well as high fraction of course and very course sand in mixture. Infiltration rate from 0.0 inches to 0.6 inches per hour. (U.S.G.A. Spec. 4 to 10 inches per hour).
..U.S.G.A. suggested rebuilding both greens. Membership would not tolerate any more inconvenience. Therefore, U.S.G.A. advised aerifying, removing cores and topdressing with different sand.

1982..Beginning third season with greens continuing in poor condition.
..Aerified and topdressed 7 times this season. ..Greens improved slightly following each aerification, but turf still not in good shape.
..Played "temporaries" a week or so this season-greens slightly improved by fall.
..P.H. almost okay.

1983..U.S.G.A. persists in their opinion to rebuild the greens but agree they are improving slightly.

..I continued aerifying program 3 times in 1983 because I hoped to build some thatch.
..Fall-greens are almost acceptable state, have changed soil top 2 to 3 inches. Starting to see roots over 1 inch for first time since initial seeding.

SUMMARY: I knew I was gambling when I constructed these greens with high sand content, but I never imagined that it could have been so difficult to grow grass on them.

This article just touches on the problems that Southview Country Club experienced with these greens. So when planning construction, proceed with caution and get more than one expert's opinion and make sure you use the right sand!

TAKE-ALL PATCH INFECTION

by JEFF MARKOW

Jeff is presently a student at Pennsylvania State University in the Turf Management Program and is interning at Minneapolis Golf Club this year. The technical information in this article has been documented by Patricia Sander, a research associate at Penn State.

Last summer several Minneapolis area golf courses were beseiged by a new monster on the block -- take-all patch (formerly Ophiobolus patch), causal organism Gaeumannomyces graminis var. avenae (herein GGA). At

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Minneapolis Golf Club yellow-green patches of irregular diameter began appearing on the fairways during the late spring but stopped short of attacking the greens. These patches eventually turned a tan-brown and often contained centers of living grass (frog-eyes) resembling Fusarium blight or wilt. The advent of hot, dry weather caused the patches to enlarge and coalesce creating an unsightly blemish in the affected areas. The application of several contact and systemic fungicides failed to provide any effective control and these factors pointed to the symptoms of take-all patch contamination. This article will review current information on GGA and summarize the symptoms, environmental conditions and possible control of take-all patch.

Take-all patch infection begins during cool wet periods, through roots, stolons and stems, but disease centers become noticeable during the warmer periods of late spring. It can be spread by equipment, wind, water or plant to plant contact through runner hyphae. These yellow- green patches turn from tan to bronze and often resemble Fusarium blight. Under high temperature stress these areas can enlarge and often infected areas will become noticeable that were not previously recognized in the spring. Diseased roots, stolons, etc. become dark brown to black and the association of thin strands of runner hyphae can be a helpful tool. Accurate diagnosis must be made in the lab to determine the presence of tiny black fruiting bodies in the plant crown, typical of GGA.

These symptoms occur most frequently on *Agrostis supp.*, but have recently been isolated on *P. annua* and *P. pratensis*. Research is continuing to determine the susceptibility of various turfgrasses with the eventual hope of resistant cultivars, but let it suffice to say, the bents are presently the most susceptible. Moisture plays a role in the spread of GGA and thus poorly drained areas, slopes and low spots can create conditions favorable for infection. It has been suggested that increased N fertility can initially increase the possibility of infection but it seems the N also provides an escape mechanism for the plant by increasing root production which outweighs the predisposing of the plant to GGA. The most important environmental condition concerning GGA infection seems to be soil pH. Alkaline conditions increase the chance of infection while the addition of acidifying fertilizers can markedly suppress the activity of GGA. Liming can increase the possibility of infection, especially when fine particles are used. The smaller particles create a more rapid rise in the pH, but the effects are often not seen for 1-3 years after liming.

The control of take-all patch can be difficult and frustrating. None of the commercially available fungicides have proven effective either in preventative or curative applications. The only proven effective control has been the application of some form of sulfur, predominantly ammonium sulfate. Studies in Washington state where GGA has been prevalent have shown suppression of take-all patch using 4 appl. of $(NH_4)_2SO_4$ at 6 lbs./M for home lawns. These rates must be modified for the area being managed, i.e. putting greens - 3 lbs./M in 6- 8 appl./season. Maintaining proper fertility levels and a balanced irrigation program will create the least favorable environment for GGA. Promising new systemics are currently being developed but as of yet none have been registered for use and, therefore, the best recourse is an attempt at control through acidifying fertilizers.

In light of this information, it seems the infections at Minneapolis Golf Club were the handiwork of GGA. As mentioned earlier the infections stopped short of the greens, possibly due to the higher maintenance program they receive. This program includes increased fungicide applications, but more importantly the application of sulfur (granular) and sul-po-mag after aerification. Since the soil and irrigation water are slightly alkaline, this would create favorable conditions for GGA infection, and coupled with lower maintenance could explain why the disease was confined to the fairways. The infections occurred in low areas and on slopes (correlating to the moisture factor) but was not universal. More research is needed into this new dilemma and the conditions surrounding its incidence. Until effective chemical can be developed, the best recourse to prevent infection seems to be sound cultural practices and experimental applications of acidifying fertilizers. Otherwise dust off the Ouija board and practice, practice, practice.

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