

Arsenic Control of Poa Annua Points to Fertilizing Study

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(At GCSA convention)

ONE OF THE major problems in the maintenance of fine turf for putting greens, fairways, lawns and athletic fields is the potential infestation with poa annua.

We see it most obviously on the putting greens in fall and spring periods when the bentgrass grows more slowly and the poa annua, because of its cool season nature, grows very rapidly and produces seedheads regardless of the height of cut. Many people have observed that vigorous growing grasses could reduce infestations of the poa annua seedlings and that good maintenance which maintained a thick cover of competitive turf was a good poa annua control.

However, many of the practices of utilizing and maintaining turf provide openings which may permit an infestation of young seedlings during at least six months of the year in the midwest.

Poa annua is a so-called annual because it can germinate and produce a seed crop in as little as two months under ideal conditions. It does not have to develop the reserves and rhizomes that Kentucky bluegrass does before seed formation. However, poa annua may live for several years, as observed around golf greens and on fairways, until either wilting or disease kills the plant. When these disasters come and the turf is lost, openings are left for crabgrass, clover, or later poa annua infestations.

Before the introduction of new insecticides, many superintendents used repeated applications of arsenate of lead as an insect control. In 1940 ninety million pounds of lead arsenate was used in the United States. In 1953 this had been cut to eighteen million pounds. About 1944 many superintendents began using chlordane and other insecticides. In 1950 they wondered if it was not the arsenic they had been using which had reduced weedy grass infestations, including poa annua and crabgrass. Several golf course superintendents who continued to use lead ar-

senate regularly report little infestation of poa annua.

Experiments Started in 1951

We started a series on the No. 6 fairway of the Lafayette (Ind.) CC in September 1951 using many chemicals, including lead arsenate at 30 lbs. per 1,000 sq. ft. On November 1, two months later, the poa annua in the area given the lead arsenate topdressing showed reduced growth, shortened root system and very little vigor.

That winter in the greenhouse, two 4 in. bentgrass plugs were placed in each of 32 flats of soil which were overseeded to poa annua. Three days later Chloro-IPC was used at 0— $\frac{1}{4}$ — $\frac{1}{2}$ —1 gal. per acre. All applications of Chloro-IPC gave good poa annua control.

However, the $\frac{1}{2}$ and 1 gal. per acre caused the bentgrass to stop growth for as long as two months. Therefore, it is not recommended for seedling growth control in established turf. Likewise, Dinitrophenol was applied at .05—.1—.2 gal. per acre with the higher rate giving control. However, Dinitros are definitely foliar burning materials and the superintendent would need to be very careful to avoid foliar burn to his existing grasses; therefore, Dinitros are not recommended for poa annua control selectively.

Meanwhile, in May 1952 the lead arsenate applied the previous September on fairway turf again showing definite poa annua weakening so that it was not competitive with the bluegrasses.

The following fall we established an additional series of poa annua controls on the same fairway and on the practice green of the Lafayette CC. We did not observe any control on the practice green where soil tests showed there were very high phosphorous accumulations.

In 1953 a second application was made to the putting green and since that time phosphorous applications have been cut considerably. A reduction in poa annua



CONNECTICUT SUPTS. HAVE PRIZE EXHIBIT AT FLOWER SHOW

Connecticut Association of Golf Course Superintendents conducted another Turf Clinic as a public service at the Connecticut Flower and Garden Show, held at the West Hartford Armory March 10-16.

The display shown above had the backdrop for the golf course scene painted from kodachrome transparencies loaned to the association by "Eb" Steiniger, Supt., Pine Valley (N. J.) CC. Turf on the green and tee was creeping bent. All other turf was Kentucky bluegrass. Trees were mostly Scotch Pine. The total area of the display was 310 sq. ft. Scale was $\frac{1}{4}$ ft. = 1 ft.

The Clinic was manned by golf superintendents at all times and hundreds of questions on lawn care were answered. In addition, the association gave away 5,000 copies of Tips on Lawn Making, a folder prepared by members of the Connecticut association.

This is the fourth consecutive year the association has held the Turf Clinic at the Connecticut Flower and Garden Show. No association funds have ever been spent for this project. Various members contribute time, equipment and materials and the show management pays the association enough to curtail actual expenditures.

The committee in charge this year was:

John Paul, Indian Hill GC, John Perkins, Jr., Keney Park GC, John Gaghan, Goodwin Park, Anthony Longo, Woodbridge GC, Harry Mensel, Yale GC, Charles Baskin, GC of Waterbury, Edward Fanfesti, Wallingford CC, Phillip Kylander, The Kylander Co., Joseph Bidwell, Avon CC and Everett Pyle, Hartford Park Department.

was not observed the first two years after arsenic was applied.

In 1953 we again utilized the greenhouse and planted poa annua in flats into which Merion bluegrass strips were seeded. Lead arsenate was used at 0—20—40—60 lbs. per 1,000 sq. ft. mixed into the upper 2 in. of the soil prior to planting. Sodium arsenite was applied at 0—2—4 and 6 lbs. of 91 per cent dry powder mixed into the surface 2 in. When the poa annua was approximately 1 month old the arsenic began to inhibit its vigor. We then applied 20 per cent super-phosphate at one ton per acre, or 50 lbs. per 1,000 sq. ft., to one-half of each flat. Within two weeks the plants previously showing arsenic inhibition began to show new growth and normal vigor which continued for the following six months. Rates of 20 lbs. lead arsenate, or 2 lbs. sodium arsenite mixed into the soil prior to plant-

ing was sufficient for one year. Regardless of the amount of arsenic applied, the super-phosphate application overwhelmed the arsenic effect. The Merion bluegrass strips showed greater tolerance to high arsenic than did the poa annua.

Topdressing Studied

This relationship then becomes one of arsenic toxicity as the young plant roots take up arsenic and combine it to the carbohydrate metabolism of the plant, replacing some of the phosphorous normally present in the carbohydrate molecules. Apparently the arsenic carbohydrates are not translocated; therefore, the poa annua does not produce new growth. The plants will survive unless drouth or disease might kill the seedling. This did not occur under the greenhouse management. However, poa annua plants five months old were no larger following arsenic toxicity than at the one month old stage.

In order to observe the effect of topdressing, we applied 1 in. of arsenic-free soil over an arsenic treated layer. The poa annua readily established a root system throughout the upper inch; the plant secured sufficient phosphorous from this top layer and the varying arsenic application was of less effect. Conversely, when we put arsenic-free soil below arsenic treated soil, the poa annua, soon after germination, absorbed sufficient arsenic that for an extended time the plants remained very weak. However, weeds gradually established a tap root into the arsenic-free soil, then after a delay they grew normally. The location relationship points out why poa annua may have become worse on greens as recent topdressings were not accompanied by lead arsenate applications.

The question arose as to the differences in the tolerance of grass species to arsenic. We prepared 500 four inch clay pots, using 0-250-500-1,000-2,000 lbs. of super-phosphate per acre. These were each divided and mixed with 0-10-20-40-80 lbs. per 1,000 sq. ft. of lead arsenate. Then Merion bluegrass, ryegrass, bent-grass and poa annua were each planted on 100 of these, giving two replicates at both low and high greenhouse temperatures.

In cool conditions, such as fall and spring weather, 60-65° F., poa annua was more subject to arsenic injury than Merion bluegrass, ryegrass was intermediate, and creeping bentgrass tolerated very low phosphorous and very high arsenic concentrations with little evidence of restriction of growth.

On the contrary, at high air temperatures, resembling summer temperatures, the poa annua showed much less arsenic inhibition. This correlates with observations made on the fairway of the Lafayette CC where it was very difficult to see the effect during the bright sunshine, long day, high temperature periods of the summer. We found a similar root reduction in poa annua plants on arsenic treated soils matching the top growth reduction.

Consider Fertilization

From the practical standpoint, this research, which is being continued, illustrates that superintendents wishing to reduce their weedy grass problems, including poa annua, crabgrass and goosegrass, should consider their fertilization practices.

Soil tests at most experiment stations

in the midwest show excess phosphorous present in fine turf soils due to the repeated application of complete fertilizers in an attempt to get a nitrogen response.

Out of more than 100 golf greens soil tests at Purdue University at least 95 per cent show excess phosphorous, indicating that the use of arsenic chemicals to secure poa annua inhibition would require rather heavy applications. Even with plant use and phosphorous fixation it is estimated that it will be over 5 years before the excess would be removed. Thus, the need to reduce the annual additions of phosphorous, when there is an excess already present.

Some superintendents may be interested in applying lead arsenate in the early fall or early spring at approximately 20 lbs. to 30 lbs./1,000 sq. ft. to two of their poa annua infested greens as an initial test application.

Then they could use lead arsenate at light rates for cutworm and sodweb worm control throughout the summer period to maintain a concentration of soluble arsenic. Since lead arsenate breaks down slowly this could maintain such a concentration that weedy grasses germinating would be reduced in vigor at an early stage.

The mechanics by which the arsenic uptake inhibits the poa annua vigor is most complicated. These factors favor arsenic inhibition:

1. Low phosphorous availability level.
2. Cool weather.
3. Short days for photo-periodic activity.
4. Arsenic application prior to cool fall and cool spring periods.
5. Having arsenic carrying soil as the surface area.

These facts have been observed:

1. Arsenic availability and application must be approximately equal to those of phosphorous for inhibition.

2. Toxicity of an application of lead arsenate at 30 lbs. per 1,000 sq. ft. on unfertilized turf is still evidenced three years afterwards when phosphorous was medium in supply and none added.

3. On new seedbeds sodium arsenate gray powder 3-6 lbs./1,000 sq. ft. mixed into soil was equal in effectiveness to 20-60 lbs. lead arsenate. Severe leaf burn occurred when used on established turf at above rates.

4. Even surface applications of phosphorous, within two weeks, over-rode arsenic toxicity in greenhouse studies.

5. When phosphorous is excess in the soil, arsenic accumulations must be greater and may not be able to inhibit poa annua.

6. There is a definite species tolerance in bentgrass and Merion bluegrass beyond that of poa annua so the latter can be controlled selectively in turf if phosphorous is not excessive.

7. Extremely heavy applications of lead arsenate might produce toxicity.

This study is being continued. Its original purpose was to determine if arsenics or other chemicals would inhibit poa annua. Other chemicals are being further tested in experimental work. This report should not be construed as an endorsement of lead arsenate alone since any form of arsenic carrying materials, if applied without damage, could achieve similar results.

And a word of caution — it may take considerable time before poa annua weakening is observed.

Greenkeepers Club of N. E. Re-Elects Officers

MICHAEL J. O'GRADY of new Bedford (Mass.) CC was re-elected pres., Greenkeepers' Club of New England at the organization's annual meeting. Also re-elected were Sec. William A. Ash, Franklin (Mass.) CC; Treas. Samuel S. Mitchell, Ponkapoag GC, Canton, Mass.

Manuel Francis, Vesper CC; Albert Allen, Kernwood CC, and N. J. Sperandino, Concord CC, are vice presidents. Paul O'Leary, Warwick CC, was elected a trustee for a 3 year term. The association has 93 members.

The New Englanders presented Dr. Jess DeFrance of the University of Rhode Island an expression of their appreciation of his valuable work for them and their clubs.

California Superintendents Hold Joint Meet at Santa Maria

GEORGE Lanphear, pres., Southern California Golf Course Supts.' Assn., and W. F. Sousa, former pres. Northern California Golf Course Supts.' Assn. got their groups together recently for a session at Santa Maria CC. More than 70 supts. attended.

Interesting feature of the meeting was the outline of the GCSA plans for its annual conference to be held at Long Beach, Calif., next February. Agar Brown,

sec., GCSA, who does an excellent job in arranging the shows, presented the outline. Brown has been in California arranging 1956 GCSA annual meeting details with GCSA Pres. Wm. Beresford of Los Angeles CC, and attending to some GCSA information matters.

Henry Mitchell Heads N. Y.- Conn. Turf Improvement

HENRY Mitchell, supt., Old Oaks CC, Purchase, N. Y. has been elected president of the New York-Connecticut Turf Improvement Assn. for 1955.

Other officers: Samuel Camberato, Vernon Hills CC, Tuckahoe, N. Y., vp; John Edgar, Sunningdale CC, Scarsdale, N. Y., sec.; and Theodore Jozwick, Ryewood CC, Rye, N. Y., treas.

The executive committee consists of Robert Laird of Winged Foot CC, Charles Sawtelle of A. D. Peterson Co., Herbert Johnson of the New York City Dept. of Parks, and George Gullen of Wacabuc (N. Y.) CC.

Longheinrich Heads Supts. of Mississippi Valley

Fred Longheinrich, supt., Sunset CC, Sappington, Mo., was elected president of the Mississippi Valley Golf Superintendents' Assn. at the organization's annual meeting.

Vice pres. is Mac Parsons, supt., Algonquin GC, Webster Groves, Mo., and sec.-treas. is Ralph Guyer, supt., Westborough CC, Webster Groves, Mo.

The Executive committee consists of Ralph Sehrt, supt., Westwood CC; Walter Ragan, supt., Greenbriar Hills CC, and August Schnatzmeyer, supt., Bellerive CC.

Charles K. Hollowell Joins USGA Green Section

Charles K. Hollowell has been engaged as Mid-Atlantic director of the USGA Green Section. He will take care of Green Section member clubs in Del., D.C., Md., Pa., Va., and W. Va.

Hollowell, long active in turf research and advisory work in Pennsylvania and closely teamed with golf course superintendents for years in helping them successfully solve their maintenance problems, is nationally known as a golf turf authority.