LEARNING TO GROW

A Volunteer Gardening Program to Involve New Audiences and Community Volunteers in Youth Development Activities.

A District 11 4-H Program Development Committee Project, under the auspices of the Texas Agricultural Extension Service, Route 2, Box 589, Corpus Christi, Texas 78406-9704
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4-H MISSION

The Texas 4-H Program develops youth and adults, utilizing research-based information in creative, diverse, hands-on educational environments. Four-H maximizes each individual’s potential through unique partnerships of youth, volunteers, university faculty and community supporters, resulting in exciting and innovative experiences which produce capable citizens to lead us into tomorrow.

4-H VALUES

We believe people are the single most important product of 4-H; therefore, we value the education and preparation of responsible, capable productive citizens.

Furthermore, we value:

- opportunities to belong, participate and contribute to diverse types of families and communities;
- progressive life skills (such as communication, decision-making, teamwork, and lifelong learning) through hands-on education in a nurturing environment;
- strong moral character and positive self-image through multi-generational, culturally diverse interactions; and
- programs designed to meet local needs through efforts of youth, volunteers, donors, professionals and 4-H alumni.

We believe 4-H builds competent, caring and productive citizens capable of living in a dynamic global society.

4-H VISIONS

Texas 4-H ... a dynamic, educational, youth-focused organization leading our state in empowering all individuals, families and communities to unleash their potentials and create positive life-shaping experiences.
LEARNING TO GROW

School: ____________________________

Address: __________________________

Contact: ___________ Telephone: ___________

Semester: __________________________

Garden Volunteer(s): __________________________
The Learning to Grow Program  
Volunteer Guide

Thank you for volunteering to serve as a Garden Volunteer for the Learning To Grow Program! This program is designed to run 12 - 14 weeks.

As a Garden Volunteer you will be asked to give one 30 - 40 minute outdoor training session a week. You may also be asked to give periodic special classroom lectures. Your main role will be to serve as a resource for the teacher throughout the semester.

To help you with your assignments you will be trained by County Extension Staff. In this manual you will also find many helpful gardening publications. Use these publications to teach the children and to assist you in trouble-shooting various concerns in the garden.

Helpful hints for a successful gardening project:

1. Always keep the teacher informed and work to include them in the outdoor activities.

2. Attempt to work in teams of two Garden Volunteers, as there will inevitably be conflicts of schedule that will arise. Friday is often reserved for field trips, so it may be advisable to avoid gardening on that day.

3. With the teacher's consent, designate one day of the week to work in the Learning To Grow Garden.

4. Always remain flexible. The following timeline is to be used as a guide, but realize weather, holidays and unforeseen circumstances are sure to effect the schedule.
## Learning to Grow Timeline

<table>
<thead>
<tr>
<th>Session</th>
<th>Classroom</th>
<th>Garden</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to MGs/Wonder of Plants</td>
<td>1st Planting</td>
</tr>
<tr>
<td>2</td>
<td>Soil Components and Preparation</td>
<td>2nd Planting, Scout Insects</td>
</tr>
<tr>
<td>3</td>
<td>Plant Growth</td>
<td>Germination, Thinning</td>
</tr>
<tr>
<td>4</td>
<td>Weeds</td>
<td>Germination, Fertilization</td>
</tr>
<tr>
<td>5</td>
<td>Plant Parts</td>
<td>Harvest, Thinning</td>
</tr>
<tr>
<td>6</td>
<td>Caring for the Environment</td>
<td>Weeding, Fertilizing</td>
</tr>
<tr>
<td>7</td>
<td>Garden Insects</td>
<td>Thinning, Fertilizing, Planting</td>
</tr>
<tr>
<td>8</td>
<td>Plant Diseases</td>
<td>Thinning, Fertilizing</td>
</tr>
<tr>
<td>9</td>
<td>Flowers, Pollination, &amp; Fruit</td>
<td>Harvest</td>
</tr>
<tr>
<td>10</td>
<td>Composting</td>
<td>Harvest, Weeding, Scout Insects</td>
</tr>
<tr>
<td>11</td>
<td>Harvest Crops</td>
<td>Harvest, Compost Material</td>
</tr>
<tr>
<td>12</td>
<td>Putting the Garden to Bed</td>
<td>Harvest, Cover Beds</td>
</tr>
</tbody>
</table>

**Good Luck and Happy Gardening!**
Garden Construction

The geographic location of your garden and the type of native soil in the area will determine the type of garden you will need to construct. This manual has been prepared assuming that two raised garden beds of 4'x8' dimensions will be constructed. The plan will need to be altered according to the individual needs of the group you are working with.

If your soil is heavy and hard to work with, as in Nueces County, where there is a clay topsoil and a caliche subsoil, raised beds are the only way to go.

RAISED BED CONSTRUCTION (8' X 4' X 10")

Materials Needed:
12- 8' landscape timbers
12- 4' landscape timbers
20- pieces 3/8" rebar 1' long
40- 6" nails

Tools Needed:
Hack Saw
Electric 1/4" Drill
3/8" Drill Bit
1/4" Drill bit
50' Electric cord
Carpenter square

Hammer
Tape Measure
4 wooden stakes
25' Twine
10 newspapers
Building Instructions:

Four 8' landscape timbers, 2 for each bed, will be drilled for the base of the raised bed. Three 3/8" holes will be drilled for the rebar to fix the timber to the ground. (see detail #2). Also, three 3/8" holes will be drilled through the timber for drain holes. (see detail #2). Four 4' landscape timbers (2 for each bed) will be drilled for the base of the raised bed. Two 3/8" holes will be drilled for the rebar approximately 10" from each end. One 3/8" hole will be drilled in the center to function as drainage hole.

The remaining landscape timbers should be drilled with 1/4" hole about 2 " deep, 1 1/2 " from one end, 4" for the other. Eight foot timber will have a hole in the center. Cut rebar in 1 foot lengths.

Lay landscape timbers drilled for base on ground (see detail #1) with the drain holes on the bottom, making certain the corners are square. Drive rebar into ground. Follow with second timber tier with 1 1/2" hole always crossing a seam. Nail in place. Add third tier again making sure 1 1/2" hole crosses a seam.

The bed is now complete. Lay newspapers in bottom of bed, covering the grass.

The bed is now ready for 1 cubic yard of garden soil mix to be delivered and dumped directly into bed if possible. If not, soil will need to be moved by wheelbarrow.

If water and hose are available, start watering process.

Note: If beds are parallel there should be 6' between beds if possible. If beds are in a line, 6' should be left between ends.

To cut costs for constructing raised beds, consider using treated 2"X10"X8' boards for the perimeter of the bed. One 4'X8' bed requires three 2"X10"X8' boards (one cut in half for the 4' ends). Rather than rebar inserted into the boards, secure the four corners with 'L' shaped braces. Position the boards with the 2" side to the ground to make a 10" deep bed. Secure a brace on the top of the boards and also on the inside of the corner joint.

For those areas that have a loamy soil, or one that has been improved over the years, a free-standing bed is an alternative garden plan option.
Preparing a Free-Standing (10' X 5') Gardening Bed

Tools and Materials Needed:
1) Measuring Tape
2) Wooden Stakes
3) Shovels
4) String
5) Rakes
6) Hoes
7) 1 - 1 1/2 gal. Watering Can
8) Fertilizer
9) Seeds

Instructions for a Free-Standing Gardening Bed

1. Select the site and measure area.
2. Mark it using a stake in each corner.
3. Till the soil either by rototilling or turning it over with a shovel. Repeat this process three to four times until soil is in a loose workable condition. You will know the soil is ready when clods of soil are thumb nail size or smaller, but don't overwork the soil into a fine powder. The soil will be ready for "bedding-up" after it has been tilled as described above.
4. Determine the distance that you want between the beds, i.e., 30" would be fine.
5. Mark beds using the string and stakes. Run the string across the width of the plot, marking bed centers at your predetermined spacing. Using another string, run this one the length of the bed.
6. Pull soil from both sides of the length-wise string with a rake to form a mound of soil over the string. Remove all strings.
7. Water the bed as needed.
8. Plant seed or transplants on top of the beds.
9. Follow planting instructions specified for each vegetable (distance per plant, rows per bed, etc.)
# LEARNING TO GROW PROGRAM

## GARDEN GUIDELINES

### Spring Season

<table>
<thead>
<tr>
<th>Session</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teachers will be responsible for watering gardens.</td>
</tr>
</tbody>
</table>
|         | Garden Watering - -  
|         | First 4 weeks after planting gardens should be kept moist and may require daily watering. After seeds have germinated twice a week watering should be adequate |
| 1       | Water bed as needed.  
|         | Bed #1 plant broccoli, carrots, radishes.  
|         | Bed #2 plant beets, lettuce. |
| 2       | Water beds as needed.  
|         | Beds #1, #2 will plant tomatoes.  
|         | each bed 3 Celebrity, 1 Cherry, planted previously in 6" pots.  
|         | Bed #1 plant green beans.  
|         | Bed #2 plant cucumbers.  
|         | Radishes should have emerged - thin to 1” spacings.  
|         | Lettuce should have emerged. |
| 3       | Water beds as needed. Check for weeds, insects - caterpillars and diseases.  
|         | Bed #2 will plant peppers and squash.  
|         | Beets should have emerged.  
|         | Thin lettuce to 2” spacings.  
|         | Cucumbers may have emerged. |
| 4       | Water beds as needed. Check for weeds, insects, disease.  
|         | Bed #1 - fertilize broccoli with 1 cup of 15-30-15.  
|         | Bed #2 - fertilize tomatoes & peppers with 1 cup of 15-30-15.  
|         | Carrots, green beans and squash may have emerged.  
|         | Cucumbers should have emerged. |
|         | Note: If broccoli leaves have holes, check bottom of leaves for green caterpillars (worms) from 1/4” to 1” long. Pick off & destroy. |
| 5       | Water beds as needed. Check for weeds, insects, disease.  
|         | Carrots may have emerged.  
|         | Bed #2 thin beets to 3” apart, side dress  
|         | Bed #2 thin lettuce to 4” apart.  
|         | Bed #2 thin cucumbers and squash to 2 plants.  
|         | Check radishes to see if ready for harvest.  
<p>|         | Green beans should have emerged. |</p>
<table>
<thead>
<tr>
<th>Session</th>
<th>Instructions</th>
</tr>
</thead>
</table>
| 6       | - Water beds as needed. Check for weeds, insects - caterpillars, disease.  
          |   - Fertilize each tomato, pepper, & broccoli plant with 2 cups 15-30-15.  
          |   - Fertilize remaining crops with 1 cup 15-30-15. (Each crop receives 1 cup total).  
          |   - Check radishes for harvest. |
| 7       | - Water beds as needed. Check for weeds, insects, disease.  
          |   - Thin green beans to 4' spacings.  
          |   - Mulch beets, lettuce, carrots, squash, and cucumbers.  
          |   - Side dress lettuce, cucumbers and squash.  
          |   - Thin carrots to 2" spacings - side dress.  
          |   - Plant 2nd crop of radishes.  
          |   - Cucumbers may be blooming, check for pollination. |
| 8       | - Water beds as needed. Check for weeds, insects, disease.  
          |   - Thin radishes to 1" spacings.  
          |   - Squash may be blooming, check for pollination til 3rd week of April.  
          |   - Fertilize each tomato, pepper, & broccoli plant with 2 cups of 15-30-15.  
          |   - Fertilize remaining crops with 1 cup of 15-30-15. |
| 9       | - Water beds as needed. Check for weeds, insects, disease.  
          |   - Harvest beets, lettuce, broccoli, cucumbers, squash. |
| 10      | - Water beds as needed. Check for weeds, insects disease  
          |   - Harvest crops as ripe. |
| 11      | - Harvest remaining crops including carrots. |
| 12      | - Harvest remaining crops.  
          |   - Pull plants after harvest is completed.  
          |   - Cover beds with black plastic, if available, for summer. |
SPRING
GARDEN PLANTING - PLAN 1

BROCCOLI

1. Make sure soil is moist. Mark plant spacing (according to diagram) with flour to guide children.
2. Dig holes 3" deep, 2" diameter, plant as shown in diagram.
3. Remove transplants carefully, not damaging plants or roots.
4. Place plants in hole the same level they were in the container. Backfill and press soil around plants.
5. Protect plants from sun for first 3 or 4 days with tepee structure.
6. Water in, keep well watered.
7. Harvest time 60-80 days.

CARROTS

1. Because seed is small, mix it with 2 cups potting soil so it can be planted.
2. Make sure soil is watered well before planting.
3. Make a shallow trench about 1/2" deep, according to diagram.
4. Sow seed mix as evenly as possible in trench.
5. Cover with 1/2" of soil.
6. With hand, compress soil for good seed/soil contact.
7. May take up to 21 days to emerge. Carrots should be full size in 70-100 days.
RADISHES

1. Be sure soil is moist before planting.
3. Plant seed about 3 or 4 inches apart.
4. Cover with soil.
5. Use hand to firm soil over seeds.
6. No water needed until seed emerges in one week.
7. Harvest about 30-35 days.

TOMATOES

1. Make sure soil is moist.
2. Dig holes according to diagram. Holes should be slightly larger than the pot the tomatoes are in and about 2" deeper. Size hole by placing tomato and pot in hole before taking out of pot.
3. Pour 1 cup starter solution in each hole (15-30-15, 1 Tablespoon per gallon).
4. Remove plant from pot being careful not to damage root system.
5. Place in hole about 1" deeper than ground soil level.
6. Backfill with soil and firm soil around plant.
7. Water.
8. Protect plant from hot sun with shingles.

GREEN BEANS

1. Be sure seed furrow is wet 3 or 4" deep.
2. Make seedling furrow about 1 1/2" deep as shown in diagram.
3. Plant seeds, 5 or 6 beans per foot.
4. Cover with soil.
5. Firm soil over beans.
6. Beans should emerge within 7 to 10 days. Harvest in 8 weeks.
SPRING
GARDEN PLANTING - PLAN 2

1. Soak seeds in water overnight.
2. Be sure soil is moist before planting.
3. Make seed furrows 1" deep as shown in diagram
4. Plant seeds 10-12 seeds per foot.
5. Cover with soil.
6. Seeds will germinate in 1 to 3 weeks. Harvest 55-80 days.

LETTUCE

1. Because seed is small, mix with potting soil - about 2 cups.
2. Be sure garden soil is moist.
3. Make seeding furrow about 1/2" deep, spaced according to diagram
4. Spread mixture in furrow.
5. Cover with soil.
6. Firm soil by pressing with hand.
7. DO NOT water until seed has emerged - 3 or 4 days.
8. Harvest in 60 days.
TOMATOES

1. Make sure soil is moist.
2. Dig holes according to diagram. Holes should be slightly larger than the pot the tomatoes are in and about 2" deeper. Size hole by placing tomato and pot in hole before taking out of pot.
3. Pour 1 cup starter solution in each hole (15-30-15, 1 Tablespoon per gallon).
4. Remove plant from pot being careful not to damage root system.
5. Place in hole about 1" deeper than ground soil level.
6. Backfill with soil and firm soil around plant.
7. Water
8. Protect plant from hot sun.

CUCUMBERS

1. Make sure soil is moist.
2. Mix 2 tablespoons fertilizer in area to be planted.
3. Plant 6 seeds in a 6" circle - 1 1/2" deep, according to diagram.
4. Firm soil over seeds.
5. Seeds should emerge within 5 to 14 days.

BELL PEPPERS

1. Soil should be moist.
2. Dig holes 4" deep and 3" in diameter as shown in diagram.
3. Pour 1/2 cup starter solution in each hole (15-30-15, 1 Tbs. per gallon).
4. Let all starter solution drain into hole.
5. Put enough soil back into hole so plant and garden soil are level.
6. Remove plants from 6 pack container being careful not to injure plant roots.
7. Place plant in hole and backfill. Firm soil around plant.
8. Peppers should begin blooming 3 weeks after planting, side dress with first bloom. Harvest 45-60 days after 1st bloom.

SQUASH

1. Mix 2 Tablespoons fertilizer where seeds are to be planted and mix well.
2. Make sure soil is moist.
3. Plant 6 squash seed in 6" circle, 1 1/2" deep, according to diagram.
4. Firm soil over seed.
5. Seeds should emerge with 5 to 7 days.
## LEARNING TO GROW PROGRAM
### GARDEN GUIDELINES
#### Fall Season

<table>
<thead>
<tr>
<th>Session</th>
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</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>Teachers will be responsible for watering gardens.</td>
</tr>
<tr>
<td>○</td>
<td>Garden Watering -- First 4 weeks after planting gardens should be kept moist and may require daily watering. After seeds have germinated twice a week watering should be adequate.</td>
</tr>
<tr>
<td>○</td>
<td>Water bed as needed.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 plant broccoli, radishes, cabbage, cauliflower.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #2 plant tomatoes, peppers.</td>
</tr>
<tr>
<td>1</td>
<td>○ Water beds as needed.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 plant carrots, eggplant.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #2 plant beets, lettuce.</td>
</tr>
<tr>
<td>○</td>
<td>Radishes should have emerged - thin to 1&quot; spacings.</td>
</tr>
<tr>
<td>2</td>
<td>○ Water beds as needed. Check for weeds, insects - caterpillars and diseases.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 will plant spinach, green beans.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #2 will plant pole beans, cucumbers.</td>
</tr>
<tr>
<td>○</td>
<td>Lettuce should have emerged.</td>
</tr>
<tr>
<td>3</td>
<td>○ Water beds as needed. Check for weeds, insects, disease.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 - fertilize broccoli, cabbage, &amp; cauliflower with 1 cup of 15-30-15.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #2 - fertilize tomatoes &amp; peppers with 1 cup of 15-30-15.</td>
</tr>
<tr>
<td>○</td>
<td>Carrots, spinach, green beans, pole beans, cucumbers, and beets should have emerged.</td>
</tr>
<tr>
<td>○</td>
<td>Check radishes, may be ready for harvest.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Note:</strong> If broccoli leaves have holes, check bottom of leaves for green caterpillars (worms) from 1/4&quot; to 1&quot; long. Pick off &amp; destroy.</td>
</tr>
<tr>
<td>○</td>
<td>Water beds as needed. Check for weeds, insects, disease.</td>
</tr>
<tr>
<td>○</td>
<td>Harvest all radishes and replant second crop.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 thin carrots &amp; beets to 1&quot; apart.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 thin green beans to 4&quot; apart.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #1 thin spinach to 2&quot; apart.</td>
</tr>
<tr>
<td>○</td>
<td>Bed #2 thin pole beans &amp; cucumbers, 4 plants to a cage.</td>
</tr>
<tr>
<td>5</td>
<td><strong>NOTE:</strong> If cauliflower head is forming, immediately tie all leaves up around head, use wire twists. Prevents greening of head.</td>
</tr>
<tr>
<td>Session</td>
<td>Instructions</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
</tr>
</tbody>
</table>
| 6       | ○ Water beds as needed. Check for weeds, insects - caterpillars, disease.  
          ○ Fertilize each tomatoes, spinach, peppers & eggplant with 2 cups 15-30-15.  
          ○ Fertilize remaining crops with 1 cup 15-30-15, (Each crop receives 1 cup total).  
          ○ Bed #1 - thin beets to 2" apart, thin radishes to 1" apart.  
          ○ Bed #2 - thin lettuce to 2" apart. |
| 7       | ○ Water beds as needed. Check for weeds, insects, disease.  
          ○ Bed #1 thin spinach to 4" spacings.  
          ○ Bed #2 thin lettuce to 4" spacings. |
| 8       | ○ Water beds as needed. Check for weeds, insects, disease.  
          ○ Radishes may be ready for harvest.  
          ○ Bed #1 fertilize broccoli, cauliflower, cabbage & eggplant with 1 cup of 15-30-15.  
| 9       | ○ Water beds as needed. Check for weeds, insects, disease.  
          ○ Broccoli, cauliflower, tomatoes, beets, spinach, green beans and cucumbers may be ready for harvest.  
          NOTE Green and pole beans must be harvested weekly to ensure continued blooming. |
| 10      | ○ Water beds as needed. Check for weeds, insects disease  
          ○ Cabbage, peppers, eggplant, lettuce, & pole beans may be ready for harvest. |
| 11      | ○ Harvest remaining crops including carrots. |
| 12      | ○ Harvest any remaining crops.  
          ○ Pull plants after harvest is completed. |
INSTRUCTIONS FOR PLANTING

BROCCOLI, CAULIFLOWER, CABBAGE

1. Make sure soil is moist. Mark plant spacing, according to diagram.
2. Dig holes slightly larger than present container, spaced according to diagram.
3. Remove transplants carefully, not damaging plants or roots.
4. Place plants in hole the same level they were in the container. Backfill and press soil around plants.
5. For protection, place a 6" bottomless pot around plant. Press into ground 3" deep.
6. Water in, keep well watered.

RADISHES

1. Be sure soil is moist before planting.
3. Plant seed about 3 or 4 inches apart.
4. Cover with soil.
5. Use hand to firm soil over seeds.
6. No water needed until seed emerges in one week.
7. Harvest about 30-35 days.
CARROTS

1. Because seed is small, mix it with 2 cups potting soil so it can be planted.
2. Make sure soil is watered well before planting.
3. Make a shallow trench about 1/2" deep, according to diagram.
4. Sow seed mix as evenly as possible in trench.
5. Cover with 1/2" of soil.
6. With hand, compress soil for good seed/soil contact.
7. May take up to 21 days to emerge.

EGGPLANT

1. Make sure soil is moist before planting.
2. Dig holes slightly larger than present container.
3. Put 1 cup of starter solution in hole.
4. Remove transplants carefully, not damaging plants or roots.
5. Place plants in hole the same level they were in the container.
   Backfill and press soil around plants.

SPINACH - NOTE: Spinach requires overnight preparation.

1. Put seeds in glass jar with water and store in refrigerator for 24 to 48 hours before planting.
2. Make sure garden soil is moist.
3. Plant pre-soaked seeds in 2 rows, 1/2" deep, 8-10 seeds per foot.

GREEN BEANS

1. Be sure seed furrow is wet 3 or 4" deep.
2. Make seedling furrow about 1 1/2" deep as shown in diagram.
3. Plant seeds, 5 or 6 beans per foot.
4. Cover with soil.
5. Firm soil over beans.
6. Beans should emerge within 7 to 10 days.
INSTRUCTIONS FOR PLANTING

TOMATOES

1. Make sure soil is moist.
2. Dig holes according to diagram. Holes should be slightly larger than the pot the tomatoes are in and about 2" deeper. Size hole by placing tomato and pot in hole before taking out of pot.
3. Pour 1 cup starter solution in each hole (15-30-15, 1 Tablespoon per gal).
4. Remove plant from pot being careful not to damage root system.
5. Place in hole about 1" deeper than ground soil level.
6. Backfill with soil and firm soil around plant.
7. Water
8. Center cage over plant. Wrap cage with 3' clear plastic and attach with clothes pins.

BELL PEPPERS

1. Soil should be moist.
2. Dig holes slightly larger than present container.
3. Pour 1 cup starter solution in each hole (15-30-15 1 Tbsls. per gallon).
4. Let all start solution drain down into hole before planting.
5. Remove plants from container being careful not to injure plant roots.
6. Place plant in hole at same level as they were in the container and backfill. Firm soil around plant.
7. Peppers should begin blooming in 3 weeks after planting.
BEETS - NOTE: Beets require overnight preparation.

1. Soak seeds in water overnight.
2. Be sure soil is moist before planting.
3. Make seed furrows 1" deep as shown in diagram.
4. Plant seeds 10-12 seeds per foot.
5. Cover with soil.
6. Seeds will germinate in 1 to 3 weeks.

LETTUCE

1. Because seed is small mix with sand - about 2 cups.
2. Be sure garden soil is moist.
3. Make seedling furrow about 1/2" deep, spaced according to diagram.
4. Spread seed mixture in furrow.
5. Cover with soil.
6. Firm soil by pressing with hand.

POLE BEANS

1. Make sure soil is moist.
2. Put cage in place according to diagram.
3. Plant 1 bean at each cage downwire, 1 1/2" deep.
4. With hand, compress soil for good seed/soil contact.

CUCUMBERS

1. Make sure soil is moist.
2. Plant 6 seeds in a 6" circle -- 1 1/2" deep, according to diagram.
3. Firm soil over seeds.
4. Center cage over planting mound.
5. Seeds should emerge within 5 to 14 days.
<table>
<thead>
<tr>
<th>VEGETABLE</th>
<th>SOURCE</th>
<th>DAYS TO HARVEST</th>
<th>SPRING PLANTING</th>
<th>FALL PLANTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bean, Bush - Green</td>
<td>Seed</td>
<td>56</td>
<td>Feb. 15th - Apr. 15th</td>
<td>Aug 15th - Sept 10th</td>
</tr>
<tr>
<td>Bean, Pole - Green</td>
<td>Seed</td>
<td>70</td>
<td>Mar. 5th - Apr. 15th</td>
<td>Aug 15th - Sept 10th</td>
</tr>
<tr>
<td>Beet</td>
<td>Seed</td>
<td>55-80</td>
<td>Jan. 15th - Apr. 15th</td>
<td>Sept. 15th - Nov. 1st</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Transplant</td>
<td>60-80</td>
<td>Jan. 15th - Feb. 15th</td>
<td>Sept. 10th - Oct. 15th</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Seed</td>
<td>60-80</td>
<td>Not Recommended</td>
<td>Sept. 10th - Oct. 15th</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Transplant</td>
<td>75-80</td>
<td>Jan. 15th - Feb. 10th</td>
<td>Sept. 10th - Oct. 15th</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Seed</td>
<td>75-80</td>
<td>Not Recommended</td>
<td>Aug. 1st - Oct. 1st</td>
</tr>
<tr>
<td>Carrot</td>
<td>Seed</td>
<td>70-100</td>
<td>Jan. 15th - Feb. 10th</td>
<td>Sept. 15th - Nov. 20th</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Transplant</td>
<td>60-65</td>
<td>Jan. 15th - Feb. 15th</td>
<td>Sept. 10th - Oct. 15th</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Seed</td>
<td>60-65</td>
<td>Not Recommended</td>
<td>Sept. 10th - Oct. 15th</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Seed</td>
<td>55-60</td>
<td>Feb. 10th - Apr. 10th</td>
<td>Sept. 1st - Jan. 10th</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Transplant</td>
<td>70-90</td>
<td>Feb. 20th - Mar. 15th</td>
<td>July 10th - Aug. 10th</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Seed</td>
<td>50-65</td>
<td>Jan. 15th - Mar. 15th</td>
<td>Sept. 1st - Nov. 1st</td>
</tr>
<tr>
<td>Pepper, Bell</td>
<td>Transplant</td>
<td>65-80</td>
<td>Feb. 20th - Mar. 15th</td>
<td>Aug. 10th - Sept. 10th</td>
</tr>
<tr>
<td>Radishes</td>
<td>Seed</td>
<td>20-30</td>
<td>Jan. 15th - Apr. 15th</td>
<td>Sept. 1st - Dec. 1st</td>
</tr>
<tr>
<td>Spinach</td>
<td>Seed</td>
<td>50-70</td>
<td>Jan. 1st - Feb. 10th</td>
<td>Sept. 15th - Dec. 1st</td>
</tr>
<tr>
<td>Squash, Yellow</td>
<td>Seed</td>
<td>41-60</td>
<td>Feb. 10th - Apr. 10th</td>
<td>Sept. 1st - Oct. 1st</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Transplant</td>
<td>68-85</td>
<td>Feb. 10th - Mar. 15th</td>
<td>Aug. 1st - Sept. 10th</td>
</tr>
</tbody>
</table>
A good plan is the first step in establishing a home vegetable garden. Planning includes selecting the garden location; deciding on size and kinds and varieties of vegetables to plant; and determining where, when and how much of each vegetable to plant in the garden.

Site Selection

Choose a place where the soil is loose, rich, level and well-drained. Do not choose low areas where water stands or the soil stays wet. Vegetables will not grow in poorly drained areas.

Do not plant where weeds do not grow; vegetables will not grow well there either.

Vegetables need sunlight to grow well. Do not plant where buildings, trees or shrubs will shade the garden. Most vegetables need at least 6 hours of sunlight daily.

Do not plant vegetables under branches of large trees or near shrubs because they rob vegetables of food and water.

Plant the garden near a water supply if possible. In many areas a garden can grow without watering, but is more likely to be successful if it is irrigated. Water is needed especially during long, dry periods or when planting seeds.

Few people have the perfect garden plot, so look for the best spot possible.

Garden Size

Making the garden too large is one of the most common mistakes made by enthusiastic, first-time gardeners. If the garden is too large, it will be too much work. Consider the following items in deciding on garden size:

Available room. For apartment dwellers, the garden may be a planter box. However, in a suburban or rural area, there may be plenty of ground space for a garden.

Available time. If planning to garden after work, school or on weekends, there may not be enough time to care for a large garden.

Family size. If gardening is a family activity, a large space can be cared for. A larger family also can use more vegetables.

Reason for gardening. If the garden is purely a recreational activity, a container or flower bed garden may be big enough. If growing vegetables for canning or freezing, a bigger area is needed.

Kind of vegetables grown. Some vegetables take a lot of room. Most need at least 3 feet of space between rows. If 10 rows of vegetables are desired, the garden must be 30 feet wide.

Deciding What to Grow

What to grow in the garden is as big a decision as where to locate it. Consider the following points in selecting vegetables to grow:

Space available. Do not plant watermelons in a small garden. They take up too much room. Other vine crops such as cucumbers and cantaloupes can be grown on a trellis or fence.

Expected production from the crop. The smaller the garden, the more important it is to get high production from each row. Small, fast-maturing crops such as radishes, turnips and beets yield quickly and do not require much space. Tomatoes, bush beans, squash and peppers require more space, but produce over a long season.

Table 1. Some vegetables for a small garden

<table>
<thead>
<tr>
<th>Bush beans</th>
<th>Chard</th>
<th>Onions</th>
<th>Carrots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>Turnips</td>
<td>Lettuce</td>
<td></td>
</tr>
<tr>
<td>Peppers</td>
<td>Beets</td>
<td>Broccoli</td>
<td></td>
</tr>
<tr>
<td>Eggplant</td>
<td>Radishes</td>
<td>Bush squash</td>
<td></td>
</tr>
</tbody>
</table>

Cost of vegetables if purchased. Plant vegetables which are expensive to buy. Broccoli usually is high priced in the grocery store. It can be grown in most home gardens.

Food value of vegetables. All vegetables are good but some are more nutritious than others.
Grow different kinds of vegetables to put more variety in the diet.

*Personal preference.* This is especially important if the garden is purely for recreational or personal enjoyment. Grow vegetables the family likes to eat.

**Location of Vegetables in the Garden**

Arrange vegetables for most efficient use of space and light. Group tall-growing vegetables such as okra, corn and tomatoes together on the north side of the garden. This reduces shading of smaller vegetables such as bush beans. Group vegetables according to maturity. This makes it easier to replant after removing an early crop such as lettuce or beets. See figure 1.

![Figure 1](image1)

Plant small, fast-maturing vegetables between larger ones. Plant vine crops near a fence or trellis if possible.

Make a drawing on paper to show the location and spacing of vegetables in the garden. See figure 2.

![Figure 2](image2)

**Timing of Planting**

Vegetables are divided into two general groups — warm season and cool season. Cool season crops can stand lower temperatures; plant them before the soil warms in the spring. They also can be planted to harvest after the first frost in the fall.

Warm season crops cannot tolerate frost and will not grow when the soil temperature is cool. Plant them after frost in the spring and early enough to mature before frost in the fall.

<table>
<thead>
<tr>
<th>Table 2. Temperature classification of some vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool season</td>
</tr>
<tr>
<td>Beets</td>
</tr>
<tr>
<td>Carrots</td>
</tr>
<tr>
<td>Cabbage</td>
</tr>
<tr>
<td>Broccoli</td>
</tr>
<tr>
<td>Onions</td>
</tr>
</tbody>
</table>

**Deciding How Much to Plant**

Some vegetables produce more than others so fewer plants will be needed. The amount to plant depends on family size, expected production and whether or not freezing or canning is planned. Do not plant too much. Over-planting is wasteful and takes too much work.

<table>
<thead>
<tr>
<th>Table 3. Amount of some vegetables to plant per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable</td>
</tr>
<tr>
<td>Approximate amount to plant</td>
</tr>
<tr>
<td>Beets</td>
</tr>
<tr>
<td>Carrots</td>
</tr>
<tr>
<td>Corn</td>
</tr>
<tr>
<td>Bush green beans</td>
</tr>
<tr>
<td>Pole green beans</td>
</tr>
<tr>
<td>Greens</td>
</tr>
<tr>
<td>Leaf lettuce</td>
</tr>
<tr>
<td>Okra</td>
</tr>
<tr>
<td>Onions</td>
</tr>
<tr>
<td>Peppers</td>
</tr>
<tr>
<td>Radishes</td>
</tr>
<tr>
<td>Squash, summer</td>
</tr>
<tr>
<td>Tomatoes</td>
</tr>
<tr>
<td>Turnips</td>
</tr>
<tr>
<td>Broccoli</td>
</tr>
<tr>
<td>Cucumbers</td>
</tr>
<tr>
<td>Collards</td>
</tr>
</tbody>
</table>
The soil is a storehouse for nutrients, organic matter, air and water plants need to grow. Soil also supports plants by providing a place to grow.

Properly prepared and cared for soil can be improved each year and will continue to grow plants forever. Uncared for soil will soon become suited only for growing weeds.

Soil Types

Texas gardeners must work with many different soils. Some are very sandy. Some are sticky clay and others are rocky and shallow.

Sandy soils do not hold enough water; in windy areas blowing sand can injure vegetables. Clay soils hold too much water and do not allow enough air to enter the soil.

Vegetables need a deep and well-drained soil with adequate organic matter. Good garden soil with proper moisture will not form a hard ball when squeezed in the hand. It also should crumble easily when forced between the fingers. It should not crack or crust over when dry. See figure 1.

Soil Improvement

Almost all garden soils can be improved. Soil additives are materials added to soil to improve its production. They are added to build up soil organic matter or to make soil more workable. Organic matter:

- Looseens tight clay
- Helps sand hold more water
- Makes soil easier to dig
- Adds some nutrients

Some common organic matter additives are:

Plant materials – leaves, straw, grass clippings. Work into the soil several months prior to planting. Most gardeners add them during the winter.

Manure – add dry well ahead of planting. Fresh manure can damage plants. About 30-40 pounds of dry manure per 100 square feet usually is enough.

Compost – made of decayed plant materials. Work into the soil prior to planting.

Sawdust – compost before adding to the garden.

Green manure – rye or oats. Plant in the fall and plow or spade under in the spring. These cannot be used if a fall garden is planted.

Do not add more than a 3-inch layer of organic material.

Most heavy clay soils benefit from the soil additive, gypsum. It adds some nutrients and helps make clay soil more workable. Spread about 3-4 pounds of gypsum per 100 square feet over garden soil after it has been dug in the winter. Work it into the soil or allow to wash in by rainfall.

Add sand to clay soil to make it more workable. Add organic material with the sand. Mix 2 inches of clean sand and 3 inches of organic material, such as leaves, with the soil. Do this during the winter.

Tilling Soil

The soil should be tilled as deeply as possible, at least 8-10 inches. Deep tilling loosens soil and lets vegetable roots go deeper. Turn each shovelful of soil completely over. See figure 2.
Till soil when it is moist, but not wet. Working soil when too wet can cause it to become rough. Spade the soil in the winter to prepare for spring planting. Winter temperature and moisture help mellow soil. This is especially important if the soil is being worked for the first time.

Add organic matter each year during soil preparation to build and maintain the soil. Be sure all plant material is turned under the soil. If organic material is added before planting a fall garden, it should be well-rotted such as compost.

Prior to planting time the soil should be raked clean and leveled. Remove all sticks, rocks and other material.

Row Preparation
In most Texas areas vegetables should be planted on raised beds. See figure 3. Raised beds:

- Allow water to drain away from plant roots
- Provide furrow for irrigation
- Allow air to enter soil
- Help plants through periods of high rainfall

If the garden is large enough, make rows 36 inches apart. Where space is a problem, some vegetables can be planted in rows closer than 36 inches, but more care is required during growing season.

Straight beds are nice but not necessary. In small gardens worked with a hoe, rake or other hand tools, straight beds are not as important.

If the garden is large and worked with a rototiller or garden tractor, the rows should be made as straight as possible.

Use a shovel or rake to pull the soil up into beds 8-10 inches high. Pack beds or allow them to settle prior to planting. Before planting, level the top of the bed and widen it to about 6-8 inches. Plant on top of the bed. See figure 4.

After completing the steps required to properly prepare soil for planting, gardening might seem anything but "easy." With proper soil preparation, gardening will get "easier" every year.
A good home gardener recognizes symptoms of plant diseases quickly and takes steps to prevent or control them. Diseased plants do not grow normally. Diseased plants may have one or more of the following symptoms: stunted, wilted, spots on leaves, stems or fruit; decayed fruit, decayed areas on the stems, distorted leaves, rapid death of leaves, and discoloration of leaves and fruit. Foliage symptoms on plants infected with a bacterium or fungus will normally develop first on the older leaves. Virus symptoms develop on the younger leaves.

Causes of Plant Diseases

Plant disease-causing organisms are divided into four groups — viruses, bacteria, fungi and nematodes. Viruses are very simple forms of life. They are often spread to healthy plants by insects or on one's hands during normal gardening practices.

Bacterial cells are much larger than virus particles, but they are still too small to see with the naked eye. Bacterial cells move in the water film on the leaf surface or in the water surrounding plant roots or soil particles. They are most often spread by splashing water.

Fungal spores are larger than bacterial cells but are not visible without a microscope. Fungi are like small plants. Most plant diseases caused by fungi are most severe during periods of moderate temperatures and when water is retained on the leaves or fruit for an extended period of time. Many fungi are spread by wind, splashing rain and equipment.

Nematodes are small, worm-like animals which live in the soil. They feed on plant roots, causing stunted plants. Root knot is the most damaging nematode in the home garden. It causes galls or knots on susceptible plants such as tomatoes, cucumbers, squash, beans and many other vegetables.

*Extension plant pathologist, The Texas A&M University System

When Do Diseases Occur?

Plant diseases are worst when light rain showers or heavy dews have fallen and when temperatures are mild. During these times, watch your garden closely for signs of disease.

Signs of Plant Diseases

Plant diseases are evident in many ways. They attack all parts of the plant, as shown in Figure 1. Plants can get diseases from the time the seed is placed in the soil until the vegetable is eaten. It is important to identify disease symptoms quickly, so that control practices can be taken to prevent unnecessary loss.

Disease Control in the Garden

Fertilize and water plants properly to keep them strong. Healthy plants do not get diseases as easily as weak ones.

It is best to irrigate the garden by running water between the rows or by trickle irrigation. Irrigate a garden by running water between the rows. Do not sprinkle leaves; this only encourages more disease problems. If you must sprinkle plants, do so before 10 a.m.

Avoid planting vegetable varieties in areas where the same vegetable or vegetable from the same plant family were planted in the last 24 months. Rotations to avoid are:

- tomatoes, eggplant and potatoes
- squash, cucumber, pumpkin, melons
- cabbage, broccoli, cauliflower, mustard, turnips and collards

It is best to plant on a raised bed. This will allow excess water to move out of the root area and prevent many root diseases and fruit rots.
When possible train vegetables to grow upright using cages or trellises. This will keep the fruit from contacting the soil and reduce fruit rots.

Plant productive disease resistant varieties when available. Resistant varieties may reduce the need for the use of crop care products on a regular schedule or in some cases their use may eliminate the need completely.

In some cases, crop care products may be required to control plant diseases during the year. These products should be used with caution and only when needed. Read and follow the label carefully. Although several products are approved for use in the garden, some of the copper-containing products and sulfur are considered to be organic-based products. However, they are not always the most effective. Before using any crop care product, make sure the vegetables that you are spraying are listed on the label.

**Nematode Control**

Nematodes in the soil are best controlled using a combination of practices that will reduce the nematode population to numbers that will not cause significant plant damage. The following practices can be used to reduce nematode numbers:

- Plant nematode resistant varieties
- Plant non-host plants in rotation with susceptible varieties
- Till the soil during the summer months to remove soil moisture (must be done after plants have been removed)
- Cover the soil with clear plastic and leave in place for 6 to 8 weeks during June, July, August or September
- Plant Elbon rye during the fall and early winter

Gardeners using one or more of these practices can reduce the population of nematodes in the soil. You can almost never completely eliminate nematodes. This means that each year you will need to take steps to control this pest.

Currently no crop care chemicals are recommended for use in the home garden for nematode control.
Plants must have light, moisture and nutrients to grow. The sun provides light. Moisture comes from rainfall or irrigation. Nutrients come from fertilizers.

Fertilizer will increase plant growth only if it is the limiting factor. Plants grown in poorly drained soils, in excessive shade or in competition with tree roots will not respond to fertilizer.

Fertilizer is organic or inorganic. Organic fertilizers are made of manures, bone meal, cotton seed or other naturally occurring materials. Inorganic fertilizers are made of man-made products. They usually are higher in plant nutrients.

Buying Fertilizers
The three numbers shown on fertilizer containers are the fertilizer analysis. They indicate the percent of nitrogen, phosphorous and potassium present in the fertilizer. These figures are always listed in the same order. So, a 100-pound sack of 10-20-10 fertilizer contains 10 pounds of nitrogen, 20 pounds of phosphorous and 10 pounds of potassium. This equals 40 pounds of nutrients. The rest of the fertilizer is simply carrier or filler, such as sand, perlite or rice hulls. See figure 1. A complete fertilizer is one with all three elements.

This bag contains:
10% Nitrogen
20% Phosphorus
10% Potash or Potassium
Figure 1

Plants need nitrogen for all growth, including roots, leaves, stems, flowers and fruits. It helps give plants their green color and also is needed to form protein. A lack of nitrogen causes the lower leaves to turn yellow. Too much nitrogen kills plants.

Phosphorous is needed for cell division and to help form roots, flowers and fruit. Phosphorus deficiency causes stunted growth and poor flowering and fruiting.

Potassium is in many chemical processes required for plants to live and grow.
A potassium shortage shows up in various ways, but stunted growth and yellow color on lower leaves are common symptoms in many plants. Potassium is sometimes called potash.
Consider the cost per pound of nutrient when buying fertilizer. Generally, higher analysis fertilizers and larger containers are less expensive. For example, a 50-pound bag of 10-20-10 may not cost any more than a 50-pound bag of 5-10-5 fertilizer, but it contains twice the nutrients.

Fertilizer Selection
Most gardeners should use a complete fertilizer with twice as much phosphorous as nitrogen or potassium such as 10-20-10 or 12-24-12. These fertilizers usually are readily available through local sources.
Some soils contain enough potash for good plant growth so no more is needed.
Since slight excesses of potash will not injure plants, it usually is best to use a complete fertilizer.
Do not use lawn fertilizers on gardens. They contain too much nitrogen and many have chemicals included for lawn weed control that can injure or kill vegetables.
Some soils need lime. Lime adds calcium to the soil and makes it less acidic.

Using Fertilizer
Gardeners should have the soil tested about every 2 years. This is especially important for beginning gardeners who are unfamiliar with growing plants. The soil test shows if additional fertilizer or lime is needed.
To collect a soil sample, select a time when the soil is moist but not wet. Dig down about 4-6 inches and take a handful of soil. Do this in several different places over the garden. Place each handful of soil in a large container and mix. From this take about ½ pint of soil for the sample. See figure 2. The sample can be taken in midwinter to prepare for spring planting. County Extension agents can supply a container and tell where to send the sample for testing.

*Respectively, Extension horticulturist — special programs and Extension horticulturist, The Texas A&M University System.
If the garden soil is not tested, use 2-3 pounds of fertilizer such as 10-20-10 for every 100 square feet of garden area. A plot 10 \times 10 \text{ feet} \ (or \ 5 \times 20 \text{ feet}) would be 100 square feet. See figure 3. If a garden is 30 feet long and the rows are 3 feet apart, each row is almost 100 square feet. Use 2 pounds of fertilizer if the garden is sandy and 3 pounds if the soil is mostly clay.

Use 2-3 pounds of fertilizer such as 10-20-10 for every 100 square feet of garden area.

Figure 3

Do not use too much fertilizer. This can kill plants. Two cups of most fertilizers will weigh about 1 pound. If a fertilizer has more nitrogen, use less. Two pounds of 5-10-5 fertilizer supplies as much nitrogen as 1 pound of 10-20-10.

If using organic fertilizer such as barnyard manure, spread it evenly over the garden and work into the soil. Use 20-30 pounds of manure for each 100 square feet of garden. Do not use too much. Do not use fresh manure as it can injure plants. See figure 4.

Mix organic matter into soil.

Figure 4

Methods of Applying Fertilizer

Fertilizers are applied four ways:

- **Broadcast before planting.** The proper amount of fertilizer is spread evenly over the garden and mixed with the soil to a depth of 3-4 inches before rows are made. This method is the least likely to cause plant damage and usually is best for home gardeners.

- **Band or row applications.** The fertilizer is applied in a strip to the side of the row before planting. See figure 5. This method requires care to prevent plant damage from roots coming in contact with the fertilizer band.

- **Starter solution.** This is used only on transplants such as tomatoes, pepper, eggplants, and cabbage. Mix 2 tablespoons of garden fertilizer in each gallon of water and stir well. Pour 1 cup of the mix into the hole and let it soak in before transplanting. See figure 6.

- **Application to growing plants or sidedressing.** This is especially helpful on sandy soils or when rainfall is high. Fertilizer is sprinkled along the side of rows and watered into the soil. See figure 7.

Sprinkle fertilizer along the side of rows and water into the soil.

Figure 7

About ½ cup of garden fertilizer for each 10 feet of row usually is enough. Easy Gardening crop publications tell when and how much fertilizer to apply. Sidedressing increases the yield of most vegetables.

Fertilizing for fall gardens is very similar to spring garden fertilizing. If a fall garden follows a well fertilized spring garden, only about one-half the recommended rate is needed at planting. Apply 1-2 pounds per 100 square feet.
Mulching your garden shows you really care about your plants. A mulch is any substance spread on the ground to protect plant roots from heat, cold or drought or to keep fruit clean.

Mulching is a long established horticultural practice. Farmers know that shallow cultivation of the soil's surface after a rain slows the rate of water loss from the soil. The shallow layer of dry surface soil acts as a mulch.

Mulches can be classified as inorganic or organic. Inorganic mulches include plastic, rocks, rock chips and other non-plant materials; whereas, organic mulches include straw, compost, sawdust and similar materials. Plastic is the only inorganic mulch used in vegetable gardens.

Value of Mulches

A thin layer of mulch on the soil surface (especially in sloping gardens) reduces the washing away of soil particles by rushing water. Also, mulches prevent raindrops from splashing on the soil surface. See figure 1.

Saving soil moisture is an important use of mulch in Texas. A mulch layer on the soil surface allows the soil to soak up more water. Mulch also reduces the rate of water loss from the soil. A 3-inch layer of mulch on the soil surface dries much faster than the soil below it. Thus it prevents water from moving into the air. See figure 2.

*Extension horticulturist-special programs, The Texas A&M University System.
Mulches modify soil temperature in home gardens. Applied in late fall, winter mulch insulates plant roots, crowns and stems of winter crops from extremely low temperatures.

Proper mulching in summer months keeps the soil cooler. Soil covered by black or clear plastic or dark organic mulch in early spring warms faster than bare soil. This allows earlier planting of warm-season crops. See figure 3.

Use light-colored paper such as newspaper in summer to keep the soil cooler. Organic mulches such as compost and sawdust also keep soil below the mulch layer cooler in summer. Dark soil warms much faster than light-colored soil. See figure 4.

Organic mulches enrich the soil as they decay and provide a better environment for plant growth. Soils high in organic matter are easier to till and better suited to vegetable gardening. Adding organic material makes soils more crumbly, especially clay soils that pack and crust.

Mulches help plants by gradually increasing soil fertility. An organic mulch such as straw or newspaper can be turned under the soil at the end of the season. This helps build the soil's organic matter content. Turn the mulch under as soon as the gardening season is over so it breaks down before the garden is replanted.

Most mulches also provide excellent weed control. Mulches do not prevent weed seeds from sprouting. However, weed seedling emergence is blocked by a mulch layer thick enough to exclude light. A 3-inch layer of mulch on the soil surface keeps most annual weed seedlings from coming through. See figure 5. Weeds that break through are removed more easily from mulched soil. Hard-to-control weeds such as nutgrass and johnsongrass may come through the mulch layer but can be pulled more easily or covered by fluffing the mulch with a fork.
A well-mulched garden can yield 50 percent more than an unmulched garden the same size. Space rows closer as there is little or no need to cultivate the soil. Plant food is more available in cooler soil, and the extra soil moisture increases plant growth and yields. You will harvest more fruit because of less fruit rot. Fruit does not touch the soil, and soil is not splashed up on the fruit. See figure 6. This is true for tomato fruits that rot easily when resting on the soil surface. Potatoes can be mulched heavily as the vines grow. This causes tubers to form in and under the mulch layer. These potatoes are less susceptible to soil rot, easier to harvest and less likely to be bruised during harvest.

Garden mulching reduces maintenance. A good mulch layer eliminates the need for weeding, and mulched vegetables are cleaner at harvest time. Fruits of tomato, melon and squash plants never touch the soil.

**Mulching Materials**

Many materials are available for mulching a garden. Some examples are: compost, straw, gin trash and sawdust.

- Compost is generally the best mulching material for the home garden. It is usually free of weed seeds and is inexpensive. Prepare compost from materials present in your yard. It is not necessary to purchase expensive materials for mulching.

- Straw is short lived and coarse textured. More straw is needed for the same effect as compost or lawn clippings. Generally, less of the finer-textured materials is required to provide a 3-inch layer of mulch after settling. Compost, however, usually requires only about 4 inches to provide a 3-inch mulch layer.

- Gin trash is commonly available in Texas. It is risky to use, however, without knowing its source and prior treatment. Make sure that the farmer did not use arsenicals on the cotton. Arsenicals are long-lived chemicals that can be present in gin trash for several months or years. Also, gin trash may contain weed seeds and diseases. Compost gin trash before applying it to your garden to make it safer and easier to use. The heat generated by composting kills most weed seeds and most disease organisms that infect plants.

- Sawdust is commonly available especially in East Texas. If well managed, it can be a good mulch. It can result in a temporary, but sharp, decrease in soil nitrogen. Add a small amount of garden fertilizer to the soil after applying sawdust directly to a garden. Even better, add nitrogen to sawdust, then compost it before spreading it on your garden.

- Plastic is an effective mulch if used properly. Use black plastic in the spring and early summer to warm the soil. Black plastic keeps light from the soil and prevents weeds from growing. Clear plastic warms the soil, but weeds can grow beneath the plastic. A disadvantage of plastic is that it cannot be turned into the soil at the end of the season. See figure 7.

**Selection of Mulching Material**

When selecting materials, consider these factors:

- *Cost of the material.* Do not spend money on mulching material when suitable materials are available at little or no cost.
- The crop you plan to mulch. Never use mulch material from the crop that is to be protected. For example, do not use potato vines from the spring crop to mulch fall potatoes for the possibility of disease is increased.

- When the mulch is to be used. Select a light-colored mulch during the summer and early fall to reflect heat. Use a dark-colored mulch in early spring to help warm the soil to permit earlier planting and hasten early growth.

**Using Mulches**

Spread mulches on freshly cultivated, weed-free soil before plants are large enough to interfere. Apply organic mulch thick enough to leave a 3-inch layer after settling. Four inches of fine materials like compost should be adequate. Remember that coarser materials, such as straw, settle and may require 6 inches or more initially. If you use newspaper, place three layers on each side of the row. See figure 8. Add more mulch during the season if you are working with organic materials. The mulch settles and gradually rots during the growing season where it meets the moist soil surface. Adding additional layers assures continuous weed control, a clean resting place for the fruits of your labor and creates a pleasing appearance all season long.
As a home gardener you are probably interested in making your vegetables as comfortable as possible, and vegetables are most comfortable in a soil with lots of organic matter. Every home garden soil benefits from the addition of organic matter each year. This replaces some of the nutrients removed by growing vegetables, but more importantly, it improves the soil’s physical characteristics, making it more workable. Organic matter also improves the soil’s water and nutrient-holding capacity.

People have home gardens to save money, and compost is the least expensive soil additive available. It can be prepared from materials usually available in your own backyard.

Compost is simply plant material that has gone through a natural decomposition process. If prepared properly, compost reaches 160° F. or more. This destroys most weed seeds, insect eggs and disease organisms and results in a relatively pest-free product to mix with the garden soil (figure 1). Finished compost is soft and pliable and smells like freshly plowed soil.

Materials

Use any plant material to make compost. Some examples of compost materials and treatment methods follow:

- Grass clippings. Mix green, fresh clippings with soil or dry plant material such as leaves. A thick layer of fresh clippings usually compacts when it settles. This prevents air from entering the pile and slows or prevents the composting process. Grass clippings are relatively high in nitrogen and make good compost.

- Dry leaves. These are plentiful in the fall and often can be found in bags by the curb waiting for the garbage collector. Most leaves compost faster and more thoroughly if shredded before adding to the pile. If you do not have a shredder, place the leaves in a row on your yard and cut them up with a rotary lawn mower. Rake the chopped leaves and add them to the compost pile.

- Sawdust. Always compost sawdust before adding to a garden soil. It is low in nitrogen and thus breaks down slowly. Add extra nitrogen to speed breakdown. Sawdust is plentiful at sawmills in many areas especially in East Texas.

- Kitchen scraps. Fruit and vegetable trimmings and leftovers are good items for the compost pile. Do not use animal products such as grease, fat and meat trimmings since they break down very slowly, attract rodents and other pests and have an unpleasant odor.

- Gin trash. This makes good compost but be sure the farmer did not use arsenicals on the cotton. Arsenic can carry over and cause vegetables to grow poorly. Your county Extension agent can tell you if arsenicals are used in your area.

*Extension horticulturist - special programs, The Texas A&M University System

Texas Agricultural Extension Service • The Texas A&M University System • Daniel C. Pfannstiel, Director • College Station, Texas

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• Other materials, which can be used, include sod removed from the lawn, hay, weeds, shredded newspaper and hedge clippings. Large twigs break down slowly so do not use them. Bone meal is a good addition to the compost pile because it is high in nitrogen.

Compost Requirements

To prepare compost, organic material, microorganisms, air, water and a small amount of nitrogen fertilizer are needed. Organic material is leaves, grass clippings, etc., added to the pile. Microorganisms are small forms of plant life, which break down the organic material. A small amount of garden soil or manure provides sufficient microorganisms. The nitrogen, air and water provide a favorable environment for the microorganisms to make the compost. Air is the only part which cannot be added in excess. Too much nitrogen can kill the microbes; too much water causes insufficient air in the pile.

Enclosure

Leave the compost pile free standing if adequate room is available. Less room is required if the pile is enclosed (figure 2). Wire fencing, cement blocks, bricks or scrap lumber make a good enclosure. Leave an opening on one side so the compost can be turned with a fork and to allow air to enter the pile. Most gardeners put the pile in a secluded area of the yard near the garden. For best results, the pile should be at least 4 feet square and 5 feet tall after settling.

Building the Pile

The most common method of building a compost pile is in layers (figure 3).

• With this method, place a layer of coarse material such as tree branches on the ground. This allows air to move beneath the pile.
• Next add a 6- to 8-inch layer of organic material such as shredded leaves or grass clippings.
• Then add a 1-inch layer of manure or rich garden soil. This provides ample organisms for breakdown. If manure is used, no additional nitrogen is needed. If soil is used, add 1 cup of garden fertilizer with the soil.
Repeat these layers and keep the pile moist (figure 4). Stir the pile weekly during the summer and monthly during the winter. The compost pile should be at least 4 feet in diameter to provide the best composting environment.

About 90 to 120 days are required to prepare good compost by the layer method. If you have room, make three piles so you will have one ready to use, one being filled and one "working" (figure 5).

Keep the pile moist but not waterlogged.

Add a 3-inch layer of compost to your garden before breaking the soil each spring and fall to develop and maintain a good soil environment for your vegetables.

Use the compost soon after it is ready or cover it with plastic to keep excess rainfall from washing out some of the plant nutrients.
NON-CHEMICAL CONTROL OF PLANT DISEASES IN THE HOME GARDEN

George L. Philley and Harold W. Kaufman

Plants are considered diseased when they do not grow and develop normally. Such a condition may result from infection by disease-causing organisms or from environmental factors. Organisms which cause disease are bacteria, fungi, nematodes, viruses, viroids, mycoplasmas and parasitic seed plants. Examples of environmental disorders are air pollution, poor soil, excessive heat, low or excessive nutrients and drought.

When organisms cause disease it usually is due to a parasitic relationship with a host plant. The parasite, or causal organism, is called a pathogen. The interaction between host and pathogen results in disease. This publication discusses only diseases where a pathogen is involved.

Prevention is the basic approach to plant disease control when using either chemical or non-chemical (organic) methods. To prevent disease, suppress the disease agent or avoid conditions favorable for disease. Utilizing as many disease-preventative practices as possible insures the best control. With some disease situations, certain control practices are more effective than others. For this reason, correct identification of a plant disease is important. Many control practices, however, aid in controlling many different disease problems. Ways to avoid disease development or suppress disease agents follow. Examples regarding their use are given where clarification is needed. A complete section on root knot nematode control is included since it is a major home garden problem statewide.

Suppressing the Disease Agent

Rotation. Vegetables in the same family group are likely to be susceptible to the same soilborne diseases. Cantaloupes and watermelons, for example, are in the same family group and have common diseases. If they follow each other in a rotation, a disease organism may be limited on the first crop but sustain enough carryover in the soil to cause severe loss on the following crop. Rotate vegetables from different family groups because they usually are not susceptible to the same disease organisms. Rotate the groups listed below so a selection from one group is not planted in the same location more than once every 2 to 3 years. Limited garden space may prevent an ideal rotation system (table 1).

Add organic matter. Organic matter increases the number and kind of microorganisms in the soil. Many of these microorganisms compete with disease agents for nourishment. In some cases, the best organic matter is obtained by turning under a green cover crop such as a small grain (wheat, oats, barley, rye) or a legume.

Plant resistant varieties. Agricultural scientists have made great strides in developing disease-resistant varieties. Resistance, however, is a relative term and does not indicate immunity. A tomato plant, for example, resistant to Fusarium wilt may develop wilt, especially if stressed but not become diseased to the degree that a susceptible variety might. Resistance means slower disease development, allowing resistant plants to produce an acceptable yield before or without losing vigor to disease attack.

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*Extension plant pathologists, The Texas A&M University System.

Table 1. Crop grouping for rotation to control soilborne diseases.

<table>
<thead>
<tr>
<th>GROUP A</th>
<th>GROUP B</th>
<th>GROUP C</th>
<th>GROUP D</th>
<th>GROUP E</th>
<th>GROUP F</th>
</tr>
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<tbody>
<tr>
<td>Cantaloupe</td>
<td>Brussels sprouts</td>
<td>Eggplant</td>
<td>Beet</td>
<td>Bean</td>
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</tr>
<tr>
<td>Cucumber</td>
<td>Cabbage</td>
<td>Spinach</td>
<td>Carrot</td>
<td>Cowpea</td>
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<tr>
<td>Honeydew melon</td>
<td>Cauliflower</td>
<td>Irish potato</td>
<td>Garlic</td>
<td>Peas</td>
<td></td>
</tr>
<tr>
<td>Pumpkin</td>
<td>Collards</td>
<td>Okra</td>
<td>Onion</td>
<td></td>
<td></td>
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<tr>
<td>Squash</td>
<td>Lettuce</td>
<td>Pepper</td>
<td>Shallot</td>
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<tr>
<td>Watermelon</td>
<td>Mustard</td>
<td>Tomato</td>
<td>Sweet potato</td>
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<tr>
<td></td>
<td>Radish</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Rutabaga</td>
<td></td>
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<td></td>
<td>Spinach</td>
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<tr>
<td></td>
<td>Swiss chard</td>
<td></td>
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<tr>
<td></td>
<td>Turnip</td>
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Sanitation. Any crop residue destruction practice that reduces the disease agent’s ability to reproduce or overseason can be included under sanitation. Examples are raking and burning diseased leaves and disposing of infected fruit. Dig up root knot nematode infected plants and remove as much of the root system as possible from the garden site. Root knot nematodes are harder to kill when protected by root tissue.

Do not pile diseased leaves, fruits and other plant parts near the garden. Fungi, for instance, often produce thousands of spores in the reproductive process and these spores can be wind-blown great distances. Burn, bury or dispose of diseased plant tissue to prevent dispersal of the disease agent. In most cases, do not put diseased plant parts in a compost pile. This is especially true for nematode-infected plants. Although many disease organisms are destroyed by heat during composting, 100 percent kill is not normally obtained. Contaminated compost may spread disease organisms as the compost is being used. Make compost with grass clippings or shrub and tree leaves as the disease organisms on grass and leaves are not likely to affect garden plants.

Heat treatment. Heating small amounts of soil is practical for potting plants and growing seedling transplants. The soil should be moist but not saturated. Heat the soil at 180°F for approximately 3 hours in a standard oven. Place an average-sized Irish potato in the middle of the soil to act as an indicator. When it is cooked, the soil should be sterile. Microwave ovens can be used for sterilizing small quantities. Using high power, heat the soil for 3 minutes. Do not overheat with either system. Excessive heating releases certain elements in the soil to toxic levels.

A new heating approach that has shown good results in Texas is solarization (soil pasteurization). Developed in Israel, it consists of covering well-tilled, highly moist soil with clear plastic, sealing the edges and leaving it for several weeks. Do not use black plastic because soil heating is not as great as heating under clear plastic. Best results have been reported with fungi control, principally those causing root rots. Certain weeds and nematodes are controlled but not consistently. Solarization also stimulates plant growth possible by creating a good environment for beneficial microorganisms; however, this phenomenon is not fully understood. Solarization works best during the hottest months; July and August are ideal for home garden sites. Continue the treatment at least 1 month.

Fallow. Leaving land idle and clean through the growing season reduces disease agents in the soil. Fallowing is especially helpful if done in the summer months when soil temperatures are high. Frequent plowing keeps the soil dry and free of plant growth and exposes soilborne disease organisms, such as nematodes, to killing heat and excessive drying. Other benefits of fallowing are weed and insect control. This practice is most effective when rainfall is low and temperatures are high.

Weed control. Weeds harbor insects and serve as hosts for many virus diseases. For most viruses to survive they must remain in a living organism, either a host plant or insect, which transmits the virus from one plant to another. Destroying weeds in and around the garden may eliminate potential overwintering host plants.

Avoiding Disease

Change planting date. Some diseases are controlled by changing the planting date. Spring-planted squash usually escapes mosaic virus, whereas fall-planted squash does not. Plant warm-season vegetables, like peas and okra, after the soil warms sufficiently to avoid seedling disease.

Obtain disease-free planting stock. It is advisable to check transplants such as cabbage, tomatoes, peppers and others for root knot nematode galls. Certified Irish seed potatoes are less likely to harbor a disease such as black leg. Some disease agents are seed transmitted; therefore, plant only the best seed.

Cultural practices.

- Select the best site. Choose a site with deep, well-drained soil.
- Plant on raised beds. Raised beds improve drainage. They also warm up faster than level soil, aiding in faster emergence. Slow emergence increases chances of seedling disease.
- Use proper plant spacing. Crowded plants reduce air circulation which enhances leaf spot diseases.
Planting on raised beds improves drainage and speeds up plant emergence, thus reducing chances of seedling disease.

Septoria leaf spot on tomatoes is an example. However, in Far West Texas, with low humidity and few leaf spot diseases, crowding tomato plants may reduce losses to curly top virus by shading the plants and making them less attractive to the insect vector.

- Overplant. Overplanting where possible insures enough production if some plants or fruit is lost to disease.
- Proper fertilization. Plants receiving all needed nutrients may resist some of the less vigorous, disease-causing organisms.
- Do not overwater. Excessive wet conditions increase soilborne fungal diseases like root rots and wilts.
- Avoid overhead irrigation. Leaf spot diseases develop rapidly when leaves are moist.
- Do not prune roots. Roots cut while cultivating reduce plant vigor and leave openings for root rot and wilt fungi to enter.

Root knot nematode control. No doubt many gardens have become infested by planting contaminated transplants or by bringing in topsoil harboring root knot nematodes. Taking steps to prevent this problem is just as important as implementing steps to control it once it is a problem. Where soils are already infested and a garden is first put into production, nematode levels generally are low. After several years of gardening and growing susceptible plants, nematode populations increase to the point that damage becomes noticeable. Control practices include

- summer fallowing, rotation, adding organic matter, planting trap crops, removing diseased plants and using resistant varieties. All these control measures are designed to reduce the soil's nematode population.

Benefits of summer fallowing have been discussed. Removing potential hosts and keeping the soil dry also reduces the nematode population as the nematode requires a moist environment for survival. Additional years of fallowing further reduce nematode populations.

Rotating with non-hosts or poor hosts of the root knot nematode is another means of reducing the population. Sweet corn is a poor host and is good to use in a rotation, especially in an area where root knot has done severe damage. Onions, garlic, asparagus and shallots also are poor hosts. Cool-season crops such as cabbage, Irish potatoes, greens (turnips), radishes and broccoli are less likely to suffer yield loss from root knot nematodes. Even though these are susceptible plants, they grow well in cooler temperatures that are not favorable for root knot nematode development.

High soil organic matter alone does not insure root knot nematode control. The higher the organic matter, however, the better the chance that antagonistic organisms will develop. Some soil fungi trap nematodes and use them as a food source. Some organic matter works better than others. Turning under a green manure crop such as small grains or legumes several weeks before planting is the best. Additional nitrogen may be necessary for adequate crop production because decay organisms in the soil use available nitrogen as they break down the green manure crop.

Sometimes people resort to home remedies to control nematodes such as planting marigolds or mixing sugar or lye into the soil. Of these three, only marigolds are effective in controlling nematode populations, and their effectiveness has limitations.

Some people think marigolds secrete a toxic substance into the soil that kills nematodes and by planting a few marigolds around annual plants in infested soil they prevent infection. This is not true. Marigolds merely act as a trap crop. Nematodes enter their roots but are unable to complete their life cycle. Trapped nematodes die without reproducing.

The type of marigold also is important. French marigolds, Tagetes patula, are more effective in controlling root knot nematodes than the African marigold, Tagetes erecta, which also is referred to as the American, Big or Aztec marigold. To be effective marigolds must be planted as a solid crop and grown for 90 to 120 days to reduce the nematode population sufficiently to grow annual plants without treatment. Plant marigolds in rows less than 7 inches apart with 7 inches between each plant so that roots penetrate the entire soil mass to trap as many nematodes as possible. If marigolds are planted close together, they form a dense canopy which retards weed and grass development. Many weeds and grasses serve as hosts for root knot nematodes. If the weeds are not controlled, marigolds may be unable to suppress the nematode population.
garden as soon as possible after production ceases. Removing the root system eliminates many of the nematodes. To remove as much of the root system as possible, use a shovel rather than just pulling the plant up by the stem.

Root knot resistant vegetable varieties are not plentiful. Fortunately, progress is being made in the development of root knot resistant tomatoes. The best resistance is found in the hybrid varieties developed in recent years. Root knot resistant varieties are noted in seed catalogs by "N" following the variety name. Preceding the "N" are often "V" and "F." "VFN" stands for Verticillium wilt resistance, Fusarium wilt resistance and nematode resistance. Hybrid tomato seed are more expensive than open pollinated seed, but the benefits in disease resistance alone are enough to justify buying them.

Diseases caused by root knot nematodes and other organisms can be prevented with non-chemical methods that either avoid the disease or suppress the disease agent. However, maximum control is only assured when using as many of these disease preventive practices as possible.

Suggested References
Beets are a cool-season crop and grow well in the cool temperatures of spring and fall. They do poorly in hot weather. Beets are well suited to large or small home gardens since they require little room. They are grown for both the roots which usually are pickled and the young tops which are used as greens.

**Soil Preparation**

Beets do well in most deep, well-drained, friable soils except tight clay. The soil should have adequate organic matter to prevent it from crusting. Hard, crusty soil causes beet roots to be tough. Beets do best in sandy soil in the spring and heavier soil in the fall because sandy soil warms faster than heavy clay soil.

Clear the planting area of rocks, trash, and large sticks. Mix fine pieces of plant material such as grass, leaves, and small sticks into the soil to enrich it. Spade the soil 8 to 10 inches deep. Be sure all plant material is covered with soil so it will break down quickly (Figure 1).

**Fertilizing**

Scatter 1 cup of a complete fertilizer such as 10-20-10 for each 10 feet of row. If the garden soil has a lot of clay, add compost. Mix the fertilizer 4

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*Respectively, Extension horticulturist (vegetables) and Extension horticulturist, The Texas A&M University System*
Beets can be planted in partial shade, but their roots reach depths of 36 to 48 inches, so do not plant where tree roots will compete (Figure 4).

Fig. 4. Avoid areas where tree roots may be present.

Varieties

Beets are grown for both the root and top. The tops of any variety can be used for greens if harvested properly.

Varieties
Detroit Dark Red
Pacemaker

After Planting

Keep the beet plants free of weeds which use nutrients and moisture. Scratch the soil next to the plants with a rake or hand tool to prevent crust ing. Do not work the soil more than 1 inch deep or the root systems may be injured. Water the plants well weekly if it does not rain. Begin thinning the beets as soon as they get crowded in the row. Young tops make excellent greens. After thinning, the plants should be 2 to 3 inches apart.

Scatter 1 tablespoon of fertilizer for each 10 feet of row beside the plants when they are 4 to 6 inches tall.

Insects

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flea beetle - 1/16 inch long; black, brown-black with light markings; jumps quickly; eats holes in leaves</td>
<td>Check with your county Extension agent</td>
</tr>
<tr>
<td>Beet webworm - 1 inch long; green, yellow, black stripe and spots on back; eats young plant leaves</td>
<td>Check with your county Extension agent</td>
</tr>
</tbody>
</table>

Before using a pesticide, read the label. Always follow cautions, warnings and directions.

Diseases

Diseases on beets are most severe in cloudy, damp weather. Check plants daily and treat with an approved fungicide if diseases appear. Ask your county Extension agent what to use. Always follow label directions.

Harvesting

Young, tender tops are the best quality, but tops can be used until they get large and strong flavored. Young plants can be cooked with the root and top together, or use the root alone when it is golf ball size or larger.

Pull the plants and cut off the root. If the tops are to be used, wash and place them in plastic bags in the refrigerator for 1 or 2 days. Roots will keep 1 to 2 weeks in plastic bags in the refrigerator.

Serving

Serve beets fresh, or preserve plain or pickled. Beet roots have small amounts of vitamins and minerals, while beet greens are an excellent source of Vitamin A and calcium.

Cleanup

If all the beets are not used, pull them and place in a compost pile or spade them into the soil.
Carrots grow best in the cool temperatures of early spring and late fall. Night temperatures of 55°F and day temperatures of 75°F are ideal for carrots. High temperatures cause poorly colored, low quality carrots. They will grow in some shade and do well in small gardens and flower beds.

Soil Preparation and Fertilization

Carrots do best in loose, sandy loam soils which are well drained. In heavy soils they mature slowly and often the roots are rough and unattractive.

Clear the soil surface of rocks, trash and large pieces of plant material. Small, fine pieces of plant material can be turned under for soil enrichment.

Spade the soil 8 to 12 inches deep. Turn the soil completely over so all plant material is covered. Scatter 1 cup of complete fertilizer such as 10-20-10 on the soil for each 10 feet of row to be planted. Using a rake, work the fertilizer into the soil to a depth of 3 to 4 inches.

Smooth the soil and work it up into beds as shown (Figure 1). Beds allow good movement of air and water through the soil. Place carrot rows 1 to 2 feet apart. If ridges are farther apart, plant two rows of carrots on each ridge (Figure 2).

Fig. 1. Ridges are important in low, poorly drained areas. They allow the soil to drain and let air enter.

Fig. 2. Two rows of carrots may be planted on each ridge.

Thin carrot plants to 2 inches apart when tops are 4 inches high. Some carrots will be large enough to eat. Thin the carrots to 4 inches apart as they continue to grow. Overcrowding and rocky soils result in poor quality roots (Figure 3). If radishes were mixed with the carrots, pull and eat them as they mature.

Five to 10 feet of row per person should supply enough fresh carrots for table use. One foot of row will yield about 1 pound of carrots.
Fig. 3. Overcrowding and rocky soils result in poor quality roots.

Varieties

Texas Gold Spike
Orlando Gold

After Planting

Keep carrots free of weeds, especially when they are small. Weeds use nutrients and moisture and cause reduced carrot yields. Scratch the soil lightly around the plants to prevent crust ing. Water the plants as required to keep the soil moist to a depth of about 3 inches. Scatter 2 tablespoons of fertilizer per 10 feet of row beside the plants when the tops are about 4 inches high. Fertilize again when tops are 6 to 8 inches high if the tops become pale.

Insects

<table>
<thead>
<tr>
<th>Name and Description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireworm - 1/2 to 1 1/2 inches long; yellow to white; dark head and tail; feeds on root</td>
<td>Check with your county Extension agent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name and Description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutworm - up to 1 1/4 inches long; dull gray, brown to black; striped or spotted, soft bodied, smooth; curls up when touched; cuts off young plants near soil level</td>
<td>Check with your county Extension agent</td>
</tr>
</tbody>
</table>

Before using a pesticide, read the label. Always follow cautions, directions and warnings.

Diseases

Carrots are troubled by some diseases. If leaf spots appear on plants, dust them with an approved fungicide. If a plant becomes yellow and stunted, remove it from the garden. If the roots have knots on them, your soil may have nematodes. Ask your county Extension agent or gardening assistant about disease control.

Harvesting

Carrots should be ready for harvest 70 to 80 days after planting. Pull them when the roots are 1 to 1 1/2 inches in diameter. Loosen the soil around the carrot with a spade to avoid breaking the carrot while pulling. To prevent roots from wilting after harvest, remove carrot tops and place them in the compost pile.

Wash carrots and store in the bottom of the refrigerator. Place them in a plastic bag for increased humidity. Carrots will keep several weeks with high humidity and a temperature near 32°F.

Serve carrots cooked or raw by themselves or in salads. They are an excellent source of Vitamin A and add color to a meal.

Cleanup

Pull unused carrots and place in a compost pile or spade into the soil.
Collards tolerate more heat and cold than most other vegetables grown in Texas. They are easy to grow, productive and well suited to either large or small gardens.

Collards grow best in cool weather and need as much sunlight as possible. They also need a deep soil that is well drained and well prepared. Collards do not form heads and are grown for their leaves. They are a member of the cabbage family.

Soil Preparation and Fertilization

The roots of the collard plant easily reach depths of 2 feet or more. Dig the soil to a depth of at least 10 inches. This loosens the soil so small feeder roots can grow more easily.

If the soil is mostly clay or light sand, add organic matter. A 3-inch layer of compost is adequate. Spread it over the planting area before digging.

Clear the soil of rocks and large sticks. Turn it to cover the plant material on the soil surface. Do this before planting to allow time for the material to begin rotting.

Just before planting, scatter a complete garden fertilizer such as 10-20-10 over the planting area. Use 2 or 3 pounds for each 100 square feet or about 1 cup for each 10 feet of row. Use a rake to mix the fertilizer 3 to 4 inches into the soil.

Work the soil into ridges 6 to 8 inches high and at least 36 inches apart. This brings the fertilizer under the row where the plants can reach it easily. The ridges also allow water to drain away from the plant roots (Figure 1).

Planting

Collards can be started from transplants or from seed sown directly in the garden. Transplants usually are used for the spring crop. They add 4 to 5 weeks to the growing season since they can be grown indoors before the weather is warm enough to plant seeds outside. Collard seeds sprout when the soil temperature reaches 45°F.

Plant the transplants into the garden as soon as the soil can be worked in the spring — February or March in most of Texas. Set the plants in the soil about the same depth as they are grown indoors. Space them 18 to 24 inches apart in the row (Figure 2). Be sure to water the plants after transplanting.

Starting from seed:

When planting seed, make a shallow furrow about 1/2 inch deep down the center of the bed. Scatter the seed lightly in the furrow. With a little practice the seed can be scattered easily by tapping the edge of the open seed packet lightly with your fingers. One teaspoon of seed plants about 30 feet of row. Cover the seed about 1/4 inch with loose soil or compost. Then sprinkle with water. The plants should come up in 6 to 12 days. However, the colder the soil, the slower the seeds will sprout.
Varieties

Blue Max
Georgia Southern

After Planting

Keep the garden free of weeds. Pull the weeds or hoe them carefully to prevent damage to the collard plant's roots.

After the plants have sprouted, let them grow until they get about 4 to 6 inches tall or become crowded in the row. Then thin the plants gradually until about 18 inches remain between them. The young plants can be either transplanted to another spot or used as greens (Figure 3). Crowding causes the leaves to be smaller and less green.

Fig. 3. Thin collard plants gradually to a final spacing of 18 inches.

Water the plants well each week if it does not rain. When the plants are thinned to their final spacing or if they become pale green in color, add a little more fertilizer. Collards need plenty of nitrogen to develop their dark green leaf color. Scatter 1 cup of garden fertilizer beside the plants for each 30 feet of row (about 1 tablespoon per plant). This is called sidedressing. Mix the fertilizer lightly with the soil and then water. The plants may need to be sidedressed again in 4 to 6 weeks if they become pale and there is no sign the change was caused by insects.

For a fall crop, plant seeds in the garden about 80 days before frost — August or September in most areas. Seed them heavy and then thin.

Insects

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
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<tbody>
<tr>
<td>Aphid: 1/8 inch long; soft-bodied; green, pink, red or brown; usually found on underside of leaf; sucks juices; often called “plant lice”</td>
<td>Check with your County Extension Agent</td>
</tr>
<tr>
<td>Cabbage looper: inchworm that feeds on foliage; light green, white or pale yellow; has three pairs of prolegs</td>
<td>Check with your County Extension Agent</td>
</tr>
</tbody>
</table>

Before using a pesticide, read the label. Always follow cautions, warnings and directions.

Diseases

Collards are subject to some diseases. If the plants have spots on the leaves, you may need to use a fungicide. Ask your county Extension agent what to use.

Harvesting

Collards can be harvested two different ways. For small plants that need thinning, cut the entire plant about 4 inches above the ground (Figure 4).

Fig. 4. Cut small plants at ground level or remove lower leaves as plant grows.

Sometimes they sprout back from the side of the stem. Usually, only the lower leaves of collards are harvested. This allows the plant to keep growing and producing more leaves. In mild regions, such as South Texas and coastal areas, collards continue to produce all winter. Collards can stand temperatures of 20°F or less in some cases. They taste sweeter after a light frost.

Serving

Collards are one of the most nutritious vegetables. They are high in protein, vitamins and minerals and low in calories. To prevent loss of nutrients, do not cook collards in too much water. Ask your county Extension agent for more information on cooking and serving collards.
Cucumbers are grown for eating fresh or preserving as pickles. They must be grown in warm temperatures and full sunlight, and will not stand frost. Cucumbers mature quickly and are best suited to large gardens but can be grown in small areas if caged or trellised.

**Soil Preparation**

Cucumbers do best in loose, sandy loam soil but can be grown in any well drained soil. Remove rocks, large sticks and trash before preparing the soil. Leave fine pieces of plant material such as dead grass and small weeds. They will help enrich the soil when turned under. Spade the soil to a depth of 8 to 12 inches. This is about the depth reached by most shovels or spading forks. Turn each shovel of soil completely over so all plant materials are covered with soil (Figure 1).

![Fig. 1. Turn over the soil to a depth of 8 to 12 inches.](image)

**Fertilizing**

Cucumbers require plenty of fertilizer. Scatter 1 cup of a complete fertilizer such as 10-10-10 or 10-20-10 for each 10 feet of row. Work the fertilizer into the soil and leave the surface smooth.

Work the soil into beds 4 to 6 inches high and at least 36 inches apart (Figure 2).

![Fig. 2. Make ridges 36 inches apart and 4 to 6 inches high.](image)

**Planting**

Since cucumbers are a vine crop they require a lot of space. Vines can reach 6 to 8 feet or more. In large gardens cucumbers can spread out on the ground. Plant cucumbers in rows on the ridges prepared earlier. Use a hoe or stick to make a small furrow about 1 inch deep down the center of each ridge. Drop three or four seeds in groups every 12 to 14 inches down the row. By planting several seeds, you are more likely to get a stand. Remove extra plants soon after emergence (Figure 3).

![Fig. 3. Plant 3 or 4 seeds in each group.](image)

Cover the seed about 1 inch deep with fine soil. Use the flat side of a hoe to firm the soil over the seeds, but do not pack it.

Do not plant cucumbers until all danger of frost has passed and the soil begins to warm.

Cucumber roots reach down 36 to 48 inches, so do not plant where tree roots will rob them of water and nutrients. In small gardens, train cucumbers on a fence, trellis or cage if wire is available. Plant three or four seeds in hills 4 to 6 inches high along the trellis or cage (Figures 4 and 5).
Fig. 4. In a small area, cucumbers can be trained to grow up instead of along the ground.

Plant fast-maturing crops such as lettuce and radishes between the cucumber hills to save space. These will be harvested before the cucumber vines get too large.

Fig. 5. Cucumbers can also grow successfully in wire cages.

Varieties

**Pickling Variety**
- Calypso
- Carolina

**Slicing Variety**
- Poinsett 76
- Sweet Success
- Dasher II
- Sweet Slice

Two types of cucumbers are grown. Pickling types are 3 to 4 inches long and up to 1 inch in diameter at maturity. Slicing types get 6 to 8 inches long and 1 inch or more in diameter when mature. Both types can be used for pickling if picked when small.

After Planting

Keep cucumbers as weed-free as possible. Do not plow or hoe the soil deeper than about 1 inch because feeder roots may be cut and plant growth slowed.

Apply about 1/2 cup of fertilizer for each 10 feet of row or 1 tablespoon per plant when the vines are about 10 to 12 inches long.

Soak the plants well with water weekly if it does not rain.

Cucumbers have two different flowers, male and female. Male flowers open first and always drop off. Female flowers form the cucumber and should not drop off. If female flowers begin to drop, touch the inside of each male and female flower with a soft brush or cotton swab. This pollinates the flowers and helps them develop into fruit.

**Insects**

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Striped cucumber beetle</td>
<td>Check with your county</td>
</tr>
<tr>
<td>1/4 inch long; yellow-green with 3 black</td>
<td>Extension agent</td>
</tr>
<tr>
<td>stripes</td>
<td></td>
</tr>
</tbody>
</table>

| Spotted cucumber beetle                  | Check with your county       |
| 1/4 inch long; yellow-green with 12 black| Extension agent              |
| spots                                     |                              |

| Squash bug - up to 1 inch long; grey-brown, reddish-brown when small | Check with your county       |
|                                                                        | Extension agent              |

**Diseases**

Several different diseases attack cucumbers. Most show up as spots on the upper or lower sides of leaves or on fruit. Check plants daily and spray with an approved fungicide. Ask your county Extension agent or program assistant for help.

Harvesting

Harvest cucumbers when they reach the desired size. Do not wait until they turn yellow. Yellow cucumbers are overmature and will be strong flavored and of poor quality.
Green beans are a popular, warm-season, home garden vegetable crop. They grow well in most Texas soils. Like most vegetables, green beans grow best in well-drained soil and plenty of sunlight.

**Soil Preparation**

Work the soil 8 to 10 inches deep before planting. Rake it several times to break up large clods. Remove all weeds and trash. Work the garden soil only when it is dry enough not to stick to garden tools.

**Fertilizing**

Beans grow best when the garden soil is well fertilized. For an area that is 10 feet long and 10 feet wide, use 2 to 3 pounds of fertilizer such as 10-20-10. Spread the fertilizer evenly over the area. Then mix it in with the top 3 to 4 inches of soil.

**Varieties**

<table>
<thead>
<tr>
<th>Snap Beans</th>
<th>Pinto Beans</th>
<th>Lima Beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topcrop</td>
<td>UH-114</td>
<td>Jackson Wonder</td>
</tr>
<tr>
<td>Tendercrop</td>
<td>Luna</td>
<td>Florida Butter</td>
</tr>
<tr>
<td>Tendergreen</td>
<td>Dwarf</td>
<td>Henderson Bush</td>
</tr>
<tr>
<td>Greencrop</td>
<td></td>
<td>Horticultural</td>
</tr>
<tr>
<td>Kentucky Wonder</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Planting

Plant beans in the spring after all danger of frost has passed. For a good fall crop, plant them 10 to 12 weeks before the first expected frost. Use 1/4 to 1/2 pound of seed for each 100 feet of row of green beans. If possible, use fungicide-treated seed to protect the seedling from disease until it is up and growing. Do not eat treated seed.

![Fig. 2. After bush beans are up, thin to 3 to 4 inches between plants.](image)

For bush beans, plant the seed about 1 inch deep and 1 to 2 inches apart in the row. The rows should be 2 1/2 to 3 feet apart. After the beans are up, thin the plants to 3 to 4 inches apart (Figures 1 and 2).

For pole beans, plant the seed in rows 3 to 4 feet apart. Plant them in hills about 3 feet apart in the row. Place a 6- to 8-foot stake in the center of each hill. Plant three to four seeds around the stake, about 1 inch deep in the soil. As the bean vines mature, they will grow up the stake (Figure 3).

![Fig. 3. Plant pole beans in hills about 3 feet apart. Place a 6- to 8-foot single pole or stake in the middle of each hill. Try to plant when there is enough soil moisture to cause the seeds to germinate and emerge quickly.](image)
Watering

Water the plants about once a week in dry weather. Do not let the soil get dry while the beans are blooming or the blooms will drop and yields will be decreased.

Care During the Season

The roots of beans are near the soil surface. When hoeing and pulling weeds, do not dig too deeply or the plant's roots will be damaged. After the plants begin to flower and set beans, apply 1/2 cup of fertilizer for every 10 feet of row. Scatter the fertilizer between the rows. This will help the plants produce more beans. Water the plants after fertilizing.

Insects

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphid - 1/8 inch long; green, pink, red, brown; feeds on underside of leaf or on leaf petioles; sucks plant juice</td>
<td>Check with your county Extension agent</td>
</tr>
<tr>
<td>Spider mite - barely visible to naked eye; spider-like; feeds on underside of leaves; causes yellow spots on top of leaves; may form tiny webs</td>
<td>Check with your county Extension agent</td>
</tr>
</tbody>
</table>

Diseases

Diseases may be a problem during cool, wet weather. If spots appear on leaves or bean pods, treat the plant with an approved fungicide. Ask your county Extension agent what you should use to control diseases. Follow directions on the container.

Before using a pesticide, read the label. Always follow cautions, warnings and directions.

Harvesting

Green beans are ready to pick when they are about the size of a small pencil. Pull them carefully to avoid damaging the plant. Beans that are overmature will be tough and stringy.

If beans are picked when they are ready, the plants will continue producing for several weeks.

Serving

Fresh green beans add color and variety to meals. Green beans are a fair source of Vitamins A and C if cooked for a short time in a very small amount of boiling water. Cook them just until they are tender. Do not cook them too long or they will become mushy and lose their bright green color.

Storing

Store fresh beans in the crisper, in plastic bags or in other containers in the refrigerator. They usually can be stored in the refrigerator for a week.
Okra is a warm season vegetable which grows well in most Texas soils. For good yields, okra must grow in full sunlight in a well drained, fertile soil.

Soil Preparation

Spade or turn the soil as deeply as possible. Okra will grow best in soil which has been worked 8 to 10 inches deep. Remove rocks and trash, and rake the soil smooth. Work the soil only when it is dry enough not to stick to garden tools.

Fertilizing

Before planting, use 2 to 3 pounds of fertilizer such as 10-20-10 for each 100 square feet of garden area. Spread the fertilizer evenly over the area. Mix it well into the top 3 to 4 inches of soil.

Varieties

Lee
Emerald
Clemson Spineless

Planting

For best yields, plant okra in the spring 2 to 3 weeks after all danger of frost has passed. For a good fall crop, plant at least 3 months before the first fall frost.

Plant okra seed about 1 inch deep and 2 inches apart in the row (Figure 1).

Fig. 1. Plant okra seed about 2 inches apart and 1 inch deep.

Space the rows at least 3 feet apart. When the okra is up and growing, thin the plants so that they are about 1 foot apart (Figure 2).

Fig. 2. Plant okra in rows 3 feet apart. After the plants are 3-4 inches tall, thin them to 1 foot between the plants.
Watering

Okra will do fairly well under dry conditions. However, watering every 7 to 10 days will give higher yields. Sandy soils usually will need water more often than clay soils.

Care During the Season

Cultivate around the okra plants to remove weeds and grass. Hand-pull weeds close to the plants to avoid damaging the roots of the okra. After the first harvest, apply 1 cup of garden fertilizer for each 10 feet of row. Scatter the fertilizer evenly between the rows. Mix it lightly with the soil. Water the plants after fertilizing.

Insects

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stink bug - brown, green or black; shield shaped; usually about 1/2 inch long; discharges a foul odor; sucks plant juices</td>
<td>Check with your county Extension agent</td>
</tr>
<tr>
<td>Aphid - 1/8 inch long; soft-bodied; green, pink, red or brown; usually on underside of leaves; sucks plant juices</td>
<td>Check with your county Extension agent</td>
</tr>
</tbody>
</table>

Before using a pesticide read the label. Always follow cautions, warnings and directions.

Harvesting

The okra will produce large flowers about 2 months after planting. The okra pods will be ready to pick 3 or 4 days later. Harvest the pods when they are 3 to 4 inches long. If the okra gets too large, it will be tough and stringy. Pick the okra every 1 to 2 days or yields will be decreased (Figure 3).

Serving

Okra is a fair source of Vitamin A. It can be eaten in many ways, including boiled, fried and cooked in soups, gumbos and casseroles.

Storing

Okra can be stored for 3 to 5 days in the refrigerator. Okra which is too mature can be dried, cured and used in flower arrangements.

Cleanup

Okra seed is easily saved for next season by leaving some of the last pods on the plant until they get very large. Remove them and allow them to dry. The seeds will shell easily from the pods. Other plant material such as leaves and stems can be put in a compost pile.

Fig. 3. Harvest okra when it is about 3-4 inches long.
Yelllow, white and red/purple onions grow very well in Texas home gardens. They grow best in full sunlight and well drained soils.

**Soil Preparation**

Before seeding or transplanting, work the soil 8 to 10 inches deep. Break up the clods and rake the soil smooth. Remove all rocks and trash. Work the garden soil only when it is dry enough not to stick to garden tools.

**Fertilizing**

Onions grow best when the garden soil is fertilized right. Spread 2 to 3 pounds of a fertilizer such as 10-10-10 over a 100-square foot area. Measure and spread the fertilizer, then mix it with the top 3 to 4 inches of soil.

**Varieties**

<table>
<thead>
<tr>
<th><strong>Bulb Onions</strong></th>
<th><strong>Green Onions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>South Texas</td>
<td>Evergreen</td>
</tr>
<tr>
<td>Texas 1015 Y</td>
<td>Bunching</td>
</tr>
<tr>
<td>Early Grano 502</td>
<td>Crystal Wax</td>
</tr>
</tbody>
</table>

**Planting**

Onions are a cool season crop and can stand temperatures well below freezing. They may be planted from seed, from small bulbs called sets or from transplants. Seeding is cheapest but takes longer before onions are ready. If you use sets or transplants, plant them 3/4 inch deep and 3 inches apart. Do not transplant onions more than 1 inch deep (Figure 1).

When seeding onions for bulbs, plant them 1/4 inch deep during October through December. Place seeds 1 inch apart. When the plants are about 6 inches high, thin them to one plant every 2 to 3 inches. Eat the extra plants as green onions.

**Watering**

Watering once each week usually is enough, but you may need to water more often during dry, windy weather. Water slowly and deeply to help grow strong, healthy roots.

**Care During the Season**

Weeds are easy to pull or cut when they are 3 to 4 inches high. Do not let weeds or grass get large as they steal nutrients from the onions. When hoeing weeds and grass, do not chop too deeply. You may be cutting onion roots. Always hand-pull weeds when possible.

When onions plants have 5 to 6 leaves, apply fertilizer again to help grow larger plants and bigger bulbs. Each leaf forms a ring in the onion bulb. More leaves mean more rings and larger onion bulbs. Use about 1/2 cup of fertilizer for each 10 feet of onion row. Scatter the fertilizer evenly between the rows. Water after adding the fertilizer (Figure 2).
Insects and Diseases

Onions do not have many insect problems, but thrips, which are very tiny insects, may be found between the center leaves. Diseases may be a problem on onions. Brown leaf tips or brown spots on the middle and lower parts of leaves may be caused by plant diseases. Ask your county Extension agent what to use to control insects and diseases. Follow directions on the container.

Harvesting

Onions seeded in October/December or transplanted in January/February should produce bulbs in May/July.

Onions may be picked as green onions from the time they are pencil size until they begin to form bulbs. For dry bulb onions, let plants grow larger. Onions are ready when the main stem begins to get weak and fall (Figure 3). Pull the plants out of the soil. Let them lay in the garden for 1 to 2 days to dry. Then remove the tops and roots and let them keep drying in baskets or boxes.

Serving

Green onions may be eaten fresh or can be chopped and added to salads. Bulb onions may be sliced and used on sandwiches or dipped in batter and fried as onion rings. Onions are a source of Vitamins A and C, but are used mostly as a flavoring in other food dishes.

Storing

Store onions in a crisper or in a dry, airy place such as a wire net in the garage or carport.
Peppers are a warm season crop that will grow in most Texas areas. They grow in all types of soils but do best in heavier, well-drained soils. Peppers should be planted in areas with at least 6 hours of sunlight each day.

**Varieties**

**Bell**
- Shamrock
- Jupiter
- Grande Rio 66
- Supersweet 860

**Hot**
- TAM Mild
- Jalapeño
- TAM Vera
- Cruz
- Serrano
- TAM Hidalgo
- Long Red
- Cayenne

**Soil Preparation**

Work the soil 8 to 10 inches deep several weeks before planting. Take it several times to break up the large clods. Add large amounts of organic (natural) matter, especially if your soil is heavy clay. Work it into the soil. You can use compost, peat moss, rotted hay or other organic matter. Work the soil only when it is dry enough not to stick to garden tools.

**Fertilizing**

Add 2 to 3 pounds of fertilizer such as 10-10-10 per 100 square feet of garden area. Spread the fertilizer evenly over the garden. Work it into the soil. If you are going to plant single plants, place about 2 level tablespoons of fertilizer on the soil in the planting area. Mix it well with the soil (Figure 1).

**Planting**

Since most families need only a few plants, it is best to buy plants rather than grow them from seed. Buy healthy plants 4 to 6 inches tall (Figure 2). About three or four hot pepper plants and eight or ten sweet pepper plants are enough for a family of four.

![Pepper Plant](image)

**Fig. 2. Buy pepper plants which are 4-6 inches tall and dark green in color.**

Peppers grow best in warm weather. Do not plant them until all danger of cold weather has passed. Plant fall peppers 12 to 16 weeks before the first expected frost.

Make the transplant holes 3 to 4 inches deep and about 11/2 feet apart in the row. Space the rows at least 3 feet apart. Before planting, fill the holes with water and let it soak in. Move the plants carefully from the box or flat and set them in the transplant holes. Leave as much soil as possible around the roots. Fill the hole with soil and pack it loosely around the plant. Do not cover the roots deeper than the original soil ball. Leave a slightly sunken area around each plant to hold water. Water the plants after planting (Figure 3).

Try to transplant peppers in the evening or on a cloudy day. This will keep the plants from wilting and getting too dry.

*Respectively, Extension horticulturist and Extension horticulturist (vegetables), The Texas A&M University System*
Watering

Water the plants enough to keep them from wilting. Slow, deep watering helps grow a strong root system. Do not let pepper plants wilt as this will reduce yield and quality of the fruit.

Care During the Season

Hoe or till the soil lightly. Deep tilling cuts the pepper roots and causes slow growth. Hand-pull weeds which are close to the plants.

After the first fruit begins to enlarge, place about 2 tablespoons of fertilizer around each plant about 6 inches from the stem. Water after adding the fertilizer. This will increase yield and quality of the peppers.

Insects

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aphid</strong> · 1/8-inch long; green, pink or brown; feeds on underside of leaves; sucks plant juices</td>
<td></td>
</tr>
<tr>
<td>Check with your county Extension Agent</td>
<td></td>
</tr>
<tr>
<td><strong>Leaf miner</strong> · small, yellowish larva inside leaves; causes &quot;tunnels&quot; or &quot;trails&quot; on leaves</td>
<td></td>
</tr>
<tr>
<td>Check with your county Extension Agent</td>
<td></td>
</tr>
<tr>
<td><strong>Flea beetle</strong> · 1/16-inch long; metallic bronze, black bronze, black, blue or green; fast jumping; eats holes in leaves</td>
<td></td>
</tr>
<tr>
<td>Check with your county Extension Agent</td>
<td></td>
</tr>
</tbody>
</table>

Diseases

Diseases can be a problem on peppers so watch the plants closely.

In mild weather, diseases start easily. Leaf spots are caused by fungus and bacteria.

If diseases become a problem, you may have to spray the plants. Ask your county Extension agent or gardening assistant what to use to control diseases.

Harvesting

If peppers are picked as they mature, yields will be greater. The first peppers should be ready 8 to 10 weeks after transplanting.

Pick bell peppers when they get shiny, dark green and firm. When left on the plant, most peppers will turn red and are still good to eat.

Harvest most hot peppers when they turn red or yellow, depending on the variety. Jalapenos are mature when they reach good size and become a deep, dark green.

Serving

Red and green peppers are good sources of Vitamin C, some Vitamin A and small amounts of several minerals. Red peppers have more Vitamin A than green peppers.

Peppers are good raw or cooked. Eat them as a snack, to decorate food, or add them to salads and casseroles. Stuff peppers with seasoned bread crumbs or meat and bake them.

Storing

Store peppers in the vegetable crisper of the refrigerator or other covered containers. Use them within 3 to 5 days after harvesting.
Radishes are a cool-season crop and do not do well in the hot summer months. They are grown for the root which usually is eaten raw, alone or in salads. Radishes, which can grow in partial shade, require very little room and mature quickly. They are well suited to small gardens, flower beds and containers.

Soil Preparation and Fertilizing

Radishes need loose, well-drained soil for easy root expansion. If the soil is crusty, roots become misshapen.

Remove rocks, trash and large sticks from the planting area. Small pieces of plant material such as grass and leaves can be mixed into the soil to make it richer.

Spade the soil 8 to 12 inches deep. Turn each shovelful completely over so all plant material is covered. Scatter 1 cup fertilizer such as 10-20-10 on the soil for each 10 feet of row to be planted. Rake the soil until smooth and work up beds as shown (Figure 1).

Planting

Radishes usually are the first vegetable harvested from a spring garden. In many South Texas areas, they are grown all winter. Plant them as soon as the soil can be worked in the spring.

Using a hoe handle, stick or similar object, make a furrow 1/2 inch deep down the center of the ridge.

Plant seeds 1/2 inch deep and 1 inch apart in the row (Figure 2). Cover lightly with loose soil and sprinkle with water. Plants should be up in 4 to 6 days.

Fig. 2. Plant seeds 1/2 inch deep and 1 inch apart in the row

Begin thinning radishes when roots start expanding. Pull every other plant (Figure 3). Larger ones can be eaten. Those left in the row will get larger without being crowded.

Fig. 3. To thin radishes, pull every other plant.

Make several plantings 8 to 10 days apart for a steady supply of radishes. They will be ready for harvest about 4 to 5 weeks from planting. Ten feet of row per planting usually is enough for a family of four.
Varieties

Red and white types of radishes generally are grown in Texas.

Cherry Belle Sparkler White Icicle

Radishes, the most popular type, are round or oval shaped.

The white type can be globed shaped or long like a carrot.

After Planting

Keep radishes free of weeds because weeds rob weak root systems of nutrients and moisture.

Scratch the soil around the plants lightly with a rake or hand tool to keep the soil from crusting. Water the plant well if it does not rain weekly.

Harvesting

Pull radishes when they are young and tender. If left in the ground too long, they get tough, hot tasting and stringy.

Pull the radishes; cut off the tops and small roots and put them in a compost pile. Wash radishes and place them in the refrigerator. They will keep 2 to 3 weeks or until the next planting is ready for harvest.

Center should be solid with no cracks.

Overmature radishes with pithy or cracked center.

Insects

<table>
<thead>
<tr>
<th>Name and description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphid - 1/8-inch long; green, pink, red, brown; feeds on underside of leaf; sucks plant juices</td>
<td>Check with your county Extension Agent</td>
</tr>
<tr>
<td>Flea beetle - 1/16-inch long; black, brown, striped; jumping beetle; eats small holes in leaves</td>
<td>Check with your county Extension Agent</td>
</tr>
<tr>
<td>Cabbage maggot - 1/4- to 1/2 -inch long; yellowish-white, legless; feeds on radish root</td>
<td>Check with your county Extension Agent</td>
</tr>
</tbody>
</table>

Before using a pesticide, read the label. Always follow cautions, warnings and directions.

Diseases

Since radishes mature so quickly, diseases usually are not a problem. If radish plants appear diseased, ask your county Extension agent or gardening assistant for help.

Serving

Radishes are eaten raw by themselves or in salads. They are colorful, tasty and good for you.

Cleanup

After the radishes get too old or start going to seed, pull and place them in a compost pile if the soil is to be replanted soon. If the soil is to be left idle, old radishes and tops can be spaded into the soil. This helps build the soil.
Greens include all leafy green vegetables. They often are called potherbs and are grown mostly for their tender leaves. Green vegetables include spinach, New Zealand spinach, chard, dandelion and kale. Spinach is the most popular of this group. Most greens are cool season crops and must be grown in the early spring or fall in Texas. Some greens will stand temperatures below freezing and thus can be grown all winter in many Texas areas. Greens grow best in a well drained soil in full sunlight but will tolerate partial shade.

Soil Preparation

Spinach has a deep taproot so the soil must be worked at least 8 to 10 inches deep. Dig the soil in the early spring when it is dry enough not to stick to garden tools. Break up large clods and remove trash and weeds. Work the soil into planting beds about 4 inches high. This is especially important in heavy soils. Add compost or other organic matter before digging the soil.

Fertilizing

Spinach grows best when given plenty of fertilizer. Adequate nitrogen is needed to develop the dark green leaf color. Before planting the seeds, apply a general garden fertilizer such as 10-20-10 at the rate of 2 to 3 pounds per 100 square feet or fertilize as directed by a soil test report. Mix the fertilizer into the soil about 3 inches. Spinach does best when the fertilizer is applied in a band 3 inches under the row (Figure 1).

Fig. 1. Apply fertilizer in a band 3 inches under the row.

Apply 1/4 to 1/3 cup of fertilizer for each 10 feet of row. Fertilize again about 30 days after the plants come up.

Varieties

Spinach
- Green Valley II
- Ozarka II
- Fall Green
- Coho (semi-savoy)

Chard
- Lucullus
- Ruby

New Zealand Spinach
- Vates
- Blue Knight

Dandelion
- Malibar

Kale

Planting

Plant spinach as early as the soil can be worked in the spring or in August or later in the fall. High temperatures and long days of summer cause spinach to "bolt" or produce a seed stalk that makes it unusable for food. Substitutes for spinach during hot weather are Malibar and New Zealand spinach and Swiss chard. Malibar and New Zealand spinach are not members of the spinach family, but their flavor is similar to spinach and they often are used by home gardeners.

Swiss chard is sometimes called summer spinach in some areas of Texas, but actually it is a member of the beet family and tastes similar to beet greens. Swiss chard is very tolerant of heat and light freezes. It can be harvested all year in many areas of Texas. Kale is a cool season crop which should be planted in early spring or late fall. It is sometimes called "flowering cabbage" and makes a good border for flower beds or along sidewalks. Unless you want to freeze or can spinach, it is best to plant several short rows of spinach 10 to 15 feet long, 10 to 14 days apart instead of planting all at once. This is called succession planting and it prevents having too much spinach at one time. Use a hoe handle, stick or similar tool to make planting furrows about 1/2 inch deep, 1 1/2 to
2 feet apart down the bed. Plant seeds about 1 inch apart down the row and cover with loose soil or compost. For the fall crop, cover with sand or other light colored material to reflect heat and keep the soil cooler.

Plant New Zealand spinach in rows 3 feet apart and thin to 2 feet between plants. New Zealand and Malabar spinach will not stand as much cold as spinach. Seeds are slow to germinate. Plants can be grown indoors and transplanted to the garden after frost in the spring. Malabar is a vining plant and should be planted next to a fence or trellis for support. Leave 10 to 12 inches between plants. Dandelion is a perennial that comes back each year.

Greens can be planted by spreading seed on a bed 18 to 20 inches wide and covering them with soil. This allows more plants to be grown per foot of row, but weed control is much harder. Weeds must be pulled by hand.

**After Planting**

Keep plants free of weeds, especially when they are small since weeds use water and nutrients needed by the growing crop. Hand pull weeds close to the crop since hoeing can cut vegetable roots and cause plants to wilt. After the plants come up and become crowded in the row, begin thinning. Leave kale 1 foot apart, chard 6 inches apart and spinach 3 to 4 inches apart. Do not throw away thinned plants as they make excellent, tender greens.

Water plants thoroughly each week. Water is needed more often in light soils and in hot weather. Do not allow the plants to wilt. Deep soaking of the soil causes crop roots to go deeper into the soil and helps them resist dry weather. A good mulch is helpful in controlling weeds and moisture loss from the soil.

About 30 days after the plants come up, scatter 1/4 cup of garden fertilizer beside the plants for each 10 feet of row and water thoroughly.

**Insects**

<table>
<thead>
<tr>
<th><strong>Name and description</strong></th>
<th><strong>Control</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf miner: small yellowish larva; tunnels inside leaves and causes white “trails” to form</td>
<td>Check with your county Extension agent</td>
</tr>
</tbody>
</table>

**Aphid:** 1/8 inch long; soft-bodied; green, pink, red or brown; usually on underside of leaves; sucks plant juices. Check with your county Extension agent.

**Diseases**

Spinach often shows some disease damage on the leaves in cool, damp weather. Do not plant spinach in the same place in your garden more than once every 2 or 3 years. If your plants get spots on the leaves, ask your county Extension agent or gardening assistant about disease control.

Before applying any pesticide, always read the label. Follow cautions, warnings and directions and observe waiting periods between spray applications and harvest.

**Harvesting**

Harvest spinach when the plant is 6 to 8 inches tall. Pull up the entire plant in the spring since it stops producing in hot weather. For the fall crop in milder areas of Texas, clip the leaves just above the crown about 1 to 2 inches above ground level. Water and fertilize lightly and the plants will continue growing. Harvest lower leaves of chard and kale as the leaves grow.

Harvest the tips of Malabar spinach plants when they are 3 to 4 inches long. Dandelion, a common weed in lawns and fields, can be used as spring greens when 4 to 6 inches tall. Dandelions get strong flavored if left too long. If you use dandelions from outside your garden, be sure they have not been sprayed with a weed killer before harvest.

**Serving**

Spinach and other greens are high in minerals and Vitamin A when cooked properly. Dandelion is the highest of all vegetables in Vitamin A. Cook greens in a small amount of water only until tender. Your county Extension agent has information on preparing and serving greens.

**Cleanup**

Remove all unharvested plants from the garden and place in a compost pile or turn them deep under the soil. This helps control diseases and builds the soil.
All types of squash are popular garden vegetables. Squash will grow well in all Texas areas. Like most vining vegetables, squash grows best in sandy, fertile soils.

Soil Preparation

Work the soil 8 to 10 inches or deeper. Remove rocks and trash, and rake the soil smooth. Work the soil only when it is dry enough not to stick to garden tools.

Fertilizing

Add 2 to 3 pounds of fertilizer such as 10-10-10 for each 100 square feet of garden area. If you plan to grow only a few plants, use 2 to 3 tablespoons of fertilizer for each plant. Scatter the fertilizer evenly over a 2 foot by 2 foot area. Work it into the top 3 to 4 inches of soil.

Varieties

<table>
<thead>
<tr>
<th>Summer Squash</th>
<th>Winter Squash</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yellow</strong></td>
<td>Butternut</td>
</tr>
<tr>
<td>Goldie</td>
<td>President</td>
</tr>
<tr>
<td>Gold Bar</td>
<td>Waltham</td>
</tr>
<tr>
<td>Multipik</td>
<td>Early Butternut</td>
</tr>
</tbody>
</table>

**Fig. 2. Plant five to six seeds in each squash hill.**

**Planting**

Squash does not grow well in cold weather. Plant in the spring after all danger of frost has passed. For a good fall crop, plant early so the squash will mature before the first killing frost.

**Fig. 3. When squash plants are 3-4 inches tall, thin to three plants per hill.**

Plant bush type squash in hills 18 to 48 inches apart on rows 3 to 8 feet apart (Figure 1). Vining types, such as hubbard or acorn, need more room.

When seeding squash, plant the seeds about 1 inch deep. Plant 5 to 6 seeds in each hill (Figure 2). Water after planting the seed. After the seeds come up, thin them to three squash plants per hill (Figure 3).
Fig. 4. Be careful when hoeing around squash plants so you will not hurt the roots.

Watering

Water the plants enough to keep them from wilting. Water them once a week or more often in real dry weather. Sandy soils need to be watered more often than heavy clay soils.

Care During the Season

Keep squash plants free of weeds. Hoe around the plants to remove small weeds. Hand-pull the weeds close to the plants (Figure 4).

When the first blooms appear, place about 2 tablespoons of garden fertilizer around each plant. Do not let the fertilizer touch the plants. Water the plants after fertilizing.

Insects and Disease

Check your squash for harmful insects. All kinds of squash need some types of insects, especially bees, for pollination. Using unneeded insecticides can kill these pollinating insects and greatly reduce yields.

Squash can get many diseases, especially when harvesting begins. Spray with an approved fungicide to help control most diseases.

Ask your county Extension agent what to use to control squash insects and diseases. Follow directions on the container.

Harvesting

Harvest yellow and green (summer) squash when the fruit and seeds are small. Always harvest squash which are ready so the plants will keep producing. Harvest winter (hard rind) squash when it is full sized, the skin is hard and the bottom of the fruit is cream-to-orange in color. A light frost will not damage fruits of winter squash. Squash is best when cut, not pulled, from the vine.

Serving

Fresh squash adds color and variety to meals.

Green and yellow squash are fair sources of Vitamins A and C. Winter squash is a good source of Vitamin A. It has fair amounts of Vitamin C.

Squash can be served in many ways, from fried dishes to casseroles. Winter squash often is baked. Cook all types of squash only until tender to keep the vitamin content.

Storing

Green and yellow squash can be stored in the refrigerator for about a week. Winter squash can be stored for several months.
Sweet corn is a crop which should be planted in larger gardens. Like most vegetables, corn will grow best in areas with plenty of sunlight.

Soil Preparation

Work the top 6 to 10 inches of soil before planting. Remove weeds, rocks and trash. Work the soil only when it is dry enough not to stick to garden tools.

Fertilizing

Use 2 to 3 pounds of fertilizer such as 10-20-10 for each 100 square feet of garden area. Spread the fertilizer evenly over the soil. Work it into the soil 3 to 4 inches deep. Rake the soil to smooth the surface.

Varieties

Yellow
Summer Sweet 7800
Sweet G-90
Kandy Korn

White
Silver Queen

Planting

Sweet corn is a warm season crop and must be planted after the soil warms and there is no more danger of frost.

If you have room, plant again when the first corn plants have 3 to 5 leaves. This usually takes 2 to 3 weeks.

You will need 1 to 2 ounces of seed for every 100 feet of row. Do not use seed saved from last year's sweet corn. The seeds will not grow a good crop.

Sweet corn grows best when planted in several short rows instead of one or two long rows. This makes it easier for the corn plants to pollinate. Good pollination is necessary for ears of corn to have plump, juicy kernels.

Plant the corn seeds about 1 inch deep and 3 to 4 inches apart in the row. Space the rows 2 1/2 to 3 feet apart. After the plants are up, thin them to 1 foot apart. If you plant them closer, your corn will have small, poorly-filled ears (Figures 1 and 2).

Fig. 1. Plant corn in several short rows, not in one or two long rows.

Fig. 2. Poorly-filled corn is caused by poor pollination.
Watering

Water corn as needed to keep it from wilting. Do not let corn suffer from lack of water when the kernels are forming.

Care During the Season

Hoe or till the soil just under the surface. Hoe the weeds off just below the soil's surface. Deep hoeing will cut the corn roots which are close to the top of the soil.

When the plants are about 2 feet tall, apply 1 cup of fertilizer for each 10 feet of garden row. Scatter the fertilizer evenly between the rows. Mix it lightly with the soil. Water after fertilizing (Figure 3).

Harvesting

The best time to pick corn is in the early morning or evening when it is cool. Juice from the kernels should be milky white, and kernels should be soft.

The silk on the ears should have turned dark brown. The ears should be firm. Kernels on the tips of the unhusked ears should be plump and milky.

Sweet corn is not ready when the juice of the kernel is watery. It is overripe when the kernels get large, chewy and pasty like dough.

To harvest the ears, hold the stalk below the ear. Twist the tip of the ear toward the ground until it breaks off. Cook the corn right away, or store it in the refrigerator until mealtime. Corn loses flavor and nutrients quickly when left at high temperature.

Watch the corn closely because the quality changes fast. Corn is ready for harvest about 2 to 3 weeks after the silk appears on the ear.

Serving

Corn has small amounts of many vitamins and minerals and contains fiber.

Corn-on-the-cob is best when picked fresh and cooked immediately. Cook fresh sweet corn on the cob or cut it off the cob.

Remove husks, silk and bad spots just before cooking.

Corn which is past its best quality is still good as cream-style corn.

Storing

Store corn in the husk. Place it uncovered in the refrigerator for 1 to 2 days. Corn which is stored more than 2 days loses its sweetness.

Cleanup

Old corn plants are good compost for adding to the garden soil. They will break down much faster if shredded before composting.
Tomatoes are the most popular garden vegetable crop in Texas. They grow well in most Texas areas if planted in well-drained soil. Tomato plants need at least 6 hours of sunlight each day.

**Soil Preparation**

Work the top 8 to 10 inches of soil several weeks before planting. Break up the large clods. Remove rocks and trash.

Tomatoes grow best in soils which have lots of organic matter. If possible, spread 2 to 3 inches of organic material over the planting area. You can use materials such as compost, leaves or rotted hay. Work it into the top 4 to 6 inches of soil. Work garden soil only when it is dry enough not to stick to garden tools.

**Fertilizing**

Add 2 to 3 pounds of fertilizer such as 10-10-10 for every 100 square feet of garden area. Spread the fertilizer evenly over the area. Mix it with the top 3 to 4 inches of soil.

If you plan to grow single plants, dig a hole 2 feet wide and 10 inches deep. Refill the hole with half soil and half organic matter. Mix 2 level tablespoons of fertilizer into this planting area.

**Varieties**

<table>
<thead>
<tr>
<th>Large tomatoes</th>
<th>Cherry tomatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny</td>
<td>Small Fry</td>
</tr>
<tr>
<td>Bingo</td>
<td>Cherry Grande</td>
</tr>
<tr>
<td>Carnival</td>
<td></td>
</tr>
<tr>
<td>Heatwave</td>
<td></td>
</tr>
<tr>
<td>Celebrity</td>
<td></td>
</tr>
<tr>
<td>President</td>
<td></td>
</tr>
<tr>
<td>Merced</td>
<td></td>
</tr>
</tbody>
</table>

*Respectively, Extension horticulturist and Extension horticulturist (vegetables), The Texas A&M University System*

**Planting**

Most families need only a few plants, so it is best to buy plants, not grow them from seed. Buy healthy green plants 6 to 8 inches tall. Do not set out tomato plants until all danger of frost has passed. Transplant fall tomatoes in the garden about 100 days before the first expected frost.

Make the transplant holes 3 to 4 inches deep, and 2 to 4 feet apart in the row. Space the rows at least 3 feet apart for staked or caged plants. For unsupported plants, leave 4 to 5 feet between rows.

If possible, set out tomato plants on raised beds of soil about 6 inches high (Figure 1).

Fig. 1. Tomatoes grow best on beds raised to about 6 inches. Leave enough spacing between rows and plants. For bush varieties that will not be staked or caged, leave 2 to 4 feet between plants. Leave 6 feet between rows.

Transplant tomatoes in the evening or on a cloudy day. This will keep the plants from wilting and getting too dry. Before planting, fill the transplant holes with water and let it soak in. Plant the transplant slightly deeper than it had been growing (Figure 2). Pack the soil loosely around the plant. Leave a slightly sunken area around each plant to hold water.

**Watering**

Water the tomato plants slowly and deeply to help grow a strong root system. Do not let tomatoes wilt severely, or yields and fruit quality will be low.
Care During the Season

Mulch the tomatoes for highest yields. Place a 2- to 3-inch layer of organic material such as compost, leaves or hay around the growing plants. Mulching helps stop weed growth and water loss from the soil.

You can let tomatoes grow on the ground, or support them by staking or caging. When staking tomatoes, put the stake in shortly after transplanting to lessen root damage. A 6-foot stake set 10 inches deep in the soil will work well. As the plant grows taller, tie it loosely to the stake every 12 inches with pieces of rag or twine (Figure 3).

Prune the staked tomatoes to produce a more orderly vine. Remove the small shoots which grow out of the point where each leaf joins the main stem. Remove the shoots by bending them sideways until they snap (Figure 4). For two main vines, remove all but the lowest shoot. It will develop into a second branch.

Caging is another good way to train tomato plants. You can make a good cage with a piece of concrete reinforcement wire 5 feet tall and 6 feet wide. Put cages over the young plants. Push the cages down into the soil to keep them from blowing over. This way, the vine has support without being tied (Figure 5). Tomatoes growing in cages do not need to be pruned.

Insects and Diseases

Several different insects and diseases bother tomatoes. Control these problems by using approved insecticides and fungicides. Ask your county Extension agent what to use to control tomato insects and diseases. Follow the directions on the container.

Harvesting

Pick tomatoes at full color for best quality. If you pick them when they are pink, let them ripen at room temperature. Store them in the refrigerator after they reach full color.

Serving

Tomatoes are a good source of Vitamin A and fair source of Vitamin C. Fresh tomatoes are popular in salads, on sandwiches and sliced. Tomatoes can be cooked and used in many different ways.

Storing

Fully ripe tomatoes can be stored in the refrigerator for several weeks.
Texas Agricultural Extension Service

Easy Gardening
Turnips and Mustards
Sam Cotner and Jerry Parsons

Turnips and mustards, members of the cabbage family, are cool-season crops. They must be grown in the cool temperature of early spring and late fall, and they need full sun and a well-drained soil for best production. Mustard is grown only for the leaves. Turnips is a dual purpose crop. Leaves are used for greens, and the root is cooked like potatoes and beets.

Soil Preparation and Fertilization

Soil should be free of large rocks, sticks and other bits of trash. If the soil is heavy clay, add compost or other organic matter to loosen the soil. This is very important if turnips are grown for the roots because heavy soil can cause roots to be tough and poorly shaped.

Dig the soil 10 to 12 inches deep. Be sure all plant material is covered. This makes it break down more quickly. Then, scatter 2 to 3 pounds of complete garden fertilizer such as 10-20-10 over the 100 square feet. If only one row is to be planted, use 1 cup of fertilizer for each 10 feet of row (Figure 1). Phosphorus, the middle number on the fertilizer bag, is especially important to grow good turnip roots.

Fig. 1. For each 100 square feet of garden, scatter 2 to 3 pounds of complete garden fertilizer such as 10-20-10.

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Bed the soil into ridges 6 to 8 inches high and 18 to 24 inches apart (Figure 2). Allow the ridges to settle or pack them before planting.

Planting

Plant turnips and mustards as soon as the soil can be worked in the spring. Seeds will sprout if the soil temperature is 40°F or higher. For a fall crop, start planting 8 to 10 weeks before the first expected frost. In South Texas and coastal areas, turnips and mustard grow well all winter.

Just before planting, drag the top off the ridges with a rake or hoe. This widens the planting bed to 8 to 10 inches. It also allows the seed to be planted in moist soil, especially important when planting the fall crop.

Fig. 2. Soil should be formed into ridges 6 to 8 inches high, 18 to 24 inches apart.

If ridges are made on 3-foot centers for planting other vegetables, two rows of mustard and turnips can be planted on each ridge. Plant one row down each side.

Cover the seeds lightly with soft soil or compost. Sprinkle to speed sprouting. When planting for a fall crop, cover the seeds with sand or light colored mulch to keep the row cool. Sprinkle the row lightly with water to prevent soil crustling until the small plants break through. Under good conditions most should be up in 3 to 7 days.

To have a continuous supply of fresh, tender mustard and turnip greens, make two or three plantings 10 days apart. Plant in full sun, if possible. Mustard works well as a border to a flower bed or sidewalk. Both the broad-leaf and curled-leaf varieties are attractive and add green to a flower bed. They are easily grown in window boxes and containers.
Varieties

Turnips can be used either for greens or for roots. A variety developed for root production can be harvested for greens, while a variety developed for greens may not produce a good root. Most varieties produce greens in 40 days. From 50 to 60 days are usually required to produce turnip roots.

Mustard varieties can be broad-leaf or curled-leaf. Broad-leaf mustard has a wide, flat leaf. Curled-leaf mustard produces more narrow, wrinkled leaves similar to spinach. Curled-leaf mustard will stand more cold and can be grown later into the winter than broad-leaf mustard. Some gardeners do not like curled-leaf mustard because it is hard to wash sand and dirt from the wrinkles in the leaves. A well-mulched garden usually does not have this problem.

<table>
<thead>
<tr>
<th>Turnips</th>
<th>Mustard</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Top (greens)</td>
<td>Green Wave</td>
</tr>
<tr>
<td>White Lady</td>
<td>Tendergreen</td>
</tr>
<tr>
<td>Royal Globe II</td>
<td>Southern Giant Curl</td>
</tr>
</tbody>
</table>

After Planting

Keep the plants free of weeds, especially when they are small. Pull the weeds by hand or use a hoe. Do not cut too deeply with a hoe. Soak the rows well with water each week if it does not rain. Water may be needed more often in some areas.

When plants become crowded, thin them by pulling some plants. Small plants of both turnips and mustard make delicious greens. Thin mustard plants until they are 6 inches apart. Leave turnips 3 to 4 inches apart. Overcrowding prevents turnip roots from developing.

Turnips and mustards need adequate nitrogen to develop dark green color. When plants are 4 to 5 inches tall, apply 1/2 cup of fertilizer for each 10 feet of row. Spread the fertilizer beside the plants, mix it lightly with the soil and water it into the soil. If your soil is sandy and the season is wet, you need to apply more fertilizer later.

Insects

Name and description

Aphid: 1/8 inch long; soft-bodied; green, pink, red or brown; underside of leaves; sucks plant juices

Flea beetle: 1/16 inch long; bronze black, blue or green; jumps quickly; eats small holes in leaves

Name and description

Cabbage looper: 1/3 to 1/2 inch long; pale green with light stripes down back; doubles up or loops when it crawls, chews leaves

Root Maggot: 1/4 to 1/2 inch long; yellowish-white; legless; feeds on turnip roots

Before using a pesticide, read the label. Always follow cautions, warnings and directions. Since greens are harvested often, follow waiting periods for pesticides.

Diseases

Diseases can be troublesome when the weather is cloudy and damp. If plants begin to look weak and unhealthy, diseases may be present. Your county Extension agent can help you select a good fungicide to use for disease control.

Harvesting

Mustard and turnip greens are good until the weather gets hot. Too much heat causes them to be tough and strong flavored. Harvest mustard leaves when they are about the size of your outstretched hand. Take only the lower leaves until the weather becomes hot. When hot weather approaches, cut and use the entire plant.

Harvest turnip greens by pulling the entire plant when the leaves are 4 to 6 inches long. Harvest turnip roots when they are 2 to 21/2 inches in diameter. If left longer, they will get tough and stringy. Both mustard and turnips lose quality and go to seed quickly when days become long and hot.

Serving

Mustard and turnip greens are high in minerals and vitamins A and C when cooked properly. Cook them only until they are tender. Use only the water that remains on the leaves after washing. Your county Extension agent has information on how to prepare and serve mustard and turnips.

Extra greens can be stored several days in closed plastic bags in a refrigerator.

Turnip roots will keep several weeks in a cool humid area such as a root cellar or bottom of a refrigerator.

Cleanup

Unused leafy vegetables make good additions to a compost pile. They break down quickly and can be turned into the garden soil.
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