Fig. 1. *Magnitude of self-perceived stress reduction. The difference between perceived stress reported before and after the visit resulted in the above scores. Negative scores represent a reduction in perceived stress.*

Two important concepts emerge: 1) stress reduction is an important reason for visiting public gardens, and 2) a self-perceived reduction in stress levels results from a garden visit. These concepts provide a strong case for garden administrators in their ongoing efforts to obtain funding. Stress reduction and restoration are important services to the community that could improve the quality of life for city dwellers; these services should be emphasized by garden administrators when applying for funds from public and private sources.

Garden administrators should further use the results of this research, combined with findings from other research, in promoting their institutions to the public. Gardens should emphasize the stress-reducing and restorative qualities of the garden visit in promotional materials.

Urban public gardens provide urban residents with an exposure to nature in an environment where such exposures are rare. Administrators of public gardens must recognize the strong affects, or emotions, they produce in urban visitors and enhance the restorative experience for all their constituents.

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Release Rates of Soluble and Controlled-release Potassium Fertilizers

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Additional index words. leaching

Summary. Release rates for 13 commercially available soluble and controlled-release K fertilizers were determined in sand columns at 21°C. Potassium chloride, KMgSO_4 , and K_2CO_3 were leached completely from the columns within 3 or 4 weeks. Osmocote 0N-0P-38.3K, Multicote 9N-0P-26.7K, the two S-coated K_2SO_4 products, and Nutricote 2N-0P-30.8K Ty 180 all had similar release curves, with fairly rapid release during the first 20 to 24 weeks, slower release for the next 10 to 12 weeks, and virtually no K release thereafter.

Potassium release from Osmocotes 0N-0P-36.7K and 0N-0P-37.5K and Polyon K_2SO_4 occurred very slowly over a 2 to 3 years.

High cation-exchange capacities of most soils prevent leaching losses of soluble nutrient cations such as K^+ or Mg^{++} , but do not retard leaching of anions such as NO_3^- (Tisdale and Nelson, 1975). Controlled-release fertilizers were developed to reduce the rate of NO_3^- leaching loss (Maynard and Lorenz, 1979; Sharma, 1979). Although coated N-P-K fertilizers are used widely in container production of ornamentals, their use in landscapes or field nurseries has been limited due to their high cost and the perception that only NO_3^- is leached readily from most soils.

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Table 1. *Potassium fertilizer materials evaluated for release characteristics.*

Abbreviation	Product	K source	% K	Origin
KCL	KCl	KCl	43.3	Atlantic FEC Fert., Homestead, Fla.
LSC	S-coated K_2SO_4	S-coated K_2SO_4	32.5	Lesco Ind., Rocky River, Ohio
LUTZ	Lutz K-Mg spike	K_2SO_4	17.5	Lutz Corp., Oregon, Ill.
MAG	MagAmp (med. grade)	$MgKPO_4$	4.2	The Scotts Co., Marysville, Ohio
MULTI	Multicote 9-0-26.7	Resin-coated KNO_3	26.7	Haifa Chemicals Ltd, Haifa, Israel
NUTR-A	Nutricote 2-0-30.8, Ty 180	Resin-coated K_2SO_4	30.8	Chisso-Asahi Fert. Co., Tokyo
NUTR-B	Nutricote 2-0-30.8, Ty 360	Resin-coated K_2SO_4	30.8	Chisso-Asahi Fert. Co.
OSM-A	Osmocote 0-0-36.7	Resin-coated K_2SO_4	36.7	The Scotts Co.
OSM-B	Osmocote 0-0-37.5	Resin-coated K_2SO_4	37.5	The Scotts Co.
OSM-C	Osmocote 0-0-38.3	Resin-coated K_2SO_4	38.3	The Scotts Co.
PCARB	K_2CO_3	K_2CO_3	25.0	Liquid Ag Systems, Pompano Beach, Fla.
PMS	$K_2SO_4 \cdot MgSO_4$	$K_2SO_4 \cdot MgSO_4$	15.2	Atlantic FEC Fertilizers
POLY	Polyon K2SO4	Resin-coated K_2SO_4	37.5	Pursell Ind., Sylacauga, Ala.
PSC	S-coated K_2SO_4	S-coated K_2SO_4	32.5	Pursell Ind.

Many soils in southeastern United States are sandy, highly leached, and often deficient in K (Tisdale and Nelson, 1975). Soluble K fertilizers applied to these soils can be lost quickly due to leaching (Broschat, 1995). Controlled-release K sources reduce K leaching losses in sandy soils and have effectively treated and prevented K deficiencies in palms and other tropical ornamental plants (Broschat, 1989).

Landscape fertilizers developed for clay-containing soils often contain controlled-release N sources, blended with soluble K sources. If these fertilizers are applied to sandy soils having very low cation-exchange capacity, any rainfall or irrigation will quickly alter the effective N and K application rates due to differential leaching of the soluble K, but not the controlled-release N. Using these fertilizers on highly leached sandy soils can induce or accentuate preexisting K deficiencies in palms (Broschat, 1989). Therefore, it is important that blended landscape fertilizers for use on such soils have appropriate N : K ratios initially and also over time. This can be achieved only by blending N and K fertilizer sources that have similar release characteristics.

Nitrogen release rates of commercially available controlled release N fertilizers have been documented (Allen et al., 1971; Oertli and Lunt, 1962; Patel and Sharma, 1977; Prasad and Woods, 1971). Holcomb (1981) and Oertli and Lunt (1962) determined K release rates from controlled-release N-P-K fertilizers, but controlled-release fertilizers developed primarily as K sources have become readily available only within the last

decade. The purpose of this study was to determine the release rates of commercially available K fertilizers.

Materials and methods

PVC columns measuring 300 mm long $\times$ 51 mm i.d. were mounted vertically into 70-mm-diameter Buchner funnels that were supported by special funnel support racks. Columns were filled to a depth of 28 cm with medium grade N HCl-washed silica sand and maintained at $21 \pm 1^\circ\text{C}$. Five grams of each of the 14 K fertilizers listed in Table 1 were applied to the sand surface of three replicate columns and were mixed into the top 1 cm of sand. Columns were irrigated with 50 ml of deionized water three times per week, and all leachates were collected in 500-ml polyethylene beakers. Once a week the leachate volumes were measured, and the samples were analyzed for K concentrations using atomic absorption spectrophotometry. Three replicate control columns containing no fertilizer also were included in this study, and their mean K content was subtracted from all treatment column data. The amount of K in each sample was divided by the percentage of K in each fertilizer material to correct for differences in percentage of K in each product. Results were expressed as milligrams of K released per week per gram applied, and as the cumulative percentage of applied K released over time.

Results and discussion

All of the soluble K fertilizer sources (KCL, PMS, and PCARB) were completely exhausted after 4 weeks; 80% or more of the applied K from

KCL and PCARB leached within 2 weeks of application (Figs. 1B and 2B). The LUTZ spikes released at a rather uniform rate up through 8 weeks, with little K available after that time (Fig. 2B).

The controlled release K sources varied considerably in their release rates. Potassium was released quickly from MAG during the first 2 weeks, but at a much slower rate thereafter through about 25 weeks (Fig. 2C). OSM-C, PSC, LSC, NUTR-A, and MULTI had similar K release curves, with fairly rapid release during the first 20 to 24 weeks, slower release during the next 10 to 12 weeks, and virtually no release thereafter (Fig. 2A, C, and D). NUTR-B released K at a uniform rate until about 50 weeks, but continued at a slower rate for another year (Fig. 2D). OSM-B released K at a fairly uniform rate through 100 weeks (Fig. 2D) and continued at a slower rate for an additional 20 weeks (third-year data not shown). OSM-A released K very slowly, but uniformly for over 3 years (third-year data not shown), while POLY released at an extremely slow rate over 2 years (Fig. 2A and C).

Products also varied with respect to the percentage of their K content that was ever released (Fig. 1A-D). Between 80% and 92% of the K in the water-soluble products KCL, PMS, and PCARB was recovered in the column leachates. Among the controlled-release products, <20% of the K from POLY was ever recovered in the leachate. On the other hand, about 95% of the K was recovered from OSM-C. Most controlled-release products released between 75% and 85% of their K in this study, although some, such as OSM-A,

Fig. 1. Cumulative K released from soluble and controlled-release K fertilizers incubated in sand at 21C.

required about 3 years to do so.

The manufacturer of NUTR-A stated that this product has a 180-day release period. This study confirms that, after 24 to 28 weeks, this product no longer released significant amounts of K (Figs. 1C and 2C). NUTR-B was claimed to release over 360 days, and these data support that claim. The effective life of OSM-C at 21C was claimed to be 3 to 4 months, but our data indicate that this material provides K for about 5 to 6 months (Figs. 1A and 2A). Similarly, OSM-B was advertised as an 8- to 9-month product, but in this study it continued to release K for about 2 years (Figs. 1D and 2D). OSM-A, a 12- to 14-month product, was even slower in its release, with consistent release over 3 years (Figs. 1A and 2A). OSM-A and OSM-B may be useful for long-term prevention of K deficiencies in sandy soil landscapes, but their release rate is too slow to be effective in treating existing K deficiencies (unpublished data). Although soil K requirements have been established for relatively few ornamental plant species, relating controlled-release fertilizer release rates to plant requirements is difficult due to wide variations in soil characteristics and rainfall or irrigation intensities.

Although the manufacturers of the S-coated K_2SO_4 products (PSC and LSC) do not give estimated longevities for their products, our data suggest that 20 to 24 weeks may be a useful life for these materials. The release rates for these S-coated K_2SO_4 sources under constant 21C temperatures were similar to those reported by Snyder and Gascho (1976) for S-coated KCl and urea under field conditions in southern Florida. The Lutz K-Mg spikes tested were claimed to provide nutrients for up to 1 year, but our data suggest that, by 8 weeks, virtually all K release had stopped. POLY was an experimental product at the time of testing and this study showed that its release rate was much too slow to be an effective K fertilizer. The MAG used in this study was claimed to last for 10 to

Fig. 2. Weekly K release from soluble and controlled-release K fertilizers incubated in sand at 21C.

20 weeks under frequent irrigation. Although >50% of the K in this product was released within the first 4 weeks of our study, there was still some K released after 20 weeks of incubation. Holcomb (1981) also reported the rapid initial release of K from MagAmp, although his study was terminated after 12 weeks when this material was still releasing K.

One of the primary objectives of this study was to obtain release curves for K fertilizers for comparison to those available for controlled-release N fertilizers. However, Patel and Sharma (1977), Prasad and Woods (1971), and Allen et al., (1971) terminated their studies after 17, 14, and 16 weeks, respectively, while many of the materials were still releasing N actively. Thus the effective life of the N sources they tested cannot be determined from their data.

In summary, although soluble K fertilizers like KCL, PMS, and PCARB are leached rapidly through sand, most controlled-release K fertilizers released K over a period of about 5 months. Exceptions included OSM-A, OSM-B, and POLY, which released K very slowly over 2 to 3 years. The 5-month life of most controlled-release K products is comparable to several controlled-release N products currently marketed in the United States for fertilizer blending purposes.

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Yield and Quality Attributes of Rainfed Green Immature Corn in Trinidad

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Additional index words. two-dimensional partitioning, maize, *Zea mays*, Creole seasoning

Summary. Three local varietal types of corn (*Zea mays* L.)—an improved landrace 'ICTA Farm Corn' derived from the Tuson population, the open-pollinated 'Across 7728', and the hybrid 'Pioneer 3098'—were grown at three cash-crop farms in Trinidad, and evaluated as green corn for agronomic, quality, and chemical traits. 'Pioneer 3098' and 'ICTA Farm Corn' had similar numbers of marketable ears and marketable yield per hectare, and both were superior to 'Across 7728'. Sensory evaluations revealed that the three varieties did not differ in overall quality when boiled with Creole seasoning. When ears were not seasoned, the hybrid variety was preferred over the two open-pollinated varieties. Two-dimensional partitioning indicated that ear appearance and kernel color were the major contributors to total variation in overall quality. The importance of quality characters of green corn to local farming system priorities affects extension recommendations and breeding objectives in Trinidad.

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