

Specialty Crop Profile: Pumpkins

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Introduction

Pumpkins (*Cucurbita* spp.) are an important specialty crop for Virginia with over 2,000 acres grown annually. The scale of production ranges from an acre or two to several hundred acres per grower. Pumpkins are marketed as an ornamental crop. The primary market window, the Halloween season, usually starts in late September and goes through October (Figure 1).



Figure 1. The primary market for pumpkins is for ornamental use.
(Photo by A. Bratsch)

The information provided in this publication covers the basics of growing pumpkins as a specialty crop, from understanding the various types and classifications of pumpkins, to field production, harvest considerations, and marketing.

Market Potential

Probably the most important task for any type of specialty crop production is the development of a marketing plan. The most common mistake growers make is to produce a crop without prior marketing research. The market for pumpkins is narrow, with early whole-

sale activity starting in mid-September, and continuing through late October. Most direct marketers start displaying pumpkins by October first, with sales ending after October 31. For operations staying open through the Thanksgiving holiday, there is limited potential for sales as table decorations, especially with the smaller varieties. Types suitable for baking, as well as other winter squashes, can also be sold.

Growers should consider various potential market outlets for their pumpkins. They can be a part of the overall roadside stand mix, or they can be sold to local food stores or other farm markets. Many growers have been successful with pumpkins as an integral part of entertainment farming, with pumpkins as the focal point of a pick-your-own experience. Often these operations do well with scheduled school tours, charging a set price per child, each taking home a prize pumpkin. For larger acreages, pumpkins can be sold wholesale in bulk bins to produce brokers at the major terminals. Wholesale marketing involves two other considerations, packaging and shipping, which are not discussed in this publication. These costs must be factored in. Usually pumpkins are sold by the pound in large bulk bins for wholesale markets, and large trucks (usually tractor-trailer rigs) are needed to transport the pumpkins to buyers. For direct marketing, it is common to sell by the piece, with the price based on size class, but by-the-pound sales are also done. Other opportunities may surface for market outlets, but these are the most common.

Good markets exist, but every season tends to be different and depends largely on the number of growers and the weather conditions affecting the growing season within a given geographical marketing region. Though pumpkins are a comparatively easy crop to grow, the competition for markets can be significant during the season peak, especially when the weather has been

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conducive across a wide area for good growth and development. In some years it is possible to buy cheaper than it is to grow them. This is especially the case for bumper-crop years when pumpkins are plentiful and yields are high, which keeps prices down. In short crop years, prices can be significantly higher, and those with a good crop by virtue of location or use of irrigation have a significant market advantage. Thus markets can be up and down and competitive, and sometimes very profitable.

Classification and Cultivars

Classification

Pumpkins belong to the Cucurbits family of vegetables. This family also includes melons, cucumbers, gourds, and summer and winter squash. All are considered vine crops, though bush forms have been developed, which simply means that internode (distance between leaves) length and number are reduced, resulting in shorter vines. Culture and insect, weed, and disease control are similar among members of this family.

Often there is confusion about the difference between a pumpkin and a squash. Is a squash a pumpkin or is a pumpkin a squash? The best answer to that is yes on both counts. The pumpkin and winter squash definition best centers around use. It is a culinary and ornamental versus a taxonomic discussion. Winter squash are grown for the mature fruit of several different *Cucurbita* species, and are used for baking/eating purposes. The definition of “pumpkin” involves both its use as puree pie material (not baked whole), and as an ornamental jack-o’-lantern. Two *Cucurbita* species fall under this category, *C. maxima* and *C. pepo*. Certain varieties are dual purpose in nature, or even triple purpose if seed roasting is considered. The best technical way to classify this group is botanically, and this description centers on the stem. It is distinct in each species: hard and ridged angular is *C. pepo* (acorn, gourd); enlarged and soft is *C. maxima* (hubbard squash); hard, smoothly angled and flared at base is *C. moshata* (butternut). Most ornamental “pumpkin” varieties are *C. pepo*, while most winter squash used for pies and baking whole are *C. maxima*.

So what does this explanation serve? It is important to be aware that there is a great diversity in cucurbit species. Knowing how “pumpkin” is defined helps to understand the varieties and opens up the possibilities for marketing and production of related groups. It is important to choose varieties or cultivars that meet the

current market demand. Species distinction is also important when saving seed from year to year. Remember that crosses can occur easily within species, but with difficulty between species.

Cultivars

Examples of popular pumpkin cultivars (cultivated varieties) include ‘Howden,’ ‘Magic Lantern,’ ‘Autumn Gold,’ ‘Prize Winner,’ and ‘Baby Bear.’ There are many cultivars to choose from, all differing in their characteristics. Pumpkins are usually classified according to size by weight, from the smallest (miniatures) to the largest (mammoth). Color, shape, stem size, and seed characteristics (naked or edible seeded) are other horticultural characteristics. Recent breeding efforts have introduced new mildew-resistant cultivars, which are more suited to low-spray or organic production methods. Resistant does not mean immune, and crop protection methods are still needed to ensure good yield and quality.

For most large-scale plantings of an acre or more, growers should obtain seed from reputable commercial seed companies versus home garden catalogs. These companies work with commercial growers of all sizes, and offer a wide selection of cultivars at bulk, wholesale prices. An Internet search for commercial seed companies will provide links to these companies, specific information about cultivars and sales contacts and ordering information. The local Extension agent can also help identify adapted cultivars that have performed well in the geographic region. A summary of the most popular cultivars is presented in Table 1, and contact information for companies specializing in pumpkin research and cultivars is listed in Table 2.

Site Selection and Preparation

Site and Soils

Field sites for pumpkins should be rotated regularly with non-cucurbit crops. This is important for the management of various soil-borne and foliar diseases, of which a few are becoming more prevalent in the state. Low-lying areas such as river bottom sites are often chosen for pumpkins because of their fertility and drainage, but they are also more susceptible to fall frost damage. Low areas also tend to have less air movement, an important factor in reducing foliar diseases. Though pumpkins can be grown without irrigation, research has shown the benefit of supplemental irrigation when rainfall is limited. Thus locating the planting within

Table 1. Cultivar recommendations for Virginia by size classification

Size	Recommended Cultivars
Giant (>50 lbs)	Big Max; Dills Atlantic Giant; Prizewinner
Extra Large (30-50 lbs)	Howden Biggie; Gold Medal (at wider spacing, see below)
Large (18-30 lbs)	Aladdin (PM ¹); Gladiator (PM) Gold Gem; Gold Medal (at closer spacing); Merlin (PM); Super Herc (PM)
Medium (12-18 lbs)	Magic Lantern (PM); Magician (PM, ZYMV ²); Sorcerer; Mystic Plus; Howdy Doody
“Pie” (4-8 lbs)	Cannon Ball (PM); Mystic Plus (PM); Hybrid Pam
Small (1-4 lbs)	Iron Man (PM, hardsides); Lil’ Ironsides (hard-shell); Baby Bear; Baby Pam; Trickster; Touch of Autumn
Miniature (<1 lb)	Apprentice (PM, hard-shell); Bumpkin; Little October; Jack-Be-Little; Wee-Be-Little; Munchkin
White (10-15 lbs)	Casper; Lumina
White (miniature <1 lb)	Baby Boo

¹ PM= Powdery mildew resistant

² ZYMV=Zucchini Yellow Mosaic Virus resistant

Table 2: Companies with active research and/or variety evaluation programs in pumpkins

Rupp Seed Company	Wauseon, Ohio	(800) 700-1199; http://www.ruppseeds.com
Seedway, Inc.	Elizabethtown, Pa.	(800) 952-7333; http://www.seedway.com
Johnny’s Selected Seeds	Albion, Maine	(207) 437-9294; http://www.johnnyseeds.com
Abbott & Cobb, Inc.	Feasterville, Pa.	(800) 345-7333; http://www.acseed.com
Harris Moran Seed Co., Inc.	Modesto, Calif.	(209) 579-7333; http://www.harrismoran.com

range of the farm irrigation system is recommended.

Pumpkins are adaptable to the Virginia climate, and will grow in most soil types in the state if given the right management conditions. However, ideal soils are well-drained silt loams with a low clay content. Heavier soils can be amended with organic matter to enhance drainage, though this usually is not practical on a large scale. Regardless of texture, a well-drained soil is imperative if growers are to be successful with pumpkins. Drainage tiles and raised beds or planting ridges are other methods used to help poorly drained soils.

Systems of Production

Historically, pumpkins have been grown on conventionally prepared fields. Thorough, deep, even soil tillage is important for the seedbed and to help ensure rapid, strong crop establishment. This system allows for easy planting and cultivation by machinery and good crop growth. Disadvantages include soil erosion on slopes, high rates of weed germination, and splashing soil on pumpkins, as well as potentially muddy conditions at harvest.

Research at Virginia Tech has shown that a no-till production system following cover crops is preferable for

slopes and rolling terrain, and results in significantly cleaner pumpkins at harvest. Many growers have adopted this system. Further information regarding no-till pumpkin production is available through the *Commercial Vegetable Production Recommendations*, Virginia Cooperative Extension publication 456-420, which can be obtained from the local Extension agent or found at <http://pubs.ext.vt.edu/456-420/>.

A third production option is to grow the crop in the plasticulture system, which utilizes plastic mulch strips over raised beds, and drip (trickle) line irrigation. Pumpkins usually are not grown on plastic because of their relatively low crop value and the cost associated with this system; however, it can be economical when following a previous crop on plastic such as cabbage or strawberries (Figure 2). The advantages of growing on plastic include earlier and increased yields because of warmer soils, fewer foliar disease problems than sprinkler irrigation, less water use, more efficient fertilizer utilization, and less weed competition. Expertise is required to manage the drip irrigation system, which requires precise water-rate and fertilizer-injection calculations



Figure 2. Plasticulture production of pumpkins, re-utilizing inputs following an earlier strawberry crop. Note chemically killed strawberry foliage. (Photo by A. Bratsch)

Fertility

Prior to planting, a soil test should be taken to determine the phosphorous (P) and potassium (K) levels and the soil pH. Both P and K nutrients are important for good fruit set and development. Soil pH is an indicator of soil acidity. For cucurbits it should be between 6.0 and 6.8. Below or above this level certain nutrients become less or more available. The addition of lime or sulphur will bring the pH up or down respectively.

Preplant P and K levels should be adjusted according to soil test results to “moderate” levels using fertilizer amendments. In deficient soils, applied P can be as much as 100 to 150 pounds of P_2O_5 per acre, with a minimum of 50 pounds per acre recommended for preplant. Pumpkins are high K users and low-K sites may require up to 200 pounds of K_2O per acre, with a minimum of 100 pounds per acre recommended for preplant application. Preplant P and K can be broadcast or banded. K applications over 50 pounds per acre should be broadcast to avoid salt injury. Postplant banding of some or all of the P may be beneficial for fruit development.

Certain micronutrients such as boron, sulphur, and magnesium can be a concern, particularly on sandy soils or soils with a high pH. Micronutrient additions should be made preplant and broadcast.

Nitrogen (N) is by far the most critical plant growth element, yet soil testing for N is usually not practical due to its mobility in the soil. In general, cucurbit crops require from 50 to 100 pounds of actual N per acre per season. The lower rate is suggested when following a legume cover crop from the previous year or if green manure was plowed down prior to planting. At planting, about one-half to two-thirds of the total N used can be broadcast with P and K. Nitrogen can also be

banded at planting, which will help reduce early weed growth between rows. However, care needs to be taken in placement to avoid burning new seedlings, placing it below, but at least four to six inches to the side of the seed. After crop emergence, the timing for the second N application should coincide with early vine “run” (Figure 3), which, depending on planting method, will be approximately 30 to 45 days after planting. A banded postplant application is most efficient. Like the starter fertilizer application, it will help reduce weed competition and places the fertilizer where the crop will reach it quickly. When using the banding method, total N rates may be reduced to 50 to 75 pounds of N per acre. Do not apply excess nitrogen, as pumpkins can develop “flat” sides from thin walls and produce excess foliage instead of fruit. Excessive foliage can also enhance disease and insect problems. Pumpkins on heavier soils may not respond to split N applications, but will benefit from a banded method of application.

Knowledge of site fertility from a soil test will save the grower many times over the cost and time involved by preventing over- or under-application of nutrients. Because of the influence of soil type, climate, and other cultural practices, crop response to fertilizers is not always adequately predicted. The fertilizer program



Figure 3. Early vine development or “running” that will eventually cover the area between rows, target period for supplemental fertilizer. (Photo by A. Bratsch)

should ensure adequate levels of all nutrients for top yields and returns. Optimizing crop growth by site may require several seasons of trial and error. The local Extension office or farm service outlet can offer assistance in taking or interpreting soil test results.

Planting

Planting should correlate with field conditions that favor stand success and also take into consideration market timing. Pumpkins planted too early will mature and

ripen before markets are ready for the product. The major market window is from Sept. 15 to Oct. 31 for the Halloween season, and to a *very* limited extent through November for the Thanksgiving holiday. Timing harvest to avoid fall frost (average date, early October) is also a consideration. Maturity periods can vary greatly by cultivar (from 90 to 125 days from seed), and should be carefully considered with the target market timing and average first frost date. For most of Virginia, pumpkins are planted late May to mid-June, depending on specific locations in the state.

Usually pumpkins are seeded directly in the field, but sometimes they are set from greenhouse transplants. As pumpkins are a warm-season crop, minimum soil temperature should be 60°F for transplants; 65°F for seed. Set transplants only when the danger of frost is past, though late planting dates make soil temperature and frost concerns a minor concern. In general, the warmer soil temperatures are, the faster seedlings and transplants will grow. Soil moisture at planting should also be high; poor stands result when soils are dry. Transplants will always require irrigation or significant rainfall soon after planting. For plasticulture production, previous crop residues should be killed chemically (Roundup™ or Gramoxone™), or removed by hand prior to planting. Transplants or seeds can be set through the plastic, by hand or by using specially designed mechanical seeders/transplanters that can plant through the plastic.

Seeding rates and transplant populations can vary considerably among cultivars. For example, larger vine pumpkins may require three to four feet in-row spacing with eight to 12 feet between-row spacing, allowing each plant 15 to 25 square feet. Bush types or small-fruited cultivars do not require as much room. Table 3 outlines some suggested spacing based on fruit size. Spacing can affect fruit number and size, with more narrow spacing leading to fewer and smaller fruit. Often, larger size cultivars can be set at closer spacing to reduce their size. This is done when certain cultivars are preferred for marketing purposes. To an extent and depending on the cultivar grown, determining row spacing will be an experiment based on predicted vine size and the equipment used by the grower. A planting method often used in cucurbits is the “hill system,” which simply means more than one seed or plant is planted in each planting hole. Later, the “hill” may be thinned to one or two plants. This method is often used with direct seeding of larger vine cultivars, and can be a hedge against poor stand establishment. For transplants grown in pot trays, more than one seed

is dropped per pot for the same effect. As the field is laid out, leave sprayer drive rows to avoid driving over a percentage of running vines as the spray program is implemented.

Table 3. Recommended between- and in-row spacing for pumpkins

Fruit and Vine Size	Between-row Spacing (feet)	In-row Spacing (feet)
Fruit >50lbs; large vine	10-12	5-6
Fruit 20 to 30 lbs; medium to large vine	7-9	4
Fruit 15 to 25 lbs; medium vine	6-7	4
Fruit 5 to 15 lbs; medium or bush vine	4-6	3
Fruit <6 lbs; medium to bush vine	4-6	2

Managing the Planting

General

In-depth information on cultivars, culture, and weed, insect, and disease control is available through the *Commercial Vegetable Production Recommendations* publication noted previously. This publication lists the current registered materials available for pest and weed management in pumpkins. This list changes from year to year. The local Extension agent can also assist with production and pest management questions.

Weeds

Following early summer planting and irrigation/rainfall, weeds will begin to grow as quickly as the crop. Weedy, over-grown fields can make harvest difficult and increase disease incidence due to poor air circulation (Figure 4). There are a number of ways to manage weeds, both culturally and chemically. A few cultural methods involve the use of a stale seedbed (repeated tillage/weed kill prior to planting), avoiding broadcasting fertilizer, and cultivating between rows. The use of killed cover crops in the no-till system is another effective method of suppressing weeds, often with minimal chemical use (Figure 5). With cucurbits, full and rapid stand establishment is critical, and early fertility and irrigation can help to achieve this. The broad, wide leaves of a vigorous plant compete with and help to suppress weeds.



Fig 4. Weedy pumpkin field makes harvest difficult and reduces air movement, increasing diseases.
(Photo by A. Bratsch)



Figure 5. Pumpkins grown no-till in a killed cover crop of cereal rye.
(Photo by A. Bratsch)

Herbicides registered for weed control in pumpkins are fewer compared to other crops, but utilizing those that are can be an effective means of weed control. For the stale seedbed preparation, a translocated, systemic, nonselective material such as glyphosate (Roundup™) is useful for eliminating perennial, spreading weeds such as Johnsongrass. Several pre-emerge compounds are available that are applied preplant or just after planting, depending on label specifications. Depending on the material and its efficacy, these compounds control both broadleaf and grass germination and growth. For postemergence control of grasses, selective materials are available that do not harm pumpkin plants. Weed control in cucurbits can be challenging, even with the use of registered chemicals. Success depends on several factors, including environmental conditions, application timing and rates, and herbicide weed spectrums. Experience each year adds to growers' ability to handle weed problems.

Insects

For pumpkins, insect control throughout the season is critical. Successful management involves understanding the pest life cycle and close observation (scouting) of pest numbers. Knowing action thresholds is a key component of integrated pest management, which is the recommended approach to pest control. Striped and spotted cucumber beetles, squash bugs, squash vine borers, aphids, and two-spotted spider mites are the primary pests to control. Not only can these pests do damage by direct feeding, but cucumber beetles and aphids can spread diseases such as virus and bacterial wilt.

Control of squash bugs is particularly important and further information can be found in *Squash Bug* Virginia Cooperative Extension publication 444-031, found at <http://pubs.ext.vt.edu/444-031/>.

Diseases

Important pumpkin diseases include powdery and downy mildew, plectosporium blight, fusarium wilt, and phytophthora blight. Successful disease management involves good cultural practices such as selection of resistant cultivars, proper site selection, and crop rotation, as well as chemical control of the disease itself and of the insects that spread it. Site rotation is particularly important to reduce or prevent soil-borne diseases such as phytophthora and fusarium.

It is important to maintain healthy, green foliage as long as young pumpkins are developing. Spray schedules should not be compromised late in the season, as squash bug and cucumber beetle build-ups can occur. They can damage not only green but colored fruit as well. Foliar disease becomes more of a factor in the late season as morning dews allow mildew growth. Maintain fungicide spray schedules as long as economically feasible, this will also help to insure strong, healthy stems and avoid fungal infection such as plectosporium, that weakens stems (Figure 6). Viruses can also affect cucurbit varieties with resistance and aphid management the primary tools for control.

Specific information for several diseases can be found in selected Virginia Cooperative Extension publications,

Plectosporium Blight of Cucurbits, Virginia Cooperative Extension publication 450-709, at <http://pubs.ext.vt.edu/450-709/>.

Downy Mildew of Cucurbits, Virginia Cooperative Extension publication 450-707, at <http://pubs.ext.vt.edu/450-707/>.



Figure 6. *Plectosporium* blight on pumpkin stem or "handle."
(Photo by A. Bratsch)

Powdery Mildew of Cucurbits, Virginia Cooperative Extension publication 450-710, at <http://pubs.ext.vt.edu/450-710/>.

Supplemental Fertilizer

As noted, supplemental nitrogen application is required to ensure quality yields. Proper timing and rate are outlined in the fertility section above.

Irrigation

Pumpkins are somewhat tolerant of dry soil conditions, but when rainfall is inadequate during critical periods, such as pollination and fruit set, the field should be irrigated. Roughly 12 to 15 inches of water are needed through the season whether provided by rain or irrigation. Soil type does not dictate amount, but rather frequency. Lighter soils hold less water and lose it faster to plant uptake and evaporation than do heavier soils, thus irrigation should be more frequent. Hotter summer periods will put greater stress on the plants. Excessive water stress reduces plant growth, fruit set, and yields. Stressed plants are also more susceptible to insect attack. For large acreages, growers often rely solely on rainfall, losing a percentage of yield, but irrigation for a small-scale production should be considered to maximize yields.

Pollination Notes

Because cucurbits have separate male and female flowers, pollen transfer is needed for adequate fruit set. Providing bees for pollination, can dramatically increase yields. Without good pollination, fruit set will be less and percentages of misshapen fruit will be higher (Figure 7). Though historically, growers have relied on native bee populations to meet this need, losses of feral bees to disease have limited natural pollination. Recommendations for bringing in bees are one to two hives per acre, during the first three to four

weeks of flowering. Costs for bee rental can run from \$40.00 to \$75.00 per hive. The use of insecticides on the crop should be avoided at this time to prevent bee kill. However, if insecticide application is necessary, it should be done with care to avoid bee kill while bees are working the flowers. This means using less toxic compounds and spraying in the evening when bees are less active.

Harvest and Handling

The most labor-intensive aspect of a pumpkin growing is harvest. Done mostly by hand, harvesting usually requires investment in additional labor. Growers plan ahead for these labor and time requirements. Often harvest will be multiple, as the crop matures, or as the market requires. This will be the time that a good marketing plan comes in handy. Nothing is more discouraging than seeing a good harvest go under utilized.



Fig 7. Poor pollination is evident in developing pumpkin fruit.
(Photo by A. Bratsch)

Good yields for pumpkins will range from 15 to 25 tons per acre, depending on the size of the cultivar and individual fruit weights. Harvest can start when the stem and rind (thumbnail test) begin to harden, the skin turns orange, and the ground color changes. Pumpkins should be harvested with three to five inches of the stem on, using long-handled loppers or pruners. Try to limit holding them by the stems to avoid stem breakage. Pumpkins without stems are not marketable. Ideal storage conditions are 50° to 55°F and 70 percent humidity. An important part of pumpkin post-harvest care is allowing for curing when possible. Curing is best accomplished at a relatively high temperature (75° to 80°F) for up to a week, causing the rind to harden even further. Often fruit are cut from the vine and left a short period in the warm field to cure (Figure 8). However because of market demand and time restraints, the curing process is often overlooked and pumpkins are loaded directly from the field and taken to market.

Summary

Pumpkins are a relatively easy vegetable crop to grow, and can be a profitable item for both direct market and wholesale operations. Proper variety selection, timing of planting, and field care are important to success regardless of the scale of production. Markets can be variable from year to year depending on local and regional weather conditions affecting crop yield. Irrigation, beehive introduction for pollination, and consistent pest management can help ensure a crop when growing conditions are less than favorable.



Figure 8. Recently harvested pumpkins curing in the field.

(Photo by A. Bratsch)

Additional References

In Print

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Online Information

Pumpkin and Winter Squash, Oregon State University, Commercial Vegetable Production Guides, <http://oregonstate.edu/Dept/NWREC/pumpkin.html>

Pumpkins and Squash, University of California Cooperative Extension Vegetable Research and Information Center, <http://vric.ucdavis.edu/selectnew-crop.pump.htm>

Growing Pumpkins and Winter Squash, North Carolina Cooperative Extension Service, <http://www.ces.ncsu.edu/depts/hort/hil/hil-24.html>

Pumpkins, Vegetables, University of Kentucky College of Agriculture, New Crops Center, UK Cooperative Extension Service, <http://www.uky.edu/Ag/NewCrops/introsheets/pumpkinintro.pdf>

Organic Pumpkin and Winter Squash Production (Summary), National Sustainable Agriculture Information Service (ATTRA site): <http://www.attra.org/attra-pub/summaries/pumpkin.html>

Growing Giant Pumpkins In The Home Garden, Ohio State University Extension Fact Sheet, Department of Horticulture and Crop Science, <http://ohioline.osu.edu/hyg-fact/1000/1646.html>

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