



Tobacco Transplant Production: Plug and Transfer System

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The use of container-grown tobacco transplants in Kentucky has increased dramatically since the mid-1980s. Interest in alternative transplant production methods stems from several areas:

- *plant bed failures;*
- *labor distribution and savings associated with container-grown plants;*
- *good survival rates, even when set under warm, dry conditions; and*
- *the fewer fumigation and chemical pest control options available for use in plant beds.*

Some disadvantages of this new system are the relatively high initial investment in materials for plant production and a limited number of chemicals available for insect and disease control. Although no method of plant production is completely foolproof, this option:

- *is relatively simple,*
- *requires a moderate level of management skill, and*
- *allows a producer to gain experience with container-grown plants on a small scale before completely committing to this system or moving to a direct-seed greenhouse operation.*

Trays

Four to 5-week old seedlings are transferred to Styrofoam™ “float” trays. Most trays are approximately 14" x 27", but cell numbers per tray varies: 200, 242, 253, 288, and 338 cell trays are available. The 200-cell tray is considered a “plug” tray, although the 242 and 253 have been used successfully.

The larger cell size (200) is generally easier to work with and will produce a slightly larger plant with larger stem diameter and a larger root system than the smaller cell sizes. Plants are easier to manage and can be held longer on the float if necessary because of weather conditions. Trays with higher cell density are normally used for direct seeding.

The number of usable plants per tray using the plug and transfer method should approach 100%. Assume 90%

usable plants per tray in determining the number of trays required for each acre of tobacco. With the 200-cell tray:

$$.90 \times 200 = 180 \text{ plants per tray}$$

$$\text{Plant population per acre: } 7,200 \text{ (burley) or } 4400 \text{ (dark)}$$

$$\text{Trays per acre needed: } 7,200 \div 180 = 40 \text{ trays (burley)}$$

$$4,400 \div 180 = 25 \text{ trays (dark)}$$

Dip trays in a 10% chlorine bleach solution and allow to dry completely before use. After use:

- *wash as much dirt as possible from the trays,*
- *dip in bleach solution,*
- *store out of direct sunlight to prevent tray deterioration, and*
- *protect from rats and mice.*

With care, trays should last at least 5 years.

Plant Populations

Consider reducing plant populations in the field if you have been setting 8,000 or more plants to the acre. Plant bed plants usually survive at a 90 to 95% rate in the field. Container plant survival will approach 100%. High yields and leaf quality can be obtained at 7,200 stalks per acre for burley and 4,400 plants per acre for dark types. Also, labor and handling costs will be reduced because fewer plants are set, topped, cut, spiked, housed, and stripped.

Potting Mix

A soil-less mix composed of peat moss, vermiculite, and perlite is used to fill the trays. Select a mix that has been formulated for tobacco. Different plants have different air, moisture, and nutrient needs, so you should use a mix that has been specifically blended for tobacco.

Plug and transfer soil mixtures are formulated with all macro- and micro-nutrients necessary for the 4-week growth period that the plants are on the float. A relatively small amount of fertilizer per cubic foot of mix is required, which makes it difficult to blend; therefore, uniform distribution throughout the blend is difficult to attain. Many growers are using non-fertilized mix and adding water soluble fertilizer to

the water. Three and one half pounds of 20-10-20/1,000 gal of water when the plants are floated are required for 4 weeks' growth.

Determining Gallons of Water in Your Water Bed

These are the two simplest ways to determine the volume of your float beds:

1. Measure the inside length and width of the bed in feet.

Determine the average water depth, again in feet.

Multiply length \times width \times depth (**in feet**) to determine cubic feet.

Multiply cubic feet \times 7.48 to determine volume in gallons.

For example, assume you have a water bed that is 15'9" long by 7' wide, with an average water depth of 4".

15'9" = 15.75' and 4" = 0.333".

Using the formula from above:

$$15.75' \times 7' \times 0.333' = 36.7 \text{ cu ft}$$

$$36.7 \text{ cu ft} \times 7.48 \text{ gal/cu ft} = 275 \text{ gal}$$

2. Here is another way to **approximate** gallons per bed:

Multiply the number of trays per bed \times the average depth of the water in inches

Multiply this number \times 1.6.

The bed described in (1) is 6 trays wide by 7 trays long for a total of 42 trays.

42 (trays) \times 4 (inches of water) \times 1.6 = approximately 268 gal.

Tray Filling

Pre-moistened potting mix will handle easily and pack properly in the trays, preventing dry cells or cells that will waterlog, which result in a lower yield of usable plants. One to 3 gal of water/3 cu ft of mix may be necessary.

A mix containing the correct amount of moisture will hold its shape when squeezed into a ball for 2 to 3 seconds before beginning to fall apart. Do not add too much water and don't "beat" the trays on a table to settle the mix.

Fill each tray, drop it gently from a height of 4" to 6" on the edge of a 1" wide board two to three times, and bring mix to level with the top. Dibbling is not required for plug and transfer.

Plants

Plants are most often obtained from commercial producers. Plants from this source have a well-formed root mass that is easily "plugged" into the larger tray. If boxed plugs are used, pay special attention to the condition of the seedlings prior to transferring. When you receive them, plants may have been stored for an extended period and be yellowed; or they may not be a size that can be handled easily without damage. Place these trays on a

fertilized float for 1 to 3 days prior to transferring. Uniformity and survivability will be greatly enhanced.

If a small greenhouse or other heated environment with good light is available, it is possible to produce bare-rooted seedlings for transfer. A nursery tray or cookie sheet is filled with potting mix and a small amount of seed is mixed with sand and evenly scattered on the surface of the tray.

Trial and error are the best way to determine plant density; use a .22 caliber long rifle casing for a measure. Normally 1 to 2 casings of seed per 11" x 20" tray will give best yield of usable plants. Cover the trays with brown paper and keep moist until the seeds germinate, generally in 5 to 7 days. Plants should be ready for transferring in 4 to 5 weeks.

The transfer rate for bare root seedlings will be about half that of plug plants: 600-800/hour compared to 1,400-1,600. Using a pegged board to make holes in the cells to accept the bare-rooted seedling will speed up the rate of transfer. This operation is not necessary with plug plants. Sprinkle 3 to 4 cups of vermiculite over the tops of plants after plugging, and mist with water to seal roots in the mix.

Bed Construction and Filling

Size the beds so that a commercially available fabric will cover them. A 9' wide canvas works well with a bed 7 trays wide. Length can be as long as desired, but it is a good idea to break beds into sections holding 60 to 80 trays (sufficient for 1.5 to 2 acres) to isolate any disease problems that may develop.

Remember: all measurements are inside dimension. Measure the tray you are using and add 1/4" to the length and width to allow the trays to float with changing water level. To prevent excessive algae growth, there should be no large areas of exposed water when trays are placed on the float.

Select a level area in full sunlight. Generally, 2" x 8" material is used for the beds. Uneven ground can be leveled with soil, sand, aglime, or sawdust. Be sure to rake the area and remove any objects that could puncture the plastic. Indoor-outdoor carpeting may be placed on the soil to protect the plastic from damage.

Don't "eyeball" during construction; use a level. Drive 2" x 2" stakes every 6 to 8 feet around the outer edges of the beds to keep the frame from bowing when filled with water.

Place water bed heaters beneath the plastic liner, one per 100 sq ft of surface area. Efficiency of the heaters can be modestly improved if they are placed on a section of foil-backed insulation board. Using water bed heaters set at 70 to 74°F will improve root growth and fertilizer efficiency but will not provide cold weather protection to the above-ground parts of the plant.

Line beds with plastic after leveling. Use a single layer of 6 mil or double layer of 4 mil black plastic.

Spread and smooth the liner and place water-filled plastic bags or balloons in the corners to hold the plastic in place while filling. Use new plastic every year. Do not secure the plastic to the edges of the frames until after the beds are filled.

Use a “clean” source of water from a municipal utility or deep well. Surface water from ponds or streams may contain black shank spores. If water is transported in a tank, be sure the tank is free of chemical contamination (such as triazine). Fill the beds a day or two before placing trays on the water to allow the water to warm as much as possible.

After trays are placed on the water the beds should be covered. PVC, metal conduit, wood framing, or wires can be used for supports to keep the cover off of the plants. A typical cover will protect the plants from wind and provide light frost protection, but will not protect plants from heavy frost or freeze.

Remember: water bed heaters keep the roots warm but do not protect leaves from frost or freeze. For additional protection during extremely cold weather:

- *Make sure that the cover is supported above the tops of the plants.*

- *If heavy frost or freeze is predicted place a plastic cover on top of the canvas cover late in the afternoon. Be sure to remove the plastic before 8:00 a.m. the next morning. Under bright sunshine temperatures under the plastic can rapidly rise to more than 100°F even if the air temperature is below freezing.*

- *String a series of 100-watt light bulbs (one bulb every 4 to 6 feet) under the bows. Be sure to follow electrical code when wiring for this application.*

Management Tips

Even when the trays are on the water and the cover is in place, the job is still not done. You must monitor beds on a daily basis for insect, disease, or fertility problems. Here are some tips to keep in mind:

- *If you are using a “fertilized” mix and plants are chlorotic or not growing properly, add 1 pound of 20-10-20/1,000 gal of water.*

- *Monitor growth of dark tobaccos closely. They will not show typical nutrient deficiency symptoms like burley; usually, they just will not grow.*

- *Dissolve the fertilizer in a bucket and pour into several areas in the bed. Use a circulating pump or clean*

paddle to distribute the fertilizer throughout the bed. Use care not to punch holes in the plastic liner.

- *Do not over-fertilize. This will result in lush growth that may increase insect and disease problems while lowering the quality of finished plants.*

- *Plants will be more uniform, stockier, and easier to handle if clipped at least once.*

- *Plug and transfer plants are usually ready to set 4 weeks after transferring, so clipping about 5 days before planting is a good management practice. Additional clippings may be required if it is necessary to “hold” the plants because of unfavorable transplanting conditions.*

- *When clipping don’t remove too much foliage; it is generally not necessary to remove more than 1/2 to 3/4” of leaf. And do not cut below the terminal bud.*

- *Keep the areas around the outside of the beds mowed. Weeds left to grow there can host insects and diseases that can attack tobacco. When mowing do not allow clippings to drop back into the tray.*

- *Do not use herbicides around float beds.*

- *Do not burn pesticide containers near the beds.*

Small amounts of pesticides carried in the smoke can severely damage tobacco seedlings.

- *Few insecticides or fungicides are currently available for use in this system. Check with your local county Extension office for the latest recommendations.*

- *Sanitation and exclusion are the keys to insect and disease control. Disinfect trays with chlorine bleach solution.*

- *Use new plastic every year.*

- *Use a “clean” water source.*

- *Do not use tobacco products when working with transplants.*

- *Wash hands with milk before touching plants to prevent infecting the seedlings with any virus particles.*

Transplanting

Plants can be used with either conventional pocket type setters or the new carousel transplanters. There will be a mass of “water roots” on the underside of the float trays when they are removed from the bed. They can be scraped or rubbed off or just left to fall off. These roots do not affect the survivability of the transplants. Removal will make plants a little easier to pull from the cells. Conventional planters may be modified to hold the trays, or trays may be placed on the transplanter box. Transplanting directly from the tray is the easiest, most efficient way to handle these transplants.

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