# PUMPKINS

Commercial Vegetable Production

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Pumpkins and winter squash are traditional fall crops in Kansas. Potential for sales at farm markets, roadside stands, local stores, or direct from the farm is expanding. The ease of growing pumpkins makes them a crop to consider in farming operations. There are many crops that complement the fall decorative market, including apples, popcorn, ornamental corn, gourds, flowers and fall-produced vegetable crops.

Pumpkins and winter squash are members of the cucurbit family, which includes muskmelon, watermelon, cucumbers and gourds. This group is characterized by sprawling vines and bright yellow flowers. Pumpkins are warm-loving crops. Traditionally, they are planted in June in Kansas so the fruit are ready for harvest in late September to mid-October.

### Is it a squash or a pumpkin?

The word "pumpkin" is derived from a French word, originally from the Greek, meaning "large melons." The term "squash" comes from a Native American word describing an edible gourd. There are three botanical species involved in the group of squash and pumpkin produced on trailing vines. By common usage, those that are round and orange are called pumpkins, while those of other shapes and colors are called squash. The vine habit for pumpkins and squash is similar, and the production or cultural practices for growing them almost identical. This guide contains information on the production of both.

### Pollination

Pumpkins produce separate male and female flowers on the same plant. Male flowers outnumber female flowers 2- to 3-to-1 and usually appear first. Bees must transfer pollen from male to female flowers. Pollination occurs during a two- to three-week period of intense blooming in late summer. Flowers close late in the day. During bloom, apply spray materials when flowers are closed and bees are not active. Poor pollination will result in poorly shaped fruit and excessive blossom drop. Pumpkins do not require as many bees for pollination as cucumbers or muskmelons, but because there are fewer flowers, a strong hive of bees for every 3 to 5 acres of pumpkins is suggested.

### Varieties

Many new pumpkin varieties are hybrids with seed costs about three times that of standard varieties. Earlier fruiting varieties are also being developed.

The type of market may determine characteristics a producer looks for in selecting varieties. Growers supplying wholesale markets want heavy and uniformly sized pumpkins with strong, dark-colored stems and deep, bright color. Growers for local markets or roadside stands may tolerate variation in size and finish, and stems are not quite as important. Growers for specialty markets may want pumpkins that are unique in size, shape or color.

One of the major differences in pumpkin varieties is fruit size. There are five general categories based on this characteristic. The table on page 2 lists selected varieties in each category.

During the last several years, emphasis has been on earlier maturing pumpkin varieties. Varieties include a genetic trait that encourages pumpkins to develop color while they are still maturing. Common examples of this type are 'Autumn Gold' and 'Big Autumn' varieties. These types are good if you want mature pumpkins by fall. One drawback is that stems are often weaker and brown in color, lacking the characteristic large and dark green stems that many markets desire. A strong, dark-green stem handle is needed for wholesale pumpkin shipments. Local markets may not require as prominent a green stem. Growers should keep track of the many new varieties of pumpkins available each year, consider the market, and plant varieties that are best suited to their operations.

The predominant market for pumpkins is for jack-o'-lantern types. Other varieties can be grown in smaller quantities for specialized markets. Small pumpkins are often needed for operations specializing in school tours where each child takes home

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a pumpkin. White- or dark-orange skinned varieties are novelty types that are increasing in popularity. Smooth pumpkins are preferred for painting or coloring. Winter squash and other decorative items often are used to round out a line of fall decorative items including decorative corn (and/or corn stalks), popcorn, honey, autumn flowers, gourds and related items.

### Yield and prices

K-State research trials and grower experience show estimated yields for the various types of pumpkins to be as follows:

Giant pumpkins – 20,000 to 30,000 lb/acre marketable;
Jack o'lantern types – 20,000 to 30,000 lb/acre marketable;
Baby types – 9,000 to 15,000 lb/acre marketable; and
Miniature types – 6,000 to 9,000 lb/acre marketable.

**Common pumpkin varieties.**

| Variety | Days to Maturity | Comments |
|---|---|---|
| **Giant (>20 lb)** | | |
| Prizewinner | 120 | Good color and shape |
| Bix Max | 120 | Bright orange |
| Big Moon | 120 | Very large |
| Atlantic Giant | 120 | Medium orange, large |
| **Jack-o'lantern (7-20 lb)** | | |
| Howden | 105 | Med orange, good handle |
| AC 510 | 95 | Round to tall, good handle, good color |
| Applachian | 90 | Semi-vine, good handle |
| Aspen | 90 | Medium orange, good handle |
| Alladin | 100 | PM tolerant, dark orange |
| Autumn King | 105 | Good handle, dark orange |
| Autumn Gold | 90 | Early coloring |
| Big Autumn | 100 | Large Autumn Gold, early coloring |
| Gold Rush | 120 | Large handle, deep orange |
| Jack of All Trades | 90 | Deep orange, semi-vine |
| Frosty | 95 | Compact vine, weaker handles |
| Sorcerer | 115 | Semi-vine, deep orange, good handle |
| School Time | 90 | Bright orange, compact vine |
| Magic Lantern | 100 | PM tolerant, dark orange |
| Merlin | 100 | PM tolerant, dark orange |
| **Small or Pie Pumpkins (4-7 lb)** | | |
| Hybrid Pam | 90 | Compact vine, dark orange |
| Trickster | 85 | Dark orange, good handle, 3-4 lb. |
| Mystic Plus | 100 | PM tolerant, 5-7 lb. |
| Oz | 100 | Smooth, 3-5 lb., early coloring |
| Neon | 70 | Early, early coloring, semi vine, PM tolerant |
| **Baby Pumpkins (1-3 lb)** | | |
| Baby Pam | 100 | 2 lb., uniform |
| Lil Ironsides | 100 | 1-2 lb., smooth, very hard |
| Lil Goblin | 100 | 3.4-1 lb., smooth, very hard |
| Baby Bear | 105 | 1 lb., good handle |
| Spooktacular | 85 | 2-3 lb., good shape and uniformity |
| **Miniature Pumpkins (> 1 lb)** | | |
| Jack Be Little | 95 | ½ lb., medium vine, |
| Munchkin | 100 | ½ lb., very uniform, bright orange |
| Sweetie Pie | 100 | bright orange |
| Baby Boo | 100 | white miniature |
| **Other Novelty Pumpkins** | | |
| Buckskin | 115 | Buff colored, acorn shaped, great for pies |
| Casper | 90 | Bright white, smooth, 10-12 lb. |
| Lumina | 100 | Flat to globe white pumpkin, 10-15 lb. (stress causes a blue tint) |

Note: PM=powdery mildew tolerant

Yields increase with good management and production practices. Greater marketable yields are usually recorded by local market growers who can sell a variety of pumpkin shapes and sizes – often not acceptable for wholesale shipments. Wholesale pumpkins are usually sold by the pound (or ton) with 8 to 9 cents per pound being a common recent price for field run, marketable pumpkins. Pumpkins sold at local markets are usually priced according to size to eliminate the need to weigh each fruit. Small pumpkins are often priced at $1 to $2 each, with larger pumpkins priced from $2 to $6 each. Giant specimen pumpkins often can sell for $15 to $30 each or more depending on size.

### Soil Preparation and Fertilization

Select areas with no perennial weed problems and good soil drainage for growing pumpkins. Long rotations of three to four years between crops are suggested. Avoid fields where a previous herbicide application may carry over. (Read the label for planting restrictions the next year.)

Use a soil test as a guide for applying phosphate and potassium. These materials should be broadcast and incorporated with spring tillage. Pumpkins will require from 75 to 100 pounds of total nitrogen. It is usually best to apply 40 to 50 lb/acre at planting time and sidedress with an additional 20 to 40 lb/acre applied along the rows when the vines start to run (6 to 12 inches long). Ideal pH for pumpkins is 6 to 6.5, however, corrections in high pH are not needed unless pH is greater than 7.5 or less than 5.5.

Because pumpkins are planted late in the season (early June), make sure to till just beforehand to kill late-germinating weeds. Avoid planting pumpkins in areas with poor drainage where water may stand after heavy rainfall.

### Planting and Spacing

Because the pumpkin market begins in late September to early October, the planting season for most varieties is early June for most of Kansas. In recent years, many markets have begun stocking pumpkins in mid-September. Careful market analysis coupled with days to maturity of the pumpkin variety chosen when determining the date for planting pumpkins. It is not unusual for summer to include a week or so of below normal temperatures, which will slow down pumpkin development. When faced with a choice of planting earlier or later, always favor earlier because pumpkins will hold in the field until a market is ready, but there is no way to hasten the ripening of green pumpkins.

**Days to maturity of pumpkins by types**

| Type | Days to Maturity |
|---|---|
| Mini | 85-95 |
| Small | 90-95 |
| Medium | 90-100 |
| Large | 100-110 |
| Extra Large | 120-130 |

Most pumpkins are planted from June 5 to 15, with June 10 being the most common planting time. Depending on days to maturity, some pumpkin varieties may need to be planted earlier or later than that date.

### Pumpkin Spacing

Most older pumpkin varieties grow in a spreading, sprawling vine that spreads 15 to 18 feet. Traditional spacings of 12 to 15 feet between rows with pumpkins 2 to 4 feet apart in rows are used for these types of pumpkins. In recent years, several newer varieties of pumpkins have been developed with less sprawling vines. Semi-vining types produce vines that can be planted in rows 9 to 12 feet apart with plants 2 feet apart in rows. Compact- or restricted-vined pumpkins can be grown even closer – in rows 6 to 8 feet apart with plants 2 feet apart in the row.

Compact-vined pumpkins will produce higher yields with no reduction in fruit size at closer spacings. Matching spacing with the type of vine pumpkin is important for making sure there is no bare soil where weeds can develop. Knowing the vine type you are purchasing is critical for correct spacing and deciding how many seeds to order. Closer spacing may require slightly more fertilizer and water to support the higher plant populations.

Pumpkins can be planted with air planting equipment, with modified plate planters, by transplanters, or by hand, using a hoe. For wide-row spacings, use every three or four planter boxes. Make sure the plate planting mechanism does not break or damage the seed. Using the furrow opening and covering mechanism of a transplanter or conventional planter and dropping the seed by hand is possible when planting pumpkins. It might be a preferred method, if a variety of seed sizes are to be planted. Some growers do this by sitting on top of a conventional corn planter with a plastic hose run down into the furrow shoe and dropping seeds in a funnel inserted into the hose. This is an inexpensive and quick way to plant pumpkins of various seed sizes. Some transplanters allow adding water with each hill. Plant seeds from ¾ to 1 inch deep into moist, but not wet, soil. Water after planting to encourage quick and even emergence in dry weather.

### Determining Seed Needed

Pumpkin seeds vary significantly in size depending on variety and type. Thus, it is difficult to estimate how much seed is needed by weight per acre. First, estimate how many seeds per acre are needed. This can be done by determining the number of hills per acre and how many seeds per hill you plan to drop.

*Determine the number of hills per acre:*
Calculate by dividing 43,560 (square feet/acre) by row width, then multiplying by in-row spacing.
Examples:
(43,560/12 feet) ÷ 2 feet = 1,815 hills
(43,560/8 feet) ÷ 3 feet = 1,815 hills
(43,560/6 feet) ÷ 2 feet = 3,630 hills

*Multiply the result by number of seeds per hill.*
Examples:
1,815 hills x 2 seeds/hill = 3,630 seeds
1,815 hills x 3 seeds/hill = 5,445 seeds

Some seed companies now offer seeds sold by the count (usually by thousand-seed lots) rather than by the pound. Seed count per pound can vary greatly depending on variety. Check with your seed supplier when ordering seeds to get an approximate seed count per pound of seed.

**How Much Seed Do I Need?**

| Type | Approximate Seed Count/Pound |
|---|---|
| Mini | 6,000 to 7,000 |
| Small | 3,000 to 4,000 |
| Medium | 3,000 to 4,000 |
| Large | 2,000 to 3,000 |
| Extra large | 1,000 to 2,000 |

Hybrid varieties cost about three times as much as standard or open-pollinated varieties. However, many newer varieties of pumpkins are hybrids, and the small amount invested in seeds can be rapidly recovered in higher yields or quality. As with other vegetables, it is best to check seed supplies in December or January. Certain varieties may be sold out if you wait until just before planting time to order. Some seed companies will take orders for later shipment and/or payment.

### Weed Control

Weed control is the most critical management practice for growing pumpkins. Weeds can become a serious problem because pumpkins are planted late just as many annual broadleaf weeds are germinating, and the vining habit makes cultivation difficult later in the season. Few herbicides are available for pumpkins, and the soft, succulent nature of the plant is not tolerant of improper herbicide applications. Combine the use of herbicides with mechanical cultivation for best weed control. See table at right for a list of herbicides and application rates and procedures.

Pumpkins should be cultivated just before the vines lay over and start sprawling over the ground. A disc or field cultivator can be used to till row middles until vines cover the area. Cultivate lightly to conserve soil moisture and keep from damaging pumpkin roots. Research shows that in July when most cultivation is done, most pumpkin and squash roots are not more than 6 inches deep and about 15 to 18 inches from the plants.

### Irrigation

Pumpkins are a deeper rooted vegetable crop that will grow with limited water. Watering after planting to activate herbicides and encourage rapid, even emergence may be necessary during dry periods. A critical period for water also occurs when blooming and early fruit set begins, usually in late July to early August. Watering after mid-August is usually not necessary in most areas of eastern or central Kansas. Drip irrigation also can be used to reduce foliage wetting and for efficient water use. A fairly wide row spacing of at least 12 or even 15 feet will minimize the amount of drip tape needed per acre. Most drip tapes cannot be used for rows longer than 600 to 700 feet to ensure even water distribution.

### Pumpkin Diseases

**Powdery mildew.** Powdery mildew is the most common pumpkin disease in Kansas and can result in yield losses of more than 30 percent if left untreated. The disease is most damaging if it appears three to four weeks before harvest. Actually, two different powdery mildew fungi called *Erysiphe cichoracearum* and *Sphaerotheca fuliginea* can infect pumpkin. The *Sphaerotheca* fungus is the dominant species in Kansas.

## Herbicides

**Applied Before Planting and Incorporated**

| | | |
|---|---|---|
| Prefar 4E | 4-6 qt/acre | Controls germinating annual grasses and some broadleaf weeds. Apply before planting and incorporate ½ to 1 inch deep. |
| Command 4EC | 1½ to 2 pt/acre | Incorporate 1 inch deep. |

**Applied After Planting Before Emergence**

| | | |
|---|---|---|
| Curbit | 2-4 pt/acre | Controls germinating grasses and broadleaf weeds. Apply to soil surface within two days of seeding . Must be incorporated with rainfall or irrigation within five days. |
| Strategy | 2-4 pt/acre | Controls annual broadleaf weeds and grasses. Broader spectrum of weed control than Curbit. (Strategy is a mixture of Command and Curbit.) Apply after seeding but before crops or weeds emerge. Must be incorporated by rainfall or water. Can use band application between rows after crop emergence or with transplants. |
| Sandea | 0.5 to 0.6 oz/acre | Controls broadleaf weeds only. Heavy rainfall or cool weather after application may result in crop injury or reduced stands. |

**Applied After Crop Emergence**

| | | |
|---|---|---|
| Poast | 1 to 1½ pt/acre | Controls annual and perennial grasses only. Best results are obtained when applied to grasses less than 4 inches. |
| Select | 8 oz/acre | Controls annual and perennial grasses only. Add a crop oil concentrate at 1% by volume. |
| Sandea | 0.5 to 0.66 oz/acre | Control of broadleaf weeds and nutsedge in row middles. Some crop injury may occur when material is applied directly over pumpkin plants. Do not apply herbicide to plastic mulch. |

**Directed or Shielded Applications**

| | | |
|---|---|---|
| Gramoxone Extra | 1½ pt/acre | Controls all emerged green vegetation. Will not translocate through plant. Apply before or after planting. Shield spray material to keep it from drifting to emerged pumpkin plants. |

**Note:** Herbicide injury is increased with small seeded varieties so use careful calibration and as low a rate as possible on mini pumpkins or other small-seeded pumpkin or squash varieties.

Plants infected with mildew initially develop white, powdery spots or blotches on upper and lower leaf surfaces. As the disease progresses, the whole plant may become covered with the white, dusty spores of the fungus. Diseased leaves prematurely turn yellow and die. Although the fruit is not attacked by the fungus, it may become malformed or develop sunscald because of a lack of leaf coverage.

Powdery mildew infection starts in early August and is favored by warm daytime temperatures, cool nights, and high relative humidity. The fungus does not require a film of moisture on the leaf surface for infection and can be a problem even during summer periods of little or no rain.

Fungicides are necessary to prevent powdery mildew infection because pumpkin cultivars now grown have little or no resistance to the disease. For effective mildew control, apply fungicide in late July or early August before symptoms appear. Applying fungicide after mildew develops is much less effective. Use a fungicide or fungicide combination that is effective in controlling both powdery mildew and another serious pumpkin disease called black rot. Apply fungicide for powdery mildew control again in mid-August. Fungicides should be applied at relatively high pressures (i.e., a mist-type blower or by airplane) to ensure adequate coverage throughout the plant canopy.

**Black rot and other fruit rots.** The black rot fungus (*Mycosphaerella melonis*) attacks all parts of the pumpkin plant. Small, brown to black spots form on the leaves and vines in early to mid-July. Vine lesions or cankers often crack and form a brown, gummy fluid. The fungus produces numerous, pinpoint, black fruiting structures on the decaying vines. The fungus also attacks the fruit and causes multiple, light-tan to black, roughly circular spots. Secondary soft-rot organisms quickly colonize the decaying tissue, penetrate the rind, and finally result in collapse and rotting of the fruit.

Several other fungi, including *Fusarium* and *Phytophthora*, also may cause significant fruit damage during wet summers. Although conditions necessary for infection by these fungi may vary, they all are favored by excessive rain, poorly drained soils, and continuously planting pumpkins in the same field.

To control black rot and other fruit rots, follow a three-year rotation with non-cucurbit crops. Avoid planting on poorly-drained soils. The black-rot fungus may be seed-borne, so purchase only high-quality seed. Fungicides should be applied in mid- and late-July to suppress injury from the black-rot fungus. Make sure the fungicide or fungicide combination selected for late July is effective in controlling powdery mildew. During wet summers, additional fungicide applications may be necessary to suppress fruit rots.

**Virus Diseases.** Virus diseases have become increasingly important as limiting factors in pumpkin production. Several virus diseases, including cucumber, squash, watermelon, and zucchini yellow mosaics may be present. Disease symptoms vary depending on the particular virus, but generally plants are stunted. Younger leaves may turn yellow or mottled and often are distorted. Older plants develop a distinct mottling of leaves and fruit. Severely affected plants fail to produce fruit.

All of the viruses mentioned above, except squash mosaic (vectored by cucumber beetles) are transmitted from plant to plant by aphids. Also, certain viruses, such as squash mosaic and cucumber mosaic, may be seed-borne. None of the viruses persist in soil for long periods.

Control of virus diseases is difficult. Certain viruses, such as cucumber mosaic, have a broad host range, so all perennial weeds near the field should be controlled. The use of insecticides to suppress aphid populations on pumpkins has not effectively controlled the spread of viruses. Weed control in and around the pumpkin planting, however, can help suppress aphid populations and decrease virus transmission. Reflective mulches also can reduce aphid feeding and the incidence of virus diseases, but this technique is not commonly used in Kansas. Unfortunately, most commercial varieties do not have resistance to these virus diseases. Avoid planting pumpkins or late-season squash crops near fields of muskmelons, cucumbers, or other early season cucurbits that may harbor viruses and insect vectors.

## Pumpkin Disease Control

### Powdery Mildew

| | |
|---|---|
| Quadris | 11-15 fl oz/acre |
| Flint | 1½-2 fl oz/acre |
| Cabrio | 12-16 fl oz/acre |
| Nova | 2½-5 fl oz/acre |
| Topsin M | ½ lb/acre |

Begin applying fungicides when symptoms first appear on leaves in early August. *Alternate* applications of Quadris, Flint, or Cabrio *with* Nova or Topsin M. Resistance will build up quickly when similar fungicides are repeated.

### Anthracnose, Black Rot, and Gummy Stem Blight

| | |
|---|---|
| Bravo Weather Stick | 2-3 pt/acre |
| Bravo 500 | 2.75-4.25 pt/acre |
| Equus | 2-3 pt/acre |
| Quadris | 11-15 fl oz/acre (alternate with Bravo or Equus) |
| Cabrio | 12-16 fl oz/acre (alternate with Bravo or Equus) |

### Viruses

No direct control of viruses is possible. It may help to control perennial weeds near pumpkin fields and to control aphids in the crop that carry the viruses. Resistant varieties are available.

### Controlling insects

Several insect pests are of concern to commercial pumpkin producers. Given their widespread occurrence, striped cucumber beetles and squash bugs might be considered major pests. Generally speaking, squash vine borers and aphids are of less concern.

Striped cucumber beetles are insects with chewing mouthparts. Having overwintered under debris in and around fields, adult beetles appear early in the season, often feeding on various alternate host plants. Eventually, beetles are attracted to newly seeded fields. Beetles may burrow into the soil and destroy plants before they break the surface. Beetles also feed on and kill seedlings.

The ¼-inch long cucumber beetles are conspicuously colored with black head and antennae, straw yellow thorax and yellowish wing covers with three distinct parallel and longitudinal black stripes. Beetles deposit eggs in the soil around the bases of host plants. While root feeding by many beetle larvae may cause stunted plants, larval feeding generally is of little concern. Feeding stops when larvae pupate.

First-generation beetles (mid-July to early August) are of less concern because by this time, most plants are large enough to tolerate feeding. A second generation of striped cucumber beetles is produced in pumpkin fields, as well as on various alternate hosts including goldenrod, sunflowers, and various ornamentals, such as asters. Second-generation adults emerge late in the season and feed until they are forced into hibernation.

The use of insecticides is essential for protecting plantings against direct feeding damage by striped cucumber beetles. Currently, there are no registered planting-time systemic insecticides. Given the steady appearance of striped cucumber beetles throughout the season, monitoring programs with action thresholds are of little use. Some states try to use scouting programs. Initiation of spray treatments is recommended early in the season when beetles first appear. Additional treatments are warranted as long as beetles appear and plants are susceptible to injury. See the table on page 7 for registered insecticides.

Barriers (floating row covers) can be used by some producers to exclude beetles from seedlings and young plants. The high cost of materials may render such controls noneconomical for a crop such as pumpkins where per-acre returns are not as great as for some other vegetable crops. Also, row covers are impractical for large acreages.

**Squash bugs** are "true bugs" that use piercing sucking mouthparts to remove plant juices. They generally occur on well-established plants.

Adult squash bugs move to plants from adjacent protected overwintering sites. Adult females deposit brownish-red eggs in clusters on lower leaf surfaces. Newly emerged nymphs are small and greenish with black legs. There are five nymphal stages. After a final molt, first-generation adults appear. Studies in Kansas have shown that first-generation adults deposit eggs for a second generation. The adults of the second generation overwinter.

High squash bug populations can literally drain plants causing them to wilt and die. Reduced yields and poor quality fruit may result from squash bug feeding.

Effective control of squash bugs is contingent upon timely insecticide sprays and thorough coverage. Observe plantings for the presence of adult bugs, and scout fields for egg masses on the undersides of leaves. Eggs become darker just before hatching. Treat when most eggs have hatched and nymphs are still small to medium-sized. Adult squash bugs have a hard, protective shell that is impervious to insecticides.

When applying insecticides use high pressure to ensure foliage penetration and thorough coverage to reach nymphs hidden on the undersides of leaves. Subsequent treatments usually are required because of the continual presence of egg-laying squash bugs. Registered insecticides are included in the table at the end of this section.

It is critical to reduce the overwintering population of squash bugs by discing and/or removing foliage and fruit immediately after harvest. This deprives nymphs of food they need to complete development. It denies recently formed adults food that would help sustain them through the winter.

**Squash vine borers** are the larvae of a clear-winged moth. Their size, shape and flying habit are somewhat like wasps, for which they are often mistaken. Squash vine borers overwinter as larvae or pupae in cocoons buried in the soil. In Kansas, adult moths emerge in late spring (probably about mid-June) as pumpkins are becoming established. Eggs are deposited individually on the underside of the vines and are often concentrated at the base of the plants. Larvae bore into the stems where they tunnel and feed. Mature larvae exit stems and then burrow into the soil to prepare overwintering cocoons. There may be a partial second generation in Kansas depending on conditions.

Because larvae seriously disrupt conducting tissues, plants often wilt and die. Holes in plant stems and an accompanying ooze, signal the presence of squash vine borers. Large white worms with brown heads are revealed when stems are cut open. Squash vine borer populations vary from location to location. They may be a major concern in some areas but inconsequential in others. Insecticidal controls must be implemented before larvae bore into plants. Treatments should coincide with the appearance of moths seen flying around during the day. Registered insecticides are included in the table at the end of this section.

Aphids can be detrimental to pumpkin production because of their ability to transmit several important virus diseases. Watermelon mosaic, cucumber mosaic, and zucchini mosaic viruses are transmitted by infected aphids entering the fields. An aphid can transmit a virus in a matter of seconds by landing on a plant and probing tissues with its stylus. It may repeat the process by flying to and piercing adjacent plants. Aphid vectors rapidly deplete the virus inoculum on their stylets. Once this occurs, they will not transmit more virus unless they acquire additional virus particles by feeding on another diseased plant.

Although there are various insecticides registered for use against aphids on pumpkins, none kill aphids rapidly enough to prevent disease spread. Rather, aphicides are useful for preventing population buildups or reducing excessive aphid populations, which can decrease plant vigor and produce large accumulations of sticky honeydew. Honeydew serves as a substrate for sooty molds, which reduce the marketability of the fruit.

### Spraying

Controlling insects and diseases in pumpkins is difficult because of the nature of pumpkin vines. Sprawling vines with large leaves make it difficult to penetrate the leaf canopy and cover all leaf surfaces. Often, failure to control a pest may be due more to misapplication than fungicide or insecticide ineffectiveness. Spreading vines make between-row applications difficult.

High-pressure spraying can move leaves and blow a spray mist into the crop canopy. Windy conditions can interfere with good spray coverage. Mist blower or air-blast sprayers can create a mixture of spray mist and air that will lift foliage and deposit spray mist into the plant canopy. Flat spray booms often have difficulty delivering spray into the plant canopy.

**Insecticides for Squash and Pumpkin**

| Material | Brand Name | Cucumber Beetles | Aphids | Squash Vine Borer | Squash Bugs | Spider Mites | Impact on Beneficial Insects |
|---|---|---|---|---|---|---|---|
| malation | Cythion | G | F | ? | | F | Moderate |
| carbaryl | Sevin | G | | | P | | Disruptive |
| dicofol | Kelthane | | | | | G | Low/Mod |
| endosulfan | Thiodan | G | G | ? | F | | Moderate |
| permethrin | Ambush, Pounce | G | F | ? | G | | Disruptive |
| enfenvalerate | Asana | G | | ? | G | | Disruptive |
| bifenthrin | Capture | G | F | ? | G | F | Disruptive |
| fenpropathrin | Danitol | G | | | G | F | Disruptive |
| imidacloprid | Admire | ? | G | | | | Low/Mod |
| abamectin | Agri-Mek | | | | | G | Low/Mod |
| neem | Azatin | | | ? | ? | | Low/Mod |
| soap | M-Pede | | F | | | F | Low |
| rotenone | | G | ? | ? | ? | | Mod/Disruptive |
| pyrethrins | Pyrenone | ? | ? | ? | G | | Moderate |

G=good, F=fair, P=poor, ?=unknown

Follow label directions for rates, application procedures, precautions, and harvest intervals.

Water-sensitive cards are available from many chemical and sprayer companies. These cards can be stapled or taped to leaves to measure the spray coverage deposited on various surfaces. It is a good idea to determine the effectiveness of sprayer applications using a technique like this to make sure that money invested in applying pesticides is not wasted by ineffective application.

## Harvesting

Pumpkins are ready for harvest when the rind or skin has toughened and stems have lost their succulence. Use your fingernail to test rind toughness. Dripping from the stems should be minimal when they are cut from the vine. It is best to cut the fruit from the vine with pruners or clippers to ensure a long, good, and undamaged stem handle. Use long-handled pruners to avoid stooping. Pumpkins are generally windrowed into piles or lines in the field so trailers or trucks can drive through to load them. Pumpkins can be contained in cardboard or wood bulk bins that can be handled with a forklift for unloading.

A light freeze before harvest is not damaging, but temperatures in the mid- to low 20s should be avoided. Store pumpkins in a well ventilated, cool location (50 to 55°F) for one to two months if necessary. Most Kansas growers harvest just before market delivery. If pumpkins will be stored longer than one month, cure them at 80 to 85°F and high humidity for seven to 10 days. Surface molds and rots can be reduced with a bleach and water solution (1 part bleach to 4 parts water) sprayed or wiped on the surface.

## Handling and containers

Usually, pumpkins are handled in bulk or loaded into bulk bins directly from the field. They are sold by the pound with trucks weighed full and empty with scale receipts as a means of payment. Those who grow pumpkins on a smaller scale may have difficulty weighing small loads or portions of loads, so a per-pumpkin price may be a better selling method. Pumpkins may be grouped into several sizes for marketing because many markets want uniformly sized fruit for particular markets.

Small or baby pumpkins can be easily damaged when handled in large bulk containers, so they may be packed in standard cardboard 1⅑ bushel vegetable cartons with a count clearly indicated on each box. Miniature pumpkins usually are washed with a standard brusher-washer and packed in cartons either using standard tomato lugs or cardboard cartons containing 10 pounds of pumpkins or gourds. A count per carton should be clearly indicated on the container. The appearance of some miniature pumpkins and gourds may be improved by dipping or spraying them with shellac. The surface must be dry and the pumpkins fully matured before applying. After dipping, let them dry before handling.

Be sure to contact your market source well in advance of delivery to discuss packaging and handling procedures. Tentative prices may be agreed on at that time, or prices may be negotiated closer to delivery.

## Marketing

Marketing should start well ahead of harvest by contacting potential buyers or preparing advertising or sales promotions. Most retail markets begin selling pumpkins and fall decorative items in early October. Wholesale sales to supply these markets often begin in mid to late September. The most active sales period is mid October, culminating with Halloween. Many growers and marketers have observed that the marketing period for fall decorative items seems to be arriving earlier, and mid-September is not too early to establish retail displays. Wholesale market deliveries may begin in early September.

Creative displays in retail markets enhance sales. Decorated pumpkins and pumpkins incorporated in arrangements of fall flowers or other items can add considerable value. Painted or decorated pumpkins can add value as well.

In the fall, many growers offer tours of the farm for school classes or the public with a per person charge for each participant. A trip to the pumpkin patch usually includes a discussion of pumpkins and how they grow or other educational topics, along with a trip to the field. Many growers charge from $1 to $2 per person for tours, depending on the time involved. A field of small pumpkins works well for allowing small children to pick out a pumpkin from the field. Tours should be scheduled to avoid conflicts. Promote this activity by developing a flyer for grade school teachers in surrounding communities. If considering this type of operation, contact your insurance carrier to make sure your policy covers liability from this type of marketing system. For a nominal cost, a rider may be added to some policies to increase coverage.

### Production Costs

The following table lists estimated production costs for commercial pumpkins. Return, yields, prices, and other values represent average or nominal values and should be adjusted for individual growers.

Fuel consumption is estimated at 1.5 gallons per hour of tractor time. Oil and lubrication is estimated at 15 percent of fuel cost. Repairs are estimated at $2.25 per hour of tractor time and $17 per acre for irrigation equipment. Fuel, repairs and taxes for a truck are not included as costs.

### Cost Return Projection for Pumpkin Production in Kansas

| **Variable costs per acre** | **Total** |
|---|---|
| Fertilizer | $75.00 |
| Seeds | $45.00 |
| Herbicides | $30.00 |
| Insecticides 4 applications | $50.00 |
| Fungicides 3 applications | $75.00 |
| Labor | $125.00 |
| Fuel and Oil | $14.00 |
| Repairs | $39.00 |
| Waters | $2.00 |
| Marketing | $100.00 |
| **Total variable costs** | **$555.00** |
| **Fixed costs per acre** | |
| Interest on Land | $60.00 |
| Taxes | $10.00 |
| Depreciation on equipment | $75.00 |
| Interest on equipment | $45.00 |
| Irrigation equipment | $65.00 |
| Insurance | $7.00 |
| Total fixed costs | $262.00 |
| **Total production costs** | **$817.00** |
| Yield per acre (lb) | 22,000.00 |
| Price per unit (lb) | $0.08 |
| Returns/acre | $1,760.00 |
| **Returns over total cost** | **$943.00** |
| **Returns over variable costs** | **$1,205.00** |
| **Variable costs/units (lb)** | **$0.025** |
| **Total costs/unit (lb)** | **$0.037** |



**Kansas State University Agricultural Experiment Station and Cooperative Extension Service**

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