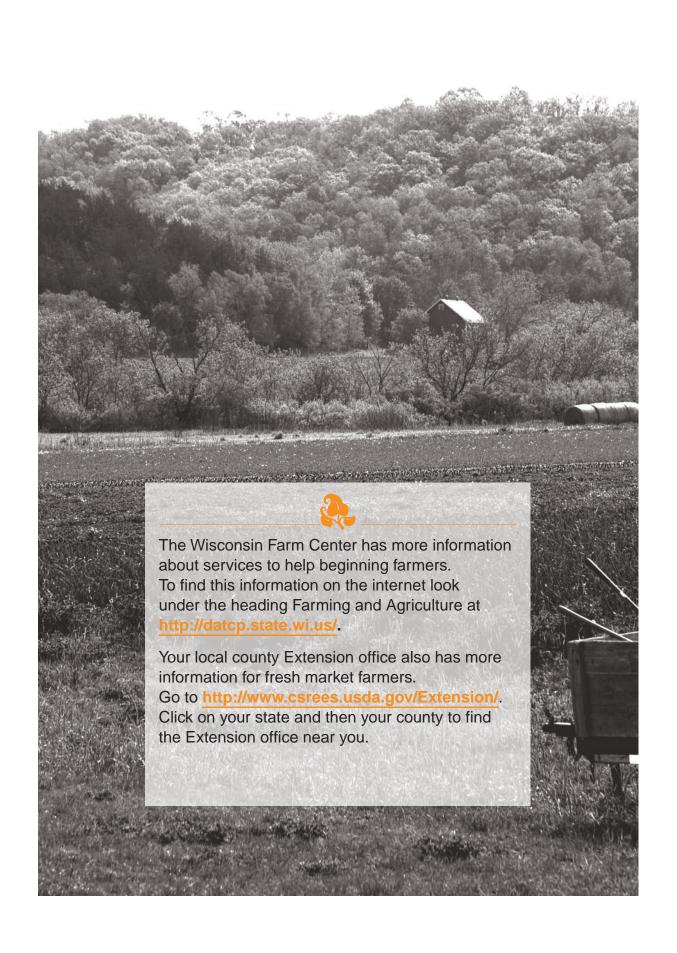


Growing Fresh Market Pumpkins, Squash, and Gourds



A. C. Newenhouse



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Pumpkins, squash and gourds are good crops to grow for the farmers market because many people want to buy them in the fall. Pumpkins and squash are used as decorations and also eaten. Gourds are used only as decorations, not food. If you have a farm and want customers to come to you, it is a good idea to grow and sell pumpkins. Pumpkins, squash and gourds grow on vines that cover the ground. If you have a field that has a lot of weeds, you can grow pumpkins, squash, and gourds to help clean up the field.

Plant Description

Pumpkins, squash, and gourds are all members of the Cucurbit family. Cucurbits are native to North and South America. Most pumpkins, squash, and gourds belong to one of three species of Cucurbits: Cucurbita pepo, Cucurbita maxima, or Cucurbita moschata. A plant called 'pumpkin' can be either Cucurbita pepo, Cucurbita maxima, or Cucurbita

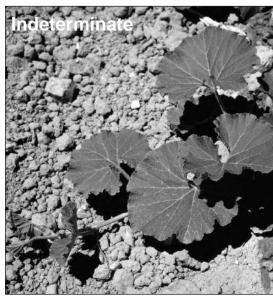
Determinate

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moschata. Each species is a little different from the others. Table A lists the plants, their species, and the countries where the plants are native.

Pumpkins, squash, and gourds are warm season annual crops. They have two types of growth pattern. One is called determinate. Determinate plants form flowers and fruit at the end of shoots. Plants are upright and bushy. Another type is called indeterminate. Indeterminate plants form flowers and fruit at the point where a leaf grows out from the stem. The shoots keep growing. Plants grow flat on the ground and form vines. Most of the plants in the Cucurbita family form short twisted branches called tendrils. Tendrils wrap around stems or stakes as the plant grows.

Pumpkins, squash, and gourds have shallow roots that grow in a wide area. Roots can grow along a vine as it lies on the ground. Roots form on the stem at the place where a leaf grows.



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Pumpkins, squash, and gourds have two kinds of flowers on each plant. One type is the male flower and the other type is the female flower. Only the female flower will form a fruit. Male flowers make pollen for female flowers. The two kinds of flowers have these differences: Male flowers have a stamen Male flowers do not form fruit. Male flowers have a long thin flower stalk. -Female flowers have a pistil A tiny fruit forms below the female flower. Female flowers have a short flower stalk.

Flowers are only open for one day, typically in early morning. Insects carry pollen to pollinate pumpkins, squash and gourds. Flowers need many bee visits to get enough pollen to set fruit. If a flower does not get enough pollen it will not set fruit. If a flower gets more pollen it will make bigger fruit.

You will need 1-2 bee hives per acre for a good crop of pumpkins, squash and gourds. Bees do not like to fly in wind, rain, or cold. If this weather happens you will get poor pollination. If you do not have good pollination, you will not get many fruit. Also, fruit will have poor shape.

If you have a field with different kinds of pumpkins, squash, and gourds, bees can carry pollen from one kind of plant to the flowers of another. The fruit that grows will not look different. If you save the seeds from that fruit and plant them, the new fruit might look like a mix of the parents.







Site Selection

Pumpkins, squash, and gourds need full sun, heat, and a long growing season. Choose well drained soils that warm quickly. Soil that are poorly drained do not warm up as fast in spring. Light, sandy soil is best. Soils that have a lot of organic matter, such as muck soil or peat soil, are not good for pumpkins, squash and gourds. Fruit grown on these soils will be soft and not as sweet.

The best soil pH for pumpkins, squash and gourds is 6.0-6.8.

Table A. Cucurbita species					
Species	Plants	Native country	Type of pumpkin		
Cucurbita pepo	Pumpkin, acorn squash, summer squash, zucchini, spaghetti squash, delicata squash, small gourds	United States , Mexico	- Bright orange skin - Hard, woody, stem with ridges		
Cucurbita maxima	Very large pumpkins, winter squash, buttercup squash, hubbard squash, turban squash, banana squash, large gourds	Chile, Argentina, Bolivia, Uruguay	- Yellow skin - Soft stem like a sponge or cork		
Cucurbita moschata	Pumpkin, winter squash, butternut squash	Mexico, Peru	- Long, not round - Tan skin - Stem has ridges		



Variety Selection

Choose varieties that resist disease. You can grow pumpkins that are meant for eating or pumpkins meant for decoration. Pumpkins meant for eating are sometimes called pie pumpkins. Pumpkins come in a lot of different colors, types, and sizes.

Squash varieties are either "summer squash" or "winter squash". Summer squash has thin skin and is ready in mid summer. Winter squash has thick skin, is ready late in the season, and keeps well. There are many flavors, shapes, colors, and sizes of squash.

There are always new varieties of pumpkins and squash for decoration. Some growers like to have the newest or most unusual varieties for their customers.





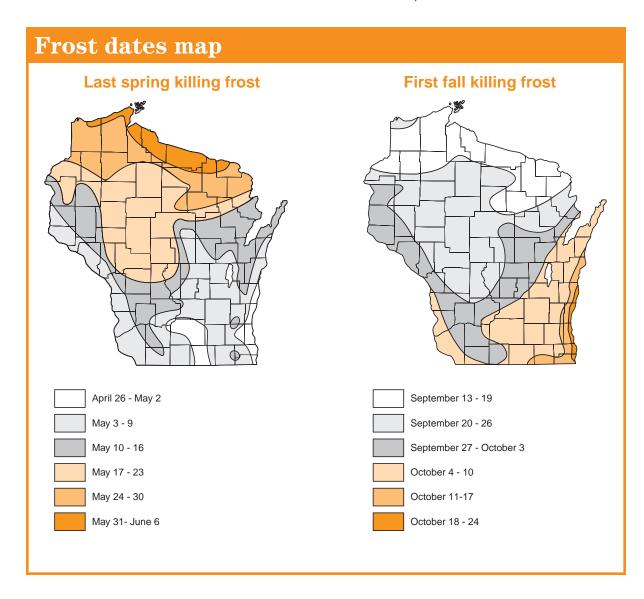
Planting and Care

Pumpkins, squash, and gourds do best when grown from seeds planted directly into the field. It is not easy to transplant pumpkins, squash and gourds because they do not do well when their roots are disturbed. Vine crops need a lot of space to grow, especially the indeterminate types of plants and the larger pumpkin varieties.

Starting Seeds

If the growing season is too short and you have to start the seeds in a greenhouse or under lights, plant them inside 3-4 weeks before they go in the field. Plant in the field after the last frost date in your area (see frost date map).

You can buy or mix your own sterile potting mix. The mix should include compost, peat, or sphagnum to hold moisture; vermiculite or perlite for aeration; and mineral and nutrient



sources to feed the new plants after the first roots form. Add water to make the mix moist before you fill the transplanting trays.

Since vine crops do not transplant easily, try to protect the roots as much as you can. Farmers plant seeds into either paper or peat pots that can be planted. Or use a paper or fiber pot that you can peel away before you plant. If you use a plastic pot or cell

pack, the shape should be tapered so it is easy to pull the plant out of the pot. Sterilize the plastic pots in a 10% bleach solution before you plant. This will prevent bacteria and fungi from infecting the young seedlings. Pots or cells should be 2" in diameter.

Make a 10% bleach solution by putting 1 part bleach into 9 parts water. For example, mix 1 cup bleach with 9 cups water.

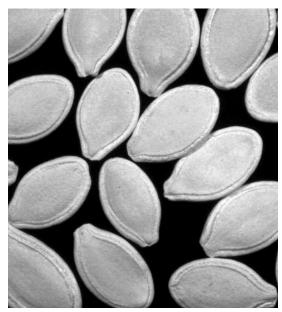






These are the steps to start seeds indoors:

- Fill the pots with potting soil.
- Plant seeds ½-1 inch deep. Plant two or three seeds per cell.
- Label the pots with variety and planting date.
- Keep soil moist but not wet.
- Use a heating mat or cable under the pots to keep the soil warm to 70°F until the seedlings sprout. You should see seedlings sprouting in 10 days.
- The temperature in the greenhouse should be 70-75°F during the day.
- The temperature in the greenhouse should be 60-62°F during the night.
- As plants grow, thin them so only 1-2 plants are in each cell. Use a scissors to clip out unwanted plants. This way the roots will not be disturbed.



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- Four to seven days before transplanting out to the field, harden off the plants by putting them outside for a few hours each day during the warmest time of the day, or move plants into a cold frame. Cold frames are a type of planting bed made by building wooden sides on each side of a bed on the ground. The back is higher than the front and the frame holds up a glass top at an angle to the sun facing south. You can use an old window to make a cold frame.
- If the temperature will go below 45°F, bring plants inside.
- Give the plants less water and no fertilizer while they are hardening off.

Plant seeds or transplants in the field after the last spring frost and when the soil temperature is at least 60°F. These crops grow best at temperatures of 65-75°F at night and 75-86°F daytime. Seeds sprout fastest at 85°F soil temperature.

Pumpkins, squash and gourds are usually planted by seed into the field. Look at table B for the amount of seed you will need, how deep to plant seed, how far apart to plant, when to plant, days to first harvest, and yield. Seeds are planted in rows or in hills. Hills are small mounds with 3-5 seeds in them. If you plant in hills, thin the seedlings to 1-3 plants per hill.

Some farmers use a small machine called a walk-behind plate seeder to plant seeds. If the soil is too cold (less than 60°F) or too wet, seeds will rot. Plant seeds 1-1.5 inches deep.

If you plant transplants, look at Table B for how far apart to plant, when to plant, days to first harvest, and yield. Do not bury stems deeper than they are growing in the pot or cell. Be gentle with plants so you do not disturb roots. You can plant the transplants by hand or use a tractorpulled machine. Be sure to water them right away after planting.

Summer squash needs 50-60 days to first harvest. You can lengthen the growing season for summer squash by planting seeds every 2-3 weeks in spring. Pumpkins and winter squash need all season to grow, 90-120 days.



Table B. Planting guide

		g time in ern Wl ^{a,c}	Plants or seeds needed for 100 ft of row	Seed depth (inches)	Spacing (inches) ^b		Days to first harvest°	Estimated yield (lb/ft of row) ^d
Vegetable	Indoors	Outdoors			Between rows	Between plants		
Pumpkin	May 1	May 10	34-50	1 - 1½″	48-72	24-60	90-120	2
Winter Squash		(seeds) May 20 (plants)	20 ½ oz.		48-96	36-96	90-120	2
Summer Squash						48-60	24-48	50-60°
Gourds					48-72	24-60	60-90	1/5 - 1/2

^a Plant about 1 week later along the lower lake shore and in the central part of the state and about 2 weeks later in the north.

^b If you use a plate-type seeder, the plate will make the spacing between plants.

^c Plant summer squash every 2 weeks until the middle of the summer for a longer growing season.

^d Estimated yields under less than ideal growing conditions; actual yields will vary widely with weather, soil fertility and cultural practices.



Soil preparation

It is important to control weeds before you plant. You can use these methods:

- Pull weeds by hand.
- Smother weeds with a cover crop (such as buckwheat).
- Cover the soil with black plastic to heat it and keep out light.
- Use weed killer sprays (herbicide sprays).

For more information on weed control read the section on weed management on page 13

Work beds 7-8 inches deep to promote good rooting. Never work wet soil because this can cause soil compaction. Compacted soils prevent oxygen and water from reaching roots, and plants do not grow as well or produce as much.

Raised beds

You can use raised beds to improve soil drainage and prevent compaction.

Raised beds are usually 4-5 feet wide and 100 feet long. Leave a 1-foot aisle on either side of each bed for a path.

Season extenders

You can make the growing season longer by protecting plants from late spring frosts and early fall frosts using these methods:

- Plant on a south facing slope.
- Plant on black plastic mulch.
- Cover young plants with a floating row cover.
- Make a wind break.

Plastic mulch. Plastic mulch raises the soil temperature early in the season. You can add 1-3 weeks to the growing season with plastic mulch. Plastic mulch also keeps weeds down. It helps prevent some plant diseases because the fungus or bacteria spores from soil do not touch leaves. Many farmers in the Midwest use black plastic mulch for pumpkins, squash, and gourds. Some farmers put drip irrigation tape down before they cover the soil with black plastic.



Lay down 1.25-1.5 mil black plastic mulch before you plant:

- Dig a trench along each side of the row.
- On a day with no wind, unroll the black plastic over the planting bed.
- As you go, push soil back in the trench to bury the edge of the plastic.
- Place soil along all four edges of the plastic so it doesn't blow away. Wind can come in on any side and lift the whole strip of plastic.
- The plastic should be tight so puddles do not form.
- If you have puddles, poke tiny drain holes in the plastic.
- You can also lay plastic mulch with a machine pulled behind a tractor, called a plastic layer.

When you are ready to plant, cut holes where the plants go. Make the holes with a scissors or a propane torch. If you cut holes with a scissors, remove the flap of plastic so it doesn't hurt the young plant.

Plants growing on black plastic need more water. Some farmers use drip irrigation tape under the plastic.

Floating row covers. Floating row covers are special sheets of white fabric made of spun-bonded polypropylene which lets sunlight and water through the fabric but stops insects:

- You can use row covers to protect plants from frost, wind, and insects.
- Row covers come in different weights and the thicker ones can warm plants by 4-8°F.
- You can use them for a short time to cover pumpkins, squash and gourds in cold weather.
- You can wash and re-use them for two to three seasons.

Put the row cover on top of the crop, gather the edges and loosely bury them along the crop row. As the crop grows it will push up enough fabric to form a "floating" cover. You can also use rocks or heavy posts to hold down the edges. Take row covers off when the air is warm enough for the crop to grow. Also take row covers off pumpkins, squash, and gourds when the plants are flowering because bees and other insects need to get to the flowers to pollinate them.

Windbreaks. If your field is in a windy location you can put up windbreaks to help keep the field warm. The effects of a windbreak cover an area 2 ½ times the height of the windbreak. For example, a 10 foot tall windbreak will protect an area up to 25 feet away. Many farmers plant a tall cover crop such as grain rye between rows of pumpkins, squash, and gourds to act as a windbreak. To protect a whole field you can also plant fast growing trees or shrubs on one side, or use a fabric or plastic mesh fence.





Soils and Nutrient Management

Get a soil test before you plant a field for the first time and then at least once every 3 years. For information on how to collect samples and where to send them for analysis, see University of Wisconsin Extension publication *Sampling Soils for Testing* (A2100).

Most soil tests include pH, organic matter, phosphorus, and potassium. You can also ask to test for nitratenitrogen, calcium, magnesium, sulfur, boron, manganese, and zinc. You will receive the results of your soil test along with fertilizer recommendations based on how you will use your field. You can also test your potting soil that you use to grow transplants.

Soil pH

Soil pH measures acidity and should be at the correct level so the crop can take up enough nutrients and minerals from the soil. Plants that don't have enough nutrients and minerals plants can turn yellow. Pumpkins, squash, and gourds grow well in a wide pH range of 5.5-7.5.

Fertilizer needs

Pumpkins, squash, and gourds need nitrogen, phosphorus, and potassium in large amounts and many other nutrients in small amounts. Table C gives the amount of fertilizer these plants need. Check your soil test results to see how much of these nutrients you need to add.

Nitrogen. Put down no more than half the amount of nitrogen you need during the growing season when you make the field ready for planting.

Table C. Annual nitrogen, phosphate, and potash for pumpkins, squash, and gourds

Nitrogen			Phosphate and potash			
Organic matter	Amount to apply ^a		Phosphate (P₂O₅)		Potash (K ₂ O)	
%	lb/a	oz/100 sq ft	lb/a	oz/100 sq ft	lb/a	oz/100 sq ft
< 2	100	3.75	50	1.9	110	4.1
2.0-4.9	80	3.0				
5-10	60	2.2				
>10	40	1.5				

^aYield goal of 15-20 tons/acre. Follow guidelines from your soil test.

Work it into the soil. Later, when the plants have two or three true leaves, put down more. At that time, put it in a strip near the plant roots. If you need to give plants more nitrogen after that, do it when the vines begin to fill the rows.

Plants that do not have enough nitrogen are smaller and do not produce as many pumpkins, squash, or gourds. Leaves will look lighter green or a little yellow.

Potassium and phosphorous.

Check your soil test results and Table C to see if you need to add potassium and phosphorous. Spread it on the soil when you make the field ready for planting. Work it into the soil.

Choose fertilizer from organic or inorganic sources. Healthy soil has tiny organisms (microbes) that break down organic matter into nutrients that plants need to grow. Over time, organic fertilizer can build your soil and make the soil more healthy and fluffy which lets plants grow more easily. Inorganic fertilizers give plants nutrients quickly but do not build the soil. Some inorganic fertilizers have a lot of salt which is bad for soil organisms.

Organic fertilizers can come from manure, compost, fish meal, bone meal, and live compost tea that includes oxygen. Recent studies show that live compost tea helps prevent plant diseases and also gives nutrients to plants.

Irrigation

Pumpkins, squash and gourds need water regularly because they use a lot of water and have big leaves. It is very important that pumpkins, squash and gourds have enough water when the plants flower and grow fruit.

As plants grow, notice if leaves wilt in the middle of the day. If so, they need water. Plants that wilt for a short time will not produce as big a yield. Plants that wilt often or for a long time might die. Pumpkins, squash and gourds need at least one inch of water every week.

Use either drip irrigation or sprinkler. Drip irrigation works very well under a black plastic mulch system. Drip irrigation saves water. Mulch can help keep moisture in the soil. Pumpkin, squash, and gourd crops grow new roots at the place where a leaf and stem touch soil. Mulch that is too thick will stop this root from growing.



Weed Management

You must control weeds to grow a good crop of pumpkins, squash, and gourds. Weeds take water, nutrients, space, and light away from your crop. Also, weeds left in the field might have diseases or insects that can harm your crop. Be sure to watch your field for weeds and remove them as soon as you can.

Perennial weeds come up every year. Annual weeds start by seed and live one year. Biannual weeds grow from seed one year and flower the next year. Biannual weeds live only two years.

Before you plant, remove weeds. You can use these methods:

- Pull weeds by hand.
- Smother weeds with a cover crop (such as buckwheat).



- Cover the soil with black plastic to heat it and keep out light.
- Use weed killer sprays (herbicide sprays).

During the growing season, remove weeds:

- Cultivate or hoe regularly to remove annual weeds.
- If you cultivate early in the season you can prevent most weed problems.

If you use chemical weed killer sprays (herbicides), be sure you check the label:

- Follow the rules on the label.
- Understand that the spray you choose is legal for the crops you sell.
- Chemicals legal for a home garden might not be legal if you sell the crops.
- Certified organic growers can only use approved organic weed killers.

Mulch helps keep weeds down and also helps prevent diseases and keeps the soil moist. You can use black plastic mulch to prevent weeds. Black plastic also helps warm the soil in the spring. Pumpkins, squash and gourds grow well on black plastic because they are warm weather crops.

You can also use straw for a mulch. A thick layer of straw blocks sunlight from reaching the soil. Weed seeds won't sprout.

Handling, and Storage

Harvest, Handling, and Storage

Summer squash

Harvest summer squash 7-8 weeks after planting. Harvest when the fruit are 2-3 inches across and up to 7 inches long. Keep picking fruit every 3-5 days so the plants produce more. Some customers look for "baby" or very small young summer squash. Some farmers also sell squash flowers for people to eat. If you sell the male flowers (after pollination) the female flowers can still grow fruit.

Be gentle when you handle summer squash. It bruises easily. Use a dry towel in the bottom of your harvest container to make a soft cushion for summer squash. Use a damp cloth to wipe the squash clean. Do not put summer squash in a water bath because summer squash is sensitive to cold.

You can store summer squash for up to 1 week and keep good quality if you have the right conditions. The storage area should be cool and humid:

- ❖ Store summer squash at 40-45° F.
- Store summer squash at 95% humidity.

Winter squash and pumpkins

Harvest winter squash and pumpkins 3-4 months after planting:

- Winter squash and pumpkins are ready to harvest when the skin is hard.
- They are ready when the skin is so hard you can't poke a hole with your fingernail.
- Pumpkins are ready when the orange color is deep and even.
- Winter squash is ready when the skin turns dull and dry.
- Gourds are ready when the stem is brown and dry.
- Use a sharp knife or pruning shears to cut pumpkins and winter squash from the vines.
- Leave 3-4 inches of stem on the pumpkin. Customers look for pumpkins with stems.
- Leave a 1 inch stem on winter squash, or no stem.
- Leave a few inches of stem on gourds.
- Do not carry pumpkins by the stem because the stem might break.
- Pumpkins with stems keep longer.
- Wear gloves when you harvest because many varieties have sharp spines on their stems.
- Be gentle and careful so fruit don't get bruises or wounds.
- Bruises and wounds spread rot.



After harvesting "cure" pumpkins and winter squash in a warm humid place to make the rind hard, heal wounds, and make fruit last longer:

- 80-85°F and 75-85% relative humidity for 10 days.
- Some farmers pick them and leave them in the field to cure.
- Take them in from the field before hard frost, (when night temperatures are colder than 28°F).
- Do not cure acorn squash.

After curing, use these techniques to store winter squash and pumpkins:

- Keep them in a shed or barn.
- Store them between 40 and 55°F and 50-70%.
- Keep them dry.
- Store them off the floor, for example on a wooden pallet.
- Give them a lot of air flow; use a fan.
- Do not stack, or no more than 3 high.
- Do not let them touch each other.
- Remove rotten ones.
- Do not store pumpkins near apples.
- Use old carpet in the packing area as a cushion to prevent bruises or wounds.

Acorn squash will keep up to 2 months. Pumpkins, winter squash, and gourds will keep for 2-3 months.

You can pack them in waxed cardboard boxes. Wipe them clean with a cloth before you bring them to market.



Preventing Stress on Your Body

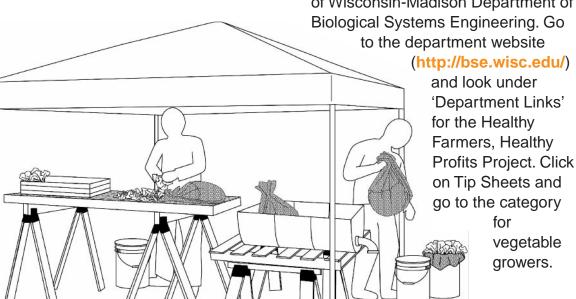
Try to prevent stress on your body when you grow pumpkins, squash and gourds:

- Try to prevent stooping or bending.
- Change your position often.
- Sit on a stool or a pail. You can use a stool that you wear as a belt, or a stool on wheels that rolls along the row like a cart.
- Use garden carts and wagons as often as you can so you do not lift and carry so much.
- If you use a standard plastic container that stacks and is easy to load, unload, and clean, you will save time.

In the place where you pack your crops, use these techniques to make packing easier:

- Set up your wash and pack area so you walk, carry, stoop, and bend as little as possible.
- Set up work areas the same height as a table.
- Short people might want to stand on a stool to reach the tables more comfortably.
- Make a smooth level floor so it is easier to work with carts and wagons.
- To move boxes of produce, there are systems you can use with small pallets and hand pallet trucks.
- You can also buy roller table to move heavy boxes of produce.

There are examples of tools that make work easier from the University of Wisconsin-Madison Department of Biological Systems Engineering. Go







Pest and Disease Management

Diseases

The common diseases that attack pumpkins, squash, and gourds are downy mildew, powdery mildew, black rot, and bacterial wilt. All of these diseases except bacterial wilt are caused by different fungi. Bacterial wilt is spread by a beetle. Use these practices to prevent fungus diseases in pumpkins, squash and gourds:

- Plant resistant varieties.
- Plant disease-free seed.
- Do not plant in poorly drained soil.
- Wait 2-4 years before you plant pumpkins, squash, or gourds in the same field.

- Keep the field clean of weeds.
- Destroy old plants, stems and leaves.
- Remove old pumpkins, squash, or gourds from the fields.
- Use drip irrigation instead of sprinkler.
- Give plants enough fertilizer and water.
- Harvest when the fruit are mature.
- Prevent cuts and wounds on the fruit.
- Keep pumpkins, squash and gourds dry after harvest.
- Store crops at the right temperature and humidity.
- Wash and dry equipment after you use it.



Howard F. Schwartz, Colorado State University, Bugwood.org

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Downy mildew

Description: a fungus

(Pseudoperonospora cubensis) invades and kills the leaves. Early in the life cycle you see yellow areas on the leaves. With more time, infection makes the leaves turn tan or brown. If the weather is damp, a fuzzy white or gray growth covers the underside of the leaves. Later these areas turn black. Leaves die. The plant forms fewer fruit and poor quality fruit. The whole plant can die. Downy mildew is worse in cool weather. Pumpkins, squash, and gourds with downy mildew get other diseases more easily.

Disease cycle: Over winter, the fungus lives in parts of diseased plants left in the field. Spores blow in the wind on to leaves of other plants.



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Wet weather with dew, fog, or rain causes more infection.

Management: use the prevention techniques above and also:

- Give good air flow between plants; don't plant too close together.
- Wait 3 years before you plant pumpkins, squash, or gourds in the same field.
- When the weather is damp and cool, try a spray of compost tea.

Powdery mildew

Description: Many different fungi cause powdery mildew. You see light yellow spots on the oldest leaves. Later a white powdery growth forms on leaves and stems. The powder can be on the top of the leaf and the bottom side of the leaf. Leaves can



Don Ferrin, Louisiana State University Agricultural Center, Bugwood.org



shrivel and die. Sometimes the whole vine dies. Powdery mildew affects older plants first. Pumpkins, squash, and gourds with powdery mildew get other diseases more easily. They produce fewer fruit, smaller fruit, and poor quality fruit.

Disease cycle: Over winter, the fungus lives in parts of diseased plants left in the field. Spores blow in the wind on to leaves of other plants. Spores start growing if there is moisture. Weather with hot days and cool nights causes more infection.

Management: use the prevention techniques above and also:

- Give good air flow between plants; don't plant too close together.
- When the days are hot and nights are cool, try a spray of compost tea or baking soda.

Black rot

Description: a fungus (*Didymella bryoniae*) causes brown or black areas on the fruit. At first, spots on the fruit or leaves look water-soaked. Later, a gooey mass oozes spores. White and black growth forms on the fruit and it begins to rot. Rot can start in the field or in storage.

Disease cycle: Over winter, the fungus lives in parts of diseased plants left in the field. Fungus spores also live on seeds. Spores blow in wind on to leaves of other plants. Spores infect the plant and start growing if there is water on the leaves

for at least one hour. If the leaves stay wet, the infection grows. Infection also starts where cuts or wounds on fruit make an opening.

Management: use the prevention techniques above.



Elizabeth Bush, Virginia Polytechnic Institute and State University, Bugwood.org

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Bacterial wilt

Description: a bacteria (*Erwinia* tracheiphila) causes leaves to wilt during the day. At night or on cloudy days the plants recover. Plants infected with bacterial wilt can have the same symptoms as plants that are being attacked by the squash vine borer, or plants that are infected with Fusarium fungus. If you cut a stem, hold the two pieces together for 10 seconds, and slowly pull them apart. If the pumpkin, squash, or gourd has bacterial leaf spot, you will see a sticky white sap.

Disease cycle: The bacteria overwinters in the cucumber beetle. When the beetle feeds, the bacteria infects the plant. Food and water cannot travel through the plant and a week later the plant wilts.

Management: The only way to manage bacteria wilt is to prevent cucumber beetles from feeding. There is no treatment for plants after they are infected. Cucumber beetles are yellow-green and 1/5 inch long. The

striped cucumber beetle has three black stripes down its back. The spotted cucumber beetle has twelve black spots on its back. The underside of a cucumber beetle is black.

You can use row covers early in the season to control the cucumber beetle and prevent it from feeding. Be sure to lift the row covers in time for bees to come when flowers open.

Some farmers trap the beetles with yellow sticky cup traps. Sprays of kaolin clay (sold as "Surround") can also prevent beetles from feeding. Other farmers have tried to plant a row of "trap crops" around the field to attract and keep the beetles. You can kill them there before they move to the market crop. If you are an organic grower, check that the method you use to kill the beetles in the trap crop is okay for organic crops. Some farmers use a propane flame burner to kill the beetles in the trap crop. Dark green zucchini or blue hubbard squash are good varieties to use as trap crops for cucumber beetles.



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Viruses

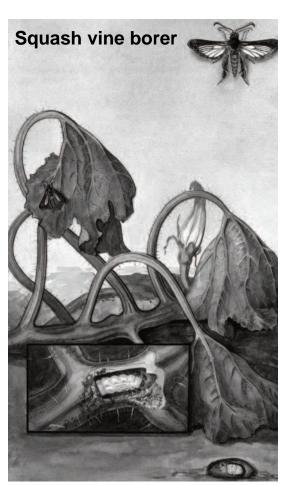
Pumpkins, squash and gourds can become infected with viruses. Plants will be weak, produce less fruit, and fruit will be poor quality. Prevent viruses from infecting crops, because there is no treatment for plants after they are infected. If you think a plant has a virus, remove it from the field quickly and destroy it. Plant resistant varieties and control weeds. If you know that an insect common to your area carries a virus, prevent the insect from feeding on your pumpkins, squash or gourds. Use the techniques described above in the section about bacterial wilt and cucumber beetles.





Squash vine borer

Description: Squash vine borers are a serious pest of pumpkins, squash, and gourds. They are worms or grubs which are the larva of a moth. Adults look like a wasp and are 1 ½ -2 inches long. They have greenish-brown front wings and clear back wings. Squash vine borers live as pupa in the soil. In late June or July, adult moths emerge. They fly during the day. They are strong fliers and sometimes you can hear a buzzing sound when they fly. It is important to



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notice these insects because you can learn to look for the eggs and larva after you see the moth.

Female moths lay small, flat, brown eggs at the base of pumpkins, squash, and gourds. They lay eggs singly, not in a group. About a week or ten days later the eggs hatch. Young larva bore into the plant and feed for two-six weeks.

Larva are white with a brown head, and they grow to be almost one inch long. When they are fully grown they leave the plant and enter the soil to form a pupa. As the larva feed, they eat through the middle of the stems. Water cannot flow through the stem and the plant wilts. At first the plants wilt only in the middle of the day. Later the plant wilts completely and can die. Look for holes near the base of wilting stems. Also look for a powder that looks like sawdust. This is called frass. If you see frass, split the stem the long way to look for the larva feeding inside.

Management: It is very difficult to control squash vine borers. The best way is to prevent them. Look for the adult moths and then check your plants regularly to look for eggs and larva. Some farmers use traps to see the moth. Make traps from yellow bowls filled with water. The moths will be attracted to the yellow container and fall into the water. Put the traps out by late June and check them every day.





If you notice adult moths of the squash vine borer, you can use row covers to prevent moths from laying eggs on the plants. Some farmers regularly put row covers on plants in late June or early July. The row covers have to be tight to the ground so moths can't get to the base of the plants. Keep the row covers on for about two weeks after you see the adult moths. If plants are flowering, be sure to lift the row covers in time for bees to come when flowers open.

Some farmers plant a second crop of summer squash in early July. This late crop will grow after squash vine borer adults have finished laying eggs.

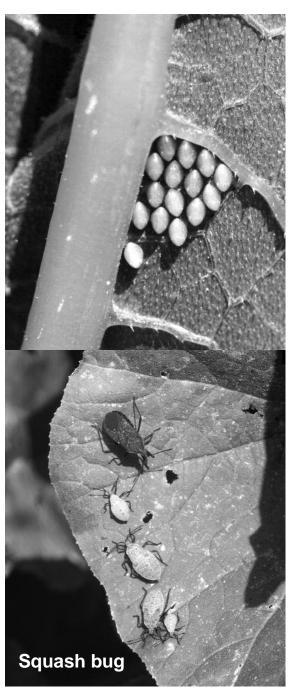
If you see plants that have been killed by squash vine borers, remove the plants from the field quickly and destroy them.

Squash bug

Description: Squash bugs are an insect that is dark gray and about 5/8 inches long. They suck sap from the leaves and stems. The plants wilt and then turn black and die. Squash bugs also eat the fruit on squash and pumpkins. Squash bugs live in protected places. Over winter they live in buildings and in parts of plants left in the field. In spring and summer they lay eggs on the underside of leaves. Eggs hatch into light green or gray immature bugs called nymphs. You can see many nymphs together on leaves and fruit.

Management: It is difficult to control

squash bugs. The best way is to prevent them. Some varieties of pumpkins, squash, and gourds are more likely to be eaten by squash bugs than others. During the growing season you can follow these steps to control squash bugs:



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- Put boards on the ground near the squash plants at night. The next morning you can kill the squash bugs that you find under the boards.
- Look for the egg masses underneath leaves and destroy them.
- You can spray an insecticide to kill the nymphs. Certified organic growers can only use approved organic insecticides.
- Pyrethrum and Neem are some insecticide sprays to kill squash bug nymphs. Check with your organic certifier about the regulations for these sprays.

If squash bugs are a problem one year, follow these steps to prevent them next year:

- At the end of the year, do not leave the old plants in the field because squash bugs will overwinter under them.
- You can remove the old plants or till them under the soil.
- Plant a cover crop in the field where the squash bugs were.
- The next year, do not plant pumpkins, squash, or gourds in the same field.
- Do not use thick mulch around the crop, because squash bugs can hide in the mulch.
- Cultivate the soil so no plant debris is left as a place for squash bugs to hide.

Striped and spotted cucumber beetles

Read about these insects above in the section about bacterial wilt.



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