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INPUT USE UNDER NATURAL VENTILATED POLY HOUSE FOR CUCUMBER CULTIVATION: A CASE STUDY OF HISAR

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Abstract:

Protected cultivation is a process of growing crops in a controlled environment. The Environment is a key factor in growing crops and this environment creates problems for the Adoption of Natural Ventilated Polyhouse in the studied area higher airflow damages the plotline sheet which raises the initial cost every six months. The major issue in the settings of this technology is the cost of various inputs used in protected cultivation. Some of the inputs cover approximately 90% of the total cost which is the maximum portion of total recurring costs or variable costs like seed, labour, and transportation input. Use of Natural ventilated Polyhouse Improvedyield and productivity of cucumber in the off-season in Hisar districts. It increases 10 times income and four times more production than the normal agriculture field. The payback period fixed cost of Natural Ventilated Polyhouseis recovered within three years. Natural ventilated polyhouse a significant change in farmer life.

Keywords: Natural Ventilated Poly house, vegetable Cultivation, Cost of Cucumber, Protected cultivation.

Horticulture Scenario

Protected cultivation becomes a modern technique in horticulture for the production of crops qualitatively, and quantitatively. Horticulture crops play a major role in total agricultural production in India. It includes fruits and vegetables, spices and condiments, ornamental, plantation, medicinal, and aromatic plants. The majority of agriculture was cultivated in an open fields. The majority of agriculture depends on climate and weather. In actuality, the most dominating factor in horticulture production is the weather (Wittwer, S. H., & Castilla, N. 1995).

Nowadays, the Horticulture sector provides excellent opportunities for raising the income of farmers through protected cultivation. Vegetables and flowers are grown in greenhouse technology. Vegetables are grown in many states of the country under varied agro-climatic conditions in plain as well as in hilly regions. It helps to increase the financial condition of small and marginal farmers in our country (Singh, H. P., & Malhotra, S. K.2011). The area and production of vegetables are increasing year after year after the green revolution. The last two and half decade's areas of protected cultivation are 75000 hectares in India (Singh, B. 2019). The area

of horticulture crops is 25.49 million hectares in 2018-19 in India. In India 2017-18 production of cucumber was1, 247000 tonnes, and shares of Haryana were 274000 tonnes (22%)[1].

Origin and Expansion of Protected cultivation

The idea of growing a plant in a controlled environment has been implemented since Roman times. Poly houses were started in Rome and spread in various parts of the world (Nair and Barche.2014). The Roman king used to eat cucumbers grown through the Titifical Method (like a Greenhouse). All structures of protected cultivation (Net house, Polyhouse, and Walk in tunnel) have been globally accepted in the horticulture field(Singh, S. K. D. V. 2019). China has a long history regarding Protected cultivation, according to the Han Dynasty (206–23 B.C.E.) (Jiang, W., Qu, D., Mu, D., & Wang, L. 2004). Greenhouse Technology in India was first time used through the Indo-Israel project Indian Agricultural Research Institute (IARI) in 1982. Protected cultivation is the alternate solution for environmental issues. In recent times more than 55 countries adopted protected cultivation. Protected cultivation or technology uses heat or without heat for the production of the crop (Wittwer, S. H., & Castilla, N. 1995). Green House technology is used at the largest scale by china. China is now the largest country that uses greenhouse technology (Nair and Barche.2014). Under Protected, cultivation-protected structures like a greenhouse, plastic tunnel, shade net house, walk-in tunnels, and plant protection nets are used for cultivation. Vegetables, fruits, and flowers are grown in these structures in Haryana. The agro-climatic conditions are suitable for the natural ventilated poly house (NVPH) in Haryana as compared to other types of protected structures (C.V.Reddy. 2017). Greenhouse soilless System was adopted for limited pest problems, minimum use of labour, and higher productivity in the off-season. (Nicola, S., Hoeberechts, J., & Fontana, E.2002, March).

The cost of cucumber cultivation under a poly house is higher than in the open field. But cucumber cultivation under poly house provided higher income than an open field. Cropping under Protected cultivation of horticulture crops produces better quality, higher output, virus-free cultivation and good remuneration to the growers that will be helpful to improve the living of the stand of farmers (Sam and Regeena2015). Import of fruit and vegetables in India 2017-18 were 1010357.00Quintal metric tons and Export was 20703.47Quintal metric tons.[3]

Adoption of Greenhouse /NVPH Technology in Haryana

Overall conditions after adopting greenhouse technology production will increase 4 times than the open field of vegetables. Income increased 10 times more than in an open field (Duran, P. K. 2016). To fulfill the appropriate vegetable supply and improve the financial condition of farmers

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*[1] This information is taken from*http://apeda.in/agriexchange/India%20Production/India_Productions.aspx?cat=Vegetables&hscode=1075

*[2] This information is taken from*https://embassies.gov.il/delhi/Relations/Indo-Israel-AP/Pages/default.aspx

[3]This information takes from http://agricoop.nic.in/sites/default/files/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf

'Greenhouse technology was adopted in Haryana. Both conditions are fulfilled when controlled unfavorable environmental conditions and greenhouse technology protected the environmental effect on vegetables. Greenhouse technology provides better quality and quantity of vegetable season and off-seasons(Kumar*et* al2016).

Ground Adoption of NVPH Technology in Haryana

Protected cultivation is a demanding farming action wherein high-value cash crops are harvest (Mehta, K., Thakur, R. K., & Guleria, J. S. 2020). Protected cultivation is a special system to control the heating and cooling in special varieties of vegetables, off-season growing vegetables and floriculture. It is six types like Greenhouse, Poly house, PolyTunnel, Shade Net House, Hydroponics and Aeroponics (Shweta *et al*., 2014).

Many crops are growing in the studied area like vegetables cucumber, capsicum, Tomato and flowers but cucumber is found suitable crop for poly house cultivation because it is a warm period harvest and it grows between 180C and 240C. Cucumbers are grown three times a year(Anonymous 2012). High cost and non-availability of refrigerated vehicles for transportation, windstorm, hailstorm, High cost of hybrid seeds, non-availability of the storage facility in the village, the high installation cost of NVPH, lack of marketing knowledge, high labour cost, the feasibility of crop, poor quality of water and soil condition are the major problems faced by the farmers (Ghanghas *et* al2018).In Protected cultivation major two irrigation systems are used one of use for cucumber,tomato and capsicum while second is used for lectures,Cabbage,some verities of cucumber and Tomato.[4]

Environmental impact faced by farmers doing poly house cultivation

The main constraint of a vegetable cultivator in poly house cultivation is the small life of the polyethylene sheet. It was damaged due to high airflow. The nematode is the most common problem and whitefly were the Maine problems that damaged plants and reduced production (kumar*et al*2019).In the personal interview of farmers, they told that due to the higher airflow Polyethylene sheet of Natural Ventilated poly house damaged soon and increased initial cost.

Under the use of the greenhouse of special plastics UV-deficient help to remove whiteflies (Gerson, U., & Weintraub, P. G. 2007).Protected cultivation is high Capita oriented method and capacity has not just increased the productivity of crops, but increases crop safety from virus-free production(Kumar, R., Reetika, S. B., Singh, C., Ugarsain, N., & Kumar, N. 2020).Vegetable cultivation under the greenhouse is very sensitive because the change in the environment can affect the productivity of vegetables. Climate change can also affect pest and disease occurrence (Narayanankutty, C., Kumbar, S., & Peter, K. V. 2019).

Subsidies Given by the National Horticulture board to farmers

The subsidy is given by govt. according to the financial condition of farmers. It provided up to 65% on installing protected structures, Up to 90% on the irrigation system and 50 percent on planting material5. The total cost of a Polly house structure is rs 3300000 (825*4000) and Subsidy

[4] https://www.actahort.org/books/87/87_6.htm
[5] *This information taken from Model_Bankable_Project-HARYANA.pdf*

given by the government is 2200000(65%). The farmer part of the protected structure is Rs. 12000006.700per m2 subsidy was given by the government in 2017 in the construction of NVPH(Promila, D., & Kiran, S. 2017). Subsidy is different according to scheme and ranges between 20 to 50 percent in poly house construction.(Prabhakar, I., Vijayaragavan, K., Singh, P., Singh, B., Manjunatha, B. L., Jaggi, S., & Sekar, I. 2017). 65% and75% subsidy was more profitable in capsicum cultivation(Singh, N.2018).

Objectives: -

- To know the use of input for cucumber crop cultivation in poly houses in Hisar.
- To know the cost of cucumber crop cultivation in poly houses in Hisar
- To know the Return of cucumber crop cultivation in poly houses in Hisar

Methodology in data

Cucumber Takes approximately 40 to45 days for the production of its crop. Cucumber is grown throughout the year under NVPH conditions in Haryana. Three crops of cucumber are taken in a year, first from August to November; second from December to March and last grown April to June (model bankable project 2013).

During the agricultural year, 2018-19 primary data was collected through the specially designed schedule. Random sampling was used for data collection. Hisar district was selected to fulfill the purpose of the study. Hisar-1&2, Hansi-1&2, Narnod, and Barwala blocks were elected on the most contributed area of cucumber under NVPH conditions. Thereafter, five villages were selected from each block. One farmer was selected from each of the villages, thus the total sample is 30farmers. During 2018-19 visited 30 natural ventilated polyhouse for primary data collection. But some of them were in not working condition So 18 natural ventilated polyhouse were found in working conditions and made it the sample size18.

Method:

Cost of cultivation=Variable cost +Fixed Cost, Profit =Total Revenue -Cost of cultivation

Pay Back period=Total investment/ Cash inflow (Profit)

All item costs taken in this study are based on average.

Use of input under Naturally Ventilated Polyhouse for Cucumber Cultivation:

In Poly house farmers earn profit in growing off-season crops like Fruits flowers and vegetables. When a farmer grows off-season crops they used a large amount of input like fertigation, spraying, packaging, grinding, transport and labour. In starting stage land is prepared (2.24) for the cultivation and use Neem cakes (Kumar, P., & Chauhan, R. S. 2017). After Land preparation, sparing (5.49) cost is another input(Malik 2017). A packaging cost is a part of the marketing cost(18.6)including transportation, packaging, loading and unloading (Duhan, P. K. 2016).Labour is a major input that covers the maximum expanses (Singh et al 2018).

Table 1.1 Land preparation cost

Estimation	Total amount (in Rs)

[6]*This information taken from*http://rkvy.nic.in/static/schemes/HorticultureInfrastructure.html

total 6 bags per crop * 600 Rs per bag	6* 600*3=10800
total 30 packets per crop 80 Rs per packet	30* 80* 3 = 7200
1650 per crop (lump sum)	1650*3 = 5000
Total	23000

Sources: Calculated through primary data.

Table1.1 land preparation depends on nutrients available in the soil. However, for better yield FYM mixed in soil preparation and use NPK dose or chemical dose during land (Anonymous 2012). Preparation explains land preparation costs. Land preparation is the starting stage of cucumber cultivation under NVPH. 6 bag composite and Rs 600 neem cakes per bag are used for land preparation.30 packets of Chemical fertilizer Rs. 80 per packet and Rs.1650 bed preparation (lump sum).Land preparation is used in polyhouse normally replace every year(Kumar et al2018).

Table 2.1Fertilization cost

Estimation	total amount (in Rs)
45 packets per crop * 80 Rs per packet	45*100*3 = 13500
500 gm per day *	
100 rs per kg	
45 days per crop	
13500	
10% contingency	1350
Total	14850

Sources: Calculated through primary data

Table 2.1 shows the fertilizer cost of cucumber in NVPH conditions. On personal interaction with farmers told that Fertilizer cost depends upon a place to place because soil fertility is varying in every land. In one acre 45 packets of NPK are used. The cost of one packet of NPK was rs 100.10% contingency also shown in this table.Under protected cultivation fertilizer is use through the water ,it was 1.45 percent and 1.27 percent, for Capsicum cucumber and Tomato PCT units respectively (Gamanagattiet al2018).

Table 2.2Spraying cost

Estimation	total amount (in Rs)
Spraying cost per years10000*3=30000	30000
Contingency @10% of Rs30000	
contingency 3000	3000
Total	33000

Sources: Calculated through primary data

Table 2.2shows the spraying cost of cucumber under NVPH conditions. In one-acre spraying cost of the crop is Rs 10000. Three crops are taken in a year. So the total cost of rs.30000 and 10%

added in cost as the contingency of Rs 3000. Spray program is use an average interval of once in a week (Anonymous 2012). Lack of awareness of spraying during the data collection it was observed that farmers have no clear picture of spraying. Some of the farmers said no need sparing cost regularly but some said that thrice in a weak is necessary.

Table 2.3 Packing cost

Estimation	total amount (in Rs)
Total production in gunny bags 75o*10	
cost per bag-rs.10	
7500	
Total	7500

Sources: Calculated through primary data

Table 2.3show the packing cost of gunny bags.750 Qtl of Rs.10per bag. So the total packing cost is Rs.7500.packing cost is used by the farmer and it is part of the marketing cost that covers 45% of the total cost (Singh et al 2018). Gunny bag helps a farmer to transfer the production in Mandi. It is a reusable item that facilitates the farmer to safely transfer crop in the market.

Table 2.4Transportion cost

Estimation	total amount (in Rs)
2 rs per Kg	2*45000*3=270000
45000 kg per crop	
Total	270000

Sources: Calculated through primary data

Table 2.4 Shows the Transportation cost of cucumber under NVPH conditions. The total production of cucumber 45000 kg per crop and the Transportation cost is rs.2 per kg. Transportation cost is a part of the marketing cost that is higher (141.26%) than the open field (Kumar et al 2015). It is different according to distance from Mandi. In the present study, transportation cost is contributing or covers (42.55%) the maximum portion of the recurring cost.

Table2.5Labour cost

Estimation	total amount (in Rs)
73 days per crop	73*350*3
	*3=76650+45*250*2*3=67500
Total	144150

Sources: Calculated through primary data

Table2.5 shows the labour cost of 73 days in a crop of Rs.350 per day and 3 crops are taken in one year. So total labour cost is Rs.144150; it covers 22.72% of the total recurring cost. High labour cost (40%) is used for vegetable cultivation because in NVPH, skilled labour is used which is costly (kumar et al 2016). Labour cost is a major part of marketing cost but normally labour could not work in Natural ventilated. So skilled labour is required in working under NVPH. But skilled

labour is hard to find all year. Skilled labour is a major challenge in front of farmers7. Low durability in the material used in the establishment of a protected structure, Lack of skilled labour and lack of processing units are the major problems faced by the farmer (Komal, M., & Vinay, K. 2019.

To sum up, we can say that transport cost plays a vital role in the recurring cost of cucumber cultivation; it takes 42.55 percent portion of the total recurring cost. The seed is the second potation; it covers 23.64 percent of total recurring. Labour is another important input that covers a large part of cost Irrigation (0.79) covers the minimum part of the year-wise recurring cost. In end concludes that seed, transport and labour cost are an important part of the recurring cost because it contributes to the largest part of the total cost. Packing, granting and irrigation are covered less than 1.5 percent.

The estimated cost of a Natural ventilated poly house for Cucumber cultivation

Under naturally ventilated polyhouse high initial cost is used for the cultivation of crops than open fields. Majorly cost is divided into two parts. One is the initial cost that calls structure cost and the other is a recurring cost of production. Recurring cost is a combination of many costs like Seed, Fertilizer cost, Spaying cost, Packaging cost, Granting cost, Transport cost, Irrigation Cost and Labour cost. One part of the production is the use of yearly fixed costs.

Table 3.1Fixed cost Used in Natural Ventilated poly house

Estimation	Total amount (in Rs)
Farmer share in fixed cost	1155000
Scrap value	150000
Remain fixed cost	1005000
Fixed cost for per year	140000

Sources: calculated through the primary data

Table 3.1 According to 35% share of (3300000) structure cost is rs1155000-150000(Scrap value after10year)/10 =140000. Fixed cost is a combination of Polyhouse sheet, Shade net, Drip and Fertigation, Misting, FYM, Black Polyethylene mulch. These inputs have different estimated life like Polyhouse sheet (2 years),Shade net (5 years),Drip and Fertigation (5 Years), Misting (10 years), FYM and Black Polyethylene mulch for a single year(Murthy, D. S., Prabhakar, B. S., Hebbar, S. S., Srinivas, V., & Prabhakar, M. (2009).

Table3. Variable cost Used in a year

Estimation	total amount (in Rs)
10000 seeds per acre per crop*4.5 per seed	10000* 5*3= 150000(23.64%)
Fertigation cost (Table-B-1)	14850(02.34%)
Spraying cost(Table-11)	33000(05.20%)
Packaging cost (Table-111)	7500 (01.18%)
Granding cost (Lumsum)	10000 (01.58%)

[7] *This information is retrieved from*http://www.visvabharati.ac.in/file/Final-Report-186.pdf

Transport Cost(Table)	270000(42.55%)
Irregation cost	5000(00.79%)
Labour cost Table -B-V	144150(22.72)
Total	634500(100.00%)

Sources: Calculated through primary data

Table3.2 shows year wise recurring cost of cucumber under NVPH Conditions. It includes seeding cost, fertigation cost, spraying cost, Packaging cost, transport cost, irrigation cost and Labour cost for the whole year. They are covers different percentage inputs like seeding 23.64%,fertigation 2.34%,Spraying5.20, Packaging1.18%,Granding1.58%,Transport 42.55%, Irrigation 0.79% and Labour 22.72%.Compost and vermicompost are part of fertigation cost. The highest cost of production was compost which covers 6% of total cost and the lowest cost of production was vermin compost that covered 2% of total production(Mohamed, A. A., Abdrabbo, M. A., Abul-Soud, M., & Farag, A. A. 2015).

Table 3.3 fixed and variable cost Used in a year

Sources: calculated through the primary data

Estimation	Total amount (in rs)
Total fix cost	140000
Total variable cost	634500
Total cost	774500

Table 3.3 shows fixed cost means the construction cost of a Natural Ventilated poly house cost, which is a major component in vegetable cultivation. Out of the total fixed cost,the major part was GI Pips covers 43% and labour charge on erection and fabrication (18%). Rs.1136 per m2 is required for constructionin 400 m2 area. UV polythene sheet generally replace in 4-5 years.Total fixed cost is required for 400 m2 poly house constructions are Rs.454330. (Lakshmi, P. S., Prema, A., Ajitha, T. K., & Pradeepkumar, T. 2018).

3.4 Payback period and profit under poly hose cultivation(Cost of 4000sqm)

Estimation	Total amount (in Rs)
Total Cost	774500
Production kg	1350000 kg
sale Prices(Rs/)per kg	8.5rs per kg
Gross Returns	1147500
Net Returns(Profit)	373000
Pay Back period=1155000/373000=3year	

Sources: calculated through the primary data

It is estimated that total fixed cost (1155000) divides into 10 parts of rs 140000 each part charges from each year profit in 4000squre meter.It is also assumed that after a 10-year scrap value of protected structure rs 150000.Total production in a year is 1350000 kg and the average price of Rs 8.50. Total gross return is rs1147500 and net return is373000. The payback period of Natural ventilated poly house observethree years. It means farmers get back his investment in three years.

Summary (why is a naturally ventilated poly house most profitable and suitable for farmers)

Natural ventilated polyhouse construct in rupees thirty-three lakh. Which is divided into two parts one is the fixed cost of the structure that covers 2250000 that is given by the govt. as a subsidy. Second is the variable cost that is paid by the farmer is rupees 1150000. It divided into 10 parts that are over 10 years. Further variable costs are divided into many inputs like seedling, fertigation, spraying, packaging, grinding, transport And Labour inputs. The maximum portions of variable inputs are 90% of seedling, labour and transportation cost. But labour and transportation cost plays a very important role in variable cost. In protected cultivation skilled labour is required and the transportation cost varies from place to place nearby the mandi. The total production of cucumber in a year is 13500 quintals and the average price in a year is 8. 50rupees. Net return is rupees 373000 in a year. The payback period shows how a farmer can get back his amount which is an investment in structure cost. This picture is representing the production of cucumber under Natural ventilated polyhouse remarkable change in farmers' life.

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