

# Beginners Guide to Home Gardening

## FOR CARLISLE, PENNSYLVANIA RESIDENTS



Written and Illustrated by Audree Khalishah  
Edited by Jenn Halpin

**This manual is made possible  
through funding by The Burpee Foundation.**

## **With the help of Dickinson College students and the Burpee Foundation, this manual is part of ongoing research to better understand Carlisle residents' attitudes toward home gardening as a means by which to supplement household food demands and diversify household diets.**

Our research is capturing information on what barriers residents experience when it comes to trying to grow food, whether access to a yard, tools, time constraints, knowledge, or even physical limitations. Over time, staff at the Dickinson College Farm along with students aspire to help inspire Carlisle residents to try their hand at growing food. To ensure success, we are offering interested residents technical assistance, access to resources, and even moral support to help plan out, plant, manage, and harvest bountiful home gardens. It is our hope that with this manual in hand, you might also help inspire others to try gardening, too!

This manual is a working document that aims to guide Carlisle residents in the process of expanding existing home gardens or starting one from scratch. In addition to providing step-by-step instructions to grow food for household consumption, this manual aims to present ideas that are easily accessible and affordable. Recognizing that gardening in the borough is a dynamic undertaking and that no two residences are alike, this manual takes into consideration potential barriers to gardening by offering ideas for how to garden successfully both in and above ground. Not every answer to every gardening question can be found in this manual. However, this document provides a solid foundation from which to start thinking, planning, and planting your home garden.

If you would like to give gardening a try with support from our team, please reach out and contact Jenn Halpin at [halpinj@dickinson.edu](mailto:halpinj@dickinson.edu) or 717-713-0275.

Best,  
Jenn  
*Director of the Dickinson College Farm*

### **THE CHAPTERS OF THIS MANUAL ARE ORGANIZED AS FOLLOWS:**

#### **CHAPTER 1 – PREP – PAGE 1**

This chapter will give you a big picture overview of all the tools and methods you need to start gardening. This chapter includes explanations on how to prepare garden beds, pots, or planters, how to plant seeds straight into your soil or start your own seedlings, and how to water.

#### **CHAPTER 2 – PESTS AND DISEASES – PAGE 10**

This chapter identifies and describes the pests and diseases that attack our most commonly grown vegetables. This chapter also includes recommendations for effective pest and disease control, and remedies that you can make or buy.

#### **CHAPTER 3 – GARDEN SCENARIOS – PAGE 21**

This chapter provides a list and simple description of the tools and methods to start your home garden, including options for gardens with or without land, and at three budget levels. This chapter also illustrates sample gardening plans you can follow year-round, accompanied by calorie counts of these garden scenarios.

THE ADDITIONAL CHAPTERS ARE ORGANIZED AS FOLLOWS:

**CHAPTER 4 – WATER CATCHMENT SYSTEMS FOR YOUR HOME – *PAGE 29***

This chapter discusses rainwater as a resource or your watering needs, with instructions to build your own water catchment device.

**CHAPTER 2 – COMPOSTING – *PAGE 30***

This chapter explains what compost is, what goes into it, and why it's valuable to a gardener. This chapter also includes instructions for making your own compost system, with tips on maintenance.

# Chapter 1: Prep

## SOIL PREP

### BASIC EQUIPMENT TO GET STARTED:

#### TOOLS:

- Spade shovel: for moving soil and can be used to dig/taper holes for transplanting.
- Digging fork: a versatile tool that breaks up and loosens soil.
- Garden hoe: to lightly disturb weeds without damaging seedlings. Allows you to work while standing straight.

#### OTHER:

- For watering: Hose with nozzle, sprinkler, drip tape, watering can
  - More on watering in **Watering** section on **page 5**.
- Soil care: soil amendments like organic fertilizers, compost, potting soil
  - More on soil amendments in **Soil Care** section on **page 3**.

### EQUIPMENT/INSTRUCTIONS FOR DIFFERENT PLANTING “MEDIUMS”:

#### RAISED BED METHOD #1:

- To frame a **raised bed**, you can use concrete blocks for the walls. One block is around 1 foot in length—how many you need will depend on the dimensions you choose. For a bed that is 7 feet by 4 feet, you will need 20 concrete blocks. Alternately, you can use untreated wood to build a raised bed. Ideal wood for this is locust, hemlock, or other hardwood. Pine wood is soft and not as suitable.
- Ideal dimensions: stretch out your arm. The length from the top of your finger to your nose is +/- 3 feet. A bed 3-5 feet in width is ideal so you can work from either side without having to step in the bed (Fig. 1). We want to avoid stepping in the bed because we don't want to compact the soil. The beds can be as long as you want.
- Raised beds will require gardeners to import soil. Great resources for finding soil include local construction companies that regularly remove top soil for building projects. Contact local construction companies and inquire about “top soil”. Top soil is literally the top layers of a given soil and ideally contains the most organic matter which is essential in gardening.

#### OPEN BED PREP METHOD #2:

1. **Open beds** do not require gardeners to import soil. Instead you will loosen existing soil.
2. Measure similar dimension requirements as raised bed. Completely remove any existing sod/grass with a shovel.
3. Once sod is removed, start at one end of your bed. Depending on bed width and what you're comfortable with, stand in the path or in the bed, working backwards to avoid stepping in your newly turned soil (Fig. 3).
4. Dig out a trench that is the width of your bed (Fig. 3). Place soil in buckets or in a pile just beyond your garden bed. With interior curve of fork facing out, push fork into ground with foot, as far as it will go, then rock fork back and forth to loosen soil below (Fig. 2).
5. Work compost or manure in with a hoe. Place one hand over the other and push the hoe in a back and forth motion, lifting smaller clumps to self. Repeat process of digging and forking.

FIGURE 1  
RAISED BED / OPEN BED METHOD

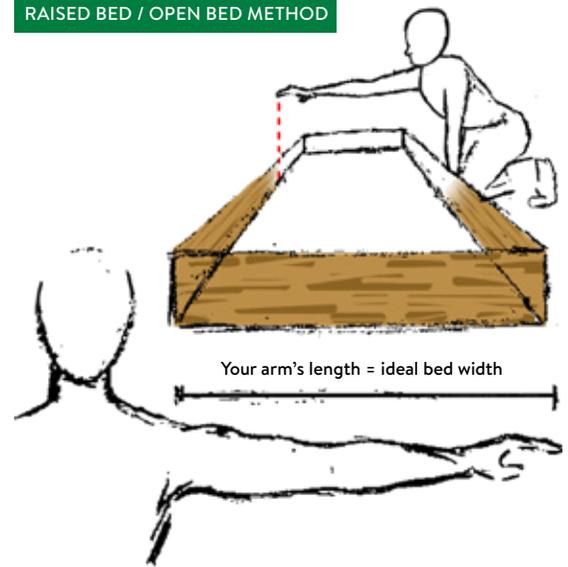
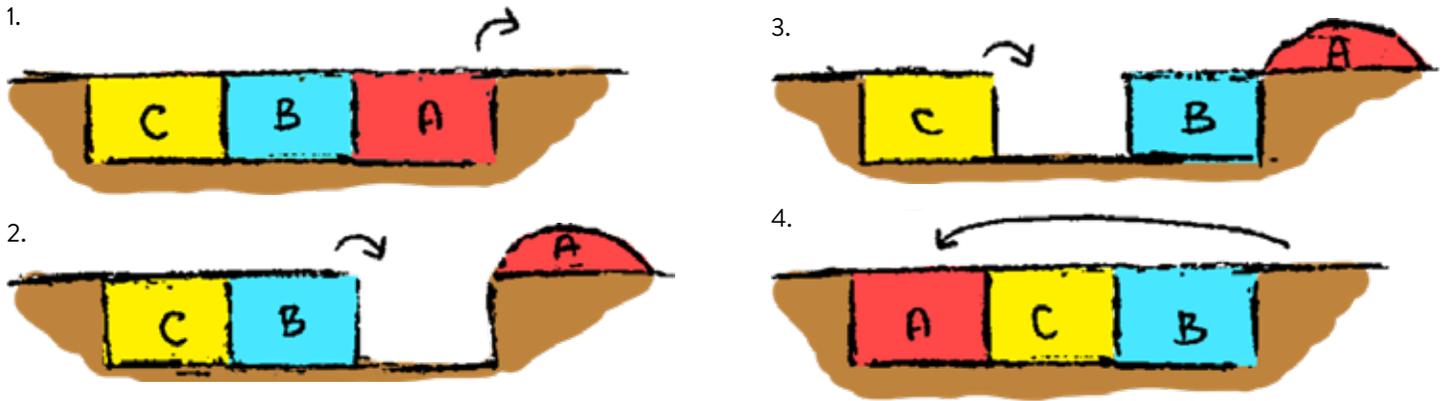
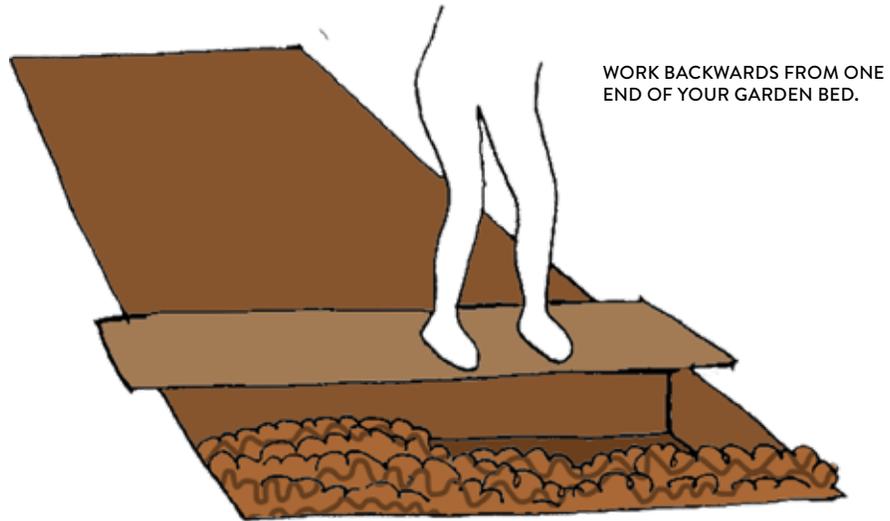


FIGURE 2. FORK METHOD 1



1. DIG OUT **A** AND SET ASIDE OR INTO A BUCKET.
2. FORK **B**, AND USE THIS TO FILL THE FIRST TRENCH (THE ONE YOU'VE MADE FROM REMOVING **A**).
3. REPEAT BY FORKING **C** TO FILL THE SECOND TRENCH (WHAT WAS **B**).
4. USE **A** TO FILL THE LAST TRENCH.

FIGURE 3. FORK METHOD 2

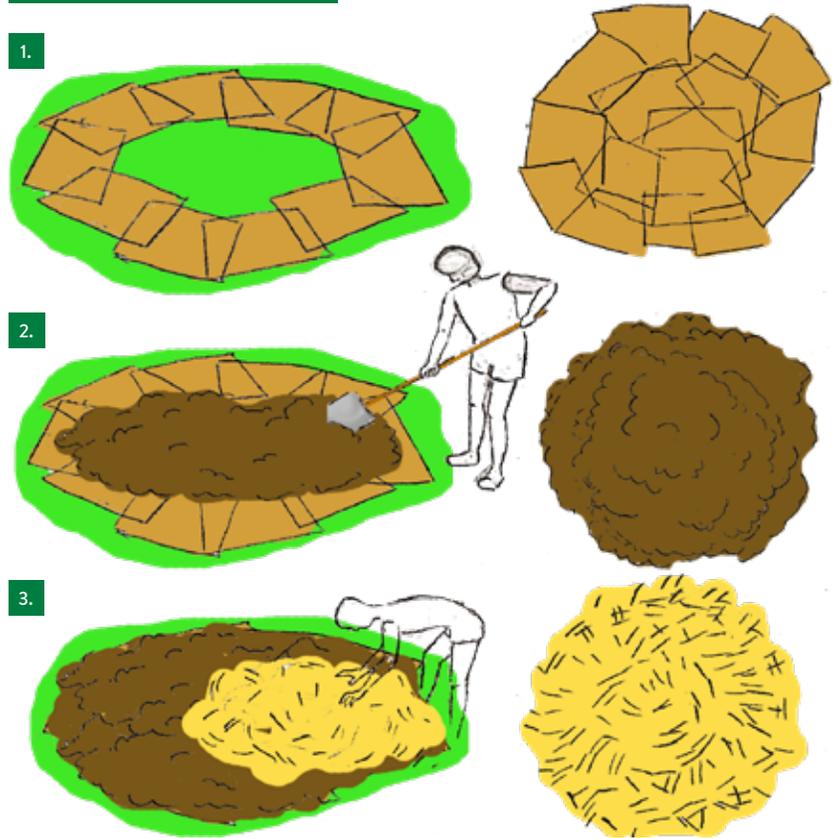


### BED PREP METHOD #3: SHEET MULCH:

Requires the least amount of work, but be aware that you will have to wait a year before planting.

1. Remove any tape from cardboard. Measure your desired dimensions and outline the edges with cardboard. Fill in the outline you made with more cardboard, fully covering the area of your bed. Overlap cardboard slightly to ensure good coverage. This will smother weeds and kill grass (Fig. 4.1).
2. Fully cover the cardboard with compost (Fig. 4.2).
3. Fully cover the compost with straw (Fig. 4.3). Leave this to sit until the next planting season.

FIGURE 4. SHEET MULCH METHOD

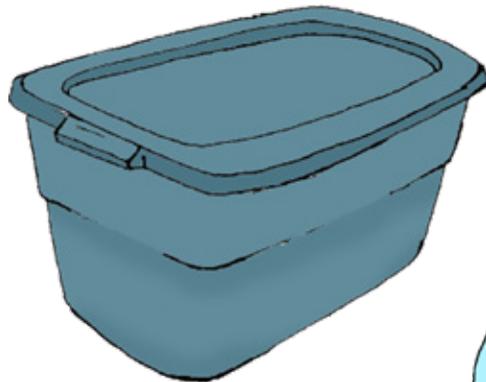


### POTS/PLANTERS—GREAT OPTION FOR THOSE WITHOUT ACCESS TO LAND:

#### • CONTAINER TOTE METHOD

- You will require:
    - a plastic tote (Fig. 5).
    - Hand drill (if you don't have one, you can borrow one from the Carlisle tool library), icepick, or sharp screwdriver.
    - Rocks/crushed brick.
    - Shredded newspaper.
    - Soil; top soil or purchased soil.
    - Compost (free from the Carlisle borough compost facility).
1. With a hand drill or any other sharp tool, pierce 3-5 holes along the base walls of the container. This will allow water to drain out.
  2. Layer down a layer of rocks/brick, newspaper, then a mixture of potting soil and compost. Don't need to fill to the top.

FIGURE 5. PLASTIC TOTE



#### • HANGING/VERTICAL GARDEN (WITH POTS, CUPS, BOTTLE)

- Reuse plastic bottles. Cut 2 holes on the bottom and run heavy-duty string through them. Tie to secure. Cut 2 circles off the sides. Turn the bottle upside-down and fill the bottle cap end (now at the bottom) with compost. Plant seedlings in.

FIGURE 6. HANGING VERTICAL GARDEN



## SOIL CARE

We want loose soil that allows water to penetrate through but still holds enough moisture for a plant to use.

### SOIL TEST:

- Test kits available through Penn State Coop Extension at \$15 or less. Call 717-540-6500.

### SOIL AMENDMENTS:

- Soil amendments are material to add or work into the soil to add nutrients and improve soil quality.
- Fertilizer improves the soil's nutrient content while compost and composted manure improve soil texture and adjusts the pH.
- Mix amendment into soil loosely following the test result recommendation. In a bed, pour amendments over soil and work it into the soil with a hoe. If you're using the container method, sprinkle amendment into soil and gently incorporate with your fingers.

## WORKING WITH SEEDLING

Best with: tomatoes and peppers (tomato family), broccoli, kale, cabbage (cabbage family).

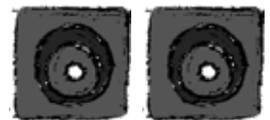
### CONTAINERS:

- Plug tray: 10x12 inches, efficient and least expensive, plastic and easily reusable.
- DIY: yogurt cups, egg carton, ice cube tray, toilet paper roll, beer/soda cans cut in half (Fig. 7). If you're using egg cartons made of recycled paper or molded pulp, make sure to line them with plastic or saran wrap before you begin. This prevents the paper from drawing too much moisture away from your soil.

### START YOUR OWN SEEDLINGS:

1. Choose your container. If you choose not to use plug trays, make sure to make a small hole at the base of your container for drainage (Fig. 8).
2. Fill container of choice halfway to top with soil, place 1-2 seeds in, cover and water.
  - You can easily buy ready-made seedling mix.
3. Place your tray by a window for sun exposure. Southern exposure is ideal, especially in late winter/early spring.
  - Maintain moisture level daily. This will be dependent on ambient temperature plus sun exposure. The ideal moisture level for seedling soil is that of a wrung out wash cloth. Over-watering can promote rot. Under-watering can result in starving your seedling to death.
- Why indoors?
  - Protects your plant from harsh outside environments like strong winds, rain, etc.
  - Allows you to "get a head start" to the growing season!

FIGURE 8. PLUG TRAYS WITH DRAINAGE HOLES

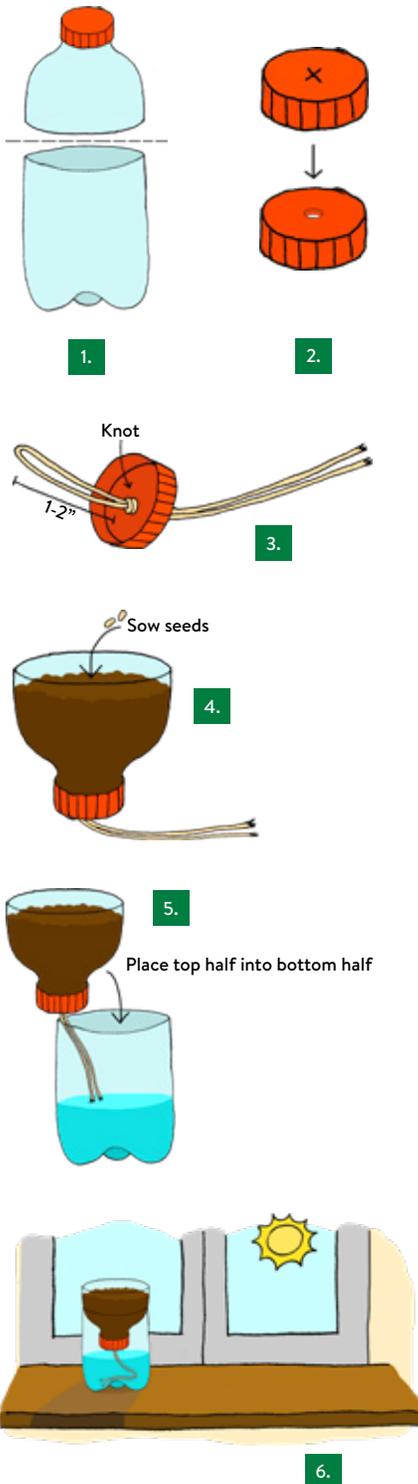


Drill small holes for drainage if needed



FIGURE 7. DIY SEEDLING CONTAINERS

FIGURE 9. PLASTIC BOTTLE SEEDLINGS



1.

2.

3.

4.

5.

6.



FIGURE 10. ROOTBALL

Hold by root ball to prevent damage.

• **DIY SEEDLINGS WITH PLASTIC BOTTLES (FUN ACTIVITY WITH CHILDREN!):**

- Any sized bottle will work.
- 1. Cut a plastic bottle in half (Fig. 9.1).
- 2. Unscrew the cap and poke a hole in the middle of it using a drill, nail or other sharp tool. The hole should be big enough for your string to fit through (Fig. 9.2).
- 3. Double your string and feed it through the hold. Knot it to keep it in place. The loop should be 1-2 inches in length (Fig. 9.3).
- 4. Screw the cap back on and turn the top upside down. Fill it with soil, dampen with water, and then sow your seeds according to directions on the packet (Fig. 9.4).
- 5. Fill the bottom half of the bottle with water and place the top half into the bottom half (Fig. 9.5).
- 6. Place somewhere sunny. Fill the bottle twice a week or as needed. If the soil gets too dry, give it a spritz of water (Fig. 9.6).
  - If your string material is cotton or other biodegradable materials, the whole structure can be transplanted to the ground. (For more information check: [www.seattlesundries.com/blogs/news/11749733-how-to-self-watering-seed-starter-pots](http://www.seattlesundries.com/blogs/news/11749733-how-to-self-watering-seed-starter-pots)).

• **SEEDLING SIGNS TO LOOK OUT FOR (WHEN BUYING OR DIY):**

- Check appearance, look for young and tender leaves. Watch out for insect eggs. They look like tiny circles.
- Hardening off: Seedlings from your house, a store, or the greenhouse have been “pampered” in the sense that they’ve been nurtured in the most ideal conditions. Moving them from this environment right out under the hot sun, drying wind, and (fluctuating moisture) could be too much for their tender leaves to handle, and could end up killing your plant. The process of “hardening off” adapts the leaves to the harsh conditions of the outdoors before you actually set them. One week before transplant, start cutting back on watering and move your tray or containers out into the sun for a couple hours a day. If the leaves turn brown or wilt, you can reduce “sun time”. If you purchased seedlings “pre-hardened”, you can skip this step.
- 1. Break seedling loose from the tray or whatever container you are using. If the container walls are thin, you can push the root ball out by squeezing the bottom. With thicker-walled containers, you can pull the base of the stem gently. If this does not work, you could use a pairing knife or a stick to loosen the ball from the sides of the container.
  - If the root ball looks too tight and compact, you can gently loosen it by kneading the root hairs. This triggers the roots to secrete growth hormone and encourages the roots to grow outwards into the soil instead of continuing to wrap around itself.
  - Ideally, once the seedling is out, you should hold it by the root ball to prevent damaging the stem or leaves (Fig. 10).
  - If you’re using egg cartons, cardboard containers, or anything made of biodegradable material, you can skip this step and plant the container directly into the soil.
- 2. Dig hole in the soil with your fingers. You are looking for a depth that is deeper than the length and diameter of the root ball, because you want the whole root ball to sit under the soil surface (Fig. 11). Place the seedling in the hole. Cover immediately with excess soil and pat gently. Gently water new seedling—focusing on dampening the soil not the plant.
  - Water will activate stored enzymes in the roots and encourage the roots to establish themselves in the soil.
  - New seedlings need to be watered regularly. If left to dry out new seedlings risk perishing.

Ideal hole for your seedling.

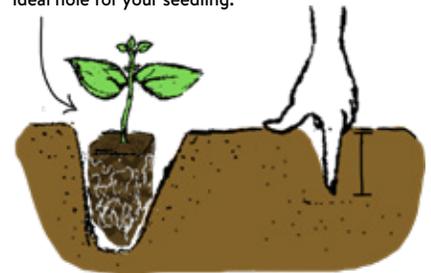


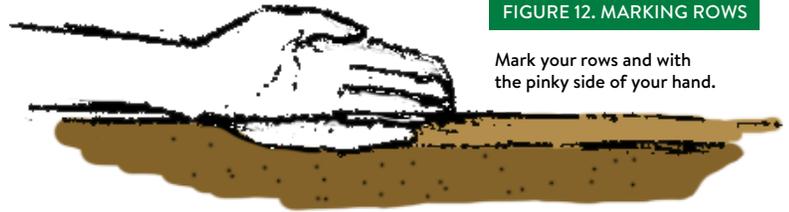
FIGURE 11. PLANTING SEEDLINGS

## WORKING WITH DIRECT SEEDED CROPS

- Best with: carrots, beets, lettuce, peas, beans, etc.
- Bury seed no deeper than the diameter of the seed (double-check with seed package). You don't want the seed to be planted too deep. Staying close to the surface of the soil provides the seed with a source for warmth and water as they germinate.

### DIRECT SEEDING:

- Mark your rows. Be sure to reference your seed packet for how best to space your rows. Drawing a line in the soil with your finger might help.
- At one end of the row, make an indentation with your fingers to the seeds required depth (on packet). Place 2-3 seeds into the indentation. A great rule of thumb is not to bury a seed deeper than it is in diameter.
- Follow packet instructions for spacing between seeds. Measure the required spacing down the row and mark your second indentation. Place 2-3 seeds in the second indentation. Repeat until you reach the end of the row.
- Lightly cover the seeds with soil, pat gently, and water.



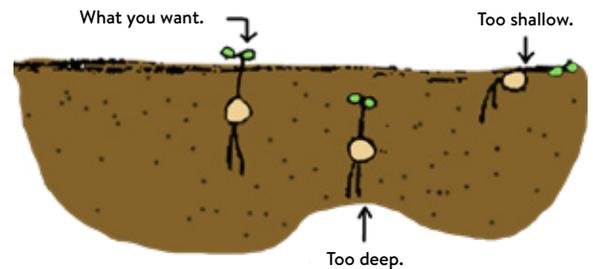
### FIGURE 13. SPRINKLING SEEDS

### BROADCAST SOWING:

- Mark your rows, and with the pinky side of your hand, drag your hand down the row to make trenches in the soil (a ruler or a board with a straight edge might help (Fig. 12). Make sure the bottom of each trench is not too deep.
- Loosely hold a handful of seed and shake hands in a back and forth motion "sprinkling" seeds as you go down the trench (Fig. 13).
- Lightly cover the seeds with soil, pat gently, and water.
- Note that you may need to thin them later (refer to **page 16** for notes on thinning).



### FIGURE 14. SEED DEPTH MATTERS



## WATERING

- Options: Hose, sprinkler, drip tape, watering can (Fig. 15).
- With watering, the first thing to remember is that you are *watering the roots, not the leaves*. Water and other nutrients are carried up to the rest of the plant from the roots, therefore it's the roots that need the water. Second, you are looking to mimic rain. Avoid directing harsh spray directly at the soil as this could compact your soil or even wash your seeds away. Instead water as gently as possible regardless of your watering method.

### WHEN TO WATER:

- By hand, plunge finger into soil (until your second knuckle touches the surface) and check for depth of moisture. If you feel the soil is damp to the tip of your fingers, or if you pull your finger out and find dark damp soil bits stuck on your finger, you could probably wait to water.
- Good and safe practice is to water lightly everyday, ideally in the afternoon or 2 hours before sunset to allow water to percolate down into the soil and be absorbed before it has a chance to evaporate (happens most when the sun is at it's peak, around noon).
- But **always** water after transplanting! In the summer, seeds/seedlings need 2-3x watering everyday to properly establish roots in the soil.



FIGURE 15. WATERING OPTIONS

- Water until the soil is wet and “shiny” for at least 3 seconds. After watering, you can plunge finger into soil again and check that you feel moisture at least 2 inches deep.

- **MATURE PLANTS**

- Typically need less water (roots go deeper and can tap into deeper moisture levels vs. younger plants where roots are closer to surface and water is more prone to evaporation). Exceptions include shallow-root plants or fast-growing leafy greens like lettuce, and are typically more “water-hungry”.
- Be careful not to over-water plants. Over-watering can “dilute” flavor.

- **WATER CONSERVATION TECHNIQUES**

- **Deep watering!**

- Just 2x/week!
- Encourage deep root growth which makes plant healthier and less vulnerable to disease and dry conditions.

- **Equipment:**

- 2 liter water bottle—use smaller bottles for container gardens, or 12” bamboo sticks (can be requested from the Dickinson College Farm).
- Nail or hand drill.

- **To Do:**

- Make 10-12 holes all over the bottom of the plastic bottle or bamboo stick.
- Plant bottle or stick beside your plant, leaving the neck and lid above the soil surface. This works best with seedlings, when the plant is still small, and you can easily work around it.
- Water around your plant and fill the water bottle to the top. You can use a funnel or another plastic bottle to make this step easier.
- If using a bottle, screw on the cap loosely. This will allow water to seep out slowly, and prevents mosquitoes and soil to enter the bottle.
- Refill 2x/week! (*Make sure to keep monitoring your plant. If it starts showing signs of wilting, you may need to fill more regularly.*)

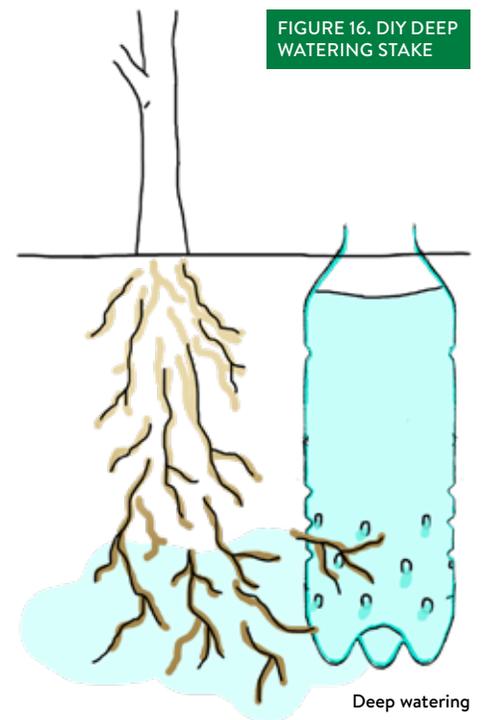


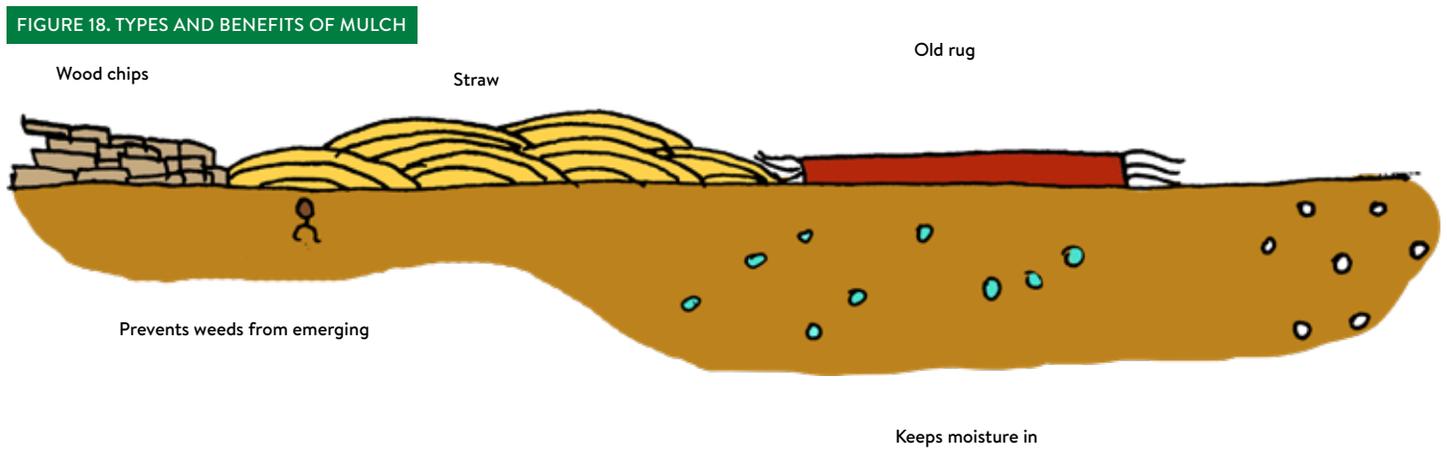
FIGURE 16. DIY DEEP WATERING STAKE

FIGURE 17. USING BAMBOO STICKS



## • MULCH

- A layer of organic or inorganic material that prevents evaporation and reduces the chances of weeds to arise (Fig. 18).
- **Types:**
  - Organic: straw, hay, wood chips, compost, shredded leaves.
  - Inorganic: plastic, rug. Plastic mulch comes in various colors but is on the pricier end, and is not recommended for small scale gardening.
    - Note that inorganic mulch is less ideal.



## COMPANION PLANTING

- Definition: combining 2 plants **close together** with the means to make the garden more productive.
- How: certain plant combinations can encourage/discourage growth, deter/trap pests, attract beneficial insects.

### • PHYSICAL COMPLEMENTARY METHODS:

- **Interplanting:** share available resources in a limited space.
- **Sun-shade method**
  - *Taller plants* pair well with ground-level “spreading” or *shade-tolerant plants*. They are not competing for the same spaces, and may even provide the necessary shade that some plants prefer.
  - Examples of taller plants include trellised beans or tomatoes and sunflowers. Examples of ground-level “spreading” plants include melons and sweet potatoes. Examples of shade-tolerant plants include beets, cucumber, and lettuce.

### • Shallow-deep root method

- Water and nutrients exist in various soil zones. *Deep-rooted plants* pair well with *shallow-rooted plants* because their roots are relying on different soil zones for these nutrient sources, and are therefore not in competition with each other (Figure 19).

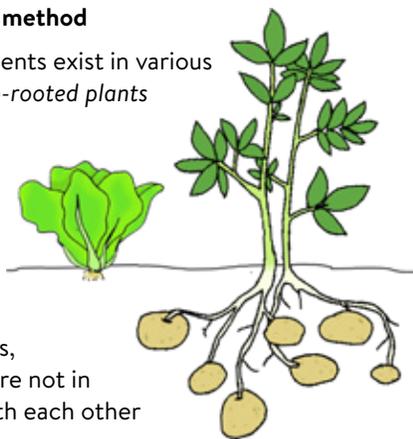


FIGURE 19. LETTUCE PAIRED WITH POTATOES

- Examples of deep-rooted plants are squash, carrots, and tomatoes. Examples of shallow-rooted plants are lettuce, spinach, and radishes.
- **Nutrient-sharing method**
    - *Heavy-feeding plants* pair well with *light-feeding plants* because they are both able to secure enough nutrients from the same resource pool.
    - Examples of heavy-feeders include cabbage, corn, tomatoes, and squash. Examples of light feeders are beans, lettuce, spinach, and herbs like cilantro and dill.

### • Life cycle method

- *Fast-growing plants* pair well with *slow-growing plants* because they will be harvested before the slow-growing plant “needs the space”. You can also use fast-growing plants to produce flowers that attract beneficial insects and will improve the quality of your slow-growing plants.
- Examples of fast-growers include lettuce, radishes, and leafy greens like spinach and mustard greens. Examples of slow-growers include brussels sprouts, onions, melons, tomatoes, peppers, and eggplant.

- You can also pair fast-growing dill and calendulas to attract beneficial insects for broccoli and beets.

### • PEST CONTROL METHODS:

#### • Repel pests:

- Some plants can provide physical or chemical barriers for another plant.
- *Physical barriers* may come in the form of off-colors that confuse or don’t attract certain pests.
  - For example, yellow/orange fruit attract less birds than red, purple cabbage/cauliflower are less attractive to cabbageworms, aphids, cucumber beetles, and onion flies, compared to their yellower counterparts, dark-coloured flowers are less attractive to Japanese beetles.
- You can also literally protect your plants with physical barriers provided by surrounding vulnerable plants with tall or bushy plants. These act as wind-break, blocking insects that “ride the wind” and other flying pests, and also act as shelter for the beneficial insects. (example: sunflowers and evergreen shrubs).
- *Chemical barriers* may come in the form of releasing fragrances or other chemicals that repel pests.
  - For example, garlic and onions pair well with tomatoes or roses as their pungent smells repel pests that can attack the tomato or rose plant, allelopathic plants like tomatoes release a repellent compound called phytoalexins that enables the plant to defend itself against disease.

#### • Trap pests:

- Some plants can act as a *decoy* for insects and *deter* them from the plants you are trying to protect. Once trapped, you can manually remove them from your garden.
- Examples include radishes that deter cabbage maggots away from your broccoli, cauliflower, and cabbage plants.

### • NURSERY CROPS/ATTRACT BENEFICIAL INSECTS

- *Provide food/shelter for pest-eating and other beneficial insects.*
- Examples from the Mint family include basil, thyme, mint, and sage (attract bees, hoverflies, etc.) Examples from the Daisy family include marigolds, sunflowers, and dahlias (attract and provide shelter for parasitic wasps, lady beetles, etc.). Examples from the Carrot family include dill and fennel (attract spiders, wasps, lady beetles, hoverflies, etc.).
- Bug bath: shallow pan with stones and water. Invites insects and birds which are also good for pest control in your garden.

# Chapter 2: Pests and Diseases

## MOST COMMON GARDEN PESTS

- APHIDS
- CATERpillARS
- COLORADO POTATO BEETLES
- CUCUMBER BEETLES (STRIPED AND SPOTTED)
- CUTWORMS
- FLEA BEETLES
- SLUGS
- BEAN LEAF BEETLES
- MEXICAN BEAN BEETLES
- JAPANESE BEETLES
- TOMATO HORNWORMS
- WHITE FLIES
- SQUASH BUG/STINK BUGS

## PLANT DISEASES

- **FUNGUS**
  - Most plant disease (85%) happen to be fungal. Fungal diseases are characterized by fungal spores, yellowish “rusts”, white powdery textures, brown spots with yellow halos around the spots. They are largely moisture and air circulation issues, so best practice to prevent or recover from them is to water wisely and improve air circulation (through spacing adjustments or trellising). This also helps sunlight flow through the foliage, which keeps the plant healthy.
  - Includes mildews, blights, rusts, rots, molds, etc.
- **VIRUS**
  - An infectious pathogen that leads to plant disease or poor plant health. Plant viruses upset plant metabolism and cell production which leads to reduced productivity, stunted growth, lower yields and greater susceptibility to other diseases.
- **BACTERIA**
  - Common characteristics include bacterial “stringy” oozes and water-soaked lesions (usually limited to leaf veins). A yellow halo may appear around these lesions. Bacterial diseases can be carried in by insects, so watch out for these disease-carrying pests in your garden. However, wind, rain, and even our own hands can carry bacterial pathogens. Therefore, best practice is to monitor crops regularly and always work with clean tools (and hands). A useful thing to note is that bacteria needs an “entryway” to infect your plant. These could be cuts or “wounds” from tools or insect damage, therefore be careful when working with your plants, especially with particularly disease-sensitive plants such as tomatoes and cucumbers. Also note that the plant has natural openings like the plant’s stomata.

FIGURE 20. DIY BOTTLE BARRIERS

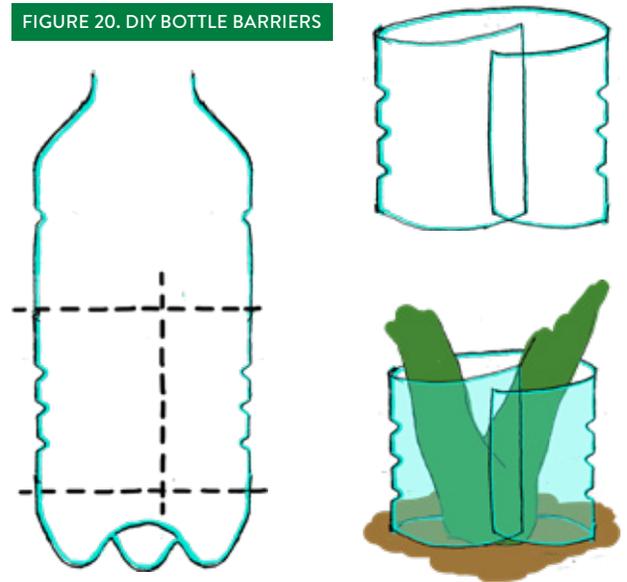


FIGURE 21. USING WOOD ASH AS A BARRIER



**\*SANITATION:** Remove any disease-affected plants (pulling up from root). Dispose or destroy through burning (unless otherwise stated). Clean up and dispose all leaves that fall. **CLEAN ALL TOOLS** between uses, especially after working with a disease-affected plant or before working with disease-prone plants like tomatoes. **WASH HANDS** before handling plants. Your hands could touch and spread diseases, too!

# COMMON PESTS AND DISEASES ORGANIZED BY MOST SUSCEPTIBLE PLANT FAMILY

## BEAN FAMILY (GREEN BEANS, SNAP PEAS, AND OTHER LEGUMES)

- **MOST COMMON PESTS:**
  - **MEXICAN BEAN BEETLES AND BEAN LEAF BEETLES (DIFFERENT FAMILY BUT LOOKS AND BEHAVES SIMILARLY)**
    - **What they do:** Feed on leaves, leaving leaf skeleton behind.
    - **Control:**
      - **Biological:**
        - Attract more parasitic wasps to your garden. Interplant beans with potatoes, or plant marigolds, rosemary, radishes, nasturtiums, and garlic around beans.
      - **Physical:**
        - Spray garlic spray on plants. Optional: mix neem oil into garlic spray.
- **MOST COMMON DISEASES:**
  - **ANTHRACNOSE**
    - **Symptoms:** Dark brown or purplish streaks or elongated circles on leaves (younger leaves more susceptible) starting from leaf vein. Spots will cause area around vein to "sink". Holes may appear, and leaves may eventually shrivel and drop. In wet weather, pink jelly-like spores may form. Spots spread to stem and pod, and could reach inside of pod, creating dark brown/black spots on the beans.
    - **Remedies:** Sanitation\* during dry weather (needs wet weather to spread). Avoid working among wet bean leaves. Be sure to remove dead plants from the garden area as the disease can survive even in dead plants from your garden area.
  - **SOFT/STEM ROT**
    - **Symptoms:** Black pea-sized fungus on stem (in cooler temps between 60°F and 65°F, bundles of little spore-filled mushrooms will form).
    - **Remedies:** Improve drainage and organic matter in soil, sanitation\*.
  - **BEAN RUST**
    - **Symptoms:** White blisters on underside, quickly turns into orange-brown pustules, usually circular in shape, on underside of leaves. Leaves drop off. May eventually develop on stems and pods.
    - **Remedies:** Sanitation\* during dry weather. Thin

and adjust spacing to improve air circulation and encourage quicker drying.

- Sulfur spray.

- **COMMON BLIGHT**

- **Symptoms:** Water-soaked spots on leaves, appearance of yellow/white blotches.
- **Remedies:** Limit over-watering and working with plant when wet.

- **POWDERY MILDEW**

- Happens under very dry conditions.
- **Symptoms:** Appearance of white "powdery dusting" on leaves. Leaves eventually dry out and curl up (fungus dehydrates the leaves). Any fruit become tasteless.
- **Remedies:** Adjust spacing to improve air circulation and increase sunlight penetration.

- **VIRUSES (BEAN MOSAIC, CUCUMBER MOSAIC)**

- **Symptoms:** Irregularly colored leaves (light/dark patches), sickly yellow blotches, plant growth stunted and plant appears dwarfed.
- **Remedies:** Sanitation\*, control pest vectors (aphids, bean leaf beetles).

## CUCUMBER FAMILY (CUCUMBER, SQUASH, MELONS, ZUCCHINI, AND OTHER CUCURBITS)

- **MOST COMMON PESTS:**

- **APHIDS**

- **What they do:** Suck on sap causing leaves to wilt and fall, secrete compound onto leaves that can cause mold growth. Some carry diseases. Feeding can transmit these diseases to the plant.

- **Control:**

- **Physical:**

- **Quick:** Hose down or brush off when you see them. You can also crush them or brush them with rubbing alcohol to kill them instantly.
- Spray with soapy water or hot pepper-garlic spray.
- Lay aluminum foil around the base of the plants. The reflected light will confuse aphids.

- **Biological:**

- Plant nasturtiums around plants.

- **Crops affected:** *all*.

- **CUCUMBER BEETLES (STRIPED AND SPOTTED)**

- **What they do:** feed on plant, cause plant to wilt. Carry diseases. They lay yellow-orange eggs on the base of the plant, in the surrounding soil.

**\*SANITATION:** Remove any disease-affected plants (pulling up from root). Dispose or destroy through burning (unless otherwise stated). Clean up and dispose all leaves that fall. **CLEAN ALL TOOLS** between uses, especially after working with a disease-affected plant or before working with disease-prone plants like tomatoes. **WASH HANDS** before handling plants. Your hands could touch and spread diseases, too!

- **Control:**
  - **Biological:**
    - Plant radishes, marigolds, catnip, and nasturtiums around plants in this family to repel cucumber beetles.
    - Grow dill to attract lacewings and ladybirds that feed on them.
  - **Physical:**
    - Till the soil and mulch to prevent beetle from laying eggs. Plant radishes, marigolds, catnip, and nasturtiums around plants in this family to repel cucumber beetles.
    - Spray with a mix of 1 cup wood ashes, juice of 1 lime, and a gallon of water.
    - In the morning when there is still a layer of dew, sprinkle plant with hot red pepper powder or chalk powder. If there is no dew, spray with water beforehand.
- **MOST COMMON DISEASES:**
  - **ANTHRACNOSE**
    - **Symptoms:** dark brown spots on leaves (younger leaves more susceptible) starting from leaf vein. Spots will cause area around vein to "sink". Holes may appear, and leaves may eventually shrivel and drop. Spots spread to stem and fruit and could leave sunken spots on fruit too. In wet weather, pink jelly-like spores may form.
    - **Remedies:** sanitation\* during dry weather (needs wet weather to spread).
  - **LEAF BLIGHT**
    - **Symptoms:** yellow to brown areas all over plant, leaves eventually die.
    - **Remedies:** rotate crops after each season.
  - **BLOSSOM BLIGHT**
    - **Symptoms:** on flower—rapid decay, identifiable by tiny black pin-shaped "fruiting-bodies" (of fungi) on bottom of flower.
    - **Remedies:** Sanitation\* (remove all blossoms and fruits and destroy immediately). Thin, trellis, or adjust spacing to improve air circulation. Avoid overwatering.
  - **LEAF SPOTS**
    - **Symptoms:** Water-soaked spots on leaves, leaves appear tan, gummy, or shinier, eventually dry out and fall off.
    - **Remedies:** limit overhead watering and working with plant when wet.
  - **BACTERIAL WILT**
    - **Symptoms:** sudden wilting of leaves, plant growth appears stunted, leaves appear distorted, fruits appear misshapen. Do an ooze test: cut stem crosswise and squeeze the stem with your fingers. Pull the cut apart. Formation of a white gooey thread indicates bacterial wilt.
    - **Remedies:** control pest vectors (cucumber beetles). Trap crops include radishes and calendulas. Trap the beetles and drown in hot soapy water. Kaolin clay, improve drainage, use row covers.
- **POWDERY MILDEW**
  - **Symptoms:** Appearance of white "powdery dusting" on leaves. Leaves eventually dry out and curl up (fungus dehydrates the leaves). Any fruit become tasteless.
  - **Remedies:** Unlike many cases of disease, you can "wash off" the fungus from the leaves with heavy watering. Apply compost tea every 2 weeks. Another option is to apply baking soda spray once a week, heavy showering with water in between applications.
- **VIRUSES (CUCUMBER MOSAIC, SQUASH MOSAIC, WATERMELON MOSAIC)**
  - **Symptoms:** brittle leaves, appearance of green and yellow mottling, fruits distorted and mottled.
  - **Remedies:** sanitation\*, control pest vectors (cucumber beetles and aphids), control weeds.

## TOMATO FAMILY (TOMATOES, SWEET OR HOT PEPPERS, EGGPLANT, AND OTHER NIGHTSHADES)

- **MOST COMMON PESTS:**
  - **COLORADO POTATO BEETLE**
    - **What they do:** Feeds on leaves until leaves look lacy.
    - **Control:**
      - **Physical:**
        - Destroy yellow-orange eggs on underside of leaves. Sprinkle wheat bran on leaves. Spray plants with pepper-onion-garlic spray and soapy water on larvae.
  - **CUTWORMS**
    - **What they do:** at night, they feed on leaves or bite off entire stems. Find them curled at the base of seedlings or the underside of leaves (to act dead).
    - **Control:**
      - **Physical:**
        - Create cutworm collars using toilet paper tubes, bottomless paper cups or tin cans, or wrap aluminum foil or newspaper around the stem. (Fig. 20).

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**\*SANITATION:** Remove any disease-affected plants (pulling up from root). Dispose or destroy through burning (unless otherwise stated). Clean up and dispose all leaves that fall. **CLEAN ALL TOOLS** between uses, especially after working with a disease-affected plant or before working with disease-prone plants like tomatoes. **WASH HANDS** before handling plants. Your hands could touch and spread diseases, too!

- Repel with crushed up eggshells mixed into the soil. If you have a chimney or have a friend with a chimney, gather soot from the inside of the walls and sprinkle around the stem (Fig. 21).
- **More info:** Cutworms are attracted to younger stems—act while your plant is young. Help give your plant a chance to get older and tougher.
- **TOMATO HORNWORMS**
  - **What they do:** eats the plants.
  - **Control:**
    - **Biological**
      - Plant dill as a trap crop or borage, basil, and marigolds to repel them.
    - **Physical**
      - Handpick.
      - They camouflage well, so place a light colored fabric under the plant and leave for a few hours. Check after for caterpillar droppings, and find the hornworms hanging above.
      - Spray plant with hot pepper or citrus peel spray.
- **MOST COMMON DISEASES:**
  - **ANTHRACNOSE**
    - **Symptoms:** dark, sunken “wet” spots on stem, leaves, and fruits.
    - **Remedies:** sanitation\* during dry weather (needs wet weather to spread).
  - **ROTS (ROOT AND STEM)**
    - **Symptoms:** visual rot on roots and stem base, dark brown to grey spots on leaves, leaves may eventually die and fall off, plant eventually collapses.
    - **Remedies:** Sanitation\* and replace soil around roots. Limit overhead watering, water in the morning, mulch, stake and adjust spacing to improve air circulation.
  - **ROOT KNOT NEMATODES**
    - **Symptoms:** plant growth appears stunted, small to large knob-like galls on roots.
    - **Remedies:** sanitation\*, plant companions.
  - **EARLY BLIGHT (ALTERNARIA)**
    - **Symptoms:** small dark brown circular spots on plant, yellow “halo” around the spots, with a magnifying glass you can see concentric rings on these spots (like a topographical map), leaves drying out, may eventually turn blackish brown. Affect older leaves first (closer to ground).
    - **Remedies:** limit overhead watering, sterilize stakes, stake and adjust spacing to improve air circulation,

water in the morning, mulch. Apply compost tea every 2-3 weeks.

- **LATE BLIGHT**

- **Symptoms:** patchy brown and dead areas on leaves (start at tip and gradually make its way through whole leaf). Affect older leaves first (closer to ground). Unlike early blight, you won’t find concentric rings on the spots. To check, pick off some affected leaves and leave inside a plastic bag with a damp paper towel for 24 hours in room temperature. Use a magnifying glass to see if any white spores appear on the underside of the leaves.
- **Remedies:** limit overhead watering, sterilize stakes, stakes and adjust spacing to improve air circulation, water in the morning, mulch. Apply compost tea every 2-3 weeks.

- **VERTICILLIUM WILT**

- **Symptoms:** early symptoms include yellowing of leaves and drooping of plant. Underside of branches may show dark vein-like streaks of the fungus.
- **Remedies:** can still consume fruit but don’t save seed and remove plant from garden after harvest. Future: compost and crop rotation.

- **VIRUSES (TOBACCO MOSAIC, CUCUMBER MOSAIC)**

- Highly contagious.
- **Symptoms:** leaves narrow, mottling light and dark green spots on leaves, leaves appear distorted, bronze streaks on fruit, low fruit yield.
- **Remedies:** sanitation\*, wash hands with soapy water before handling plants, control insect vectors and weeds.

## CRUCIFEROUS VEGETABLES AND OTHERS IN BRASSICA FAMILY (BROCCOLI, KALE, CAULIFLOWER, BRUSSELS SPROUTS)

- **MOST COMMON PESTS:**

- **CATERPILLARS (INCL. CABBAGE LOOPERS, CABBAGE WORMS, CABBAGE MAGGOTS)**

- **What they do:** they chew holes through leaves and bore through vegetables.
- **Control:**
  - **Physical:**
    - Remove all crop debris in the fall.
  - **Quick:** If you want, you could wear gloves or use kitchen tongs and hand pick them and squish to kill.
  - Keep an eye out for their little white eggs, usually on top of leaves, or even within fallen debris.
  - Sprinkle wood ash onto plants.

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- Sprays that work include garlic spray and vinegar milk spray (4 teaspoons per cup of milk). Spray every 3-7 days, until there is no more evidence of caterpillars.

## • FLEA BEETLES

- **What they do:** feed on leaves, leave round holes on leaves. Feeds on younger plants.
- **Control:**
  - **Physical:**
    - Get rid of weeds and other garden debris.
    - Quick: flea beetles dislikes moisture, so shower them with water for a immediate fix.
    - Spray with soap spray or hot pepper spray.
    - **Traps:** find or paint cards white or yellow and smear Vaseline or mustard oil on the card. Hold the card over the plant and gently shake plant to get beetle to hop onto the card and stick. You can also hang the cards in your bed to attract and trap them.

## • SLUGS

- **What they do:** very destructively chomps on plants (can eat 30-40 times its body weight) and can hibernate for many years. Silvery trails are good indicators of their presence.
- **Control:**
  - **Physical:**
    - Create barriers around plant using wood ashes, crushed up egg shells, powdered ginger, or short hair clippings around and mixed into the soil at the base of the plant (Fig. 20). Bottomless plastic bottles their caps off make good barriers for seedlings (Fig. 21). If you want, you could wear gloves or use kitchen tongs and hand pick them off. Directly salt them or drop them in a bucket or jar filled with equal parts water and vinegar. Note they are nocturnal, so you want to start 2 hours after sundown.
    - **Traps:** If you don't want to hand pick them, you can create a beer trap. Pour beer about 1 inch into any-sized container (option: used salsa or hummus container, pie tin, etc.) and set it in your garden near the plants that are being attacked. The beer will attract and drown the slugs.
      - The slugs are attracted to the yeast in the beer. If you don't have any beer on hand, you can make an alternative solution using 2 tsp flour, 1 tsp baker's yeast, 2 tsp sugar, and 2 cups warm water. Pour solution into container, as you would beer.
      - When working with these traps, keep in mind

that slugs (and snails) are attracted to dead bodies of their own kind too.

- **Traps:** Turn a hollowed-out grapefruit or orange upside down and set it near your plant the slugs are drawn to. The slugs take shelter in these domes—so make sure to look under them in the morning!

## • Biological

- Plant rosemary around your plants. It can act like a protective barrier.

- **Crops affected:** *all*.

## • MOST COMMON DISEASES:

### • BLACK LEG

- **Symptoms:** wilting of the leaves, may eventually turn purplish in color. Brownish gray spots may appear on the plant, stem appears bruised. Plant eventually collapses.
- **Remedies:** Sanitation\*. If you're starting from seed and have the option of doing so, choose seeds originating from the West where the black rot bacteria is very rare. If working with a seed of an unknown origin (e.g. given to you from a friend), you could heat-treat the seed in hot water.
- **How to heat-treat:** Place seeds in something porous like a cheesecloth, cotton cloth, or a tea infuser, and tie in place (make sure seeds aren't packed together, and can move around easily). Soak seeds in hot water (120F°) for 20 minutes to kill off traces of the bacteria. Transfer to a container of cold water to cool. Remove seeds from porous cloth and spread evenly on a cookie sheet lined with paper towels to dry. Plant immediately.

### • BLACK ROT

- **Symptoms:** yellowish V-shaped patches on leaf margins, gradual yellowing/browning of leaves starting from the outer more exposed leaves (rain, wind, etc. creates more "breaks" on leaf surface for bacteria to enter), discoloration in stems (cut crosswise, you may find a continuous dark ring), plant appears dwarfed or growth appears one-sided, and eventual premature death.
- **Remedies:** Sanitation\* and limit overhead watering. If you're starting from seed and have the option of doing so, choose seeds originating from the West where the black rot bacteria is very rare. If working with a seed of unknown origin (e.g. given to you from a friend), you could heat-treat the seed in hot water. Soak in hot water (120°F) for 20 minutes to kill off traces of the bacteria.

### • YELLOWS (WILT FUSARIUM)

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- **Symptoms:** lifeless foliage, leaves appear yellow or curled and are dry and brittle to the touch, plant droop.
- **Remedies:** Sanitation\*.
- **WHITE RUST**
  - **Symptoms:** white blisters on underside of leaves, causes chalky white patches on underside of leaves, upper side show yellowish spots.
  - **Remedies:** Sanitation\* and harvest nearby plants of the same species (may have contracted the disease even if no symptoms appear).

## NOTES

- It's **good practice** to always harvest or remove mature or old plants from garden. This prevents over-accumulation of plant debris or rotting plants that can attract pests and even harbor disease and pests between seasons.
- It's **good practice** to avoid working with plants when they are wet. As you can tell, diseases tend to thrive in wet and humid conditions.
- It's **good practice** to remove diseased plants from the garden so that disease does not spread.
- Always be on the lookout for disease-free seed and resistant varieties of crops! If the problem persists, this may be the only option. Note however that some resistant varieties may not exist.
- If only one plant, between many healthy plants, shows deficiencies, this may indicate disease. If many plants show deficiencies, this may indicate a nutrient deficiency.

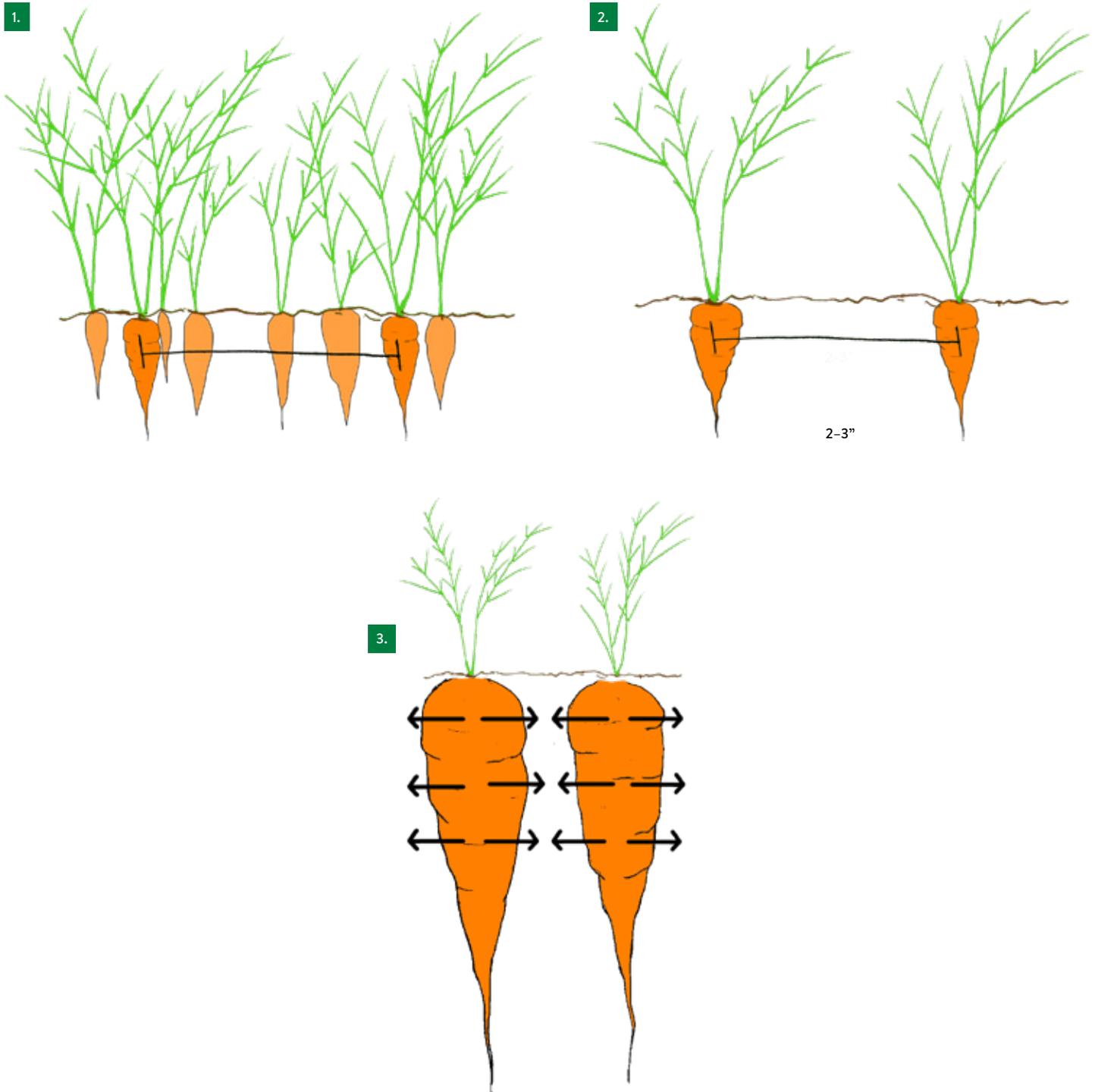
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**\*SANITATION:** Remove any disease-affected plants (pulling up from root). Dispose or destroy through burning (unless otherwise stated). Clean up and dispose all leaves that fall. **CLEAN ALL TOOLS** between uses, especially after working with a disease-affected plant or before working with disease-prone plants like tomatoes. **WASH HANDS** before handling plants. Your hands could touch and spread diseases, too!

## THINNING

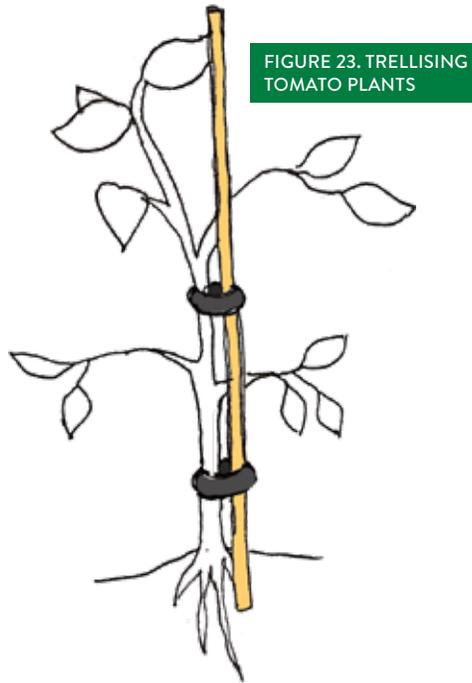
- Broadcast seeding may cause “overcrowding” at the seedling phase (Fig. 22.1).
- Thin seedlings by pinching or snipping off the excess seedlings, leaving the remaining ones spaced 2-3 inches apart or as recommended on the seed packet (Fig. 22.2).
- This ensures that there is enough space and resources for the crop to fully develop (Fig. 22.3).
  - **NOTE:** common plants that need to be thinned: carrots, parsnips, radishes.

FIGURE 22. THINNING CARROTS



## TRELLISING

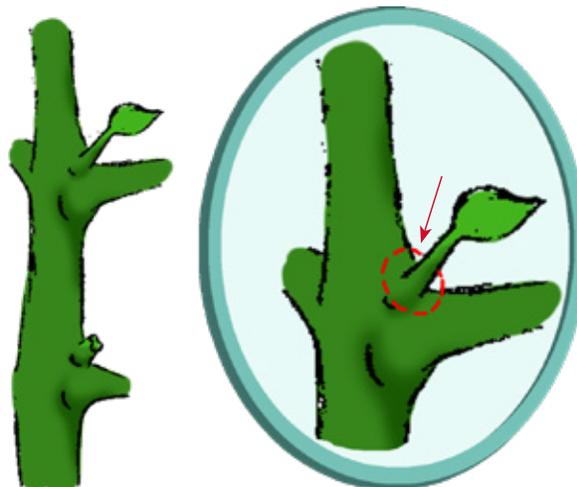
- When the plant reaches 12–18 inches in height, gather metal or wooden stakes or bamboo sticks (request from the Dickinson College Farm!).
- If you're using bamboo sticks, stick them all the way to the bottom of the planter.
- Secure the plant to the stake with string, being careful not to tie string too tightly around the plant (Fig. 23).
- Monitor the plant and re-trellis as the plant continues to grow.
- **NOTE:** common plants that need to be trellised: tomatoes and beans.
- **NOTE:** Don't trellis when the plant is wet.



## PRUNING

- Once the plant is trellised, you can start pruning.
- Using clean scissors or pruning shears. Trim off lower level of branches and suspicious or damaged leaves and stems.
- Find “suckers” and trim off (Fig. 24).
- **NOTE:** common plants that need to be pruned: tomatoes and raspberries.

FIGURE 24. PRUNING TOMATO PLANTS



## PEST/DISEASE HOME REMEDIES

### • SOAPY WATER

- Kills insects and insect larvae.
- **How to:**
  - For a 2% solution, mix in 2 teaspoons liquid hand soap or dish soap per pint of water or 5 tablespoons per gallon of water.
  - For a 3% solution, mix in 1 tablespoon liquid hand soap or dish soap per pint of water or 8 tablespoons per gallon of water.
  - Pour into spray bottle and spray stem, bud, and underside of leaves. Let sit for 2-3 hours then rinse plant with water. Tip: spray early in the morning so you can rinse in the afternoon.

### • BAKING SODA SPRAY

- For powdery mildew and other fungal diseases.
- **How to:**
  - Mix 1 teaspoon baking soda, ¼ teaspoon dish soap, 1 quart water together and pour into spray bottle. Spray once a week.

### • DIATOMACEOUS EARTH

- Keeps slugs and cucumber worms away, controls aphids, and paired with essential oils can keep rodents away too.
- You can buy a 4lb bag of Safer Brand Diatomaceous Earth for \$17.68 or a 2.5lb bag of EasyGoProducts Diatomaceous Earth for \$12.99 on Amazon (<https://rb.gy/uajiu5>).
- General price range \$4-5/lb.

### • POWDERED MILK

- For powdery mildew, fruit rots, leaf spots.
- Acts as a calcium supplement, balances soil pH, acts as a fungicide.
- **How-to:**
  - For before planting: Mix ¾ cup powdered milk into soil around hole before planting, repeat sprinkling every 2 weeks during growing season.
  - For after planting: Dilute ¼ cup powdered milk with water, pour into spray bottle, and spray area around the base of plant throughout the growing season, or every 2-3 weeks.
  - Using regular milk can work too. Mix a 50/50 ratio of milk and water and spray area around the base of plant throughout the planting season, or every 2-3 weeks. Note that this mixture can be diluted more.
  - Check plant 1-2 hours after spraying and wipe off any milk residue that did not get absorbed.

### • EPSOM SALT

- For blossom end rot of tomatoes and peppers.
- **How to:**
  - For spray method: mix in 1 tablespoon Epsom salt with 1 gallon water. Spray at initial bloom and a 2nd spray 10 days later.
  - For pour method: mix ½ cup Epsom salt with 1 gallon water, pour solution around plant (avoid leaves).
- You can buy 18lb of agricultural grade Epsoak Epsom Salt on Amazon (<https://rb.gy/vh5p48>).
- Affordable. You can find these in many stores too—usually in the Personal Care/ Bath and Body section.

### • CRUSHED GARLIC

- Anti-fungal and repels cutworms, slugs, and whiteflies.
- **How to:**
  - Crush 3 heads of garlic, mix with 3 tablespoons of oil (e.g. neem oil) or any mineral or olive oil, and let sit for 24 hours. Add 1 tablespoon liquid soap and 3 cups water. Store in fridge until you need it. When you're ready to use it, strain and dilute half a cup of solution with 1 quart water. days. Spray plant (especially leaves).

### • GARLIC-HOT PEPPER SPRAY

- Control flea beetles, deer, woodchucks, mice.
- **How to:**
  - ½ tbs p, 3 cloves garlicks, ½ quart water, 1/2 tbs dish soap, let stand for 24 hours, strain, and spray.

## • CITRUS PEEL SPRAY

- Deter pests and has insecticidal properties.
- **How to:**
  - Chop up peels and pour boiling water over it. Blend and let mixture sit overnight. Strain and spray onto plants.

## • BEER TRAPS

- Captures slugs.
- **How to:** Refer to page 8.

## DIY FERTILIZERS

- **A note on fertilizing:** Good and healthy soil doesn't need to be fertilized. Only fertilize when you notice your plant "lacking" in some way. Over fertilizing is counterproductive and could actually harm your plant and soil!

## • BANANA PEEL

- Potassium supplement.
- Soak banana peel in water for 3 days. Strain banana and spray banana water onto soil around plants.

## • FISH EMULSION

- Nitrogen supplement.
- Follow instructions on package.

## • EGG SHELLS

- Calcium supplement
  - **Direct method:** crush shells and bury with soil just below the surface.
  - **Spray method:** boil 20 eggshells with 1 gallon water, leave overnight, strain and spray onto soil around plants.

## • FIREPLACE ASH

- Sprinkle on soil around base of your plant and mix in.

## • BONE MEAL

- Phosphorus supplement.
- For all plants that are root crops or tuberous like potatoes, carrots, turnips, as well as other vegetables. Bone meal can also be applied to roses.
- Reserve any bones you have from cooking or eating. You can store them in the freezer until you are ready to process them. You can use chicken, turkey, beef, pork or bones from other animals. Be aware that larger bones will take longer to process.
- Remove as much meat or fat from bones as you can. To ensure bones are clean, boil bones for 1-3 hours or until bones are clean. Place bones on a baking sheet and bake a 400°F oven until they are dried out (about an hour for medium-sized bones). Set aside and cool. Grind bones in a blender or coffee grinder.
- Add a few tablespoons into the bottom of the hole before planting or sprinkle about half a cup over soil.

## WEED CONTROL

- Weeds are any plant that is not your desired plant. They compete with your plant for nutrients and space, and could introduce disease to your garden. Hand weed or invest in a cultivator to break up topsoil layer. You can also borrow one from the Carlisle tool library!
  - Hoes do the job of weeding, but they also "fluff" up the soil, aerating your soil and improving water flow.
  - For small plots and dealing with smaller weeds especially, hand hoes are your best friend. Here is an option you can get on Amazon that is relatively affordable and has a high and dependable number of ratings (<https://rb.gy/Oskdin>).
  - A standing hoe is good for bigger plots and gives you the ability to work while standing upright. Here is an option you can get on Amazon that is relatively affordable and has a high and dependable number of ratings (<https://rb.gy/nurh8r>).
- **VINEGAR**
  - Kills weeds. Apply with a brush directly onto weeds. Make sure there is no rain forecasted on the day you are doing this.
  - Make sure to apply only to the weed and not your crop plant.

- **MULCH**

- We want to first, prevent seeds from mature weeds from spreading, and second, prevent any seeds that did get in from germinating. Mulch prevents sunlight, water, and air from reaching the weed.
- Use carpet, layers of cardboard or newspaper (wet before adding), plastic bags, or organic mulch like wood chips, straw, layers of dried leaves (Fig. 18).
  - Make sure you are using **straw** not hay. Hay has lots of weed seeds.
- Place on top of all non-productive areas, even pathways, to prevent weeds from growing. If using woodchips, straw, or leaves, be sure to add at least a 2" layer of mulch for best results.

# Chapter 3: Garden Scenarios

## DIFFERENT GARDEN MODELS BASED ON TIME AND FUNDING CONSTRAINTS:

### \$30 INVESTMENT – WITH LAND

#### Basic Necessities for Home Garden Production

- **Cardboard** – free (check with local grocery or liquor stores) *remove tape*
- **Newspaper** – free
- **Compost** – free (Carlisle Borough Compost Facility)
  - Post Rd., Carlisle, PA 17015
  - Check [www.carlislepa.org/government/borough\\_departments/public\\_works/compost\\_facility.php](http://www.carlislepa.org/government/borough_departments/public_works/compost_facility.php) for opening hours
- **Straw** (bales from Lowe's cover 80sq ft for \$8/each)
- **2 gallon watering can** (Walmart \$4-\$7/can)
- **Digging fork** (\$20-\$35) or borrow from tool library

### \$30 INVESTMENT – WITHOUT LAND

#### Basic Necessities for Home Garden Production

- **5 gallon bucket** (Walmart under \$5/bucket)
- **Nature's Care Soil** (Home Depot \$8/bag)
- **Sterlite 19 gallon tote** (Walmart \$10/each)
- **2 gallon watering can** (Walmart \$4-\$7/can)
- **ADDITIONAL ITEMS TO PURCHASE OR ACQUIRE:**
  - **Drill** from Carlisle Tool Library or other tool for poking holes through containers (drainage)
  - **Seeds**
  - **Stick** 4' to 6' tall for staking crops if needed

### \$50 INVESTMENT – WITH LAND

- **Digging fork** (\$20-\$35) or borrow from tool library
- **Spade shovel** (\$15-\$20) or borrow from tool library
- **Garden hose, 75 ft, with hose nozzle** (Lowe's under \$40)
- **Soaker hose, 75 ft** (Lowe's \$18)
- **Rabbit fencing infrastructure (10' x 3') mesh fencing \$15.00 plus 4 ft u-post \$4 x 4 corners**

### \$50 INVESTMENT – WITHOUT LAND

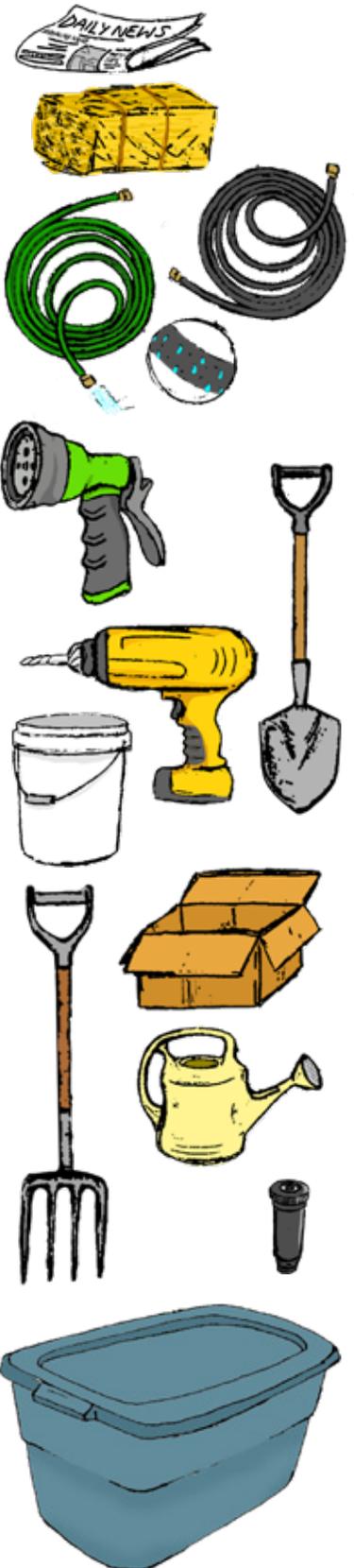
- **5 gallon bucket** (Walmart under \$5/bucket)
- **Nature's Care Soil** (Home Depot \$8/bag)
- **Sterlite 19 gallon tote** (Walmart \$10/each) **18 gallon** (Lowe's \$5-7)
- **Garden hose (75 ft) with hose nozzle** (Lowe's under \$40)

### \$75 INVESTMENT – WITH LAND

- **Digging fork** (\$20-\$35) or borrow from tool library
- **Spade shovel** (\$15-\$20) or borrow from tool library
- **Garden hose (75 ft) with hose nozzle** (Lowe's, under \$40)
- **Soaker hose (75 ft)** (Lowe's \$18)
- **Rabbit fencing infrastructure (10' x 3') mesh fencing \$15.00 plus 4 ft u-post \$4 x 4 corners**
- **2'x6'x8' for lumber** \$7 each
- **Black Kow composted manure (50 lbs)** \$6
- **Topsoil** (need to find good source of this!)

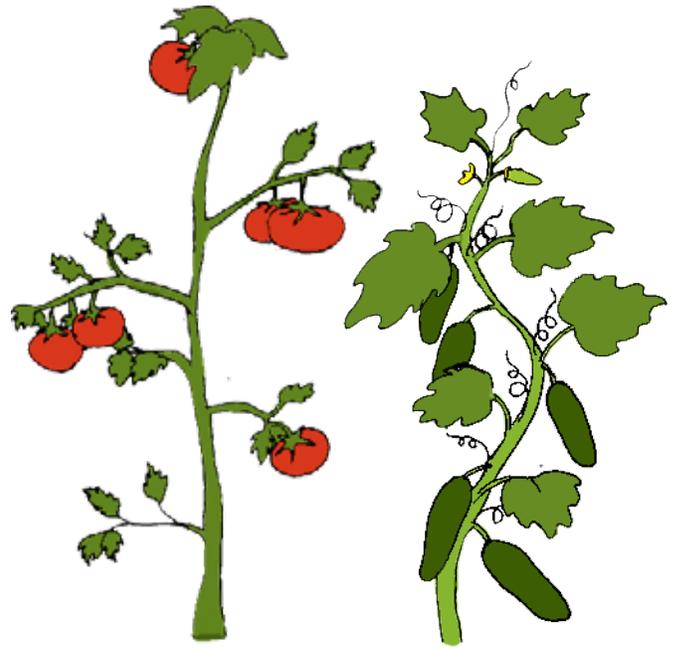
### \$75 INVESTMENT – WITHOUT LAND

- **5 gallon bucket** (Walmart under \$5/bucket)
- **Nature's Care Soil** (Home Depot \$8/bag)
- **Sterlite 19 gallon tote** (Walmart \$10/each) **18 gallon** (Lowe's \$5-7)
- **Garden hose (75 ft) with hose nozzle** (Lowe's under \$40)



**TIME SAVING INVESTMENTS FOR ANY HOME GARDENER:**

- Soaker hose 75 ft (Lowe's \$18)
- Drip irrigation kits \$25-\$50
- Sprinkler or wobbler systems \$25-\$45
- Watering Timer approx. \$50
- Mulch (natural and synthetic) like Weedguard (50') from Gardner's Supply \$25



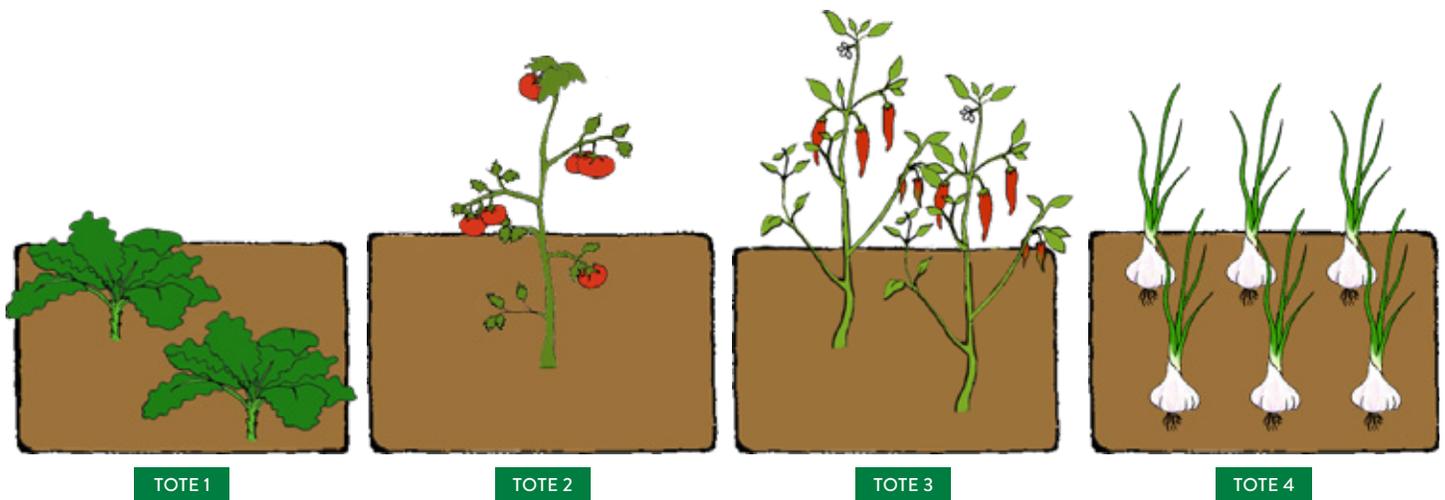
**BUCKET GARDENS:**

- One tomato plant per five gallon bucket
- One cucumber plant per five gallon bucket
- One Melon plant per five gallon bucket
- One eggplant plant per five gallon bucket
- One pepper plant per five gallon bucket

**TOTE GARDENS:**

- TOTE DIMENSIONS: 21.5IN X 39.75IN

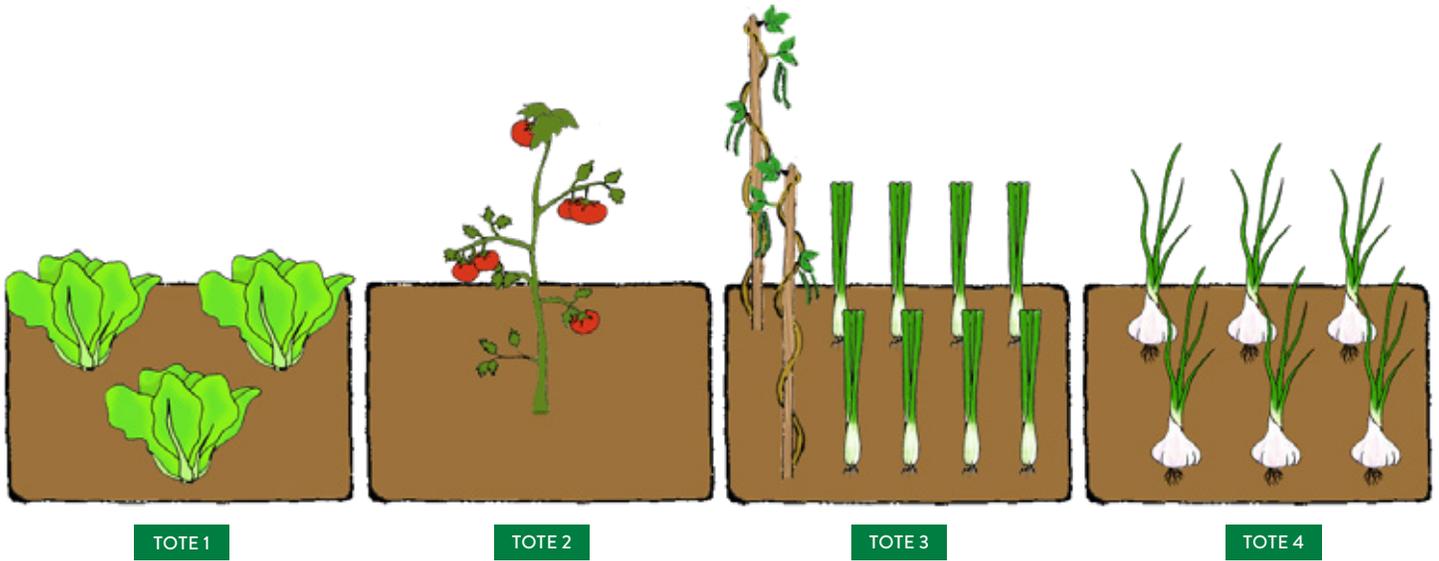
FALL 2020						
	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Tote 1	Kale	128	0.45	2	3	172.8
Tote 2	Tomatoes	100	5	1	3	1500
Tote 3	Hot pepper	112	1	2	3	336
Tote 3	Garlic	640	0.4	18	6	1536



### SPRING 2021

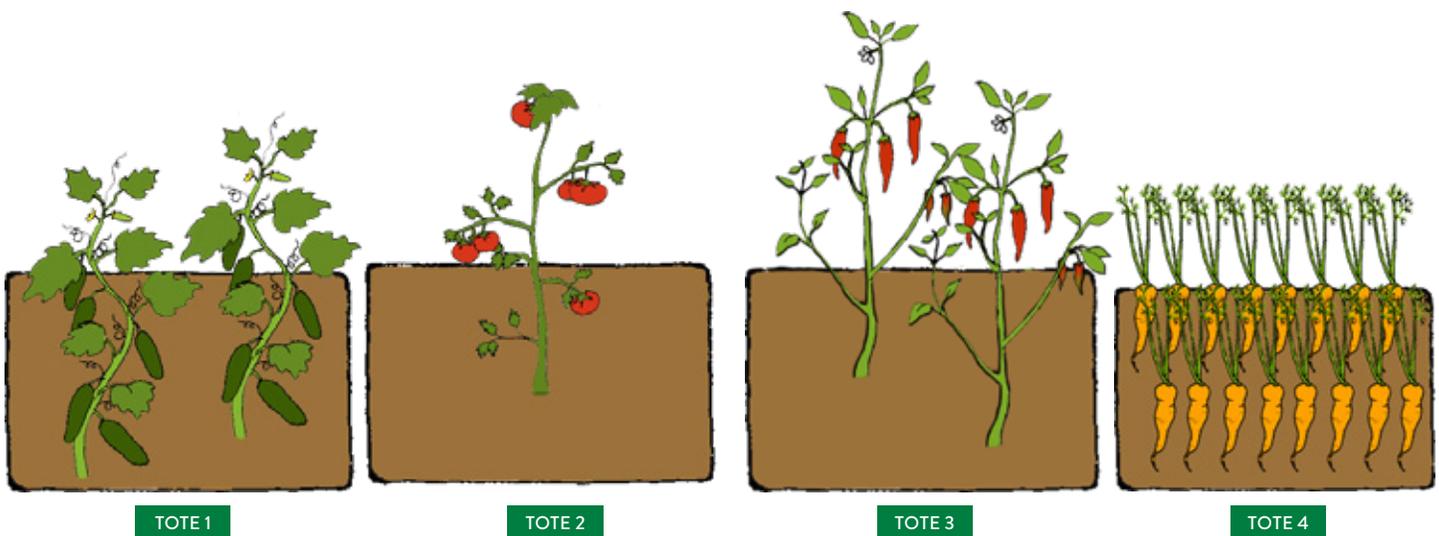
	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Tote 1	Lettuce	77	0.96	5*	6	443.52
Tote 2	Tomatoes	100	5	1	3	1500
Tote 3	Pole beans	128	0.75	2	2	192
Tote 3	Scallions	151	0.0625	12	6	56.625
Tote 4	Garlic	640	0.4	18	6	1536

\*5 PER PLANTING, CAN POTENTIALLY HAVE 2 PLANTING SUCCESSIONS



### SUMMER 2021

	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Tote 1	Cucumber	65	2	2	3	390
Tote 2	Tomatoes	100	5	1	3	1500
Tote 3	Hot pepper	112	1	2	3	336
Tote 4	Carrots	156	0.77	42	6	720.72



**FALL 2021**

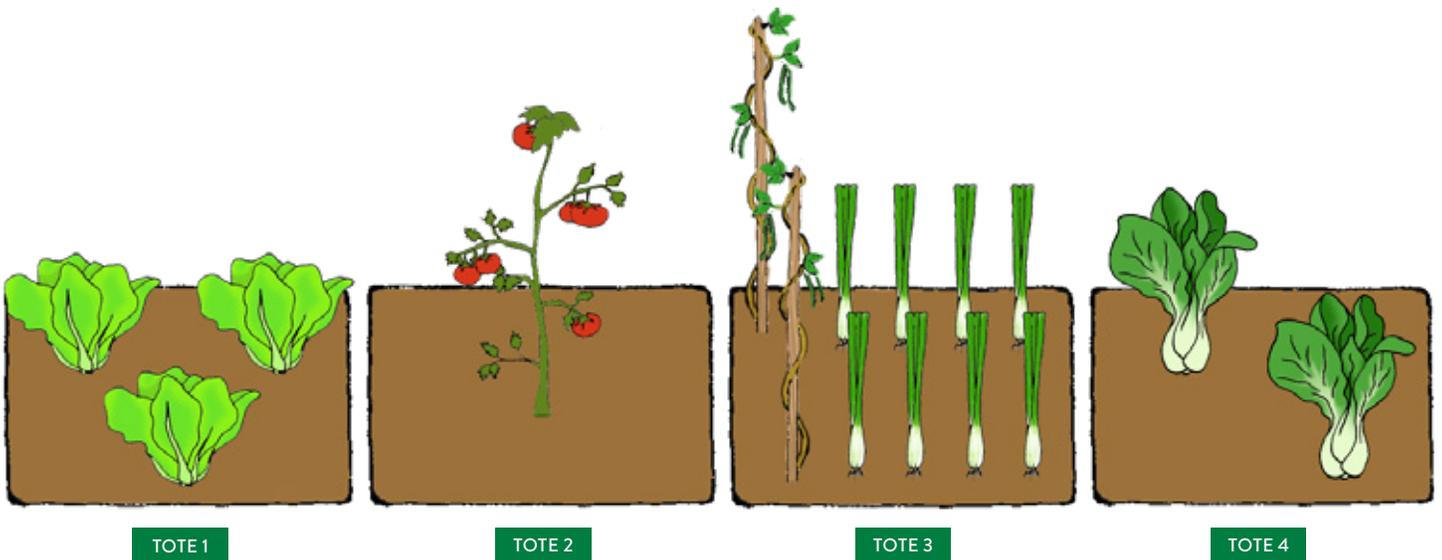
	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Tote 1	Kale	128	0.45	2	3	172.8
Tote 2	Tomatoes	100	5	1	3	1500
Tote 3	Hot pepper	112	1	2	3	336
Tote 3	Spinach	85	0.37	24	9	283.05



**SPRING 2022**

	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Tote 1	Lettuce	77	0.96	5*	6	443.52
Tote 2	Tomatoes	100	5	1	3	1500
Tote 3	Pole beans	128	0.75	2	2	192
Tote 3	Scallions	151	0.0625	12	6	56.625
Tote 4	Bokchoy	59	1.48	5*	6	523.92

\*5 PER PLANTING, CAN POTENTIALLY HAVE 2 PLANTING SUCCESSIONS

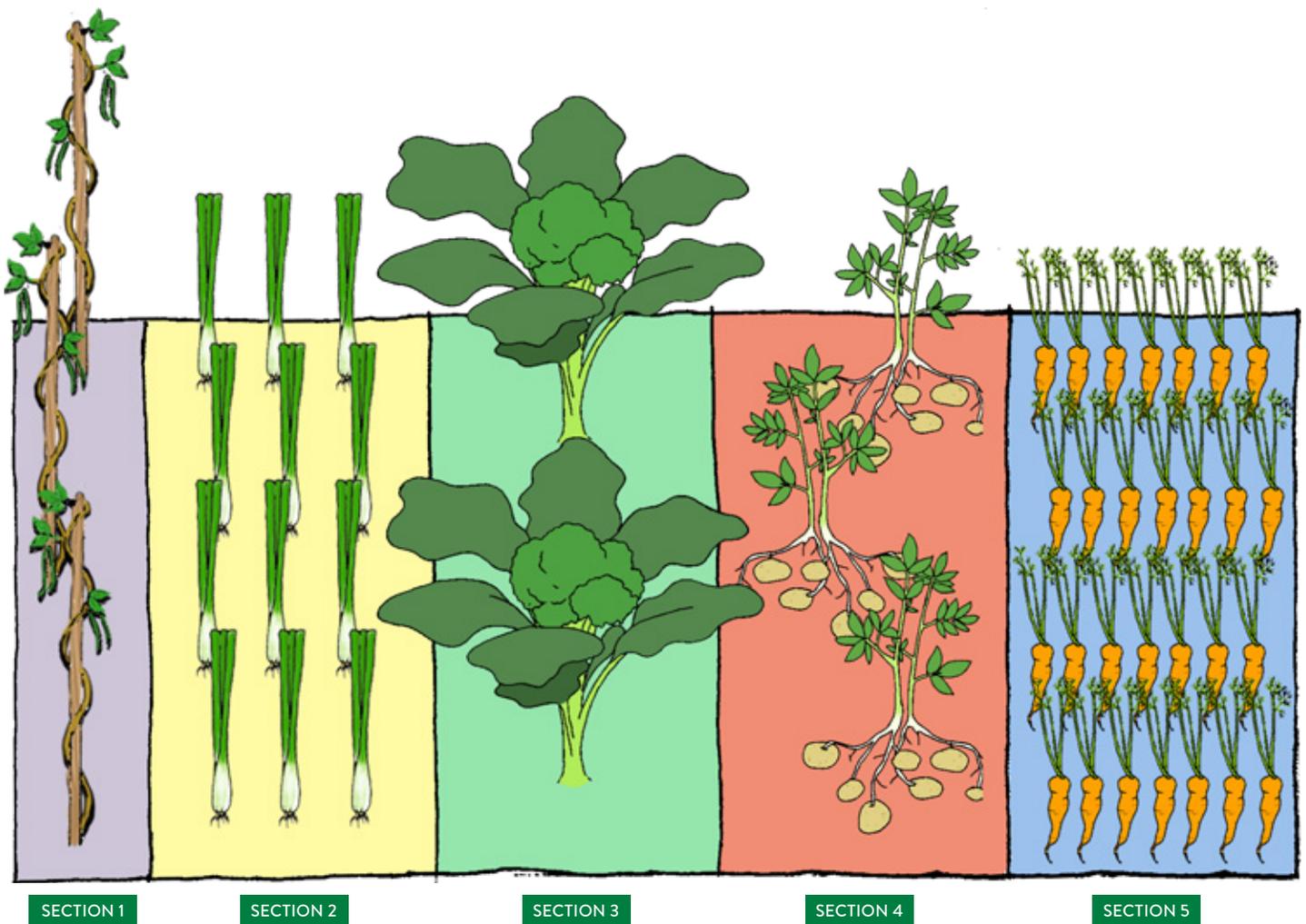


## BEDS PER SEASON:

- BED DIMENSIONS: 4FT X 8 FT

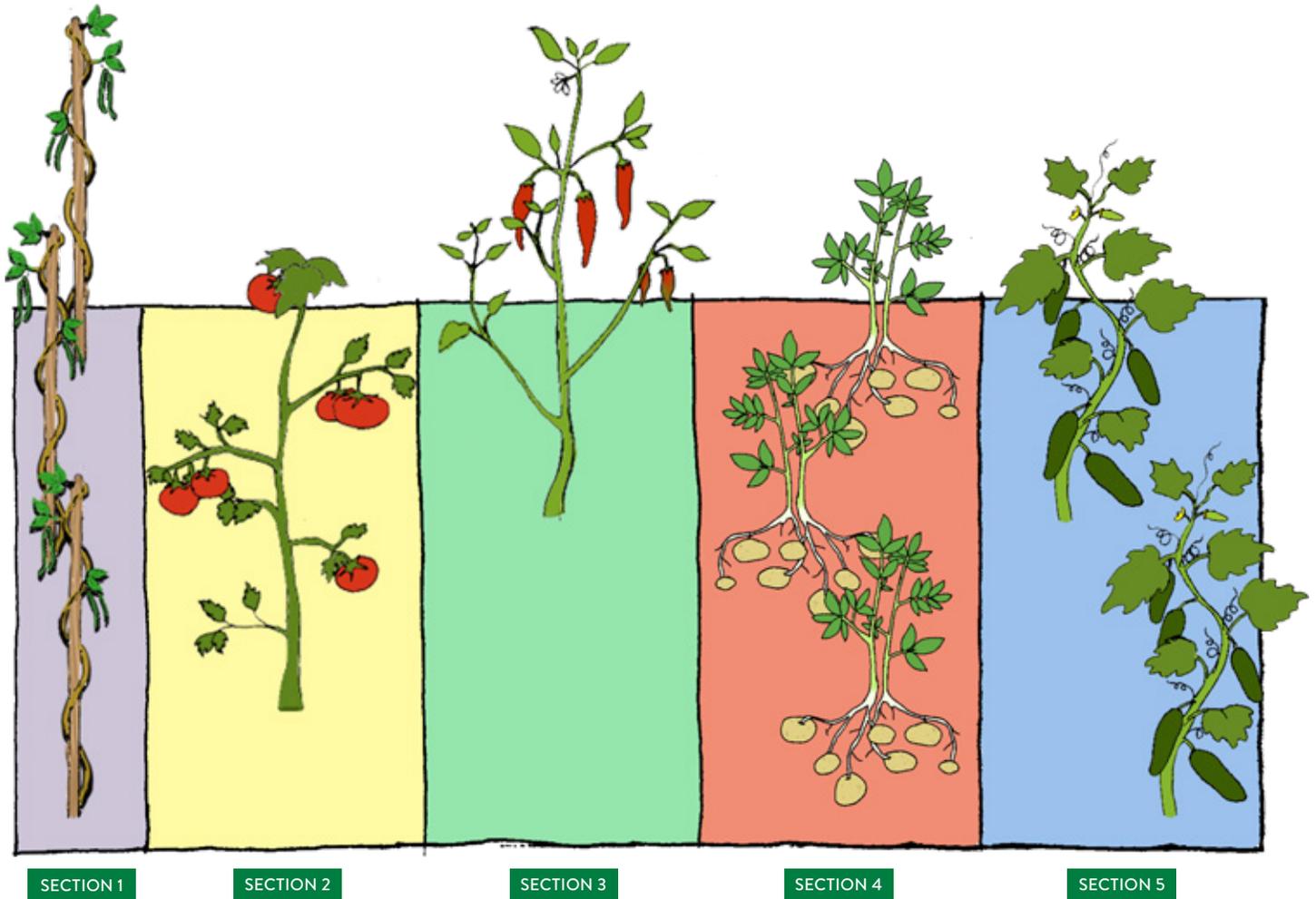
SPRING						
	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Section 1	Pole beans	128	0.75	3	4	384
Section 2	Scallion	151	0.0625	27	12	113.25
	Radish	69	1	96	12	828
Section 3	Broccoli	113	1.3	1-2*	4	146.9
Section 4	Potatoes	279	1	6-8	4	1116
Section 5	Beets	137	0.65	36	12	1068.6
	Carrots	156	0.77	84	12	1441.44

\*2 PLANTS DIAGONAL



**SUMMER**

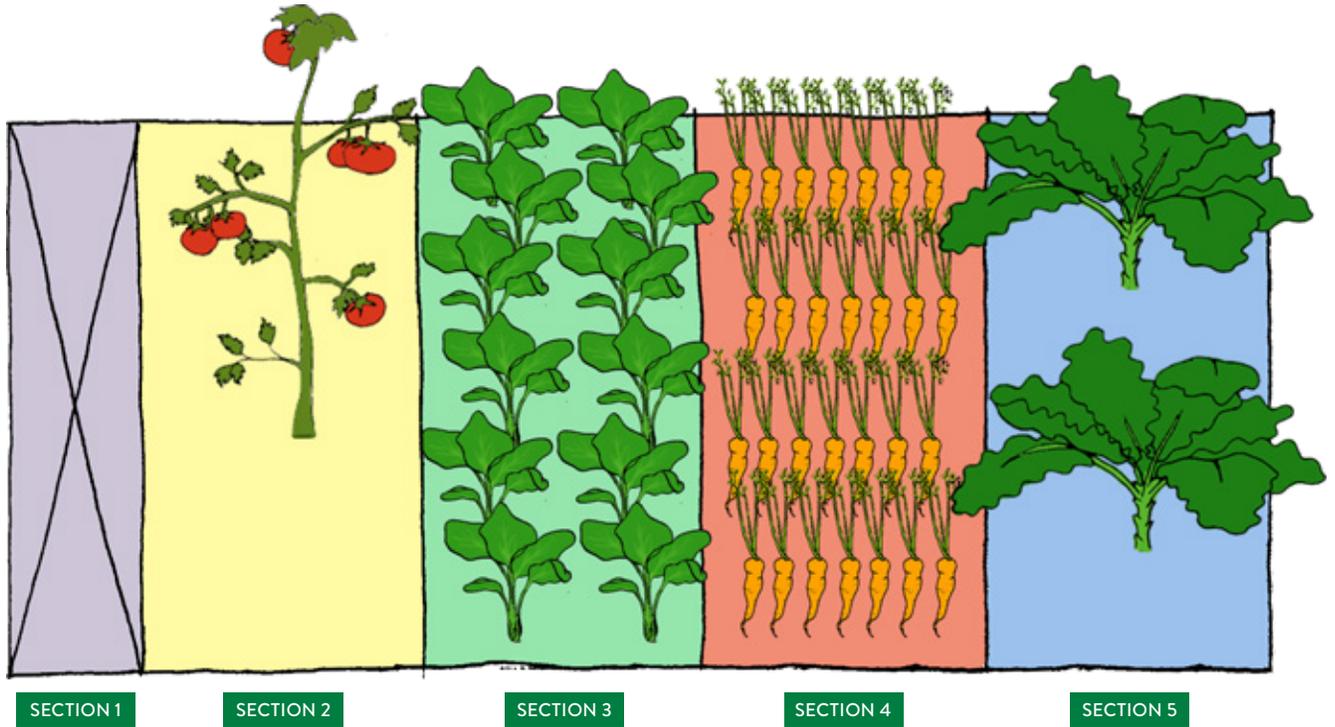
	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Section 1	Pole beans	128	0.75	4	384	3
Section 2	Tomatoes	100	5	4	2000	2
	Basil	121.5	0.15	4	72.9	4
Section 3	Hot pepper	112	1	4	448	2
	Bell pepper	82	3	4	984	2
	Eggplant	111	0.75	4	333	2
Section 4	Potatoes	279	1	8	2232	6-8
Section 5	Cucumber	65	2	4	520	2



**FALL**

	Crop Name	Cal/lb	Lbs/Row Foot	# Plants	Row Foot	Total Avail. Cals
Section 1	Oats/Peas	Cover Crop				
Section 2	Tomatoes	100	5	4	2000	2
Section 3	Spinach	85	0.37	20	629	50
Section 4	Carrots	156	0.77	6	720.72	42
	Onion	157	1	4	1256	8
Section 5	Kale	128	0.45	8	460.8	2*

\*2 PLANTS DIAGONAL



Dickinson

# Chapter 4: Water Catchment Systems for Your Home Garden

There is more to harvest in a garden than just crops! Collecting rainwater is an economical way to nourish your garden and protect the environment.

## How much rainwater can you harvest from your roof?

1,000 square feet of roof will yield approximately 620 gallons of water for every 1-inch of rain. Thus, you can collect about .62 gallons of water per square foot of roof. To determine the potential water collection from your roof, simply multiply the area (length x width) by .62 gallons/square foot.

Example:

Let us imagine we have a roof that is 60 ft by 30 ft. To find the square footage of this roof, multiply the length (60ft) by the width (30ft). The product of this calculation is 1800 square feet. Now multiply the square footage (1800ft) by .62 (approximate gallons of water per inch of rain), to determine the approximate water collection from this roof is

1116 gallons for every inch of rain.

$$60\text{ft} \times 30\text{ft} = 1800 \text{ square feet of roof}$$

$$1800\text{sft} \times .62 \text{ gallons of water} = 1116 \text{ gallons per inch of rainfall}$$

One of the best at-home water catchment systems is a rain barrel. This can be done cheaply and efficiently in one afternoon.

## COMPOST

The Cumberland County Rain Barrel Project is a partnership between the conservation district and Cedar Cliff High School. Each year students build 50 rain barrels and sell them on a first come, first serve basis to community members. The rain barrels hold approximately 55 gallons of water.

ALLARM (Alliance for Aquatic Resource Monitoring) is an organization at Dickinson College that hosts rain barrel workshops and provides barrels for residents who attend the workshops.

Freecycle and Facebook marketplace are other options for finding free or low-cost rain barrels.

### If You Can't Find One, Build One!

#### DIY Rain Barrel in 8 Easy Steps

Price Estimate: \$40-50\*

##### What you need:

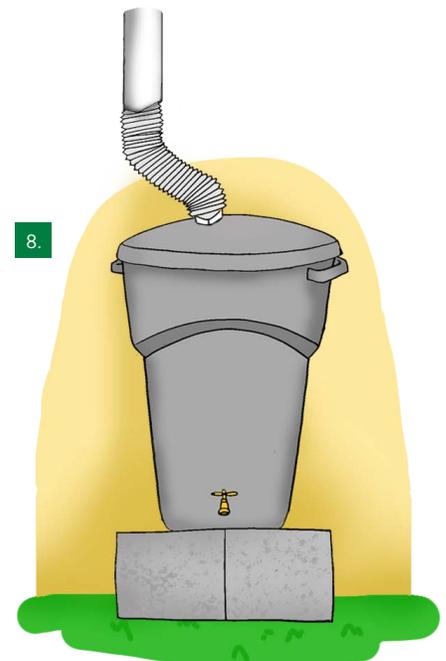
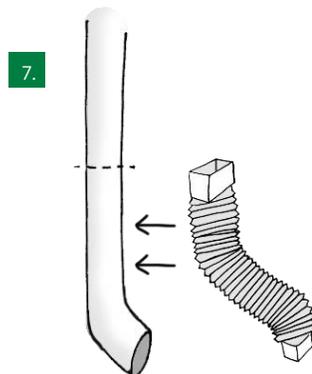
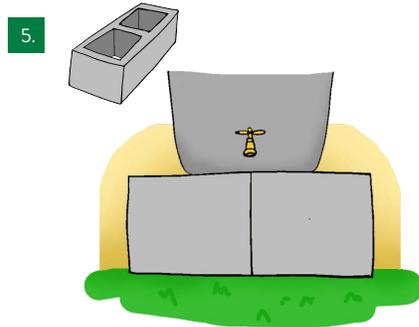
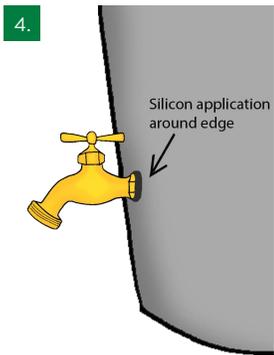
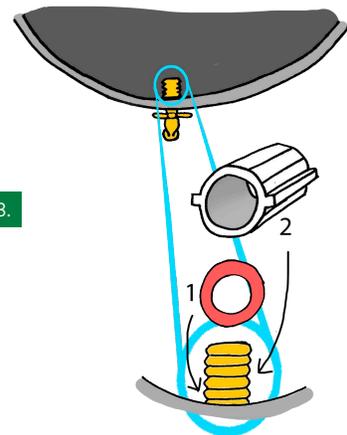
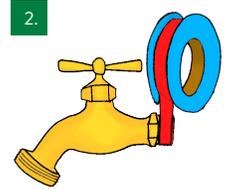
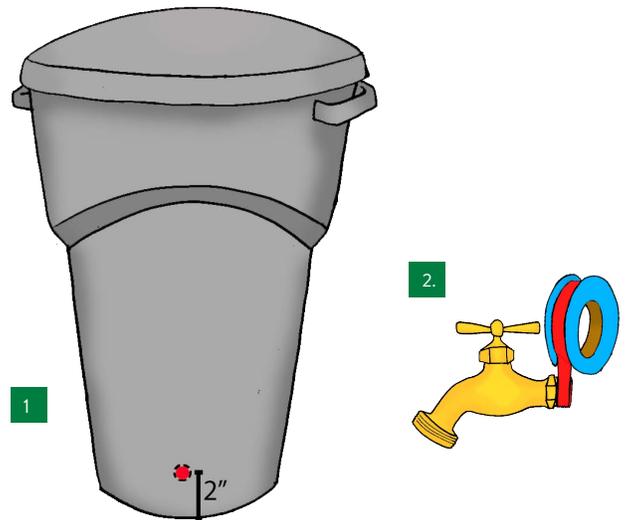
- 32-gallon trash can
- Down spout attachment
- 2 elbows
- Spigot
- Threaded attachment
- Washer
- Marker
- Sealing tape
- Silicon

**Tools needed:** Cordless drill with ½-inch bit and safety glass; utility knife

FIGURE 25. DIY RAIN BARREL

**Directions:**

1. Mark and drill a hole on trashcan for the spigot, about 2-inches from the bottom of the garbage can (shown as red circle on Fig. 25.1).
2. Attach the spigot to the barrel by wrapping the sealing tape around the threads of the spigot (Fig. 25.2). Thread the spigot through the hole in the can. It is a nice tight fit. You will need to turn the spigot as you insert it, until it is tight up against the garbage can.
3. Secure the spigot on the inside of the trash can by pushing the washer over the threaded connection on the inside of the spigot. Screw the PVC threaded attachment tightly up against the spigot over the washer (Fig. 25.3).
4. To avoid leakage, apply silicon seal around the edge of the spigot on the outside of the trash can (Fig. 25.4). Allow to dry for 3 hours.
5. Level the area under your downspout. Place two cinderblocks or stack some bricks to place the rain barrel on (Fig. 25.5). This is important because it creates room for the spigot and makes the barrel easier to operate.
6. Measure downspout for the cut: Attach the elbows to either end of the downspout attachment and place the lid on the trash can. Put one end of downspout attachment on the top of the lid to see where the attachment lines up with your home's downspout. Use the marker to trace the place of attachment on the trash can lid and make a mark where the attachment meets your home's downspout (Fig. 25.6).
7. Use a hack saw to cut the downspout (Fig. 25.7). Use a utility knife to cut out the area on the trashcan lid that you outlined with the marker.
8. Put the lid on the trash can. Attach the short portion of downspout you assembled to the house downspout. Insert the end of the downspout into the hole in the lid of the trashcan (Fig. 25.8).



# Chapter 5: Composting

## COMPOST

Compost is waste from your home and garden that is used to strengthen the improved quality of soil in your garden. Compost is created with air, water, with green (nitrogen rich) and brown (carbon rich) matter to fill it with. Compost is created when nitrogen-rich materials are mixed with carbon-rich material. The addition of moisture and air results in a finished product that we call compost. In the case of compost, nitrogen-rich materials are typically food scraps or grass clippings. Carbon-rich material includes leaves, straw, even cardboard.

By having your own compost at home, you can recycle food waste instead of throwing it in the trash and strengthen the quality of your soil while doing so. Think of it as completing the food circle cycle, eating the food, tossing the food waste, and re-planting with the decomposed food!

## COMPOSTING AT HOME

### What you need:

- A container that allows for water, air, and somewhere to input waste. Examples include garbage bin, bucket, chicken wire.
- Water
- Green material
- Brown material

**Tools needed:** Shovel

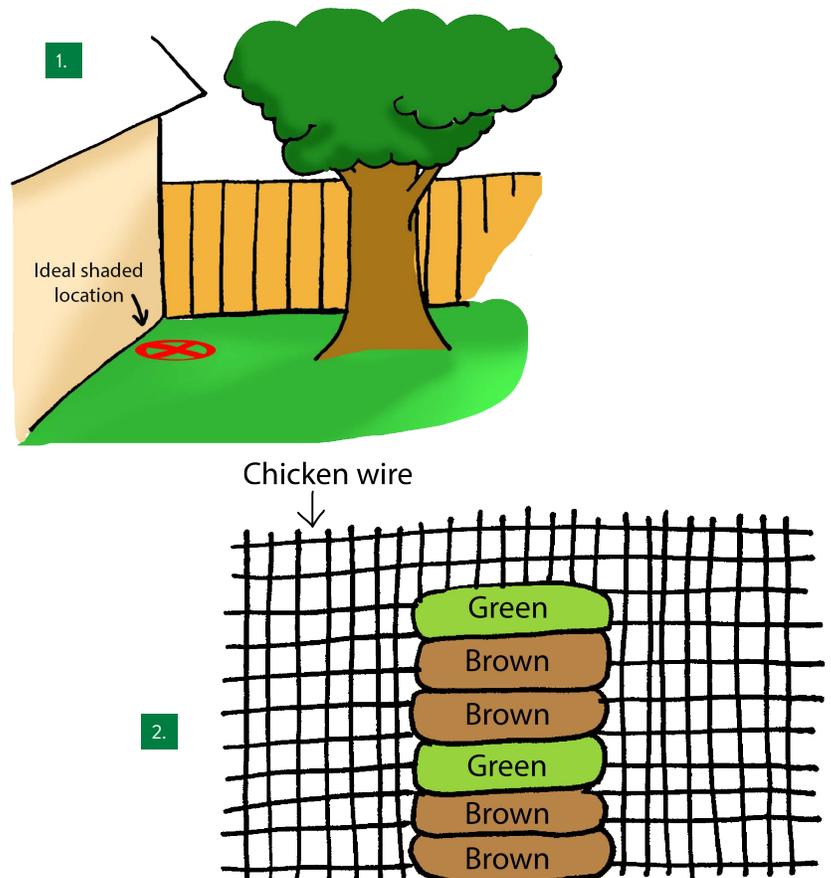
### Directions:

1. Select a dry and shady spot near a water source (Fig. 26.1).
2. Add Brown and Green Materials in alternating layers – You should have more brown matter than green so, 2 layers of brown to 1 layer of green is perfect (Fig. 26.2). Imagine that you are building a compost lasagna!
3. Moisture in the compost pile is important. It helps to decompose the waste and keep the pile at a regulated temperature. Every time you add a new layer, keep the process of compost breaking down by lightly watering. If there is a heavy downpour of rain, use a lid to cover your compost pile. The compost pile should remain at a moisture level that the content feels like a wrung-out wash cloth.

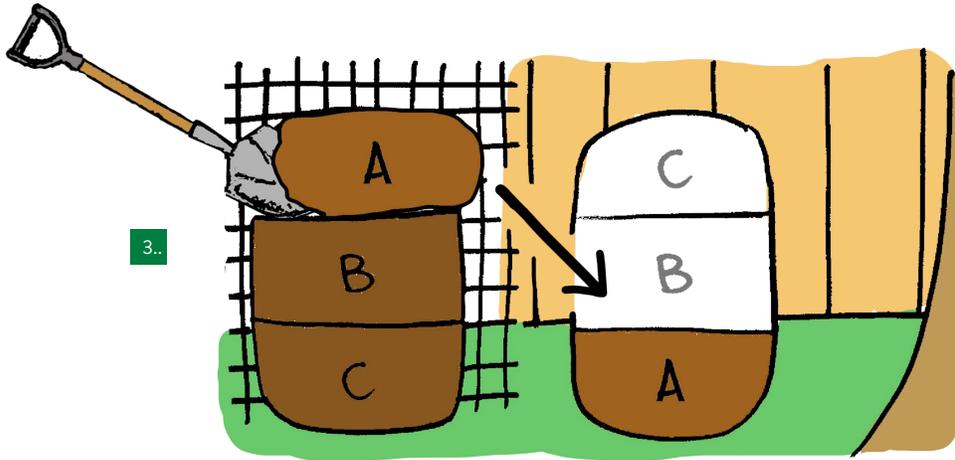
**Green material** is any source of nitrogen needed to “ignite” the compost pile that would provide better growth for the crop. Options include food scraps, grass clippings, tea bags, citrus peels, coffee grounds, wilted salads, and manure.

**Brown material** is any source of carbon that gives the compost pile additional nutrients and keeps the pile from being too wet. Options include dry leaves, used animal bedding, shredded cardboard minus tape and labels/newspaper, sawdust and wood chips, small branches/twigs, and paper towel.

FIGURE 26. COMPOSTING AT HOME



4. Compost needs aeration. For the process of decomposition to happen, there needs to be adequate oxygen in the compost pile. Turn your pile one time every one to three months to ensure that your compost pile is getting enough air to break down the nutrient from the pile. To turn refer to instructions below and accompanying visual (Fig. 26.3):
- If your compost is in chicken wire, unwrap it to give yourself access to the contents.
  - Divide your pile into three sections: A, B, and C in the diagram. The topmost layer of your current compost pile will be the very bottom layer of the new compost.
  - Use a fork to lift the top A section of the compost and place it onto another location. Repeat with the middle B section, placing it on top of A, then finish by placing the bottom C section on the very top of your new pile.
  - Now you have flipped your own compost like a composting pro!



While your pile is sitting, your compost is breaking down the microbes in the pile to create moist soil-enriching compost for use.

Compost is ready, it looks like rich dirt rather than rotting vegetables. It should also be deep brown and crumbly with the scent of fresh dirt.

All that is left now is mixing compost with dirt to enrich soil that you will use for your produce!

#### CAUTION:

- NEVER INCLUDE:** Plants or wood treated with pesticides or preservatives, black walnut tree debris, weeds that have gone to seed, or any diseased or insect-infested plants.
- COMPOST SHOULD NOT SMELL ROTTEN.** If this happens add some brown matter like dry leaves or dry grass to help keep the pile from accumulating too much moisture.

