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where moisture persisted (extreme environment) as on some plots, PMAS failed to render control, irrespective of carrier.

(3) Milorganite and topdressing produced earlier greening than spray treatments.

(4) Effectiveness of the Milorganite as measured by density, vigor and color throughout the growing season, was considerably superior to topdressing.

(5) Milorganite, topdressing, or the combination alone (without chemical) did not effect control of the snowmold.

(6) Soluble nitrogen (ammonium sulfate) produced severe damage resulting in almost complete destruction of the turf.

Some variation between the results obtained in 1955-56, and those of previous years are noted. These variations will be discussed.

Carrier Infestation

Check plots, as well as plots which received carrier alone (without chemical) were heavily infested with snowmold. See Figs. 1, 2 and 3. The degree of infestation was less on plots receiving carrier alone than on the check plot (Fig. 3). Nevertheless, the necessity of using a chemical to effectively control snowmold is obvious, since any degree of infestation is undesirable.

Calo Clor applied in late fall-early winter at a rate of three ozs. per 1000 sq. ft. under the conditions studied, controls development of snowmold, irrespective of carrier or severity of environment (Fig. 3). Effectiveness of Calo Clor may also be noted in Figs. 1 and 2. Figs. 4 and 5 show effectiveness under field conditions. While the three oz. rate was satisfactory under controlled test conditions, it would appear that four ozs. per 1000 would be a more practical and desirable rate for golf course greens. It likewise appears that in the northern sections of the border states and in Canada, an even higher rate may be desirable.

In the 1955-56 test, PMAS at three ozs. per 1000 sq ft. failed to produce the satisfactory control experienced during the previous years of the study. It should be pointed out that certain plots receiving PMAS were completely free of snowmold (Fig. 2): nevertheless, the average infestation for all plots in all replications was such that the overall performance in 1955-56 was rated unsatisfactory. This average was materially influenced by the heavy infestation occur-



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ring on plots located in areas classified as having an extreme environment. The failure to control the disease on these plots is probably related to the soluble nature of phenyl mercury, since it appears that under normal environment, PMAS does render satisfactory control. Heavier rates, as well as retreatment with PMAS in late winterearly spring, may produce satisfactory control under all conditions.

Uniformity of Coverage

Uniformity of coverage is essential for effective control of snowmold. This is illustrated in Fig. 3, which shows the development of the disease along plot borders where treatments did not completely abut. Also, the development of disease along spreader borders where material was not lapped (Fig. 4) and where the hopper was exhausted of material midway through one lap (Fig. 5) illustrates importance of uniform coverage. The evidence indicates that where carrier is used with the chemical, it is held in place with little to no lateral movement.

As noted, earlier spray applications are as effective in the control of snowmold as are those in which an organic carrier is used. The convenience of applying chemicals with available spray equipment may, under certain conditions, constitute an advantage for this method. It should be noted that the carrier may be applied dry and the Calo-Clor sprayed over the material in place, as well as mixing carrier and chemical before application.

The major advantage of using an organic carrier appears to be the early greening produced. Plots receiving Milorganite and topdressing alone or in combination "greened up" some two to three weeks earlier than sprayed plots (Figs. 1 and 3). This early greening may be partially explained by the thermal effects produced. The dark material absorbs and holds more heat; hence, raises the temperature of the microclimate enough to permit early growth activity. The presence of available nitrogen at this time stimulates additional growth.

Other than the initial early greening produced by the topdressing, there appeared to be little advantage from using topdressing as a carrier. However, plots which received Milorganite alone or in combination with topdressing displayed continued superiority in density, color and vigor in almost direct relation to the amount of material used. The rates of Milorganite used in the 1955 test supplied three and six lbs. of nitrogen; in the 1953 and 1954 tests, 12 lbs. of nitrogen; and the rate used at the Somerset CC in 1955, 6/10 lbs. of nitrogen per 1000 sq. ft. In one series of plots in 1955, ammonium sulfate was applied at a rate to supply six lbs of nitrogen per 1000 sq. ft.

Effect of Nitrate Rate Release

It is highly significant to note that damage to the turf in the form of burning or over succulence from even the 12-lb. rate of nitrogen from sewage sludge did not occur, whereas severe damage, actually almost complete kill, resulted from the use of six lbs. of nitrogen from the soluble carrier (ammonium sulfate). The contrasting results can be attributed only to the difference between the rate of release of nitrate from the two types of carriers.

The failure of the Milorganite treated plots to develop succulence and the resultant damage associated with this condition may be partially explained by the slow breakdown of the material. The application was made very late in the fall; low temperatures at that time, as well as during winter, prevented complete breakdown. Subsequent spring temperatures were such that decomposition proceeded rather slowly, with no apparent ill effects. The possibility exists that the grass may be able to utilize some of the early products of decomposition (amino acids) for its very reduced metabolic activity during its period of dormancy. The use of soluble nitrogen at materially reduced rates to produce early greening may be possible; however, the results of this study do not warrant a recommendation as to the rate or time of application.

In the central and southern extremities of the snowmold zone, it would appear that low rates (10 to 20 lbs.) of Milorganite would be preferable to the higher rates (up to 50 lbs.) which appear satisfactory in the more northern areas. Although the 100 and 200-lb. rate of Milorganite gave satisfactory results, it is felt that a maximum of 50 lbs. per 1000 sq. ft. is adequate. Higher temperatures and more infrequent snowfall in the central and southern belts would undoubtedly lead to a release of more nitrates than would be experienced in the northern belts. This conceivably could produce sufficient succulence which, when coupled with rapid drops in temperature, might produce damage to the turfgrass.

Conclusions

Based on the results of experiments and observations conducted at the Toro R. & D.

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Center for the past three years, the following conclusions regarding the prevention and control of snowmold on golf course turfgrass seem warranted:

1. Three to four ozs. of Calo Clor per 1000 sq. ft. provide satisfactory chemical control of snowmold.

2. Spray applications of Calo Clor give effective control of snowmold, but grass takes longer to green up than when Milorganite or topdressing is used as a carrier.

3. Milorganite or topdressing may be applied and Calo Clor sprayed onto them with the same results as obtained from mixing chemical and carrier before application.

4. Ten to 50 lbs. of Milorganite per 1000 sq. ft. will produce greening some two to three weeks earlier. Greens so treated will exhibit superior color, density and vigor for an extended period of time in almost direct relation to the amount of material used. Low rates (10 to 20 lbs.) are suggested for central and southern belts; higher rates appear satisfactory in more northern areas.

5. Topdressing used as a carrier produces early greening, but fails to produce the improvement in quality experienced on Milorganite treated areas.

6. The combination of topdressing and

Milorganite used as a carrier produces satisfactory results – early greening and superior quality. Prolonged superiority from a quality standpoint is directly related to the amount of Milorganite used.

7. PMAS (10 percent) used at a rate of three to four ozs. per 1000 sq. ft. may provide satisfactory control under normal conditions, but appears inadequate under extreme environment – heavy and persistent snow pack and low poorly drained areas. Retreatment in late winter – early spring, or possibly higher rates may be necessary to produce completely satisfactory control.

8. Uniform application of any chemical is essential for satisfactory control.

9. Treatment of aprons, approaches and shoulders, as well as the green proper, is recommended. Such will protect the bentgrass present on these areas and possibly prevent invasion of weeds.

10. The results of these studies clearly indicate that from a practical standpoint, snowmold can be effectively controlled and greens may be brought into play considerably earlier by correct choice of chemical carrier. Nevertheless, further research on all phases of this investigation is warranted.

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Swinging Around Golf

(Continued from page 86)

Golf lost three of its most helpful pioneer amateurs when A. Linde Fowler, Albert C. Wheeler and Wm. G. Curtis, sr., died in September . . . Fowler started writing golf on the Boston Transcript in the '90s and continued until 1930 . . . "Archie" Wheeler, who died at his home in Bridgeport, Conn., at the age of 91 was Gene Sarazen's first strong booster and got George Sparling, pro at Brooklawn CC, Bridgeport, Coon., to give Gene his first job as asst. . . Curtis, who was 90 when he died at his home in Detroit, was pres, Detroit Golf Assn., for 12 years and was responsible for getting Detroit's big public golf program under way . . . He played a round a week before he died.

British professionals played many exhibition matches last week in September raising funds for British National Golf Foundation . . . The Foundation finances junior instruction by pros and is taking 50 more schools on its list this fall.

Louis T. Stanley writing in Golf Monthly, Edinburgh, criticizes British women's attire on golf courses . . . Says "Women's golf in these islands is undoubtedly on the up-grade. It is a pity that dress-sense is not equally improved. On the latter, our American counterparts are well ahead. But in other sports our representatives are much smarter. I was present at the Wightman Cup (tennis) dinner. We may have lost the cup, but our girls looked much nicer than the over-tanned, over-exposed Americans."

Arthur J. Chapman, 68, who retired in 1953 after 23 years service as pro at the Wheeling (W. Va.) CC, died at his home in Wheeling, Sept. 7 . . . "Chappie" was born in England and served under J. H. Taylor . . . After serving as pro in Berlin, Germany, he came to the Parkersburg (W. Va.) CC as pro . . . He won the West Virginia-Open in 1927 . . . He won the West Virginia-Open in 1927 . . . He is survived by his widow, Alice; a son, Alex in Denver; a daughter, Mrs. Kathleen Schafer residing on Long Island; and a brother and sister overseas . . . "Chappie" was beloved by thousands he had met and helped as dean of West Virginia pros . . . He enjoyed the Open this year as a guest of a member of his club and a long-time pal, Jack Grimes.

Bill Booe, a semi-finalist in the 1955 National Amateur, has turned pro as asst. at Brooklawn CC, Bridgeport, Conn. . . . Ted Kroll touring in air-conditioned Cadillac, with flags on fenders . . . Flags read "Ted Kroll, World Champion Golfer." . . . Gold lettering on side of car proclaims George S. May sponsorship of the Kroll exhibitions. . . . What, no calliope? . . . Tam O'Shanter members had \$7.50 for Evans caddy scholar-



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ships added to recent month's bill . . . Members have contributed \$36,375 to Evans fund . . , It's been matched by \$36,375 from Tam's owner, George S. May and his wife.

owner, George S. May and his wife. Frank Reeser, Dunlop ball regional mgr. with headquarters at Chicago, recovering after series of operations at Condell hospital, Libertyville, Ill. . . New Ulm (Minn.) CC clubhouse interior gutted by fire . . . Women's Trans-Mississippi 26th annual amateur at Monterey Peninsula CC, Pebble Beach, Calif., Oct. 8-14, has capacity field of 200.

Bill Sherman, National Golf Foundation field man, says record entries for tournaments in northern Dixie gave headaches to tournament officials this summer . . . Johnny Bibb of Nashville Tennessean told Bill 300 wanted to play in the 15th City Open but there wasn't enough time or courses to handle them all . . . Kelly Cocanougher of the Louisville Times told of Chmn. Ed Lowry of the 6th annual River Road Invitation getting 217 entries for a field limited to 128 . . . Dan Scism, sports editor of the Evansville Courier, went 5 extra holes to beat Francis Fleming in the Evansville CC championship.

Dudley Green of Nashville Banner says increased play on courses in Mid South and satisfactory performance of moderate-priced watering systems has many courses planning fairway watering to be in operation next year.

Lou Bola, Highland G&CC pro, at Indianapolis, Ind., and co-chmn. of PGA committee collaborating with National Golf Foundation, a key figure in getting new 18-hole club under way in Columbus, Ind. . . . Pro Bill Williamson has aroused so much golf interest in promoting 9-hole Crestview CC he owns at Muncie, Ind., there's talk about need of a muny course there.

Kiwanis Club of Lexington, Ky., committee headed by Melvin Flynn, is campaigning for a semi-private 18 . . . Indian Hills CC at Bowling Green, Ky., 18 under construction with club members doing a lot of the work and having Saturday night parties, following work on the course, in remodelled farmhouse which is the clubhouse.

Joe Belew of Milan (Tenn.) Chamber of Commerce and Buck Fuqua of Milan Jaycees head drive for building 9-hole semi-private course and industrial area adjoining new airport . . , Hilwood CC at Nashville, Tenn. making fast progress on \$600,000 new club building program . . Bubber Johnson designed and is building course . . Brentwood CC at Nashville expects to begin construction on course in 1957.

This year has been by far biggest in senior tournament entrics . . . Nevada State seniors at Desert Inn CC, Las Vegas, had field of 100.

Carlos (Charlie) Smith, gen. mgr. and supt., Guadalajara (Mex.) CC. says Gene Tift bent is doing great on greens down there . . . With Aerifier and Verticut steadily used, Smith advises that greens maintenance troubles are down to minimum . . . Mid-Atlantic Assn.