267.64
6	34266.66	0.649	22239.06	1541087.32	1000165.67	977926.60
7	34266.66	0.606	20765.6	1541087.32	933898.91	913133.32
8	34266.66	0.561	19223.6	1541087.32	864549.98	845326.39
9	34266.66	0.523	17921.46	1541087.32	805988.66	788067.20
10	34266.66	0.485	16619.33	1541087.32	747427.35	730808.02
11	34266.66	0.452	15488.53	1541087.32	696571.46	681082.93

12	34266.66	0.42	14392	1541087.32	647256.67	632864.67
13	34266.66	0.39	13364	1541087.32	601024.05	587660.05
14	34266.66	0.363	12438.8	1541087.32	559414.69	546975.89
15	34266.66	0.338	11582.13	1541087.32	520887.51	509305.38
16	34266.66	0.314	10759.73	1541087.32	483901.41	473141.68
17	34266.66	0.293	10040.13	1541087.32	451538.58	441498.45
18	34266.66	0.272	9320.532	1541087.32	419175.75	409855.21
19	34266.66	0.253	8669.465	1541087.32	389895.09	381225.62
20	34266.66	0.235	8052.665	1541087.32	362155.52	354102.85
Total	1846216	-	1510711.00	30821746.40	15732960.45	14222249.12

Table 4. Net present worth of polyhouse with the government subsidy of large farmer

Year	Cash out flow (₹)	Discount Factor @ 0.075	Present value of cash outflow @ 0.075 (₹)	Cash Inflow (₹)	Present value of cash inflow @ 0.075 (₹)	NPW (₹)
0	1976389	1	1976389	0	0	-1976389
1	34266.66	0.93	31867.99	1541087.32	1433211.208	1401343.21
2	34266.66	0.869	29777.73	1541087.32	1339204.881	1309427.15
3	34266.66	0.806	27618.93	1541087.32	1242116.38	1214497.45
4	34266.66	0.751	25734.26	1541087.32	1157356.577	1131622.31
5	34266.66	0.699	23952.40	1541087.32	1077220.037	1053267.64
6	34266.66	0.649	22239.06	1541087.32	1000165.671	977926.60
7	34266.66	0.606	20765.60	1541087.32	933898.9159	913133.32
8	34266.66	0.561	19223.60	1541087.32	864549.9865	845326.39
9	34266.66	0.523	17921.46	1541087.32	805988.6684	788067.20
10	34266.66	0.485	16619.33	1541087.32	747427.3502	730808.02
11	34266.66	0.452	15488.53	1541087.32	696571.4686	681082.93
12	34266.66	0.42	14392.00	1541087.32	647256.6744	632864.67
13	34266.66	0.39	13364.00	1541087.32	601024.0548	587660.05
14	34266.66	0.363	12438.80	1541087.32	559414.6972	546975.89
15	34266.66	0.338	11582.13	1541087.32	520887.5142	509305.38
16	34266.66	0.314	10759.73	1541087.32	483901.4185	473141.68
17	34266.66	0.293	10040.13	1541087.32	451538.5848	441498.45
18	34266.66	0.272	9320.53	1541087.32	419175.751	409855.21
19	34266.66	0.253	8669.46	1541087.32	389895.092	381225.62
20	34266.66	0.235	8052.66	1541087.32	362155.5202	354102.85
Total	2661722		2326217	30821746.4	15732960.45	13406743.12

Table 5. Net present worth of polyhouse without the government subsidy

Year	Cash-out flow (₹)	Discount Factor @0.075	Present value of cash outflow (₹) @ 0.075	Cash Inflow (₹)	Present value of cash inflow (₹) @0.075	NPW(₹)
0	4219030	1	4219030	0	0	-4219030
1	34266.66	0.93	31867.99	1541087.32	1433211.20	1401343.21
2	34266.66	0.869	29777.73	1541087.32	1339204.88	1309427.15
3	34266.66	0.806	27618.93	1541087.32	1242116.38	1214497.45
4	34266.66	0.751	25734.26	1541087.32	1157356.57	1131622.31
5	34266.66	0.699	23952.40	1541087.32	1077220.03	1053267.64
6	34266.66	0.649	22239.06	1541087.32	1000165.67	977926.60
7	34266.66	0.606	20765.60	1541087.32	933898.91	913133.32
8	34266.66	0.561	19223.60	1541087.32	864549.98	845326.39
9	34266.66	0.523	17921.46	1541087.32	805988.66	788067.20
10	34266.66	0.485	16619.33	1541087.32	747427.35	730808.02
11	34266.66	0.452	15488.53	1541087.32	696571.46	681082.93
12	34266.66	0.42	14392.00	1541087.32	647256.67	632864.67
13	34266.66	0.39	13364.00	1541087.32	601024.05	587660.05
14	34266.66	0.363	12438.80	1541087.32	559414.69	546975.89
15	34266.66	0.338	11582.13	1541087.32	520887.51	509305.38
16	34266.66	0.314	10759.73	1541087.32	483901.41	473141.68
17	34266.66	0.293	10040.13	1541087.32	451538.58	441498.45
18	34266.66	0.272	9320.53	1541087.32	419175.75	409855.21

19	34266.66	0.253	8669.46	1541087.32	389895.09	381225.62
20	34266.66	0.235	8052.66	1541087.32	362155.52	354102.85
Total	4904363	-	4568858	30821746.40	15732960.45	11164102.12

In the second part, the benefit-cost ratio of polyhouse for large farmers was calculated from Table 4. The total cost polyhouse was found to be ₹ 4219030. The Government provided a subsidy of ₹ 2242642 out of the total cost. Hence, a farmer's net cost of a polyhouse was ₹ 1976389. The total cost of profit was found to be ₹ 1541087.32. Present worth of cash inflow and present worth of cash outflow were ₹ 15732960.45 and ₹ 2326217.00, respectively. The benefit-cost ratio was estimated to be 6.76. Since B-C ratio was greater than one so the establishment the polyhouse was considered to be economically feasible. The third part was calculated from Table 5 which shows non subsidized Benefit Cost ratio of polyhouse. The total cost polyhouse was found to be ₹ 4219030. The total cost of profit was found to be ₹ 1541087.32. Present worth of cash inflow and present worth of cash outflow were ₹ 15732960.45 and ₹ 4568858.00, respectively. The benefit-cost ratio was estimated to be 3.44. Since the B-C ratio was also greater than one so the establishment the polyhouse without government subsidy was also considered to be economically feasible.

Internal rate of return (IRR): The internal rate of return (IRR) is a crucial metric used to evaluate the feasibility and potential profitability of a polyhouse project, providing valuable insight into how such an investment compares with other opportunities. In the context of cucumber production within a polyhouse, the IRR serves as a key indicator of the financial viability across different farming scales and subsidy scenarios. For small farmers who benefit from a government subsidy, the IRR in polyhouse cucumber production is impressively high, estimated at 133 percent. This suggests a very strong return on investment, making it an exceptionally profitable venture for small-scale farmers. Large farmers, who also receive subsidies, experience a slightly lower but still robust IRR of 84 percent, indicating that the project remains highly attractive and financially rewarding at a larger scale. Even in cases where the polyhouse structure is not subsidized, the IRR is still notable, calculated at 36 percent for cucumber production during the Summer and Rabi seasons within a 4000 square meter area of the polyhouse. This demonstrates that, while the profitability is reduced without the financial support of subsidies, the investment remains feasible and continues to offer substantial returns.

4.CONCLUSION

The findings of the study conclude that the polyhouse structure cost, was ₹ 4077530, while the irrigation system and equipment cost was ₹ 141500. Combining these two, the total establishment cost amounts to ₹ 4219030. For small farmers (< 2 hectares holding), NHM offers a subsidy covering 75 percent of the polyhouse structure cost, which amounts to ₹ 3058147.5. Large farmers (>2 hectares holding) receive a subsidy covering 55 percent of the polyhouse structure cost, equating to ₹ 2242641.5. The payback period of polyhouse by cucumber cultivation, for small farmers after covering the subsidy, was 0.75 years and for large farmers, it was 1.28 years. The net present worth of polyhouse for small farmers was ₹ 14222249.12, for 20-year expected life at a 7.5 percent discount rate. It was ₹ 13406743.12 for large farmers and ₹ 11164102.12 for assumed non-subsidized farmers. The benefit-cost ratio for the subsidized small farmer was 10.41 and it was 6.76 for the subsidized large farmer. The benefit-cost ratio for the assumed non-subsidized farmer was 3.44 for the cucumber cultivation in polyhouse. The Internal Rate of Return was 133 percent, 84 percent, and 36 percent for the small, large, and non-subsidized cucumber-cultivating polyhouse farmers.

5. POLICY RECOMMENDATION

The establishment cost of a polyhouse is very high. Small farmers get a 75 percent subsidy but still have to pay ₹ 11 lakh, which is not easily possible, whereas big farmers get a 55 percent subsidy and have to deposit 45 percent of the amount, so this amount is also higher. Therefore, an alternative arrangement may be made where farmers can deposit their contribution in installments out of return from the polyhouse within a specified period of time.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author of this manuscript claim that part of the manuscript was prepared by AI which has now been done manually.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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