Table 1. The effect of ozone on petunia and geranium flowers and on poinsettia bracts and involucres.

Species	Ozone concn (μl/liter)	Anthocyanin content (Absorbance at 525nm)	Flower fresh wt (g)	Flower circumference(cm)	Bract size (cm^2)
Petunia	0	3.090a[z]	0.170a	16.0a	
	2-4	3.241a	0.172a	16.2a	
	6-8	2.451b	0.184a	16.0a	
	10-12	2.485b	0.203b	16.3a	
Geranium	0	1.822a	0.267a		
	2-4	1.660a	0.256a		
	6-8	1.635a	0.297a		
	10-12	1.274b	0.330b		
Poinsettia	0	0.613a		81a	32.1a
	2-4	0.698b		75a	27.9a
	6-8	0.757c		74a	24.9a
	10-12	0.882d		66b	19.6b

[z]Column means for each species followed by different letters are significantly different at 5% level by Newman - Keuls test.

growing in the highest level ozone. As increases in flower fresh wt did not represent an increase in flower size, ozone apparently increases water retention in flowers.

These studies indicate that low levels of ozone in the atmosphere can have an effect on color, fresh wt and size of plant inflorescences. All responses described in this paper came with no visible oxidant damage to plant leaves.

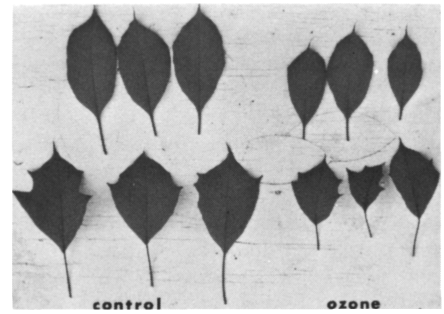

Fig. 1. Bracts from poinsettia plants treated with 10-12 μl/liter ozone for 50 days compared with control.

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Performance of Rice Hull Media for Pot Easter Lilies Under Three Forcing Systems[1]

A. E. Einert
University of Arkansas, Fayetteville

Abstract. **Potting media containing parboiled rice hulls as a sand or soil substitute were compared to a soil-sand-peat mix for the production of potted *Lilium longiflorum* Thunb. cv. Ace under 3 forcing systems: precooling (PC), natural cooling (NC), and controlled temperature forcing (CTF). Plants grown in media containing rice hulls were delayed in flowering (2-3 days) and possessed more flower buds (0.9 buds) independently of forcing system with no effect on stem ht and root dry wt at bloom time. NC and CTF reduced forcing time, and increased stem ht and flower no. over PC. Rice hulls-sand-peat mix increased leaf no. by approx 10 leaves per stem over soil-sand-peat mix under PC or NC but in soil-sand-peat mix, CTF plants had 11 to 15 more leaves per stem than PC and NC plants. Rice hulls in the potting media resulted in lighter wt and improved drainage.**

Increasing unavailability and cost of top soil for greenhouse potting mixes have contributed to the wider use of soil-less or "artificial" media. Soil-less media may provide other advantages over soil such as lighter wt, greater freedom from pathogens, and more consistent physical and chemical characteristics (11). Boodley and Sheldrake (4) have shown that a lightweight medium of 2 peat:1 perlite:1 vermiculite adequately provides moisture holding capacity as well as proper drainage for the Easter lily.

Recently, residues from lumber mills have proved successful components of floricultural potting media (1, 14) providing practical, ecologically safe, and potentially profitable disposal outlet for these byproducts. Residues from rice, sugar and lumber processing are now nationally marketed as potting mix ingredients. The present study was conducted to evaluate the performance of rice hulls, as a component of soil and soil-less media for the production of potted Easter lilies with 3 commercial forcing systems.

Non-cooled 'Ace' bulbs (7 to 8 inch) were used with each of 3 lily forcing systems (8): PC (17), NC (5) and CTF (6). The PC bulbs were cooled at 5°C for 6 weeks, potted and brought to a 18° greenhouse for forcing on Dec. 7. Bulbs for NC and CTF handling were potted and placed under the appropriate conditions on Oct. 24, 1970 and brought under forcing Dec. 22. The CTF method was modified by placing the potted bulbs in a 18° greenhouse for the rooting phase rather than in a constant temperature room.

Three potting media were used for bulbs under each forcing system. A standard mix of 1 soil:1 sand:1 peat (v/v) was compared to media in which parboiled rice hulls were used in place of the soil or sand component. The pH of each medium was adjusted to 6.8 with lime. Osmocote[2] (13.5-4.1-7.5, N-P-K) was incorporated at 3.5 kg/m^3 before planting. Only the soil was steam sterilized prior to mixing and none of the complete mixes were steamed. Preliminary investigations at this station have shown that steaming of rice hulls causes the release of reserve Mn in amounts that can be toxic to plant material. Parboiling of hulls by the producer destroys pathogens and weed seeds without releasing toxic levels of Mn.

All bulbs were placed in new 6-inch clay pots. On Dec. 22, 1970, the 9 treatments (3 media x 3 forcing systems) were established in a randomized complete block design with 6 replicates, each with 2 plants per treatment, to determine plant performance. Growth and flowering data were recorded at the end of the forcing period. Forcing time was from entry into the greenhouse following cooling treatment to anthesis of the first flower.

Potting media influenced forcing time and flower bud no. independently of forcing system but had no effect on stem length and root dry wt (Table 1).

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[2]Slow release fertilizer manufactured by Sierra Chemical Co., Newark, Calif.

Table 1. Effects of medium and forcing system on growth and flowering of 'Ace' lily.

Treatment	Forcing time (days)	No. flower buds per stem	Stem ht[y] (cm)	Root dry wt (g/plant)
Medium				
Soil, sand, peat	100 a[z]	6.28 a	18.7 a	10.8 a
Soil, hulls, peat	103 b	7.19 b	17.7 a	14.7 a
Hulls, sand, peat	102 b	7.17 b	18.6 a	10.2 a
Forcing system				
Precooling	106 a	5.6 a	16.6 a	10.0 a
Natural cooling	102 b	8.0 b	18.1 b	12.4 a
Controlled temperature forcing	97 c	7.1 b	20.2 b	13.9 a

[y]Pot rim to base of lowest flower peduncle.
[z]Means in columns within medium or forcing systems with different letters are significantly different at the 5% level. Each mean is composed of 12 plants.

There was a decrease in forcing time of 2-3 days and an increase of 0.9 buds per stem with media containing rice hulls as compared to soil-sand-peat mix but no differences within media containing rice hulls.

Plants from NC and CTF handling flowered sooner, were taller, and had more flowers than PC plants. No direct comparison between these 3 forcing systems has been previously reported. However, NC increased bud count on 'Croft' and 'Georgia' and reduced stem ht and forcing time as compared to PC (5,13) and CTF increased bud count and leaf no. on 'Ace' and 'Nellie White' with no significant effect on forcing time or plant ht as compared to PC (7). Both NC and CTF allow rooting to occur before bulb cooling and it has been suggested (5,7) that the higher bud no. with these systems is a result of earlier root development, whereby the bulb produces its max root growth potential earlier in its plant development. The present study tends to support this hypothesis since root dry wt differences at flowering were not significant (Table 1). The faster forcing of CTF grown lilies over PC plants as well as stem length differences observed in the present study may have resulted from conditions of bulb storage or the presence of light during the CTF rooting period. Days to flower and plant ht in lilies can be influenced by postharvest temp prior to bulb cooling (12), moisture content of packing material during bulb precooling (10, 16), and light duration and quality during bulb cooling (9, 18, 19).

Leaf no. was influenced by an interaction between medium and forcing system. The rice hulls-sand-peat medium increased leaf no. over the soil-sand-peat mix when plants were precooled or naturally cooled (Table 2), but no significant differences in leaf no. resulted in response to medium under CTF. In soil-sand-peat mix, CTF had an average of 13 more leaves than PC and NC plants in the same medium. This influence of forcing system on leaf production has previously been recorded (6, 7). Blaney et al. (2) demonstrated that warm storage prior to bulb cooling increases leaf no. and it is probable that the 18° rooting period

Table 2. Effect of media and forcing system on leaf no. of 'Ace' lily.

Medium	Forcing system[y] PC	NC	CTF
Soil, sand, peat	82.8 a[z]	86.5 ab	98.0 c
Soil, hulls, peat	87.0 ab	86.5 ab	92.2 bc
Hulls, sand, peat	92.0 bc	97.5 c	91.7 bc

[y]PC=precooling; NC=natural cooling; CTF=controlled temperature forcing. Means with the different letter are significantly different at the 5% level.
[z]Each mean is composed of 12 plants.

for CTF was responsible for these results. Forcing system had little effect on leaf no. within each media containing rice hulls. An increase in leaf length was also observed on CTF and NC plants over PC plants. Leaf no. is closely correlated with no. of days to flower. Leaf counting methods for timing the flowering of a crop have already been standardized for the cultivars 'Croft', 'Ace' and 'Nellie White' (3). Data from the present study indicate that media influences on leaf totals must also be considered and that media must be standardized for successful leaf counting precedures.

Media containing rice hulls retained less moisture and required more frequent watering than the soil-sand-peat mix. Rice hulls resisted decomposition and were intact after the 6 month growing period. Analyses[3] of parboiled rice hulls were as follows: N, 31 ppm; P, 12; K, 50; and Zn, 23; Ca, 25; Fe, 36; Al, 50; Mn, 722. The amounts of these elements available for plant growth has not been determined, although Spurway analysis (15) of dilute acetic acid extracts of the intact hulls detected only trace amounts of Mg and Ca. The influence of media containing rice hulls on lily growth may be either the indirect result of improved soil aeration or the possible contribution of nutrient elements, or both. Rice hulls also decreased wt of media. Average wt of clay pot, medium, and plant at maturity were: soil-sand-peat, 2584 g; soil-hulls-peat, 2098 g; and hulls-sand-peat, 2241 g.

This study shows that parboiled rice hulls can be used successfully as a component of greenhouse potting media for the Easter lily.

[3]Conducted by Wisconsin Alumni Research Foundation.

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