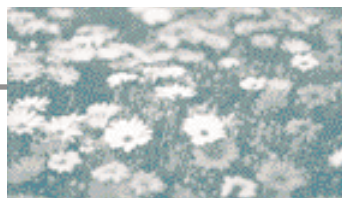

Want To Grow Greenhouse Tomatoes?

Producing greenhouse tomatoes requires dedication to both management and time. Furthering your knowledge will either make you realize that you can profit in the enterprise or convince you that they are best left to other growers.

By Dr. Rick Snyder

I know that *GPN* caters primarily to floriculture producers. But, just in case there are some readers out there wanting to broaden their offerings into the world of greenhouse tomatoes, *GPN* has asked me to provide some information to you. What we will do is give you some background on greenhouse tomato production, and then plunge into two important topics — plant fertility and pollination. Then, I'll tell you where to find more information if growing greenhouse tomatoes sounds like something you want to try.

As greenhouse growers, you already know the technicalities and risks of growing crops in the greenhouse. Tomatoes are no exception. There is much for a new grower to learn. I've sometimes told prospective growers that the good thing about getting into this business is that there are only 100 things the new grower needs to learn. Unfortunately, only one new thing can be learned each year. That's mostly a joke, but it is true that there are many things a new grower will have to learn.

GETTING STARTED

The successful grower must have time to tend to the crop every day. A reasonable estimate of the time required to grow a tomato crop is 20 hours per week per bay. This time per week is averaged over the entire crop. In other words, less time is needed while the plants are young and just beginning to bloom, but more time is needed when the plants are mature. Once the crop is bearing ripe fruit, the grower must juggle harvesting, grading, packing, marketing, selling and delivery with all of the production demands — pruning, wrapping, leaning and dropping, pollinating and spraying or distributing biological control agents, etc. Without the proper time, a crop cannot do very well.

Also, as with any greenhouse crop, there are a number of devices that must be maintained to keep the operation running smoothly. Small problems can be devastating to a crop. As little as an hour of extreme high or low temperature can destroy every flower in the greenhouse, causing thousands of dollars in crop loss.

The likelihood of success with greenhouse tomatoes is closely tied to the grower's ability to manage. Management is making the right decisions at the right time, and with greenhouse tomatoes, there are many decisions that need to be made every week. Therefore, the prospective greenhouse tomato grower needs to learn as

much as possible about this crop before venturing forward. Once armed with the right information, a good grower will find greenhouse tomatoes to be a profitable crop.

FERTILITY

The fertility level of tomato plants is one of the most important aspects of the whole management program. Even if all other components are perfect (e.g., temperature, light, water, humidity, pollination, pest management, etc.), an improperly fertilized crop can yield poorly or produce low-quality fruit.

In greenhouse systems, fertilizer is generally applied during irrigation, and is therefore referred to as a nutrient solution. The overall strength of the solution can be measured with an EC meter. EC is a general reference for how much fertilizer is dissolved in the water. However, it does not give any indication of how much of each individual fertilizer element is present. So, although EC is an important indicator, it does not give all the information needed.

POLLINATION

As with most other vegetables and fruits, tomato flowers must have pollination before fruit will set. Any activity or inactivity that prevents thorough pollination causes a reduction in the number of fruit per plant. Poor pollination can also result in misshapen fruit, which occurs when seeds do not develop uniformly throughout the fruit, or smaller fruit, which occurs when locules do not fill out with seed and gel. Pollination can be prevented by various stresses, such as cold or hot temperatures, drought, high humidity, nutrient deficiencies, nutrient toxicities and lack of pollen transfer.

The optimum temperature for pollination is within the range of 70-82º F. Optimum relative humidity is 70 percent. Above 80 percent relative humidity, pollen grains stick together and are not dispersed well. With extended periods of relative humidity less than 60 percent, the stigma may dry out so that pollen grains will not stick to it. Under ideal conditions, fertilization occurs 48 hours after pollination.

Most smaller growers use an electric pollinator to hand-pollinate flowers. This is simply a small, hand-held device with a vibrating wand. Pollinators can be purchased from any greenhouse supplier.

How much time does it take to pollinate? Each cluster (not each blossom) should be vibrated for about half of a second. Touch the wand to the topside of the pedicel (flower stem). Do not touch individual blossoms, as this will damage them, causing damaged fruit; it may even knock the flowers off, reducing yield. One acre (about 10,000 plants) is estimated to take 5-6 hours to pollinate. For a 24- x 96-foot greenhouse, pollinating should take about 20 minutes.

It is important for serious greenhouse tomato growers to use an electric pollinator to ensure that they get good fruit set. What is a "serious" grower? One who grows tomatoes for a profit. In a hobby greenhouse, the expense of a pollinator is probably not necessary.

Electric pollinators can be powered either from a disposable alkaline battery or with a rechargeable 6-volt battery. Purchasing a rechargeable battery may be less expensive than continually buying alkaline batteries. Also, you will never get caught short of power, as long as you remember to charge the batteries after each use.

Pollination should be done every other day or three times per week. Pollinating less often risks reducing fruit set. Pollinating more often is very likely a waste of time. The best time of day for pollinating is when relative humidity is between 60-70 percent. Since this is difficult to control, find when the relative humidity is at its daily low point. If the amount of moisture in the air stays constant, the relative humidity decreases as the temperature increases. This is because warm air can hold more moisture than cool air. The warmest time of day is usually mid-day. This is why the best time to pollinate is generally between 11 a.m. and 2 p.m.

You can see pollen dispersal actually taking place. If the air is relatively dry and the light is good, you can see a small cloud of yellow powder around the flower immediately after pollinating. These are the pollen grains. This is your insurance that conditions are excellent for pollination.

In cloudy weather, the relative humidity is high. In such conditions, pollination is not as effective because pollen tends to stick together in clumps rather then dispersing as individual grains. However, it is still important to hold to the schedule of every other day because if the cloudy days turn into a cloudy week, fruit set and quality will certainly be decreased without pollination.

As mentioned above, pollination in very wet conditions is not as effective as in dry weather. One solution is to dry the air before pollinating. Turn on the heating system for 30-60 minutes before pollinating. Ventilate to maintain the temperature requirements. This will dry the flowers and the air, improving pollen transfer.

HOW TO POLLINATE

With many types of vegetables, such as watermelon, cucumbers and squash, bees and other insects are relied upon to transfer pollen from male flowers to female flowers. They do their job so well that we usually do not have to think about it, as long as there are enough bees visiting our field. However, not all vegetables are insect-pollinated.

Field tomatoes rely primarily on the wind for pollination, although bees assist to some degree. Tomato flowers have both male and female parts within every flower. Botanically, these are termed "perfect" flowers. Most of the pollen from a flower fertilizes the ovary within the same flower, although some pollinates surrounding flowers. Wind normally shakes the flower enough so that pollen leaves the anther and travels to the stigma.

In the greenhouse, wind is not adequate to ensure that flowers are sufficiently shaken and pollen is transferred. It is true that as we ventilate the greenhouse with fans, there is some wind. But, on cooler days when the fans are not operating, the air is relatively motionless.

If you want to maximize your yield, you really need to use either an electric pollinator or bumblebees. If you would be happy with a lower yield, then it is not so important. Bumblebees have been shown to be very effective pollinators and are recommended for all growers with over 10,000 square feet under one roof, and some growers with 5,000-10,000 square feet if labor is either too expensive or unavailable.

HOW TO LEARN MORE

If you want to learn about greenhouse tomatoes in a relatively short time, the best way is to attend a workshop that addresses this crop. There are only a few programs each year in the entire United States, so be prepared to travel. However, the volumes of information that you can absorb in a couple of days will be a very worthwhile investment. You will come away from the workshop either much better informed or convinced

that this is not the right crop for you. Either way, the time commitment is valuable.

Starting at the top of the calendar year, in January, the Bioresource Engineering program at Rutgers University in New Jersey hosts the workshop Design of Greenhouse Systems. For information, check their web site at http://aesop.rutgers.edu/~horteng or call (732) 932-9534.

The American Society for Plasticulture has a program on all uses of plastics in agriculture, including greenhouse applications, each year. The next conference will be February 23-26, 2002, in San Diego, Calif. For information, contact Pat Heuser, ASP Executive Secretary, at 1924 N. Second Street Harrisburg, PA 17102, call (717) 238-9762 or send E-mail to pheuser@calabreseheuser.org. The ASP also has a Web site at www.plasticulture.org with all of the conference information.

Every March the Greenhouse Tomato Short Course is held at the Mississippi Agriculture & Forestry Museum in Jackson, Miss. This is a 2-day program with national and international speakers, ➧

FERTILIZER PRIMER

Since achieving the right fertility is so important in tomatoes and since we occasionally all need a refresher about fertilizer basics, Here are a few quick things to keep in mind.

The most common method for measuring fertility is through electrical conductivity. EC measurements will usually be represented in mhos (pronounced MOZE). Mhos are too large to measure fertilizer solutions for greenhouse crops, so they are generally expressed as millimhos (mmhos), or thousandths of a mho. Sometimes, micromhos (thousandths of a mmho) are used instead. Incidentally, microsemens can be used interchangeably with micromhos, and millisemens can be used the same as millmhos, but that's another story.

One other common measurement for fertilizer solutions is total dissolved solids, sometimes referred to as TDS. The units for TDS are parts per million (PPM). TDS is simply the total concentration of each of the individual components in a solution added together.

PPM is a measurement of concentration, i.e., how much of a substance is dissolved in a certain amount of water. For each 1 part of an element in 1 million parts water, there is 1 PPM of that element. PPM is a handy way to express the amount of individual fertilizer elements dissolved.

followed by optional greenhouse tours. For information, see the short course web site at www.msstate.edu/dept/cmrec/GHSC.htm, contact Dr. Rick Snyder at (601) 892-3731 or use the E-mail address at the end of this article.

In July, the Southern Greenhouse Vegetable Growers Association holds a meeting in Texas. For information, check their Web site at www.sgvga.org or call (903) 365-2457.

Do you have Internet access? The Greenhouse Tomato FAQ can be found at www.msucares.com/crops/comhort/greenhouse.html. This web page has some of the most commonly asked questions about raising greenhouse tomatoes (and answers, too). It also has links to many other sources of information as well as entire publications on-line. You can access the Greenhouse Tomato Handbook (Mississippi State University Extension Service) from this page as well.

You should also check the greenhouse tomato sites at North Carolina State University, www.ces.ncsu.edu/depts/hort/greenhouse_veg, and the University of Arizona Web site, at ag.arizona.edu/hydroponictomatoes/index.htm. Both are full of information. And, for a comprehensive link to greenhouse and hydroponic resources (not just Web sites), be sure to take a look at www.ces.ncsu.edu/depts/hort/greenhouse_veg/topics. GPN

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