

FOR THE SCHOOL GARDENING PROJECT  
AN INITIATIVE OF:  
ENVIRONMENTAL CAMPS FOR CONSERVATION AWARENESS, NEPAL  
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**SCHOOL GARDENING:  
A MANUAL FOR BEGINNERS IN FRAMING**

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## SCHOOL GARDENING PROJECT



School gardens are a wonderful way to use the school yard as a classroom, reconnect students with the natural world and the true source of their food, and teach them valuable gardening and agriculture concepts and skills that integrate with several subjects, such as math, science, art, health and physical education, and social studies, as well as several educational goals, including personal and social responsibility.

- To help students to learn focus and patience, cooperation, teamwork and social skills as garden-based teaching addresses different learning styles and intelligences.
- To help students to gain self-confidence and a sense of "capableness" along with new skills and knowledge in food growing — soon-to-be-vital for the 21st century
- To help students to become more fit and healthy as they spend more time active in the outdoors.
- To diversify and beautify the school yard;



## **INTRODUCTION: ORGANIC FARMING**

Looking at 30/40 years back, our grandparents had never seen pesticides and chemical fertilizers. And yet they were producing diversified food (cereals, vegetables and fruits) needed for daily consumption. And today the situation is turned upside down, people think they don't have any option instead of using chemical and pesticides. But, if we truly believe and want to change the paradigm, chemical less farming is possible. The way of farming without using chemicals and pesticides while promoting healthy behavior is called organic farming. Organic farming works on the principle of integrated farming (integration of livestock and plants together) and recycling of resource. Chemical farming is a method of farming which focuses on increasing production which is sustainable only for a time being, but organic farming is a method of farming which focuses on building up of soil, increasing the soil organic matter, improving soil micro-organisms and improving our agro ecosystem which in return will help in increasing the aggregate production.

### **Need of organic farming and urban farming:**

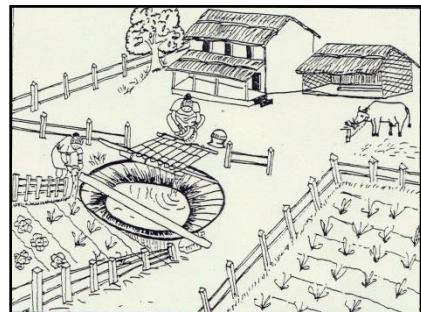
With the use of chemical and pesticide, soil in many parts of the world is dead (without any micro-organisms), diversity is decreasing and health hazards increasing. We are looking at more and more news everyday related to cancer, heart disease, genetic disorder and many others, out of which the major cause is the food we consume. The chemical farming, which was being practiced since 1960s already failed in many countries as early as in 1980 and 1990s, but we are still following the practice which were developed during and after world war to end the fight for food. Today's challenge is to increase the production, fight climate change, ecological farming and all this is possible with a single tool, that is, organic farming and urban farming.

### **Benefits of Organic Agriculture**

*(Govinda Sharma)*

Chemical fertilizers and pesticides have numerous hazardous effects. To mitigate these hazards it is better to promote organic agriculture. Organic agriculture will provide the following benefits for agriculture and school children and the world -

- Maintenance of health
- Conservation of biodiversity
- Increased competency in the global market
- Improved nutrition
- Mitigation of air, water and soil pollution
- Improved taste and medicinal quality of our food
- Utilization and preservation of traditional knowledge and skills of the community



- Reduction in requirements for external inputs for farming practices investment, thereby increasing self-reliance
- Increased use of local resources
- Improved quality and quantity of available natural resources
- Rehabilitation of soil fertility and increase in total productivity in the agricultural system.
- Reduction of the financial needs of the farm, emancipating farmers from cycles of debt
- Less loss due to pests in both the fields and storage areas
- Increased market potential including foreign exports

### **SCHOOL GARDENING: Introduction**

A school garden is a powerful environmental education tool. Through gardening, students become responsible caretakers. They have an opportunity to engage in agricultural practices on a small scale, learning about the responsibilities and impacts of land cultivation. They explore the web of interactions among living and nonliving components of life. By doing so, they develop a greater understanding of the natural world. Students also learn the importance of caring for natural resources. A school garden is an innovative teaching tool and strategy that lets educators incorporate hands-on activities in a diversity of interdisciplinary, standards-based lessons. The garden engages students by providing a dynamic environment in which to observe, discover, experiment, nurture, and learn. It is a living laboratory where lessons are drawn from real-life experiences rather than textbook examples, allowing students to become active participants in the learning process. Through the garden, students gain an understanding of ecosystems, an appreciation for food origins and nutrition, and knowledge of plant and animal life cycles. At the same time, they learn practical horticultural skills that last a lifetime.

### **Need of school gardening:**

The primary objective of school gardening is to relate the issues of climate change, food security, nature, nutrition and responsibility from an early age. Though school gardening primarily focuses on farming, it teaches many other things viz responsibility, creativity, art and improves cognitive development in children. Students learn focus and patience, cooperation, teamwork and social skills, they gain self-confidence and a sense of "capableness" along with new skills and knowledge in food growing, garden-based teaching addresses different learning styles and intelligences; our non-readers can blossom in the garden. It basically has following advantage for the children.

- **Teaches Responsibility-** Taking care of the plants, watering them, weeding, protecting from insect pest teaches responsibility in children
- **Art:** The structure of plant growth, the shapes of leaves, the pattern of development, the seasonal variation teaches art and creation in students.
- **Physical activity:** Playing with the soil and involving in group activities promotes physical activity rather than spending time in virtual games.
- **Understanding:** Cause and effect relationship, how watering plants helps them grow, how a seed turns into a plant, how sunshine affects growth and color and so on.
- **Creativity:** Many researchers suggest being around nature itself refreshes one's mind and promotes creativity. And learning ways to plant, different methods of organic farming helps them broaden their mind and think outside of the box.
- **Love and care:** Plants grow only with care and love and when students start to realize this, the learning is portrayed in their daily behavior, with friends and family.
- **Self Confidence:** Looking at a seed they planted turn into a plant and a flower and fruits, changing their color creates an image in their brain and make them believe in themselves, enhancing their self-confidence.
- **Nutrition:** Food and nutrition go hand in hand; through farming they can relate the learning with their own feeding habit.
- **Cognitive development:** Being around nature nurtures mind and promotes thinking, generating ideas and relating things with one another, which is a must have knowledge for every individual today.

## SOME USEFUL CONCEPTS

### Permaculture

Permaculture is a practical concept and philosophy for designing a sustainable livelihood system. It integrates all the natural, social and technical aspects to establish a sustainable system functioning in a synergistic manner. It deals on all aspects of farming viz. soil management, compost and soil plant nutrient management, water management, seed management, interconnections and market linkage, vegetable producing techniques and many more. Knowledge of such techniques of designing vegetable farm will be very helpful for all farmers in allocating limited resources (manure, labour, etc.) to gain maximum return. Philosophy of Permaculture was founded by Bill Mollison and David Holmgren in 1974.

## Mixed cropping and crop rotation

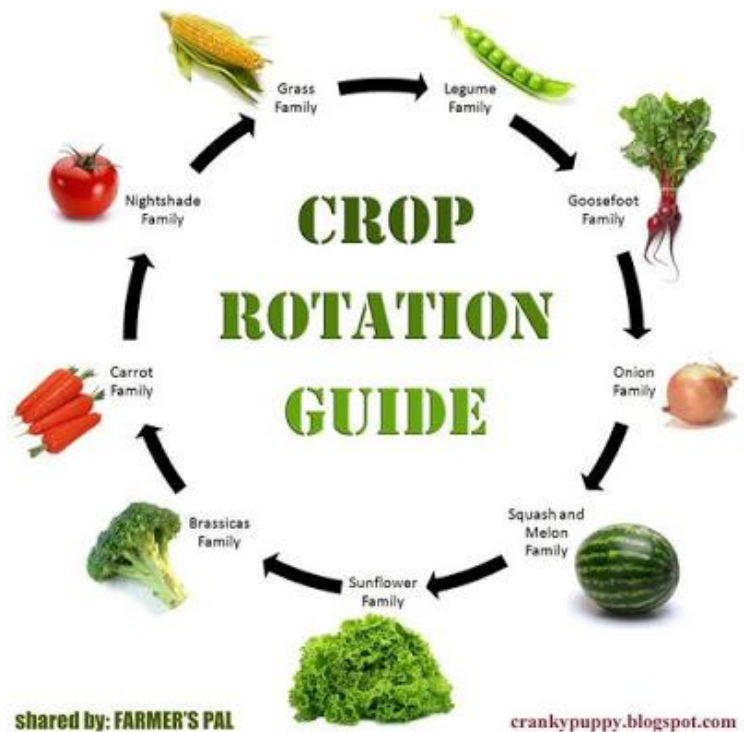
Crop rotation refers to the cultivation of different crops on a particular piece of land over time. The succession of crops to be grown is carefully designed to ensure soil nutrients are sustained, pest populations are controlled, weeds are suppressed and soil health is built.

A crop rotation will cycle through cash crops (such as vegetables), cover crops (grasses and cereals) and green manures (often legumes). The exact sequence of crops will vary depending on local circumstances, with the critical design element being an understanding what

each crop contributes and takes from the soil. For instance, nitrogen depleting crop should be preceded by a nitrogen fixing crop.

A well designed crop rotation makes land both more productive and more environmentally sustainable. It improves the financial viability of a farm by increasing productivity whilst reducing chemical input costs. Key advantages of crop rotation are:

- Improved soil fertility and structure
- Disease control
- Pest control
- Weed control
- Increased Soil Organic Matter
- Soil erosion control
- Improved biodiversity
- Increased yield
- Reduced commercial risk



Mixed cropping, also known as polyculture, inter-cropping, or co-cultivation, is a type of agriculture that involves planting two or more plants simultaneously in the same field, so that they grow together. In general, the theory is that planting multiple crops at once saves space since crops in the same field might ripen at different seasons, and provides a wealth of environmental benefits. Documented benefits of mixed cropping include the balance of input and outgo of soil nutrients, the suppression of weeds and insect pests, the resistance of climate extremes (wet, dry, hot, cold), the suppression of plant diseases, the increase in overall productivity, and the management of scarce resources (land) to the fullest degree.



Mixed cropping in HASERA Farm

### P4 plantation

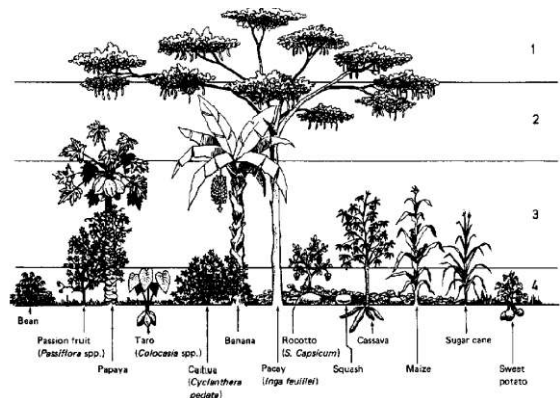
P4 plantation is similar to mixed cropping. P4 stands for **Pest Preventive Planting Pattern**, which is mixed cropping done with a major objective of pest control. In this system we try to mix plants with different smell (cauliflower with tomato and onions), different leaf structure, different color, and different root depth all at once. This system of plantation helps in proper nutrient recycling from different root depth, insect repellent because of smell and structure and synergistic effect in yield.



We will carry out these techniques on the field at different schools.

### Small scale intensive farming

Small scale intensive farming is a way of farming to produce more from a small piece of land. To achieve this, as mentioned earlier multiple things are planted on the same land. Rather than producing 10 Kg of tomato alone, we mix different plants together to produce 5 kg of tomato, 3 kg of cauliflower, 3 kg of broad leaf mustard, 1 kg of green onion, 1 kg of





carrot and radish, 200 gm. coriander greens etc. resulting in the total production of 15 kg.

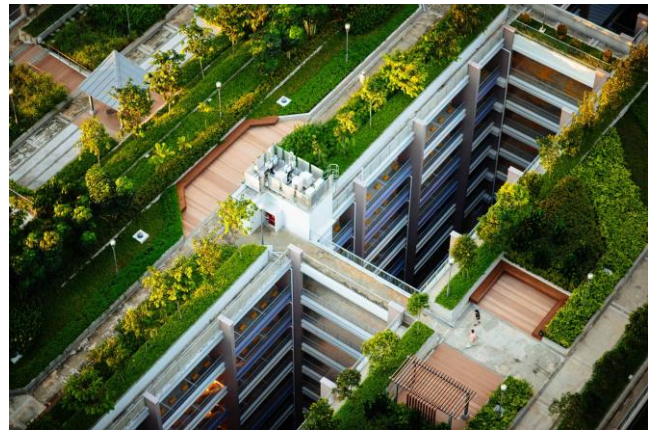
This is also achieved by vertical planting, using the available vertical space, planting plants of different height at the same time.

### **Micro climate**

Microclimates are spaces in any given landscape where the temperature and climate significantly differ from the immediate surroundings. Microclimates occur naturally in the natural world and can also be created through human design. They depend on the concentration of certain natural elements in specific places. For eg, we can create shade and cool climate by planting big trees and we can create warmth by installing a plastic house. This small modification in climate is very important to grow multiple crops in a small area. This can also push off seasonal production of many vegetables and flowers.

### **INTRODUCTION TO URBAN GARDENING**

Urban agriculture can be defined shortly as the growing of plants and the raising of animals within and around cities. The most striking feature of urban agriculture, which distinguishes it from rural agriculture, is that it is integrated into the urban economic and ecological system: urban agriculture is embedded in -and interacting with- the urban ecosystem. Such linkages include the use of urban residents as labors, use of typical urban resources (like organic waste as compost and urban wastewater for irrigation), direct links with urban consumers, direct impacts on urban ecology (positive and negative), being part of the urban food system, competing for land with other urban functions, being influenced by urban policies and plans, etc. Urban agriculture is not a relict of the past that will fade away (urban agriculture increases when the city grows) nor brought to the city by rural immigrants that will lose their rural habits over time. It is an integral part of the urban system.



Urban agriculture is part of the urban ecological system and can play an important role in the urban environmental management system. Firstly, a growing city will produce more and more wastewater and organic wastes. For most cities the disposal of wastes has become a serious problem. Urban agriculture can help to solve such



problems by turning urban wastes into a productive resource. In many cities, local or municipal initiatives exist to collect household waste and organic refuse from vegetable markets and agro-industries in order to produce compost or animal feed, but one can also find urban farmers who use fresh organic waste (which may cause environmental



and health problems). Quality compost is an important input that can fetch a good price. Compost allows an urban farmer to use less chemical fertilizers and by doing so preventing problems related to the contamination of groundwater. In addition, compost-making initiatives create employment and provide income for the urban poor.

## **GARDENING PRACTICES**

### **Urban Gardening (Small area gardening)**

Urban agriculture can be defined shortly as the growing of plants and the raising of animals within and around cities. The most striking feature of urban agriculture, which distinguishes it from rural agriculture, is that it is integrated into the urban economic and ecological system.

Environmental stewardship - Students who participate in gardening clearly learn how access to fresh fruits and vegetables. This will create a sense of connection with nature and earth resulting in environmental stewardship.

Quality of Life - Urban farming can help strengthen stewardship, give students a sense of accomplishment, offer benefits of exercise, build on community and individual resourcefulness, take advantage of unused resources, add more green space and more.

Freshness - As anyone who has ever eaten a tomato right off the vine, nothing beats eating ripe produce as soon as possible.

Sustainability - Eating local is one of the best things we can all do for the planet and avoiding transportation energy costs is one of the main reasons why.

Access to quality food - Some residents in cities do not have access to high quality, affordable fresh fruits and vegetables and an urban vegetable garden can make all the difference to them.

## Methods to prepare in schools

### 1. Raised Bed

Materials required

#### Method 1

1. Wooden plank of size 25-30 cm height, 2-5 cm breath and length as per the desire
2. Manure + Fertile soil
3. Seeds and seedling
4. Plastic sheet



#### Method 2

Just raise the soil from the ground so that it avoids the water stagnation.

### Double digging beds

#### Double Dig Instructions

Dig a trench 2 ft deep, one meter wide and length as per your choice

Separate the top soil from the sub soil and put them aside

Collect some biomass- both green and dry around 50 kg each

Fill the trench with layers of green biomass followed by dry biomass followed by little soil and continue this until the trench is completely full

Then the top soil which was kept aside before, mix it with compost (50-50) and make raised bed of around 1 ft high.

Repeat the procedure to make more double dug beds in





the field. Make a space of 50cm in between two beds which makes it easier to walk.

Double dug beds once made doesn't need any extra manure and much care until 4- 5 years.

### **Hot beds**

Hot beds were very popular in lower climatic areas. Once set up, they can be used to grow salad crops in winter, get a head start on seed sowing in the spring (by up to a month), for growing any of the cucurbitaceous family in the summer. A hot bed provides bottom heat, using manure rather than electricity as the heat source, thus speeding up plant growth of seedlings and tender plants.

As a hotbed will only last for up to 2 months - contents will have to be removed and replaced with fresh materials. However, the material on top will be well decomposed and can be used directly on the garden in the spring. The bottom layers may have to be composted again to mature.

### **Vertical Gardening**





## Concept

A vertical garden is a technique used to grow plants on a vertically suspended panel by using reusable materials like tyre, plastic bottles, wooden logs etc. These unique structures can either be freestanding or attached to a wall. This method is used especially in the city places where flat land is not available for farming.

## What to plant?

Leafy vegetable

Climbing and vining vegetables (Tomatoes, Beans, Chayote, Pumpkin, Pole beans,.....)

## Bottle Gardening



## Method to prepare

1. Get a unused plastic bottles
2. Cut them in a way so that you can plant vegetables (you can use your creativity as much as possible)
3. Fill the bottles with rich soil in organic manure
4. Make sure you have holes at the bottom to assure water flow and to prevent the bottles from water stagnation.

5. Fill the bottles with soil and manure
6. Plant a seed or seedling

### **What to plant?**

Short and fibrous rooted plants like onion, coriander, spinach and other leafy vegetables.

### **Other gardens**

### **Sack Gardening**





## Shoe gardening



## Jeans gardening



## Drum Gardening





## **Pest control practices:**

### **Liquid manure:**

Liquid manure is used as an alternative to fermented manure. Manure in both forms is used as a nutrient-enriched fertilizer for plants, because farm animals excrete most of the nitrogen, phosphorus, and potassium that is present in the food they consume.

Liquid manures are used extensively in cropping and fruit production, particularly to supply nutrients during the transition period when changing to an organic management system.

### **Why use liquid manure?**

- To prevent pests and disease destroying our crop
- To avoid using harmful, manufactured chemicals
- To provide nutrients
- To provide irrigation

### **Benefits:**

- Uses local resources
- Saves cost
- Protects beneficial insects
- Uses local knowledge
- Protects the environment
- Helps us to be self reliant
- Improves the soil
- Saves our health by reducing use of harmful chemicals.

We can use many more plants and local substances, according to what's available in our area.

### **How to make it?**

- Collect as many plants (herbs) as you can find, or will fit in the container available.
- Cut the plants into small pieces and fill the container.
- Add urine (animal or human) or water if urine isn't available to fill up 3/4th of the container.



- Keep it for at least 7 days to 15 days with continuing to steer everyday to increase the microbes growth.
- It is read to use in field

## Using Liquid Manure

### 1. How to use on young plants

Newly made liquid manure is very strong so it needs diluting with more water. When the liquid is used up, water is added again to the biomass in the container, which becomes less strong each time more water is added.

- The first time, mix one part liquid manure with 12 parts water to spray.
- The second time, mix one part liquid with 8 parts water to spray.
- The third time and onwards, mix one part liquid with 4 parts water to spray.

### 2. Using liquid manure on older plants

When they are bigger and more mature, plants can stand stronger liquid manure. Insects are often stronger as well. Liquid manure helps to repel these insects. Plants can take in nutrients from liquid Manures through their leaves. On the soil, liquid manure also acts as irrigation.

- The first time, mix one part liquid with 8 parts water to spray.
- The second time, mix one part liquid with 4 parts water to spray.
- The third time, mix one part liquid with 1 part water to spray.

## When to spray liquid manure

Mix in a suitable container according to above instructions and spray the liquid Manure. Spray whenever pests are present, or before they are expected to arrive. Our objective is to repel, not to kill. The pests may come again, so liquid manure needs to be re-applied from time to time. Pests are repelled because of the various smells and tastes. And the plants get some food as well as water. **Don't use liquid manure** when there is disease attract (fungus) otherwise the disease may multiply.

## Pheromone Trap:

Pheromones are chemicals used by insects and other animals to communicate with each other. Insects send these chemical signals to help attract mates, warn others of predators, or find food. Using specific pheromones, traps can be used to monitor target pests in agriculture or in residential areas. By constantly monitoring for insects, it may be possible to detect an infestation before it occurs. Early detection of pest insects using pheromone traps can also lessen damage to agriculture and other plants. It can also limit the presence of stinging insects near you.

Using pheromone traps can help find locations where the pests are becoming established. Sometimes traps can also remove large populations. Large amounts of pheromone dispersion can be used in agriculture to disrupt insect mating.

Pheromones use the scent of a female insect which attracts the male towards the trap. And inside the bottle insect could smell the female so it enters and will die of suffocation because of pungent smell.



### How to make?

1. Pheromone traps are of different shapes and can be bought in the market. It has two components, a bottle and a pheromone (bait). Bottle can also be made at home. Make 1 to 2 holes in a 1 liter plastic bottle to allow moths to enter.
2. Hot nail can be used to make holes easily.
3. Put a wire from the cover to suspend the bait.
4. Put 5 traps in 1 ropani of land.
5. One pheromone can control only one pest and specific pheromones have to be bought for specific pest.

### Pests controlled

1. Cabbage looper
2. Cotton bollworm
3. Cotton boll weevil
4. Corn earworm
5. Diamondback moth



6. Fruit fly
7. Hornworm
8. Leaf folders

### **Reminders while using pheromone traps**

1. Buy the pheromone that lures the pest you want to control.
2. Always label the trap. The name of the species you are trapping, the date the bait was placed, and the name of the bait if you are using several.
3. Change bait according to manufacturer's recommendation.
4. Dispose properly the bait wrappers. The tiny amount of pheromone left near the traps will compete with your bait.
5. Wash your hands between handling baits. Minute traces of other chemicals can render the baits completely ineffective.
6. Always remove all captured adults during each visit. Discard them away from the field. Put live ones into a bucket with soap solution to drown.

### **Sticky trap:**

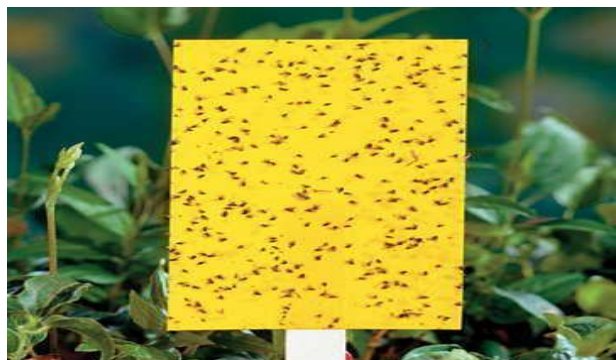
Sticky cards are glue-based traps frequently used in pest control to catch and monitor insects and other pests. Typically sticky cards consist of a sticky glue layer mounted on a piece of cardboard that is folded into a tent-structure to protect the sticky surface. Most sticky traps contain no pesticides, although some may be impregnated with aromas designed to be attractive to certain pests.

Some of the pests readily trapped by sticky traps include flying insect, moths, mosquitoes, flies etc. Sticky traps are not effective in trapping bed bugs.

Sticky traps are useful for monitoring an area for flying and also crawling insects to some extent, and as such are frequently used by professionals to enhance their ability to detect pests during pest control inspections. Sticky traps allow an inspector to detect pests that are active at night or other times when people are not present.

### **Materials required**

Sticky traps can be easily bought in the market and are cost effective too. They are found in Blue and yellow color, but for field insect control, yellow is regarded better.



**Benefits:**

Highly effective, non-toxic and easy to use.

No. of traps per Ropani: 5 - 6

**Harmful Insects**

It is not hard to imagine harmful insects in our garden. Harmful insects destroy our plants, eat our fruit, ruin our flowers, and can turn our beautiful yard into a living nightmare.

A few examples of harmful insects include (but are by no means limited to):

**Aphids:** Aphids are like lice: they move into a garden, spread throughout all the plants, and can be hard to get rid of. They are small, usually less than 1/8" in size, and cause stunted plant growth and spread diseases among plants.

**Grasshoppers:** Grasshoppers chew on vegetation, and the majority of grasshopper species will eat any type of vegetation they can.





**Mealy Bugs:** feed on the juices of greenhouse plants and thrive in warm, moist environments.

**Caterpillars:** Not all caterpillars are harmful. Some may be beneficial, and many turn into butterflies, which will be beneficial. But in this stage of life, caterpillars are leaf-eating, plant destroying nuisances.

**Beneficial insects**

Beneficial insects are any of a number of species of insects that perform valued services like pollination and pest control. The concept of beneficial is subjective and only arises in light of desired outcomes from a human perspective. Not all insects are pests. There are a number of species we refer to as beneficial insects that could help eliminate and control pests that do a great deal of damage to our beautiful gardens and lawns. Beneficial insects could be considered a component of biological control, which refers to the method of controlling pests using other living organisms.

# 7 BENEFICIAL INSECTS FOR GARDEN PEST CONTROL

INSECTS	PREYS ON	ATTRACTED BY
 <b>LADYBUGS</b>	<ul style="list-style-type: none"> <li>• APHIDS</li> <li>• WHITEFLIES</li> <li>• COLORADO POTATO BEETLES</li> </ul>	<ul style="list-style-type: none"> <li>• DILL</li> <li>• DANDELION</li> <li>• FERN-LEAF YELLOW</li> <li>• BASKET OF GOLD</li> </ul>
 <b>GROUND BEETLES</b>	<ul style="list-style-type: none"> <li>• SLUGS</li> <li>• CATERPILLARS</li> <li>• COLORADO POTATO BEETLES</li> <li>• CUTWORMS</li> </ul>	<ul style="list-style-type: none"> <li>• EVENING PRIMROSE</li> <li>• AMARANTHUS</li> <li>• CLOVER</li> </ul>
 <b>MINUTE PIRATE BUGS</b>	<ul style="list-style-type: none"> <li>• SPIDER MITES</li> <li>• APHIDS</li> <li>• THRIPS</li> <li>• CATERPILLARS</li> </ul>	<ul style="list-style-type: none"> <li>• CARAWAY</li> <li>• FENNEL</li> <li>• ALFALFA</li> <li>• SPEARMINT</li> </ul>
 <b>GREEN LACEWINGS</b>	<ul style="list-style-type: none"> <li>• APHIDS</li> <li>• WHITEFLIES</li> <li>• LEAFHOPPERS</li> <li>• MEALYBUGS</li> </ul>	<ul style="list-style-type: none"> <li>• DILL</li> <li>• ANGELICA</li> <li>• GOLDEN MARGUERITE</li> <li>• CORIANDER</li> </ul>
 <b>APHID MIDGES</b>	<ul style="list-style-type: none"> <li>• APHIDS</li> </ul>	<ul style="list-style-type: none"> <li>• DILL</li> <li>• PLANTS WITH PLENTY OF NECTAR AND POLLEN</li> </ul>
 <b>DAMSEL BUGS</b>	<ul style="list-style-type: none"> <li>• CATERPILLARS</li> <li>• MITES</li> <li>• APHIDS</li> <li>• CABBAGE WORMS</li> </ul>	<ul style="list-style-type: none"> <li>• CARAWAY</li> <li>• PETER PAN GOLDENROD</li> <li>• SPEARMINT</li> <li>• FENNEL</li> </ul>
 <b>BRACONID WASPS</b>	<ul style="list-style-type: none"> <li>• CATERPILLARS</li> <li>• APHIDS</li> </ul>	<ul style="list-style-type: none"> <li>• FERN-LEAF YARROW</li> <li>• LEMON BALM</li> <li>• PARSLEY</li> <li>• COMMON YARROW</li> </ul>

VISIT [ORGANICLESSON.COM](http://ORGANICLESSON.COM) FOR THE EXTENDED LIST



## **Why Use Beneficial Insects**

1. Chemical pesticides – the first and most obvious benefit to using these insects is not having to resort to chemical pesticides. The non-toxic approach allows you to grow plants organically. You won't have to worry the next time you take a bite out of your home-grown fruit or vegetable.
2. Good bugs – keep in mind that chemical pesticides don't only wipe out the bad bugs. They are just as deadly to the beneficial insects. This is bad for the long-term maintenance of your garden as there won't be a population of natural predators to feed on the pests. Pesticide may be effective at wiping out of the first wave of pests, but the same cannot be said for the second wave.
3. Cost saver – beneficial bugs are there to stay if you are able to build an environment for them to thrive in. You might not even have to spend money if the beneficial insects are native to your area.
4. Resistance – a number of insects are starting to show greater resistance to chemical pesticides. According to the Pesticide Action Network, between 500 and 1,000 insect and weed species have developed resistance to pesticide since 1945. There is nothing much a pest can do if it is getting eaten by a predator though.

## **How to attract Beneficial Insects?**

One of the biggest problems with most traditional pesticides is that they kill all garden insects, including those that are beneficial to your plants. Even many organic pesticides still destroy the insect life of our garden.

The simplest, and perhaps easiest way to attract beneficial insects to our garden is to plant the kinds of plants to attract the beneficial insects to our garden. Most beneficial insects are attracted to fragrant, bright colored flowers, and require a source of water as well. Leaving a source of water available, like a shallow dish or a small pool of water.

## NURSERY MANAGEMENT: INTRODUCTION AND IMPORTANCE

Nursery is a place where small plants are grown with special care. A plant can grow healthy if it is free from any diseases from the very beginning of its life. Thus special management of nursery is important to help the plant grow healthy and ensure good production.

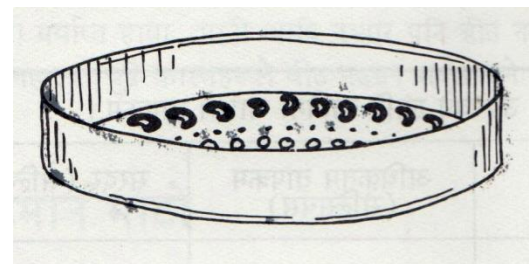
### Nursery Preparation

#### Seed Preparation

Before selecting the seed to sow in the nursery, it must be tested for its purity, viability and health. If we fail to carry out these tests, we may end up with diseased crop and loose production for years. Loose smut of wheat, blast of rice, brown spot of rice, anthracnose of legumes, and stalk rot of cabbage are major diseases spread from seeds. Ill performing seeds can be culled out through seed testing.

The following are the steps to be followed while selecting seed for sowing in the field:

- a. Take the proposed seed, winnow it and dry in good sunshine
- b. Separate all the inert materials, off size and off colored seeds from the main seed lot
- c. Dump the seeds into a bucket of clean water
- d. Throw away all the suspended seeds (diseased seeds will float while healthy seeds will sink to the bottom)
- e. Take the seeds that have sunk to the bottom and dry them
- f. Take 100 seeds and put them for the germination test in any white platform like cotton, cloth or paper.
- g. Observe them throughout the normal period for germination for that variety.
- h. If the seeds are germinating uniformly and without any stain in the bottom of the platform, these seeds are good for sowing – select them.
- i. If there are any stains in the bottom of the platform- there might be some disease in this seed lot – reject them



#### Site Selection and Area Estimation

Select a well aerated, radiated, fertile land with light soil where management, inspection and irrigation will be easy.

The area required for a nursery differs from crop to crop. Look at the table presented in the next page to estimate the required area of nursery.

## **Soil preparation**

Soil should be tilled up to a depth of 20 cm with out any stones, clods and weeds. If there is possibility of some soil burning diseases, heat treatment may be required.

## **2.4 Bed preparation**

Style of the nursery bed varies according to the season. During the rainy season, we make it raised, in dry season, we make it depressed and in the normal season, we make it almost flat. Choose appropriate methods of bed preparation according to the season and other relevant factors.

## **Seed sowing**

Sow the seeds thinly in straight lines. Cover them with soil of a depth of 2 times of the thickness of the seed.

## **Mulching / Shading / Tunneling**

As required

## **Thinning and Grading of Seedlings**

This is very important exercise in nursery production. One should perform it very carefully.

When the seeds start to germinate, watch them closely. When almost 50 % of the seeds are germinated completely, stir the soil gently so as to stop other seeds from germinating. Delay in germination means some weaknesses in the seeds. We must not let such weak seeds to grow.

Already cull out if there are any diseased or mal-nourished seedlings.

When they start growing, never let their leaves overlap to one another. If this happens, thin them.

Continue this process until the time of planting. If required, execute any other inter-cultural operations like weeding, watering, loosening, and pest control. If we follow these steps, the nursery bed will not need any pest management.

At the time of transplanting, harden them for one or two days, then transplant the seedlings once they have stronger root system. Never accept ones with weak roots.





## **SEED MANAGEMENT (*Govinda Sharma*)**

### **STEP 1. Identification of the desirable characteristics of the crop in concern**

This is very tricky step. We must be very smart and wise to identify our needs. Desirable characteristics are sometimes controversial. For example, to make it lodging resistant, we may desire shorter maize. However, when we think of the requirements for fodder, then we start to look for a tall variety instead. Similarly, desirable characteristics differ according to market availability, taste preference of family members, and alternative uses of the harvest.

Considering our specific requirements, we will select the crops from which we will produce seed.

#### **Desirable Characteristics of Onion**

**(for example):**

- Short time duration required for growing
- Erect and strong leaves
- Shining color and thick sheaths of the bulb
- Less pungent
- Orange shaped bulb with about 5 - 10 cm diameter
- Non-splitting & non flowering in field
- Able to thrive in drought and infertile conditions
- Good table quality
- Disease and pest tolerant

### **STEP 2: Get and grow the variety that has as many desirable characteristics as possible.**

Source seed of such kinds may be available in our home, in the neighbor's home, in the community or in a nearby research center.

### **STEP 3: Grow the crop in as optimal conditions as possible.**

**STEP 4: Select the plants suitable for seed collection** (based on the criteria we enlisted at the beginning) with the help of red cloth (strip) or some red woolen threads. Continue the selection for three to 5 times-

- at the time of first crop stand
- at the time of flower initiation
- at the time of grain filling
- at the time of maturity
- at the time of harvest

It is better to monitor and index the crop 5 times as mentioned above. If the available time does not permit, 3 times monitoring serves equally well. When we repeat this cycle for 3 – 5 continuous seasons, we will get our desired variety of seed. We can give our own name to this variety and popularize if we wish. This is the way many research farms develop new crop varieties.

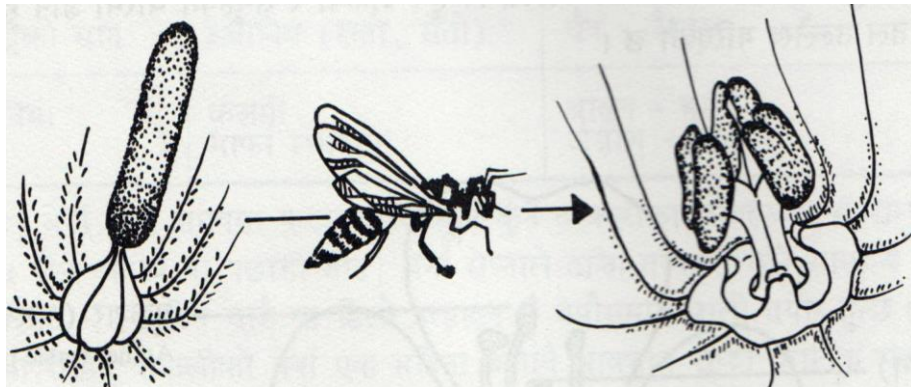
## Kinds of Seed

Based on pollination behavior, there are different kinds of seeds:

**Open Pollinated Seeds:** Seed produced by natural pollination.

**Self Pollinated:** Pollen grains pollinate the stigma of the same flower. Fertilization occurs this way in paddy, wheat, and mustard.

**Cross pollinated:** Pollen from other flowers have to come to pollinate and fertilize the stigma of the flower in concern like in maize, cucumber, and papaya.



## Hybrid Seeds

Selected varieties are cross-pollinated in a designed sequence to produce a specific desired quality in the seed. Hybrid seeds will not exhibit the same qualities when saved and re-planted. Farmers who use hybrid seeds must purchase new seeds each year if they want to continue growing the same variety. Over time, one can cultivate hybrid seeds and eventually restore them to a local state, but they are lower quality seed, so many seed savers say it is not worth trying to save hybrid varieties.



Thus, self pollinated crops can maintain their seed quality very easily. It is a bit difficult in case of cross pollinated crops and highly difficult in hybrid seeds.

### **Terminator Seeds**

Terminator seeds produce sterile seeds in the entire plant that they pollinate. This is an anti-sustainable technology initially produced by Monosanto, an American company. Currently, there is a strong global protest this seed technology and marketing strategy.

### **GM Seeds**

These are the seeds produced by transferring genes from one species to another. For example, adding fish genes to tomato plants to produce varieties of tomato that are resistant to water logging and blight from too much moisture.

In organic farming we prefer open pollinated seeds. In case of need, hybrid seeds can be applied but in limited proportion. Terminator seeds and GMOs are totally banned from organic agriculture.

When seeds are selected, all the inert materials mixed with them should be screened and the selected lot should be dried properly. The storage space should be as dark, dry and cool as possible. Storage containers and bins should be dry and rat proof.





### Seed Viability (In Years)

Seeds have different duration of viability. Viability means ability to germinate. The following list provides some glimpse of the seed viability duration –

Carrot	3
Brinjal	5
Maize	2
Pumpkin	7
Cucurbits	8
Pea	2
Bean	3
Onion	2
Mustard	3
Spinach	1
Lady Finger	4
Suger Beet	4
Cauliflower	3
Cabbage	3
Sweet Pepper	2



## Crop Calendar

समय	पात खाने	फल खाने	कोसा खाने	जरा खाने
बैसाख, जेष्ठ, आशार	देशी चम्सुर, लेट्युस लीक, चाईनिज बन्दा, तोरी को साग, धनिया, लसुन, प्याज	काक्रो, भिंडी, रामतोरिया, लहरे बाली, कुरिलो, गोलभेडा, रुख टमाटर	भटमास, सिमि, बोडी	गाजर, मुला, सलगम, पिंडालु, गान्टेमुला,
श्रावण, भाद्र, अशोज	सुप, धनिया, लीक, रायो, चम्सुर, पालुंगो, मेथीको साग, चाईनिज बन्दा, चाइनिज साग, लसुन, प्याज	काउली, ब्रो काउली, ग्याठकोबी , बन्दा	केराउ, बकुल्ला, राजमा, चौमसे सिमि	मुला, गाजर, चुकन्दर, सखरखण्ड, गान्टेमुला
कार्तिक मंग्सिर पौष	सुप, धनिया, लीक, रायो, चम्सुर, पालुंगो, मेथीको साग, चाईनिज बन्दा, चाइनिज साग, लसुन, प्याज	काउली, ब्रो काउली, ग्याठकोबी , बन्दा	केराउ, बकुल्ला	मुला, गाजर, चुकन्दर, सखरखण्ड, गान्टेमुला
माघ, फाल्गुन, चैत्र	स्विसचाई सुप, लसुन, प्याज, लट्टे, धनिया, लीक, रायो, चम्सुर, पालुंगो, मेथीको साग, चाईनिज बन्दा, चाइनिज साग,	भिडे खुर्सानी, खुर्सानी, काक्रो, फर्सि, अन्य लहरे बाली, काउली, बन्दा, गोलभेडा	केराउ, बकुल्ला, राजमा, चौमसे सिमि, तुने बोडी	मुला, गाजर, चुकन्दर, तरुल