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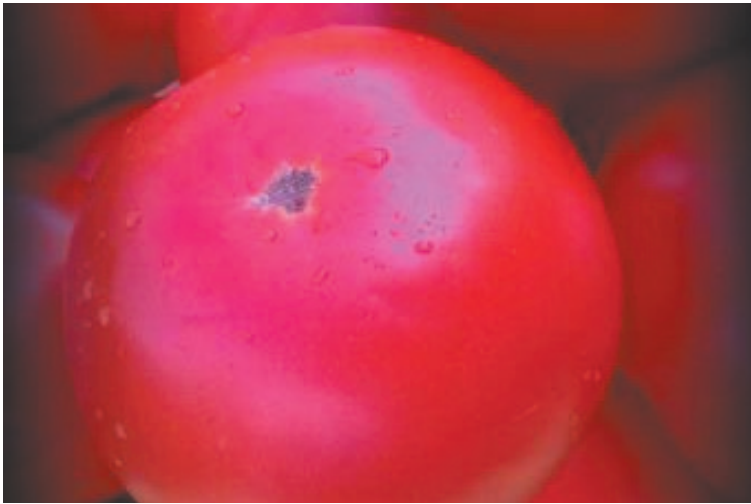
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2020

Growing tomatoes part I: intro and site selection



Written by Extension Agents: Shannon DeWitt, Anthony Carver, and Natalie Bumgarner.

As the most popular crop grown by home gardeners in Union County, tomatoes are certainly king of the garden. This is definitely because of the number of participating gardeners, but it is also due to gardeners' passion about their home-grown tomatoes.

The number and variety of tomatoes currently on the market and maintained through personal seed saving is a testament to the importance of this botanical fruit that is most often referred to as a vegetable. Tomatoes are a great source of vitamins C and A, as well as lycopene, which has been shown to be beneficial to cardiovascular health.

Gardeners must make two important decisions related to the types and cultivars of tomatoes for the home garden. The first is related to the determinate or indeterminate habit of the plant.

Determinate tomatoes are typically shorter and can be easier to manage in the garden. Determinate tomato fruit are set over a relatively short period of time and then ripen over four to five weeks.

Indeterminate plants may produce over a longer period of time for fresh eating throughout summer and into fall. Indeterminate tomatoes are taller and require taller stakes to provide good support. Unless damaged by insects, disease or environmental stress, indeterminate tomatoes will produce until killed by low temperatures in the fall.

Also consider the time available to invest in plant support, training, disease and pest control, and picking throughout the season.

Tomato cultivar selection is important, but the selection or production of the quality of the plants is also crucial. Tomato fruit yield and garden performance begin with high quality plants. Whether grown or purchased, tomato plants should be stocky with strong root systems. Plants that have been grown with suboptimum light or improper temperature conditions will often be "leggy" or have thin stems with larger distances between leaves. Also look for transplants that have a healthy green color and are free from damaged or yellowed leaves that indicate insects or plant stress. Inspect leaves for any sign of disease.

Avoid purchasing transplants grown out of state, as these have been a major source of disease problems in Tennessee gardens. Purchase locally grown transplants, if possible. Tomato plants are commonly six to eight weeks old when ready for garden planting. All transplants should be "hardened off" before planting. This term refers to slowly subjecting plants to outdoor conditions to lessen their stress at transplant and help them to better handle the sun, wind and temperatures they will experience in the garden.

In the next article, we will discuss soil preparation, fertilizing, weed control. For more information, please contact Shannon DeWitt, UT Extension Union County (865) 992-8038 or sdewitt@utk.edu

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Tomatoes part II: initial fertilization & mulching



Written by Extension Agents: Shannon DeWitt, Anthony Carver, and Natalie Bumgarner.

In the first part of our tomato series, we discussed selecting the right variety of tomato for your garden and preferences. In this edition, we will talk about fertilization and one of the two biggest problems with growing tomatoes, weeds. Of course, being an Extension Agent, I must always recommend a soil test before planting your garden.

INITIAL FERTILIZATION

Tomatoes produce a significant plant and fruit biomass and require relatively large amounts of nutrients to achieve optimum productivity. Fertilizer will generally be applied before planting and during crop growth. The pre-plant fertilizer application often uses a complete fertilizer (one with all three primary macronutrients), such as 10-10-10 or 6-12-12. Your soil test report will suggest fertilization materials and rates according to the balance of nutrients in the soil. Fertilizer should be evenly spread and incorporated or banded near transplant roots. Make sure not to apply chemical fertilizer where it can directly contact young plants because the high salt level can burn young roots or stems.

OPTIONS FOR PREVENTATIVE WEED CONTROL

Cultural practices

Weeds are one of the largest challenges in the home garden, so a combination of control measures is best. Cultural practices to prevent weed issues rely on removing annual weeds before they have a chance to mature and produce seeds. Likewise, perennial weeds may be physically pulled and should be completely removed to ensure that rhizomes (plant stems that can produce new weed plants) are not able to remain and cause additional problems.

Other practices that can reduce weed pressures in the home garden are mulching (discussed below) and appropriate uses of cover crops which can cover the ground and outcompete weeds. Solarization, or the heating of soil by covering with plastic sheeting, can also be a tool to reduce weed seeds and subsequent weed and disease issues. For more information about these weed control measures, contact us for additional resources.

Chemical control

Herbicides are not often used in home gardens because of the low number of products available to consumers and the challenge in using these products in gardens where many crops are being produced across several seasons. Some pre-emergence (applied before weed seeds germinate) herbicide products may be useful if application rate and timing are

carefully followed. Post-emergence products are more challenging to use because of their broad range of activity and the risk of overspray or drift onto garden vegetables. Additionally, tomato plants are one of the most sensitive crops to herbicide damage and can be severely harmed by small amounts of herbicide drift that may not damage other nearby crops. Use caution in managing any nearby lawn or garden area where there is any chance that spray drift or herbicide residue in soil could contact garden tomatoes.

Mulching

Mulching materials, such as straw, leaves, grass clippings or compost can be applied after planting. When applied 3 to 6 inches thick, these mulches provide weed control for most annual weeds, moderate soil moisture levels, and reduce some disease problems. Organic mulches (from previously living things, not meaning USDA-certified organic) are often not applied at planting because they can cool early season soil temperatures by blocking sunlight from warming the soil. It may be best to apply them after the plants are established and soil temperatures have warmed. Organic mulches can be an asset in the heat of summer by moderating and cooling soil temperatures.

Inorganic or plastic mulches can also provide benefits to home garden tomato production. Black is the most common plastic color because it prevents weed growth while warming up the soil in the early season to aid in early growth. As with organic mulches, plastic mulches moderate soil moisture levels and also reduce some risks of leaf diseases by reducing soil splashed on leaves from precipitation. Install 4-foot-wide strips of plastic in the row area and seal the edges with about 6 inches of soil about two weeks before the planned transplanting date. Plastic mulch is a great addition to raised beds because the two methods increase early season drainage and soil warming. Install plastic after lime and fertilizer applications have been completed. It is essential to also install drip irrigation under the plastic mulch because it is impermeable to rainfall. Tomatoes are planted through slits cut in the plastic. Tomato stakes also can be driven through the plastic, but be careful to avoid the underlying drip line (see photo 1).

In the next article, we will discuss garden layout and planting techniques. For more information, please contact Shannon DeWitt, UT Extension Union County (865) 992-8038 or sdewitt@utk.edu

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Tomatoes part III: planting & watering

Written by Extension Agents: Shannon DeWitt, Anthony Carver, & Natalie Bumgarner

In the second part of our tomato series, we discussed fertilization and weed control. In this edition, we will talk about two important parts of growing tomatoes, planning the garden layout and the thing we seem to either have too little or much of, water. Water is a critical resource in everything we do as humans. Sufficient water is the key to success in our gardens. I'd also like to share a photo from my 2019 tomato season, my daughter helping me with planting our garden (Photo 1). I must insist that eating the garden dirt would be an unpleasant experience, but she disagreed. We had so much fun planting the tomatoes, watching them grow, and learning to walk as she quickly needed to inspect our plants daily.

PLANTING

Garden layout

It is best to plan the planting arrangement and measure distances between rows and plants ahead of time. The distance between plants in the row (in-row spacing) depends on the type of tomatoes being grown and the pruning methods that will be used. Determinate varieties do not grow as tall as indeterminate and can normally be spaced closer in the row. Gardeners can choose to plant at a wider in-row spacing to allow easier access. Pruning will be discussed in detail below and is commonly used to manage growth in indeterminate tomatoes. Between-row spacing can be related to the type of tillage equipment being used and can be wider if needed. Keep in mind, though, that wider plant and row spacing will also mean more space open for weed growth.

When choosing a site, it is best to choose a location that receives morning sun and afternoon sun. Morning sun will dry the plants' leaves and stems from overnight dewfall and/or rain. Moisture can promote bacterial and fungal growth on tomato plants. Soil moisture is good, moisture on the leaves and stems can lead to increased disease.

Planting techniques

When soil is properly prepared and the threat of spring frost is passed. There is a 10% chance of frost after April 28th in Union County using the last 30 years of weather data from the NOAA. Tomato transplants can be planted in the garden. Young plants should be around 6 to 10 inches tall and properly hardened off at transplanting. In well-prepared soil, a hole is dug deep enough to cover the root ball of the plant. If transplants have been grown in fibrous containers that are planted rather than removed, make sure that all parts of the container are covered with soil to prevent water loss from exposed edges. Often, a soluble starter fertilizer will be added to the planting hole to provide moisture and nutrition for the young transplant.

Tall, leggy plants are a challenge in the home garden. It may be best to install the support system at planting to support the tall plants and plant them at a normal depth. Stems closest to the ground should be pruned off. Removing the lower stems reduces contact of the plant's leaves to the soil, which will possibly prevent disease transmission.

Some gardeners make a trench to lay a portion of the stem horizontally under the soil or they bury the plant extra deep.

While roots will emerge from these buried stems, such practices can lead to stem breakage or lower soil temperature, aeration or nutrients for the deeply planted roots. Additionally, both of these practices will negate the impact of grafted rootstocks if grafted plants are used. The best practice is to select and plant healthy and appropriately sized tomato plants.

WATER MANAGEMENT

For best growth, keep the soil in the root zone moist enough to prevent wilting of tomatoes. This is especially important soon after transplanting when the plant is transitioning to garden conditions. Garden tomatoes will generally require 1 to 1.5 inches of water per week, but this number can change according to environmental conditions and plant size. Managing water in garden tomatoes is based on knowing the rainfall received on your site and then applying water if rainfall is not sufficient. Rain gauges and weather tracking can help you determine how much water to apply.

One major contributing factor to disease in tomato plants and all vegetable plants is moisture. The soil needs to be moist, not the leaves and stems. Moisture on the leaves and stems will increase bacterial and fungal disease of tomato plants. Water applied to tomatoes using sprinklers will cause more disease issues. Additionally, more water will be required to provide sufficient moisture to the soil using a sprinkler than soaker hoses and drip irrigation. Soaker hoses can be cost-effective and versatile in the garden, but they do not deliver water as evenly as drip irrigation lines. If sprinkler irrigation is the only option, apply at a time when leaves will dry before nightfall to lower the risk of leaf disease.

Most years in Tennessee there will be periods of the spring, summer and early fall when rainfall is insufficient or inconsistent for the best tomato plant growth. Tracking the volume over the season will help make irrigation practices more precise. When irrigating, it is best to apply 1/2 to 3/4 inch of water twice a week rather than the full amount in one irrigation event. This will reduce runoff and provide more consistent soil moisture but provide enough water to wet the soil for several inches. Likewise, it is best to deliver irrigation to the root zone of the plants through trickle or drip irrigation rather than overhead watering. Drip irrigation will be more efficient in water use and will keep the plants' leaves dry. Soaker hoses are also common in the home garden and deliver water directly to plant roots. They can be purchased or constructed from used garden hose.

In the next article, we will discuss plant management, support, and pruning. For more information, please contact Shannon DeWitt, UT Extension Union County (865) 992-8038 or sdewitt@utk.edu



Tomato lover Henley DeWitt, daughter of Extension Agent and County Director at Union County Extension, Shannon DeWitt

Tomatoes part IV: plant support & pruning



Written by Extension Agents: Shannon DeWitt, Anthony Carver, and Natalie Bumgarner

In the third part of our tomato series, we discussed garden layout and water. In this edition, we will talk about plant support and pruning. This is an area where we can make it easier to manage our gardens and harvest the fruits of our labor. Also, depending on the type of tomato plant, pruning can yield larger fruit when the plant can devote as much energy as possible into fruit production.

PLANT MANAGEMENT

Support and pruning

Proper plant management and support are needed to produce both the best yield and the best quality tomatoes. An added bonus of good plant management and support is that it can save time during picking.

Plant support

Tomatoes are normally supported with stakes or cages. Staking can be carried out for individual tomato plants or installed and tied as a row. If stakes are used, they should be durable hardwood about 4 to 5 feet tall for determinate types or 6 to 8 feet for indeterminate tomatoes. Aim to have about 1 foot of the stake length in the ground for stability. For individual staking, tie plants loosely to the stakes at 8- to 10-inch intervals. Make sure to use cloth or a string material that will not damage the stems as the plant weight increases. Stakes also can be placed every two plants and twine woven around them to form a basket that supports all the plants in the row. This method is sometimes called the "Florida Weave." String is tightly stretched horizontally along both sides of the stakes at the same height, with plants held between the string layers (see Photo 1). Twine is wound around each middle stake to maintain tension and tied off at the end stakes. These layers of support are repeated every 8 to 10 inches vertically as the plant grows.

When cages are used for support, they must be strong enough to support the plant for the entire growing season. Cages can be purchased or constructed at home with materials such as concrete reinforcing wire. As a guide in cage construction, a 6-foot length of wire will form a cage about 21 inches in diameter. Cages should be well anchored in the soil to support the weight of the plants and fruit and allow access to ripe fruit for removal without damage.

Pruning

The method of pruning and plant management depends on the type of tomato and the method of support. Indeterminate tomatoes that produce fruit clusters and leaves throughout the season are commonly trained to a single stake or grown in a cage. If stakes are used, lateral branches (called suckers) are often removed to create a plant with a single main stem. Suckers can compete for plant resources and be a challenge to support on a single stake. The removal of suckers is less commonly practiced if tomato cages are used (Photo 2). Yields per plant are usually higher in a cage than when supported by stakes because fruit is harvested from both the main stem and lateral branches. Fruit may ripen slower in cages, but sunscald (fruit tissue death due to high temperatures) is often reduced.

Determinate tomato plants are generally pruned less than indeterminate plants, and some gardeners chose not to prune them at all. Because their main stem stops growing at a certain point, many of the fruit of a determinate tomato are produced on lateral branches. Determinate plants can be challenging to train to a single stake because of lateral branches, but cages and the Florida Weave system work well.

As the plants grow, they will require additional pruning. Prune out stems with yellow leaves or curling leaves. Also, prune non-bearing stems. Non-bearing stems will not have flowers, but will require energy to grow. Pruning should enable the plant to devote its energy to producing stems with leaves, buds, and fruit. Pruning damaged and non-bearing stems will increase sun penetration and air flow to the plant.

Sometimes a few leaves and lateral branches are removed below the first flower cluster because it can increase early yield and fruit size. It is best to leave one or two suckers below the first flower to avoid leaf curling, stunting and reduced yield.

In the next article, we will discuss ongoing fertilization and harvesting. For more information, please contact Shannon DeWitt, UT Extension Union County (865) 992-8038 or sdewitt@utk.edu



Tomatoes part V: nutrient management & fertilization



Blossom End Rot

Written by Extension Agents:

Shannon DeWitt, Anthony Carver, and Natalie Bumgarner.

In the final article for home tomato gardening, we will discuss fertilization, common challenges and harvest. The 2019 tomato season was my favorite because my daughter discovered the joy of planting, patiently growing, harvesting and consuming my favorite vegetable. The joy on her face when she picked and ate her first tomato filled my heart. I hope you will find the same satisfaction as the 2020 growing season approaches.

Nutrient management and fertilization

In addition to initial fertilization discussed in Part II of this series, tomatoes need adequate nutrition throughout the growing season to produce well. "Side-dressing" is the application of fertilizer in a small furrow 2-4 inches to the side of the row during plant growth because all the nutrient needs of tomatoes cannot be well supplied by only a pre-plant fertilizer application.

The timing of this application of fertilizer is often made after the first cluster of fruit has set and young tomatoes are the size of a golf ball or slightly smaller. Timing is important because young tomatoes that are supplied with too much nitrogen will produce much stem and leaf growth which can slow or reduce fruit set and yield. Often these side-dressings are repeated once a month while the plant is bearing.

One of the most important concepts for home tomato growers is calculating fertilizer needs across the whole season. The most common nutrients applied in a side-dressing are nitrogen and potassium. Nitrogen is needed for many plant growth processes, while potassium is important for many reactions in the plant and for high fruit quality. An example is provided below.

Common targets for nitrogen and potash (K₂O) over a season are often around 0.5 lb./100 sq. ft. and 0.7 lb./100 sq. ft., respectively. If 3 lbs. of 10-10-10 (10% N, K₂O) was added at planting to 100 sq. ft., then 0.3 pounds of N and K₂O (3 lbs. x 10%) were applied.

Two subsequent monthly side-dressings of 1.5 lbs. of 6-12-12 (6% N, 12% K₂O) per 100 sq. ft. beginning after the fruit set on the first cluster would provide a total of 0.18 lb. N and 0.36 lb. K₂O to come quite close to N and K₂O seasonal tar-

gets. Recommendations in the soil test report also provide fertilization tactics throughout the growing season.

COMMON CHALLENGES IN HOME TOMATO PRODUCTION

Physiological issues

Blossom end rot (BER) involves the death of cells at the flower end of the fruit followed by decay (Photo 1).

This condition is related to inadequate calcium levels in the developing fruit. Maintaining proper pH can reduce BER risk because lime (calcium carbonate) supplies calcium while increasing the pH and making it easier for the plant to take up calcium. Calcium nitrate fertilizer can also be added to the soil as a means of preventing BER and should be applied as a side-dressing three to four weeks after transplanting, but use caution due to the possibility of oversupplying nitrogen as presented above. Providing uniform soil moisture by using soaker hoses or drip tape and mulches is also a benefit because calcium must dissolve in soil water to be taken up by plants. Tomatoes may also have less BER if they are not pruned too heavily or excessively fertilized. Sometimes, BER affects only the early fruit and clears up without action.

Misshapen fruit is often related to poor pollination, which can lead to different growth rates in areas of the fruit.

Examples include cat facing, puffiness and odd fruit shapes. Temperatures that are cool (below 50 F), especially at night can lead to poor pollination, but warm temperatures, fertilization or humidity issues can also impact pollination.



Cracking Tomatoes

Cracking (Photo 2) can appear as concentric rings around the top of the fruit or cracking down the fruit. It can be related to variety characteristics, but is most often linked with irregular patterns in growth and/or water issues. Swings in moisture or nutrition can both lead to cracking, which is best prevented by maintaining optimum and consistent moisture. Modern varieties are less prone to cracking than heirlooms.

Harvest, handling and storage

Most home garden tomatoes are harvested fully ripe. This practice will enable full flavor development but also reduces shelf life and produces fruit that is more susceptible to damage during handling. Fruit harvested at 60-80 percent full color will ripen well in the home if handled correctly. Cherry tomatoes are often picked slightly before full maturity to prevent cracking that can occur quickly after ripening.

Most gardeners remove the fruit from the vine while leaving the calyx (small green leaves and stem) on the plant. Removing the calyx and stem can reduce fruit punctures during picking and handling. Tomatoes are best picked into shallow boxes and placed one to two layers deep to prevent damage.

Fully ripe tomatoes are generally of the highest quality when stored at room temperatures in the home and eaten within two to three days. So, it is best to harvest tomatoes from the garden when they will be consumed in a few days. If you are like my daughter, she prefers to eat tomatoes while still in the garden (Photo 3). Tomatoes are chilling sensitive and refrigeration can cause flavor loss. It is common for newer hybrid cultivars to retain a firmer texture and avoid decay for longer periods after harvest than many heirloom cultivars. If frost is on its way at the end of the season and tomato fruit is still on the plants, they can be harvested green to slowly ripen in the home. They may not be quite as flavorful as an August garden tomato, but they can be an excellent addition to a fall salad, providing a final taste of summer for the year!

For more information, please contact Shannon DeWitt, UT Extension Union County (865) 992-8038 or sdewitt@utk.edu



Henley DeWitt enjoys homegrown tomatoes

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