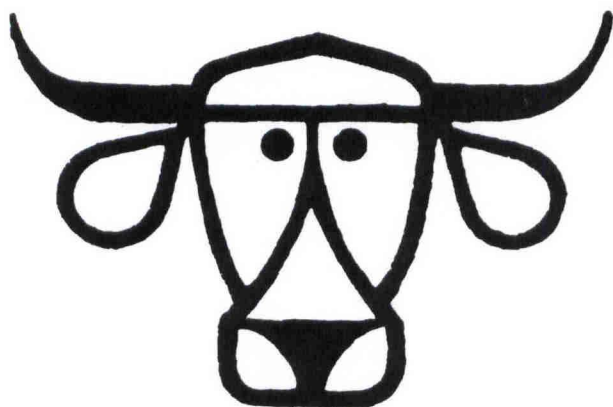




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PHYTOTOXICITY OF LEACHATE FROM COASTAL BERMUDAGRASS ROOTS
ON GERMINATION AND ROOT GROWTH OF GRASS AND CLOVER

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SUMMARY

Coastal bermudagrass roots were soaked in distilled water for either 24 or 48 hours. Leachate was filtered and utilized to wet germination pads. Four grass species (Gulf ryegrass, Bradford and Coker 762 wheat and Mesquite oats) and three clovers (Chief crimson, Yuchi arrowleaf, and Mt. Barker sub. clover) were treated with distilled water, 24 hours leachate and 48 hour leachate. Results from this study indicate that germination of the grass or clover was not reduced by the leachate. In addition, root length of the grass species was not reduced by the leachate compared to the control.

INTRODUCTION

During the past few years there has been an increasing interest and research on allelopathy. Allelopathy is the injurious or toxic effects on plants caused by release of toxic substance or compounds from other plants. Many species release toxic chemicals that will not allow certain other plants to grow within that area (3). Hoveland (2) studied the effect of root extract (ground root tissues) of bermudagrass, bahiagrass, dalligrass, johnsongrass, sorghum alnum and tall fescue on germinating seed of white, ball, crimson clover, and alfalfa. He reported that johnsongrass and sorghum alnum extracts caused the most severe reduction in germination and seedling vigor. Bermudagrass was the next most toxic grass followed by dalligrass and bahiagrass, with tall fescue having little effect. Germinating clover seedlings reacted differently to source of extract. Cope (1) studied the effect of leachate from germinating seed of eight grass and clover species on all eight species. Germination and seedling growth of a species was not inhibited by leachate from its own seeds. There was no phytotoxicity of any grass to other grass species. Cope found that leachate from one commercial lot of annual ryegrass seed almost completely inhibited germination and root growth of each of the legumes. Other cultivars of ryegrass varied in their phytotoxicity of their leachate. The objectives of this study were to determine if leachate from Coastal bermudagrass roots would delay or reduce germination of wheat, ryegrass, oats or clovers and to determine whether leachate from Coastal bermudagrass would affect seedling root length of the above species.

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KEYWORDS: Leachate/ germination/ wheat/ oats/ clovers

PROCEDURE

Coastal bermudagrass roots and rhyiomes were collected and washed in distilled water. Leaf blades were partly removed, leaving approximately 3 cm. At a ratio of 100 g plant material per liter of water, the bermudagrass was soaked in distilled water. Treatment #1 was distilled water which was a control; treatment #2 was the bermudagrass soaked for 24 hrs; and treatment #3 was a 48 hr soak. Once the plant material had soaked the respective time it was removed and the leachate filtered through a medium-fast qualitative filter paper and stored at 4°C. Seeds were germinated in petri dishes on germination pads. Twenty-five seed per petri dish were watered with 5 mls of fresh leachate of the respective treatments. Each dish was randomly placed (within a replication) in a seed germinator for 50-60 hrs at 22°C. Percent germination was determined at this time. The grass seedlings were given an additional 5 ml of leachate to prevent drying and returned to the germinator. Root lengths were then determined in 24-48 hrs.

This study was observed in 5 replications (blocks), 3 treatments and 7 varieties. The study was conducted in September and repeated in December to determine if leachate from dormant bermudagrass would be different than leachate from actively growing bermudagrass.

In order to make comparisons between the 3 treatments the percent seed germinated from the distilled water treatments were given the value of 100 percent. The other treatments were a percentage of that and in some cases were greater than the control or greater than 100%.

RESULTS AND DISCUSSION

Percent germination: Although there was some slight variation, there was no significant difference for percent germination caused by leachates from bermudagrass (Table 1.). This was true for leachate from both the active and dormant bermudagrass. Neither the grass or legumes were affected by these treatments.

Root lengths: There were no significant differences (0.05 level) for root length between leachate treatments for any of the 4 grasses (Table 2). Therefore, the leachate from Coastal bermudagrass as obtained in this study did not reduce early seedling root length. With Coker 762, there may have been a slight stimulation by the leachate in both the active and dormant sod.

These results do not agree with the findings of Hoveland (2) or Cope (1); however, Hoveland used leachate from ground tissue and Cope used leachate from seeds. We believe the technique we followed more closely relates to conditions found in a sod under field conditions than either of their studies. Our data indicates that allelopathy is

probably not a problem when planting the species in this study into a Coastal bermudagrass sod.

LITERATURE CITED

1. Cope, Will A. 1982. Inhibition of germination and seedling growth of eight forage species by leachates from seeds. *Crop Sci.* 22:1109-1111.
2. Hoveland, C. S. 1964. Germination and seedling vigor of clovers as affected by grass root extracts. *Crop Sci.* 4:211-213.
3. Rice, Elroy L. 1972. Allelopathic effects of Andropogon virginicus and its' persistence in old fields. *Amer. J. Bot.* 59(7):752-755.

TABLE 1. PERCENT GERMINATION OF WHEAT, RYEGRASS, OATS, RED CLOVER, AND ARROWLEAF IN EXTRACTS FROM ACTIVE AND DORMANT TILLERS OF COASTAL BERMUDAGRASS SOD

Forage variety	Active bermudagrass				Dormant bermudagrass			
	Harvest date 9-30-83		48 hr.		Harvest date 12-9-83		48 hr.	
	Distilled water	24 hr. soak	48 hr. soak		Distilled water	24 hr. soak	48 hr. soak	
Ryegrass - Gulf	100	97	95*		100	101	99*	
Wheat - Bradford	100	100	99*		100	97	98*	
Wheat - Coker 762	100	99	99*		100	99	101*	
Oat - Mesquite	100	98	97*		100	97	95*	
Mean (grass)	100	99	99*		100	98	98*	
Clover - Chief	100	109	105*		100	119	114*	
Clover - Yuchi	100	99	102*		100	110	100*	
Clover - Mt. Barker	100	102	99*		100	92	89*	
Mean (clover)	100	103	102		100	107	101	

* No significant differences in percent germination between the three treatments from either the active or dormant bermudagrass.

TABLE 2. ROOT LENGTHS OF 5 GRASSES GERMINATED AND GROWN IN A CONTROL AND 2 EXTRACTS FROM SOD OF ACTIVE AND DORMANT COASTAL BERMUDAGRASS

Forage - variety	Active bermudagrass				Dormant bermudagrass			
	Harvest date 9-30-83		48 hr		Harvest date 12-9-83		48 hr.	
	Distilled water	24 hr. soak	48 hr soak	LSD	Distilled water	24 hr. soak	48 hr. soak	LSD
Ryegrass	2.9	2.8	3.8	0.65	2.9	2.8	2.6	0.63
Wheat - Tx-7393	4.8	5.3	4.9	0.65	4.2	4.6	4.5	0.63
Wheat - Coker 762	4.9	5.8	5.7	0.65	4.7	5.9	5.0	0.63
Oat - Mesquite	4.5	4.6	4.7	0.65	5.1	4.6	5.1	0.63
Mean	4.3	4.6	4.6	-	4.4	5.2	4.9	-