

COST EFFECTIVE WOODEN STRUCTURED GREENHOUSE

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INTRODUCTION

There has been a growing interest throughout the world in controlled environment horticulture. People have come to realize that in view of consistent world population growth, better system of intensive horticulture are required to meet the fruits and vegetables needs of tomorrow and at the same time conserve those resources that are non-renewable. Green house horticulture offers scope of production of fancy crops in off-season with yield often far greater than achievable under conventional horticulture.

The main purpose of greenhouse technology is to provide a good growing environment for successfully growing high quality plants round the year. In developed countries, the climatic conditions are mild in general. The growing of fruits, flowers and vegetables under polyhouse is common practice. Greenhouse structures are commonly used to grow off-season horticultural crops when the conditions are not favourable for their normal growing. Greenhouse ensures continuous supply of fruits, vegetables and flowers throughout the year.

The controlled environment/techniques like plastic greenhouses would be essential to promote agriculture particularly in the prevailing varied range of agro-climatic conditions in the country.

Greenhouses are structures covered with transparent to translucent materials such as LDPE, FRP and Polycarbonate sheets etc. which allows the solar radiation to pass through, but traps the thermal radiation emitted from the objects within. This creates a congenial environment for plant growth. Energy received from the sun is converted to heat within the greenhouse during the day as well as used for evaporate water during the normal transpiration of plants. The various parameters influencing plant growth such as Light, heat, CO₂ and moisture could be controlled in these structures.

The cost of basic structure for housing rigid or flexible covering material depending upon the structure materials selected such as G.I. pipe, M.S. angles, fibre glass reinforced polyester, glass, acrylic etc. Besides the cost of setting-up of greenhouse also depends on the covering materials used.

Such as greenhouses made of costly materials as mentioned above are however expensive and beyond the means of the average Indian farmer. To overcome these problems and to suit to farmer's economy in construction of these greenhouses in their field, a low cost wooden structure has been designed and field-tested. These structures are suitable for any covering materials like film plastic sheets, shaded nets, UV stabilized LDPE film sheets. The procedure for erection of such greenhouses are explained in this manual to facilitates a greenhouse user to have more space within the greenhouse, to carryout various agricultural practices.

The results obtained from the plant grown under these greenhouses suggest that this might be a feasible technology for small and marginal farmers as it result in a much higher yield and enables growing off season crops like vegetables.

PROCEDURE FOR ERECTING OF 35'x 20' WOODEN STRUCTURED GREENHOUSE

MATERIALS REQUIREMENT

1) WOODEN POLES

Selection of wooden poles play an important role in structure strength. Eucalyptus poles have many advantages than Casuarina poles as termite and fungal attacks are very minimal on Eucalyptus poles. Moreover, if nailed, these poles will be intact and its layers may not peel away because of good fibre strength.

Two sizes of wooden poles are normally used. One is of larger diameter 7 to 10 cms and other is around 5 cms diameter. The large size stems are used for the main structure and smaller size stems are used for the main structure and smaller size stems are used for the supporting structure.

No. of Poles required:-

Large diameter poles	:	21 nos.
Small diameter poles	:	34 nos.
Total no. of poles required	:	55 nos.

2) G.I. WIRE

4 mm diameter G.I. wires are used to fasten the bamboo sticks to the mainframe structures.

Total kg of G.I. wire required 2 kg

3) NAILS

Long wire nails are used for fixing the wooden poles with supporting poles as well as in the pole joints.

Nails required 7 cms long : 3 kg

4) UV STABILISED LDE FILM

The structures are suitable for any flexible greenhouse covering materials.

LDPE (Low density polyethylene) film is the most commonly used for greenhouses in the world. Moreover they are less expensive and easy to install. In India, LDPE films manufactured by Indian Petro Chemicals Ltd (IPCL) have many features and most suitable covering material for these wooden structured greenhouses. In our experience we found that IPCL LDPE film has many advantages and the parameters influencing plant growth such as light heat, CO₂ and relative humidity are well maintained under these coverings.

Total film required

The film (U.V. Film Low Density Polyethylene Film) required is about 2.48 times more than the floor area. E.g. to construct a greenhouse of 35' x 20' = 700 sq.ft. will require 1736 sq.ft. of UV film having total weight of approximately 30 kilograms having thickness of 200 microns.

6) Coaltar/BITUMEN: 2 Litres

7) LDPE FILM ROLL (10 cms width)

Ordinary LDPE film roll/leftover UV stabilised LDPE film roll of 10 cms width should be prepared to wrap all the poles, joints and wires to avoid direct contact with the UV stabilised LDPE film.

Total film required in kgs: 3 kgs

8) PLASTIC ROPE

Plastic ropes are used to sandwich over the LDPE sheet between the truss structure and the rope itself. This is to prevent any tearing of the sheet due to excessive wind force.

Plastic rope required: 5 kg

9) BAMBOO STICKS

Bamboo is used along a perimeter connecting the joints over the top in order to support the LDPE sheets that are laid over them.

Total no. of bamboo sticks required: 30

11) TAG NAILS

Tag nails are used with rubber washer to tag the LDPE sheets with the wooden truss structure. These tag nails are used to fix the sheets firmly on the wooden poles so as to fasten the sheets uniformly on the truss structure.

Tag Nails required (1" length): 250 gms

PROCEDURE FOR ERECTING OF 35'x 20' WOODEN STRUCTURED GREENHOUSE FOR LDPE FILM COVERING

STEP 1

SITE SELECTION AND ORIENTATION OF GREENHOUSE

A good and suitable site can make a difference in the functional and environmental operations of greenhouse. Ground slope for drainage is an important factor. Adequate provision should be made to divert surface water away from the greenhouse.

A short access to all weather public road will facilitate material handling to and from greenhouse. Moreover, if greenhouse situated near the market, it will be an added advantage. One of the important factors also to be considered is dependable supply of good quality water available near the site.

Greenhouse should be located away from other buildings and trees to avoid obstruction of sunlight.

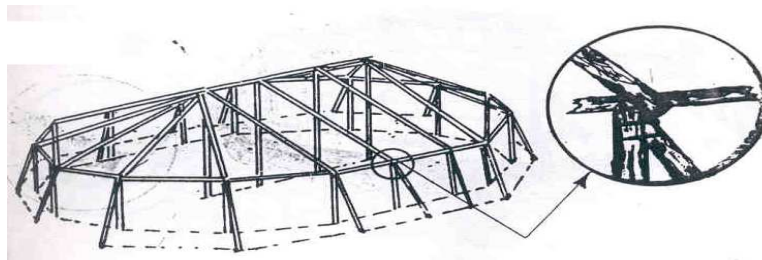
An east-west oriented greenhouse maintains better winter light level as compared to north-south oriented one.

It is very important to consider many factors pertaining to greenhouse orientation and such orientation has to be decided at specific site location depending on wind direction, available wind break as well as availability of sunlight throughout the day.

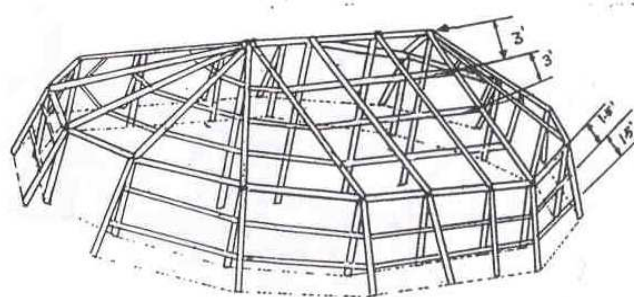
STEP : 2

Take large diameter wooden poles and coat them with bitumen and then wrap the poles with any LDPE film with the help of polypropylene sutli. This is to prevent them from any termite attack.

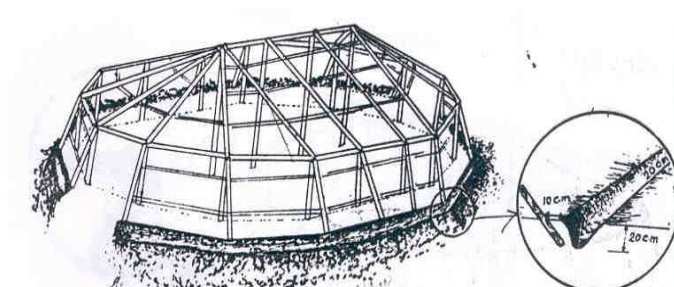
The greenhouse wooden structure to be constructed by means of suitable Casuarina poles of different sizes so as to form a truss structure as shown in the figure



Use bamboo cane to cover the total surface area as shown in the figure

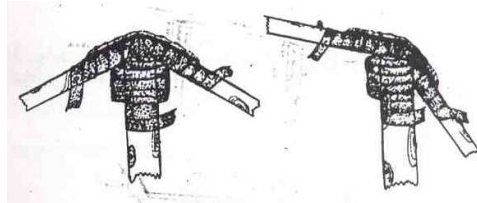


Dig 0.2 m x 0.2 m wide trenches along the length of the green houses. Throwing the soil outwards so that it can be used for burying the edge of UV stabilised LDPE film. Make sure that the soil used for covering this film is free from rocks or any sharp objects.

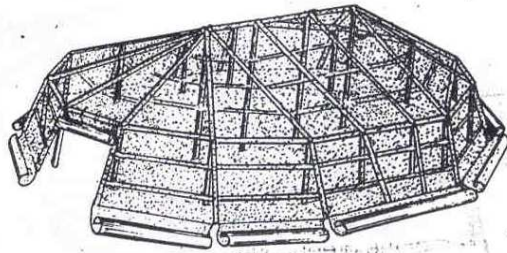


Wrap the LDPE film roll on all the poles which would come in contact with UV stabilised LDPE film. This is done to check the exposure of any sharp points to the UV stabilised LDPE films which can thus be damaged and also to avoid degradation of the film due to migration of resins from the wooden poles.

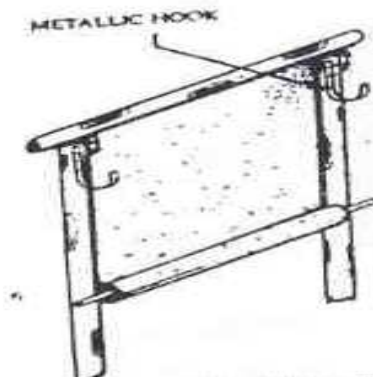
Wrap the film roll (as shown in the below picture)on al the pole joints which would come in contact with UV stabilized LDPE film. This is done to check the exposure of any sharp points to the UV stabilized LDPE films, which can thus be damaged, and also to avoid degradation of the film due to migration of resins from the wooden poles.



Clad the UV stabilised LDPE film across the length of the greenhouse as shown in the below picture. Fold on the either edges to a width of 2" and tag with nail and rubber washer at an equal distance of 4". Roll down the sheet in to the pit dug along the end. Cover the front and rear sides of the green house with LDPE sheets and cut the sheet so as to fit exact without any shrinkage and use nail and rubber washer to tag them with the structural member. Roll off the corners in to the pit as done previously and bury them with soil filled in to the pit, except for the sides on the either portions of entrance where the HDPE sheet on the side in rolled and hanged as shown.



Fabricate a metallic hook as per the figure and install two hooks on either entrance. The hook serves to rest the rolled LDPE sheets at the two entrances.



The greenhouse structure designed at MCRC has the following advantages.

- Low cost
- Easy to construct
- Using locally available materials
- Designed for use of UV treated LDPE sheets or thin plastic sheets

Withstand wind force

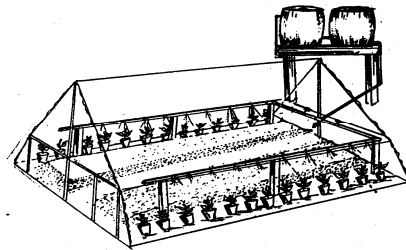
Long life

More greenhouse space & Greenhouse parameters like humidity and temperature can be controlled easily

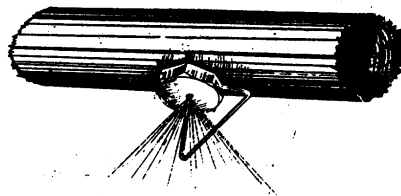
GREENHOUSE INNOVATIVE & SIMPLE MIST UNIT SYSTEM

MIST UNIT SYSTEM

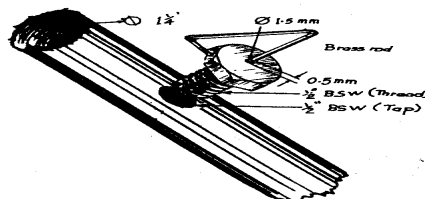
It is very important to apply water frequently to plants, which grow inside greenhouse to avoid plant wilts and slow growth. Moreover, it is very difficult to apply water manually to the plants because of higher temperature prevailing inside greenhouse. To overcome these problems, MCRC has designed and fabricated mist unit system consisting of Two HDPE 200 litres drums and G.I. pipelines with nozzles that spray water over the plants. This system can also be connected with any water distribution pipelines or overhead tanks with sufficient pressure.



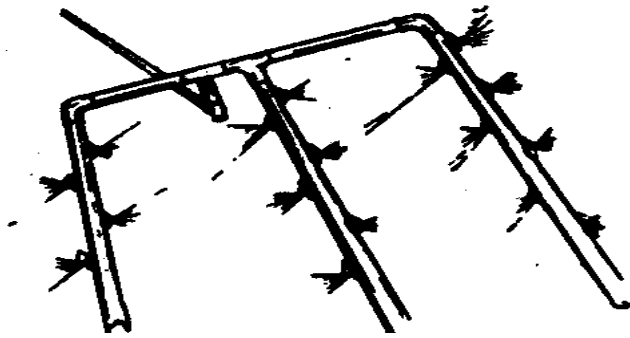
NOSSLE SPECIFICATION



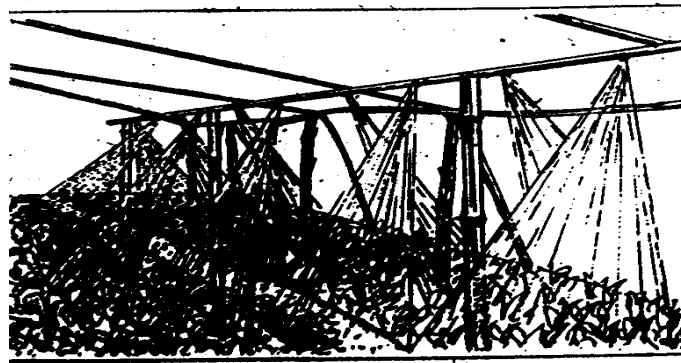
These nozzles can be designed and fabricated at workshop. Nozzles with appropriate sizes available in the market can also be used. In MCRC these low cost nozzles were designed using brass bolts. These Nozzles are made of brass to put out a spray arc of 180o - 190o. These nozzles are designed to accomplish an extremely high emission velocity with a low flow rate. For dependable efficiency, the nozzle's orifice and inner surfaces were properly shaped. The advantage of the specially designed is that no wrench or big instruments are required for tightening or removal and it requires no tape or sealant for sealing. It can be installed directly into rigid piping or tubing of almost any size provided there is adequate wall thickness.



One no. M.S. pipe of size 1 1/4" and having a length of 20 ft. is to be used. To one end of the pipe a valve has to be fixed and the other end has to be permanently closed by means of M.S. dummy. Seven numbers of 1.2" BSW tap at an angle of 45o to the horizontal were cut on either side of the above pipe. 1/2" BSW brass bolts having a central hole of size of 1.5 mm were screwed to the above tap. Then 2mm brass rod was bent in the form of a square size of 1", one end of it was welded to the side of the bolt head and the other end was made to project directly in front of the central hole present in the bolt. The distance between the bolt face and the rod was about 0.5 mm.



SPRAYING OF WATER IN MIST FORM USING GREENHOUSE MIST SYSTEM



The nozzle can spray up to a radius of 4 ft. and the mist system is fixed at a height of 5 ft. from the ground. The average velocity of the nozzle is around 4m/min.

Specification of Mist Unit System

Total Capacity of water tank	: 400 L
Water tank height	: 20 feet
Total no. of nozzles	: 28
Spraying area covered	: 4-6 feet/nozzle

This system works without using compressed air and works on the overhead tank pressure alone and requires no electricity.

Each nozzle consumes approximately 300-500 ml water to cover a radius of 4-6 feel depending upon the pressure in the overhead water tank. This system not only requires less water to irrigate plants but also to cover sufficient area in stipulated time. It was also observed, if manual watering

was used, the water consumption will be around 10 times more than the water used by the above system. Moreover, sufficient water will be supplied on time because of ease of application and requires no skilled persons to operate the mist system.

LOW COST WOODEN STRUCTURED GREENHOUSES

