Tomato Transplant Production Tips

Dr. Matt Kleinhenz, Asst. Professor and Extension Vegetable Specialist
Department of Horticulture and Crop Science, OSU/OARDC - Wooster
Ph. 330-263-3810; FAX 330-263-3887; E-mail kleinhenz.1@osu.edu;
Internet http://www.oardc.ohio-state.edu/kleinhenz

Proper transplant production is often required for successful tomato production. This article summarizes transplant production information for the field or controlled-environment (e.g., greenhouse) tomato grower. Whether you intend to grow or purchase transplants, it may pay to refresh your understanding of the techniques and issues described here.

"Profit" may be the only word needed to describe the importance of transplant production for many tomato growers. Why? Well, going from seed to crop is a very complex challenge and the challenges, risks and investments in the crop increase with each stage. Therefore, mistakes made early on, such as during transplant production, are multiplied through the rest of the season and will significantly effect your bottom line.

A simple example can illustrate this point. Joe Grower calculated that he needs to grow 100,000 transplants for field planting. But, through a combination of circumstances and small errors in management, he now has only 75,000 usable transplants. Worse, many are weak. With things the way they are, Joe knows he'll have a non-uniform crop and that he'll have to buy additional transplants or plant a smaller crop. Unfortunately, Joe's profit potential has been reduced even before planting. This is why early steps in production, like transplant production, are particularly important.

Preplant Factors

When preparing to produce or purchase transplants, four preplant factors should be considered: (1) variety selection, (2) seed quality and seed handling, (3) equipment and material, and (4) the market. Of course, varieties need to be chosen using grower- and buyer-oriented criteria as superior genetics and high demand for a variety are critical to your operation's success. Varieties differ in vigor, disease resistance, and other factors that must be kept in mind when growing or selling transplants. Equipment and material need to be available and in good working order when needed. Starting with high quality seed and handling it properly are also important.

Three aspects of seed quality are most important: genetic, physical and physiological. Genetic quality refers to hybrid vigor, the genetic superiority of particular varieties, and whether the seed is true-to-type. Physical quality refers to whether the seed is undamaged and free of contaminants, such as weed seeds or pathogens. Physiological quality refers to seed viability and transplant vigor. Viability simply asks whether the seed will germinate. In many respects, germination is a purely physical process not necessarily indicating that the seedling will grow. Vigor asks how strongly the young seedling will grow. Viability and vigor are influenced by genetics and management, including how the seed is handled.

Seed Quality and Handling are Key

Choosing high quality seed and handling it properly are key. But, depending on germination and other factors, a grower may actually need to plant up to 40 percent more seed than the number of transplants actually needed. Seedling loss is the reason. Over-seeding (relative to the number of transplants needed) is required to compensate for a lack of germination or emergence and seedling death. It is also important to have additional transplants in order to select a vigorous, uniform group for transplanting. The percent of seedlings lost for reasons listed above vary by operation and situation. In general, lack of germination (10 percent) or emergence (10 percent) and seedling death (5 percent) may require over-seeding by up to twenty-five percent. Selecting out unhealthy or weak transplants may add an additional ten percent to the number of seed needed. Seed quality and age impact germination and vigor. Expect reduced quality with greater age.

Germination, emergence, or vigor are sometimes less than desirable. When these problems develop, growers sometimes turn to the seed supplier for input, perhaps suspecting low quality seed is to blame. It may be. But, it is important to keep two points in mind: (1) seed quality is cumulative, a function of everything that happens to the seed until it is planted and (2) maintaining seed quality is the responsibility of the supplier and user. Seed quality and, therefore, the ability to produce high quality transplants, depends upon the quality of the seed as it was when it was delivered to the grower plus everything the grower did to or with it after it was received.

Seed storage conditions, especially temperature and relative humidity, are especially important. Storage temperatures should not exceed 45 to 50°F and relative humidity should not exceed 45 to 50 percent (20-30 percent is best).

When seed is delivered, do not leave it in the greenhouse, pickup, sun, or other place where it may be exposed to adverse elements, even briefly. Doing so can reduce percent germination. Once opened, a seed packet's moisture barrier is compromised. Use the entire packet or take steps to ensure that remaining seed is stored properly.

Do not smoke or use tobacco products when handling tomato seed. Tobacco products may carry tobacco mosaic virus (TMV) which, after infecting tomato plants, causes common mosaic disease which reduces yield. TMV may be transferred from tobacco to tomato when using tobacco products while handling tomato seed. Workers who use tobacco products must disinfect their hands and wash them with soap and water before handling seed. It is also important to note that TMV and the closely related tomato mosaic virus (ToMV) may persist on clothing and in plant debris for extended periods so sanitation is key part of reducing infection and spread of TMV or ToMV.

Important Growth Factors

After choosing high quality seed and handling it properly, keep in mind factors important from planting through transplant maturation.

Cleanliness can be next to "profit-ness." This means that, as much as possible, materials — from rooting media to trays, flats, floors, walls and irrigation water — should be clean and free of contaminants, such as weed seeds and disease organisms. Sub- or flood irrigation, recirculating irrigation, and reusing trays or flats are common practices. When using these practices, special care must be taken to prevent the carryover and spread of contaminants,

especially disease inoculum. Although not always feasible, using new materials can reduce the likelihood of contamination. Therefore, when reusing materials, make sure they are in good condition and surface sterilized (e.g., with a 5% bleach solution, Physan-20 or Formalin).

Rooting medium is a commonly discussed factor in transplant production. The best medium meets the specific needs of the operation with cost, irrigation method, and components as primary factors. Whichever medium is selected, it must be clean, loose and well drained. Many commercial mixes are available, including those that are custom-made to user specifications. Remember that the primary function of the medium is to provide physical support, water, and nutrients to the young plant. Therefore, the medium should not restrict airflow to the roots.

Environmental conditions (temperature, light) as well as water and nutrient levels must be optimum. With the exception of temperature, growth requirements vary by crop stage. Seed germination tends to be best near 85°F, especially when applied with "bottom heat." Germination is often complete within two days and newly germinated seed (young seedlings) should be removed from the germination area (temperature) immediately thereafter. Growth can then proceed at a constant day-night temperature near 68°F until transplants are used. Medium moisture needs to be highest in the early germination and establishment phases, moderate during the maintenance stage, and least during finishing or "hardening off." Higher moisture (but not so much that air cannot penetrate the medium) is needed to promote root growth in developing seedlings. However, less moisture is needed after establishment and during maintenance. And, seven to fourteen days before using transplants, medium moisture can be reduced further to harden off the transplants and reduce transplant shock. A somewhat similar pattern is followed when fertilizing. However, nutrient demands tend to peak during establishment and maintenance with lesser amounts required during germination and finishing. Nutrient supplies may be reduced when beginning to harden off the transplants but transplants should be given a nutrient solution high in phosphorus one day before use.

Water and nutrient requirements are often influenced by growing container, medium properties, irrigation method, and fertilizer properties. For example, rooting media differ in water absorption, re-wetability, moisture release and nutrient retention and release. Fertilizer materials also differ in the number of nutrient units they deliver per unit weight and, if solid, rate of nutrient release. The shape and size of the transplant production tray or flat may also influence the amount of water it retains (e.g., shallow cells retain more water than deep cells and square cells have a greater volume than round cells). Taken together, these factors influence the rate and timing of irrigation and fertilizer application.

Inappropriate moisture levels are a common problem in transplant production. Often, this shows up as uneven growth throughout the house caused by not providing all transplants with the same amount of water. An "edge" effect may develop in which transplants located along the sides or backs of benches or other areas receive less water and grow more slowly than those receiving the required amount of water. Likewise, gaps between the rooting medium and bottom of the tray may be problematic in flood irrigation. Air bubbles in the gaps may prevent water from reaching the medium or roots, thereby leading to wilting or stunting. Over-watering compounded by poor air circulation may promote seedling diseases.

Water quality must also be considered when producing transplants. For example, water

in some areas is high in sulfur and steps must be taken to correct such problems. Sometimes it is not so much that the level of a particular nutrient or pH is out of line but that nutrient and pH levels are out of balance with each other. Take steps to understand relationships between pH and nutrient availability. The availability of many macronutrients is reduced at pH levels less than 6-7. In contrast, the availability of some micronutrients increases in acidic solutions. In extreme cases, micronutrient or ion concentrations can reach toxic levels. Water temperature is also important. Water circulated through the heating system, drawn from a well, or obtained from a municipal supply must be allowed to equilibrate with the greenhouse air temperature before use (water temperature generally should not exceed 72°F).

In summary, a large proportion of profit potential is determined early in production. Early errors "ripple" through the rest of the season and are difficult to overcome. Proper variety selection, buying high quality seed and handling it well, making sure all the required materials are on hand and in good condition, and paying attention to market requirements are important preplant factors. Purchase the best quality seed available, reviewing all aspects its quality from age to cleanliness and germination. When buying transplants, make sure that they are the proper variety, vigorous, uniform, and disease-free. Planting time is often hectic, so problems at that point are difficult to resolve.

Employ methods documented to be successful. There are many sources of information for transplant production. In addition to Cooperative Extension, consultants, your own experience, and other growers may assist in decision making. Take advantage of learning opportunities as many are available for those who want to learn more about tomato transplant production.

Make adjustments as needed. If a problem emerges, make slight adjustments on a small scale and take note of the results rather than changing conditions throughout the operation and perhaps complicating the problem.

For More Information

Transplant production. *In*: 2000 Ohio Vegetable Production Guide, Bulletin 672-00.
http://www.ag.ohio-state.edu/~ohioline/b672/index.html

Transplant production. *In*: Vegetable Production Guide for Florida. SP170
http://edis.ifas.ufl.edu/scripts/htmlgen.exe?MENU_CV:VEGPROD

Plug transplants for processing tomatoes: production, handling, and stand establishment.
wysiwyg://18/http://www.gov.on.ca/OMAFRA/english/crops/facts/94-061.html

Mosaic Disease of Tomatoes.
http://www.canr.uconn.edu/ces/ipm/veg/htms/mosvirto.html