Successful Propagation Of Purple Fountain Grass From Single-Internode Culm Cuttings

In the first article of a two-part series, researchers discuss how propagation daily light integral and root-zone temperature influence root growth and development of single-internode purple fountain grass culm cuttings.

by **W. GARRETT OWEN** and **ROBERTO LOPEZ**

PURPLE fountain [*Pennisetum ×advena* (formerly known as *P. setaceum* 'Rubrum')] grass is commercially grown and marketed as a horticultural annual in the U.S. and prized for its dark-purple foliage and inflorescences. Production of young purple fountain grass plants or liners is limited because seeds are sterile and most outdoor stock plants are usually lost from killing frosts.

Purple fountain grass liners are started from crown divisions (Figure 1A) or tissue-culture plantlets (Figure 1B). While crown divisions are the most popular and recommended method for propagating purple fountain grass, growers have reported this method to be costly. Alternatively, tissue-cultured plantlets are a more cost-effective propagation method because growers can root and divide the plantlets.

Growers who receive divisions or tissue-cultured plantlets during winter months and early spring may experience slow growth and delayed flowering, especially across the northern U.S. when the average greenhouse propagation daily light integral (PDLI) ranges from 5 to 10 mol·m^{-2}·d^{-1}. Under these low-light conditions, rooting time is often delayed and liner quality is sacrificed. In addition to low light, suboptimal root-zone temperature (RZT) may inhibit or limit root growth and development.

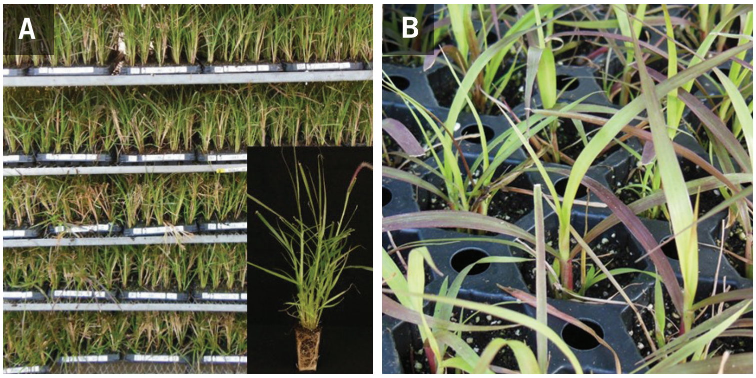

Figure 1. **Purple fountain grass is commercially produced from (A) crown divisions and (B) tissue-cultured plantlets.**

Propagation of purple fountain grass from vegetative or flowering culm cuttings, as an economically attractive alternative to the conventional method of crown divisions, has been a focus of our research. However, little is known about the combined effects of PDLI and RZT on shoot and root growth and development of vegetative cuttings. Therefore, our objectives were to determine the effects of PDLI and RZT on shoot and root growth and development of purple fountain grass single-internode culm cuttings.

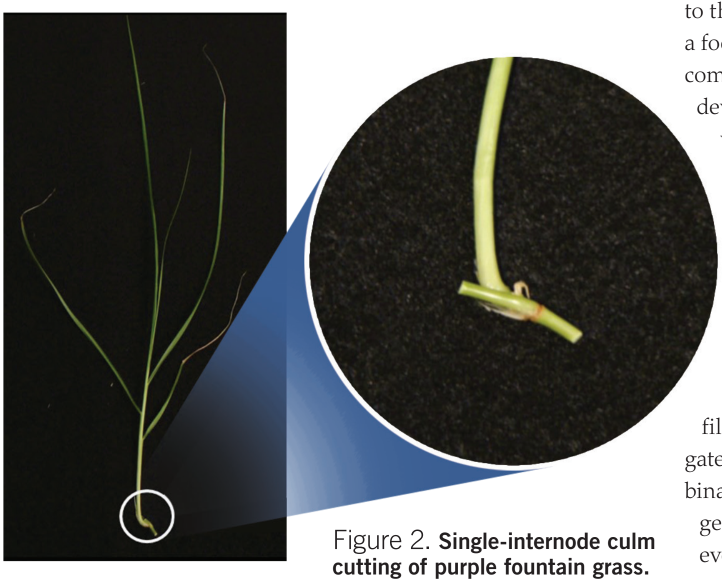

Figure 2. **Single-internode culm cutting of purple fountain grass.**

Purple Fountain Grass Stock Plants

Purple fountain grass liners in 50-cell deep liner trays (received from a commercial greenhouse) were transplanted into 5-inch diameter containers and allowed to bulk for 42 days before being transplanted in 3-gallon nursery containers filled with a commercial soilless medium. The plants were irrigated as necessary with acidified water supplemented with a combination of two water-soluble fertilizers to provide 200 ppm nitrogen (N). To promote growth, stock plants were manually pruned every three months. Stock plants were spaced equally and grown in a glass-glazed greenhouse at Purdue University, West Lafayette, IN. During stock plant growth and management, the daily light integral (DLI) and average daily temperatures (ADT) were 16.3 ± 6.3 $mol \cdot m^{-2} \cdot d^{-1}$ and 72 ± 3.1°F, respectively.

Propagating Purple Fountain Grass

Culmed vegetative tillers with four nodes were excised from stock plants above the node closest to the crown, therefore avoiding any preformed adventitious (aerial) roots. Harvested tillers with three nodes were excised 1-cm below the second to fourth node sequentially distal to the first node, resulting in 400 uniform, unrooted single-internode culm cuttings with two leaf blades and a length of approximately 7 inches (Figure 3). Each culm cutting was dipped for 3 seconds into a solution containing 1000 ppm indole-3-butyric acid (IBA) + 500 ppm 1-napthaleneacetic acid (NAA) (Rooting Hormone) and individually placed into a 50-cell liner tray filled with a propagation medium comprised of (by

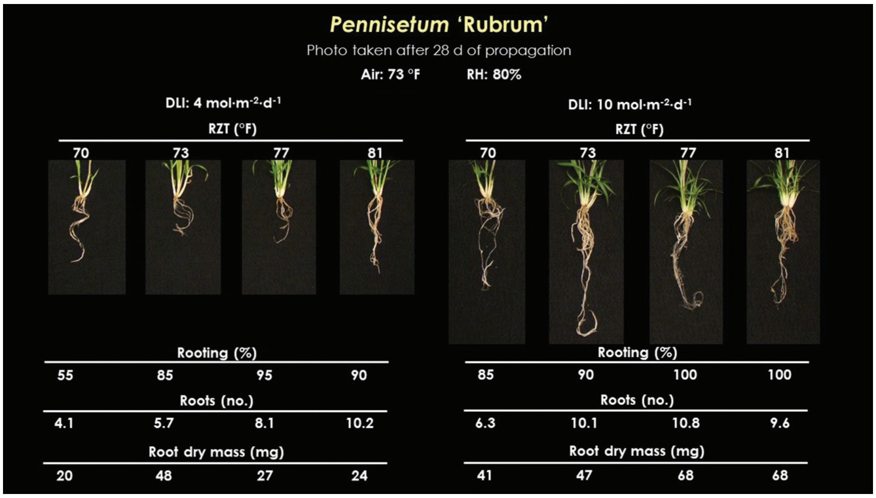

Figure 3. **Rooting percentage, average number of roots formed, and root dry mass during root development of purple fountain grass [*Pennisetum ×advena* (formerly known as *P. setaceum* 'Rubrum')] single-internode culm cuttings. During experiment 1, cuttings were rooted for 28 days under propagation daily light integrals (PDLIs) of 4 and 10 $mol \cdot m^{-2} \cdot d^{-1}$ and with root-zone temperatures (RZTs) of 70°F, 73°F, 77°F, and 81°F.**

volume) 50% commercial soilless medium and 50% course perlite. To avoid water accumulation on the leaf blades, cuttings were sprayed to runoff with a solution containing 300 ppm of a surfactant.

Propagation DLI And RZT

Cuttings were placed on propagation benches under PDLI treatments with root-zone heating. During experiment 1, cuttings were placed under PDLIs of 4 or 10 $mol \cdot m^{-2} \cdot d^{-1}$ and during experiment 2, were placed under PDLIs of 8 or 16 $mol \cdot m^{-2} \cdot d^{-1}$. Root-zone heating environments were individually programmed to temperature set points of 70°F, 73°F, 77°F, or 81°F. The greenhouse air temperature and RH set points were 73°F and 80%, respectively.

continued on page 42

continued from page 40

At stick, mist consisting of reverse-osmosis water was controlled and applied for 6 seconds/10 minutes. After one day, misting frequency was reduced and after two days, misting frequency was adjusted for each treatment.

Mist was discontinued after 10 days and cuttings were over-head irrigated once daily with reverse-osmosis water supplemented with a water-soluble fertilizer and micronutrient supplement to provide 60 ppm N.

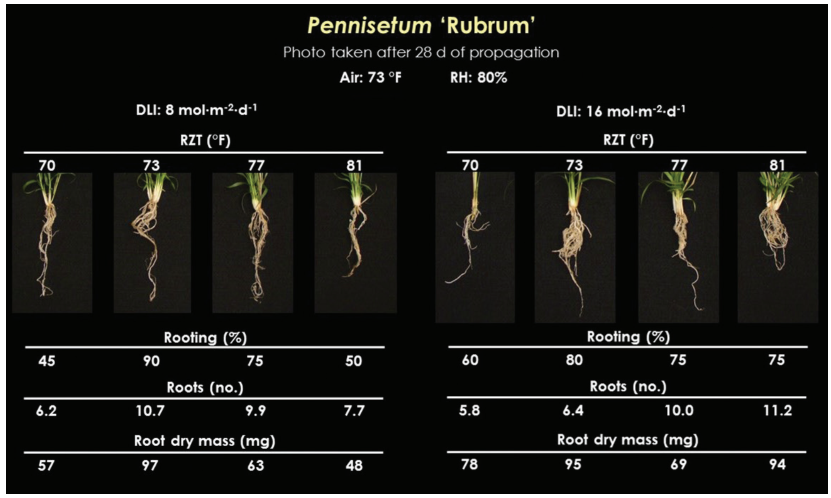

Figure 4. **Rooting percentage, average number of roots formed, and root dry mass during root development of purple fountain grass [*Pennisetum ×advena* (formerly known as *P. setaceum* 'Rubrum')] single-internode culm cuttings. During experiment 2, cuttings were rooted for 28 days under propagation daily light integrals (PDLIs) of 8 and 16 mol·m^{-2}·d^{-1} and with root-zone temperatures (RZTs) of 70°F, 73°F, 77°F, and 81°F.**

After 28 days, the percent of single-internode culm cuttings that rooted under each treatment was determined. The number of roots ≥5 mm in length that developed during propagation were counted to determine root density (number) per cutting. Root dry mass of each single-internode culm cutting was determined.

Rooting Results

In experiment 1, under a PDLI of 4 mol·m^{-2}·d^{-1}, the percentage of cuttings that rooted after 28 days increased by 73% as RZT set points increased from 70°F to 77°F, whereas rooting percentage was unaffected by RZT under a PDLI of 10 mol·m^{-2}·d^{-1} (Figure 3). When comparing a PDLI of 10 to 4 mol·m^{-2}·d^{-1}, we observed rooting percentage to increase by 55% at a RZT set point of 70°F.

In general, more roots were present on single-internode culm cutting when RZTs increased from 70°F to 81°F under each PDLI. Under a PDLI of 10 mol·m^{-2}·d^{-1}, single-internode culm cuttings developed more roots at a 73°F RZT, whereas a higher RZT of 77°F was needed to achieve similar root development under a PDLI of 4 mol·m^{-2}·d^{-1}. Compared to 4 mol·m^{-2}·d^{-1}, a PDLI of 10 mol·m^{-2}·d^{-1} resulted in the greatest root dry mass, which indicates liners would be ready or marketable sooner.

During experiment 2, the percentage of cuttings that rooted after 28 days of propagation under a PDLI of 8 mol·m⁻²·d⁻¹ increased by 100% when RZT set points increased from 70°F to 73°F, while under a PDLI of 16 mol·m⁻²·d⁻¹, rooting percentage was similar among all RZTs (Figure 4).

When PDLI increased from 8 to 16 mol·m⁻²·d⁻¹ at RZT set points of 70°F and 81°F, rooting percentage increased by 33% and 50%, respectively. When RZT increased from 70°F to 81°F, the number of roots per cutting was unaffected by a PDLI of 8 mol·m⁻²·d⁻¹ but increased by 93% under a PDLI of 16 mol·m⁻²·d⁻¹.

Root dry mass increased by 70% as RZT increased from 70°F to 73°F under a PDLI of 8 mol·m⁻²·d⁻¹, but were statistically similar among all RZTs at a PDLI of 16 mol·m⁻²·d⁻¹.

Based on these results, it is recommended that a PDLI of approximately 8 to 10 mol·m⁻²·d⁻¹ and a RZT set point of approximately 73°F to 75°F should be maintained to economically propagate purple fountain grass from single-internode culm cuttings. When PDLIs inside the greenhouse are ≤8 mol·m⁻²·d⁻¹ or ≥16 mol·m⁻²·d⁻¹, we suggest providing supplemental light or shade, respectively, to achieve the recommended PDLIs. Finally, it is possible to obtain uniform purple fountain grass liners in less than four weeks when utilizing the combination of PDLIs and RZTs described here (Figure 5). **GG**

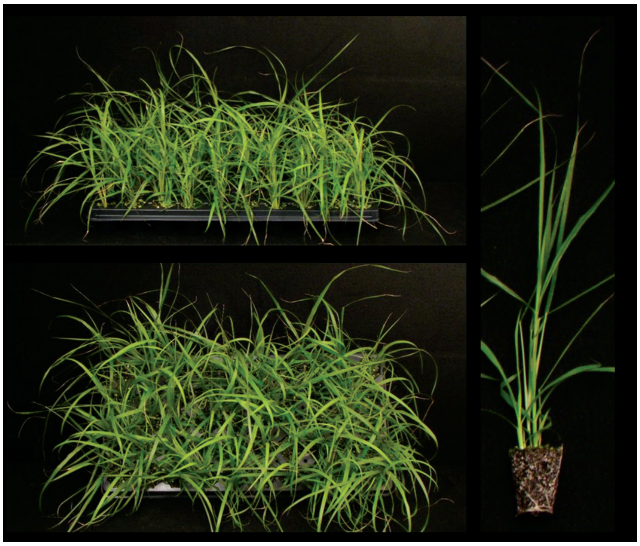

Figure 5. **A 50-cell liner tray of purple fountain grass after 28 days when single-internode culms cuttings were propagated under a PDLI of 8 mol·m⁻²·d⁻¹ and RZT of 73°F.**

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