

Growing Fresh Market Cucumbers

Fresh market vegetables continue to increase in popularity throughout the area. Small producers of vegetables may be able to expand production for local sale by adding a new crop to their list or by concentrating on a few profitable crops. In either case, cucumbers for sale in the fresh market may have potential.

Varieties

Fresh market cucumber varieties are white-spined, uniformly dark green, and 6 to 9 inches long at edible maturity. In general, hybrids offer greater yield potential and greater uniformity, although hybrid seed will be more expensive than seed of open-pollinated varieties.

Varieties recommended for Maryland include both gynoecious and monoecious types.

Gynoecious types, which are earlier maturing and generate greater, more concentrated yields, produce only female flowers (the flowers that produce fruits). Gynoecious types also generally exhibit better disease resistance. Since the gynoecious type does not produce pollen, 10 to 15 percent of a gynoecious planting must be monoecious plants for pollination and fruit set to occur. Check to see if your seed company automatically includes the necessary proportion of monoecious seed with a gynoecious order. If not, you will have to order the required monoecious seed separately.

Monoecious types, which produce both male and female flowers on the same plant, have a longer growing season than the

gynoecious type. For growers desiring a long picking season, such as for keeping roadside stands stocked, monoecious varieties may therefore be an advantage. Table 1 shows varieties of cucumbers that are recommended for Maryland.

Field Selection and Fertilization

Cucumbers grow best in well-drained, sandy or sandy-loam soils, although they grow well on any good, well-drained soil. Soil with a high percentage of organic matter and a pH of about 6.0 to 6.5 is also desirable.

Soil Testing, Liming, and Fertilization

Have the soil tested for pH, magnesium, phosphorus, potassium, calcium, and organic matter by the University of Maryland Soil Testing Lab. To determine the proper amounts of lime and fertilizer to add, check Extension Bulletin 236, "Commercial Vegetable Production Recommendations." Follow recommendations based on the results of your soil tests.

Cucumbers generally need about 100 to 125 pounds per acre of nitrogen. With bare-ground culture, apply 25 to 50 pounds per acre broadcast and disked in during field preparation, then band 25 pounds per acre with the planter. When vines begin to run, apply the remaining 25 to 50 pounds per acre as a sidedress application or through the irrigation water. If the field will be mulched with

plastic, apply the fertilizers before the beds are formed so that the materials will be in the bed area. For fumigated fields, apply at least half the nitrogen in the nitrate form.

Recommendations for phosphorus and potassium application rates are based on soil tests and appear in a table in EB 236.

Magnesium, if needed, can be added as magnesium sulfate (Epsom salts) if soil pH is adequate and no liming materials are needed. You can use dolomitic limestone if the pH needs to be raised and magnesium is also needed. Ideally, limestone should be added at least 6 months before planting, although applying needed lime at planting time will still benefit the crop.

Cover Crops and Manuring

Planting and plowing down a fall cover crop before the cucumber crop is planted helps increase organic matter content. Applying well-rotted manures before plowing can meet some of the fertility needs of the crop and will also help raise the organic matter content of the soil. The use of fresh manures on cucumbers is not recommended due to food safety concerns. The University of Maryland provides a manure analysis service as part of a nutrient management program. Contact the Maryland Cooperative Extension office in your county for information about soil and manure testing services.

Using Plastic Mulches

Use black or clear plastic mulch to increase both crop yield and early fruit production. Clear 1 ½-mil plastic mulch applied before planting the field will increase early yields more than an application of black plastic will; however, fumigation will be needed to control weeds under clear plastic.

Fumigate with Vapam HL (30 to 37 gallons per acre) according to manufacturer's instructions and lay plastic mulch on well-prepared beds 30 days before field planting. The plastic cover should be 4 feet wide (available in 4,000-foot rolls) and laid on 5- or 6-foot centers immediately over the fumigated soil. The soil must be moist (neither too wet nor too dry) when the fumigation treatment takes place. Producers normally hire custom operators to perform this operation, although some growers with large acreage may have their own equipment and do the work themselves.

The use of clear plastic often results in the growth of some uncontrolled weeds, which choke out the cucumber plants. Therefore, to avoid serious weed problems if you use clear plastic without fumigation, it is important to treat the soil with herbicides before the plastic is applied. Follow manufacturers' instructions carefully, since some herbicides are not recommended or labeled for use under plastic mulch, and damage to the crop could occur.

Table 1. Varieties of Cucumbers Recommended for Maryland

Variety	Disease Resistance ¹
Gynoecious slicer types	
Encore	ASLR, DMR, PMR, SMR
Raider	SMR
Dasher II	ALSR, AR, DMR, PMR, SMR
Striker	ALSR, AR, DMR, PMR, SMR
Monoecious slicer types	
Medalist	SMR, DMR, PMR
Cyclone	AR, DMR, PMR, SMR
Gynoecious pickling types	
Lafayette	DMR
Vlaspik	DMR

¹AR = anthracnose resistant; ALSR = angular leaf spot resistant; DMR = downy mildew resistant; PMR = powdery mildew resistant; SMR = scab and mosaic resistant.

If black plastic mulch is used, herbicides under the plastic are not necessary.

Although fumigation may aid in the control of soilborne diseases, it may not prevent the diseases from causing serious losses. Fumigation under black plastic, therefore, is not required for disease control and should not be used in place of long rotations. Whether you apply clear or black plastic, however, use fumigation where nematodes are known to be a problem or where soil tests indicate high populations of damaging nematodes.

If trickle irrigation tubing is to be used under the mulch to provide an even, plentiful supply of water to the plants during the season, tubing can be applied at the time the mulch is laid (see "Irrigation").

Planting

Seed Treatment

Check seed packaging to determine if seed has been treated with an insecticide or fungicide. Although untreated seed for organic production is available from seed suppliers, you must usually specify your request for untreated seed when you place your order. If seed has not been treated and treatment is desired, you can treat it using the fungicide Thiram 75WP ($\frac{1}{2}$ teaspoon per pound) and an approved commercially available insecticide such as Lorsban 50SL; follow label instructions for both.

Direct Seeding

Cucumbers produce fruit quickly from direct seeding when soil and air temperatures are warm (above 60° F). Plant seed mechanically or by hand. When plastic mulch is not used, space rows 3 to 4 feet apart with plants 9 to 12 inches apart in the row. Plant about 1 $\frac{1}{2}$ pounds of seed per acre.

Growing Transplants

Since cucumbers produce fruit quickly from direct seeding, they are not normally grown from transplants. However, if the use of transplants for the early market is desired, the following guidelines may help:

- The amount of seed necessary depends on field spacing and seed germination percentage. If the seed is of good quality and has a high germination percentage (90 percent or higher), one seed per pot or tray cell is sufficient.
- Grow transplants in pots or flats that provide an area of at least 2 inches by 2 inches for each plant. Smaller pots or cells restrict root growth and result in less vigorous transplants. Do not allow transplants to become too large prior to planting. Transplants should have two true leaves when they are set in the field. The two-leaf stage will occur about 3 weeks after seeding.

Planting into Plastic Mulch

If container- or cell-grown transplants are used, plant them through the plastic when daily mean temperatures have reached 60° F. Transplanting is generally done by hand, but mechanical transplanters are now available for use on plastic mulch. Planting dates usually fall between May 1 and May 15 in most of Maryland. Transplants may be used for early plantings; protect transplants with strips of a fall-planted small grain cover crop left between the rows of cucumbers. Grain strips protect the crop at a distance of 10 times the height of the small grain. (A 3-foot-tall small grain strip will protect the cucumber crop for a distance of 30 feet.) The strips can also function as drive rows for spray application and for removing harvested fruit from the field.

If cucumber seed is used, seed it directly through the mulch by hand using a jabber-type planter or by mechanical seeders designed to plant seed through plastic mulch. As with direct-seeding into bare soil, allow the soil and air temperatures to reach 60° F before seeding.

Pollination

A sufficient number of pollinating insects is necessary in cucumber fields to ensure adequate fruit set. Unpollinated cucumber flowers do not develop, but shrivel and drop off. Flowers that are partially but not adequately pollinated tend to develop at the stem end only, producing unmarketable nubs or nub-

bins. Lack of bees in cucumber fields is a common cause of cull fruit.

Because local bees are seldom plentiful enough to provide adequate pollination, rent honeybees—or maintain them yourself—for this purpose. One strong hive per acre is needed in the field when female blossoms start appearing. Each hive should contain at least 800 square inches of brood and enough adult bees to care for the brood, regardless of the weather.

Make sure a clean water supply is available within $\frac{1}{4}$ mile of the beehives. If fields must be treated with insecticides during bloom, apply the insecticide in the evening when bee activity is reduced, to protect both wild and rented bees. Be sure to warn the beekeeper before you apply any insecticide; it may be necessary to remove hives from the field if the insecticide poses serious potential danger to the bees.

Irrigation

An irrigation system will help ensure a good cucumber crop, especially during droughts. Maintaining soil moisture near optimum levels increases production, improves color and shape, and reduces the percentage of cull fruits. Moisture supply is most critical during flowering and fruit production, in late June and July. One to $1\frac{1}{2}$ inches of water per week is necessary during this time. You can use tensiometers to help determine soil moisture content; they will indicate when it is necessary to irrigate, before plants become stressed. During the early part of the season when plants are small or when the weather is cool, less water is required.

There are several types of irrigation systems available that work well for producing cucumbers. Small growers usually use trickle, hand moved sprinkler, or traveling gun irrigation systems. When you select a system, consider purchase and maintenance costs; the source, quantity, and quality of water; terrain; and operating labor requirements.

Weeds, Diseases, and Insects

Producing a profitable, high quality cucumber crop requires excellent management of weeds, diseases, and insects. The information that follows describes common cucumber pests and recommended control strategies. For more detailed information on recommended pesticides, consult a current edition of EB 236, "Commercial Vegetable Production Recommendations." Many of the pest control materials are applied as a spray. Consult with a farm supplier for types and capacities of sprayers that are available. If you wish to grow cucumbers organically, contact the Maryland Dept. of Agriculture for listings of materials that are accepted for organic production.

Weed Management

If possible before planting, identify the weeds in the field in order to determine the potential severity of weed pressure. Timely mechanical cultivation and hand hoeing will suppress weeds until the crop establishes itself. Cultivation should be shallow to avoid injury to cucumber roots.

If you are using herbicides, select those materials that are effective on the weed species known or expected to be in the field. Consult the appropriate tables in EB 236 for more information on herbicide effectiveness, preharvest intervals, and crop rotation planting restrictions. Consider the following herbicides for cucumbers:

For planting into soil without plastic mulch:

Preplant Incorporated:

Naptalam—2 pounds per acre. Apply as 1 gallon of Alanap 2SC incorporated 2 inches before seeding or transplanting. Weed control may not be satisfactory on sandy soils with less than 1 percent organic matter. Alanap may be weak on grasses, common cocklebur, and jimsonweed.

Bensulide + naptalam—4 to 6 pounds per acre + 2 pounds per acre. Apply as 1 to 1.5 gallons of Prefar 4EC plus 1 gallon of Alanap 2SC before seeding or transplanting. The two

materials can be tank mixed. Prefar controls grasses well.

Preplant Incorporated or Preeemergence:

Bensulide—5 to 6 pounds per acre. Apply 5 to 6 quarts of Prefar 4EC. Incorporate 2 inches deep or less before seeding or transplanting, or apply preeemergence and activate with 0.5 to 1 inch of irrigation immediately after seeding. This application is primarily for grass control, so control of broadleaf weeds will be weak.

Chlomazone—0.125 to 0.188 pound per acre. Apply as 4 to 6 fluid ounces of Command 4EC to control annual grasses and many broadleaf weeds including common lamb's-quarter, velvetleaf, spurred anoda, and jimsonweed. Use lowest rate on sandy soils low in organic matter. Combine with Curbit 3EC to control pigweed species. **WARNING: Command spray or vapor drift may injure sensitive crops or other plants up to several hundred yards away from application. Do not apply when weather conditions favor drift or to fields adjacent to sensitive crops.**

Preeemergence:

Ethalfluralin—0.56 to 0.75 pound per acre. Apply 1.5 to 2 pints per acre of Curbit 3EC to control annual grasses and some broadleaf weeds such as carpetweed and pigweed. Other broadleaf weeds may not be controlled.

Postemergence:

Naptalam—1 to 2 pounds per acre. Apply 2 to 4 quarts of Alanap 2SC when plants are ready to vine. Do not apply early in the season when growing conditions are cold or wet. Do not apply if rain is expected within 6 hours.

Paraquat—0.5 pound per acre. Apply 1.6 pints Gramoxone Extra 2.5SC as a directed spray to control emerged weeds between the rows after the crop is established. For best results, treat annual grasses when they are actively growing and before tillers are present.

Sethoxydim—0.2 to 0.3 pound per acre. Apply 1 to 1.5 pints Poast 1.5EC with oil concentrate as 1 percent of the spray solution. Apply postemergence to control annual grasses and some perennial grasses.

Postharvest:

Paraquat—0.5 to 0.6 pound per acre. Apply 1.5 to 2 pints Gramoxone Extra 2.5SC as

a broadcast spray after the last harvest to reduce weed seed formation.

For soil strips between rows of plastic mulch, follow these recommendations to avoid potential injury to the crop:

- Prepare the soil and lay plastic (and trickle irrigation tubing if desired) before herbicide application.
- Spray herbicide(s) on the soil and the shoulders of the plastic strips in bands before weeds germinate. Wet only the outside 3 to 6 inches of plastic but do not spray the herbicide onto the center of the plastic strips. Herbicides may wash from a large area of plastic into the plant hole and result in crop injury.
- Incorporate herbicide into the soil with $\frac{1}{2}$ to 1 inch of rainfall or overhead irrigation within 48 hours of application and **before planting or transplanting.**
- Apply Gramoxone to the soil strips. May be used in combination with other residual herbicides that are registered for cucumbers.

Disease Management

Among the diseases of cucumber that can occur in this region are viruses, bacterial wilt, angular leaf spot, anthracnose, downy mildew, powdery mildew, scab, belly rot, gummy stem blight, Pythium, and Phytophthora blight. Fortunately, they do not all occur every year.

Practice long crop rotations of 3 years or more, if possible. Do not include other cucurbit crops such as pumpkin, watermelon, muskmelon, or squash in the rotation; do not follow any of these crops with cucumbers. If Phytophthora has been a problem in the field, do not plant cucumbers after peppers, tomatoes, or eggplant crops that may have been infected with this disease.

Select varieties with genetic disease resistance when possible. This may be especially important for organic production, as fungicides will not be used.

Recommended pesticides may be effective in reducing losses in yield or quality caused by some diseases. Check a current edition of EB 236 for updated recommendations on rates, timing of applications, and restrictions.

Cucumber Diseases

Damping off can occur in plant beds or in the field. Apply Ridomil Gold at planting (not for use in a closed environment).

Viruses of cucumber are usually spread by aphids. Once in the plant, viruses cannot be eliminated, so prevention is very important. Select resistant varieties, practice strict aphid control early in the season, and plant late fields (after July 1) as far from other cucurbit fields as possible to minimize virus infection.

Bacterial wilt is carried by the cucumber beetle; beetles must be controlled before they begin feeding on plants. Since infected plants cannot be cured, it is important to avoid infection and prevent spread of the disease within a field if it does occur.

Angular leaf spot is also caused by a bacterial pathogen. It can be spread by splashing rain, by insects, during hand harvest, on equipment, and by windblown soil containing infected debris. Buy seed from a reputable supplier, use crop rotation, and select varieties with resistance, if possible. Apply fixed copper plus mancozeb at first sign of the disease and repeat every 7 days. Avoid working in the field when the foliage is wet, to reduce the mechanical spread of the bacteria.

Anthracnose, downy mildew, scab, belly rot, and gummy stem blight are all foliar diseases. The fungicides most effective on most of these are Bravo Weather Stik and mancozeb, which may be applied at 5 to 7 day intervals. Apply before an expected rain, if possible, to protect foliage when leaves are wet. See EB 236 for additional fungicides that may be labeled for these diseases on an individual basis.

Powdery mildew is not controlled well by Bravo, so adding Bayleton alternated with Benlate or Topsin on a 14-day schedule will enhance control. See EB 236 for more details.

Pythium and *Phytophthora*, as soilborne diseases, are more serious when drainage is poor. Use good crop rotations, select fields with good drainage, and use cultural and tillage practices that prevent water from accumulating around the base of the plants. Applications of Ridomil Gold/Bravo may provide some pythium and phytophthora control.

Insect Management

Cucumber beetles, aphids, and spider mites are the most destructive insect and mite pests on cucumbers in most areas of Maryland. Check a current edition of EB 236 for the most recent recommendations for control of these and other insect pests.

Cucumber beetles can transmit bacterial wilt into cucumbers, but they can also cause extensive feeding damage on small plants. EB 236 lists effective insecticides.

Aphid control materials will depend on the type of aphid causing damage. Treat green peach aphids with diazinon, Metasystox-R, or Thiodan; treat melon aphids with Lannate or Thiodan.

Spider mites are too small to be seen easily; use a 10X magnifying glass to detect them. They are most often found on the underside of the leaf. Mite infestations usually begin around the edges of the field and in grassy areas. Mite damage is usually worse during hot, dry weather and when Sevin or pyrethroids have been used. Agri-Mek, Kelthane, and Metasystox-R are currently recommended for mite control.

Harvesting

Under favorable growing conditions, cucumbers should produce fruit of harvestable size about 8 weeks after planting. Fresh market cucumbers normally are picked when fruits are 1 ½ to 2 ¾ inches in diameter and 6 inches or more in length. Cucumbers mature rapidly; pick daily during the harvest season. Harvest fruit before the seed coats harden and before the skin begins to turn yellow. To stimulate maximum production, pick all fruit of marketable size and all oversize and cull fruit at each harvest, although unmarketable fruit may be left in the field.

Fruit should be picked with no stems attached; grasp the fruit firmly and apply pressure with the thumb on the fruit stem. Roll the vines over toward the center of the row, remove the cucumbers, and then roll the vines back into place.

Table 2. Costs and Returns

Returns based on yield and price assumptions

1 ½ bu (50 lb) Boxes per acre	Price per box		
	\$6	\$7.50	\$9
200	\$1,200	\$1,500	\$1,800
300	\$1,800	\$2,250	\$2,700
400	\$2,400	\$3,000	\$3,600

Estimated cost per acre

Item	Cost per acre
Land rent	\$75.00
Plowing, discing, fertilizer application, planting	\$50.00
Seed (1 ½ lb per acre @ \$13 per lb)	\$19.50
Bees	\$30.00
Cover crop	\$30.00
Fertilizer	
(115 lb N @ \$0.30/lb)	\$34.50
(100 lb P @ \$0.30/lb)	\$30.00
(150 lb K @ \$0.16/lb)	\$24.00
Lime (0.33 ton @ \$26/ton)	\$8.58
Pesticides	\$279.30
Prefar, 0.3 gal @ \$38	\$11.40
Alanap, 0.3 gal @ \$27	\$8.10
Pounce, 6 x 0.17 gal @ \$181	\$181.00
Bravo 720, 0.4 gal @ \$62	\$24.80
Pesticide application, 9 @ \$6	\$54.00
Irrigation (3 @ \$20)	\$60.00
Boxes (300 @ \$1)	\$300.00
Harvest and packing labor (200 hours @ \$7)	\$1,400.00
Hauling and marketing	\$100.00
Interest (6 mo interest APR @ 10% on 2,000)	\$100.00
<i>Total estimated costs</i>	<i>\$2,540.88</i>

(Does not include irrigation or depreciation on machinery)

Marketing

Much of the crop grown on a small scale can be sold directly to consumers through roadside stands and farmers' markets. Cucumbers should be clean, separated by size and color, and attractively presented. Check displays frequently and remove unattractive fruit. Replenish stocks as needed to maintain full displays.

For wholesale marketing, make contacts with buyers early to establish price, fruit quality standards, packaging, and shipping or transportation requirements. Sometimes, it takes several years for a rapport to develop between producers and buyers that allows each to benefit from the transaction. Start with a small acreage, learn production and marketing skills, then expand as market opportunities allow.

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