Unit 1

Care and Maintenance of Protected Structures

Protected structures have two main components, namely structure and covering material. Greenhouse, net house, shade net, nursery, tunnels, etc., are examples of common protected structures.

In greenhouses, components like polythene film, insect proof net, pump, foggers, drip line, filter, control panel, heating system, shade net, etc., are delicate and some items like exhaust fans, pumps, motors, etc., are machine based. If these systems are not maintained from time to time they can get damaged due to mishandling or carelessness. Further, because of poor maintenance, frequent breakdowns are likely, hampering production resulting in losses. To avoid this, we have to properly maintain the various components of greenhouses very carefully.

Session 1: Care and Maintenance of Protected Structure Components

Maintenance of Protected Structure

Structure

- Check the nuts and bolts of trusses and purlins and if found loose, tighten them.

- Check the nuts and bolts in the main column and foundations, trusses and gutters, and if found loose, tighten them.
- Check the nuts and bolts of motors, cranks and gearboxes.
- Do periodic oiling and greasing of moving parts wherever they are present in the system like gearbox, crank, doors, etc.

Polyethylene film

- Wash polyethylene film with pressurised water flow once in a month during the day for fast evaporation, else algal growth may develop.
- During washing, do not use any brush or blade. Use a hosepipe with pressurised flow of water using cloth, if required.
- During washing, take care of the film to prevent it from tearing.
- If polyethylene sheet is torn by wind, use an adhesive tape (poly repair tape or tape roll) to repair the sheet from the inside and outside.
- Check the nuts and bolts in aluminium profiles, spring and tighten them properly.
- Always use new polyethylene film after 3–4 years of use.
- Avoid dismantling and installation of polyethylene film during windy conditions.
- During the installation of a polyethylene film, stretch it properly and fix one side in locking profiles and later, fix all the other sides in profiles.

Exhaust fan (in case of forced ventilated greenhouse)

- When the fan is on, don't put any materials or hand inside.
- When the fan is on, don't touch the louvers or push them forcefully.
- Oil and grease all the movable machine parts like louvers, bearing, etc., once in a month.

- Always check the nuts and bolts of the fan and its motor.
- Protect the motor from water.
- Periodically check the fan belt and pulley.
- Before starting repair work of the fan, stop electrical supply and check.
- Before starting the fan, after it is repaired, close the GI mesh properly.
- When the fan is being repaired, take care that no one switches it on.
- All the electrical work should be done by a trained or professional electrician only.

Heating and cooling system

- When the fan is on, don't put any materials or hand inside the heating and cooling system.
- The heating and cooling system should be operated only with permission from the incharge.
- Always check the nuts and bolts of the heating and cooling system and its motor.
- Before starting the heating and cooling system, stop the electrical supply and check.
- Do not allow the heating and cooling system to run continuously to avoid burning or melting of the duct.

Side curtains

- Ensure proper lifting of the side curtains using the curtain handles.
- Apply a lubricant, in case the handle is jammed.
- In winter, close the curtains from evening to the early hours of the next morning.
- Close the side curtains, when there are high speed winds, storm or rain, else the greenhouse may get flooded and polyethylene may get torn.

Shade net

- Before the shade net is installed, all the wires should be tightened properly.
- During installation, ensure that the net is not torn.

NOTES

- Don't use any sharp tools to fix the shade net.
- Before fixing the shade net, stretch it from all the sides, not leaving it loose.
- Before dismantling, rolling and storing it in the shade, ensure that there are no cuts or tears.

Motor, pump, control panel and electrical cable

- Use a proper shielded cable for the greenhouse.
- Always check the pumps, motors, etc.
- The pump and motor should be serviced periodically.
- Call the electrician to check the panel.
- Protect the panel from water.
- Only a trained person should operate the panel.
- Follow the instructions of an electrician or engineer.
- A motor, pump, control panel and electrical cable should be ISO/BIS marked.

Precautions to be taken during Care and Maintenance

- The greenhouse should have double doors.
- Both the doors should remain closed.
- Close the doors after entering the greenhouse.
- Keep footwear outside the greenhouse.
- Don't smoke inside the greenhouse.
- Clean hands and feet before entering the greenhouse and workers should not wear bright coloured clothes.
- Don't touch the leaves or parts of diseased plants or use gloves while touching them.
- Ensure there is no water logging in the greenhouse.
- Don't open the side curtains or doors during heavy wind and rainfall or in severe winter.
- Shut off the entire system before leaving the greenhouse (except the heating system in severe winter) in the evening and restart it in the morning.
- Check that the voltage is proper, before starting the control panel. If there are fluctuations in the recorder, check the system properly and use a voltage stabiliser.

- Check the water level in the tanks daily and ensure that they are filled.
- In winter and low light conditions or cloudy days, the shade or silver net inside the greenhouse should be folded back for proper solar radiation.
- Check all nuts and bolts, pipes, drip system, fogging system, sprinkler system, and cable networks inside the greenhouse periodically.

Practical Exercise

Activity 1

Visit a polyhouse or shade net house and find out from the grower about the maintenance activities being carried out.

Material required: Writing material

Procedure

- Visit the site in consultation with the farmer.
- Interact with him and find out the maintenance activities that are being taken up regularly.
- Note down the activities.

Check Your Progress

A. Fill in the blanks

1. _____ is strictly prohibited inside the greenhouse.
2. Oiling and greasing should be done periodically wherever _____ are present in the greenhouse system.
3. Do not open the _____ during heavy wind, rainfall and severe winter, else the greenhouse may get flooded.
4. All critical maintenance work related to faulty cables in the greenhouse should be done by the _____only.
5. The electric control panel should be protected from _____.

B. Multiple choice questions

1. What should be done to improve lighting conditions during cloudy days in a greenhouse?
   (a) Spread a silver net inside the greenhouse
   (b) Fold back the silver net inside the greenhouse
   (c) Cover the top with a shade net
   (d) None of these

2. The polyethylene film should be changed after every _____.
   (a) 1 year
   (b) 3 years
   (c) 2 years
   (d) 5 years
3. The entire greenhouse system should be shutoff in the evening or night except _____ system in severe winter.
   (a) Irrigation
   (b) Cooling
   (c) Heating
   (d) Fertigation
4. _____ is used to regulate solar radiation inside the greenhouse.
   (a) Insect net
   (b) Shade net
   (c) Mulching sheet
   (d) Weed mat

C. Subjective questions

1. List the measures to be taken for the maintenance of a greenhouse.

   _____
   _____
   _____

2. What steps should be taken to maintain an exhaust fan?

   _____
   _____
   _____

3. What precautions should be taken while running a heating system?

   _____
   _____
   _____

4. Why should polyethylene or cladding material be washed periodically? How should it be done? What are the precautions to be taken while washing?

   _____
   _____
   _____

D. Match the columns

A	B
1. Greenhouse	(a) Water
2. Footwear	(b) Two doors
3. Protect motor	(c) Kept outside

Session 2: Care and Maintenance of Drip Irrigation and Fogging Systems

There are four types of maintenance schedules of drip irrigation system.

1) Daily maintenance
2) Fortnightly maintenance
3) Periodic chemigation
4) Seasonal, storage and re-installation maintenance

General Maintenance Guidelines for Filters

Emitters, mini sprinklers and drip lines have to be safeguarded from clogging. Proper maintenance of filters is essential to avoid clogging. This results in maximum efficiency of the irrigation system.

Daily maintenance

- Start the pump and let the pressure stabilise in the system and check for leakages.
- Depending upon the irrigation design, correct the pressure at the sub-main level, by adjusting the throttle.
- Inspect whether water is reaching all the corners of the beds. If it is not, find the cause and correct it. If there is any twist, fold, cut, punches, or any such thing causing variation, correct it immediately.
- Inspect whether the uniform wetting pattern is seen at the end of the irrigation shift. If dry patches are found, check the drippers.
- Check for the formation of scale or solid substance precipitated from a solution and damages caused, if any.
- In case of any damage in the drip lines causing leakage, correct it by using proper joints.
- Flush all the drip lines by opening the end plugs, starting from the nearest point to the water source allowing flushing for three minutes or more till clean water starts flowing.
- Flush each of the sub-mains at the end of the irrigation until dirt-free water flows out. Check the pressure level at both the inlet and outlet of the filters by using a pressure gauge.

Notes

- Remove slurry from the hydrocyclone filter after every five hours.
- The screen or disc filter, hydrocyclone and media filter should be flushed every day. Back wash or flush out the filtration system before switching on/ off the irrigation system.

Periodic or fortnightly maintenance

- Take out the elements of the screen filter or disc filter and clean them properly.
- Clean the media filter by reversing the direction of the flow and stirring the media manually while the system is in operation.

Periodic chemical treatment

Quality of water is the most important factor for successful functioning of a drip system. The drip system consists of a large number of emitters, which have very small flow paths. The emitters are prone to blockage or clogging due to contamination in source water.

A drip system could be clogged due to the following reasons:

- The presence of large particles as well as suspended silt and clay load in source water
- Growth of bacterial slime in the system
- Growth of algae in the water source and in the drip system
- Bacterial precipitation of iron or sulphur
- Chemical precipitation of iron
- Chemical precipitation of dissolved salts (present in source water) in laterals, drip tapes and drippers.
- Mechanical disruption due to some breakage or broken components.

Physical treatment like filtration does not remove the dissolved solids or salts, bacteria or microscopic algae from water. Bacteria and algae can grow in the drip system or can interact with particles of silt and clay and form clusters or catalyse precipitation of salts. Such precipitation can cause clogging or blockage of

laterals and drippers. Chemical treatment of water either at source or within the system is the most useful method of preventing or rectifying the clogging problem. In chemical treatment, acid or chlorine is injected in the drip irrigation system with irrigation water. Water analysis is the most reliable way to decide on chemical treatment. Soil and water samples should be collected during the survey and then analysed to recommend acid or chlorine treatment as per the quality of water being used.

Seasonal, storage and re-installation maintenance

- Before retrieving the system, carry out fortnightly maintenance.
- Remove end plugs and wind drip lines from the end plug side to the starting connector in separate rolls for each row. Farmers often disconnect the drip lines from the sub-main and stack them there to carry out inter-cultural operations. This should not be done.

Maintenance of Hydrocyclone Filters

- A hydrocyclone filter does not require much care for its maintenance. However, the inside portion of the under flow chamber should be checked and accumulated dirt, if any, must be cleaned. The chamber must be flushed by opening the flush valve or cap or the main valve.
- Dirt has to be cleaned regularly. The walls can erode due to excess pressure and/or uncleaned dirt chamber.

Maintenance of Sand Media Filter

- Sand filter is effective for removing heavy organic and inorganic contaminants. In due course of time, the contaminants in water accumulate and clog the pore space of the filter, reducing its efficiency. A sand filter must be backwashed daily. Backwashing is a process that involves reversing the water flow. It results in lifting of the sand to release the collected dirt through a backwashing valve.

- Backwash flow must be adjusted properly because insufficient backwash flow will not clean the sand properly.

Maintenance of Screen Filter

- A screen filter should be flushed daily for proper maintenance. If the pressure falls to more than 0.5 kg/cm^2 (5 m at water head), then flushing of the screen filter is recommended. Checking the inlet and outlet pressure helps in observing the pressure difference.
- Flushing is done by opening the drain valve and allowing the force of water to flush out the dirt through the drain valve. It is also necessary to clean the screen at regular intervals. For cleaning screen filters, the lid has to be opened to remove the screen filter and then cleaned under flowing water, rubbing it gently with a soft cloth or nylon brush, etc.
- While cleaning, be careful to avoid scratches. If any portion gets scratched, it should be painted with oil paint to avoid corrosion.

General Maintenance Guidelines for Foggers

- Proper operation of foggers is important to maintain temperature and humidity in the greenhouse. Water quality is very important for proper operation of the foggers. If the water is hard and saline, it blocks the hole of the nozzle. The water pH should be less than 7.
- For chemical treatment of hard water, do not use acid in flowing water as it will damage the plants. Always take out nozzles periodically and simply keep them in a plastic bucket containing diluted acid for one night. The next day, wash all the nozzles with fresh water. Sometimes, if there is excessive salt deposit, air pressure could be needed to clean the same. After washing with fresh water, again fix it with anti-leak. Do not use any pin or nail or a sharp object, etc., to clean the fogger nozzle.
- Always check and clean the filters daily before operating the fogger system. While operating the

fogger system, check the pump pressure daily near the filter because sometimes due to clogging of the filter, the inside pressure gets reduced.

(a) Screen filter cleaning

(b) Disc filter cleaning

Fig.1.1: Cleaning of filters

Practical Exercise

Activity 1

Visit any farmer's field that has drip irrigation and note down the measures being carried out for filter maintenance.

Material required: Writing material

Procedure

- Visit the field with prior appointment and permission to clean filter.
- Observe the type of filter.
- Carry out maintenance based on the type of filter.

Activity 2

Draw different filters used in a greenhouse irrigation system and their sequence from water source to plant.

Material required: Writing material

Procedure

- Enlist the types of filters used.
- Write briefly about these filters.

Activity 3

Visit a farmer's greenhouse and ask him to open any filter and explain how it is cleaned.

Material required: Writing material

Procedure

- Open the filter.
- Clean the filter as suggested.
- Retighten the filter.
- Write down your observation.

Check Your Progress

A. Fill in the blanks

1. Physical and chemical treatment of water are the two important methods of rectifying _____.
2. The pH of water should be less than _____ for irrigation or fogging.
3. The role of water quality is very important in a _____.
4. The scratched portion should be painted with _____ to avoid corrosion.
5. Proper operation of foggers is important to maintain _____ and _____ in the greenhouse.

B. Multiple choice questions

1. A filter effective for removing sand particles from water is known as _____.
   (a) screen filter
   (b) sand filter
   (c) hydrocyclone filter
   (d) all of the above
2. When water contains algae, _____ is used for cleaning the water.
   (a) sand filter
   (b) chlorine
   (c) sulphuric acid
   (d) screen filter
3. It is recommended to flush the screen filter, if pressure falls to more than _____.
   (a) 0.5 kg/cm^2
   (b) 1.0 kg/cm^2
   (c) 1.5 kg/cm^2
   (d) 2.0 kg/cm^2
4. The clogging of a drip system could be due to _____.
   (a) growth of algae in the drip system
   (b) chemical precipitation of iron
   (c) bacterial precipitation of sulphur
   (d) all of the above

5. Generally, how many types of maintenance schedules are advised for drip irrigation system?
   (a) 2
   (b) 3
   (c) 4
   (d) 5

C. Subjective questions

1. Why should we use different filters in a greenhouse irrigation system?

   _____

   _____

   _____

2. What are the major causes of clogging in a drip system?

   _____

   _____

   _____

3. Explain the maintenance of a sand filter.

   _____

   _____

   _____

D. Match the columns

A	B
1. Physical method	(a) Drain valve
2. Chemical treatment	(b) Filtration
3. Flushing of dirt	(c) Chlorine treatment

SESSION 3: SANITATION PRACTICES IN GREENHOUSES

For maximum benefits, the environment in greenhouse cultivation should be healthy. The following practices, if adopted, would lead to better production inside the greenhouses.

- Keep the premises neat and clean.
- Use a sanitiser before entering the greenhouse or net house.
- Do not allow people other than regular workers inside the structure.

- Use double door entry (anteroom) but always open only one door at a time. It must be closed immediately after you enter, to avoid pest and disease infestation.
- Stick yellow sticky traps in the ante room or paste yellow polythene on the walls and spread grease on it to check the entry of small insects, etc.
- Always use safety shoes, apron, cap, goggles and gloves while working.
- Always keep a first-aid box handy. It should contain bandage, band-aid, potassium permanganate, cotton, iodine, pain reliever, etc.
- Always use a folding ladder, scaffolding, scissors or lift while working at a height. Don't use a single ladder while working at a height.
- Keep a fire hydrant equipped with CO_2 cylinder so that it can be used immediately in case of fire.
- Display the contact number of ambulance, hospitals, police station, fire station and emergency at the site.
- Do not smoke and chew tobacco at the site while working.
- Keep chemicals in a proper plastic packing jar.
- Always wash your hands with a sanitiser before having lunch or dinner.
- Use a rubber mat while working with an electrical equipment.
- Always switch off the mains while working with any electrical equipment.
- Do not burn any plastic items while working. Keep them at one place for safe disposal.
- Use protective clothes while working. Try to wear cotton clothes.
- Do not throw or burn any plastic carry bag, empty packet, bag and boxes at the site. Keep them safely at one place, away from the reach of children or animals (animals should also be kept away from the greenhouse area).
- Do a mock drill operation for emergency once in a fortnight or monthly so that workers remain aware about the safety measures during an emergency.

- Always conduct periodic training related to sanitation, safety and health.

Practical Exercise

Activity 1

Visit a farmer's field that has a polyhouse and note down the observations on different aspects of sanitation.

Material required: Writing material

Procedure

- Visit the field that has a polyhouse.
- Note down the sanitary practices that are followed by the farmer by observing as well as interacting with the farmer.

Check Your Progress

A. Fill in the blanks

1. _____ cylinder should be kept near the fire hydrant so that it can be readily used in case of fire.
2. Use _____ mat while working with an electrical equipment.

B. Multiple choice questions

1. Which contact numbers should be displayed at a working site?
   (a) Ambulance
   (b) Hospital
   (c) Police station
   (d) All of the above
2. The greenhouse should have a _____.
   (a) single door
   (b) double door
   (c) both (a) and (b)
   (d) none of the above.
3. While working at height, always use a _____.
   (a) single ladder
   (b) folding ladder
   (c) both
   (d) none of the above

C. Match the columns

A	B
1. Anteroom	(a) Fire hydrant
2. CO_2 cylinder	(b) Iodine
3. First-aid box	(c) Working with electrical equipment
4. Rubber mat	(d) Double door entry

D. Subjective questions

1. Explain the sanitary requirements in and around a greenhouse.

   _____

   _____

   _____

2. Explain the importance of a clean greenhouse cultivation.

   _____

   _____

   _____