



Soil Facts

Tobacco Seedling Nutrition in the Greenhouse Float System

Proper nutrient management is essential when producing tobacco seedlings in a greenhouse float system. The main benefit of proper nutrient management is high seedling quality. Additional benefits include potential reductions in disease pressure, clipping severity, salt injury, production costs, and environmental threats. Nutrient management is more critical in the greenhouse system than in the traditional seed-bed system due to lack of soil nutrient reserves.

Introduction

Float fertility rates are based on float bed volume. Therefore, it is important to know the volume of the float beds. Volume in gallons can be calculated by multiplying bed length x width x depth x 7.48. All measurements, including depth, must be in feet to apply this formula. A flow meter, available at plumbing supply houses, also can be used to determine the actual amount of water in the bed.

If needed, alkalinity neutralization should be performed before the trays are floated. The type and amount of acid to add is determined from a **recent** water (solution) analysis. The recommendations from the analysis should be followed carefully, as over-application of acid can lead to undesirably low pH and possible root damage. The Agronomic Division of the North Carolina Department of Agriculture and Consumer Services provides a solution advisory service to help farmers manage float systems. More information on alkalinity

problems can be found in the N.C. Cooperative Extension Service publication *Producing Tobacco Transplants in Greenhouses-Water Quality* (AG-488-3).

General Fertility Information

In the float system, all the fertilizer should be added through the waterbed. Complete (N-P-K) fertilizer rates are based on nitrogen needs. Beyond the complete fertilizer, supplemental phosphorus or potassium is not needed. Split applications of fertilizer are recommended to reduce soluble salt problems. One-hundred ppm nitrogen early in the season is adequate. For flue-cured, apply another 100 ppm at 4 weeks after seeding. This rate is excessive for burley and could cause salt injury or complicate disease management. For burley make two applications of 50 ppm each at 4 and 6 weeks. It may also be beneficial for burley seedlings to delay the initial application of fertilizer until up to 10 days after seeding. All fertilizer applications

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should be based on the amount of water the float bed holds, not the amount of water added.

The addition of fertilizer at 4 weeks after seeding should coincide with the first addition of water to the beds. Adding water with the second fertilizer application should aid in mixing in the beds. It may be helpful to add fertilizer and water at several spots in the bed. A submersible pump can be placed in the float bed to aid in mixing solution after fertilizer applications.

Formulating water-soluble fertilizers has its limits, and no single fertilizer

can supply all nutrients needed for good seedling growth. For instance, a particular fertilizer may not supply calcium, magnesium, and/or sulfur. In order to supply a **complete fertility program**, gypsum (calcium sulfate) and Epsom salts (magnesium sulfate) may be needed. The materials and rates are determined by the fertilizer used and by whether acid was used for alkalinity correction. Sulfuric acid, if needed for alkalinity neutralization, will supply sufficient plant-available sulfate. Acid should be only used for alkalinity correction, not solely as a fertilizer. Table 1 gives the nutrient content of several popular fertilizers. Note that fertilizers that have similar

N-P-K analysis can be very different in content of other nutrients, such as magnesium, calcium, sulfur, and boron. Table 2 gives the rates for each fertilizer and for the supplemental materials needed for each fertilizer.

Other Fertility Concerns

Urea has been found to be toxic to tobacco seedlings in the float system. Some fertilizers, such as 20-20-20 (see Table 1) and some “off brands” of 20-10-20, contain a high percentage of their nitrogen in urea form. Always check the label to be sure

Table 1. Comparison of nutrient contents of several water-soluble fertilizer materials.

Material	Total N	NO ₃ -N	NH ₄ -N	Urea-N	P ₂ O ₅	K ₂ O	Ca	Mg	S	B
	-----%-----									
15-5-15	15	11.75	1.20	2.05	5	15	5.00	2.00	0	0.0150
16-4-16	16	12.27	2.10	1.63	4	16	4.00	2.00	0	0.0100
16-5-16	16	10.00	6.00	0.00	5	16	0.00	3.00	4	0.0200
Carolina Partners	6.9	6.05	0.68	0.14	1.5	6.7	5.19	0.86	0.9	0.0009
21-5-20	21	12.60	6.51	1.89	5	20	0.00	0.00	0	0.0200
20-10-20 GP	20	12.24	7.76	0.00	10	20	0.00	0.05	0	0.0068
20-10-20 PL	20	12.23	7.77	0.00	10	20	0.00	0.15	0	0.0200
20-20-20 GP	20	6.11	3.89	10.00	20	20	0.00	0.05	0	0.0068
Gypsum	0	NA	NA	NA	0	0	22.00	0.00	17	NA
Epsom salt	0	NA	NA	NA	0	0	0.00	10.00	14	NA
13-2-13	13	11.90	0.30	0.80	2	13	6.00	3.00	0	0.0060
15-2-20	15	12.70	1.50	0.80	2	20	3.75	2.00	0	0.0300

Compiled from product information from Scott's Horticultural, Miller Chemical, Chilean Nitrate, and Carolina Greenhouse. Carolina Partners data based on label recommended mixture of blue and gold liquids.

High urea or phosphorus contents (numbers in **red**) are undesirable in the float system.

Note: several fertilizers have low boron (B) content (**gold** numbers) and should not be used with source water that does not contain boron, as is common in the burley region.

13-2-13 and 15-2-20 have not been tested with tobacco but may be useful for other crops.

that the fertilizer supplies most of its nitrogen in ammonium or nitrate forms. The small amount of urea in 15-5-15, 16-4-16, Carolina Partners, and 21-5-20 is not harmful.

Over fertilization with nitrogen and phosphorus may result in succulent plants that could be more prone to disease. In addition, overfertilized plants must be clipped more frequently. Each clipping increases the possibility of introducing or spreading disease. To avoid over fertilization with phosphorus, do not use fertilizers with more than 10 percent phosphorus. Float the trays as soon as possible after adding fertilizer to avoid excessive algae growth.

Extensive research and a grower waste solution survey have indicated that previously used fertility programs (20-20-20, 20-10-20) contained too much phosphorus. Newer materials such as 15-5-15, 16-4-16, 16-5-16, and Carolina

Partners are considered low phosphorus fertilizers. Potential benefits of low phosphorus fertilizers include less tendency to produce “leggy seedlings,” decreased clipping demand, fewer “tender” transplants, and little or no phosphorus in the waste solution. Seedlings grown with low phosphorus fertilizers may appear to grow more slowly but will be ready at the normal time.

Boron deficiency can occur when fertilizer without boron is used with water low in boron. To prevent deficiency, a fertilizer containing at least 0.01 percent boron should be used when a water analysis indicates less than 0.5 ppm boron. Since boron can be toxic and only very small amounts are needed for good growth, use of Sol-u-bor or borax to supply boron is not advisable except in cases of confirmed deficiency.

Fertilizers that contain urea phosphate have a low pH. This will

depress the pH in the solution, but it **cannot** be relied upon to correct alkalinity problems. Care must be taken not to overapply these acidic fertilizers when the irrigation water pH is also acidic. Also, these fertilizers are not compatible with sulfuric acid in the concentrated solution used in an injector tank. Instead, add acid directly to the float bed.

Carolina Partners and 16-5-16 are the only fertilizers that contain sulfur. Even though most soilless media brands contain sulfur, deficiency has been observed. Sulfur can be supplied by adding Epsom salts if acid is not used for alkalinity correction. Do not mix 15-5-15 or 16-4-16 with acid or Epsom salts in an injector tank. Epsom salts should be added directly to the float bed when 15-5-15 or 16-4-16 is used.

The Carolina Partners material is a two-part liquid that supplies a

Table 2. Fertility options, rates, and additional materials needed for water-soluble materials.

Fertilizer	100 ppm N	75 ppm N	50 ppm N	Epsom Salts	Gypsum
	----- ounces -----				
16-5-16	8.3	6.2	4.1	0	5
16-4-16	8.3	6.2	4.1	3 if no acid	0
15-5-15	8.8	6.6	4.4	3 if no acid	0
20-10-20	6.5	4.9	3.2	3	5
21-5-20	6.2	4.6	3.1	3	5
Carolina Partners	See label	See label	See label	0	0

To mix directly in the water bed, the rates (ounces) in the table should be added per **100 gallons** of water.

With a fertilizer injector, use the rates in the table for each **1 gallon** of 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. Please note that mixing 15-5-15 or 16-4-16 with sulfuric acid and/or Epsom salts in an injector tank will likely result in salting out of the mixture

All fertilizers except 20-10-20 are low phosphorus.

complete nutritional package without any additional materials needed. It is a low-phosphorus program and has been formulated especially for tobacco seedlings. Use according to label directions. Exceeding recommended rates may result in excessive seedling growth.

Sample Fertility Programs

Several complete fertility programs based around popular fertilizers are described in Table 2. Other programs may work as well. Gypsum and Epsom salts, where needed, should only be applied before seeding. There is no need to reapply gypsum or Epsom salts when adding water. In addition, gypsum is not soluble enough to be used with an injector and should be slurried and added directly to the float bed. See Table 2 for recommended rates.

Summary and Additional Information

Proper management of fertility in the float system is essential to the production of high quality transplants. With proper attention to fertility, transplant quality can be improved while potentially decreasing disease pressure, clipping severity, salt injury, and production costs.

More information on the production of tobacco seedlings in greenhouses can be obtained from the following N.C. Cooperative Extension Service publications, which are available online:

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

Flue-cured Tobacco Information (AG-187)
<http://ipm.ncsu.edu/Production-Guides/Flue-cured/contents.html>

Burley Tobacco Information (AG-376)
<http://ipm.ncsu.edu/Production-Guides/burley/contents.html>

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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