

Learn the Six Laws of Plant Growth, the Real Secret to a Great Garden



Mittleider Soil-Bed Gardening

A Short Course Introducing the Mittleider Gardening Method



By Dr. Jacob R. Mittleider and James B. Kennard

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Food for Everyone Foundation



Jim Kennard

Food for Everyone Foundation is a 501(c)(3) Public Charity created by James B. (Jim) Kennard when Dr. Jacob R. Mittleider turned over all of his work to him in 1998. The purpose of the Foundation is to expand the use and knowledge of Dr. Mittleider's amazing gardening system. Jim has devoted many years to teaching the Mittleider method of gardening both in the United States and in other countries including Armenia, Turkey, Colombia, the Republic of Georgia and Madagascar.

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- Alan Deshazer for his constant encouragement, advice and support.

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Preface



Dr. Jacob R. Mittleider

In the mid-'70's, Jacob R. Mittleider's book *More Food From Your Garden*, which is now called *Mittleider Grow-Box Gardens*, became very popular, and my family used it to create an extremely productive container or Grow-Box garden on a sunny 20' x 30' part of our yard. We practically lived out of the garden for 6 months that year, and we were sold on this amazing system of growing!

In 1976 Jacob Mittleider moved from Loma Linda, California to Salt Lake City, Utah, and because we only lived a mile apart we soon became acquainted.

Our family continued to grow great gardens every year, and in 1989 I acquired a 3/4 acre parcel of land adjacent to Utah's Hogle Zoo. I created a Mittleider soil-bed garden of 125 30'-long beds on 1/2 acre of ground, installed the recommended automated watering system, and then asked Dr. Mittleider if I could put his name on the garden, because 700,000 visitors to the zoo each year saw the garden, and I wanted to promote his methods.

Jacob gave me permission to advertise his name, so long as I maintained the garden according to his standards, so we became much better friends, as he would occasionally come to the garden and work with me and invite me to his home to work in his garden and learn from him.

By 1998 I had been with Dr. Mittleider to the Zaoksky, Russia Agriculture College, and assisted him on another major project in Utah. I then retired from other full-time pursuits and determined to devote myself to carrying on his work.

The purpose of *The Mittleider Gardening Course* can best be explained in Jacob's own words:

Nearly six decades..."of almost constant study, research, and field application on food production problems in many parts of the world have long since convinced me that the most promising approach is a synthesis of the best features of several major methods of gardening.

"Organic gardening emphasizes plant access to all available soil nutrients and microbial activity; conventional gardening emphasizes adequate fertilization and pest control; hydroponic gardening emphasizes high-density planting in a controlled environment.

"But each of these methods, alone has some limitations.

“What I have been teaching and demonstrating in various countries is a bringing together of the best scientific knowledge and experience in each of these approaches. I believe that the results speak for themselves.

“This book is a step-by-step guidebook to the use of my methods by the home gardener.”

For 43 years Dr. Jacob Mittleider quietly and without fanfare dramatically improved the lives of millions of people, and even changed the economies of countries, by teaching people how to better feed their families by growing healthy and highly productive vegetable crops – both personally and commercially. He created 75 teaching and demonstration projects in 27 countries – and documented his experiences and the great lessons he learned in 10 books, 9 manuals, and 86 video lectures.

It was an honor and a privilege to know and work with Dr. Jacob R. Mittleider for 30 years, and I am grateful that he tasked me with carrying on his work and expanding the knowledge and use of this great gardening system.

I was able to make the first major revision of this book under Jacob’s supervision in 1999. With the help and encouragement of many wonderful and dedicated people The Foundation has digitized all of Jacob Mittleider’s books and other training materials and created a website in order to share them with the world.

Jacob was constantly experimenting and making improvements to the method. The Foundation works constantly to make improvements to the implementation of the method. I think he would be pleased with this new edition.

This is the first color edition of the book. The book design and content have been updated and photographs and illustrations have been added to enhance the book. Many of the photographs are from new and experienced Mittleider gardeners.

Prepare to grow an amazing garden by following the simple principles taught in this book!

James B. (Jim) Kennard



Image used with permission © Derek Haynie.

Above: Allyson's harvest from the family Mittleider garden in Mapleton, Utah.

Below: Dian's one day harvest in late August from her Mittleider garden in Salt Lake City, Utah.



Image used with permission © Dian Thomas.

How is this method different?

The Mittleider gardening method is really a system of growing that strictly follows the scientific *laws of plant growth*. Those laws are immutable (unchanging) and non-negotiable, yet very few gardeners understand them or follow them. Following is a simple explanation of those laws.

The Six Laws of Plant Growth

#1: Light

- The source of all life.
- Produces photosynthesis—essential to plant growth.
- Direct sunlight—all day long is best.
- Avoid all shade—even other plants.



#2: Temperature

- Plants require very narrow temperature range. Ideally:
 - Seed germination—soil temperatures 70–85 F
 - Seedling production—soil and air temperatures 65–85 F
 - Outdoor plants—air temperatures 60–90 F
- Consider partial shade during extreme heat.
- Provide shelter and supplemental heat during cold weather.



#3: Air

- Plants receive 3 nutrients from the atmosphere: carbon, oxygen, and hydrogen from which they create carbohydrates.
- Plants primarily take in air from their roots.
- Proper soil drainage provides soil-air to plants.



#4: Water

- A plant is over 80% water.
- Water carries nutrients from soil through roots to plant.
- Water must be available to root zone of plants.
- A wilting plant is dying.
- In hot weather water cools the plant by transpiration.



#5: Nutrition

- There are 16 nutrients essential for plant growth.
- Three—carbon, oxygen, and hydrogen—come from the air.
- Thirteen can be supplied by the soil and by man as follows:

Macro-Nutrients:

Nitrogen, Phosphorus, Potassium

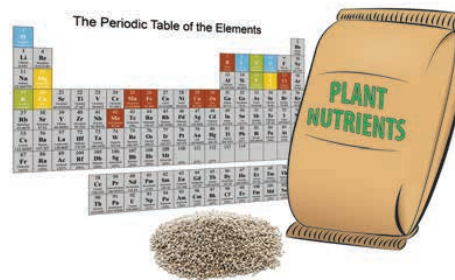
Secondary Nutrients:

Calcium, Magnesium, Sulfur

Micro-Nutrients or Trace Elements:

Boron, Chlorine, Copper, Iron, Manganese, Molybdenum, Zinc

- Plants require balanced nutrition all the time for healthy growth.
- Plants receive nutrients as water-soluble minerals, through their roots.

**#6: Competition—Protecting Against**

(Not really a “law” of plant growth, but essential nonetheless.)

- Weeds—Remove all annuals and perennials. Weed early and often
- Insects—Maintain wide bare aisles and perimeter, remove old leaves and those touching the ground
- Animals—Use effective barriers including fences, screens, netting, etc.
- Diseases—Produce fast-growing healthy plants with minimum days in the garden



You will learn how these laws apply to growing your garden as we refer to them throughout the pages of this book. .

Part II: Soil-Bed Basics

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Whether your garden is large or small, take time for planning. It will be well worth the effort in the long run.

Above: (Part of Nicole's garden in Utah, zone 6b) Cabbage and peas are planted in 10' rows.

Below: Student planted cabbage, kale and broccoli in 30' rows in the Foundation garden in NW Missouri.



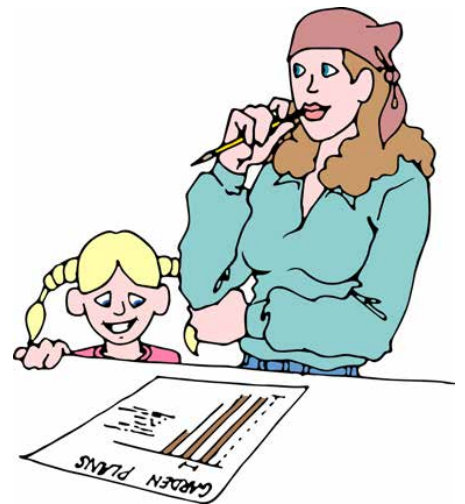
Lesson 1: Soil-Bed Planning

In this lesson, you will learn how to answer these questions:

Where should I locate my garden?
What size should I make my soil-beds?
How should I arrange my soil-beds?
What should I plant?
When should I plant?
What tools will I need?
How much time will it take?

Where should I locate my garden?

- Choose a sunny location that gets 6–8 hours of sunshine from mid-morning throughout the afternoon. Remember light is the first law of plant growth. (See Introduction: Six Laws of Plant Growth—#1 Light).
- Choose a level area. If you choose an area that is reasonably level, there will be less work. An area with a slight southern slope is ideal.
- Plant on the contour if using steeper slopes. Just level the soil-beds themselves.
- Avoid slopes facing north, because they have more shadows, diffuse the sun's rays, and are often too cold.
- Stay away from low spots where drainage is poor. Plants die for lack of oxygen where standing water accumulates. Temperatures can also be colder.
- Plant rows may run in any direction—north-south, east-west, etc. For north-south rows plant tall plants on the east. For east-west plant tall plants on the north.
- Avoid large trees and tall hedges, unless they are north of the grow-bed area. Crops growing in shade do poorly. Tree roots also compete for water and food.
- Avoid open areas where strong winds blow, or else build windbreaks. Winds can quickly destroy the fragile, but very important plant leaves, reducing your crop yield.
- Make sure water is available close by.





Learn More

Terracing Soil-Beds

- [*6 Steps to Successful Gardening*](#) (p. 19)

The Erosion Problem

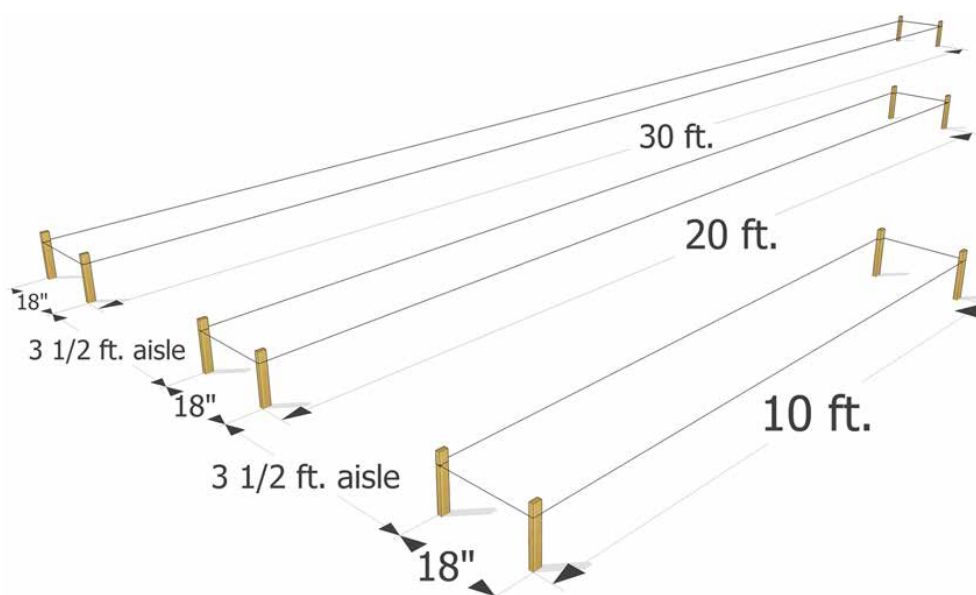
- [*Food for Everyone*](#) (p. 122)

- Protect the area from animals or unwanted visitors. If necessary, construct a chain-link fence 6' to 8' tall.

On the *Garden Plot Plan* found in *Appendix A: Garden Genius Planning Forms*, briefly describe where you plan to locate your garden. Does your location meet the criteria listed above?

What size should I make my soil-beds?

The standard size soil-bed used throughout this book is 30' long. Each bed holds two rows of plants at the base of the two ridges of soil or if growing vertically, the bed holds one row of plants at the base of one ridge. The ridges are 18" apart. Aisles between beds are 3 1/2' with 5' at the ends of the soil-beds.



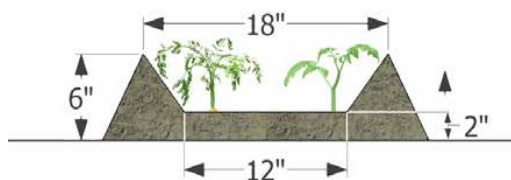
Why 30' long?

Since many gardens can readily accommodate 30' soil beds, the specific measurements for applying the optimum amount of fertilizer throughout this book are based on this length.

Tip: For smaller gardens, adjust your soil-beds to any length that works for you; then adjust the fertilizer measurements in like manner.

Why 18" wide with ridges?

- A 12" wide flat area between the ridges allows growing space between the two rows of plants.
- The ridges help you to determine where the seedlings or seeds are to be placed.
- The flattened center area is designed to carry water and fertilizer to the plant.
- The ridges take the chore out of controlling weeds.



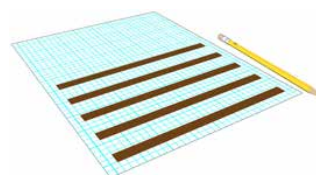
You will learn more about the importance of 18" wide beds with ridges in *Soil-Bed Lessons 2-6*.

Why such wide spacing—18" beds, 3 1/2' aisles, and a 5' perimeter?

- “Conventional” gardening places one row of plants every 30" thus two rows of plants take 5'. Dr. Mittleider put the two rows of plants closer together to reduce watering, feeding, and weeding by 50%.
- If the space in the aisles between beds is restricted, for many of the larger plants the result will be crowded plants and poor yields.
- It also causes poor inspection of the crops. This sets the stage for problems with weed control, inadequate watering, disease and insect problems, and harvesting on time, etc.
- With adequate space, leaves and vines have sufficient room to spread in the aisles for maximum light, essential for best growth.
- Wide aisles also prevent foot traffic from damaging plants.
- A 5' bare and dry perimeter aisle or other barrier protects against weeds, bugs and diseases.

How should I arrange my soil-beds?

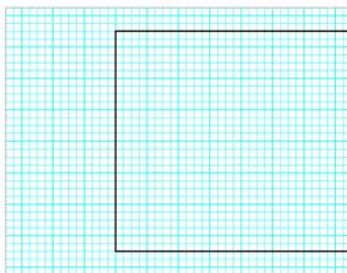
Plan in advance the number and placement of your soil-beds by creating a “blueprint” of your garden area.



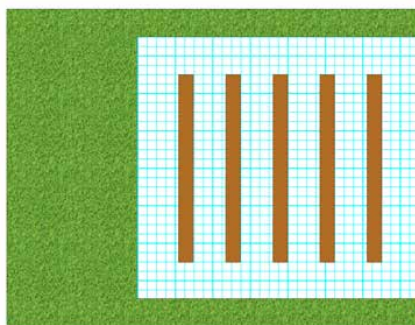
Your plants will very likely produce much more than you have in the past, so you should consider starting small.

Facing soil-beds any direction will work—just plant tall plants to the north or east of short plants.

To create a garden plot plan or “blueprint”, first show the outer dimensions of your garden on a grid.



Second, show where you plan to place the soil-beds.



Tip: If you cannot create soil-beds 30' long, create them any length that works for you, but write them down and remember them. Doing so will help you be more accurate when planting seeds or transplants and applying fertilizer.



Create a “garden blueprint” for your garden, by following the directions on the *Garden Plot Plan* found in *Appendix A: Garden Genius Planning Forms*.

What should I plant?

To decide what and how much you should plant ask yourself:

- Which crops are most valuable?
- What will my family eat?
- How much will my family eat?
- How much do I want to preserve?
- How much can I comfortably care for?

Plant only what your family will eat or preserve, sell, or give away and what you can care for.



Here is a suggested garden for a family of four to live on, consisting of less than 1/20th of an acre. Yields assume you are using the secondary edible parts of the plants. See *Lesson 7: Soil-Bed Harvesting*.

Sample Garden Plan

What to Plant	How Many	Yield
1 bed potatoes	92 plants	145 pounds
1 bed beans, bush	240 plants	68 pounds
1 bed peas, bush	362 plants	90 pounds
1/2 bed broccoli	26 plants	40 pounds
1/2 bed cauliflower	26 plants	50 pounds
1/2 bed lettuce, head	31 plants	56 pounds
1/2 bed cabbage	31 plants	75 pounds
1 bed sweet corn	92 plants	115 ears
1 bed zucchini	18 plants	150 pounds
1 bed banana squash	18 plants	120 pounds
1 bed cantaloupes	41 plants	246 pounds
1 bed watermelons	16 plants	320 pounds
1 bed tomatoes	41 plants	615 pounds

Here's what can be planted later in the fall for a second harvest.

What to Plant	How Many	Yield
1 bed potatoes	92 plants	145 pounds
1 bed beans, bush	240 plants	68 pounds
1 bed peas, bush	362 plants	90 pounds
1/2 bed broccoli	26 plants	40 pounds
1/2 bed cauliflower	26 plants	50 pounds
1/2 bed lettuce, head	31 plants	56 pounds
1/2 bed cabbage	31 plants	75 pounds
1 bed sweet corn	92 plants	115 ears

Melons, squash and tomatoes are planted close together and grown vertically. You will learn how to do this in *Lesson 15: Caring for Climbing Plants*.

Tip: Greatly increase your yield by eating the secondary edible parts of plants. See *Lesson 7: Soil-Bed Harvesting* to learn more.

See *Appendix B: Reference Tables for Planning Your Garden for an Extended Season Sample Garden Plan*.

Learn More

Growing Crops Vertically

- **Lesson 15: Caring for Climbing Plants**
- [*Let's Grow Tomatoes*](#) (pp. 64-69)

Soil-Bed Yields & Costs

- [*Grow-Bed Gardening*](#) (pp. 15-18)

Growing Tomatoes

- [*Let's Grow Tomatoes*](#) (p. 122)
- **Garden Planting Details (Appendix B)**

Secondary Edibles

- **Lesson 7: Soil-Bed Harvesting**



Extended Season
Sample Garden
Plan



Yields for
Common
Garden Crops



Garden Genius

To harvest two crops with the assortment of foods listed above in one season, it is important to transplant well-grown potted plants in the beds. Lesson 22: Seedling Production will teach you how.

To help plan your garden, refer to *Yields for Common Garden Crops* or the *Garden Planting Details* found in *Appendix B*. These tables will help you decide what and how much to plant in your garden to meet your family's needs.

As you decide what you will plant, you may need to modify how you arrange your soil-beds in your garden plot plan.

Tip: Place short plants south or west of tall varieties. In this way, the shadows from tall plants will not interfere with the light needed by short plants.

Use the *Planting Plan* found in *Appendix A: Garden Genius Planning Forms* to record the names of the crops you are going to plant in each soil-bed and how many plants you will need to plant in each bed. Refer to and modify your *Garden Plot Plan* as necessary.

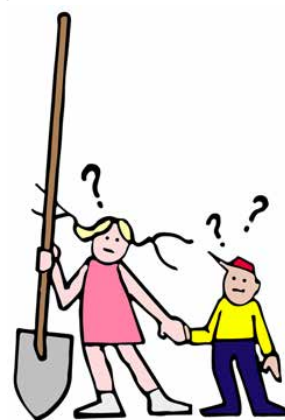
When should I plant?

Because temperature is the second law of plant growth, the proper time to plant partly depends on the climate and the growing season where you grow your garden. (See *Introduction: Six Laws of Plant Growth—#2 Temperature*).

Vegetable seeds need sustained temperatures above 70 degrees Fahrenheit for fast, even germination and growth. In cooler weather, plant seedlings in your garden or use mini-greenhouses to warm the soil.

The **growing season** usually refers to the days between the average date of last frost in the spring (ADLF) and the average date of first frost in the fall (ADFF). These dates give you a general idea as to when certain crops can be planted in your area and what types of crops to plant.

To help you determine when to plant your garden, find out the **average date of last frost** (ADLF) for your area.



Tip: If you do not know the average date of last frost for your area, call your county Agricultural Extension agent or look for it online.

Plant hardiness also partly determines when to plant.

- **Hardy** plants can tolerate a hard frost (27–30 degrees) and can be planted 3 to 6 weeks before your average date of last frost.
- **Moderately-hardy** plants can handle a light frost of 30–32 degrees. Plant these 2–3 weeks before your average date of last frost.
- **Cold- and frost-sensitive** plants will be damaged by even a light frost. Plant them on your average date of last frost and protect them against late frost.
- **Frost-intolerant** plants will not survive any frost and must be planted 2–3 weeks after your average date of last frost.

To see a table showing examples of each of these types of plants, refer to *Plant Hardiness and Planting Times* or the *Garden Planting Details in Appendix B: Reference Tables for Planning Your Garden*.

Tip: Protection is always a good investment in extending your growing season. Read more in *Lesson 23: Cold-Weather Gardening*.

Use the *Planting Plan* found in *Appendix A: Garden Genius Planning Forms* to record when you plan to plant each of your crops. Refer to *Plant Hardiness and Planting Times* or *Garden Planting Details in Appendix B* to make your decisions.



Plant Hardiness
and Planting Times



What tools will I need?

You will need the following tools for your soil-bed garden.

- A round-headed shovel with a long handle. The shovel is used to turn the soil over. It is also excellent for removing perennial weeds and rhizomes.
- A 12" or 14" garden rake. A rake is used to level the soil and to shape the soil-beds. Use the back of the rake to break up clods.
- A 16" rake is not recommended. It is too big to use comfortably in a soil-bed, and too heavy to be practical for long-time use.

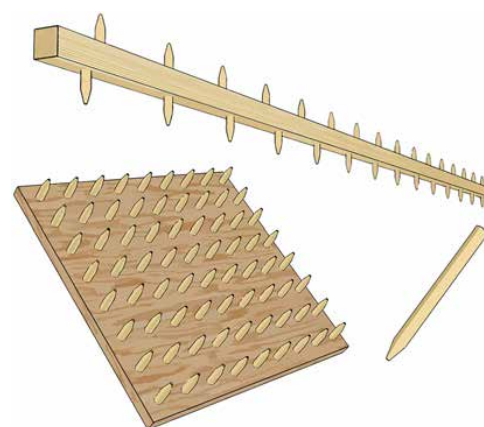


- A straight-blade hoe (also called a scuffle-hoe or two-way hoe) not a curved chopping hoe. Use the two-way hoe just under the soil surface to remove annual weeds by cutting them off below the crowns (available at www.growfood.com/shop).
- Two five-gallon buckets with lids for fertilizer compounds.
- A garden hose with the end securely wrapped **several times** with an 18" towel extended past the end of the hose. Do not tie the end of the extended cloth. Leave it open.
- The towel around the hose will prevent the water from digging a hole in the soil, and it allows you to turn the water on full volume to water your garden rapidly.



You should also use markers to provide proper spacing for plants. Different markers are used for different purposes:

- To mark seed flats
- To press holes uniformly deep
- To space plants in soil-beds or grow-boxes



You will learn more about markers and how to make them in later lessons.

Here is a summary of the tools you will need for your soil-bed garden. Refer to the *Soil-Bed Tools and Materials List* found in *Appendix A: Garden Genius Planning Forms* to record which tools you will need to get.

- Round-headed shovel
- 12" or 14" garden rake
- Straight-edged hoe (two-way hoe)
- Two five-gallon buckets
- Garden hose
- 18" towel for end of hose
- Plant spacing markers

Tip: Never use a dull tool. Use a file to sharpen your tools. Keep your tools in good condition by oiling the handles.



How much time will it take?

The amount of time and work required to build and maintain your Mittleider garden varies according to the size of your project, the condition of the land to be cleared and prepared, and on how you obtain your seedling plants. If you grow your own seedling plants, additional work is involved. (On the other hand, you will save on the cost of buying the seedlings from a nursery and have them when you want them).



A good sized soil-bed garden to feed a family of 4 consists of an area about 62' x 40', divided into 11 soil-beds 18" wide by 30' long, with 3 1/2' aisles between the beds. In addition a 5' bare, dry perimeter aisle or other barrier is needed to protect against weeds, bugs and diseases.

The following time estimates are based on a soil-bed garden as described above. Because growing conditions vary widely, these are only approximations.

- To clear your gardening area, construct soil-beds, and make aisles and footpaths, plan on 8 to 16 hours of labor.
- To prepare the soil, plant seeds, and transplant seedlings, plan on another 12 to 16 hours.
- To water, feed, inspect, and care for your plants after you have planted them, you should plan to spend 30 minutes per day (preferably in the early morning).
- To harvest your crop may require an additional 1 to 5 minutes per soil-bed, depending on the type of vegetable and the amount to be harvested.

To anticipate your garden work and when it needs to be done, it is helpful to create a ***Gardening Cycle Calendar***—a month-to-month “to-do” list that reminds you of crucial gardening tasks. Here is an example of a gardening cycle calendar created by Dr. Mittleider for zone 5.

Dr. Mittleider's Gardening Cycle Calendar

January	<ul style="list-style-type: none"> Plan your garden. Will I use soil-beds or grow-boxes? What tools will I need? Where will I locate my garden? Decide what to plant. What will be started from seed? What will be transplanted? Calculate plant spacing requirements.
February or March	<ul style="list-style-type: none"> Plant tomato and pepper seeds in flats indoors or in a seed house or cold frame. Calculate the timing so plants will be 8 to 12 weeks old when planted outdoors.
March	<ul style="list-style-type: none"> In the seed house or cold frame, transplant seedling plants (tomatoes and peppers) into larger-size containers to give them more growing room. In the seed house or cold frame, start cabbage, cauliflower, and broccoli from seed.
April	<ul style="list-style-type: none"> When weather permits, plant peas, radishes, and green onions outside. Transplant seedling cabbage, cauliflower, and broccoli. Provide protection from freezing temperatures at night.
May	<ul style="list-style-type: none"> Transplant seedling tomatoes and peppers. Plant melons, cucumbers, squash, eggplant, beans, and corn.
June–July	<ul style="list-style-type: none"> Care for growing plants. (30 min/day).
July–August	<ul style="list-style-type: none"> Harvest first crops Start a second planting for second crop

This is a typical example of the gardening cycle for Dr. Mittleider's garden in zone 5.

Refer to the *Gardening Cycle Calendar* found in *Appendix A: Garden Genius Planning Forms* to create your own month-by-month gardening to-do list. You may wish to refer to your *Planting Plan* to note when you need to plant specific crops.





Above: When planning your garden layout make sure plants are not shaded by other plants. The peppers in the center row are shaded most of the day.

Below: Raised beds saved these zucchini plants from suffocating in standing water.





(Mittleider Gardening students prepare soil-beds for planting). **Above (l):** Sprinkling the fertilizers between the ridges of the soil-bed. **Above (r):** Mixing the fertilizers into the soil with a shovel. **Below:** This soil-bed is ready for planting.



Lesson 2: Soil-Bed Preparing

In this lesson, you will learn how to answer these questions:

How do I prepare my garden?
What about the soil?
How do I construct soil-beds?
How do I level soil-beds?
How do I get soil-beds ready for planting?

How do I prepare my garden?

Clear the Area

- Make your garden beautiful. A clean, neat, and orderly garden is pleasing to the eye, more productive, and has fewer weeds and pests.
- Clear the area by removing all undergrowth and brush, all living and dead shrubs, roots, and top-growth. Remove everything that will interfere with gardening such as rocks, trees, stumps, and trash.
- Place stakes and string to outline the perimeter.



Eliminate Weeds

There are two types of weeds: annuals and perennials.

- **Annuals** sprout from seed every year. These can be burned, removed with a shovel or two-way hoe, or plowed under using a roto-tiller or tractor.
- **Perennial** plants keep growing for several years. You must dig perennials up, roots and all, destroying the rhizomes (underground stems) and runners. If perennials are not removed, they will be a continual nuisance throughout the garden, all through the year.

Break up the Soil

The soil should be broken up (with a shovel, digging fork, or tiller) to a depth of 8 to 10" in the bed area. Doing so at this time will speed up the actual shaping of the soil-beds later.

Soil in the aisle area only needs to be broken up 2 to 3" deep, so that soil can be moved into the bed area. Deeper tilling makes working more difficult, and brings weed seeds to the surface.

What about the soil?

Soils are made mostly of basic inorganic elements that include mineral combinations such as potassium, phosphorus, calcium, iron, manganese, magnesium, etc.

Soil serves these five essential functions.

1. Provides anchorage and protection for plant roots.
2. Holds air and water for plant use. (See Introduction: Six Laws of Plant Growth—#3 Air and #4 Water).
3. Includes minerals which plants need for food. Soil also holds and stores additional minerals that may need to be applied to it (See Introduction: Six Laws of Plant Growth—#5 Nutrition).
4. Acts as a temperature regulator in hot weather. (See Introduction: Six Laws of Plant Growth—#2 Temperature).
5. Soil affords drainage for plant roots. If soil is too hard and compact, it will not drain. (See Introduction: Six Laws of Plant Growth—#3 Air).

Crops fail when one or more of these five essential functions is missing.

Using the recommended Mittleider fertilizing strategy (See *Lesson 5: Soil-Bed Fertilizing*), will ensure your plants receive adequate minerals that may be lacking or unavailable to plants in your soil.

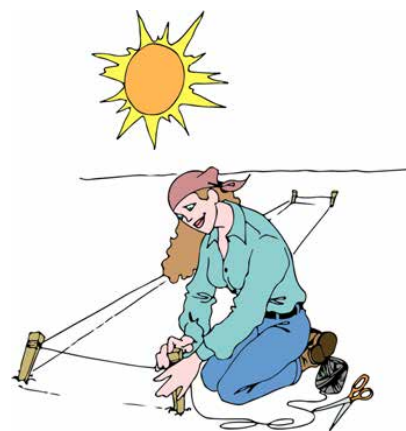
How do I construct soil-beds?

Step 1: Refer to Your Plan

Refer to your *Garden Plot Plan* to determine where to place your soil-beds. See *Appendix A: Garden Genius Planning Forms*

Step 2: Stake Out Beds

Plot out each soil-bed by placing stakes at each of the four corners (18" by 30'). Tie and stretch string to the stakes to show the placement of the two ridges of the soil-bed.



Learn More

Common Soil Problems and Remedies

▪ **Lesson 19: Problem Soils**

Soil pH

▪ *Food For Everyone* (pp. 132-136)

Testing the Soil

▪ *Food For Everyone* (pp. 137-141)

Settling the Weed Problem

▪ *Food For Everyone* (pp. 313-320)

▪ *6 Steps to Successful Gardening* (pp. 7-10)

Tip: After tying one end of the line to a stake, wrap the other end around the opposite stake one complete time only and pull the line tight. Lift the line over the tight line at the corner of the stake. The tight line keeps the string from slipping. To loosen or remove the line, give it a quick, sharp pull upward! This procedure eliminates tying knots at the stake to keep the lines tight and speeds up work.

Step 3: Raise the Beds

With a garden rake, pull 2" of soil from the aisles into the staked-out area, creating an 18"-wide flat top below the strings about 5" higher than the aisles.



In addition to a long-handled shovel and a garden rake, the following materials are needed to construct soil-beds. Refer to the *Soil-Bed Tools and Materials List* in *Appendix A: Garden Genius Planning Forms* and mark the items you will need to get.

Tools and materials needed to construct soil-beds:

- 1"x 2" stakes (wooden or metal) 18" long, with one end pointed (4 stakes per soil-bed)
- Nylon string or Mason line
- Hammer for driving stakes
- Pick-ax for hard soils

How do I level soil-beds?

Leveling is essential as it facilitates the movement of the water and even distribution of nutrients when irrigating and makes the process easy and more efficient. A little time spent leveling will save more time later. Here's how to do it.



Step 1: Make a Leveling Device

Lay a straight 8' 2"x3" (or 2"x4") board on edge and securely fasten a spirit level to the center of it.

See *Appendix C: DIY Workshop* for more details.



Leveling Device

Step 2: Check Level and Move Soil

Starting at one end of the soil-bed, use the level to check the level of the ground. Move the soil from the high end to the low end to make the flat top level from one end of the soil-bed to the other. For water to move slowly make sure the soil-beds are level, or with a drop of only 1" in 30'. It is not necessary to level the aisles.

Step 3: Loosen and Break Up Soil

Moving the soil in this leveling process is a good time to loosen it and break up any clods that were not broken up during the initial ground-preparation stage.

Tip: Prepare the soil-beds only as you are ready to plant them. This will give plants an even chance with the weeds.

Learn More

Terracing Soil-Beds

- [6 Steps to Successful Gardening](#) (p. 19)

The Erosion Problem

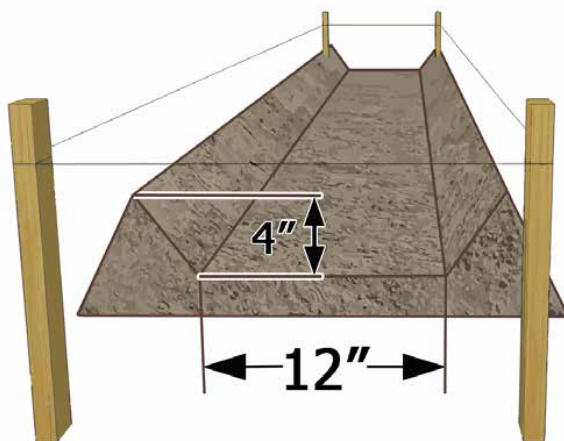
- [Food for Everyone](#) (p. 122)

How do I get soil-beds ready for planting?

Once your soil-beds are formed and leveled, they are ready for the final planting preparations. Here's what you do next.

Step 1: Ridge the Soil-beds

This is one of the most important steps. With the rake tines facing down, pull 2" of soil from the center of the soil-bed to the strings creating a ridge on each side, 4" high on the inside and 6" higher than the aisles.



Step 2: Apply Fertilizers

To the 12"-wide planting area between the ridges in each 30' soil-bed, evenly spread **30 ounces** (by weight) of the Pre-Plant Fertilizer (1 ounce per linear foot for shorter beds) plus **15 ounces** (by weight) of the Weekly-Feed Fertilizer (1/2 ounce per linear foot). You will learn how to make these fertilizers in *Lesson 5: Soil-Bed Fertilizing*.

***Step 3: Mix Fertilizers with Soil***

Mix the fertilizers and soil together to a depth of 8" with a shovel, digging fork, or tiller. Make sure to keep the beds level.

Step 4: Flatten the Center

Next, flatten and re-level the center of the soil-bed, creating an area about 12" wide. Make sure it is flat (not rounded). This is where the water will flow during irrigation.

Your soil-bed is now ready for planting!



(Garden training project in Colombia, South America) **Above:** The man in the middle is transplanting seedlings into the garden. Notice how he works from the opposite side of the row from where the plants are placed. It is easiest to dig the holes by pulling the dirt toward you. The man on the right is marking the next row with a plant marker for even spacing. **Below:** Cabbage is planted on each side of the soil-bed at the base of the ridges. These men are observing an experiment. See Lesson 17, page 161 for the details.



Lesson 3: Soil-Bed Planting

In this lesson, you will learn how to answer these questions:

Should I plant seeds or seedlings?

How should I space my plants?

Can I grow crops vertically?

How do I make a marker?

How do I plant seeds in soil-beds?

How do I plant very small seeds?

How do I transplant seedlings?

Should I plant seeds or seedlings?

There are advantages to growing plants from seed ahead of the normal planting season and transplanting them as seedlings in your garden.

Many soils harbor insects and diseases. These frequently kill seeds just as they are sprouting or pushing through toward the light.

Cold soils delay germination. Prolonged germination and retarded growth have a permanent adverse effect on plant growth and yield.

The second law of plant growth requires temperatures between 70 and 85 degrees Fahrenheit for best seed germination, and between 60 and 90 degrees for plants to grow well in the garden.

Healthy seedlings, grown in a protected environment, have the advantage of fast germination and a well-developed root system. When transplanted in the garden, they are better able to resist any antagonistic forces. Thus, yields are better and the crops mature earlier. This lengthens the growing and harvesting period and makes it possible to raise two crops of some vegetable types in the same soil-bed during one growing season.

In summary, plants transplanted in the garden from seedlings:

- are stronger and more vigorous.
- mature earlier.
- produce more uniform and larger yields.
- cut costs on weed and insect control.





Transplanting/
Planting Guide



Garden Genius

Learn More

Home Seedling
Production

▪ **Lesson 22:**
**Seedling
Production**

Building an
Inexpensive
Seedling
Greenhouse

▪ **Lesson 24:**
**Building a
Greenhouse**

Importance of the
Greenhouse in
Disease and Insect
Control

▪ *Food For Everyone*
(pp. 487-540)

You can purchase seedling plants at nurseries or you can grow them yourself in your own inexpensive greenhouse. Most retail nursery stock is not fed and so is nutrient deprived when you buy it. Growing your own assures a healthy beginning.

Dr. Mittleider grew most crops first in the seed house and then transplanted to the garden. However, he seeded certain crops directly into the soil.

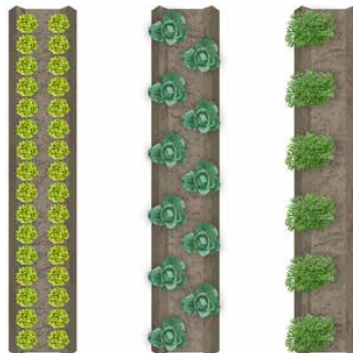
Refer to the *Transplanting/Planting Guide* or *Garden Planting Details* in *Appendix B* to learn which plants respond well to transplanting and which are best planted directly from seed.

Use the *Planting Guide* found in *Appendix A: Garden Genius Planning Forms* to indicate which of your crops you will plant from seedlings and which you will plant from seed.

How should I space my plants?

Spacing seedlings (or seeds) uniformly, tailored to their full-grown shape and size, will provide adequate space and light for them to mature. Plenty of light is essential to produce high-yield crops. (See *Introduction: Six Laws of Plant Growth—#1Light*).

Spacing between plants varies according to the type of plant. There are three basic patterns for arranging plants in soil-beds.



- **Double Rows** are used for plants such as potatoes, corn, radishes, and leaf lettuce.
- **Double-Alternating Rows** are used for plants such as head lettuce, cabbage, broccoli and similar-size crops.
- **Single Rows** along one side of the soil-bed are used for tomatoes, cucumbers, melons and other vertically grown crops or large plants such as zucchini.

To ensure uniform spacing, use the special plant marker described in the next section.

Refer to the *Transplanting/Planting Guide* or the *Garden Planting Details* in *Appendix B* to learn about row arrangements and spacing requirements for many common crops.

Go to the *Planting Guide* found in *Appendix A: Garden Genius Planning Forms* and enter the spacing, row arrangements, and depth of planting seeds or seedlings for your crops. Refer to the *Garden Planting Details* or *Transplanting/Planting Guide* in *Appendix B* as needed.



Transplanting/
Planting Guide



Garden Genius

Can I grow crops vertically?

With Mittleider gardening, you can grow plants both horizontally and vertically. Some plants are normal climbers, for example: pole beans, pole peas, and certain squashes. Other crops can be made to grow vertically. These include tomatoes, cucumbers, and melons.

Growing crops vertically has these advantages:

- More plants can be grown in a small area.
- Better quality crops are produced because of the extra light each plant receives.
- Plants are easier to feed, water, prune, and harvest.
- The fruit does not sunburn and the vines and leaves are not damaged during harvesting.
- The fruit does not mildew, get eaten by bugs and animals, or get stepped on.

There are two ways of growing crops vertically. You can use stakes, or you can **use the preferred T-frame structure**. You will learn about T-frames in *Lesson 15: Caring for Climbing Plants*.

Using Stakes

To grow crops vertically using stakes, you need 2" x 2" x 8' long stakes. These are driven 12" into the ground at the base of the ridge furthest from the sun, starting 5" from the end of the bed and spaced 18" apart.

Learn More

Pruning & Using T-frames

▪ **Lesson 15: Caring for Climbing Plants**

Growing Tomatoes Vertically

▪ *Let's Grow Tomatoes*
(pp. 64-69)



Starting 2" in from the end of the bed and in line with the stakes, tomatoes, cucumbers, melons, or squash are planted 6" apart in pairs with 12" between pairs, so that two plants can be tied to one stake.

Using 18" pieces of baling twine tie the middle of the string to the stake, and then tie the ends to each plant, leaving space for the plant stem to thicken as it grows.

Prune plants to single-stem vines by removing all suckers. As plants grow continue tying to the stake until they reach the top.

After the growing season remove the stakes and store them for next year.

Tip: Paint your stakes white before using to improve their appearance and durability.

Using T-frames

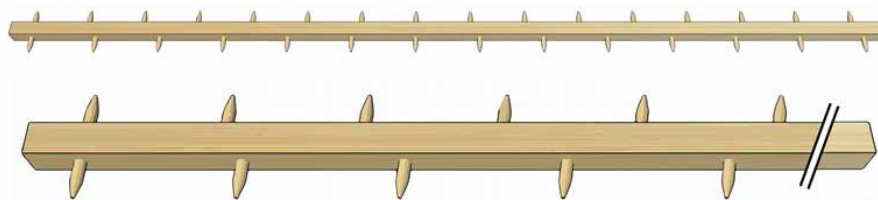
The preferred method for growing vertically uses T-frames. Building and using T-frames is covered in *Lesson 15: Caring for Climbing Plants*.



How do I make and use a marker?

Markers help you mark the soil to ensure uniform spacing between plants.

To make a marker for showing the placement of seeds or seedlings at 2-, 3-, 4-, 6-, 8-, 12-, and 18" (6" marker), or 7-, 14-, and 21" intervals (7" marker), you will need the following materials and tools.



Materials

- Two 4' lengths of 1/2" wood doweling
- One 2"x 2"x 8' board
- Glue (preferably water-proof)

Tools

- Saw
- Drill and 1/2" wood or steel drill bit
- Wood rasp, belt sander, or a carpenter's 1/2" pencil sharpener
- Tape measure

Tip: If using the carpenter's pencil sharpener, sharpen dowel pieces *after* they are glued and set in place in the 2" x 2" x 8' board.

Procedure

- Cut the doweling into 2 1/2" pieces and sharpen one end of each if using a wood rasp or a belt sander. If using a carpenter's pencil sharpener, sharpen the dowel pieces after they are glued into the board.
- Starting at 2" from the end of the 2"x2" board, drill 1/2" diameter holes 3/4" deep at 6" intervals on one side and at 7" intervals on the opposite side.
- Glue the pieces of dowel in the holes (pointed ends out).
- If using a pencil sharpener, sharpen dowel now.

Using the Marker

Transplanting in damp soil is preferred, but the same results can be achieved in dry soil if you water immediately after planting.

- With the marker, mark where the planting holes should be by dragging across the soil in the soil-bed.



- Using your hand or a trowel, make the actual hole just before you set each plant.
- The holes should be large enough to accommodate the root ball without crowding.

Tip: The 6" and 7" marker is the most useful as a universal marker. Use this marker to make reference points in your soil-beds and then plant with other spacing increments (e.g., 2, 3, 4, and 9") by referring to the reference marks.

Consider the spacing requirements for the crops you will be planting by referring to your *Planting Guide*, and determine which markers you plan to use for each crop.

- 6" interval marker (between 2 and 12" spacing)
- 7" interval marker (for 7, 14, and 21" spacing)

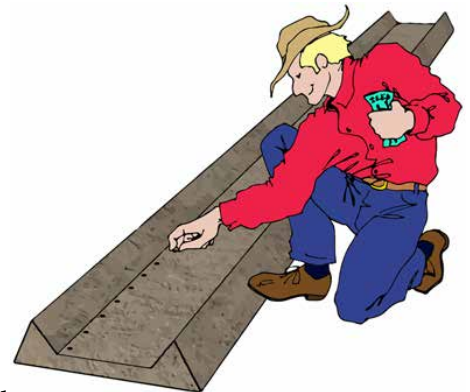
Go to the *Soil-Bed Tools and Materials List* in *Appendix A: Garden Genius Planning Forms* and indicate which markers you plan to make.



How do I plant seeds in soil beds?

If you sow seeds directly into your soil-beds, remember these points:

- Plant at the bases of the ridges, not at the top.
- Use certified seed, whenever possible. Certified seed is produced under more rigid inspection.
- Don't plant too early, while the soil is cold!
- Do not cover seeds too deep. Use the following guidelines.



Covering Seeds

- Tiny seeds—cover only with sand or custom soil mix.
- Medium seeds—cover 1/4" to 1/2"
- Large seeds—cover 3/4" to 1"

Tip: Cover all seeds only with sand or custom soil mix, and only cover 2 1/2 times the thickness of the seed.

How do I plant very small seeds?

The following procedure permits you to plant small seeds evenly and quickly by hand so that thinning later is unnecessary.

Step 1: Mix Seed with Filler

Mix the desired amount of seed with sand. Mix 100 parts of sand with 1 part seed.

Step 2: Make Furrow

Using a pointed garden tool, such as the HANDLE-END of your hoe or rake, scratch a shallow furrow 1/2" deep along the inside base of each ridge. The space between the furrows should be 12".

Step 3: Spread Seed

Take a small amount of the seed mixture in the hand. With a swinging motion of the hand and arm spread the seed in the furrows along the length of the beds.

Tip: Using a 15-ounce-can may increase your accuracy in distributing seeds evenly throughout the length of the soil-bed.

Step 4: Cover Seed

Cover the seed very lightly with sand or special seed-house soil— never with garden soil. Cover with wet burlap or cheesecloth to avoid moving seeds when watering.

Step 5: Water Soil

Water the soil-beds by gently flooding the area between the ridges. If the seeds are covered with burlap, gently water through the burlap covering until seeds begin to sprout.

Step 6: Keep Soil Damp

Watering often enough to keep the burlap moist will help to keep the soil damp but not soaking wet during germination, which takes from 2 to 6 days with soil temperatures of 80 degrees Fahrenheit.

Step 7: Remove Burlap

Remove the burlap covering as soon as you see the first sprouts. Failure to do this will result in weak, thin seedlings.



Transplanting/
Planting Guide

How do I transplant seedlings?

Refer to the *Transplanting/Planting Guide* or *Garden Planting Details in Appendix B* for guidelines on how deep to transplant different crops.



After marking the soil-beds, make holes at each mark. It's best if you make the holes right at the time of transplanting. The holes should be deep enough and large enough to accommodate the root-ball and plant stem without crowding.

Tip: Water the seedling plants heavily just prior to actual transplanting. Wet soil hydrates the plant and keeps the root ball from falling apart when removing from the pot or tray.

Transplant the seedlings as early in the day as possible to reduce transplant shock.

Step 1: Take Plant in Hand

Take a young plant in hand. Slip the plant stem between the index and middle fingers.



Step 2: Prune Leaves

Remove older leaves. A new transplant cannot support as many leaves as before due to transplant shock to its roots.

Step 3: Turn Pot

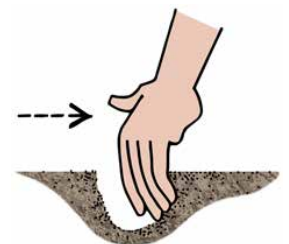
Keep the fingers in place and turn the pot upside down. Tap the bottom of the pot with the free hand. If the root ball is wet the plant slips easily from the pot. If transplanting from an open seedling flat hold by the root ball, keeping as much soil and roots as possible.



Tip: Keep the root ball and soil intact as much as possible.

Step 4: Make Hole

Hold the plant by a mark in the soil-bed, and with your free hand make a hole at the base of the ridge large enough to accommodate the roots. It is easiest to work from the opposite side of the bed and pull the soil toward you.



Step 5: Place Plant in Hole

Turn the plant right side up while lowering the roots into the hole.

Step 6: Position the Plant

Set the plant deep, into the soil, down to the crown, but do not plant the crown below the soil level in soil-bed.

Planting the crown too deep can cause root-rot, which will kill the plant.



Note: The crown of the plant is the top part of the plant base or the point at which the roots transition to the stem.

Step 7: Fill the Hole

After the plant is set properly in the hole, bring loose soil in contact with the plant roots sufficient to fill the hole. This should take just one movement of the hand. Do not pack the soil around the plant.

**Step 8: Repeat Procedure**

Repeat the transplanting procedures, planting one plant at each mark.

Step 9: Apply Fertilizer

After a soil-bed is planted, apply 7 1/2 oz (1/4 oz/ft) nitrogen fertilizer in a narrow band between rows, avoiding plant stems. Following are nitrogen sources in order of preference: 34-0-0, 27-0-0, 46-0-0, 21-0-0.

Step 10: Water

Water promptly, thoroughly soaking the soil-bed to dissolve the granular fertilizer and keep the plants from wilting.

**Step 11: Start Regular Fertilizing Schedule**

Apply the regular application of Weekly-Feed Fertilizer three days after transplanting. You will learn how to do this in *Lesson 5: Soil-Bed Fertilizing*

Calculate how much nitrogen you will need when transplanting your plants. Allow 7 1/2 oz per 30' bed–1/4 oz/ft. Enter this information on your *Soil-Bed Tools and Materials List in Appendix A: Garden Genius Planning Forms*.





You will learn in the next lesson how to easily water your soil-beds with a hose, but you can also build an inexpensive watering system using PVC pipe. Lesson 16 will teach you how. **Above:** These sugar-baby watermelons have been watered only at the root zone. Sprinkling wastes water and encourages weeds to grow in the aisles. **Below:** Watering cherry tomatoes—notice how the ridges hold the water keeping it concentrated at the roots.



Lesson 4: Soil-Bed Watering

In this lesson, you will learn how to answer these questions

What should I know about plants and water?
How does this method conserve water?
How do I water my soil-beds?

What should I know about plants and water?

- The fourth law of plant growth is water. (See Introduction: Six Laws of Plant Growth—#4 Water).
- Over 80% of a plant's weight is water. Tender, crisp, flavor-filled vegetables need water often, generally on a daily schedule.
- A continuous “pipe” runs from the tip of the deepest root to the end of the highest leaf in a plant.
- Every time a plant begins to wilt it has already stopped growing.
- In addition to keeping a plant from wilting, water is necessary to carry nutrients from the soil to the plant roots. Dry fertilizer can do nothing until it is dissolved.
- The larger the leaf area of a plant, the more water it requires for transpiration.
- Since soils are not dams for storing water, it is false economy to supply excess water during irrigation. When you see standing water, the soil has reached “field capacity” and can hold no more.



Is sprinkling a good way to water?

No. Water escapes through the leaves. The droplets you see on plant leaves in the early morning hours are water leaving the plant—this is called transpiration. (A wilting plant is somewhat helped by sprinkling, but usually not enough to support optimum growth.) Sprinkling wastes water and encourages weed growth in the aisles. Sprinkling also promotes fungus diseases such as mildew and mold growth on leaves.



Learn MoreAutomating
Watering▪ **Lesson 16:**
Automated
WateringEffective Water
Systems▪ Grow-Bed
Gardening
(pp. 103-108)

Soil Water

▪ Food for Everyone
(pp. 106-116)

How does this method conserve water?

The Mittleider method simplifies watering and conserves water.

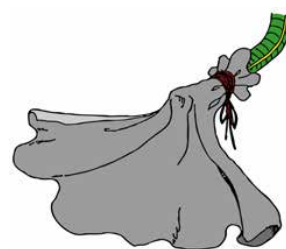
- Plants receive water at the roots where they can make the best use of it.
- Water is conserved by minimizing evaporation and overwatering.
- The same water supplies two rows of plants at the same time, thus cutting in half the amount of water used in conventional methods.

How do I water my soil-beds?

Here is the procedure for watering soil-beds.

Step 1: Tie an 18" Towel to the Garden Hose

Wrap the towel several times around the hose, and extend the towel 12" past the end of the hose. This will modify the speed of the water coming out of the hose without affecting the water volume.



Tip: You can also use a “hose bubbler” instead of a towel.

Step 2: Turn the Water on Full Volume

Water should flood the 12" flattened width of the soil-bed and quickly move to the other end of the bed (usually in less than 5 minutes).

Step 3: Allow Water to Reach End of Bed

By the time the water reaches the end, it should have reached the base of each ridge, bringing water to the stems and roots of the plants.

Step 4: Move the Hose to the Next Bed

When you see standing water move the hose to the next bed.

Step 5: Water Daily

If drainage is satisfactory, water the beds daily.

Tip: Less water is lost to evaporation and the plants are fully hydrated and able to handle heat stress, if you water in the cool of the morning. Water plants at any time of day if plants show a need for it. Don't wait.

An alternative watering method

Lesson 16: Automated Watering will show you how to automate your watering to make the job easier and faster while providing water uniformly to all plants.



Above: (Ron's soil-bed garden in Missouri). Build an inexpensive watering system from PVC pipe.



When your garden is weed free and plants receive proper nutrition, they are beautiful, bug resistant and disease resistant.



Lesson 5: Soil-Bed Fertilizing

In this lesson, you will learn how to answer these questions:

Why do I need to fertilize?
What nutrients do plants need?
What kind of fertilizers should I use?
How much fertilizer should I use?
How do I mix the Pre-Plant Fertilizer?
How do I mix the Weekly-Feed Fertilizer?
How often should I fertilize?

Why do I need to fertilize?

Plants are like people in that they require balanced nutrition.

They get 3 essential nutrients—carbon, oxygen, and hydrogen—from the air, from which they produce carbohydrates. (See *Introduction: Six Laws of Plant Growth—#3 Air*).

Plants receive 13 more nutrients essential to healthy growth as water-soluble minerals through their roots. (See *Introduction: Six Laws of Plant Growth—#5 Nutrition*).

The 13 essential natural minerals from which plants make food have come to be called fertilizers.

These natural mineral nutrients in soil can be compared with a checking account in a bank.

- Every crop reduces the amount of soil nutrients just as writing checks reduces the money in a checking account.
- If the amount of the check is more than the amount in the bank, the bank will not accept the check. Growing crops affect the soil in the same way. Planting a large crop when the supply of fertilizer is too low will result in crop failure.
- Applying fertilizer to growing crops is just like making a deposit to a bank account.



What nutrients do plants need?

There are 16 essential plant nutrients. They include:

Airborne Nutrients

- Carbon (C)
- Oxygen (O)
- Hydrogen (H)

Primary or Macro Nutrients

- **Nitrogen (N)** A component of proteins & chlorophyll. Gives plants their green color, rapid growth, high protein, and yield.
- **Phosphorus (P)** Plays a vital role in plant reproduction. Affects early vigor, healthy roots, and quality.
- **Potassium (K)** Vital for plant growth. Produces healthy plants, high-quality seeds and fruit.

Secondary Nutrients

- **Calcium (Ca)** An integral part of plant cell walls. Promotes early root growth, high vigor, and seed formation.
- **Magnesium (Mg)** Associated with chlorophyll formation, photosynthesis, and oil and fat formation.
- **Sulfur (S)** Component of proteins and vitamins. Aids root growth, green color, and seed production.

Micro-Nutrients or Trace Elements

- **Boron (B)** Essential for seed and cell wall formation.
- **Copper (Cu)** Catalyzes several plant processes.
- **Iron (Fe)** Is associated with chlorophyll formation which gives plants their green color.
- **Manganese (Mn)** A part of certain enzyme systems.
- **Zinc (Zn)** Aids chlorophyll and carbohydrate formation
- **Molybdenum (Mo)** Plays a vital role in nitrogen fixation by microorganisms and nitrogen processes in plants.
- **Chlorine (Cl)** Essential for plant growth.

What kind of fertilizers should I use?

No matter how the soil is fertilized, whether by compost organic matter, or fertilizer from a bag, the elements used by plants are the same. On a molecular level, nitrogen is nitrogen, regardless of its source. What is important is that plants receive an accurate and proper balance of the required nutrients.

The elements used in Dr. Mittleider's fertilizers are obtained from commercial sources. Twelve of the thirteen nutrients plants get from the soil are a natural part of the earth's crust and are mined from the rocks and then packaged and sold commercially. You will learn much more about fertilizers in *Lesson 17: Understanding Fertilizers*.

Dr. Mittleider recommended the following four-step strategy for applying fertilizers. You will learn how to mix Pre-Plant and Weekly-Feed fertilizers later in this lesson.

Step 1: Pre-Plant Fertilizing

Before planting, apply fertilizers to the soil-beds and mix with the soil. At this time you should fertilize with the Pre-Plant Fertilizer (1 oz per linear foot) as well as an application of the Weekly-Feed Fertilizer (1/2 oz per linear foot).

Step 2: Transplant Fertilizing

After transplanting seedlings, apply 1/4 ounce per linear foot of a nitrogen fertilizer—between 21-0-0 and 46-0-0—in a narrow band between rows in each soil-bed. This will help jump-start the young seedlings and overcome transplant shock.

Step 3: Weekly Fertilizing

After crops are in the soil, wait 3 days and then apply only the Weekly-Feed Fertilizer on a regular basis, every 7 days thereafter.

Step 4: Special-Need Fertilizing

If plants show symptoms of nutritional deficiencies (*Lesson 18: Nutritional Deficiencies*), apply corrective fertilizing formulas on a different day than the Weekly-Feed Fertilizer.

Learn More

Organic vs. Inorganic Gardening

- **Lesson 17: Understanding Fertilizers**
- [*6 Steps to Successful Gardening*](#) (pp.44-46)
- [*Food for Everyone*](#) (pp. 258-261)

How Fertilizers Are Packaged and Sold

- **Lesson 17: Understanding Fertilizers**

Recognizing Plant Deficiencies

- **Lesson 18: Nutritional Deficiencies**
- [*The Garden Doctor*](#) (Books 1-3)
- [*Food for Everyone*](#) (pp. 142-254)

Corrective Treatments

- **Lesson 18: Nutritional Deficiencies**
- [*The Garden Doctor*](#) (Books 1-3)

How much fertilizer should I use?

Pre-Plant Fertilizing

Before planting, evenly spread the following on each 30' soil-bed:

- 30 ounces of the Pre-Plant Fertilizer
(1 oz per linear foot)
- 15 ounces of the Weekly-Feed Fertilizer (1/2 oz per linear foot)



All measurements are by weight. Mix thoroughly with the soil.

Weekly-Feed Fertilizing

Apply **15 ounces** of the Weekly-Feed Fertilizer evenly down the center of each 30' soil-bed (**1/2 oz per linear ft**). Measurements are by weight. Water the bed after applying fertilizer to dissolve the granules.

Tip: Weigh the amount of fertilizer needed. Pour into can; mark a line on can; fill can to fill line for each feeding.

Use a 15-oz can that holds enough fertilizer for an 18" x 30' soil-bed. Hold the can in your hand at an angle, start at one end, and gently shake the can to distribute the fertilizer. Walk along the soil-bed distributing the fertilizer until you reach the other end. Refill the can with fertilizer and start on the next row.

Calculate how much of each fertilizer you will need for **one** application on all of the soil-beds in your garden.

- Pre-Plant Fertilizer
- Weekly-Feed Fertilizer

Enter these amounts on the *Fertilizing Schedule* found in *Appendix A: Garden Genius Planning Forms*.

How do I mix the Pre-Plant Fertilizer?

Pre-Plant Fertilizer is of great importance to healthy plants. It helps seeds to grow roots and gives seedlings a healthy start.



To make **Pre-Plant Fertilizer**, mix together the following (by weight):

- 20 pounds of lime or gypsum*
- 1 pound of magnesium sulfate (Epsom Salt)
- 4 ounces of boron (20 Mule Team Borax)



This mixture will sufficiently prepare ten 30' soil-beds.

Tip: Be accurate in measuring and applying fertilizers to the soil. Overfed plants can produce poor yields just as underfed plants can. Remember, the most accurate feeding is done by weighing the needed amount and then marking the feeding container. Thereafter always feed that amount.

****Should I use lime or gypsum?***

Lime and gypsum supply calcium to crops. Use one or the other of these sources of calcium depending on whether you have acid or alkaline soils.

- In areas where the annual rainfall is more than 20" the soil will be acidic and you should use agricultural lime (calcium carbonate) or dolomite lime.
- In areas where the annual rainfall is less than 20" the soil will be alkaline and you should use gypsum (calcium sulfate).

Where do I get these ingredients?

Garden shops (nurseries), farm supply stores, and chemical shops usually carry packaged fertilizers, including gypsum and/or agricultural lime. Powdered or granular gypsum/lime will work.

Boron and magnesium sulfate are frequently sold in supermarkets under the following names: Twenty Mule Team Borax (a detergent) and Epsom Salt—magnesium sulfate (a laxative).

Based on how much Pre-Plant Fertilizer you will need for your garden, calculate how much of each ingredient you will need.

- lime or gypsum (either powdered or granular)
- magnesium sulfate (*Epsom Salt*)
- boron (*Borax*)

Learn More

What Are Commercial Fertilizers?

▪ **Lesson 17:**

Understanding Fertilizers

▪ [*Food for Everyone*](#) (pp. 255-257)

Calcium & Magnesium, Secondary Nutrients

▪ **Lesson 18:**

Nutritional Deficiencies

▪ [*Food for Everyone*](#) (pp. 192-200)

Soil pH—Acidity and Alkalinity

▪ **Lesson 19:**

Problem Soils

▪ [*Food for Everyone*](#) (pp. 132-136)



Learn More

What Are
Commercial
Fertilizers?

- **Lesson 17:**
**Understanding
Fertilizers**
- *Food for Everyone*
(pp. 255-257)

Enter these amounts on the *Soil-Bed Tools and Materials List* found in *Appendix A: Garden Genius Planning Forms*.

How do I mix the Weekly-Feed Fertilizer?

Weekly-Feed Fertilizer provides for the on-going nutritional needs of growing plants. There are two ways to mix the Weekly-Feed Fertilizer. One way is to obtain and mix the individual ingredients comprising the Mittleider Magic™ Weekly Feed. However, because it may be difficult to find the ingredients in small, affordable quantities, we recommend you use the second method we call the “Easy Mix” Weekly Feed. Directions for both methods follow.

Mittleider Magic™ Weekly-Feed Fertilizer

If you are able to find all the ingredients below, and don't mind the trouble, to make 25+ pounds of *Weekly-Feed Fertilizer*, mix together the following (by weight):

***Ammonium Sulfate** (*Nitrogen*)

NH_4SO_4 (21-0-0) 5 pounds 4 ounces

***Urea** (*Nitrogen*)

CH_4N_2O (46-0-0) 5 pounds 4 ounces

Phosphorus

P (0-45-0) 4 pounds 8 ounces

Potassium

K (0-0-60) 6 pounds

Magnesium Sulfate

$MgSO_4$ (Epsom Salt) 3 pounds 12 ounces

Boron

B (*Borax*) 3 ounces

Manganese

$MnSO_4$ 2 ounces

Zinc

$ZnSO_4$ 4 ounces

Iron Sulfate

$FeSO_4$ 1/2 ounce

Copper Sulfate

$CuSO_4$ 1/2 ounce

Molybdenum

Mo 1/4 ounce



***Note:** Dr. Mittleider's original Weekly-Feed formula contained 10 1/2 pounds of ammonium nitrate (34-0-0), which is no longer available to most people. Another alternative to 10 1/2 pounds of (34-0-0) fertilizer could be 13 pounds 5 ounces of all calcium nitrate (27-0-0).

“Easy Mix” Weekly-Feed Fertilizer

If you have trouble finding several ingredients in the Mittleider Magic™ Weekly-Feed, mix together the following (by weight), which will prepare almost 30 pounds. Most people use the “Easy Mix” Weekly-Feed. It works just as well as the original Mittleider Magic™ Weekly Feed.

- 25 pounds (16-16-16) fertilizer
- 4 pounds magnesium sulfate (Epsom Salt)
- 10 ounces of micro-nutrients (available at www.growfood.com/shop packaged as two 10-oz bags)

See *Appendix C: DIY Workshop* for more details about mixing and storing Mittleider Fertilizers.

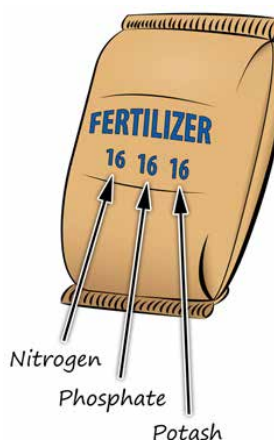
What do the numbers 16-16-16 mean?

Throughout the world, fertilizer is sold using standard labels. The three numbers show the percent of nitrogen (N), phosphorus (P), and potassium (K) in the fertilizer. For instance, the fertilizer bag shown here contains 16% of each element.

What should I do if I can't find a 16-16-16 fertilizer?

Substitute one of the following mixtures, shown here in order of most acceptable substitute to least acceptable:

- 17-17-17 fertilizer
- 15-15-15 fertilizer
- 19-19-19 fertilizer
- 13-13-13 fertilizer



Refer to the *Soil-Bed Tools and Materials List in Appendix A: Garden Genius Planning Forms* and check off the materials you need to get for the Weekly-Feed formula you have chosen to use.



Mittleider
Fertilizers



Learn More

Recognizing Plant Deficiencies

- **Lesson 18: Nutritional Deficiencies**
- [*The Garden Doctor*](#) (Books 1-3)
- [*Food for Everyone*](#) (pp.142-254)



Suggested Fertilizer Applications



How often should I fertilize?

Fertilize with the **Weekly-Feed Fertilizer** every 7 days, applying down the center of the bed and 4" away from plant stems.

When to Begin

For transplanted plants, apply the first regular application of the Weekly-Feed Fertilizer 3 days after transplanting and on a weekly basis thereafter.

For crops planted from seed, fertilize immediately after seedlings sprout.

How Many Applications

To see a table showing how many weekly applications are recommended for various crops, refer to *Suggested Fertilizer Applications* or *Garden Planting Details in Appendix B*.

- Any time plants look like they are hungry, they should be fed. Judge by the visual appearance of the plants.
- Fertilizing with Weekly-Feed should continue until 3 weeks before harvest for single-crop varieties, and until 8 weeks before the first expected killing frost for ever-bearing plants.
- Ever-bearing crops (tomatoes, peppers, squash, melons, etc.) should receive an additional Pre-Plant feeding 8 weeks after transplanting into the garden.

What are the signs of a hungry plant?

"Plant hunger" is shown by thin, weak looking plants, poor leaf color, blossoms not developing into fruit, and inferior quality of fruit.

Go to the *Fertilizing Schedule* in *Appendix A: Garden Genius Planning Forms* and enter the recommended number of Weekly-Feed Fertilizer applications for each of your crops. Use this schedule to record the dates you fertilize each crop.

Can I use Mittleider fertilizers on trees, bushes and vines?

Trees, bushes, and vines love the Pre-Plant and Weekly Feed - just as vegetables do. However, they don't need it as often, because they are much slower-growing, and because of that they are also able to get some nutrition from the soil without your help.

A small tree that has just been planted could use one ounce of Weekly Feed, sprinkled on the soil surface over an area corresponding to the size of the root zone, and watered in.

A large tree with trunk diameter of 1' or more would be able to use 16+ ounces applied the same way. Trees larger than 1' diameter can be fed as much as 32 ounces.

Depending on the size of the tree, you should adjust the application between those amounts - and do it 3 or 4 times per year depending on your growing season - always watering the nutrients into the soil thoroughly. Fruit trees will benefit from an extra feeding – see paragraph below.

Any plant, bush or vine that is expected to grow and mature fruit quickly, such as berries and grapes, will do well with 5 or 6 evenly spaced feedings, depending on the length of your growing season. All feeding should stop 3 weeks before harvest.

Here are the extremes: A large vegetable plant like a tomato gets about 2/3 to 1 tablespoon per week of Weekly Feed. A large 50-100 year-old tree would get 24-32 ounces spread under the leaf line and watered in well.

Everything else is somewhere in between. A single row of berry bushes could be fed about the same as a row of vegetables. A large grape vine might get 2 ounces. A tree with a 3"-diameter trunk could be fed 4-6 ounces, and a 6"-diameter trunk would get 10-12 ounces.

Pre-Plant should always be fed twice the amount as you give Weekly-Feed, but just once each year at the end of the dormant season in early spring.

Times for feeding fruit trees:

1. At the end of dormant season after you have fed the Pre-Plant Mix (leaf bud emergence).
2. 4-6 weeks later when blossoms open
3. 3-4 weeks later when you see fruit forming.
4. In late June/July, when the tree is producing leaf and fruit buds for next year.
5. In long growing seasons, at least 8 weeks before dormant period begins.



Keep your aisles bare and dry. Make the bugs walk across the Sahara Desert to get to lunch!



Lesson 6: Soil-Bed Weeding

In this lesson, you will learn how to answer these questions

Why should I eliminate weeds?
When do I start controlling weeds?
How do I control annual weeds?
How can I prevent weeds?

Why should I eliminate weeds?

- Fertilizers are too costly to be used for growing weeds.
- Insects and diseases are more difficult to control with weeds in the garden.
- Weeds reduce crop yields by taking up space, air, food, and water.
- Crop increases of 100%–600% have resulted from proper weed control.

When do I start controlling weeds?

Most of us are used to thinking that we must wait until weeds are big enough to pull up before we worry about getting rid of them. But the best time to start is before they start! There are two kinds of weeds—perennial and annual.

- **Perennial** weeds keep growing year after year from the same rhizomes (underground stems) and runners.
- **Annual** weeds start from new seeds every year.

There are two main times to control weeds.

Time One: When Preparing the Soil for Planting

This is the best time to attack perennial weeds. You should try at this time to remove the rhizomes and runners of all perennial plants. Some of the biggest weed nuisances spread through runners. Removing them will save a lot of unnecessary effort later.

Time Two: When the Weeds First Sprout

Usually about 5 to 8 days after planting your crop, annual weeds begin to sprout. This is the time to stop them.



How do I control annual weeds?

Sprout and destroy surface weeds and remove them when no taller than 1".

Do not cultivate to remove weeds, as cultivation can damage crop roots (root pruning). Cultivation also brings more weed seeds to the surface.

You'll need only two simple tools for "Early & Often" weeding:

- a garden rake
- a scuffle hoe (Kenyon two-way hoe head www.growfood.com/shop).

Step 1: Pull Soil Away from Ridge

With the two-way hoe or the rake tines pointing down, pull away the soil from the 4" ridge into the aisles, cutting or uprooting all weeds. *Caution: Be especially careful—if you have planted seeds—not to disturb the area where you planted them.*

Step 2: Pull the Soil Back

If the soil surface is dry turn right around and pull the soil back, rebuilding the ridges, while taking care not to re-plant any weeds!

Step 3: Smother Sprouting Weeds

While reshaping the ridges (those with transplanted seedlings), allow a thin film of dirt to slide around the plant stems. This will smother the weed seeds sprouting among the seedlings.

Step 4: Disturb Area between Rows

With the rake or scuffle hoe, remove sprouting weeds between the planted rows by disturbing the area between the two rows. Make sure to maintain the flat, level quality of this area (to promote accurate and complete watering).

Note: There should be few weeds in the center between the planted rows because the band of fertilizer spread there is strong enough to kill most sprouting weed seeds.

Step 5: Remove Weeds from Aisles

Using the rake or scuffle hoe, remove sprouting weeds from the aisles. Shallow tilling with a small garden tiller is also an option.

How can I prevent weeds?

There are several ways to prevent weeds from growing in the first place:

- Irrigate with well water.
- Do not use sprinklers.
- Use a domestic water supply (garden hose connected to water faucet).
- Do not put unsterilized manure on your garden. Many weed seeds pass right through the cow.
- Plant seeds or seedlings in custom-made soil (using sawdust, perlite, concrete sand, coffee hulls, pine needles, ground tree bark, etc.) in grow-boxes. See *Part III: Grow-Box Basics*.

Should I use black plastic or weed cloth?

Some non-Mittleider gardeners lay down sheets of black plastic or weed cloth, and plant seedlings through small holes cut in them. While preventing much of the broad-leaf growth for a time, grasses and nut sedges will not be stopped, as weed cloth does allow water to penetrate to the soil.

Black plastic presents even more of a problem. It deteriorates fairly quickly, loses its effectiveness, and becomes an eyesore and cleanup problem. Neither is recommended.



Weed early and often using a two-way hoe, also called a scuffle hoe.



Mittleider Gardeners enjoy the fruits of their labors. **Top (l):** Pumpkins—John in Ohio; **Top (r):** Squash in wheelbarrow—Tom in Wyoming; **Middle (l):** Corn—Steve in North Carolina; **Middle (r):** Tomatoes, beans and greens—Sue in Idaho; **Below:** Students participating in a Humanitarian Project in South America harvest food to donate to the needy:



Lesson 7: Soil-Bed Harvesting

In this lesson, you will learn how to answer these questions:

How do I protect my harvest?
What parts of the plant can I harvest?
When should I harvest my crops?

How do I protect my harvest?

You can protect and enhance a bountiful harvest by following a few simple rules:

- When the days are hot, harvest vegetables in the cooler morning hours.
- Treat produce gently—avoid bruising.
- Keep freshly-picked produce out of the sunshine and wind. Cool it promptly to keep it from wilting.
- Keep produce clean—consider eye-appeal.
- For the ultimate in health, flavor and eating quality, allow crops to mature and ripen on the plants or vines.



Tip: Fruit picked too early will be lacking in vital nutrients, and if fruit is left on the vine past maturity the plant senses the completion of its life cycle and starts to die. Harvest at peak maturity to assure a long and delicious harvest of healthy fruit and a longer shelf life.

What parts of the plant can I harvest?

Many people waste the majority of the nutrition produced by their plants. Leaves and stems of several root crops such as beets, turnips and carrots are edible, tasty, and nutritious, and the same is true for most of the brassicas, such as broccoli and cauliflower.

Rather than growing these plants for 60-90 days and eating for one day on the floret, the head, or the root, pick the outer leaves—1 to 3 from each plant each week— and eat healthy, fresh produce every day after the first 4 to 6 weeks.

The chart below provides important details to help you harvest and eat more from your garden.

Edible Parts of Vegetable Plants

Vegetable	Common Edible Parts	Other Edible Parts
Beans, snap	pod and seeds	leaves
Beans, lima	seeds	pods, leaves
Beets	roots	leaves
Broccoli	flowers	leaves, flower stem
Carrot	root	leaves
Cauliflower	immature flower	flower stem, leaves
Celery	leaf stems	leaves, seeds
Corn, sweet	seeds	young ears, unfurled tassel, young leaves
Cucumber	fruit with seeds	stem tips and young leaves
Eggplant	fruit with seeds	leaves edible, but not flavorful
Kohlrabi	swollen stems	leaves
Okra	pods with seeds	leaves
Onions	roots	young leaves
Parsley	tops	roots
Peas, English	seeds	pods, leaves
Peas, southern	seeds, pods	young leaves
Peppers	pods	leaves after cooking, immature seeds
Potatoes, sweet	roots	leaves, stem shoots
Radish	roots	leaves
Squash	fruit with seeds	seeds, flower, young leaves
Tomato	fruit with seeds	
Turnip	roots, leaves	
Watermelon	fruit - interior pulp and seeds	rind of fruit

Reference: Secondary Edible Parts of Vegetables: M. J. Stephens, Department of Horticulture, University of Florida; Vegetable Production & Marketing News, Dr. Frank J. Dainello, editor, April, 2002.

When should I harvest my crops?

To enjoy vegetables at their prime, you need to pick them at the right time.

- Avoid harvesting in the middle of the day.
- Do not leave crates of fresh produce in the sun or wind, to wilt and heat up.

Harvest . . .

- **peas** when the pods are full—leaves at any time.
- **broccoli** and **cauliflower** just as the heads loosen and before flowers appear—leaves at any time.
- **red beets at any size**—leaves throughout the growing cycle.
- **red and Swiss chard**— keep outer leaves picked all season.
- **new potatoes** while the skins slip easily—allow potatoes for winter use to remain 3 weeks after the vines die back.
- **tomatoes** best when red-ripe—to individual taste.
- **cucumbers** before seeds mature.
- **zucchini squash** at any size, but before seeds mature.
- **cabbage** before the heads split—leaves at any time.
- **turnips** while the bulbs are solid and crisp—leaves any time.
- **sweet corn** when silk turns brown and kernels are plump.
- **radishes** before the bulbs are pithy—they are best in cool weather—leaves at any time.
- **cantaloupes** when the fruit separates easily from the stem.



A beautiful assortment of beans—Donna in Connecticut



Mittleider gardeners display their beautiful harvests. **Top:** A wonderful medley of vegetables and fruit—Avery in Georgia; **Middle (l):** Tomatoes and beans—John in the United Kingdom; **Middle (r):** Peppers and tomatoes—Susan in South Carolina; **Bottom (l):** Peppers, beans, tomatoes, and cucumbers—Jeffrey in Virginia; **Bottom (r):** Beans, peppers, and tomatoes—Susan in South Carolina



What to do now?

You now have the basics of gardening in the soil at your fingertips, and you can have a great garden by implementing what you've learned.

Remember, by following the Six Laws of Plant Growth, you can raise an abundance of vegetables and other crops in almost any soil by simply following the steps outlined in just this one section of the Mittleider Gardening Course!

Considering Going Above and Beyond the Basics?

If you're subject to extreme temperatures, if you are interested in advanced topics, or if you simply want to learn more about this gardening system, *The Mittleider Gardening Course* book includes everything you'll want to know about the complete Mittleider Gardening Method, including growing in containers—or as we call them, grow-boxes.

The complete book includes 10 advanced topics and numerous other resources to help you get the most out of your gardening efforts...

- **Grow-Box Gardening**—the Mittleider Method adapted for containers
- **Automated Watering**—to water your garden more quickly and easily
- **Caring for Climbing Plants**—growing vertically to greatly increase yields
- **Nutritional Deficiencies**—learn to diagnose and correct plant problems
- **Seedling Production**—produce your own high-quality seedlings
- **Cold and Hot-Weather Gardening**—to greatly extend your growing season
- **Beating the Competition**—avoiding and controlling pests and diseases
- **Building a Greenhouse**—the Mittleider way!

For more information, please visit:

<https://www.growfood.com/shop>



Image used with permission © Ben and Tabitha Ricks.

A beautiful head of broccoli in a Mittleider grow-box—almost ready to harvest.

What is the Mittleider Gardening Method?

A complete gardening system developed by Dr. Jacob R. Mittleider which guarantees high-yields, no guesswork, and success anywhere in the world.

High-Yield Gardening

- Maximum utilization of space, time, and resources
- Plant spacing is closer than traditional methods.
- Vining plants are grown vertically.
- Plants are fed natural mineral nutrients.
- Plants can be grown in either soil beds or containers called "grow-boxes."
- Combines the best of soil gardening and hydroponic gardening without hydroponic expense

No Guesswork - An easy-to-follow plan that includes:

- What to plant
- When to plant
- Where to plant
- Proper spacing for the plants
- What and how often to feed the plants
- Efficient watering including an optional automated watering system
- How to produce the strongest and healthiest seedlings

Success Anywhere!

- Raise an abundance of vegetables and other crops in almost any soil, season, climate, and elevation.
- Grow a great garden on a patio, a city yard, a country lot, a farm, a hillside, or a parking lot.
- Proven around the world for over 50 years to dramatically increase garden productivity.

