The Oklahoma Cooperative Extension Service

WE ARE OKLAHOMA

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Original factsheet was developed by Jim Motes, Warren Roberts, Jonathan Edelson and John Damicone.

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EXTENSION

Cucumber Production

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Origin and Cultivar Groups

Cucumber is native to India and is one of the oldest vegetables mentioned throughout history. Cucumber includes three different types of cultivars including fresh market (slicers), processing (pickling) and greenhouse (slicers). Regarding cucumbers nutritional value, very little vitamin A is available from the fruit, particularly if it is eaten peeled, although some vitamin C is contained in the fruits (Peirce, 1987). Cucumber is monoecious (female and male flowers separate on the same plant), but several varieties developed within the past 40 to 50 years are gynoecious meaning they produce mostly female flowers and require some monoecious pollinator plants to be in the field to provide for pollination (Iowa State University, 2020). Parthenocarpic varieties often are used in greenhouse and high tunnel production, since they do not require pollination to develop fruit (Guan, 2018).

Production Requirements

Cucumber is a warm-season crop and susceptible to cold and frost damage. Planting should wait until soil temperatures are 60 F or higher (75 F to 90 F preferred). Extremely high temperatures may cause light green fruit color and bitterness in many cucumber varieties. Cucumbers will grow on almost any well-drained soil. A good slicing cucumber yield in Oklahoma is 300 bushels per acre, although much higher yields are possible.

In field production, there will be a need for pollen transfer from male flowers onto the stigma of the female flower primarily provided by insect pollinators. Therefore, protecting and managing pollinator insects is critical for fruiting. Better pollination translates to more fruit and the corresponding increases in yield.

Cucumber producers should to take into consideration the high amount of labor required for harvest. For slicing production, harvesting will need to be repeated several days each week to maintain additional fruit set. Processing cucumbers may allow for a one-time harvest, which will reduce the long term need for harvest labor.

Incidence of disease is reduced by lower humidity conditions, which helps to reduce both fruit and foliar diseases. Humidity levels are influenced somewhat by location (western Oklahoma tends to be drier), plant populations in the field (higher populations = higher humidity) and by managing crop irrigation (timing, watering methods). Several viral diseases have cucumber as a host and it can be difficult to control them. There is evidence the use of sorghum x Sudan grass hybrid or other annual warm-season forage grasses can reduce the level of virus in cucurbit crops when planted as wind-breaks between crop rows prior to crop establishment.

Sites and Soils

Cucumbers grow best on well drained, warm, sandy or silt loam soil, but a variety of soil types can be used. Where early harvest is of importance, sandy soils located where there is good sun exposure and air drainage are best. If soil drainage is less than optimal, cucumber will benefit from the formation of free-standing raised soil beds, which also will capture more heat from direct sunlight, speeding emergence and development of the crop. These beds can be formed by using a commercial bed-shaper. Drip irrigation tape and plastic mulch also can be installed with most bed-shapers during bedding.

Mulch/drip tape layer and bedder.

Nematodes can be a problem and producers should rotate fields to non-host species such as annual grasses or cereal grains to reduce the chances of nematode populations increasing.

Windbreaks are advisable on sandy soils to reduce soil erosion "sand blast" damage and stunting-stressing of young seedlings during spring winds. Windbreaks can consist of strips of winter cover crop that have been left in the field between every two to three rows of crop or strips of sorghum x sudan (haygrazer) planted earlier in the spring prior to the establishment of cucumbers. To reduce the risk of diseases and insects, do not plant on land where cucumber, melons, watermelon, squash or pumpkin have been grown during the past three years.

Varieties of Cucumber

Several varieties of cucumber are grown in Oklahoma, see OSU Extension HLA-6035 "Commercial Vegetable Varieties for Oklahoma" for more information. Listed below are varieties that have performed well in Oklahoma. On-farm trials are important in reducing the risk of trying new varieties. Disease resistance varies considerably between varieties. Disease resistance should be considered, particularly to powdery mildew and Fusarium wilt, if diseases have been a major problem. No varieties have shown insect or nematode resistance.

Varieties

Slicers: Dasher II (F1), General Lee (F1) (gynoecious), Turbo (F1) (resistant to several diseases), Market More 80 (resistant to several fungal diseases) and Thunder (resistant to several diseases)

Pickling: H-19 Little Leaf (resistant to several diseases), Max Pack (resistant to several diseases)

Parthenocarpic: Diva (F1), Poniente (F1)

Soil pH and Fertilizer

Base soil pH and fertility needs for the crop on soil test results and recommendations. Cucumbers are tolerant to a wide range of soil pH, but soil with a pH between 6.0 and 6.8 is preferred. If the soil pH is below 5.8, it should be limed to increase the pH to 6.0 or above. Base liming rates and recommended amounts of phosphorus (P_2O_5) and potassium (K_2O) on OSU soil test recommendations. Rates for phosphorus and potassium are given in Table 1.

Nitrogen

The nitrate-N value given by the soil test report should be used to determine nitrogen fertilizer needed on a particular soil. Subtract the available nitrogen given in the soil test results from that needed initially by the crop. For example, if the soil test indicates 15 pounds of available nitrogen, subtract that 15 pounds from the pre-plant nitrogen application of 50 pounds, meaning 35 pounds of nitrogen would need to be applied prior to planting. On soils with low levels (5 pounds or less) of nitrogen, apply 50 pounds per acre of nitrogen pre-plant incorporated along with recommended P_2O_5 and K_2O (Table 1) prior to planting. An alternative to pre-plant application of nitrogen would be to band all fertilizer with the planter 3 inches to 4 inches below and 2 inches to 3 inches to the side of the seed row. High levels of nitrogen in the soil will cause excessive growth and delayed flowering and fruit set; therefore, do not over apply nitrogen. Cucumbers will respond to nitrogen fertilizer, so top-dressing (applying fertilizer to the soil surface then cultivating or watering it into the soil) is advised. One pre-plant application of nitrogen at 50 pounds per acre should be followed by two supplemental top-dresses of nitrogen. The first supplemental top-dress should include 50 pounds per acre of nitrogen and the second 25 pounds per acre. Time the first top-dress three weeks after seedling emergence and the last three weeks after the first top-dress. These three nitrogen applications should supply ample nitrogen for the crop. Another method of managing nitrogen is to inject it through a drip irrigation system if that system is used for crop watering.

Table 1. Phosphorous and potassium requirements for cucumbers.

Phosphorous Requirements (lbs. P_2O_5/Acre)					
When test shows	0	10	20	40	>65
Add lbs. P_2O_5	120	100	80	45	0
Potassium Requirements (lbs. K_2O/Acre)					
When test shows	0	75	125	200	>250
Add lbs. $_{K2}O$	120	100	80	40	0

Drip fertilizer injector.

The advantage of applying nitrogen through the drip system is that smaller amounts of nitrogen can be applied on a more regular basis, thereby reducing the risk of over applying nitrogen and reducing nitrogen loss from leaching by heavy rains. In addition, less nitrogen will be available for weedy competitors since nitrogen applied through the drip system is applied down the row, not broadcast over a wider area. Even if fertilizer is injected through the drip irrigation system, it is wise to make a pre-plant application of nitrogen, phosphorus and potassium based upon soil test recommendations, or apply all of them through the drip irrigation system if a water-soluble complete fertilizer (fertilizer containing N-P-K) is used.

Soil Preparation

Conventional clean tillage methods can be used during soil preparation including deep-plowing, disking and harrowing. An alternative to tilling the entire field area would be to strip-till, where a cool-season cover crop strip is left between every two to four rows of cucumber, allowing for wind breaks

Harvesting

In normal seasons, the first picking can be made 45 days to 60 days after planting. Generally, cucumbers are harvested every two days to three days, but with ideal growing conditions, daily harvest may be needed for a high percentage of fancy grade fruit. Sequential plantings at two- to three-week intervals can be helpful for ensuring a steady supply for market. When picking, do not pull the cucumber from the vine, this may tear the fruit and damage the vine. The proper picking technique is to push the stem off the fruit with the thumb, or it can be clipped with a small pair of shears. Cucumbers must be fresh and crisp when received by the consumer. The market desires a uniform dark green cucumber that is well formed, straight and of medium size. This requires frequent picking and careful handling and grading. Trellising will improve the quality and color of the cucumbers, but extra labor and supplies are required to construct and remove the trellis, and to train the plants to grow onto the trellis. Allowing fruit to become too large on the vine will reduce quality and yield of the crop.

White plastic mulch with trellis system.

Handling, Storage and Marketing

Cucumbers can be held 10 days to 14 days at 50 F and 90% to 95% relative humidity. The fruits are very susceptible to shriveling so the relative humidity must be kept high. Below 50 F, cucumbers are subject to chilling injury and at high temperatures, they turn yellow. Do not store cucumbers with fruits that produce ethylene such as ripe tomatoes, apples or cantaloupes. Slicing cucumbers are usually waxed after washing and grading. This adds slightly to the cost of production, but improves appearance and is effective in preventing shrinkage and loss of freshness during storage, shipping, and marketing. Cucumbers are normally packed and sold in cartons or crates holding 50 pounds to 55 pounds.

Related Extension Publications

E-832 OSU Extension Agent's Handbook of Insect, Plant Disease and Weed Control
E-929 Guide for Identification and Management of Diseases to Cucurbit Vegetable Crops

References

Pierce, L.C., 1987, Vegetables Characteristics, Production, Marketing, Wiley NY, NY.

Iowa State University, 2020, How do gynoecious cucumber varieties differ from other varieties? https://hortnews.extension.iastate.edu/faq/how-do-gynoecious-cucumber-varieties-differ-other-varieties

Guan, W., 2018, What you need to know about cucumber varieties for high tunnel production, Purdue Vegetable Crops Hotline, https://vegcropshotline.org/article/what-you-need-to-know-about-cucumber-varieties-for-high-tunnel-production/

Conventional tillage (top) and strip tillage (bottom).

and later for harvest and spray alleys if spraying is necessary. Cucumbers often are grown on flat soil with no raised bed. With normal conditions, there is no advantage in bedding-up well drained sandy soil. However on low, tighter bottom ground or if wet weather is anticipated then bedding-up into free-standing raised beds can be beneficial.

One potential challenge with conventional clean tillage is the loss of soil organic matter due to the physical cutting up of organic residues and the increase of soil microbial activity in breaking down organic residues. One solution to this loss of organic matter would be the use of winter cover crops to increase soil organic matter. When a winter legume such as Austrian winter pea or winter clovers, etc. are included with a cereal grass in the cover crop mix, not only will soil organic matter be increased, but also there will be a gain in available nitrogen for subsequent warm-season crops such as cucumber. Research has indicated a direct benefit to using cover crops with at least one legume in the cover crop mix in the winter prior to planting a warm-season crop such as melon. In an organic system, legume cover crops are a good source of nitrogen that will be available for an extended period during the growing season.

Planting and Plant Spacing

A key aspect of establishing cucumbers is waiting until the soil temperature at planting depth is at least 60 F (75 F to 90 F optimal germination temperature), otherwise plants will be slow to emerge and crop stands will be variable with plants in various stages of growth. In addition, cold soil temperatures early in the season can result in blossom end rot (BER). Blossom end rot is a physiological condition where calcium is reduced in availability during flowering and fruiting that results in a brown leathery area on the bottom (blossom end) of the fruit, rendering the fruit unsaleable. Blossom end rot usually occurs on early set fruit and is related to several conditions with cold soils being a major factor.

Planting into black plastic mulch will help to increase soil temperatures early in the season, while opaque white plastic mulch is useful for soil moisture management, crop cleanliness and weed suppression with mid-summer plantings.

Direct seeding is the primary method used for crop establishment. Seed cucumber approximately ½ inch to 1 inch deep in rows 36 inches to 48 inches apart or wider if space is needed for field or harvest operations. Seed should be spaced 9 inches to 12 inches apart in the row, with a thinned spacing of 12 inches between plants.

Transplants also can be used for establishment of cucumber and will take approximately three weeks to four weeks to produce prior to transplanting in the field (HLA-6020). That said, unless the producer is targeting a very early market, transplants aren't normally used as the medium-sized seeds will germinate and grow rapidly when soil temperatures are conducive to germination. Transplanting into raised beds covered with black plastic mulch will reduce the time to harvest, particularly during cool, wet springs.

Weed and Moisture Management

Whether conventional clean tillage, strip tillage or mulches are to be used, producers will encounter weed competition when producing cucumbers. Weed control will be critical in the early growth stages while seedlings or transplants are small. Shallow cultivation by tractor-drawn cultivators, hoeing by hand or hand tilling will be required in the early stages of crop development in an organic system and also may be needed in conventional production. When cultivating, be certain to cultivate at a depth that is shallow, but deep enough to be effective for killing weeds, since deep cultivation will damage crop roots and bring more weed seed to the surface. Promoting early and rapid growth of the crop will allow it to begin shading the soil surface earlier and will result in less cultivation being needed to maintain the field. Further control of weedy species can be attained through the use of organic mulches once soil temperature has increased to 80 F to 90 F and crop growth is rapid. Some organic mulching materials during decomposition can compete directly with the crop for nitrogen, therefore don't use mulches with high carbon-to-nitrogen ratios (bark, wood chips and ground wood products). Mulching materials such as clean straw in addition to reducing weed competition, can reduce water loss due to evaporation and have a cooling effect on the soil surface. In

Clean straw mulch.

addition, the need for tillage can be reduced considerably if pre-emergence or post-emergence herbicides are an option for the farm. Registered herbicides for cucumber can be found in E-832, "Extension Agents' Handbook of Insect, Plant Disease and Weed Control." As with any pesticide, be certain to read and follow label instructions pertaining to what crops it can be used with and how to properly store and use the material.

Irrigation

Adequate moisture is needed by all crops to grow and flourish. Cucumbers require moderate amounts of moisture while making their most vigorous growth early in the season and until the early fruit-set is fully sized. Irrigation is needed when the crop is not receiving adequate rainfall to meet its needs. If adequate rainfall is lacking, it will be necessary to provide supplemental irrigation totaling 1.5 inches of water every seven to 10 days during the hottest months of the summer. Moisture stress during harvest can seriously reduce the yield of marketable fruit. Do not operate an overhead sprinkler irrigation system between sunrise and 11:00 a.m. during the flowering and fruit-setting period, since this may prevent bees from pollinating the open flowers. When overhead sprinkler irrigation is used, water should be applied early in the day, except during pollination, so leaves can dry before nightfall to reduce the incidence of fruit rot and foliar diseases.

Water can be delivered to the crop in a number of ways including overhead sprinklers, furrow irrigation and drip irrigation systems. Drip irrigation often is used in situations where there is not adequate water volume or pressure to meet the higher use requirements of overhead systems. Drip systems are a very efficient means of distributing irrigation water, since water is either applied to the surface of the soil or subsurface with buried drip tape. Other benefits to drip irrigation include being able to carry on other field operations during irrigation, not wetting the crop foliage, thereby reducing crop disease pressure and being able to fertilize through the drip system.

Drip irrigation and plastic-covered raised beds.

Field Scouting for Crop and Pest Development

Fields should be scouted at minimum once per week after planting by walking across the entire field in a V-shape or X-shape pattern and recording plant development and weed and insect occurrence and numbers. Results of surveys will be needed to make decisions regarding projection of harvest date, the need to bring in honey bees for pollination and pest control decisions.

If known, scout for diseases in areas of a field in which diseases tend to appear first. Otherwise, use the V-shape or X-shape sampling pattern outlined for insects. Some foliar diseases will appear where air circulation is reduced and leaves remain wet, such as in low areas and along borders sheltered by trees. Foliar diseases typically appear first on crown leaves close to the base of the main stem. Shaded crown leaves often die and can be mistaken as diseased. Root diseases tend to appear where soil remains wettest, such as in low areas and in heavier soils.

Insects

Fields previously in sod or having heavy infestations of weeds in the prior year should be treated with a soil-applied insecticide at planting to control soil insect pests including cutworms. Small seedlings are extremely susceptible to feeding damage from adult striped and spotted cucumber beetles. Protecting seedlings may require treatment with a foliar-applied insecticide to prevent complete defoliation and/or infection by bacterial wilt pathogens that are transmitted by cucumber beetles. Adult cucumber beetles must be controlled in mid-season to prevent egg laying near fruit, where larvae can feed and damage the rinds, resulting in non-marketable fruit. Squash bugs must be controlled early in the growing season to prevent large populations building throughout the growing season. Treatment decisions should coincide with scouting for all life stages, including eggs laid in groups on the underside of leaves. Aphids can cause leaves to become discolored and wilted, and they excrete honeydew as a waste product that can form deposits on fruit, reducing marketable yield. Like aphids, feeding damage from spider mites and other mite species result in leaf discoloration. Low numbers of mites can be tolerated throughout most of the season, but scouting will indicate increasing populations and the need for treatment.

Good fruit set and development are dependent upon insects, primarily honey bees, to pollinate the female flowers. Flowers are receptive to pollination for a matter of hours on the day they open. Flowers should be examined to determine pollinator activity. If less than one bee per 10 flowers is noted during the morning hours, the producer should bring bee hives into the field to ensure adequate pollination.

Squash bug nymphs.

Diseases

Cucumber is susceptible to several diseases that attack the roots, foliage, and fruit. The most common diseases in Oklahoma have been anthracnose, angular leaf spot, downy mildew, bacterial wilt, powdery mildew and virus diseases. Gummy stem blight, damping-off, and root-knot nematodes also have been problems. Consult OSU Extension E-929, "Guide for Identification and Management of Diseases to Cucurbit Vegetable Crops" to help identify these diseases.

Disease management is essential in the production of high quality slicing cucumbers. A preventive program that combines the use of cultural practices such as crop rotation, field sanitation, proper site selection, managing irrigation and genetic resistance combined with appropriate chemical controls as needed usually provides the best results.

Cultural practices are useful for limiting the establishment, spread, and survival of pathogens that cause cucumber diseases. Many of the fungal, bacterial, and nematode pathogens survive in old crop debris and in soil. Fields should be rotated with non-cucurbit crops for at least three years to reduce pathogen levels. Grass crops are ideal for rotations where nematodes are a problem. Select well-drained soils to minimize damping-off, root rots and fruit rots and consider using free standing raised beds to improve soil drainage. Late plantings should not be situated nearby and downwind of early planted cucurbit fields where foliar or virus diseases already exist. Avoid the movement of contaminated soil or plant debris into clean fields on workers or equipment. Diseases such as anthracnose, angular leaf spot and gummy stem blight are known to be carried on seed. This can lead to the introduction of diseases into clean fields. Purchase seed from reputable sources and apply a fungicide seed treatment prior to planting. Most foliar diseases are spread by water-splash or are favored by long periods of leaf wetness. Utilize drip irrigation or avoid frequent sprinkler irrigations with small amounts of water. Finally, till fields soon after harvest to promote the rapid decomposition of old vines and fruit.

The use of disease-resistant varieties is an economical means of controlling diseases. In slicing cucumber, excellent resistance is available to most of the important diseases and variety selection should be the primary method of disease control. Several varieties are resistant to angular leaf spot, anthracnose, downy mildew, powdery mildew, scab, and one or more virus diseases.

Given proper cultivar selection and other cultural practices, foliar disease management with fungicides should not be necessary unless gummy stem blight becomes a problem. Fields should be monitored at least weekly for early disease detection. A spray program should be initiated shortly after the first appearance of gummy stem blight. A 14-day spray schedule is adequate. Management of bacterial wilt may require the use of insecticide to control cucumber beetles which spread the disease. Consult OSU Extension publication E-832 "Extension Agent's Handbook of Insect, Plant Disease and Weed Control" for a listing of fungicides approved for use on cucumbers.

Pesticide Applications

Insecticide applications should be made only when necessary as determined using results of field surveys. For control of diseases, fungicides are most effective when applied before disease pressure begins to increase. The potential for very rapid increase is greatest shortly before harvest when the canopy is most dense or anytime during prolonged periods of rainfall. Effective squash bug control depends on sufficient penetration of the leaf canopy by insecticides to contact and kill the bugs. Insecticides and fungicides should be selected based on proven effectiveness. Ground applications should be made in a minimum spray volume of 20 gallons per acre at 40 psi to ensure adequate canopy penetration and foliar coverage. Aerial applications should be in a minimum spray volume of 5 gallons per acre. Chemigation is an effective method for applying some fungicides.

Bee hives maintained near fields for pollination must be protected from spray drift by removing the hives or covering them. Additionally, the bees working the fields must be protected by using insecticides with a low toxicity to bees and by withholding applications until late in the day, when bees are less active.

Animal Pests

Animal pests are not as great a problem in cucumbers as in watermelons and other melons. Field mice and rats can cause extensive damage by destroying planted seeds before germination. The fungicide thiram, when used as a disease control seed treatment, has some repellent action against mice and rats. Fence row sanitation and brush control around fields will reduce the population of mice and rats.

Crows, coyotes, raccoons and other animals can destroy ripe cucumbers. Many devices have been used to keep crows out of fields. Aluminum foil strips or shiny can lids hung from poles placed at various intervals are sometimes effective. A propane or carbide gun is usually effective in repelling crows during the day. A propane gun, loud radio and flashing light can effectively repel coyotes, raccoons and other animals at night. To maintain effectiveness, the noise makers and lights should be moved to a new location each day and the explosion interval of the propane gun changed frequently.

Wildlife exclusion fence. It is 8 feet tall.