Table 3. Phytotoxicity evaluations of insecticides applied to woody ornamental plants.

Plant Species	Insecticides											
	Baygon		Temik		Phosvel E.C.		Phosvel W.P.		Orthene		Meta-Systox-R	
	1X	4X	1X	4X	1X	4X	1X	4X	1X	4X	1X	4X
Carissa grandiflora	0	0	0	0	0	2+	0	0	0	0	0	0
Eriobutrya japonica	2x	4**	0	2*	0	4x	0	3*	0	2x	0	3**
Euonymus japonicus	0	2x	0	0	1x	2x	0	0	0	0	0	0
Juniperus chinensis	0	0	0	0	0	0	0	0	0	0	0	0
Ligustrum japonicum	0	2*	0	0	0	0	0	0	0	0	0	0
Phoenix canariensis	0	0	0	0	0	0	0	0	0	0	0	0
Pittosporum tobira (Green)	0	3xx	0	0	0	3+	0	0	0	0	0	0
Pittosporum tobira (Varigated)	0	2*	0	0	0*	2*	0	0	0	0	0	0
Podocarpus macrophylla	0	1*	0	0	0	0	0	0	0	0	0	0
Rhododendron indicum	1x	3x	0	0	1+	3+	0	1*	0	0	0	0
Sabal palmetto	0	0	0	0	0	0	0	0	0	0	0	0
Viburnum suspensum	0	0	0	0	0	0	0	0	0	0	0	0

0 = no damage, 1 = very slight damage, 2 = slight damage, 3 = moderate damage, 4 = severe damage, 5 = very severe damage

* = leaf deformity, x = burn, + = chlorosis, ** = leaf deformity and burn, xx = deformity and chlorosis

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DEACTIVATION OF KERB WITH SEWAGE SLUDGE, TOPDRESSING AND ACTIVATED CHARCOAL

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Abstract. **Factorial combinations of sewage sludge, topdressing and activated charcoal were evaluated for effectiveness in deactivating 3,5-Dichloro-N-(1,1-dimenthyl-2-propnyl) benzamide (Kerb), a pre- and post-emergence herbicide used for Poa annua control. Treatments were applied immediately after application of Kerb and treated areas then seeded with Medalist II ryegrass as a bioassay for effectiveness. Sewage sludge was ineffective in deactivating Kerb and hindered adsorbing ability of charcoal. Topdressing provided some benefit, possibly by improving environmental conditions or by forming a physical barrier between Kerb and ryegrass seedlings. All levels of activated charcoal deactivated Kerb with effectiveness dependent upon quantity used.**

Annual bluegrass (*Poa annua*) is a major weed problem on most golf courses throughout Florida and the entire United States. Appearance

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of this grass on golf courses during winter months produces unsightly fairways and greens with poor putting surfaces. Rapid death of *Poa annua* during spring transition also leaves areas of thin, worn bermudagrass, weeds and/or bare soil which are unsightly and undesirable. These problems have made *Poa annua* control necessary for quality and proper winter playing conditions of golf greens.

Several cultural techniques and herbicides have been tested with little success in an effort to control *Poa annua*, except for 3,5-Dichloro-N-(1, 1-dimenthyl-2-propnyl) benzamide (Kerb). However, kerb has a long residual toxic effect to overseeded coolseason grasses used to maintain winter color and quality of putting surfaces in Florida, necessitating a 60-day waiting period between application of Kerb and subsequent overseeding.

Use of activated charcoal for adsorption and subsequent detoxification of undesirable chemicals recently has been investigated (2,3). Jagschitz (5) reported no harmful effects by charcoal to soil or plant materials in experimental and field studies and Jordan (6) found that activated charcoal could adsorb up to 97% of a tested material. Anderson (1) reduced damage to oats caused by high concentrations of simazine and linuron by activated charcoal application.

Topdressing and Milorganite (activated sewage sludge) applied to herbicide-treated soil prior to overseeding reportedly minimized detrimental residual effects of some herbicides (4).

Methods and Materials

A 2x2x3x3 factorial experiment with treatments replicated three times was initiated October 14, 1972, at the Horticultural Research Unit, Gainesville on established Tifgreen-328 bermudagrass maintained under putting green conditions. Effects of topdressing, Milorganite and activated charcoal, on deactivating herbicidal properties of Kerb when applied with Kerb immediately prior to overseeding were determined. Treatments were terminated after 7 weeks on December 2, 1972.

A split-split-split plot design was used with topdressing as whole plots, Milorganite as sub plots, Kerb as sub-sub plots and activated charcoal as sub-sub-sub plots. Kerb, a 1% granular material, was applied at rates of 0, 1 and 2 lbs. ai/A with a Scott's drop-type spreader. Norit-Ex activated charcoal was applied immediately after application of Kerb at 2.5, 5.0 and 10.0 lbs./1000 ft.^{2} The charcoal which had a bulk density of 14 lbs./ft.^{3} and a surface area (B.E.T.) of 950 m^2/g was applied as a spray slurry with an 8003 T-jet band nozzle at 20 psi in 10 gals. of water/1000 ft.^{2} for the low level of charcoal and 40 gals./1000 ft.^{2} for the high level of charcoal. A water hose with a standard nozzle was used to wash adhering charcoal off plant parts into the sod. Milorganite at 0 and 20 lbs./1000 ft.^{2} was applied with a Gandy drop-type spreader after the area was dry. This was followed by 0 and 0.25 in. topdressing applied with a Ryan Spread-Rite topdressing machine and hand raked into the grass.

Following treatments the test area was uniformly overseeded with Medalist II ryegrass at the rate of 50 lbs./1000 ft.^{2} using a Scott's drop-type spreader. They were then hand brushed into the turf. The test area was not mowed during the experiment to facilitate seedling counts and to eliminate possible detrimental effects to seedling from mowing and to emphasize treatment differences.

Three plugs were taken at random from each plot at the termination of the experiment with a standard soil probe and ryegrass seedlings counted and averaged. Duncan's Multiple Range Test was used for treatment comparisons.

Results and Discussion

Herbicidal toxicity to ryegrass seedlings was greatly reduced by applications of activated charcoal and to a lesser extent by Milorganite and topdressing (Tables 1 and 2). Apparently herbicide molecules were adsorbed to inner surfaces of the charcoal which allowed germination and growth of most ryegrass seedlings.

Milorganite did not deactivate Kerb and apparently hindered absorbing ability of charcoal permitting higher levels of herbicide to remain active in the soil as indicated, by numerial comparisons, between Milorganite and non-Milorganite treatments (Table 1).

High seedling counts at the zero level of Kerb and 2.5 lb. rate of charcoal in the presence of Milorganite were probably due to enhancing effects by Milorganite on conditions necessary for germination. Detrimental effects of Milorganite were substantiated since its use in the mixture required the 5.0 lb. rate of charcoal to deactivate 1.0 lb. ai/A Kerb, compared to the Kerb check, whereas only 2.5 lbs. charcoal was required when Milorganite was not used.

Topdressing provided some benefit in deactivating Kerb possibly by improving environmental conditions necessary for germination or by forming a physical barrier between the herbicide and the

Table 1. Interaction effects of Kerb, charcoal, and Milorganite on number of ryegrass seedlings/in.[2z]

	lbs. Milorganite/1000 ft.^{2}					
	0			20		
	lbs. charcoal/1000 ft.^{2}			lbs. charcoal/1000 ft.^{2}		
lbs. ai/A Kerb	2.5	5.0	10.0	2.5	5.0	10.0
0	30.56abc	34.53a	34.03a	33.59a	31.00ab	30.47abc
1	29.56abc	30.49abc	31.54ab	25.97cd	30.34abc	30.91abc
2	13.14e	28.30bc	32.66ab	9.04e	28.10bcd	32.76ab

[z]Means within rows and columns having letters in common are not significantly different at the 1% level by Duncan's Multiple Range Test.

Table 2. Interaction effects of Kerb, topdressing, and charcoal on number of ryegrass seedlings/in.[2z]

	No Topdressing			0.25 in. Topdressing		
	lbs. charcoal/1000 ft.^{2}			lbs. charcoal/1000 ft.^{2}		
lbs. ai/A Kerb	2.5	5.0	10.0	2.5	5.0	10.0
0	31.98ab	31.89ab	29.92abcd	32.17abc	33.64ab	34.59a
1	26.52cd	30.07abcd	30.43abc	29.00cd	30.77abc	32.65ab
2	8.53g	25.55de	32.53abc	13.56f	30.85abc	32.89ab

[z]Means within rows and columns having letters in common are not significantly different at the 1% level by Duncan's Multiple Range Test.

grass seedlings (Table 2).

There was no difference in seedling counts obtained with and without topdressing for similar rates of charcoal at the 0 to 1.0 lb. ai/A rate of Kerb, but numerical counts were higher where topdressing was used. Benefits from topdressing are most evident at the 2.0 lbs. ai/A rate of Kerb. Without topdressing 10.0 lbs. of charcoal were required to produce seedling counts comparable to those at the zero level of Kerb whereas only 5.0 lbs. were required when topdressing was used.

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