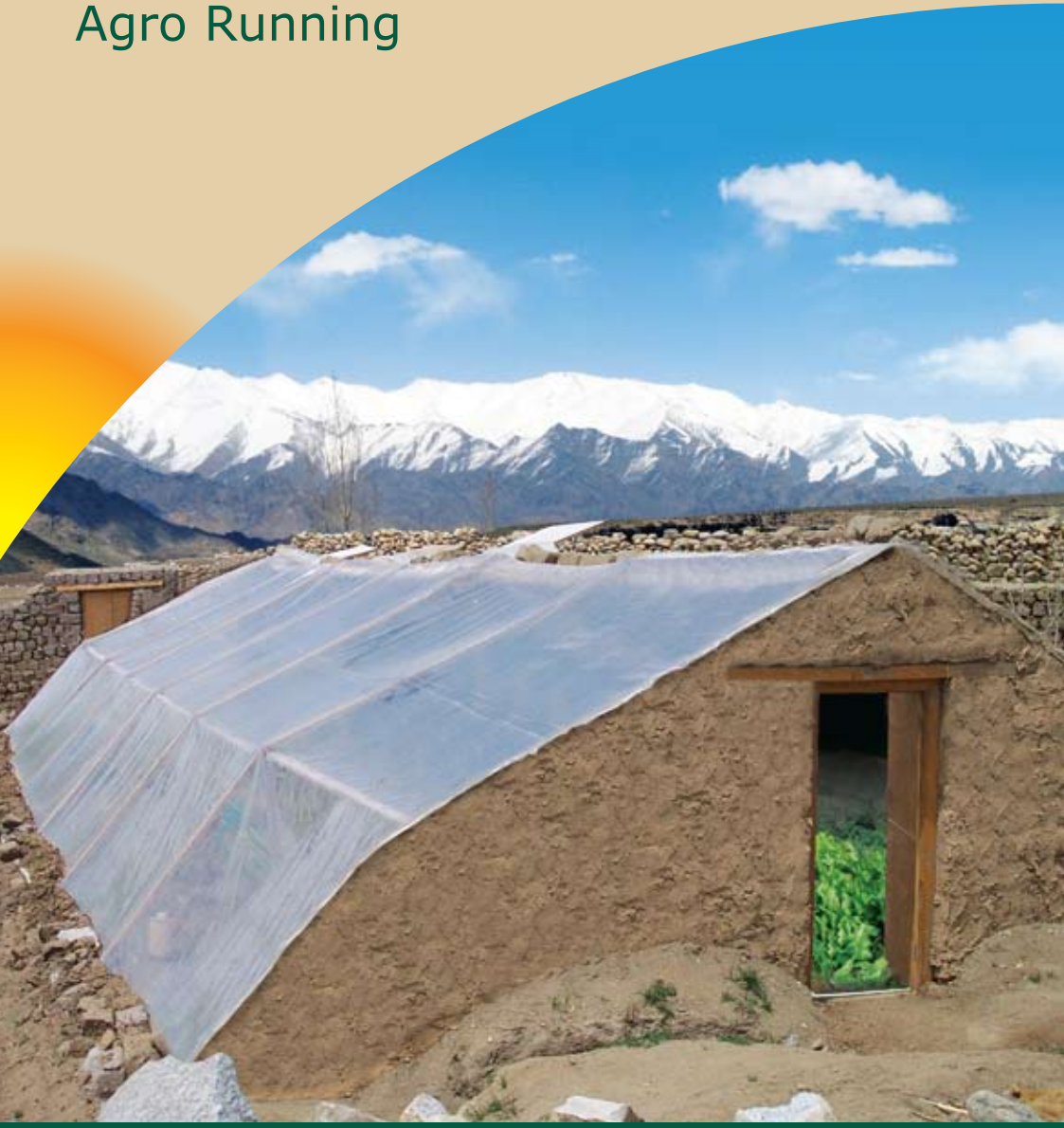
# Improved Greenhouse

## Agro Running



geres
Energy
Environment
Solidarity

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## Improved Greenhouse (IGH)

Due to the harsh winter conditions of Ladakh, fresh vegetables are quite seasonal and can be grown only in open field from May to October. The region remains cut from the rest of the world for almost six months during the winter. Thus, the only means of supply for vegetables is being done via plane at astronomical prices. Hence, to meet the demand for green vegetables during winter at reasonable prices LEHO introduced an innovative construction design to build the Improved Greenhouse (IGH) that serves as a source of vegetables during the lean season. The innovative IGH design has been found to further enhance the vegetable production as well as the income generation potential of the people.

To be efficient and successful an Improved Greenhouse should:

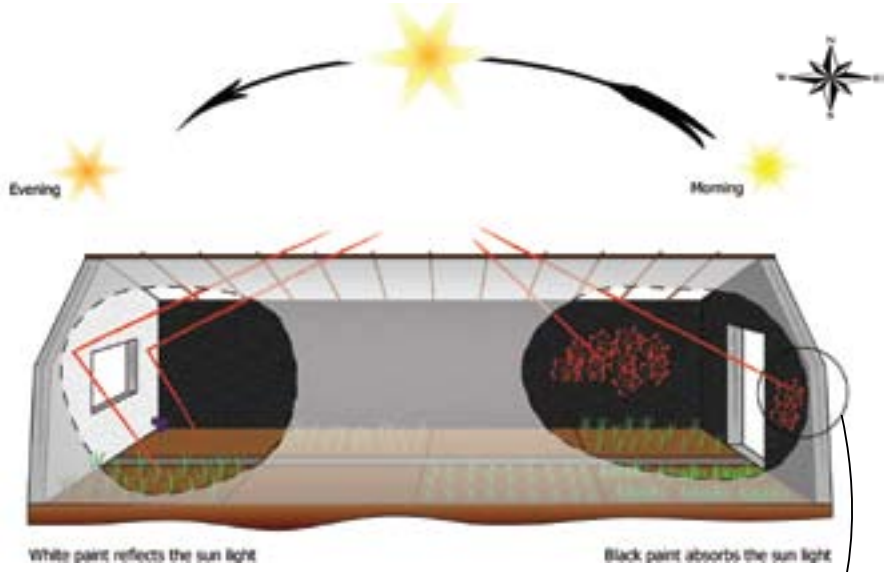
- Gain solar energy
- Store the solar energy

## Main Design Concepts

*Gain and Store the solar energy for longer time.*

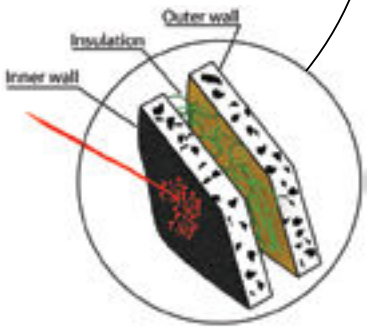
### To gain solar energy

An IGH should be projected at 35 degree angle facing in the south direction with a slope roof to gain more solar radiation.




### To conserve solar energy

Double wall with insulation doesn't allow heat to escape and the inner wall stores the heat for the night.



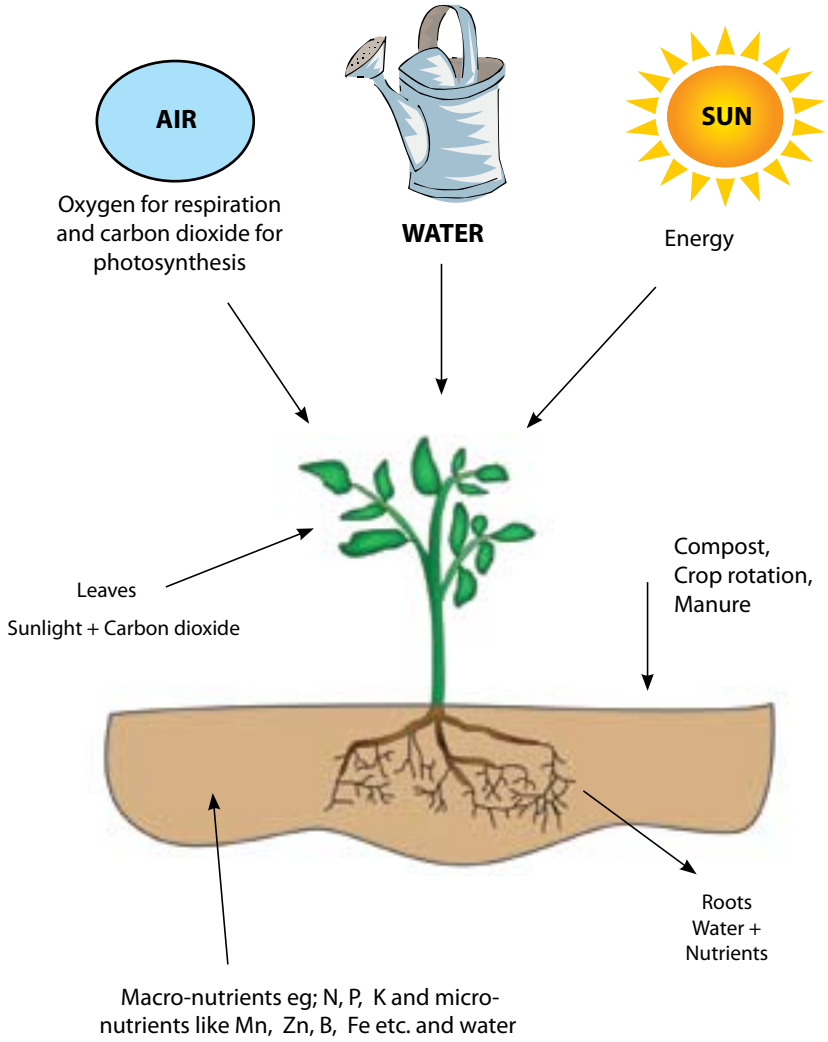

*Double wall detail*

### Night cover

Night cover (double / black poly-sheet or cloth) helps in minimizing heat loss during the night. It will protect plants from freezing.

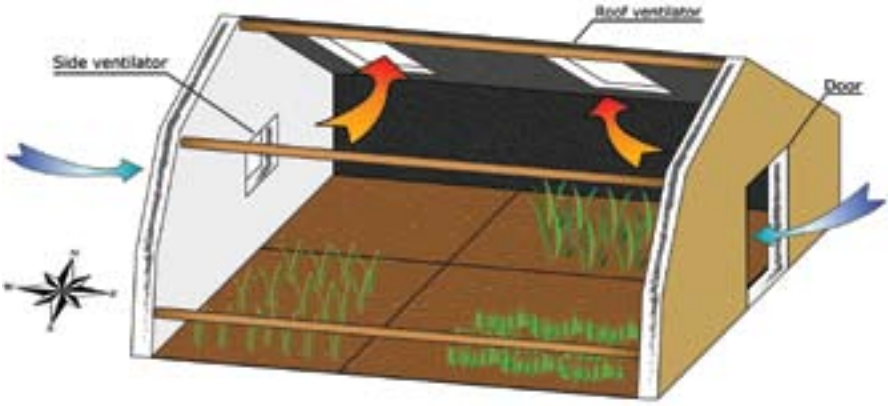
## The plant's nutrient requirements

A plant needs air, water and sunlight to make its food from the soil.



## Ventilation

Warm air being lighter rises and goes out by roof ventilator/s. Cold air enters through the door and side ventilation




Ventilation is very important for vegetable growth because:

**It controls and maintains the temperature.**
Too high temperature (over 30°C) is not suitable for the proper growth of vegetables.

**It controls humidity.**
High humidity level gives higher risk of diseases, disturb the soil fertility and reduce plant growth

## Plot preparation

1) Remove stones & weeds

2) Add Manure / compost

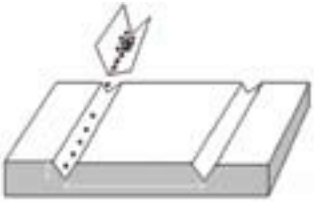
3) Mix manure with soil

4) Sowing

The soil should be finely ploughed, well leveled and humid before sowing.

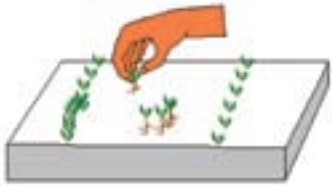
## Sowing and thinning Mongol seeds

- Trace the sowing lines, respecting depth and distances adapted to each crop.
- Cover seeds with fine soil and press gently.
- Irrigate.



I –Sowing Depth- 1/2″

3 weeks



II -Thinning: plant 3″ apart

1 month

III – Transplanting
Plant to plant: 6-8″
Row to row: 10-12″

| Plant | Distance | | Sowing depth |
|---|---|---|---|
| | Plant to plant | Row to row | |
| Mongol | 1-2″ or line sowing | 6-8″ | 1/2″ |
| Carrot | 2-4″ | 18-24″ | 1/2 to 1/4″ |

## Weeding

Ideally one should visit each bed in the IGH at least once to check each plant for signs of sickness/infestation, weeds (make sure to remove the roots too), dead/dying leaves or flowers (remove with clippers).

### Pruning

If a leaf is just browning at the edges or at the tip, cut or prune off the browning or dead areas, leaving the rest of the leaf alone.

### Seedlings production

Good and healthy seedlings are obtained by:
Respecting distance between the plants and rows
Providing good irrigation, light, mature compost and green manure
Opening the greenhouse progressively one week before the transplanting in order to acclimatize the seedling to the outer environment
By keeping ventilators open to avoid over heating and high temperature

Good seedling

Bad seedling

## Mongol transplantation


Roots that are one to two months old are the best to transplant, whereas old roots are less productive.

Two main points should be respected while transplanting Mongol roots:
Keep only 1 or 2 small leaves and remove the bigger one.
Keep soil well settled around the roots to avoid being getting disturbed.

Note: The most important point for good production in winter is to sow Mongol in August and to transplant it in September
Timely transplanting will make the roots strong and hardy thereby making the plant resistant to cold.
When transplanting, always keep in mind to respect distances between plants and rows.

Recommended spacing for commonly cultivated plants while transplanting:

| **Plant** | **Plant to plant distance** | **Row to row distance** |
|---|---|---|
| Mongol | 4-6″ | 10-12″ |
| Spinach | 6″ | 12-18″ |
| Tomato | 16″ | 30-36″ |
| Cabbage | 20″ | 24-36″ |
| Cauliflower | 15″ | 24-36″ |
| Onion | 3″ | 12-18″ |

## Quantum and frequency of irrigation

The main principle of irrigation is:
To apply it at the best time, at the right place (where active roots are) and with minimal water loss.

The quantum and frequency of irrigation depends on physical factors such as:

- Temperature inside the IGH
- Soil moisture content
- Humidity inside the IGH
- Type of crop

| Soil type | Quantum and frequency |
|---|---|
| Clay | Low |
| Loam | Moderate |
| Sandy | High |

## Harvesting technique

To get the best out of your vegetable harvest, you must pick them at the right time and in the right way for a flavorsome and bountiful. Harvest big leaves at the base by leaving the new leaves at the centre in order to:

- Minimize the loss of the energy by feeding the remaining part.
- To protect the plant from any disease.
- Always keep smalls leaves in order to fasten the regeneration rate.

*Before Harvesting*


*After Harvesting*

**Step 1:**
Harvest spring Mongol by cutting the bigger leaves before it bolts

**Step 2:**
Pick Mongol in the morning for best flavor and texture.

**Step 3:**
Avoid washing Mongol that will be stored for more than a day or two since it will begin to wilt.

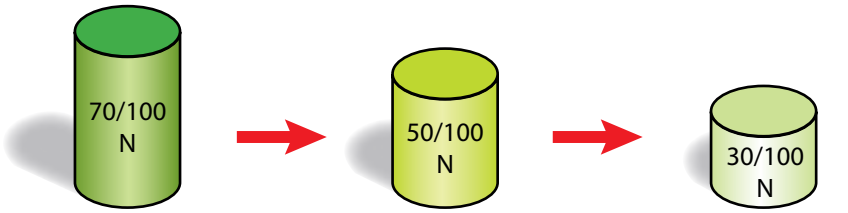
## Mongol seeds production

To improve and enhance the production in future it is very important:

- To select the best and healthy roots
- To keep those selected roots
- To wait for seeds maturation
- To store seeds in a cool and dry place

## Soil fertility

Crop production under an IGH is an intensive process, thus the soil losses its fertility gradually. Monocropping or growing the same crop season after season in the same location will deplete the soil of nutrients needed by that crop. For example, Mongol depletes Nitrogen




**Season I- Mongol** **Season II- Mongol** **Season III- Mongol**

To maintain soil fertility two things are important:

- Practice crop rotation
- Make compost and mixing it well with the soil.

### Crop rotation:

Crop rotation is of two types:

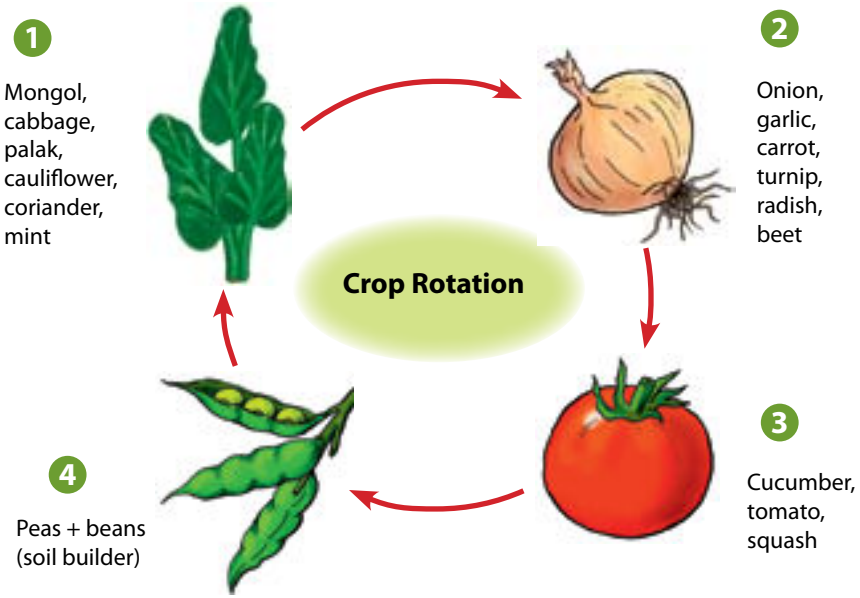
**Nutritional crop rotation**

It is practiced in order to balance the nutrient demand each crop makes on the soil.

**Preventive crop rotation**

Crop rotation is also used to control pests and diseases that can become established in the soil over time. Plants within the same family tend to have similar pests and pathogens. By regularly changing the planting location, the pest cycles can be broken or limited.

| Crops | Type | Nutrient uptake |
|---|---|---|
| Mongol, Spinach, Salad, cabbage, cauliflower, coriander, mint | Leafy | Nitrogen |
| Cucumber, tomato, squash | Fruit | Phosphate |
| Onion, garlic, carrot, turnip, beet | Root | Potash |
| Peas + beans (soil builder) | Legume | Phosphate |



## Pest control

How to detect Aphids infestation:
Honeydew and white skins left on plants by aphids are signs that can be used to detect aphid infestation
Curled new leaves, distorted growth.
Ants are often attracted to the honeydew, so if you see ants on your plants, inspect them carefully for aphids.

Aphids are more prevalent under the following conditions:

- High temperature
- High humidity
- Poor sanitation
- Low irrigation
- High plant density
- Growing the same susceptible plant in the same location year after year

**Preventive steps:**

- Take good care of sanitation inside and around an IGH.
- Apply control measures before sowing and if needed after or during transplanting.
- Make smart use of the ventilators.
- Apply adequate irrigation, proper weeding and thinning.
- Maintain recommended plant to plant and line to line distances while sowing and transplanting.
- Timely prune the infested part.
- Avoid moving infested plants to new areas where susceptible plants are growing.

| Control measure | Concentration | | Protocol | Interval |
|---|---|---|---|---|
| | LOW | HIGH | | |
| Pepper solution | 100 gm + 1.5 liter water | 200 gm + 1.5 liter water | 100 gm or 200 gm+ 1.5 liter water for 24 hours + diluted with 6.5 liters water before spraying | At 3 days interval successively for three times and give one week rest |
| Chilly | 50 gm + 1.5 liters water | 100 gm + 1.5 liters water | 50 gm or 100 gm+ 1.5 liters water for 24 hr + diluted with 6.5 liters water before spraying | At 3 days interval successively for three times and give one week rest |
| Garlic + Chilly powder | 200 gm Garlic + 50 gm chilly | 500 gm garlic + 50 gm chilly | 200 gm or 500 gm Garlic + 50 gm chilly + soak in1.5 liter water for 24 hr + dilute the solution with 6.5Lt.of water | At 3 days interval successively for three times and give one week rest |
| Soap + mustard oil | 50 gm soap + 650 ml water | 50 gm soap + 350 ml oil + 650 ml water | 50 gm soap + 650 ml water) boil until soap dissolved + 350 ml mustard oil + 6.5 liter of water for dilution. | At 3 days interval successively for three times and give one week rest |

## Compost

The compost is a fantastic soil improver, and it usually comes with a healthy population of micro-organisms which will contribute to soil's health once incorporated into it.
Compost returns nutrients to the soil and improves plant growth by acting as:

- A stimulant plant growth
- Condition the soil
- Reduce soil borne diseases
- Increase water holding capacity
- Increase soil aeration
- Maintain the soil texture and check erosion

### Compost making

Main technical points to make compost:
Make a 4x6 feet area, 2 feet deep pit at a location getting good sun period of minimum 8 hours.
Prepare your mix with organic materials that you have:

Straw, saw dust or
Dried grass or
Dried leaves or
Green grass
} 1/2 of total quantity

Torn newspaper, unbleached paper and card board.

Farm yard manure (FYM) or
Dung (cow, goat, compost toilet) or
Poultry or pigeon manure or
Agricultural or kitchen waste or
Wood ash or charcoal (Sola)
} 1/2 of total quantity

Butter milk or
Waste of chang preparation
Soil or compost from a previous heap
} Activators

News paper
Add a small amount of Urea or animal urine or poultry waste in the compost mixture to increase the Nitrogen content of the soil.
Add water and then cover the heap with polysheet.
Compost should never be dry, and it's good to turn regularly (aeration).
To be ready compost need microorganisms and microorganisms need air and water to be alive.
Wait for at least 1 year for maturation.

**Benefits of Compost over un-composted organic matter or synthetic fertilizers:**

- Composting makes plant nutrients available over a longer period of time.
- Compost can activate minerals that are ordinarily unavailable—such as rock phosphate—can be activated by composting.
- Compost also conditions the soil and builds soil structure.
- Organic matter in compost lightens and aerates heavy clay soils, while it improves soil moisture holding capacity in sandy soils.
- In irrigated systems, compost serves to improve water penetration, stores and releases water.
- The heat of the composting process kills most plant and human pathogens because plant pathogens seldom survive temperatures above 50° C (122° F).

1 Mix materials

2 Put into the pit

3 Take out and add water

4 Put back into the pit

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