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CAUSAL PATHOGEN - KOCH'S POSTULATES

Simply finding the presence of fungal structures or fruiting bodies in a diseased patch of turf does not indicate it is the causal pathogen. Researchers must successfully complete Koch's postulates before the causal pathogen of a new disease can be identified. The steps are:

1. The pathogen must be found associated with the particular disease in all plants examined.
2. The pathogen must be isolated and grown in pure culture on nutrient media, and its characteristics described in the case of an nonobligate parasite, or on a susceptible host plant in the case of an obligate parasite.
3. The pathogen derived from pure culture must be inoculated onto healthy plants of the same species and cultivar on which the disease is observed, and it must produce the same disease symptoms on the inoculated plants.
4. The pathogen must be re-isolated in pure culture and its characteristics determined as exactly those observed in step 2 above.

SIGNIFICANT NEW DISEASE?

A new concern in terms of increased disease has been experienced in the United States. It involves a disease that attacks perennial ryegrass (*Lolium perenne*), which is principally noticeable on closely mowed fairway and sports turfs. The injury symptoms involve a general fading and thinning under hot, humid conditions. The appearance is similar to an under-fertilized turf or a partially senescent plant. There are no distinct lesions on the shoots. Its occurrence has been observed from southern New England through the Carolinas and Georgia; as far west as Kentucky and Ohio; and possibly in Illinois.

Laboratory examinations reveal the presence of the *Pyricularia grisea* pathogen. This fungus is reported in scholarly texts as occurring on perennial ryegrass, but it has not been recognized or proven as a significant problem under typical field conditions. Koch's postulates have not yet been accomplished to prove that *Pyricularia grisea* is the causal pathogen of this newly recognized disease. There is the possibility that a complex of several causal organisms is involved.

Obviously there is a lot to learn about the cause of this disease on perennial ryegrass. Is this an occurrence that is limited to extraordinary hot, humid conditions similar to the summer of 1995, or will it be an annual reoccurrence in future summers? How can it be controlled? This is just another example of the continual changes and new developments in the diverse biology of turfgrass science and culture. It is what makes turfgrasses so interesting and challenging to those of us involved.

JB VISITATIONS:

October - Italy.

Presented a lecture on the Italian bentgrass cultivar characterization research sponsored by the Italian Golf Federation. The occasion was the first National Conference sponsored by the Italian Golf Course Superintendents Association. Best wishes for continued professional development of the golf course superintendents in Italy!

During the 1994 growing season this bentgrass cultivar research showed that those new cultivars with increased dollar spot disease susceptibility did require greater fungicide use to control the problem.

October - Japan.

The Institute continues to provide guidance in planning and monitoring turfgrass research in Japan. El Toro zoysiagrass is performing better than the *Zoysia japonica* genotypes commonly used in Japan. This includes better fall low temperature color retention, shoot density, lateral stem development, rooting, and establishment rate.

The interlocking mesh element root zone stabilization system continues to perform superior in terms of far less divoting and more rapid turf recovery in the turfed starting gate areas and steeple jump areas at the horse race rack in Nagoya.

November - France.

Presented two talks at a European Golf Seminar in Montpellier. Take-all patch (*Gaeumannomyces graminis*) continues to be a major concern in Europe, especially on new bentgrass (*Agrostis* spp.) greens. Fortunately this disease can now be controlled, see Turfax II-5-1994. Our rolling research for putting greens also generated numerous questions, as did the hydrophobic soil problem.

The golf course boom of Europe has now run its cycle. Now some of the courses are struggling with a lack of funds and members. Typically these courses were built at a very high cost by investors and their American architects who had unrealistic expectations and a lack of detailed study concerning the financial reality.

November - Malaysia.

Presented a 3-day seminar on "Diagnosing Turfgrass Problems and Corrective Actions" in Kuala Lumpur. Attendees ranged from Hong Kong to Malaysia to Singapore to Indonesia. New golf course construction has slowed from its rapid rate of the late 1980's and early 1990's, but the golf course industry remains very healthy.

Malaysia is building facilities to host the Commonwealth Games. Thus, new sports field construction is very active.

Contaminated hybrid bermudagrass (*Cynodon* spp.) planting stock is a big problem, as is the mycoplasma-like organism (MLO) that causes a loss of chlorophyll in the shoots of individual bermudagrass plants.

There is an increasing trend to use zoysiagrass (*Zoysia matrella*) on golf course fairways and tees in Malaysia. It remains to be determined whether this is a wise long-term decision.

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The goal of the six issue per year TURFAX™ newsletter is to provide international turf specialists with a network for current information about turf. This newsletter is faxed to all Institute Affiliates that use the ISTI technical assistance services on an annual basis. Faxing is more costly, but ensures quick delivery to those outside the United States.

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JB COMMENTS - MANUAL *Poa annua* CONTROL:

Most preemergent herbicides exhibit some phytotoxic effects on bentgrasses grown on putting greens that consist of restricted rooting and shoot density. For newly constructed putting greens established to creeping bentgrass, this author has been fostering and monitoring for over 12 years a long-abandoned approach. First it was pursued with golf course developments in Germany, then in Japan, and more recently in the United States. It involves a program of hand weeding the annual bluegrass (*Poa annua*) seedlings from the greens.

This program was initiated in south Germany where laws do not allow the use of most pesticides on golf courses. I was working with a group addressing the problems caused by these laws. It was found that one person who worked a half-day per week in manual removal could maintain *Poa annua*-free bentgrass putting greens on 18 holes, even on golf courses where *Poa annua* was the dominant species on the fairways. The key is that (1) the program must be initiated on newly constructed greens before the *Poa annua* starts to encroach and (2) must be done each and every week throughout the growing season for *Poa annua*. The typical response when this approach is first mentioned is "too costly." However, those using it are pleased with the result, which is accomplished without any phytotoxicity to the creeping bentgrass and at a surprisingly reasonable cost.

UPCOMING JB VISITATIONS:

Provided for Institute Affiliates who might wish to request a visitation when I'm nearby.

- January 14 to 18 - Boston, Massachusetts.
- February 1 to 3 - Austin, Texas.
- February 6 to 12 - Orlando, Florida.
- March 1 to 4 - Vancouver, BC, Canada.
- March 6 to 9 - Cromwell, Connecticut.

UPCOMING INTERNATIONAL EVENTS:

February 1 to 3, 1996. 1996 TPI Midwinter Conference & Expo. The Stouffer Austin Hotel, Austin, Texas, USA.

Contact: Turfgrass Producers International, 1855-A Hickes Road, Rolling Meadows, Illinois, USA. 60008.
Phone: 708-705-9898
Fax: 708-705-8347

February 5 to 11, 1996. 67th International Golf Course Conference and Show of the GCSAA. Orange County Convention Center, Orlando, Florida, USA.

Contact: Golf Course Superintendents Association of America, 1421 Research Park, Lawrence, Kansas, USA. 66049-3859.
Phone: 913-841-2240
Fax: 913-832-4455

NEW PUBLICATION AVAILABLE:

Managing Turfgrass Pests. by Thomas L. Watschke, Peter H. Dernoeden, and David J. Shetlar. Lewis Publishers. 361 pages. 1995.

The focus of this book is on the cultural practices and systems that minimize pest problems of turfgrasses. It is organized in three sections representing the major pests of turfgrasses: weeds, diseases, and insects/mites. The theme is that while pesticides are a necessary component in managing turfgrass pests, first priority should be on cultural systems that will either avoid the need for pesticide use or else enhance the effectiveness and reduce the amount of pesticide use. The turfgrass pests described are from both cool and warm climatic regions.

Contact: Lewis Publishers, CRC Press, Inc., 2000 Corporate Blvd, N.W., Boca Raton, Florida, USA. 33431.

EFFECTS OF ELEVEN HERBICIDES ON THE VEGETATIVE ESTABLISHMENT OF ADALAYD SEASHORE PASPALUM

by

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Seashore paspalum (*Paspalum vaginatum* Swartz) is adapted to and found in many of the tropical-subtropical regions of the world. It can be found growing primarily along coastal areas from North Carolina to Florida to Texas and is being considered for use in many other areas where high soil pH and salinity levels cause problems in the culture of conventionally adapted turfgrass species. This interest in the use of seashore paspalum prompted an evaluation of pesticide tolerances of this species; and more specifically, tolerances to various herbicides that might be used during its vegetative establishment. The cultivar of seashore paspalum used in this study was Adalayd.

MATERIALS AND METHODS

A 465 m² (5,000 sq ft) area of Lufkin fine sandy loam was modified by mixing a medium textured, washed sand at a rate of 8.2 m³/100 m² (10 cu yd/1,000 sq ft) to a depth of 150 mm (6 inches). This area was subsequently fumigated with methyl bromide and stolonized with seashore paspalum at a rate of 0.36 m³/100 m² (10 bushels /1,000 sq ft). An application of 13-13-13 fertilizer was made prior to planting, at a rate of 0.75 kg/100 m² (1.5 lb/1,000 sq ft) each of N, P_2O_5 and K_2O.

The area was stolonized on April 26, 1984, and the herbicides applied on May 23, 1984. The turf was approximately 50% established at the time the herbicides were applied. Herbicides were selected for this study based on current use for weed control in sod production and, also, on the possibility of their use in the future. A list of materials applied is shown in Table 1.

Table 1. Eleven herbicides and associated rates applied during the vegetative establishment of Adalayd seashore paspalum.

Herbicide Treatment (generic/trade names)	Formulation*	Application Rate	
		lbs A.I./acre	kg A.I./ha
Asulam (Asulox)	3.34F	2.1	2.35
Atrazine (Aatrex)	80W	2.0	2.24
Benefin (Balan)	2.5G	3.0	3.36
Bensulide (Betasan)	4EC	10.0	11.20
Ethofumesate (Progress)	1.5 EC	2.0	2.24
Metribuzin (Sencor)	50W	0.5	0.56
MSMA (Daconate)	6EC	3.0	3.36
Oxadiazon (Ronstar)	2G	2.0	2.24
Pronamide (Kerb)	50W	0.75	0.84
Sethoxydim (Poast)	1.5EC	0.50	0.56
Simazine (Princep)	8W	2.0	2.24
Untreated check		----	----

*Legend: EC - emulsifiable concentrate; F - flowable liquid; G - granule; W - wettable powder

The herbicides were applied using a small hand-held, CO_2 pressurized plot sprayer. Materials were sprayed in a volume of water equivalent to 672 liters/ha (72 gal/acre) at 30 psi. The individual plot size was 1.8 x 2.4 m (6 x 8 ft). All treatments were replicated three times in a randomized block design.

Establishment ratings were initiated two days after application of the herbicides and continued at 8, 16, 30, and 44 days after treatment. Phytotoxicity ratings were taken 6, 14, and 28 days after treatment.

RESULTS

The use of bensulide, oxadiazon, and pronamide during the vegetative establishment of Adalayd seashore paspalum caused no discernable visual antagonistic effects on turf establishment (Table 2) and produced no significant visual phytotoxic symptoms to the shoots (Table 3).

Benefin and ethofumesate caused a slight discoloration of the leaves; and both materials tended to induce a slight delay in vegetative turf establishment.

Turfs treated with asulam showed an increasing degree of phytotoxicity through the fourth week following application and then began to show signs of slow turf recovery.

Table 2. Effects of eleven herbicides on the establishment rate of Adalayd seashore paspalum.

Herbicide Treatment	Percent Turfgrass Cover*				
	5/25/84	5/31/84	6/8/84	6/22/84	7/6/84
Oxadiazon	53 a**	55 a	87 a	100 a	100 a
Pronamide	52 a	52 abc	80 ab	97 a	100 a
Bensulide	50 a	55 a	80 ab	95 a	100 a
Ethofumesate	52 a	53 ab	68 b	82 a	100 a
Untreated check	45 a	57 a	85 ab	97 a	100 a
MSMA	40 a	33 bc	37 c	68 b	99 a
Benefin	55 a	53 ab	75 ab	92 a	98 a
Sethoxydim	38 a	32 c	18 d	25 c	84 a
Metribuzin	45 a	3 d	4 de	4 cd	62 b
Asulam	43 a	40 abc	40 c	26 c	55 b
Simazine	52 a	40 abc	20 d	5 d	25 c
Atrazine	46 a	2 d	0 e	0 d	5 d

* Percent turfgrass cover was visually estimated.
** Values in a column followed by the same letter are not significantly different at the 5% level of Duncan's Multiple Range Test.

Table 3. Evaluation of eleven herbicides for their phytotoxic effects on Adalayd seashore paspalum.

Herbicide Treatment	Shoot Phytotoxicity Ratings*		
	5/31/84	6/8/84	6/22/84
Untreated check	1.0 a**	1.0 a	1.0 a
Pronamide	1.0 a	1.0 a	1.0 a
Oxadiazon	1.0 a	1.3 a	1.0 a
Bensulide	1.7 a	1.3 a	1.0 a
MSMA	7.7 de	5.3 c	1.3 ab
Benefin	1.0 a	2.0 ab	3.0 b
Ethofumesate	1.0 a	3.3 b	3.0 b
Sethoxydim	6.3 cd	8.3 d	8.0 c
Asulam	4.0 b	6.5 c	9.0 c
Simazine	5.7 bc	8.0 d	9.0 c
Atrazine	9.0 e	9.0 d	9.0 c
Metribuzin	9.0 e	9.0 d	9.0 c

* Ratings based on 1 = no phytotoxicity; 9 = severe phytotoxicity.
** Values in a column followed by the same letter are not significantly different at the 5% level of Duncan's Multiple Range Test.

Sethoxydim produced very adverse effects on the appearance and growth of Adalayd seashore paspalum, which worsened with time. The effects of sethoxydim were not terminal, and the Adalayd exhibited a significant degree of turf recovery by the last rating date.

When treated with MSMA, an immediate burning of the shoots occurred and there was a noticeable decline in leaf growth for several weeks. However, these turfs had almost fully recovered by the final rating date.

Metribuzin produced immediate adverse effects on the appearance and establishment of seashore paspalum. However, these turfs had shown significant recovery at the last rating period. Regrowth from the edges of and within each metribuzin-treated plot supports the assumption that there was little or no residual toxicity from this compound.

The symmetrical triazines were the most phytotoxic to the growth and development of Adalayd seashore paspalum (Table 3). The adverse effects of atrazine were more pronounced than those produced by simazine. However, both herbicides showed significantly greater residual toxicity than the other herbicides evaluated (Table 2). The final rating of percent cover indicated some regrowth capabilities in soils treated with the triazines. This regrowth from the triazine-treated areas was measured from ten 100 mm (4-inch) turf plugs of seashore paspalum that had been replanted after the herbicide treatments.

SUMMARY

This study was conducted to determine specific herbicide tolerances on seashore paspalum during vegetative establishment for sod production.

When applied at the recommended rate, bensulide, oxadiazon, and pronamide showed no interference with vegetative turf establishment of Adalayd seashore paspalum. Even though producing a very slight phytotoxicity, benefin and ethofumesate could be used safely during establishment of Adalayd seashore paspalum.

Based on the results of this study, herbicides that should not be used on Adalayd seashore paspalum include: asulam, atrazine, simazine, metribuzin, MSMA, and sethoxydim.

1. Beard, J.B, S.M. Batten, S.R. Reed, K.S. Kim, and S.D. Griggs. 1982. A preliminary assessment of Adalayd seashore paspalum (*Paspalum vaginatum*) for turfgrass characteristics and adaptation to Texas conditions. Texas Turfgrass Research - 1982. Texas Agric. Exp. Sta. PR-4039. pp. 33-34.

Note: The paper was adapted from a research report published earlier as Progress Report 4333 in Texas Turfgrass Research - 1985. Texas Ag. Exp. Sta., pp 183-189. August, 1985.

SEASHORE PASPALUM CONTROL?

In my recent travels one of the questions that arises very consistently is a possible chemical control for seashore paspalum (*Paspalum vaginatum*) which behaves as a weed in other desired warm-season turfgrasses, especially in hybrid bermudagrass (*Cynodon dactylon* x *Cynodon transvaalensis*) putting greens. The problem with seashore paspalum, especially on putting greens, is that the vertical leaf growth rate is extremely rapid compared to that for hybrid bermudagrass. Consequently even though the greens are mowed daily in early morning, the more rapid, patchy leaf growth results in erratic ball roll by midday. Unfortunately, there is no published research data available concerning potential chemicals that can be used in the selective control of seashore paspalum.

However, this author was involved in one research study that was summarized on the previous two pages. The major objective was to identify herbicides that could be used selectively or safely on Adalayd seashore paspalum. The converse relationship would be to use that data to provide leads as to herbicides that might be effective in the control of the seashore paspalum. Summary Table 4 was organized using this approach.

There are four herbicides listed that may have potential for the selective control of certain genotypes of seashore paspalum in certain warm-season turfgrass species. They are atrazine, simizine, metribuzin, and asulam. Atrazine and simizine are labeled for selective use on all three warm-season turfgrasses — bermudagrass, zoysiagrass, and St. Augustinegrass; while asulam can be used safely on bermudagrass and St. Augustinegrass, but metribuzin can be used only on bermudagrass. If atrazine, simizine or asulam is being considered for use on bermudagrass, the label should be checked carefully or consultation made with the manufacturer as to its selectivity or safety on a specific species or cultivar of bermudagrass. Also, note that metribuzin is not labeled for use on closely mowed turfs, especially greens, tees, and collars of golf courses

Table 4. Summary table regarding four herbicides that may have potential for the control of certain genotypes of seashore paspalum in three warm-season grass species.

Herbicide generic/ trade names and rate (kg AI/ha)	Tolerance of three turfgrass species to four herbicides labeled for use in the United States			Seashore paspalum control 4 weeks after application in mid-spring***
	bermuda-grasses (*Cynodon* spp.)	zoysia-grasses (*Zoysia* spp.)	St. Augustine-grasses (*Steno-taphrum secunda-tum)*	
atrazine (Aatrex 80W) at 2.24 kg	T*	T	T	9.0
simizine (Princep 8W) at 2.24 kg	T*	T	T	9.0
metribuzin (Sencor 50W) at 0.56 kg	T**			9.0
asulam (Asulox 3.34F) at 2.35 kg	T*		T	9.0

* Injury may occur to certain species and cultivars. Be sure to read the label before using.

** Not labeled for use on one or more of the following: putting greens, native soil greens, tees or collars on golf courses; and on similar closely mowed turfs.

*** taken from Table 3.

T - adequate tolerance when used according to the label, as approved by the United States EPA.

When utilizing this approach, note that the research cited involved the Adalayd cultivar. It can not be assumed that all other genotypes of seashore paspalum would behave similarly. However, these data do provide important leads on how to proceed. Using this information, some test plots could be established on the particular seashore paspalum problem in a given turf area to confirm its effectiveness on that particular genotype under those environmental, soil and cultural conditions. In other words, proceed with caution by conducting your own "real world" experimental tests before attempting to use a particular herbicide on extensive turf areas.