ECONOMIC AND COST ANALYSIS OF BEAN AND ONION PRODUCTION INSIDE POLY HOUSE WITH DRIP AND MICRO-SPRINKLER IRRIGATION IN HILLY REGION

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***Abstract*: Randomised Block Designed (RBD) experimental plots were considered inside a high-tech poly house with two treatments of irrigation system (drip and micro-sprinkler) and three replications. Field trials with two vegetable crops (Bean and Onion) were carried out in each treatment and monitored the crop growth, yield and production economic. Drip irrigation system provides comparatively better vegetative growth and yield of onion than the micro-sprinkler irrigation system inside the high-tech poly house. Agricultural cost production includes how economically and efficiently the production can be done. It includes Land Preparation cost, Nursery and Seedlings preparation cost, Manures and Fertilizers cost, Plant Protection measures, Hired Human labor cost and other cost *etc.* The economics of production of Onion and Bean cultivation includes the Gross returns (Rs/Ha), Net returns per unit area (Rs/Ha), Net profit per unit production (Rs/q). The benefit cost ratio was found more in drip irrigation for the productions of Onion but less on Bean crop than the micro sprinkler system. B:C ratio for Drip and Micro Sprinkler on Bean is 1.03 and 1.09 respectively. For onion B:C ratio with Drip system and Micro Sprinkler system is 1.08 and 1.05 respectively.**

***Keywords*: Economic of Production, Cost production, High-tech Poly house, Drip irrigation, Sprinkler irrigation system, Onion, Bean.**

INTRODUCTION

To improving agricultural production with adoption of advance technologies such as protective cultivation help to protect soil fertility and soil erosion, protect the crops from heavy rainfall, storm and exposure of sun light, and not the least increase the agricultural production yield and quality. High-tech poly house where natural environment is modified using sound engineering principles to achieve optimum plant growth and yield (more produce per unit area) with increased input use efficiency. High-tech poly house technology is rather used to protect the plants from the adverse climatic conditions such as wind, cold, precipitation, excessive radiation, extreme temperature and even protects from insects, diseases and other birds and animals. Micro-sprinkler irrigation is a low pressure, low to medium volume irrigation system suitable for high value crops such as fruits. If managed properly, micro irrigation can increase yields and decrease water use and fertilizer and labor requirements when compared to irrigated pipe/furrow irrigation systems. Thus, the present study has addressed the objectives of effect of drip and micro-sprinkler irrigation on growth, yield and productivity of Onions and Beans inside a High-tech poly house. The water use efficiency (WUE) of drip irrigation is 90-95%, whereas micro-sprinkler is 70-80%. Experiment was conducted in the year 2015-2016 in the experiment field of Agriculture Engineering Department of Assam University, Silchar.

MATERIALS AND METHODS

Experimental Site:

The focus area of this study was the high-tech poly house situated in the hilly terrain of Assam University, Silchar (24.68˚N, 92.75˚E) under the Barak Valley zone (6941.2 km^2) in the state of Assam in North East India. The hillock of Assam University, Silchar covers an area of 968.28 m^2 in which the high-tech poly house enclosed 100 m^2 area. A view of experimental site is shown in Fig 1.

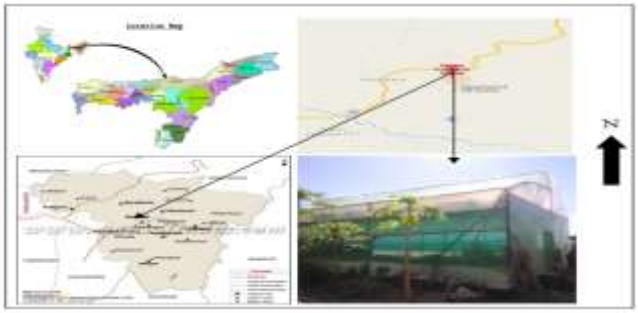

Fig 1: Location of the experimental site

Selection of Crop Variety:

Bean seeds of Pole type and Onion seeds of Nasik Dark red were selected inside the high-tech poly house with crop spacing of (45×50)cm and(10×30)cm for Bean and Onion crop respectively. The duration of bean crop is 60-90 days and the schedule of plantation is January-February and the duration of onion crop is 130-175 days and the schedule of plantation is October-April.

Layout of irrigation system:

The experimental design of plots focused on two treatments one plot with drip irrigation system (T_1) and other with micro-sprinkler systems (T_2). Each treatment was replicated thrice and for each replication 5 and 10 number of Bean and Onion plants was considered respectively. The drip irrigation system includes the main components such as water tank (1000 L) which is placed on roof top of 8 m above the ground surface, online drippers (4 L/h), laterals (12 mm diameter) and PVC main pipe (50 mm diameter) with control valve and flush valve. The micro-sprinkler irrigation system includes the main components such as pump (2HP) fitted with Water tank (1000 L), micro-sprinkler (10 L/h), laterals (16 mm diameter), mains (50 mm diameter), control valve and flush valve. The number and spacing of laterals, drippers and micro-sprinklers in each lateral was determined based on the crop to crop and row to row spacing.

High-tech poly house and its features

High-tech poly houses are basically naturally ventilated climate controlled and have a variety of applications, the majority being, growing of vegetables, floriculture and planting material acclimatization, fruit crop growing for export market. The high-tech poly house generally reflects back about 43% of the net solar radiation incident upon it allowing the transmittance of the "photo synthetically active solar radiation" in the range of 400-700 nm (Nanometer) wave length. The sunlight admitted to the protected environment is absorbed by the crops, floor, and other objects. So, a high-tech poly house situated in the aforementioned study site was selected for the present study (Figure 3.2).In the existing high-tech poly house, two types of irrigation systems such as drip and micro-sprinkler irrigation systems are available. It is a high cost structure of about Rs.2,23,000 and has been selected to carry out the experiment.

Figure 2: A view of high-tech poly house selected for study site

Yield Parameter

Yield parameters such as number of fruits and fruit weight per plant of Bean in each replication were also monitored at the time of flowering. For Onion, yield parameters such as bulb weight per plant of Onion monitored at the time of harvesting.

Fig 3: A view of study of Bean crop treatments

Fig 4: A view of study site of Onion crop treatments

Cost of production and Economics of production:

In response to a shift toward specialization and mechanization during the 20th century, there has been momentum on the part of a vocal contingent of consumers, producers, researchers, and policy makers who call for a transition toward a new model of agriculture.

Cost of production:

Agricultural production economics includes how economically and efficiently the production can be done. It includes the following:

- Land Preparation cost: Land preparation operations must be related to prevailing site conditions and must be cost-effective since these initial costs are compounded over an extended period.
- Nursery and Seedlings preparation cost: It includes all the seed cost, shading, soil arrangement.
- Manures and Fertilizers cost: It depends upon the amount of fertilizer used in the seedbed preparation and the market price of this manures at present time.
- Cost involved in Plant Protection measures: Amount of cost involved in the plant protection measures of the damages of the plant and insecticides and pesticides cost for prevention of insect and diseases of the plant.
- Hired Human labor cost: Labour inputs were employed for operations of levelling, sowing and inter-culturing, application of fertilizer harvesting, weeding and picking.
- Polyhouse set up cost: It is calculated total polyhouse area divided by area of treatment.
- Irrigation Cost: Irrigation cost per ha converted to treatment plot size

Economics of production

The economics of production of Onion and Bean cultivation includes the following components:-

- Gross returns (Rs/Ha) – It is calculated as the average yield of crop in q/ha multiplied by the average price received from market in Rs/q.
- Net returns per unit area (Rs/Ha) – It is the difference between the gross returns (Rs/Ha) to the cost of cultivation (Rs/Ha).
- Net profit per unit production (Rs/q) – It is the difference between the average price received (Rs/q) to the average cost of production (Rs/q).

RESULTS AND DISCUSSIONS

Effects on Yield of Bean

The replication wise average yield per hectare in treatment (T-2) recorded highest yield (446.60 kg) per plot, this treatment statistically significantly superior over the other treatment (T-1). The lowest yield (422 kg) per plot found the treatment (T-1) as shown on table 2. The maximum yield in treatment T-2 was due to enough water available the crops producing high value crops.

Table 1: Replication wise average yield per plot

Treatments	Replication wise yield (kg) per plot			Yield (kg/plot)
	R1	R2	R3	
Treatment-1	2.01	1.44	1.30	4.75
Treatment-2	2.10	1.56	1.36	5.02

Effects on Yield of Onion

Replication wise average yield per hectare was found more in treatment T-1 (0.918kg/plot), and the lowest yield (0.894kg/plot) found in treatment T-2. The maximum yield in treatment T-1 was due to large sized of bud and increased vegetative growth which might have increased the synthesis of carbohydrates which ultimately promoted greater growth and yield as shown on table 2. Thus it shows that drip irrigated plot is more productive than micro-sprinkler irrigated plot.

Table 2: Replication wise average yield of Onion per plot

Treatments	Replication wise yield (kg) per plot			Yield (kg/plot)
	R1	R2	R3	
Treatment-1	0.302	0.306	0.310	0.918
Treatment-2	.292	.299	.303	0.894

Cost of production for Bean and Onion:

The agricultural production economics of Bean and Onion crops were estimated considering the different components of cost of production and presented in Table 3. The unit cost for each component were collected and used for analysis of production cost. The cost of production does not include the cost for erection of high-tech poly house structures and the cost involved in setting up of drip and micro-sprinkler irrigation system.

Table 3: Cost of production of Bean and Onion crop in each treatment in high-tech poly house with Drip and Micro-Sprinkler

Components	Cost of Production of Bean in T-1	Cost of Production of Bean in T-2	Components	Cost of Production of Onion in T-1	Cost of Production of Onion in T-2
Land Preparation	25.00	25.00	Land Preparation	20.00	20.00
Nursery/Seedlings	10.000	10.00	Nursery/Seedlings	10.00	10.00
Manures and Fertilizers	25.00	25.00	Manures and Fertilizers	10.00	10.00
Hired Human Labour	100.00	100.00	Hired Human Labour	20.00	20.00
Land Revenue	25.00	25.00	Land Revenue	25.00	25.00
Total Cost for 7.5 m^2 Area	185.00	185.00	Total Cost for 7.5 m^2 Area	85.00	85.00
Total Cost in Rs./ha	2,46,666.00	2,46,666.00	Total Cost in Rs./ha	1,13,333.00	1,13,333.00

Economics of Vegetables Production:

Economic analysis was carried out considering the investment, operation and production costs and the results are presented in Table 4, for both the crop. As the production cost values differs in different treatments the gross return (Rs/ha), net return per unit area (Rs/ha) and B:C ratio values were found significantly higher in treatment-2 followed by Treatment-1for Bean crop and higher in treatment-1 followed by treatment-2 for onion crop. According to economical evaluation, considering the selling price (Rs/kg) same for two treatments for both the crops, the maximum gross and net return per unit area (Rs/ha) was found for Bean Rs.2,53,600; Rs.6,934 (T-1) and Rs.2,68,053; Rs.21387 (T-2) respectively and for Onion crop maximum gross and net return per unit area (Rs/ha) obtained as Rs.1,22,400; Rs.9,067 (T-1) and Rs.1,19,200; Rs.5,867 (T-2). The benefit cost ratio was found more in drip irrigation for the productions of Onion but less on Bean crop than the micro sprinkler system. B:C ratio for Drip and Micro Sprinkler on Bean is 1.03 and 1.09 respectively. For onion B:C ratio with Drip system and Micro Sprinkler system is 1.08 and 1.05 respectively.

Table 4: Economics of Bean and Onion production in each treatment

Particulars	Economics of Production of Bean in each treatment		Particulars	Economics of Production of Onion in each treatment	
	T-1	T-2		T-1	T-2
Cost of Cultivation(Rs/Ha)	2,46,666	2,46,666	Cost of Cultivation(Rs/Ha)	1,13,333	1,13,333
Total yield/plot	4.755	5.026	Total yield/plot	0.918	0.894
Gross returns(Rs/Ha)	2,53,600.00	2,68,053.00	Gross returns(Rs/Ha)	1,22,400.00	1,19,200.00
Net returns per unit area(Rs/Ha)	6,934.00	21,387.00	Net returns per unit area(Rs/Ha)	9,067.00	5,867.000
B:C Ratio	1.03	1.09	B:C Ratio	1.08	1.05

CONCLUSIONS

Thus cost and economic analysis of drip irrigation and micro-sprinkler irrigation of bean and onion crop inside a high-tech poly house in a in hilly region revealed that the Bean crop is more suitable with Micro sprinkler inside the polyhouse in termes of income and production. However, drip irrigation system is more efficient in production of Onion and better economic return than micro-sprinkler irrigation inside a high-tech poly house which may be because of water distribution in the effective root zone depth. But to counter adverse climatic condition and control damages from various factors cultivation inside polyhouse is a very suitable. And by the application of micro-irrigation more yield and good quality production can be obtained.

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