HAS - DECLINE OF ANNUAL BLUEGRASS

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Anthracnose, caused by Colletotrichum graminicola (Ces) Wils., is an important disease on annual bluegrass, fine leaf fescue and perennial ryegrass. Anthracnose was originally described as a disease of annual bluegrass (Poa annua L.) in 1954 by J. Drew Smith (3). He demonstrated its pathogenicity and included excellent photo micrographs (pictures taken through a microscope) of the infectious process in the article. Couch (1), in his book on turfgrass diseases, described anthracnose as an important disease on many turfgrasses, although not on annual bluegrass. However, in a more recent article, he reversed his earlier opinion and now believes C. graminocola is only a saprophyte (2). Vargas and Detweiler (6) and Vargas (4,5) found severe anthracnose infections associated with the loss of annual bluegrass fairways and greens during the warm summer weather. Collectotrichum graminicola was isolated and subsequent inoculation experiments in the laboratory supported Smith's (3) earlier conclusions that C. graminicola was a pathogen on annual bluegrass and caused the disease called anthracnose.

The significant discovery was not that C. graminicola caused anthracnose on annual bluegrass, but that something other than direct high temperature kill or "wilting" was responsible for annual bluegrass loss during high temperature stress. Anthracnose appeared at the time to be the major factor responsible for loss of annual bluegrass (4,5,6,7,8). This belief was based on the large amounts of anthracnose (acervuli) present on the diseased plants, inoculation studies with C. graminicola and the fact that the only other pathogenic fungus isolated was Helminthosporium sorokinianum (syn Drechslera sorokinianum), the cause of leaf spot. H. sorokinianum was orginally ruled out as a major factor because the benzimidazole systemic fungicides (benomyl, thiophanate-methyl and thiophanate-ethyl), which gave excellent anthracnose control, were reported not to be effective against Helminthosporium disease whereas laboratory bioassays showed the benzimidazole fungicide to be very effective against C. graminicola. It was logically concluded, based on these facts, that anthracnose was the major cause for the annual bluegrass dying.

Based on subsequent research, three factors are now believed to be responsible for annual bluegrass loss during the warm summer weather where the symptoms are a yellow-bronzing of the turf followed by tan to brown withering and, eventually, death. The term used to describe this disease complex is HAS decline of annual bluegrass - Helminthosporium leaf spot caused by H. sorokinianum, Anthracnose caused by C. graminicola and Senescence or the dying of a plant due to "old age." Research is currently underway to evaluate these factors to determine the role each plays in HAS decline of annual bluegrass during heat stress periods.

The key environmental factor in the development of HAS decline appears to be high nighttime temperature. This is not to say high daytime temperature or high humidity are not predisposing factors, but unless 70°F plus temperature is experienced for 2-3 nights in a row, severe HAS decline epidemics will not occur. The past two seasons (1978-1979) the daytime temperatures were above 85°F many times including several days above 90°F, but HAS decline was not a serious, widespread problem because the warm nighttime temperatures did not occur. HAS decline was only a problem in 1978-79 where no fungicides at all were used, where annual bluegrass herbicide control programs were being used, where phytotoxic fungicides were applied during warm weather, or where poor soil and air drainage were present, but, there has not been a severe HAS decline epidemic since 1977 in the northern areas of the cool season grass regions.

Preventing annual bluegrass loss through the use of fungicides meant a golf course superintendent no longer had to stand by and helplessly watch his annual bluegrass die during the warm summer weather. Nor did he have to feverishly rush around syringing or irrigating to prevent his annual bluegrass from "wilting," only to have it die anyway. He could treat his annual bluegrass with a fungicide and have it survive the warm summer weather.

For the scientific community, it meant a re-evaluation of annual bluegrass as a potential desirable turfgrass species and the subsequent research on its fertility requirements, mowing requirements, cultural requirements, disease and insect problems. This has now begun, even if begrudgingly, and even if sometimes only through pressure from golf course superintendents associations for answers on how to maintain annual bluegrass. This pressure is understandable when you consider the superintendent has been bombarded with annual bluegrass chemical controls for the past 50 years, none of which have been very successful. The reasons include: 1) lack of chemical efficacy, 2) lack of thorough research on these herbicides before they were introduced, and 3) the belief that a chemical is going to selectively remove a "weedy" grass species from an environment it is adapted to and replace the weedy grass with an unadapted "desirable" species without changing the management regime. Such reasoning is ludicrous and has directly contributed to past failures. If annual bluegrass could be removed selectively and prevented from returning through the use of herbicides what grass is going to replace it? If it is replaced with Kentucky bluegrass maintained at 1/2 inch mowing height and irrigated frequently to maintain soft fairways, then the question has to be, what will replace the Kentucky bluegrass when it dies if annual bluegrass is prevented from doing so? Creeping bentgrass? *Poa trivialis*? Or perhaps bare soil? The problem is not the annual bluegrass, but the cultural regime under which the turf is being maintained. Annual bluegrass is simply replacing the Kentucky bluegrass which is not adapted to close mowing and frequent irrigation because it is adapted to such a management regime and no chemical is going to change that! The selective herbicide may prevent the annual bluegrass from returning but it will not prevent the Kentucky bluegrass from leaving.

What is wrong with annual bluegrass? Nothing. It is no better or no worse than any other cool season turfgrass species. They all have their strong and weak points. Annual bluegrass is adapted to the 1/2 inch mowing height and frequent irrigation regimes employed on golf courses where the golfer insists on low-cut, soft fairways. It does have its share of disease problems but so do all the other turfgrass species (Table 1). If a healthy annual bluegrass turf is to be maintained, these diseases have to be treated. The same is true of all the other species. If the diseases on annual bluegrass are not controlled, it will die and the voids will be filled in by annual bluegrass.

Table 1. Major turfgrass diseases on the 4 major cool season turfgrasses.

Kentucky Bluegrass	Creeping Bentgrass	Annual Bluegrass	Perennial Ryegrass
Melting-out	Dollar spot	Dollar spot	Brown blight
Fusarium blight	Brown patch	Brown patch	Brown patch
Stripe smut	Pythium blight	Pythium blight	Pythium blight
Fusarium patch	Leaf spot	Leaf spot	Anthracnose
	Typhula blight	Anthracnose	Red thread
	Fusarium patch	HAS Decline	Rust
		Fusarium patch	Typhula blight
		Typhula blight	

Therein lies the difference. Kentucky bluegrass, creeping bentgrass, and perennial ryegrass die only once. Annual bluegrass dies year after year after year if its disease problems are not treated. The fact that the other turfgrass species died is forgotten because they only died once. The problem did not occur year after year. The fault is never placed on the disease that caused the "desirable" turfgrass species to be lost, the fault is placed on the annual bluegrass which replaced it. Annual bluegrass didn't make the voids, it simply filled them in. The voids occurred from diseases, insects, wear or mismanagement. If annual bluegrass had not filled in these voids some other "weedy" grass or broadleaf weed would have. The reason annual bluegrass persisted was because it was the species most adapted to the cultural regime under which the turf was being maintained.

Cultural regimes of the various turfgrass species can be seen in Table 2. You will notice a cultural regime for perennial ryegrass is missing. Little research has been done to determine the optimum cultural system for growing perennial ryegrass in spite of the fact that it is widely recommended as a desirable turfgrass species, because of its improved mowability over common perennial ryegrass.

Table 2. Comparison of survival requirements for fairway grasses.

	Kentucky Bluegrass	Creeping Bentgrass	Annual Bluegrass
Mowing height	1-1 1/2"	1/2"	1/2"
Irrigation	Minimal	Minimal	Frequent
Nitrogen	1-4 lbs/s	1-4 lbs/s	3-4 lbs/s
Phosphorous	Adequate	Adequate	High

The other failure of annual bluegrass chemical control programs has been the lack of understanding of the turfgrass plant itself. There are two subspecies of annual bluegrass: Poa annua var. annua L. Timm., an annual type, and Poa annua var. reptans (Hauskins) Timm., a perennial type. The annual type is supposed to be a winter annual which germinates in the fall, lives through the winter, produces seed in the spring and then dies. But in the cool season grass regions, seed production is usually followed by a resurgence of vegetative growth, suggesting that the perennial type is dominant. When death does occur, it is usually later in the season during warm weather stress. If it was a true annual or if the annual type was dominant, should not death occur soon after seeding? If it was a true annual, or if the annual type predominated, should annual bluegrass not die every year? Yet, on well-drained, adequately irrigated fairways, severe annual bluegrass loss occurred only in 1975 and 1977 during the past five years in the upper Midwest and Canada. This is even true of areas where no fungicides were applied! If it was a true annual, should not all the plants die everywhere every year? The fact is that most of the plants present in a fairway or green do not die every year. All the annual bluegrass plants are not lost on a fairway or green even in years of severe HAS decline. It is predominantly annual bluegrass plants that are growing in stress areas (poor soil or air drainage, slopes, heavily trafficked areas) that most frequently die, suggesting that something other than normal dying of a winter annual is occurring. The exception is where annual bluegrass herbicides, like the arsenicals, have been used, nearly all the annual bluegrass plants in a treated area will be destroyed during heat stress periods.

Wilt

The term wilt is often used to describe what happens to annual bluegrass when it dies during heat stress periods. When grass wilts, it turns dark blue to purple in color. Annual bluegrass does not wilt in the northern areas of the cool season grass region without mitigating circumstances. These circumstances can be knolls or slopes where adequate irrigation is not applied or where irrigation cannot be applied fast enough. This form of wilt is controllable with soil modification, proper irrigation, timing, and an adequate irrigation system. Wilt can be found on annual bluegrass fairways where irrigation is adequate, but recent studies have shown much of this is due to grubs, either the common large white grub or the smaller Black Ataenius beetle grubs. Both can be controlled with the application of an effective insecticide.

The fact that annual bluegrass normally does not wilt from high temperature alone where adequate irrigation is properly used first has to be accepted. Next time annual bluegrass begins to wilt, tear back the sod to determine if grubs are present before reaching for the irrigation system. It could help save your fairways!

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However, wilt is not the problem being referred to. The problem being referred to is one that causes an annual bluegrass turf to turn a dull yellow to bronze in color and evenutually die. The disease involving these symptoms is called HAS decline. The symptoms are very different from the bluish-purple color turfgrass turns when it wilts.

HAS Decline Management

HAS decline management involves a cultural system for maintaining annual bluegrass plus fungicide application at the proper time. The cultural system will probably change with time because it is currently based on a limited research. This is due to the fact that past research on annual bluegrass has been limited to means of controlling it. Research on how to culture annual bluegrass has been conducted only in the past few years. At the current state of the art, the following is the best program available for maintaining annual bluegrass fairways.

Mowing height - 1/2-7/8 inches.

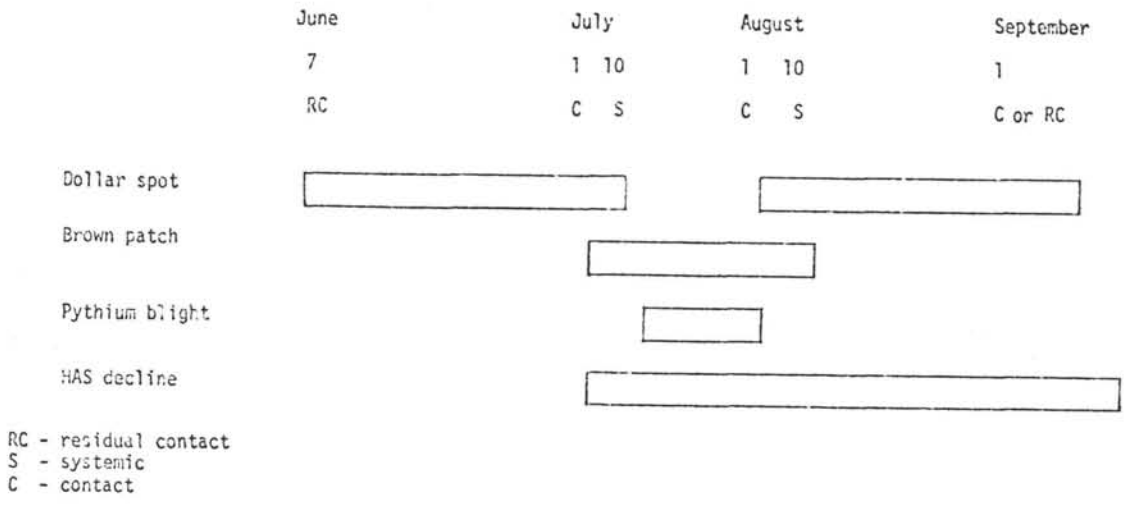
Irrigation
- infrequent and deep during cool weather to encourage deep root growth.
- light, frequent during warm weather. May involve daily syringing during warm weather depending upon: soil type, spring weather, capacity of irrigation system.

Fertility
- Nitrogen
  - 1/2 lbs of actual N June, July, August.
  - 1 lb of actual N September and dormantly.
  - new research data (Illinois) indicates annual bluegrass survives better with no nitrogen in July in the warmer areas of the cool season grass region.
- Phosphorus and potassium as needed, based on soil test. Preliminary evidence indicates higher phosphorus levels favor annual bluegrass survival.

Fungicide Program

There are 4 major annual bluegrass diseases which occur during the growing season: Sclerotinia dollar spot, Pythium blight, Rhizoctonia brown patch and HAS decline. Trying to maintain annual bluegrass without managing these diseases is futile. The following is an idealized fungicide program for managing these diseases. It is not a hard and fast program which should be followed to the letter. It is a framework from which you can build your own fungicide program.

The program incorporates all fungicide types at the most appropriate time. The best contact fungicides for HAS decline management are chlorothalonil, mancozeb, and maneb + zinc sulfate. The best systemic fungicides are benomyl, thiophanate-ethyl, and thiophanate-methyl. This is not to say other fungicides may not be appropriate. Substitutions should be made, based on personal experiences.



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