

PROTECTED VEGETABLE PRODUCTION - MORE PROFITABLE

SANATH M. BANDARA, Research Officer
and P.S. AMARASINGHE, Research Assistant
Horticultural Research and Development Institute

Agricultural scientists have developed many new varieties of several crops to increase the crop production in order to meet the increasing demand for food. In many instances, the main emphasis in the development of these varieties has been obtaining high yields. As a result many of these crop varieties are prone to pest and disease damage and are easily affected by many other environmental factors like heavy rain and wind. Consequently, they have to be protected from such environmental and biological factors. Heavy doses of pesticides are applied to these varieties causing environmental pollution and destroying several beneficial organisms.

Therefore, a concept of protected agriculture was developed to minimize the outside influence on these crop varieties. The crops are grown inside structures which allows only the sunlight and air to enter thereby protecting the crops from other environmental factors. This is very popular in temperate countries where crops are

successfully grown in glass houses during winter. However, this concept can also be successfully used in our country with tropical climate to protect crops especially from heavy rain and many pests and diseases.

The initial investigation on protected agriculture was started at Horticultural Research and Development Institute (HoRDI) in early 1995 with the view to introduce this concept to farmers. The objectives of these investigations are as follows.

1. To find out the suitable, long lasting, cheap materials to construct protective structures.
2. To find out the potential of the ordinary polythene for this use
3. To find out the nature of the structure as completely covered tunnels are not needed to protect crops from heavy rain.
4. To find out the suitable crop varieties and agronomic practices for those varieties.

The research activities were conducted at HoRDI and in farmers' field at Matale, Madolkele and Rathkarauwa (Welimada).

RESULTS AND DISCUSSION

THE STRUCTURE

To construct permanent frame of the structure, metal pipes or beams can be used. Semi-permanent structures can be constructed using PVC pipes, bamboo, or arica nut trees. Ordinary polythene or ultra-violet

rays resistant polythene can be used to cover the frame.

Eight meter long (length of 2 PVC pipes) and 04 meter wide (length of single PVC pipe) structure was constructed using PVC pipes to minimize wastage of pipes. The pipes were joined not using any glue so that they can be dismantled easily when necessary. The structure is depicted in figure 1.

The bamboo structure can be constructed as shown in figure 2. This structure is strong and has proper ventilation.

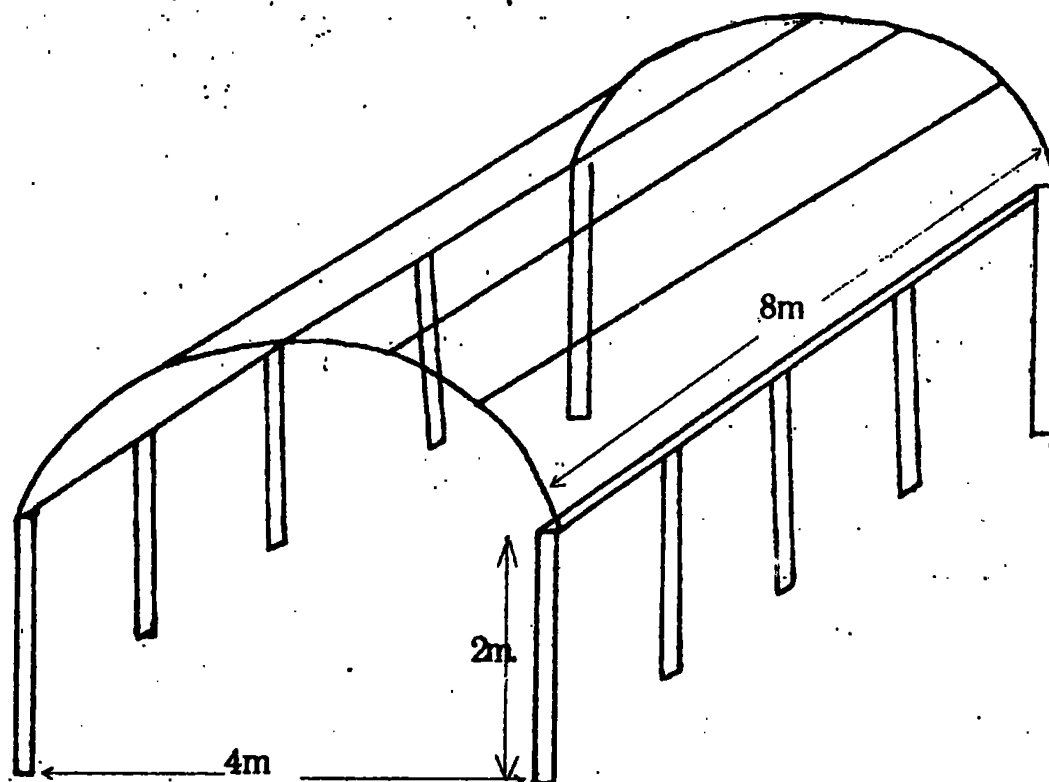


Figure 1: Protected structure constructed with PVC pipes

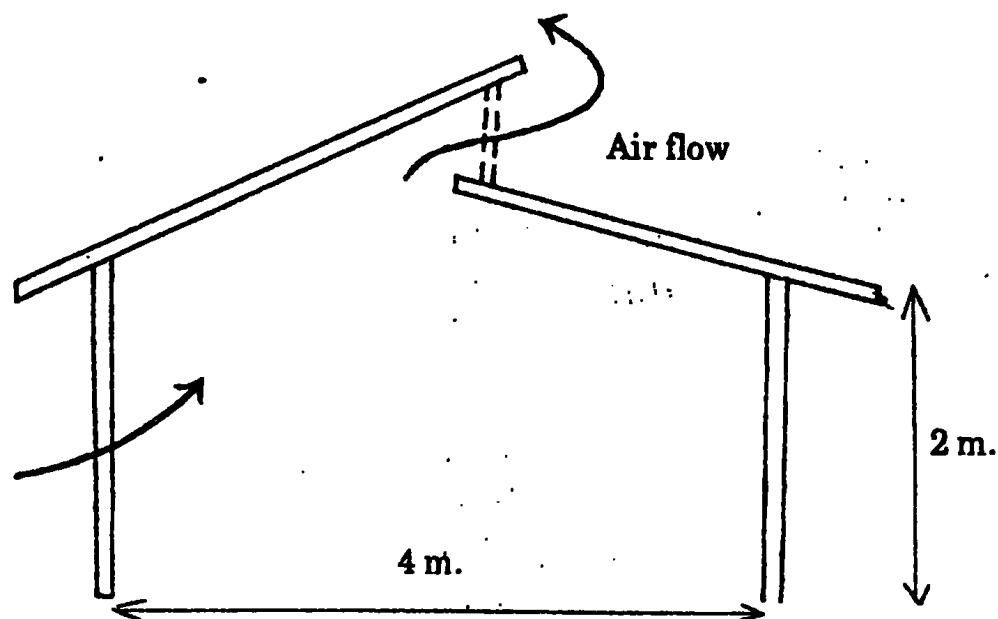


Figure 2: Cross Section of a protected structure made with bamboo frame

The expenditure for constructing structures with different materials and their lasting duration are given in table 1.

Eighty tomato plants can be planted inside a 32 sq.m. structure. On an average 03 kg of fruits can be easily obtained from each plant totalling 240 kg per crop. The price

of tomato varies from Rs. 5/- to Rs. 100/- per kg depending on the season. If the crop is grown during off season and a farm gate price of Rs. 25/- per kg can be obtained, the income would be Rs. 6,000/- per crop. The cost of a semi permanent structure (Rs. 10,000) can be recovered in 02 crops and further cropping will bring about

Table 1: The expenditure and duration of structures made with different materials.

Material	Expenditure (Rs.)	Lasting duration
Bamboo frame with ordinary polythene cover	1,800.00	Cover 06 months Frame 01 year
PVC pipe frame with ordinary polythene cover	6,000.00	Cover 06 months Frame 03 years
Metal pipe frame with ordinary polythene cover	10,000.00	Frame long term Cover 06 months
Metal pipe frame with UV resistant polythene cover	25,000.00	Cover 03 years Frame long term

higher profits. The crops and time of planting for protected structure therefore, have to be selected carefully to obtain the maximum income.

The locally available ordinary polythene can be used for cover but, as it cannot last longer, it can be a problem for farmer. In areas without heavy wind thin polythene can be used but it has to be replaced every season. Very thick polythene which is little expensive can last for about 7 - 8 months.

This structure is referred to as "tunnel" and sometimes "polytunnel." However, it actually refers to the completely covered plant houses that saves heat in the temperate regions. Our experiments indicate that completely covered structure is

not suitable for our climate. The temperature inside the covered structure rises to about 50°C during mid day and therefore a cooling device is a must. Therefore, construct the structure without any cover on the sides or in such a way that the polythene cover on the sides can be raised.

SELECTION OF CROPS

The table 2 indicates the yields obtained from some crops grown outside and inside the protected structure.

The average weight of a capsicum pod was 52 g under the protected cover while it was 26g outside.

The crops can be selected according to framers' preferences however, as the initial cost for this

Table 2: Yields of some crops grown inside and outside the protected structure at HoRDI

Crops	Inside the protected structure			Outside the protected structure		
	No. of Plants	Yield (kg)	Av. yield of a plant (g)	No. of Plants	Yield (kg)	Av. yield of a plant (g)
Red radish						
1st crop	283	12.6	44.5	269	07.1	26.3
2nd crop	400	21.0	52.5	406	19.2	47.2
Beet	145	35.5	244.0	119	16.0	134.0
Capsicum	20	5.76	109*	20	4.47	177*
Tomato	30	72.6	2.42**	30	48.8	1.62**

* - No. of pods.

** - Kg.

structure is high, it is advisable to select crops with high market demand and price. Capsicum, red radish, lettuce, cauliflower, salad cucumber and beet enjoy high market prices throughout the year and therefore, are suitable for cultivation under protected covers. Cultivate tomato in such a way that the harvesting coincides with periods of high market price. Mono cropping or mixed cropping can be practised inside the structure.

QUALITY OF THE PRODUCE

The quality of all the vegetables grown under the polythene cover inside the structure was found to be superior to those produced in the open fields. The products were devoid of blemishes and any other spots. Further, post harvest losses and disease incidences were low inside the protected cover compared to open fields. The plant growth of the protected crop was more luxuriant compared to

unprotected crop. The table 3 indicates the comparison of rotten fruit percentages in tomato under the protected cover and in open fields.

If the protective cover could be made insect proof, it is possible to grow crops without the use of any insecticides. Such produces will certainly enjoy good prices specially from specific consumers who look for chemical free vegetables. Farmer, can therefore, make much more profit.

MICRO-CLIMATIC CHANGES INSIDE THE PROTECTED COVER

Figure 3 depicts the changes in the maximum and minimum temperatures inside a completely covered protected structure (tunnel) at Gannoruwa and the comparison of the same with the open space. There are no considerable differences in the minimum temperature between

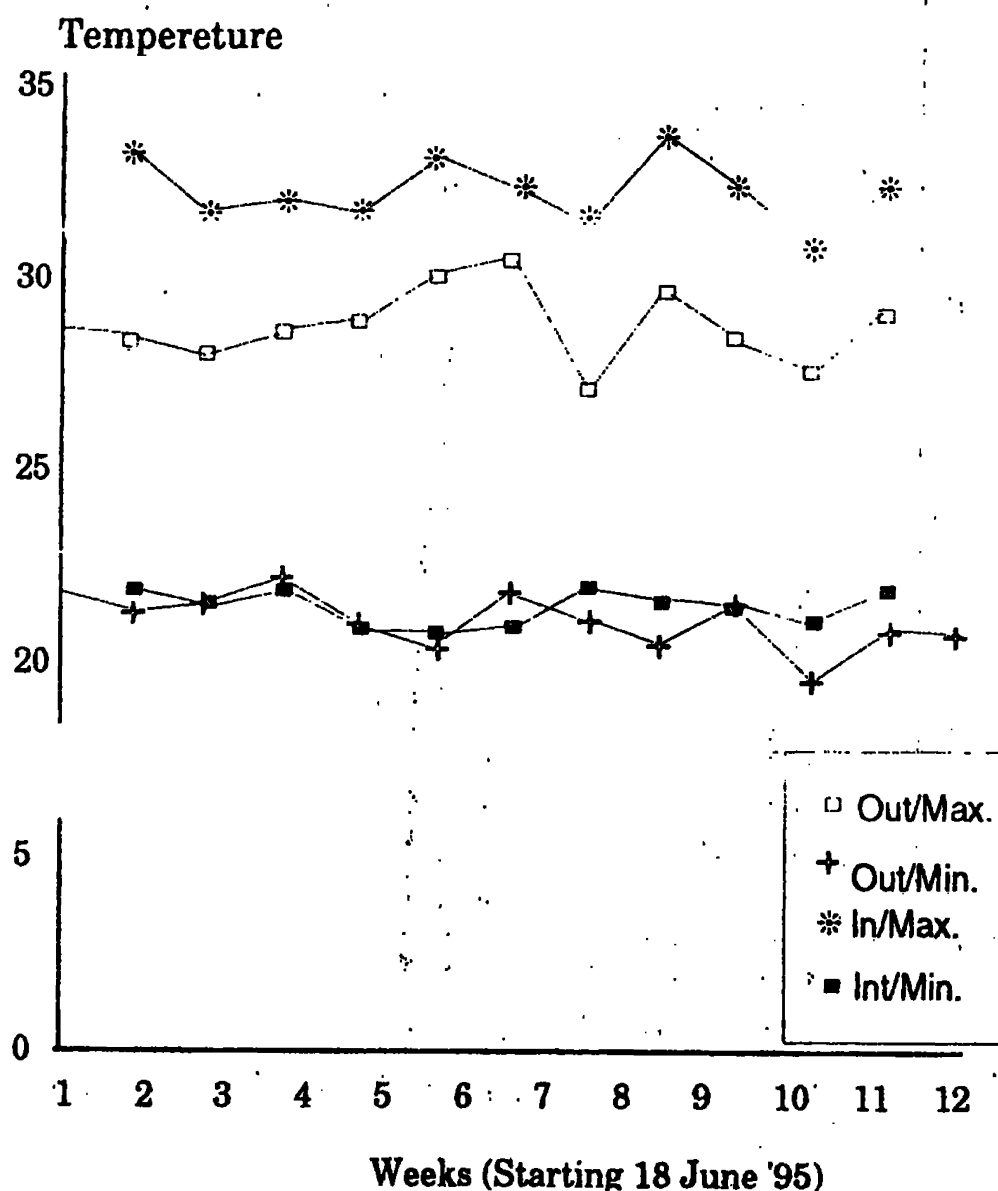
Table 3: Rotten fruit percentages of tomato under the protected cover and in open fields.

Tomato variety	% rotten fruits	
	Inside the cover	In Open fields
KWR	2.4	7.0
B-2	1.9	3.3
T-146	2.5	6.1
Caraibo	2.8	3.8

outside and inside of protected structure. However, the maximum temperature is higher inside the protected cover compared to outside. Therefore, in Sri Lanka some method has to be employed to reduce the temperature inside the protected structure if the temperature rises very high.

The rainfall (mm) and the relative humidity (%) inside the protective cover and outside at Gannoruwa for 11 weeks starting mid June are presented in figure 4. The data shows that the outside relative humidity corresponds to the rainfall while the RH% inside the cover is free of the influence

Figure 3: Temperature variation inside and outside the tunnel



of rainfall. Thus the crops inside the cover will not be affected by the diseases that develop due to high humidity during the rainy seasons.

CONCLUSIONS

Protective covers provide opportunities to obtain higher profits from limited land area. As the crops can be grown throughout the year without consideration for season, higher

profits are ensured with protective covers.

The produces of the protective covers are of better quality and therefore, can fetch higher prices. It is also possible to supply produces for specific markets.

It is possible to construct low cost structures thereby recovering the construction cost within 1-2 crops.

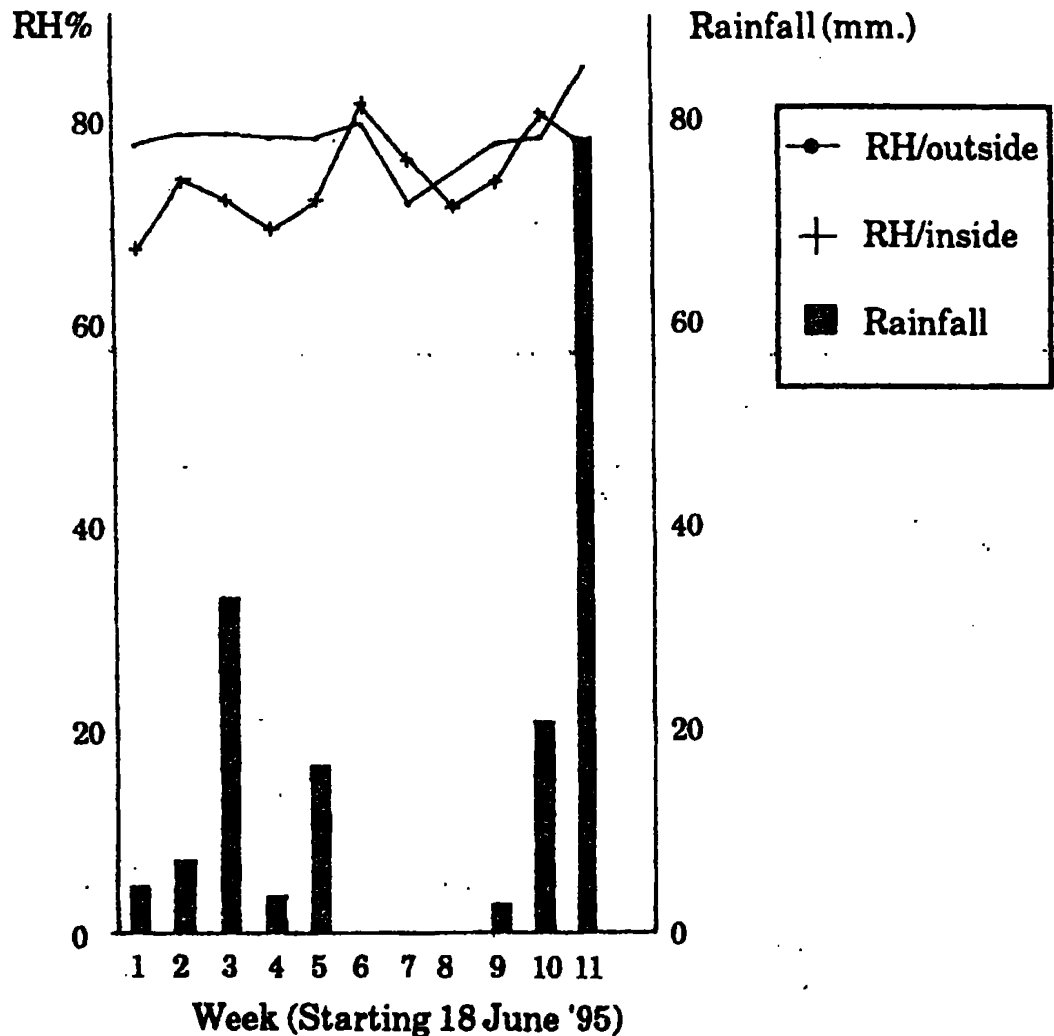


Figure 4: Relative humidity variation inside and outside the tunnel in relation to rainfall.