

Low-cost plastic rain-shelter and poly-tunnel for protected vegetable cultivation in high rainfall

The actual problem of low productivity of vegetables in Arunachal Pradesh has been attributed to the extremes of rainfall (2,500 mm) and 142 rainy days, which prohibits year-round vegetable cultivation at large scale. This difficulty is also an opportunity of growing vegetable crops in protected cultivation and the area under protected cultivation is growing larger day-by-day and now farmers can cultivate in off-season with the induction of an artificial technique like low-cost plastic rain-shelter and poly-tunnel.

IN Arunachal Pradesh, the high rainfall during pre-monsoon and South West monsoon period is one of the major limiting factors for low production of high value vegetable crops like king chilly, tomato, etc. The average annual rainfall is very high around 2,500 mm and the seasonal rainfall distribution indicates that 20.80% and 63.20% rainfall occurred in pre-monsoon and South West monsoon period, respectively. The number of rainy days is 142, so in rainy season, it is difficult to get rain free days. Indigenous farmers normally face major problem for production of vegetables in open field condition due to heavy rainfall.

Hence, looking into aforesaid difficulties, ICAR Research complex for NEH region, Arunachal Pradesh centre, Basar has designed a low-cost rain-shelter along with rainwater harvesting system to fulfill the water requirement for irrigation of the crops inside the structure. With the total amount of rainfall received, the structure has potential to harvest 2.8 lakhs liters of water in year, which is far beyond the requirement of the crops. This shelter is made up of the locally available bamboo and UV

stabilized polythene (200 micron). Simultaneously, this centre organizes trainings, conducts awareness among the farmers to adopt low-cost protected cultivation technology and similarly, structures were set up at the adopted villages of tribal sub-plan (TSP) project. With these efforts, many farmers are ensuring better yields, greater price and are saving their input resources year after year that helped them to uplift their socio-economic livelihood in the state.

Seedlings of tomato (Arka Samrat F₁) were transplanted in the spacing of 90 × 60 cm on raised bed (1.8 × 1.8 m) and total 144 plants were accommodated. To utilize the inter-bed space and side space, 50 king chilli plants were also accommodated. The king chilli plants were transplanted 20 kg capacity of plastic bags. Tomato was cultivated two times (May-Aug. & Nov.-March). Regular monitoring and standard intercultural operations were done.

In the 1st year, ₹ 15184.00 was generated as income but from this small structure one can easily generate income of ₹ 141312.00 within 3 years. The CB ratio of

Table 1. Economy of plastic rain-shelter

Item	Quantity	Amount (₹)	Item	Quantity	Amount (₹)
Expenditure for establishment of unit in the size: Length- 20 m, Width- 8 m & Height (One side-2.5 m & another side-2 m)					
UV stabilized polythene, 200-micron thickness	216 m ²	14000.00	Bamboos (Post)	15 nos	2250.00
Green agro-shed net -75%	80 m ²	3500.00	Labours	15 nos.	5250.00
Bamboos (medium)	100 nos	6000.00	Water tank 500 L cap.	2 nos	11000.00
Steel raiser for water harvesting	7 nos	3500.00	Plastic rassi (rope)	25 rolls	3750.00
Binding wire	1.5 kg	450.00	Rose/watering cane	2 nos	700.00
Sub-total					50400.00
Operational cost (FYM-3900.00, labour-35000.00, lime-400.00, plastic rope-300.00)					39600.00.
					Total 90000.00



View of rain-shelter with water harvesting system

rain-shelter is 1.81. So, it may be a suitable option for protected cultivation of tomato and king chilli in such high rainfall area. It is economically viable and also enable the farmers to grow high value low volume crops like king chilli, tomato, etc. for livelihood improvement of resource poor farmers through income generation.

Total yield of tomato was 1108.80 kg and get return of ₹ 60984.00 @ ₹ 55 per kg, total fruit production of king chilli were 6800 nos. and get return of ₹ 44200.00 @ ₹ 6.50 per fruit. Total return from tomato and king chilli was ₹105184.00. In 1st year, net income was ₹ 15184.00.

The life-span of the structure is minimum 3 years. The expected return from above structure during 2nd & 3rd year will be ₹ 210368.00 and the subsequently expected income will be ₹ 126128.00 (210368.00 – operational expenditure i.e. ₹ 79200.00 – maintenance cost of ₹ 5040.00). Total benefit will be ₹ 141312.00 (₹ 15184.00 + 126128.00). The cost: benefit ratio will be 1.81.

Low-cost plastic tunnel for vegetable nursery

Growing of off-season vegetable nurseries under poly-tunnel structure has become profitable to the farmers. The cost of king chilli seeds is very high so, it is necessary that every seed must be germinated with maximum germination and it requires controlled conditions. The main purpose of raising nursery inside the poly-tunnel is to get higher profit and disease-free seedlings in off-season to bring the early crop.

Similar to rain-shelter, this structure also made up of the locally available bamboo and UV stabilized polythene (200 micron). Seeds of fully matured fruits of king chilli were sown inside poly-tunnel in lines with 8-10 cm spacing & 1 cm depth. After 45 days after sowing (DAS), seedlings were ready for transplanting. Seeds were sown staggered manner thrice a year (Nov.-Dec., Feb.-March & April-May). Regular monitoring and standard intercultural operations were done.



Tomato in vegetative stage



Tomato in fruiting stage



Harvested tomatoes



Second plantation of tomato + king chilli



King chilli in ripening stage



Harvested king chilli

In the 1st year, ₹ 101830.00 was generated as income. The CB ratio of plastic tunnel is 26.18. So, it may be a suitable option for protected vegetables nursery of king chilli in such high rainfall area.

Table 2. Economy of plastic tunnel

Item	Quantity	Amount (₹)
Expenditure for establishment of unit in the size: Length- 5.50 m, Width-1.50 m & Height -1.50 m		
UV stabilized polythene, 200-micron thickness	24 m ²	1680.00
Bamboos (medium)	12 nos.	720.00
Labors	2 nos.	700.00
Plastic rassi (rope)	2 rolls	300.00
Sub-total		3400.00
Operational cost (FYM-100.00, Neem cake-350.00 and lime-40.00)		490.00
Total		3890.00

Total production of king chilli seedlings were 5286 numbers and get return of ₹ 105720.00 @ ₹ 20 per seedling. In 1st year, net income was ₹ 101830.00. The cost: benefit ratio will be 26.18.



View of low-cost poly-tunnel



Healthy king chilli seedlings inside poly-tunnel

Advantages of low-cost plastic rain-shelter and poly-tunnel

- It provides conducive micro-climatic conditions for production of high-quality vegetables and allows growing multiple crops on the same piece of land in a year.
- It gives opportunity to fetch a better price of the produce by growing them in off-season.

- It supports well to easily raise nurseries of different vegetable crops and also protects them.
- Raising of vegetable nursery in poly-tunnel structure has manifold benefits such as easy management, early nursery and protected from biotic and abiotic stresses.
- It increases the yield productivity with better quality and attracts enhanced return per unit resource invested.
- It provides alternative venture to cultivate the vegetables in high rainfall areas.
- It also fulfils the demand of producing nutritionally rich and hygienically healthy vegetables due to lesser use of pesticides.
- It facilitates effective control to pests and diseases and becomes easier to produce disease and insect free seeds of king chilli.
- Low-cost protected structures are ideally suited for progressive farmers having small holdings.

Constraints/Limitations of low-cost plastic rain-shelter and poly-tunnel

- High price fluctuations and lack of market information are the major marketing constraints in the way of protected cultivation.
- In marketing channel of produce, the major constraints faced by the farmers include the bad road conditions and high cost of transportation.
- Frequent occurrence of windstorms, hailstorms are also serious constraints.

SUMMARY

ICAR Research complex for NEH region, Arunachal Pradesh centre, Basar has designed a low-cost rain-shelter along with rain water harvesting system. The rain-shelter is made up of the locally available bamboo and UV stabilized polythene (200 micron). Inside rain-shelter, tomato (Arka Samrat F₁) and king chilli plants were grown and income of ₹ 141312 was generated with recorded CB ratio of 1.81. Similar to rain-shelter, poly-tunnel was also set up with locally available bamboo and UV stabilized polythene (200 micron). Under this structure, seeds of fully matured fruits of king chilli were sown in staggered manner thrice a year (Nov.-Dec., Feb.-March & April-May). From this structure, the recorded CB ratio was 26.18. So, it may be a suitable option for protected vegetables nursery of king chilli in such high rainfall area.

Future prospects

Revalidating the developed agro-techniques under harsh climatic condition and refining the technologies developed as per need and demand.

For further interaction, please write to:

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