

Why are the Begonia Plugs Dying?

The production manager for a 60,000 sq. ft. greenhouse operation in Shawnee County, Kansas, called an extension specialist for a consult on her begonia crops on February 18. She has four turns [sequential crops in the same season] of begonia plugs to produce, and seedlings in the first turn are exhibiting stunted growth, interveinal to total chlorosis, that might be described as bleaching, of the first true leaf, and death of a high percentage of seedlings that had originally emerged. The specialist visited the operation, made the following observations, obtained a copy of the grower's water quality report (Table 1), and returned to her lab with several flats of plugs for nutrient analyses (Table 2). Upon returning to her office, she checked reference books to confirm basic information about begonia production, shown below.

Summary of Production Details and Observations

Pelleted fibrous begonia [*Begonia xsemperflorens-cultorum*] seed was sown with an automatic cylinder seeder into 384 plug trays filled with Metro 360 soilless root medium [for plug germination; includes a starter nutrient charge]. Seed was not covered and trays were placed on carts in a germination chamber with fluorescent lights, high humidity, and a temperature of 78°F. Germination was very close to 100%. Plug trays were held in the lighted germination chamber for up to two weeks after germination, through plug Stage 2. 75 ppm N was applied as constant liquid feed (CLF) from Excel 21-5-20 [31% NH₄-N : 60% NO₃-N]. After being pulled from the germination chamber, the seedlings were grown on bench space under double-layer polyethylene that was exposed to full ambient light intensities [no shade was available]. The grower relayed that she had observed that right down the center of the bench with the Turn 1 begonias, the plants in the center appeared to have less of the damage, and this was observed across different cultivars.



Photo A: Trays of the first begonia turn are in the foreground and those of the second begonia turn are in the background.

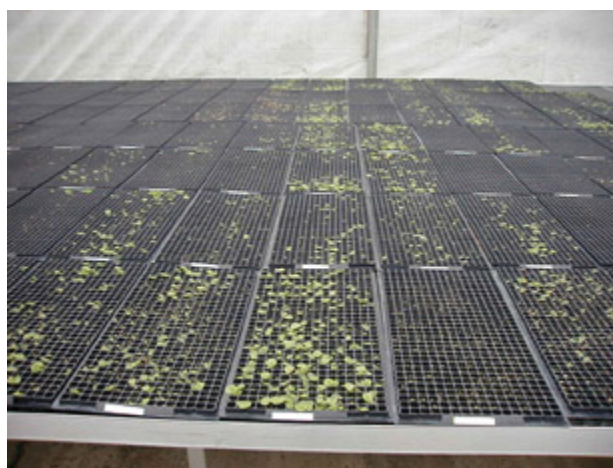


Photo B: Closer view of trays in the first begonia turn. Though germination was 100%, many seedlings died before reaching plug Stage 3.

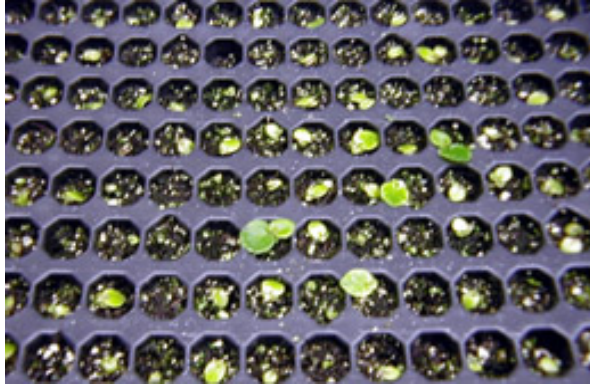


Photo C: Close-up of begonia seedlings from the first turn. The first true leaf is distinctly white on many of the plants.

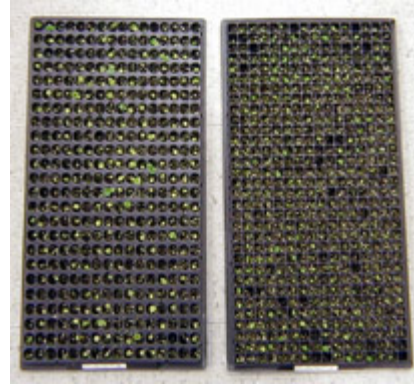


Photo D: Plug tray on the left is from the first turn and the tray on the right is from the second turn, planted two weeks later. Seedlings in the right-hand tray are approaching Stage 3, have a seedling in nearly every cell, and are just beginning to show symptoms of foliage whiting.

Water Quality Analyses. The following information was provided in a report from a sample that the grower had submitted in December, just before the spring season started.

Soluble salts				1.26 mmhos/cm			
pH				7.30			
Total Alkalinity				393 ppm			
Ca (ppm)	Mg (ppm)	Na (ppm)	Cl (ppm)	B (ppm)	Fl (ppm)	Fe (ppm)	Mn (ppm)
153	24	77	196	0.06	0	0.16	0.34
Cu (ppm)	Zn (ppm)	Mo (ppm)	Al (ppm)	NO₃-N (ppm)	NH₄-N (ppm)	Total N (ppm)	K (ppm)
0.01	0.01	0.02	0.03	4.44	0.42	4.86	8.73

Root Medium Analyses. Samples were collected using the Squeeze Method: the trays were watered with distilled water and allowed to stand for 30 min. Sample cells were selected from each tray and the root medium was "pressed upon" to extract solution from that cell. Over 15 cells were randomly sampled from each tray with extracts pooled.

Sample	pH	EC	Ca	K	Mg	Na	Fe	Mn	Zn	Cu
		(mmhos/cm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Begonia 1 st turn	6.3	3.31	254	142	81	194	0.4	0.5	0.15	0.07
Begonia 1 st turn	6.6	2.70	245	151	79	193	0.4	0.5	0.15	0.06
Begonia 2 nd turn	6.5	2.92	258	156	80	150	0.3	0.4	0.12	0.05

Assignment: You assume the role of the specialist.

Evaluate the data above and answer the questions: What factors likely caused the severe chlorosis and eventual death of the begonia seedlings? What advice will you provide the grower via a fax to solve this problem, both for the short-term and in the long-term? Detail your conclusions in a succinct list of statements that you would fax to the grower [along with the root medium analyses, but no need to re-state the analytical results in your answer for class]. Support your statements by pointing to specifics in the analyses and/or noted observations.

Following is a summary of the information that the specialist revisited in reference books upon returning to her office:

In plug production, the germination process is divided into four stages:

Stage 1 - Radicle emerges

Stage 1.5 - Radicle penetrates the root medium

Stage 3 - First true leaves develop

Stage 4 - Seedling is almost ready to transplant / holding

Production of fibrous begonia plugs:

Temperature:

Stage 1 (germination) - 5 to 10 days : 75 to 80F (24 to 27C)

Stage 2 - 10 to 14 days : 70 to 72F (21 to 22C)

Stages 3 and 4 - 4 to 5 weeks : 65 to 70F (18 to 21C)

After 7 to 9 weeks : 62 to 68F (17 to 20C)

Relative Humidity:

high moisture in the growing media and high humidity greater than 95% are essential for fast, uniform germination

Lighting:

seeds should be exposed to light while germinating

supplemental lighting in the seedling stage may increase plant quality and shorten crop time, but intensity should not be excessive

keep daytime intensity at 450 to 700 f.c. (5 to 8 klux), and continue from dusk to 2:00 a.m.

after germination, seedlings cannot tolerate high light intensity, e.g. > 2,000 f.c

Fertilizer:

Stage 2 : apply 50 to 75 ppm N per week (NO₃-N form preferred)

Stages 3 and 4 : 100 ppm weekly (NO₃-N form preferred)

After 7 to 9 weeks : 150 ppm N weekly from a formula such as 20-10-20

Growth Regulators:

Apply B-Nine, Bonzi, or Cycocel during finishing as needed at label rates to control

internode elongation

Propagation:

Light is a requirement for germination. Cool-white fluorescent lamps can be used at a duration of 14 to 24 hr until the first true leaves have developed up to 1.5 in (1.3 cm) long

Root medium temperature is critical and should be 78 to 80F (26 to 27C) because germination rates will decrease with lower temperatures. Air temperature should not exceed 80F (27C). After 2 weeks, lower temperature to 65F (18C) nights. For hardening, 60 F (16C) is acceptable. For plug production the following conditions are used:

Stage 1: Seed uncovered, 78 to 80 F (26 to 27C), for 7 days

Stage 2: 72 to 78 F (22 to 26 C), 21 days, 50 to 100 ppm N one to 2 times per week

Stage 3: 70 to 75 F (21 to 24C), 21 days, 150 ppm N two times/week

Stage 4: 62 to 68F (17 to 20C), 14 days, fertilize as needed

High humidity or fog during germination is required for rapid and uniform germination. Care must be taken not to wash seeds out of the medium. Young plants should not be water stressed.

Root Medium:

Peat, perlite, and vermiculite (1:1:1) by volume is a recommended mix.

Nutrition:

Begonia seedlings initially form shallow roots and care should be taken to ensure that nitrate levels are adequate because nitrates can easily leach out of the root zone. Frequently, most of the required nutrients are incorporated into the root medium prior to planting as a "starter charge."