Although conductivity readings were similar between the S. Gro and O.S. and Os + T.N. treatments, the shoot and root growth of areca palm was much less with S. Gro. It would appear that the low pH could have been a contributing and, perhaps major, factor in the response inasmuch as low pH has been associated with poor growth of areca palms (3). Ixora, by contrast, grew best at the lowest pH (S. Gro).

The only clear difference in any factor evaluated which may have been caused specifically by the addition of micronutrients occurred in the quality ranking of schefflera between Os and Os + T.N. (Table 1). However, this difference was not observed between P.G. and P.G. + T.N. These results indicate that there was probably enough micronutrient "contamination" of the various chemicals used in the manufacture of these fertilizers to supply most plant needs in a small container over a time span such as was used in this experiment so that the addition of supplemental micronutrients was not important. However, plants requiring longer growing periods will likely require the addition of some kind of micronutrient component for proper growth.

The efficiency of nutrient uptake from various slow release fertilizers for ornamental plants varies between plant species. Through natural selection plants have developed fairly specific physical requirements for optimal growth such as soil type, soil pH, soluble salts, and nutrient availability. Thus for plants adapted to acid conditions such as ixora and podocarpus, acid fertilizers were superior to others in this test. Other plants, such as areca palms, which require more nearly neutral soil conditions, did not respond as well to the more acid fertilizers. Two nitrogen sources, Osmocote and Sure-Gro showed the most consistent results in providing adequate nutrient levels to container-grown ornamental plants, although in some cases specific plant species may have responded better to another fertilizer tested.

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# EFFECTS OF OXADIAZON PREEMERGENCE HERBICIDE ON WEED CONTROL AND GROWTH OF SIXTEEN SPECIES OF CONTAINERIZED ORNAMENTAL PLANTS[1]


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*Abstract.* **Oxadiazon (Ronstar(R))[2] 2G (2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl) $-\Delta^2$ -1,3,4 oxadiazoline-t-one) was applied at rates of 0, 2.24, 4.48, and 8.96 kg a.i./ha (0,1,4, and 8 lbs a.i./acre), 4 times at 6 week intervals to 16 species of ornamentals growing in 15.2 cm diam. plastic containers during the spring and summer of 1977. Plants were:** Araucaria heterophylla **Franco (Norfolk Island pine),** Asparagus densiflorus **Jessop (Sprengeri Fern);** Brassaia actinophylla **Endl. (schefflera);** Chrysalidocarpus lutescens **H. Wendl. (areca palm);** Citrus **(seedling 'Temple' orange)[3];** Codiaeum variegatum **Blume (croton);** Eriobotrya japonica **Lindl. (loquat);** Eugenia uniflora **L. (Surinam Cherry);** Ficus benjamina **L. (Benjamin Fig);** Gardenia jasminoides **Ellis (gardenia);** Ixora coccinea **L. (red ixora);** Ligustrum japonicum **Thunb. (ligustrum 'recurvifolia');** Livistona chinensis **R. Br. ex Mart. (Chinese Fan Palm);** Murraya paniculata **Jack (orange jasmine);** Podocarpus macrophylla **D. Don (podocarpus);** Severina buxifolia **Ten. (Chinese Box Orange). With the exceptions of** Gardenia, Livistona, **and** Podocarpus, **none of the plants were affected by any treatment. The growth index (G.I.; (ht + width) ÷ 2) of** Gardenia **treated with 8.96 kg rate was greater (P = .05) than those of the other rates, while the G.I.'s of** Livistona **at the 2.24 and 4.48 kg rates were greater than the 0 or 8.96 kg rates, which were similar to each other. All G.I.'s of** Podocarpus **were similar and larger than that of the 0 rate. Weeds harvested from treatments averaged 2.8 g/pot for the 0 rate; 0.8 g/pot at 2.4 kg; 0.6 g/pot at 4.5 kg; and 0.1 g/pot at 9.0 kg. Weed genera controlled were identified and their frequency of occurrence in the treatment replicates were tabulated; control of** Pilea **was 100% at all rates above 0.**


Weed control is essential in the efficient, profitable prodution of both container grown and field grown ornamental plants. Weeds effectively compete for fertilizer, light and water needed by the ornamental, and some weeds secrete inhibitory (alleolopathic) substances which further retard the growth of the ornamental (2, 7, 9, 13). Container grown plants are particularly vulnerable to competition because their root systems are very restricted.

Hand weeding is very expensive, with costs being estimated as much as $8,800/ha/year ($3,560/acre/year) (5). Considerable work on the use preemergence-type herbicides on ornamental plants has been done in various states including Florida, and results indicate that certain materials can be used effectively and safely on certain species at great cost savings (5, 10, 11). However, the use of any pesticide (herbicides are classified as pesticides) for other than a use specified on the label is a violation of the law, and no preemergence-type herbicides have been labeled for use on container grown ornamental plants as of late 1977.

Research is being done with preemergence herbicides to establish phytotoxicity and efficacy data which are necessary to labeling procedures. Oxadiazon is one of several preemergence herbicides which has been investigated by other researchers (5, 10, 11, 13, 14) as having potential for use on containerized ornamentals. This paper describes work done

[1]Florida Agricultural Experiment Station Journal Series No. 870.

[2]Mention of a trademark name should not be contrued an endorsement of one proprietary product by the University of Florida over another one possessing equivalent characteristics.

[3]'Temple' is a reputed tangor (tangerine x orange). Ed.

at the Agricultural Research Center, Fort Lauderdale, with oxadiazon on 16 species of ornamentals in containers.

## Materials and Methods

Well established plants of the 16 species listed above growing in 15.2 cm (6 inch) diam. black plastic gallon containers were used in the expt. Plants were grown in a soil mix containing 25% sand, 50% peat, and 25% muck. Osmocote[R] (18-6-12) fertilizer was supplied to the plants at an annual rate of 2,800 kg N/ha (2,500 lbs N/a (approx. 32g/ "gallon" pot/year). Well water was supplied by overhead irrigation. The experiment was conducted in full sun on a hard-surfaced area. Treatments consisted of applications of oxadiazon 2G at rates of 0, 2.2, 4.5, and 9.0 kg a.i./ha (0,2,4, and 8 lbs a.i./a), equivalent to 0, 204.3, 408.6, and 817.2 mg of the 2G formulation/pot, every 6 weeks repeated 4 times. Treatment dates were March 1, April 15, June 6, and July 20. Ten replicates of each treatment were arranged in a randomized complete block design.

The ht of above the soil and the greatest width of each plant were measured March 1 and again August 12. A growth index (G.I.) was computed at each date for each plant by dividing the sum of the ht and the width by 2. The difference between the initial G.I. and final G.I. was used as a measure of plant growth; comparisons between these differences were made with analysis of variance, with Duncan's multiple range test being used to separate treatment effects at the $p=0.05$ level.

The plants were all hand weeded before the experiment began. Plants were weeded at its conclusion, and the weeds from each treatment replication (all weeds harvested from all 16 plants in the rep.) were weighed and identified. If a given species of weed was found in 1 replication of a given treatment rate, then it was assigned a frequency score of 10%. If the same species were found in 6 replicates, then it scored 60%, and so on. Weed infestation of the pots was left to airborne seed in this experiment.

## Results and Discussion

With the exceptions of gardenia, Chinese Fan Palm, and podocarpus, none of the plants were affected by any treatment (Table 1). The growth of gardenia treated with 9 kg rate was greater than growth at the other rates. Chinese Fan Palm growth was promoted at the 2.2 and 4.5 kg rates, while growth at the 9 kg rate was similar to that of the control, Growth of podocarpus was promoted at all rates above the control.

Weeds harvested from the treatments averaged 2.8 g/pot for the control group, 0.8 g at the 2.4 kg rate, 0.6 g at the 4.5 kg rate, and 0.1 g at the 9 kg rate (Table 2). At higher rates, sedges and spurges (*Cyperus sp.* and *Euphorbia sp.*) were partially controlled. Dog fennel (*Eupatorium sp.*) was controlled at the 2 highest rates. Artillery fern (*Pilea sp.*) pigweed (*Amaranthus sp.*), and sow thistle (*Sonchus sp.*) were not observed in any herbicide-treated replicates, but were found in control replicates.

Table 1. Effect on the change of growth index (Ht + Width) of 4 applications of oxadiazon preemergence herbicide applied at 2.2, 4.5, and 9.0 kg a.i./ha every 6 weeks on 16 species of ornamental plants.

| Species | Change in Growth Index in 32 weeks, application rate in kg a.i/ha | | | |
|---|---|---|---|---|
| | 0 | 2.24 | 4.8 | 8.96 |
| Norfolk Island Pine | 8.2[z] | 8.4 | 6.7 | 7.2 |
| Sprengeri Asparagus Fern | 38.9 | 30.8 | 34.5 | 34.2 |
| Schefflera | 9.5 | 7.0 | 10.8 | 7.9 |
| Areca palm | 3.8 | 2.5 | 6.3 | 2.5 |
| Seedling 'Temple' | 7.4 | 7.2 | 10.0 | 6.6 |
| Croton | 3.2 | 7.2 | 9.5 | 7.9 |
| Loquat | 19.5 | 19.7 | 22.1 | 23.4 |
| Surinam Cherry | 25.2 | 23.0 | 23.7 | 24.1 |
| Benjamin Fig | 7.4 | 7.4 | 6.0 | 8.6 |
| Gardenia | 10.8b | 13.2b | 12.0b | 18.8a |
| Red ixora | 10.1 | 15.2 | 17.2 | 15.0 |
| Ligustrum | 15.0 | 18.9 | 19.0 | 15.8 |
| Chinese Fan Palm | 0.2b | 42.4a | 40.2a | 0.2b |
| Orange jasmine | 16.5 | 16.8 | 11.6 | 20.5 |
| Podocarpus | 10.6b | 18.9a | 17.4a | 20.8a |
| Chinese Box Orange | 2.5 | 1.9 | 3.3 | 2.6 |

[z]Means followed by no letters or the same letters do not differ at the $p=0.05$ level according to Duncans Multiple Range Test.

Table 2. Weights and frequency of occurrence of genera of weeds harvested from ornamental plants treated with oxadiazon 4 times at 8 week intervals at rates of 2.2, 4.5, and 9.0 kg a.i./ha.

| Weed genus | 0 Kg freq. score % | 2.2 Kg freq. score % 238.3 (.80) | 4.5 Kg freq. score % 91.3 (.57) | 9.0 Kg freq. score % 15.2 (.10) |
|---|---|---|---|---|
| Cypress sp (Sedge) | 90 | 90 | 60 | 20 |
| Pilea sp (Artillery Fern) | 60 | 0 | 0 | 0 |
| Euphorbia sp. (Spurge) | 90 | 70 | 30 | 30 |
| Eupatorium (Dog Fennel) | 30 | 40 | 0 | 0 |
| Panicum sp. (Torpedograss) | 10 | 0 | 10 | 0 |
| Digitaria sp. (Crabgrass) | 10 | 0 | 10 | 0 |
| Dichondra sp. (Dichondra) | 20 | 0 | 10 | 10 |
| Begonia sp. (Begonia) | 10 | 0 | 0 | 10 |
| Amaranthus sp. (Pigweed) | 10 | 0 | 0 | 0 |
| Sonchus sp. (Prickly lettuce) | 20 | 0 | 0 | 0 |
| Bidens sp. (Spanish Needles) | 10 | 0 | 0 | 0 |
| Oxalis sp. (Oxalis) | 20 | 0 | 10 | 10 |
| Erigeron annunus (fleabane) | 20 | 0 | 0 | 0 |
| Echinochloa (Barnyardgrass) | 10 | 0 | 0 | 0 |
| Abrus (Rosary pea) | 10 | 10 | 0 | 0 |
| Eugeron canadensis (Horseweed) | 10 | 0 | 10 | 0 |
| Mollugo (Carpetweed) | 10 | 10 | 0 | 0 |
| Unidentified Grasses | 70 | 10 | 40 | 30 |
| Unidentified Broadleaf | 70 | 50 | 30 | 10 |
| Average weight of weeds harvested per pot in grams | 2.8 | 0.8 | 0.6 | 0.1 |

The promotion of growth of certain herbicide treated plants has been observed by other researchers (1, 12, 13). Reduced competition of weeds may be a factor in some of these reports, but other work has shown that certain herbicides can exert growth regulatory effects (4) or can reduce the severity of plant disease either by inhibiting disease organisms in the soil (3, 6, 8) or by modifying plant growth so that the plant is less susceptable to attack (1). Whether these or other factors were operative in this experiment was not ascertained; that poses a question for future research.

Oxadiazon was shown to reduce weed growth 72% at the lowest rate and by 96% at the highest rate with no detrimental effects on the growth of any of the species used in this experiment. The growth of 3 species was actually improved by treatments.

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