



Improving water use for dry season agriculture by marginal and tenant farmers
in the Eastern Gangetic Plains

A Report on the bio-physical intervention in protected cultivation of crops at Dhalaguri and Uttar Chokowakheti Villages

Working Paper

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Introduction

Protected cultivation means cultivation of crops inside an artificially constructed structure where microclimatic parameters are controlled or modified to a direction favourable for crop growth, development and flowering. The concept of Greenhouse Technology derived in temperate European and North American countries where due to extreme cold seed germination and establishment of plants were not possible. After the development of polyethylene as a cladding material the concept of film plastic greenhouse was developed and the technology transferred to the rest of the world for various agricultural purposes. But the difference in basic principle is that in cold temperate region they spend much money to step up the temperature and in the subtropical and tropical warmer regions spend much money to lower down the temperature. Besides favourable microclimate simulation, protected cultivation has multifarious advantages like – Year round cultivation, off-season cultivation, improvement in quality of produce, increase in yield per unit area, judicious application of agro-input, restricted use of water, protection of crops from heavy precipitation, production of seedling for off-season cultivation and supply of seedling to the market etc. A plant can exert its best performance when it feels that it is in its native home. Hence, to get quality production from high-value crops, creation of provision for favourable microclimate as per the requirement of that particular crop is essential. Now-a-days crops can be protected from excessive precipitation, scorching sunlight, excessive heat and cold by preparing small bamboo made protected structures in homestead areas. Management of such house becomes easier for the farmers. The material requirement for such a bamboo made protected structure of 5m x 10m x 3m (central height

a. Bamboo (locally available) –

Pole of 3m – 22 pieces

Pole of 5m – 14 pieces

Bits of 2.75m – 16 pieces

Bits of 0.5m – 8 pieces



*(one piece of Bamboo approximately runs 5.5m-6m)

- Total requirement – 34 number of Bamboos (matured bamboo will be selected)
- 10% will be required extra because sometimes height mismatch will be there
- So, additional 4 number of bamboos will be required for this purpose
- Another 3 number of Bamboos will be required to prepare splits and supports
- Hence a total of 40 number of bamboos will be required

One number of bamboo costs about Rs. 80/-

The total cost for bamboo is = **Rs. 3200/-**

b. UV stabilized polyethylene sheet of 200 gauge thickness –

Total requirement is 160m², the value of which is about = **Rs. 10500/-**

c. Nails, spring, channel, rope, ribbon, frame of door etc. – about **Rs. 1000/-**

d. Shade net (50%) requirement- 100 m² including 10% extra, the value of which is about= **Rs. 2000/-**

e. Wages of two mandays for two days @Rs.250/- / day / person = **Rs. 1000/-**

f. Miscellaneous other costs = **Rs. 500/-**

Grand Total = **Rs. 18200/-**

** (if farm family will involve and carrying cost of material will be omitted by collecting from nearby sources, the cost will be reduced further)

Selection of crops in the protected structures:

Under the project, two number of small bamboo made protected structures (matured seasoned bamboo) in each site namely Dhalaguri and Uttar Chokowakheti have been established along with drip irrigation facility. The year round cropping sequence, after discussion with the beneficiaries have been identified for those four houses which is presented below –

Dhalaguri –

Month	Crops	Month	Crops
	Protected structure - 1		Protected structure - 2
December, 2016 – June, 2017	Off-season Capsicum	December, 2016 – April, 2017	Cucumber
July, 2017 – September, 2017	Off-season Cauliflower	May, 2017 – Mid-August, 2017	Off-season Coriander leaf and off-season Palak
October, 2017 – May, 2018	Capsicum (both main season and off-season)	Mid-August, 2017 – October-November, 2017	Cauliflower
June, 2018 – September, 2018	Off-season Cauliflower		

Uttar Chokowakheti –

Month	Crops	Month	Crops
	Protected structure - 1		Protected structure - 2
June, 2017 – September, 2017	Off-season Coriander leaf and off-season Palak	June, 2017 – September, 2017	Off-season Coriander leaf and off-season Palak

Standard agronomic practices and water requirement of some vegetable crops:

Selection of crop with an eye to efficient water management includes the choice of low water requiring crops as well as introduction of competent irrigation system and at the same time the crop must be a high value one to compensate the additional investments. Here drip irrigation system is

utilized as the proficient irrigation system to harness more crop per drop. In both the sites namely Dhalaguri and Uttar Chokowakhethi demonstration units of drip irrigation system have been established to sensitize the growers. The photograph of such a unit is presented below -



Among various other crops, seven potential ones for this region are explored for introduction in the protected structures afterwards. The agronomic standards of those crops are presented here -

Classical water requirement of some vegetable crops along with agronomical standards

Name of crops	Water requirement in Acre inch	Critical stage	Seed rate	*Fertilizers (N ₂ :P ₂ O ₅ :K ₂ O) Kg/ha	Cost of production	Expected yield
Sprouting Broccoli	20-25	heading	300-400 g / ha	100:80:100	Rs. 70000/ha	6-6.5t/ha
Cucumber	15-25	Vining, fruit set	5 Kg / ha	120:60:60	Rs. 70000/ha	15-20t/ha
Cauliflower	20-30	3-4 pairs of leaf stage	500-600 g / ha	100:60:60	Rs. 70000/ha	20-25t/ha
Bell Pepper	25-35	Establishment	200-250 g / ha	150:80:80	Rs. 90000/ha	20t/ha
French Bean	15-20	Pod set	30 Kg / ha	50:75:75	Rs. 50000/ha	15t/ha
Cabbage	20-30	Growth stage	500-600 g / ha	120:60:60	Rs. 90000/ha	30t/ha
Okra	15-20	Growth stage	8-10 Kg / ha	100:60:60	Rs. 60000/ha	15t/ha

*Every crop needs 20 tonnes of well rotten FYM/ha as basal manure application

Imparting training on:

- Management of protected structures at both Dhalaguri and Uttar Chokowakhethi :

This part of training includes the cleaning of protected structures, maintenance of the surroundings, maintenance of bamboo frame and use of shading nets

- Land preparation technique at both Dhalaguri and Uttar Chokowakheti :

This part of training covers the techniques of preparation of land, how to make it suitable to the plants, techniques for application of basal manures and fertilizers

- Crop management at both Dhalaguri and Uttar Chokowakheti

This part of training comprises of the techniques for preparation of seedbed and raising of seedling, transplanting technique, training techniques of Capsicum and Cucumber, top dressing of nutrients, intercultural operation and plant protection measures

- Drip Irrigation and management of irrigation system:

This part of training encompasses the filling of tank, technique for application of water in the protected structures through drip irrigation system, management of valves, maintenance and management of the system and management of emitters



Project personnel are working in the polyhouses along with respondents



Hands on experience on management of drip irrigation system



Training on seed sowing



Papaya seed sowing in polyethylene packet filled with soil and vermicompost mixture



Hands on experience on sowing of seeds



Seed sowing in polyhouses



Land preparation

Training on drip irrigation



Transplanting of Capsicum seedlings

Collection of information:

- Data on discharge ability of individual drip emitters have been collected in both the two sites. The average discharge from drip emitters in the protected house of Dhalaguri is 2.86 lit / hr, whereas, in Uttar Chokowakheti it is 2.88 lit/hr
- The duration of using the drip irrigation system at Dhalaguri in Cucumber and Capsicum were recorded by the farmers of Dhalaguri and in case of cucumber the duration was about 6 hours and in capsicum it is about 8 hours, in Palak and Coriander leaf the usage of this system is 1 hour each as on date.
- The application of agro-inputs in Cucumber, Capsicum, Palak and Coriander leaf was also recorded and presented here.



Cucumber in polyhouse



Data collection on discharge ability of emitters



Data collection regarding tank filling



Scientists visiting the protected structures



Information regarding protected cultivation under the project

Sl. No.	Crop	Area covered	Seed required	Cost of seed	Manures and fertilizer application	Cost of manures and fertilizers
1	Cucumber	24m ²	10g	Rs. 220/-	150 Kg vermicompost	Rs. 600/-
2	Capsicum	48m ²	5g	Rs. 400/-	300 Kg vermicompost	Rs. 1200/-
3	Coriander leaf	24m ²	500g	Rs. 120/-	NIL	NIL
4	Palak	24m ²	500g	Rs. 240/-	NIL	NIL
5	Cauliflower	48m ²	5g	Rs. 200/-	300 Kg vermicompost	Rs. 1200/-

(contd.....)

Sl. No.	Water requirement in open field	Water application through drip irrigation	Cost of water application	Cost of production	Yield	Selling price	Net return
1	20 hectare centimetre	686.40 lit	Rs. 8.24	Rs. 838.24 (including crop protection)	40 Kg	Rs. 480/-	(-)Rs. 358.24 (4 months)
2	25-40 hectare centimetre	1830.201 lit	Rs. 21.96	Rs. 1641.96 (including crop protection)	100 Kg	Rs. 5000/-	Rs. 3358.04 (7 months)
3	5-10 hectare centimetre	232.00 lit	Rs. 2.78	Rs. 132.78 (including crop protection)	7200 plants	Rs. 2880/-	Rs. 2747.22 (2 months)
4	5-10 hectare centimetre	225.6 lit	Rs. 2.71	Rs. 252.71 (including crop protection)	120 Kg	Rs. 4200/-	Rs. 3947.29 (2 months)
5	15-30 hectare centimetre	915.20 lit	Rs. 10.98	Rs. 1450.98 (including crop protection and nursery raising)	100 Kg	Rs. 4500/-	Rs. 3049.02 (3-3.5 months)

** A negative impact in Cucumber production was due to the following fact that the farmers' started the protected cultivation with that crop and they were not habituated with the system wherein they mixed up the techniques of conventional open field cultivation and cultivation under protected situation. Soon after this they made themselves acquainted with the technology and got success in Capsicum cultivation. Besides, instead of band placement they applied the vermicompost in the entire soil before starting of cultivation to improve its fertility status. The vermicompost was produced by themselves and hence they did not procure it but when the cost of production is determined it adds some more value in it making the production a non-remunerative one.

*** The health of plants and the quality of Capsicum fruits produced under protected situation is much better than the Capsicum grown in open field condition. The lobes are uniform in polyhouse grown Capsicum and the appearance and colour are much agreeable fetching a better price in the market.



Capsicum plant in fruiting stage in open field



Palak in polyhouses



Coriander leaf and Palak grown in polyhouses







Training in Capsicum



Scientists visiting the capsicum house



Farmer with produce

	
<p>Discussion regarding selection of crops</p>	<p>Farmer with produce</p>
	
<p>Capsicum under protected structure and open field</p>	

Preparation of information bulletin:

Leaflets on - Profitable vegetable growing through protected cultivation, cultivation technique of vegetables in protected structures under drip irrigation system, Protected cultivation technique of Capsicum, protected cultivation technique of French Bean, protected cultivation technique of off-season Coriander Leaf and protected cultivation technique of off-season Palak in regional language (Bengali) have been prepared and distributed among the farmers.