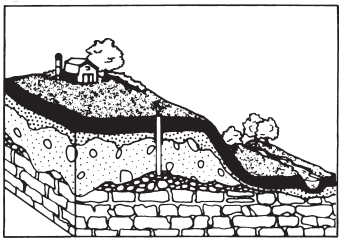

Soil Facts

Production of Tomato Transplants in Float System Greenhouses

Successful production of tomato transplants in the float system requires strict attention to fertilization and height management. Proper nutritional practices, along with additional height control measures, will promote production of high-quality transplants.

Introduction

Conventional tomato seedling production can be labor intensive. The float system may be a less labor-intensive alternative. Float system technology is used extensively to produce tobacco seedlings in greenhouses, but it is used infrequently for horticultural crops. Potential advantages may include lower production costs, more efficient use of water and nutrients, reduced foliar disease levels because plant foliage stays dry, and elimination of nutrient leaching to groundwater below the greenhouse. However, if nutrient levels are not managed carefully, seedlings can grow too fast, resulting in tall, leggy, low-quality transplants.

Briefly, the float system involves constructing shallow (4 to 6 inches deep) wooden frames on the floor of the greenhouse. At the beginning of each season, the frames are lined with polyethylene sheeting and filled with a nutrient solution formulated from water-soluble, horticultural-grade fertilizers.

Polystyrene flats, filled with peat- and vermiculite-based soil-less media, float on this nutrient solution. All irrigation is by capillary movement of the nutrient solution into the medium. Because the soil-less medium has a low nutrient content, the majority of the nutrients needed for seedling growth must be provided by a nutrient solution.

Greenhouse and field experiments were conducted in North Carolina from 1998 to 2002 to identify effective production practices for producing tomato transplants in the float system. Preliminary research revealed that use of a commercial tobacco medium and current tobacco nutrient recommendations resulted in fast-growing, tall, leggy seedlings unsuitable for transplanting. Subsequent research has focused on developing a production system that will produce shorter, stockier transplants. Float transplants grown with the new system were field-tested in 2001 and 2002 to ensure that their fruit yield, earliness, and quality were comparable with transplants produced using conventional overhead irrigation.

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Irrigation Water Quality

An analysis of the irrigation water should be completed before float system production of any crop begins. In North Carolina, the N.C. Department of Agriculture and Consumer Services' Agronomic Division provides this service (http://www.ncagr.com/agronomi). If water alkalinity is high, as is common in the eastern part of the state, the report's sulfuric acid recommendation for tobacco transplant production should be used. However, any other nutrient recommendations for tobacco do not apply for tomato transplant production.

Media and Tray Selection

Many brands of commercial soil-less media sold for float systems contain a nutrient charge. While this is acceptable for tobacco and many other crops, a nutrient charge may contribute to leggy tomato transplants. If a commercial medium without a nutrient charge cannot be found, one can be easily formulated by mixing equal amounts of ground peat and vermiculite. For proper pH, add 9.25 pounds of finely crushed lime per cubic yard of medium. All other nutrients will be provided by the nutrient solution. **Bark-based media will not wick properly and thus will not work in a float system.**

Tomato transplants need more growing space than tobacco. In a tray size experiment, good results were obtained with 128-cell Todd flats. It is possible to produce good seedlings with 200-cell trays, but there is a tendency toward excessive stem growth; thus good height management is critical in preventing leggy transplants.

Fertilizer Selection

Proper fertilizer selection is critical for successful tomato transplant production in the float system. High-phosphorus fertilizers result in tall, leggy transplants. Under no circumstances should fertilizers with more than 5 percent phosphorus (P_2O_5) be used for tomato transplants in the float system.

Two fertilizer grades, 15-5-15 and 15-2-20, have been tested and found satisfactory for tomato transplant production in the float system. Since they are similar to 15-5-15, the tobacco float fertilizers 16-4-16 and 16-5-16 should also work well. Using 15-2-20 may provide additional height reduction; however, purpling of leaf undersides due to phosphorus deficiency may occur. Excessive phosphorus deficiency has the potential to damage field yield, so an application of fertilizer (5 to 10 ppm P_2O_5) should be made if leaf purpling occurs.

Nitrogen requirements for tomato transplant production are much lower than those for tobacco. Research has shown that two applications of fertilizer, each at a rate of 25 parts per million nitrogen, should be sufficient. The applications should be spaced 2 weeks apart. Higher rates lead to rapid growth and low-quality transplants.

No single water-soluble fertilizer can supply all the nutrients needed for good seedling growth. For instance, a particular fertilizer may not supply calcium, magnesium, or sulfur, or an effective combination of these. To supply complete nutrition, gypsum (calcium sulfate) and Epsom salts (magnesium sulfate) may be needed. Addition of these materials is especially important when using an uncharged medium. The fertilizer chosen for N, P, and K determines what supplemental materials are needed (see Table 1).

To mix solution **directly in the waterbed**, the rates (ounces) in Table 1 should be added per **100 gallons** of water. With a proportional fertilizer injector, use

Table 1. Main fertilizer and supplemental material rates for 25 parts per million nitrogen nutrient solution.

Fertilizer formulation	*Rate of application in ounces*[1]		
	Fertilizer	*Epsom salts*	*Gypsum*
16-5-16	2.1	0	5
16-4-16	2.1	3	0
15-5-15	2.2	3	0
15-2-20	2.2	3	5

[1] When mixing solution directly in the waterbed, use these rates for each 100 gallons of solution. When using a proportional fertilizer injector, use these rates for each **1 gallon** of concentrated solution in the injector tank, and set injector to 100:1.

the rates in the table for each **1 gallon** of concentrated solution in the injector tank. The injector should then be set to 100:1, which will result in 1 gallon of concentrate being delivered into 100 gallons of water. Note that mixing 15-2-20, 15-5-15, or 16-4-16 with Epsom salts in an injector tank will likely result in calcium and sulfur precipitating out of the solution. Delaying the first application until one week after seeding greatly aids in height control. Apply Epsom salts and/or gypsum only once, at the first application. The second application at three weeks should be the N-P-K fertilizer only.

Height Reduction

Research has shown that additional height control measures may be needed beyond the nutritional controls discussed above. The delay in fertilization mentioned above is essential with fertilizers containing 4 to 5 percent phosphorus, and is helpful with materials containing 2 percent phosphorus. Additional height control can be achieved by brushing the plants, which involves gently bending the plants to a 45-degree angle with a broomstick or pipe. Generally, 10 to 40 strokes per day are needed.

Clipping, the practice of removing some leaf material from the top of the plant with a raised lawn mower, is typically used to control tobacco transplant height. However, clipping should not be used to control the height of tomato transplants in the float system. Tomato, unlike tobacco, has its terminal bud at the top of the plant. It is far too easy to accidentally remove the bud when attempting to clip tomato seedlings with a lawn mower.

Additional Recommendations and Information

As with any new production system, you should not shift all of your seedling production to the float system the first year. Build a small float frame first and try a few trays to get accustomed to the faster growth and height management requirements of the system. Seed germination and seedling growth in the float system may be faster than in conventional systems, and transplants may be ready before the fields are ready. Trying a few flats during the time of year that you normally produce seedlings will help you get a handle on production time.

Disease and insect control options are limited in the float system. Sanitation is the best option. Trays may be fumigated with methyl bromide. Daily scouting for insects and disease is vital to success with the float system.

Lastly, consult your county Extension office for more information. Agents will have access to all of the publications mentioned here, as well as new information as it becomes available.

For Additional Information

More information on the float system can be obtained from the following N.C. Cooperative Extension Service publications, which are available on-line and from your county Extension Center.

SoilFacts: Tobacco Seedling Nutrition in the Greenhouse Float System. (AGW-439-48) www.soil.ncsu.edu/publications/Soilfacts/AGW-439-48/agw-439-48.pdf

Producing Tobacco Transplants in Greenhouses series (AG-488-1 through AG-488-5) www.ces.ncsu.edu/resources/crops/tobacco/transplants/

The NCDA&CS Agronomic Division provides a solution advisory service to assist in the management of float systems. More information can be obtained on the Internet at http://www.ncagr.com/agronomi.

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