

# GROWING PUMPKINS

Pumpkins are sometimes considered a magical crop—they bring to mind images of children happily painting or carving pumpkins. Historically, pumpkins were one of the fabled three sisters of Native American agriculture—corn, beans, and pumpkins. Today they are grown in this area primarily as a Halloween ornamental.

Growing pumpkins for a profit, however, can be difficult if a marketing plan is not in place prior to planting. In simple terms, grow only what you can sell for a profit.



## Types

The pumpkin is a member of the gourd family. There are several types and varieties, and some can be distinguished by the size of the stem (commonly called the handle) where it attaches to the fruit.

*Cucurbita pepo* (true pumpkin): has a hard stem with a point of attachment not much larger than the diameter of the stem; pumpkins such as 'Howden,' 'Wizard,' 'Connecticut Field,' and 'Spookie.'

*Cucurbita maxima* (true squash): has a soft stem that sometimes is smaller at the point of attachment; 'Big Max,' 'Atlantic Giant,' 'Mammoth Orange Gold,' 'Turks Turban,' 'Hubbard' (all types).

*Cucurbita moschata* (field or large cheese types): has a hard stem that is greatly enlarged at the base point of attachment; butternut and winter crookneck.

Another distinction often made is that pumpkins are to be carved, squash is to be cooked, and gourds are to be looked at.

## Selecting a Variety

Varieties and types are numerous, and some are listed in Table 1. Select the variety that meets your market or customers' needs. Maryland Cooperative Extension Bulletin (EB) 236, "Commercial Vegetable Production Recommendations," is revised annually and suggests new varieties and production practices that can be used in conjunction with this fact sheet.

## Field Selection

Pumpkins will grow well in fertile, well-drained soil that has not had cucurbits (muskmelons, watermelons, squash, cucumbers, or pumpkins) planted in it for at least three years. Growers intending to sell directly from the field should select fields to accommodate that method of marketing (good drainage, space for parking, etc.).

## Liming and Fertilization

Before planting, take a soil sample and have it tested. For a list of soil testing labs, check with your county agent or go to the web at <http://www.agnr.umd.edu/soiltesting>. A pH range of 6.0 to 6.5 is satisfactory; apply lime if pH is less than 6.0. On soils testing optimum in fertility, apply 50 to 75 pounds of nitrogen, 50 pounds of phosphorus (P<sub>2</sub>O<sub>5</sub>), and 100 pounds of potash (K<sub>2</sub>O). On sandy soils, apply two-thirds of the fertilizer before planting. See EB 236 for more details.

## No-Tillage Culture

In Maryland, about 60 percent of the pumpkins are grown no-tillage. With no-tillage, pumpkins are cleaner and somewhat less disease-prone

because they are not in contact with the soil. Harvesting during wet weather may also be easier than during dry weather. In general, no additional nitrogen is needed where hairy vetch is used as the cover crop. Cereal grains such as rye, barley, or wheat can also be used as a cover crop for no-till pumpkin production. It may be possible to harvest a barley crop and then plant pumpkins no-till in some locations in Maryland, especially in southern areas. EB 236 has complete details for no-till pumpkin production.

## Planting and Spacing

In most parts of Maryland, late May through early June is the normal planting period for pumpkins. The soil temperature should be at least 60°F. Plant seed 1 to 2 inches deep. Seeding rate and spacing depend on varieties and size of pump-

**Table 1. Pumpkin and squash varieties**

	Type	Size (lb)	Days to Harvest
<b>Large Pumpkins</b>			
	Howden	15-20	105
	Howden Biggie	30	115
	Pro Gold 510	15-20	95
	Gold Rush	30	120
<b>Mid-sized Pumpkins</b>			
	Jack of All Trades	12	90
	Wizard	12	115
	Trick or Treat (pie, seed, carving)	10	105
	Autumn Gold	10	90
<b>Small Pumpkins</b>			
	Oz	4	105
	Peek-a-Boo	3-4	90
	Mystic	7-8	105
	Sugar Treat	4	90
<b>Miniature Pumpkins</b>			
	Baby Bear	1	105
	Baby Boo (white)	1/4	100
	Jack-Be-Little	1/4	95
<b>Squash Types</b>			
	Casper (white)	10-15	90
	Orange Mammoth Gold	20	105
	Prize Winner	50-200	120
	Atlantic Giant	100-600	120
<b>Moschata Types</b>			
	Buckskin (processing)	12	115
	Fairytale (baking)	15	100

**Table 2. Suggested square feet per plant by type and some areas per plant based on between-row and in-row spacings**

Type			Suggested sq ft/plant		
Giant			72		
Large			30-40		
Mid-sized			24		
Small and Mini-sized			10-18		

  

Between Rows (ft)	In-Row (ft)	Sq ft per plant	Between Rows (ft)	In-Row (ft)	Sq ft per plant
12	2	24	6	2	12
	3	36		3	18
	4	48		4	24
	5	60		5	30
	6	72		6	36
10	2	20	5	2	10
	3	30		3	15
	4	40		4	20
	5	50		5	25
	6	60		6	30
7.5	2	15		2	
	3	23		3	
	4	30		4	
	5	38		5	
	6	45		6	

kins desired. Each variety or type has an optimum plant spacing for its best performance. Closer spacings can stress the plants, reduce fruit size, and reduce fruit set. To achieve the desired final plant stand, overplant and hand thin or accurately plant and then hand replant to fill skips. A number of other factors also need to be managed to maintain desired stands. These include seed corn maggots, wire worms, birds, mice, and too much or too little water. Plan ahead as much as possible for dealing with these potential problems.

When you plan spacing for different types, consider the square feet available per plant, which can be varied by changing the between-row and in-row spacings (Table 2).

## Managing Pests

Weeds, diseases, and insects can take the enjoyment as well as the profit out of growing pumpkins. A good long rotation can help minimize some potential problems. Information on prior herbicides and chemicals used in the field is also important. Plant a cover crop or no-

till mulch crop in the fall prior to spring pumpkin planting. Both the conventional and no-tillage culture systems are discussed in detail in EB 236.

Currently recommended herbicides are also listed in EB 236, which suggests materials for use on broadleaf and grassy weeds. If you want to grow pumpkins without herbicides, you might try using hairy vetch as a fall-seeded cover crop. The vetch can be killed mechanically using a flail-type mower, which will leave residue uniformly distributed on the soil surface. Follow all label precautions and rates if you use herbicides.

Table 3 contains information about insect pest identification, damage, and recommended insecticides. Be sure to consult an updated revision of EB 236 for current recommendations.

## Disease Management in Pumpkins

Diseases that can be significant in pumpkins include bacterial wilt, *Phytophthora* blight, downy mildew, powdery mildew, black rot (a fruit rot

caused by the same fungus that causes gummy stem blight of several cucurbits), *Plectosporium* fruit speckle, and viruses. Disease management is an important part of a successful pumpkin production system.

## Bacterial wilt

First symptoms appear as wilting and dying of individual leaves; affected leaves also can exhibit injury caused by cucumber beetles, which carry the bacteria to plants. Later, leaves wilt on one or more laterals or on entire plants. Initially, wilted parts might appear to recover at night, but they wilt on successive sunny days and finally die. To check a plant for bacterial wilt, cut the stem near the base of a wilted lateral, pinch the base of the cut stem, and watch for the appearance of a white exudate from the cut surface of the woody vascular tissue within the stem. The exudate, made up of the causal bacteria, is sticky and can string out somewhat like honey after it is touched. Because cucumber beetles can carry the bacteria to plants, bacterial wilt can be controlled by preventing beetles from feeding on plants.

## Phytophthora blight

*Phytophthora* blight can affect the roots, crown, and fruit. It can become serious when soil remains wet for extended periods. It can affect peppers, eggplants, tomatoes, and all cucurbits. On pumpkins, seedlings can be killed early, resulting in poor stands. In addition, the base of large plants or large segments of vines and petioles can rot severely, resulting in death of leaves and sparse foliage. Symptoms on fruit frequently appear first on the lower half of the fruit and often start as water-soaked, somewhat greasy-appearing spots that can expand rapidly on the fruit surface. Under extended periods when conditions are moist, the fungus grows on the affected area, producing a whitish gray, low-growing mold with a yeastlike consistency. When wet conditions persist, the entire fruit can rot and collapse, especially after the seed cavity is invaded. Infected fruit that appears healthy at harvest can rot after harvest.

The fungus can survive in soil at least two years, and possibly much longer. Soil moisture is the most important factor in development of the disease, and *Phytophthora* can be dispersed by irrigation and surface water. Once stems and fruit are affected, new sporangia are produced and can be airborne from aerial parts of the plant. During wet conditions, disease development is promoted by summer heat. The most effective control is based on water management. Avoid fields with heavy, poorly drained soil. Promote the best drainage possible. Avoid long irrigation periods. Rotate crops to allow at least three years between pumpkins and other cucurbits, peppers, tomatoes, and

eggplant. Chemical controls that sometimes are helpful include soil fumigation, Ridomil treatment of soil, and foliar sprays with Ridomil combination products and with fixed coppers.

## Downy mildew

Downy mildew can affect all cucurbits. Irregularly shaped yellowish to brown spots appear on upper sides of leaves, usually at the center of plants. Under moist conditions, a purplish mildew develops on the underside of leaf spots. Leaves die as spots increase in size. Spread is rapid from crown leaves toward new growth.

The fungus does not overwinter in northern areas of the United States except in greenhouse-grown cucurbits. Therefore, the fungus usually has to be introduced each year as windborne spores from southern plantings that are infected by downy mildew. Usually, downy mildew does not appear in the mid-Atlantic area until mid-August.

Where downy mildew occurs, fungicides are useful. The protectant materials, Bravo and maneb are labeled for use on pumpkins; mancozeb is not labeled for use on pumpkins. In addition, Ridomil/Bravo, Ridomil/Copper, and Aliette (fungicides that have some systemic activity) are labeled for use on pumpkins. Where these fungicides are used at fourteen-day intervals, apply one of the protectant materials seven days after each application of the systemic material.

## Powdery mildew

This mildew can affect all cucurbits including pumpkins. The disease appears initially on crown leaves as a white powdery mold. With time the mildew appears on younger leaves until all but the very youngest are affected. Severely mildewed leaves wither and die.

Plant pathologists believe that most powdery mildew, at least in northern areas, starts from the white powdery spores that are produced on mildewed leaves and then is spread by wind to other plants. The disease is thought to advance from southern to northern areas of the U.S. in a stepwise progression, as cucurbits are planted and mature. New research also indicates that the fungus could overwinter as specialized spores produced on leaves in the fall, and that these overwintering spores could be primary inoculum for first infections the following summer. In addition, the cucurbit powdery mildew fungus can infect pineapple weed. It is possible that this or other weeds could play a role in powdery mildew initiation on cucurbits.

Most pumpkin varieties are susceptible to powdery mildew. Therefore, fungicides are needed late in the season in most years to control powdery mildew on susceptible varieties. If fields

**Table 3. Insect descriptions, damage, and recommended insecticides**

<b>Pest</b>	<b>Description</b>	<b>Damage</b>	<b>Treatment</b>	<b>Remarks</b>
Seed corn maggot	Yellowish-white, legless worms or maggots; 1/4 inch long.	Germ of the seed is hollowed out.	Lorsban 50SL seed treatment (See EB 236)	Before using this insecticide, read the seed label to determine if the seed has already been treated.
Cucumber beetle	Spotted: greenish body with black spots; 1/5 inch long.  Striped: yellow body with black stripes; 1/5 inch long.	Larvae (rind-worms) feed on the rind and disfigure the pumpkin fruit.	Adios, Asana XL, Sevin, or Thiodan (See EB 236)	Can also transmit bacterial wilt.
Squash vine borer	Larvae: wrinkled bodies with brown heads; up to 1 inch long. Adults: clear-winged moths; lay eggs on stems and petioles.	Sudden wilting of plants; greenish-yellow frass on stems.	Asana XL, methoxychlor, or Thiodan (See EB 236)	Start treatments when vines begin to run. Apply at weekly intervals for 4 weeks. Crop rotation also helps reduce populations of this pest.
Squash bug	Nymphs: reddish head, thorax, and legs; green abdomen. Immatures: dark brown, wingless; smaller than the adults. Adults: brown body (sometimes with gray or light brown splotches); 5/8 inch long; hard shell.	Wilted vines	Ambush, Asana XL, Pounce, or Sevin (See EB 236)	Begin control after vines have started to run. Treat every 7 to 10 days or as needed.
Aphids	Small, greenish, soft insects; winged and wingless.	Aphids transmit mosaic virus. Thorough spray coverage beneath the leaves is important.	Thiodan or Vydate (See EB 236)	Viruses can be serious on sensitive varieties such as Jack-Be-Little. Thorough spray coverage on undersides of leaves is important. Mites (two-spotted)
	Extremely small yellow dots moving on white paper; found under leaf with webbing.	Yellowing and defoliation of leaves if severe.	Agri-Mek or Kelthane (See EB 236)	Mite infestations begin around field edges and grass areas. Continuous use of Sevin, Furadan, or the pyrethroids can result in outbreaks.

Note: For no-tillage production, check the mulch cover for cutworms, armyworms, and other pests before planting. It might be necessary to treat mulch before planting or just after seeding or planting. Refer to EB 236 for more information.

are monitored closely for disease, fungicide applications can be delayed until the first symptoms of powdery mildew appear in an area. The powdery mildew fungus has developed resistance to some fungicides. To minimize fungicide resistance, alternate application of Quadris, a new systemic fungicide good for powdery mildew control, with Bravo used alone or, when available, in combination with other new powdery mildew fungicides that are unrelated to Quadris.

### Black rot

Black rot symptoms on fruit begin as circular-to-irregular spots, initially grayish, but later dark brown to black. Although the spots can be small, usually they expand quite rapidly, first causing a dry rot, but frequently changing to a soft rot once the seed cavity is invaded. Sometimes black rot is confused with *Phytophthora* fruit rot. Since controls for these two fruit rots usually are different, it is important to distinguish between black rot and *Phytophthora* rot. On Halloween pumpkins, black rot usually affects ripe fruit at or after harvest and does not affect vines, whereas *Phytophthora* blight

affects plants any time after emergence and is prevalent on green fruit as well as on ripe fruit. In addition, color of the rot can help distinguish the two diseases. Black rot fruit spots usually are black, whereas *Phytophthora* rot usually starts as a water-soaked area and becomes grayish and yeastlike. Most confusion with diagnosis occurs at the final stages of rot development, when fruit affected by either disease can collapse. The black rot fungus can survive for at least two years in residue from diseased plants and also can be seedborne.

Controls include starting with clean seed from reputable seed producers, rotation, using varieties with as hard a rind as possible, minimizing weed and insect problems, applying Quadris alternated with Bravo at regular intervals starting at fruit set, avoiding frost damage to fruit, avoiding harvest and post-harvest injury to fruit, and, when feasible, heat curing fruit at 80 to 85°F and 75 to 80 percent RH for about ten days after harvest.

### *Plectosporium* blight (speckle)

This affects cucurbits, especially pumpkin and summer squash. Symptoms on fruit stems,

**Table 4. Estimated Costs of No-till Vetch Pumpkins**

Material	Cost per acre
Vetch (25 lbs @ \$1.00/lb)	25.00
Pumpkin seed (2-1/4 lb)	36.00
1/3 ton lime	9.50
Fertilizer	27.50
Herbicides	27.60
Insecticides	12.50
Fungicides	169.76
Bee rental	30.00
Irrigation (6" @ \$20/in)	120.00
Land charge	100.00
Machine charge	124.00
Labor (225 hrs @ \$6.25/hr)	1,406.25
<b>Hauling, trucking, and marketing:</b>	
10 ton	250.00
15 ton	375.00
20 ton	500.00
<b>Cost per acre to produce and harvest:</b>	
10 ton	\$2,338.00
15 ton	\$2,463.00
20 ton	\$2,588.00

leaf petioles, and sometimes leaves, are light tan to “bleached,” sunken, spindle-shaped lesions. Symptoms on fruit include white, tan, or silver russeting, sometimes starting as specks or somewhat larger spots, but frequently merging to affect large areas of the fruit. Green fruit appears to be more susceptible than ripe fruit. The disease sometimes is associated with specific varieties, but this could be related to fruit maturity at the time when conditions favor infection. Bravo applications are reported to provide good control.

## Mosaic Viruses

Symptoms caused by viruses sometimes develop on new foliage, but usually are recognized when mottling appears on fruit. Most of the viruses that affect pumpkins are aphidborne: cucumber mosaic virus, watermelon mosaic virus, papaya ring spot virus, and zucchini yellow mosaic virus. Current controls, which are only partially effective, are attempting to eradicate reservoir hosts including perennial weeds near fields, controlling aphid vectors, using reflective mulches to repel aphids, spraying with mineral oil to minimize spread by aphids, and using netting or floating row covers to keep aphids from feeding on plants. Hopefully, newer varieties will carry genetic resistance to the viruses.

## Disease Summary

Several significant diseases can develop on pumpkins, but no single control method is effective for all of them. Most successful pumpkin producers follow an integrated disease management program that considers rotation, soil drainage, air drainage, varietal resistance, proper planting time, appropriate seeding rate, cucumber beetle and aphid control, weed control, use of fungicides, careful handling at harvest, and, when possible, heat curing immediately after harvest. Refer to EB 236 for current recommendations.

## Pollination

Pumpkins have separate male and female flowers. Available evidence shows that the plants must be insect-pollinated, that honey bees are the chief pollinators, and that multiple flower visits by insect pollinators are needed. Where yields are low, provide an additional one to three bee colonies per acre for at least three years to determine their value. Research indicates that colonies near the field are most effective. Bees would rather visit other, more attractive crops than pumpkins, as bees get little nectar and pollen from pumpkins. Bee colony management, location, and timing of introducing hives into the fields can be critical to successful pollination.

## Harvesting, Handling, and Storing Pumpkins

Several references, including USDA *Agriculture Handbook 66* and EB 236, suggest the following for pumpkin storage:

- Keep at optimum temperature of 50 to 55°F;
- Keep at optimum relative humidity of 50 to 70 percent;
- Place on racks, in bins, or in baskets;
- Hold in ventilated or common storage.

The *Agriculture Handbook* also points out that pumpkins are subject to chilling injury at low temperatures and that some cultivars such as ‘Connecticut Field’ cannot be expected to hold in good condition more than two to three months at 50 to 55°F. The question of curing is also addressed in the handbook, which suggests that a curing period of ten to twenty days at 75 to 80°F was originally thought to enhance storage life, but recent research did not prove that curing was always beneficial.

Because many growers lack adequate labor and space to move pumpkins into curing and storage prior to sale and many pumpkins are sold directly from the field in pick-your-own operations, stor-

**Table 5. Net return or loss per acre at various yields**

Price per lb	10 Ton		15 Ton		20 Ton	
	Cost	Return	Cost	Return	Cost	Return
.08	2,338	1,600	2,463	2,400	2,588	3,200
.10	2,338	2,000	2,463	3,000	2,588	4,000
.12	2,338	2,400	2,463	3,600	2,588	4,800

age might not be feasible. There are some things that can be done, however, to maximize shelf life and limit post-harvest losses.

Start with good-quality pumpkins. They do not improve in quality once they are harvested. To produce good quality, select a variety that has characteristics you desire. Field research indicates some varieties hold better after harvest than others. Use cultural practices such as vetch mulch and a fungicide schedule, if these practices fit with the desired culture, that contribute to good quality.

Because handle strength and integrity are important, select varieties that offer long, thick handles. A rigorous fungicide application program in the field during the growing season will contribute to stronger handles and longer storage after harvest for those susceptible varieties grown during a wet season. In general, smaller-fruited types have better handles than large, "face-type" varieties. For production of organic or pesticide-free pumpkins, choose carefully among the varieties that offer better quality without pesticides.

Some of the novelty types do not have as much disease tolerance as standard types. In particular, two of the white squash-types ('Lumina' and 'Casper') seem to have a higher proportion of fruit lost from black rot. The mini-pumpkin 'Jack-Be-Little' is quite susceptible to a virus that results in various amounts of green coloration on mature fruit.

Many growers are now using long-handled loppers to cut the stems from the vines at harvest. This takes little time and allows workers to

pick up several fruit at a time after they are cut. The use of leather gloves also facilitates harvest, because some varieties tend to have strong, sharp spines on the stems. When handling or moving pumpkins, use as much care as possible to avoid physical damage. Throwing and dropping fruit can break off handles and cause puncture injury to fruit walls from other handles.

For direct sales, try to have parking near the sales area so customers don't have to carry their purchases very far. Providing carts or wagons for customer use makes handling easier. If you sell wholesale, load trucks or bulk bins as carefully as possible to reduce physical damage. Control mice and rats in storage areas to reduce feeding damage.

Sort through pumpkin displays periodically and remove damaged and diseased fruit. Customers are reluctant to purchase if they see rotten fruit in the display along with sound fruit. Set up outdoor displays in an area with good drainage so pumpkins are not sitting in mud or water following rain.

## Economics

Table 4 shows estimated production costs for wholesale pumpkin production using no-till vetch culture. Remember that your budget might differ. Your income will depend on the quantity of pumpkins you grow and the price at which you are able to sell them (Table 5).

*Mention of trade names does not constitute an endorsement by the University of Maryland Cooperative Extension.*

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, University of Maryland, College Park, and local governments. Bruce L. Gardner, Interim Director of Maryland Cooperative Extension, University of Maryland.

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