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Stock Plant Fertilization and Cutting Storage Temperature and Duration Affect Growth of Golden Pothos Cuttings

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ABSTRACT

Cuttings of *Epipremnum aureum* (Linden & André) Bunt. (golden pothos) were collected from stock plants receiving 32 g 18N-2.6P-10.3K Osmocote per 4-liter basket or weekly or constant application of 0.83 g•liter-1 24N-3.5P-13.3K water soluble fertilizer. These cuttings were either planted immediately or subjected to three or seven days of storage at 20°, 25°, or 30°C. For unstored cuttings, weekly application of the soluble fertilizer resulted in the best cutting growth than the other two fertilizer regimes. Cuttings from stock plants receiving Osmocote and stored for three days at 20° or 25°C or seven days at 20°C produced fewer leaves than the unstored cuttings. When given the water soluble fertilizer weekly, all cuttings had normal growth except those stored at 30°C for seven days which produced fewer leaves and shorter stems than the control. With constant fertilization, cuttings stored at 20°C for three or seven days or 20° or 30°C for seven days produced inferior plants than the unstored cuttings.

RESUMEN

Estacas de *Epipremnum aureum* (Linden & André) Bunt, fueron colectadas de plantas madre. Las plantas madre estaban recibiendo 32 g de Osmocote 18N-2.6P-10.3K por maceta de 4 litros o aplicación constante o semanal de fertilizante soluble en agua en una concentración de 0.83 g•litro de 24N-3.5P-13.3K. Las estacas fueron plantadas inmediatamente o fueron almacenadas por 3 o 7 días a 20°, 25°, 30°C. En las estacas que no fueron almacenadas, la aplicación semanal de fertilizante soluble produjo mejor crecimiento que los otros dos regímenes de fertilizantes. La estacas provenientes de las plantas madre que estaban recibiendo osmocote y que fueron almacenadas por tres días a 20° o 25°C o por 7 días a 20°C produjeron menos hojas que las estacas no almacenadas. Cuando el fertilizante soluble en agua fue proporcionado semanalmente, todas las estacas tuvieron un crecimiento normal con la excepción de aquellas que fueron almacenadas a 30°C por siete días, las cuales produjeron menos hojas y tallos más cortos que las testigos. Con fertilización constante, las estacas almacenadas a 20°C por tres a siete días o 20° o 30°C por 7 días produjeron plantas de calidad inferior que las estacas no almacenadas.

The environmental conditions under which cuttings are held and shipping duration determine the quality and survival rate during propagation (Conover, 1976; Wang, 1987). Wang (1987) determined that unrooted cuttings of *Codiaeum variegatum* (croton) stored at 30°C for 15 days in darkness had more leaf abscission but longer roots after a four-week rooting period than those stored at 15° or 20°C. Using cuttings produced overseas, Poole and Conover (1988) found that cuttings of *Epipremnum aureum* 'Marble Queen' stored for four to twelve days had slower growth than the unstored cuttings. Storage temperature had no effect, however, as cuttings stored for one day at temperatures between 10° and 18°C had similar growth.

Providing proper fertilization to stock plants is necessary to ensure rapid growth of cuttings (Wang, 1990). It has not been documented whether fertilization during production affect cutting quality and growth following prolonged storage at various temperatures.

The objectives of this study were to determine the combined effects of stock plant fertilization and cutting storage temperature and duration on propagation of golden pothos.

MATERIALS AND METHODS

Single-node unrooted cuttings of *Epipremnum aureum* (golden pothos) with leaf were planted 12 in a 4-liter (30-cm diameter) hanging basket, filled with a peat-lite medium (Sunshine no. 1, Fisons Horticulture, Inc., Vancouver, BC) on 15 Nov. 1990. Pots were placed in a mist propagation bed for two weeks to promote new growth (Wang, 1990) and then moved to a greenhouse bench receiving a maximum photosynthetic photon flux (PPF) of 420 $\mu mol \cdot m^{-2} \cdot s^{-1}$. Plants were fertilized weekly with 24N-3.5P-13.3K water soluble fertilizer (Grace-Sierra Horticultural Products, Milpitas, Calif.) at 0.83 $g \cdot liter^{-1}$ until 26 Feb. 1991 when three fertilizer treatments were initiated. These treatments consisted of weekly (≈2.8 $kg \cdot m^{-3}$ medium) or constant (≈5.7 $kg \cdot m^{-3}$ medium) applications of the above water soluble fertilizer or a surface application of 32 g 18N-2.6P-10.3k Osmocote (equivalent to 8 $kg \cdot m^{-3}$ medium, 8 to 9 months release time at 21°C) per basket. Each plant had three to five leaves at the time of treatment initiation. Hanging baskets were arranged in a randomized complete block design with one pot representing an experimental unit, replicated six times.

Shoots were severed above the basal fourth node of ten vines in each basket on 24 May 1991 and cuttings were collected and counted, excluding the tips containing the uppermost fully expanded leaf (Wang and Boogher, 1988). From each of the three fertilizer treatments, seven groups of twenty-five cuttings each were randomly selected. One group was planted one cutting per 0.5-liter pot immediately following collection. The other six groups were put in separate airtight plastic bags and two bags of each were placed in three growth chambers maintained in darkness at 20°, 25°, or 30°C. At the end of three and seven days, a bag of cuttings from each fertilizer treatment was removed from growth chambers and planted. All cuttings received two weeks of misting and the 24N-3.5P-13.3k water soluble fertilizer weekly and were grown under a maximum PPF of 630 $\mu mol \cdot m^{-2} \cdot s^{-1}$ in a greenhouse until being harvested 23-25 July. Five pots, each with a single plant, represented an experimental unit and treatments were replicated five times in a randomized complete block design. Data collected for each plant included: number of leaves, stem length, shoot fresh weight, and total leaf area.

RESULTS AND DISCUSSION

The number of cuttings harvested from plants in hanging baskets were unaffected by fertilizer treatments applied to stock plants (data not presented). Similarly, a recent study has shown that cutting production was not affected by fertilizing geranium stock plants with 100 to 400 mg $N \cdot liter^{-1}$ (Ganmore-Neumann and Hagiladi, 1992).

At the 32 g/basket rate of Osmocote, cuttings stored at 20° or 25°C for three days or at 20°C for seven days produced plants with fewer leaves than unstored cuttings (Table 1). Plants from cuttings stored at 25°C for three days and at 20°C for seven days had less fresh weights and smaller total leaf areas than the controls.

When given the water soluble fertilizer weekly, plants from stored cuttings were similar to the controls, except those stored at 30°C for seven days which produced fewer

Table 1. Effects of fertilizer applied to stock plants of *Epipremnum aureum* (golden pothos) and simulated shipping duration and temperature on subsequent cutting growth. [z]

Fertilizer[y]	Incubation period (days)	Temp. (°C)	Number of leaves	Vine length (cm)	Shoot fresh weight (g)	Total leaf area (cm^2)
Osmocote	0	---	7.1 a	26.5 a	13.2 ab	203.0 abc
(32 g/pot)	3	20	6.2 c	22.9 a	13.4 ab	205.8 abc
		25	6.2 c	17.8 b	12.0 b	191.6 cd
		30	6.8 ab	24.2 a	14.4 a	217.9 ab
	7	20	6.3 bc	26.3 a	12.1 b	176.1 d
		25	6.7 abc	24.9 a	12.9 ab	195.7 bcd
		30	6.8 ab	25.4 a	14.6 a	224.5 a
Soluble Weekly	0	---	7.2 a	27.8 ab	14.5 bc	222.8 bc
(0.84 g/1)	3	20	6.8 a	30.2 a	15.8 ab	224.3 bc
		25	7.0 a	26.9 ab	15.5 ab	240.5 ab
		30	7.1 a	30.6 a	17.4 a	258.3 a
	7	20	6.9 a	30.3 a	14.2 bc	212.0 c
		25	6.7 a	30.4 a	14.1 bc	207.7 c
		30	5.6 b	22.7 b	12.5 c	198.9 c
Constant	0	---	7.9 a	38.7 a	18.9 a	269.7 ab
	3	20	6.5 c	28.2 b	15.5 cd	234.3 cd
		25	7.3 ab	29.0 b	17.2 abc	264.5 abc
		30	7.3 ab	32.5 b	18.1 ab	275.1 a
	7	20	6.7 bc	28.8 b	15.9 bcd	233.4 cd
		25	7.2 ab	34.0 ab	16.6 abc	242.1 bcd
		30	5.8 c	20.9 c	14.2 d	222.9 d
Contrast						
No storage:						
Osmocote vs soluble weekly			NS[x]	NS	NS	NS
Osmocote vs soluble constant			**	**	**	**
Soluble constant vs weekly			**	**	**	**

[z] Mean separation within columns and fertilizer treatments by Duncan's multiple range test at a = 0.05.

[y]Fertilizers were Osmocote 18N-2.6P-10K, 9 months release time at 21°C and Peters 24N-3.5P-13.3K water soluble fertilizer.

[x]NS and **, non-significant and significant at a = 0.01, respectively.

leaves. With constant fertilization, cuttings stored at 20°C for 3 days and at 20°C or 30°C for 7 days had slower growth compared to plants from fresh cuttings, producing shorter shoots with fewer leaves and less fresh weight (Table 1). Poole and Conover (1988) reported that the white variegated *Epipremnum aureum* 'Marble Queen' cuttings had slow growth following storage of 4 to 12 days.

Previous research has shown that unrooted cuttings of another tropical species, *Codiaeum variegatum*, could be stored between 15° and 30°C for up to 15 days with excellent appearance (Wang, 1987). However, cuttings stored at 30°C for 15 days lost an excessive number of leaves (31%) during rooting. Although storing *Philodendron scandens oxycardium* and *Epipremnum aureum* 'Marble Queen' for one day at temperatures between 18° and 29°C did not affect cutting growth (Poole and Conover, 1988), storing cuttings of tropical species at 30°C for an extended period will cause deterioration.

When cuttings were planted immediately following collection, those from stock plants receiving the constant application of the soluble fertilizer resulted in more vigorous cutting growth. These plants had larger and heavier shoots, more leaves, and greater total leaf area than plants from cuttings receiving the other fertilizer treatments (Table 1). Previous research (Wang, 1990) showed that cuttings obtained from stock plants given the same rate of Osmocote (32 g/basket or 8 kg•m^{-3}) resulted in similar growth as those from stock plants receiving a weekly application of the soluble fertilizer. In this study, cool weather during the winter months might have reduced the fertilizer release rate from the surface applied Osmocote, resulting in less than adequate nutrient levels in the cutting for optimal shoot growth.

It has been found that, in agromonic crops, tissue nitrogen content correlates with its respiration rate. High respiration rates of leaf, stem, and roots in *Glycine max* is directly related to elevated tissue nitrogen concentrations (Kishitani and Shibles, 1986). Although tissue N content was not analyzed in this study, previous reports have consistently shown that tissue N content of tropical foliage and flowering plants increased with increasing rates of N application during production (Conover and Poole, 1986; Lyons et al., 1987; Poole and Conover, 1976, 1981). The dark respiration rates of some tropical and subtropical plant species are found to be higher at increasing temperatures between 25° and 40°C (Todaria, 1986). In this study, the combination of applying the water soluble fertilizer (possibly resulting in high tissue N content and high respiration rate) and storage at 30°C for 7 days (possibly resulting in prolonged high respiration rate) may have depleted large amounts of the reserved nutrients, resulting in poor subsequent shoot growth of cuttings from stock plants receiving constant application of the water soluble fertilizer.

Results show that stock plants of golden pothos need to receive a constant feed of 200 ppm N or a higher rate of Osmocote than that used in this study during winter and spring to produce cuttings for rapid subsequent growth. For short shipping time (three days), cuttings stored at 30°C have equal or better growth compared to unstored ones, regardless of fertilizer rate. For shipping time as long as seven days, cuttings collected from heavily fertilized stock plant should be stored at 25°C for the best growth.

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