PROCEEDINGS

of the

11th ANNUAL NORTHWEST TURF CONFERENCE

October 3-4, 1957

STATE COLLEGE OF WASHINGTON PULLMAN, WASHINGTON

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PROGRAM

Thursday
October 3, 1957

Morning

Wilson Compton Union Building
Rooms 215-216

Chairman, A. G. Law, Department of Agronomy, WSC

8:30 - 10:00

Registration

10:00 - 10:10

Welcome, S. P. Swenson, Dean, School of Agriculture

10:10 - 10:40

Turf Research in Progress at WSC, Roy Goss

10:40 - 11:20

"Delayed Action" Fertilizers, Roy Goss and cooperators

11:20 - 11:50

What's going on in Turf Research, Bill Bengeyfield, Western Director, U. S. G. A.

Afternoon

Chairman, Milt Bauman, President, Pacific Northwest Turf Association, Overlake Golf Course, Medina, Washington

1:15 - 1:45

Business Meeting

1:45 - 2:15

Research Report on Disease Control on Turf Areas, Chuck Gould, Plant Pathologist, WSC, Puyallup, Washington

2:15 - 2:45

Turf Grass Research, H. M. Austenson, Agronomist, WSC, Puyallup, Washington

2:45 - 3:00

Break

3:00 - 5:00

Field Tour (Roy Goss in charge)

6:30 p. m.

Banquet, Elwyn Schwartz, Speaker, Rooms 212-123

Friday
October 4, 1957

Morning

Wilson Compton Union Building
Room 213

Chairman, J. K. Patterson, Department of Agronomy, WSC

8:45 - 9:30

Budgets, Panel Discussion, Sam Zook, Chairman, Glen Proctor Cliff Everhart, and Henry Land, Sr.

9:30 - 10:00

The Use of New Chemicals for Establishment and Maintenance of Turf Grass, H. H. Schudel, Manager, Oregon Turf and Chemical Company (Formerly Agronomist at Oregon State College).

10:11 - 10:15

Break

10:15 - 11:15

Panel on Turf Equipment, Hogan, Chairman, Equipment Representative

11:15 - 11:45

The Impact of Cultural Practices upon Disease Incidence and Summer Time Behavior of Bent Grasses, Charles Wilson, Milwaukee Sewerage Company

Afternoon

Chairman, Roy Goss, Department of Agronomy, WSC

1:15 - 2:15

Panel on Fertilizers for Turf Areas, Paul Brown, Chairman, Clarence Baker, Henry Land, Jr., and Lee Fryer

2:15 - 3:00

Panel on Weed Control for Turf Areas, Tom Muzik, Chairman, Charles Wilson, Ken Putnam, and Wm. M. Senske

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WHAT'S GOING ON IN TURF RESEARCH

W. H. Bengeyfield
Western Director
USGA--Green Section

In 1930, there was one golf course for every 47,000 people. Today, there is one golf course for every 167,000 people. These figures are from the National Golf Foundation. A survey made two years ago in Southern California indicated that 9% of our golfers did not play more golf because the courses were too crowded. Several western courses now play over 10,000 rounds of golf every month during the golfing season.

This is a lot of golf and presents you, the superintendent, with a multitude of problems. Problems are solved through research, and we must look to our colleges and other agencies for the research and for the solutions.

What are we doing in research?

In the first place, research costs money. Dr. Marvin Ferguson, USGA Turf Research Coordinator, pointed out in his talk before the National Turf Conference last February, that American industry spent about four billion dollars on research during 1955. At this same time, our nation economy was something like 400 billion dollars. A little arithmetic will show us that about 1% of the total economy of the United States went back into industrial research. American industry believes in research and has proved that it pay dividends.

Today there are over 5,000 golf courses in the U. S., and it has been estimated that they spend an average of $20,000 a year for turf maintenance. Again, a little arithmetic will show us that an approximate over-all total of 100 million dollars is spent yearly for the maintenance of golf courses in the U. S. If we in the turf business are to keep up with American industry in their research plans, we should be spending 1% of the 100 million dollars or, one million dollars, for turf research each year. Dr. Ferguson doubts that we spend more than 1/5th of this amount at the present time for turfgrass research. Therefore, we fall far short of coming up to research levels established by American industry.

Who supports turf research?

It is encouraging to find that turf research moneys are growing each year. For example, your local association is contributing to turf research and is one reason to support them 100%.

The Golf Course Superintendent's Association of America has developed a turf research fund and, in the west, are carrying out a study on Kikuyugrass control at UCLA.

Commercial firms are constantly contributing to research projects at our state colleges. One mowing machine manufacturer has established a Turf Research Center, fertilizer manufacturers have grants at several colleges, and equipment, fungicide and other companies support research programs that will help you do a better job.

The USGA has always been interested in turf research. As a matter of fact, it started in 1923 in cooperation with the U. S. Department of Agriculture

at the Arlington Turf Gardens, just outside of Washington D. C. In later years, it has moved to the USDA Plant Industry Station, Beltsville, Maryland. The improved bentgrasses, improved bluegrasses, disease controls, 2,4-D and many other practices now in common use were developed through this cooperation between the Department of Agricultura and the USGA. Today, with moneys from Green Section activities, USGA Tournaments, and from National Golf Day, approximately $20,000 in turf research grants are placed throughout the country.

Our Canadian neighbors and turf interests in Great Britian are also carrying out turf research programs and are contributing to our reservoir of knowledge.

The fact remains, however, that turf research funds lag tremendously for a business that spends 100 million dollars every year for golfing turf.

The turf research review publication

In 1956, the latest issue of "Turf Research Review" was published by the USGA. This is a small bulletin listing a bibliography of turf literature since 1951. It also carries a report on research projects at the various experiment stations and informs us that today there are 26 experiment stations in the United States engaged in some sort of turf research, and over 130 individuals now spend all or part of their time on turf work. Copies of this bulletin are available through any USGA office.

What have we received from turf research in the last five years?

Many new grasses have come before us in the last several years. Penncross is a bentgrass strain that has been synthesized by the crossing of numerous selected parents. All indications are that Penncross will be superior to Seaside bentgrass for our putting greens, and we should establish a small plot of Penncross on our course as soon as possible in order to investigate it under our conditions. Pennlu is a vegetative bentgrass that has been introduced and has found limited use. In some instances, Pennlu has had a tendency to become puffy and therefore has not been as widely planted as earlier anticipated. Several new bermudagrasses have been developed as well as two new Zoysias. Merion bluegrass has been planted extensively and found considerable favor in some areas. Although rust is a problem on Merion, we believe that good cultural practices will mask the rust effect. Pennlawn creeping red fescue is finding favor in some areas. Workers at UCLA have grown mixtures of warm-season and cool-season grasses and have met with some success in developing a turf that will give good year-round color in the southern sections of the United States. The development of slow nitrogen-release fertilizers has taken place over the past several years. Readily soluble fertilizers have also been widely used during the 1950's. Chelated iron compounds have been introduced as well as new methods for the control of thatch and improved irrigation techniques.

Possibly the most important management technique introduced in the last five years is the development of a man-made soil mixture for putting greens that will resist compaction. Research accomplished at UCLA and at Texas A&M indicates that a soil mixture containing 85% sand, 7 1/2% clay, and 7 1/2% peat moss produces a soil that will reduce compaction and facilitate water percolation.

Gibberellic Acid has been placed on the market within the past year, but good turf managers will wait for our experiment stations to work with this material before they allow themselves to use it indiscriminately on their golf course.

Considerable progress has also been made in the matter of controlling diseases. Broad-spectrum fungicides have been developed that will cover and control several turf-disease organisms. The Washington Experiment Station has carried out extensive snow-mold control studies.

Weed control work continues at many stations. Some progress has been made in retarding Poa annua on putting greens by using yearly lead arsenate applications and maintaining a fertilization program with low phosphorous levels. Another material, Maleic Hydrazide, a growth inhibitor, has found considerable use in turf management. Its effect on grass plants is to retard growth whereas Gibberellic Acid has the effect of producing elongated growth in our plants. Soil sterilization is becoming of more and more importance on our golf courses. Dowfume (methyl bromide), Vapam, and Aero Cyanamid are producing sterilized soil for many superintendents throughout the United States.

We have accomplished a great deal in the past five years with our limited research funds. Not all research produces outstanding results. The failures are just as important to a research man as are the successes. When you leave this conference and draw up your budget for 1958, may I suggest that you consider the 1% that American industry is spending on research for their advancement. Perhaps a small portion of your budget for turf research work and for the advancement of our field is worthy of your consideration.

TURF RESEARCH IN PROGRESS AT WSC

Roy L. Goss

Several new turf grasses have come into the picture in very recent years, but it is not known how these grasses will perform under varied management systems of golf course green "aprons," tees, and fairways, and also for parks, home lawns, etc. It was decided, therefore, to set up trials here at WSC and make these comparisons. The grasses selected for this experiment and their origin are listed as follows:

1. Pacific Northwest Bluegrass selections (4)--It was decided to compare these bluegrass selections against some standard turf grasses. These are new selections made here at WSC by A. G. Law, Dr. J. K. Patterson, and John Schwendiman and came from an original introduction from Sweden. They have not yet been released as new bluegrass varieties; however, they are being tested at various locations over the U. S. at the present time.

2. Merion Bluegrass--This grass was included in the trials to compare with the other bluegrasses. This is an outstanding bluegrass here in the Northwest, but has a few weaknesses.

3. Park Bluegrass--This grass was slected by the Agronomy Department at the University of Minnesota as an outstanding bluegrass for that area.

4. Newport ~~Delta~~ Bluegrass (selection)--This grass originated from an Oregon sea coast selection. (Oregon state college)

5. Carnegie Bluegrass Selection (delta)--This is a bluegrass selection from Athabasca, Canada, made by Carnegie Institute Research workers.

6. Creeping red fescue--This is the standard variety and is used for comparative purposes.

7. Colonial Bentgrass--This bentgrass was chosen due to its popular use here in the Northwest for comparison purposes.

These grasses were planted in June of 1956 in plots 8'x10' and were replicated four times. They were given no special treatment the first year except for light maintenance nitrogen applications, sprinkling, mowing, and weed control. On May 1, 1957, fertilizing and cutting treatments were initiated. Subplots in the main plots were cut at 1 inch and at 1/2 inch high and received 8 lbs. per 1000 sq. ft. of actual nitrogen and 2 1/2 lbs. per 1000 sq. ft. respectively of actual nitrogen from urea for the season, divided into four equal monthly applications. These rates were chosen to observe and measure the effect of cutting heights on grasses treated with high and low levels of nitrogen fertilizers. The following points were observed during this last summer:

1. Three out of the four Northwest bluegrass selections appeared to be equal to and possibly superior in minor aspects to Merion bluegrass. The color was excellent, texture good, produced a very tight ground cover, and responded perfectly to both cutting heights and nitrogen levels.

2. Merion bluegrass, as expected, performed very satisfactorily. It did not appear to be superior to the Northwest selections except in its lower

yield of clippings. Two of the Northwest selections appeared to have a better texture and tighter turf at the 1/2-inch cutting than did Merion.

3. Park bluegrass, the Minnesota variety, was very slow in developing compared to the other bluegrasses, with the exception of Newport Delta. Park did not make a tight turf, but was always one of the higher yielders at the 1-inch cutting height and high nitrogen level. The Park plots receiving the high level of nitrogen and 1/2-inch cut did not stand this treatment during the first half of the growing season, and about one half of these plots died out and never completely filled in the rest of the season. At this time, it cannot be rated very highly as a desirable turf grass for this part of the country.

4. ~~Newport~~ Delta Carnegie selection bluegrass reacted much the same as Park in establishment and response to cutting height. It did yield somewhat lower than Park.

5. ~~Carnegie~~ New Port Delta bluegrass (selection) appears to be more desirable for turf than Park or ~~Newport~~ in this area. Yet, it does not, at this time, compare with the Northwest selections and Merion. Its color is good, and it is not a fast-growing strain. It seems to fill very slowly from seeding to maturity and may possibly be a slow "healer" following injury.

6. Creeping Red Fescue responded very satisfactorily to the nitrogen levels and cutting heights. During the hottest weeks of summer, it slowed in growth some, but not significantly.

7. Colonial bentgrass made its greatest growth in the early part of the season, tapered off some in the middle of summer, and picked up again in September and was still growing on October 1 when the other grasses were practically dormant. Low cutting and high nitrogen appeared to be the combination producing the best response.

It might be mentioned that one of the weaknesses of Merion is the slow germination and emergence. In the germination and other seeding trials conducted here, it was found that the Northwest selections emerged much faster, and, therefore, they had a higher percentage of emergence.

It appears from what happened on the Overlake Golf & Country Club, that Merion should not be seeded in mixtures with the bentgrasses. In this case, bentgrass was not seeded with Merion. But native species of bent invaded the Merion in 1956, and, by the spring of 1957, no Merion could be found on the tee. This Merion stand, prior to invasion, could be classed as outstanding from the standpoint of color, texture, and healing after divots were removed. Since Merion goes dormant fairly early in the fall and doesn't break dormancy until somewhat later in spring than bents, it might be suspected that the bents crowded the Merion out over the winter.

Molybdenum trials

Since the use of molybdenum has had some favorable publicity in the last year or so and conscientious turf managers are always looking for something new, it was decided that a few molybdenum plots on putting greens were in order. Several trials were put out west of the Cascades in areas with possible deficiencies. The material was applied at the rate of one pound of actual molybdenum per acre in early spring. It was applied on just parts of greens so that any differences could be readily observed. However, in no case was there any response to this material. This may not be conclusive evidence as to its need, but is an indication that little gain can be expected from its use.

Neburon--chickweed and crabgrass preventer

This herbicide, produced by the DuPont Company, is a substituted urea intended for pre-emergence control of the above weeds. However, since mouse-ear chickweed, Poa annua, and pearlwort have caused much concern for a long time, an attempt was made to obtain some control of these weeds by the use of Neburon.

An application was made on the Rainier Golf & Country Club by Glen Proctor in the summer of 1956, and a good kill was obtained on Poa annua. This is, of course, bad on the average older greens in Washington, since many run up to 90 per cent Poa annua, but on newly established greens with small amounts of this weed present, it "may" just be possible to keep it clean. More work is being done along this line.

As for mouse-ear chickweed and Pearlwort, 100 per cent kills were achieved at the Tacoma Country & Golf Club in one application where spots in the greens were sprayed. This material is not on the market at this time, but may be in the very near future.

"DELAYED ACTION" FERTILIZERS

Roy L. Goss and Cooperators

Delayed-action fertilizers are those that are in some way made available to the plant over a longer period of time than the ordinary commercial fertilizers, whereby, the material is slowly broken down and may or may not be released for plant use at an optimum rate. At any rate, this is a point about which this panel will discuss the results of some actual trials.

The delayed-action fertilizer being reported herein is a urea-formaldehyde type. It was agreed by this group that it would be applied at the rate of 10 lbs. of actual nitrogen per 1000 sq. ft. or 27 lbs. of this 38% N material. These trials were all begun in March of 1957, and this material was put on in one application. There was no visible injury produced in any case by this rate, and all greens were mowed without baskets for one or two times and the material was hand watered in as well.

Western Washington trials

Henry Land, Sr., Superintendent of the Tacoma Country & Golf Club, fertilized as follows: On March 15, 1957, one half of a putting green was treated with 27 lbs. per 1000 sq. ft. of uramite and the other half with 13 lbs. of Uramite per 1000 sq. ft., plus monthly applications of 1 lb. of actual N from urea (46%N).

There was no obvious difference in the two halves of the green at any time during the trial period, either in appearance or in the amount of clippings produced. By June 15, 1957, the green appeared to be lacking in nitrogen, and, by July 15, 1957, the deficiency became so obvious that the regular fertilizing program was resumed. Henry's objections--high cost and little result.

John Jaslowski, Superintendent of Broadmoor Golf & Country Club, reports as follows: The effect of applying 10 lbs. of actual N per 1000 sq. ft. from Uramite on a putting green at this location lasted not more than eight weeks. At the end of eight weeks, additional nitrogen was needed to keep the grass color up to par. The appearance of the green was normal until the effect was lost. John's objection is that the cost is too high for the effects gained. Glen Proctor, Superintendent off the Rainier Golf & Country Club, and Ken Putnam, Superintendent of Seattle Golf & Country Club, report the same as Broadmoor. The greens which were tested looked good as long as the fertilizer lasted, but that wasn't long enough.

Milt Bauman, Superintendent of the Overlake Golf & Country Club, after having tried this same material for two years, related essentially the same report as the above mentioned superintendents except that even less results were experienced. Milt reports that his current program of nitrogen fertilization is much superior to urea-formaldehyde fertilizers, considering the cost difference and results.

Eastern Washington trials

The results between western and eastern Washington show considerable differences in response to the urea-formaldehyde forms of nitrogen. Only two trials were made on this side, one being at the Manito Golf & Country Club and

the other here at Pullman on the College golf course. The results are as follows:

Cliff Everhart, Superintendent of the Manito Golf & Country Club at Spokane, reports that on an area of 520 sq. ft., he applied 13 lbs. of Bordens 38 in one application. The remainder of this nursery green received the normal fertilizer program as the rest of his course. He states that the Bordens-38-treated area yielded more clippings, and the color was as good as the remainder of the green. Cliff says this area looked as good as any of his greens until early September when it seemed to start losing color.

Here at Pullman, we treated a green on one half with 27 lb./1000 sq. ft. of Uramite and the other half with 1 lb. of actual N from urea (46% N) every two weeks. It was planned that each half would get 10 lbs. of actual N per 1000 sq. ft. for the entire season.

The Uramite treated half showed response immediately and appeared outstanding until June 25 when the color began fading. Up to this time, it looked better than urea, but then began losing ground. The manager of the course then made a second application of 8 lbs. of actual N per 1000 sq. ft. from Uramite, and this carried the greens into September in excellent condition.

In summary, I believe that it is apparent that large differences occur between eastern and western Washington in response to urea-formaldehyde forms of nitrogen, and I believe that this knowledge will enable us to carry out a more intelligent and economical nitrogen fertilization program in the future.

It is with certainty that we realize the need for a good, slowly available form of nitrogen, not only from the standpoint of labor savings, but due to the fact that most of us are losing nitrogen from leaching by overwatering. It must also be borne in mind that one good man can fertilize over 20 average-sized greens in one-half day at a cost of about $8.00.

The results reported by this panel are not intended to be final, but as an indication of response at this time. More experimentation is being planned and will be conducted next year.

I wish to express my thanks to the cooperators mentioned in this report as well as others not mentioned for making these trials possible under actual playing conditions.

TURF DISEASE RESEARCH IN WESTERN WASHINGTON

Charles J. Gould, Plant Pathologist
Western Washington Experiment Station
Puyallup, Washington

Survey of turf diseases

Fusarium Patch (caused by F. nivale and sometimes called Pink Snow Mold) causes over 90% of the spotting on golf greens in western Washington. It is usually most common in the fall, next in the spring, and least common in dry summers. The disease also develops on shoulders of greens and occasionally in lawns.

Red Thread (caused by Corticium fuciforme) affects 5 to 10% of the greens in western Washington, and those affected are predominantly of bentgrass. On such greens the fungus spreads slowly, killing the grass as it grows and producing a ring-like area whose center becomes re-invaded by weeds and annual grasses. In contrast, the fungus usually produces a scorched effect on turf in fairways, parks, cemeteries, and lawns. This scorching is particularly noticeable on turf suffering from lack of water and poor nutrition. Such a condition was widespread in western Washington in the winter of 1956 and appears to be developing again in the fall of 1957. The scorching symptom has been attributed wrongly sometimes to winter injury.

Fairy Ring (caused by Marasmius oreades). This disease, although present, was not as troublesome in 1957 as in 1956. Mushroom production was most abundant in the spring and fall. Fairy Ring remains the number-one headache to home owners.

Miscellaneous. Although the fungi mentioned above are believed to cause most turf diseases in western Washington, many others are suspected of causing trouble. In order to obtain as complete a disease picture as possible, another intensive survey is under way with major emphasis on high-cut turf (fairways, lawns, parks, cemeteries, etc.). This survey is in cooperation with Dr. M. Eglitis (also at the Western Washington Experiment Station). The possibilities that there are different strains of the Fusarium Patch and Red Thread fungi are being investigated, also.

Results of tests and recommendations for control

Fairy Ring

Tests and observations have shown that the following methods will control or alleviate the ravages of this disease.

(1) Water and fertilize generously. Inadequately watered and nourished turf is less able to compete with the mushroom fungus with the result that the disease becomes more pronounced under such conditions. Consequently, keeping the grass growing vigorously will reduce the ravages of the fungus.

(2) Drench with solutions of phenyl mercuric acetate. The fungus has been suppressed, but not eradicated, by drenching diseased areas monthly with solutions of phenyl mercuric acetate. Such areas were spiked or aerified before application to facilitate penetration of the solutions. The latter were

applied with a sprinkling can. Many other compounds have been tested, but they have either failed to give as consistent results as the above material or were injurious to the turf.

(3) Fumigate with methyl bromide. The results of tests indicate that apparently we have been able to eradicate the fairy ring fungus by fumigating diseased areas with methyl bromide. A full report on tests with this and other fumigants will be made later. Meanwhile we are recommending the material for trial use in the following manner:

a. Treat in late spring or early fall.

b. Spike or aerify the area before treating.

c. Treat when soil temperature is 60° or warmer at a depth of 4 inches.

d. Use methyl bromide at 2 lbs. per 100 square feet.

e. Keep area covered with a gas-proof tarp for 48 hours.

f. Follow the manufacturer's directions for use. Methyl bromide is a deadly gas.

g. Reseed the treated area after 1-2 weeks.

(Dr. H. M. Austenson and Mr. Vernon L. Miller have cooperated in these studies on Fairy Ring.)

When properly done, the treatment apparently kills fungi, insects, weeds, and grass. Grass seed can be sown directly on top of the dead turf. The re-seeded area should be kept well fertilized and watered.

This methyl bromide treatment, although apparently effective, is rather drastic. A more simple treatment is needed, particularly for use by home owners. Our search for one will be continued.

Red Thread

Disease resistance. Fairway plots have been established at the Tacoma Golf and Country Club in cooperation with Henry Land, Superintendent, and Dr. H. M. Austenson (WWES) in order to study the possible resistance of grasses to the red thread fungus. Under study are: Merion, Kentucky, and WSC blue-grasses; chewings, creeping red and Pennlawn fescues; and colonial bent.

Fungicides. PMAS has not controlled this disease. Other materials will be tested during the coming season.

Fertilizers. More red thread disease was observed in poorly nourished lawns during the winter of 1956/57 than in well-nourished ones. In order to verify this observation, an undernourished, infected lawn in Sumner, Washington, was fertilized with the following materials in the spring of 1957: none, Noxmoss, Uramite (with and without ammonium sulfate), Urea, 10-10-10, and Milorganite. All the fertilizers gave a favorable response. Heavy applications of nitrogen have also aided recovery of red thread-infected greens on two golf courses. Thus, it appears that proper fertilizing and watering will help overcome this disease, although it will not, of course, eliminate the fungus. Heavy

use of nitrogen fertilizers on greens should be confined to the summer, since they may increase losses from Fusarium Patch in the spring and fall months. (Cooperative with Dr. Austenson.)

Fusarium Patch (Pink Snow Mold)

Disease resistance. In cooperation with Dr. H. M. Austenson (WWES) and Henry Land, Superintendent at the Tacoma Golf and Country Club, a nursery area was fumigated with methyl bromide and subsequently planted to the following nine grasses in the spring of 1957: Poa annua (annual bluegrass), Colonial, Rhode Island #5, Seaside, Highland, Cohansey, Pennlu, Penncross, and Congressional. The area is being cut at greens height. Infection by the Fusarium is being permitted to occur naturally. Preliminary counts indicate that Colonial Bent is much more susceptible than are the other types of grasses. Perhaps Poa annua predominates in western Washington greens because Fusarium destroys Colonial and opens the way for invasion by the Poa.

Fungicides. Most of our recent efforts have been directed toward the use of fungicides, since they offered most immediate hope of controlling this important disease. The fungicides showing the most promise in preliminary screening tests at the Western Washington Experiment Station, were first used in a test on a putting green in cooperation with Roy Goss (Washington State College) and Milt Bauman, Superintendent at the Overlake Golf and Country Club (Medina). This experiment was started on August 21, 1956 with applications at 10-, and later, 14-day intervals of materials in 10 gallons of water per 1,000 square feet. PMAS (@ 1 oz.) and Calocure (@ 3 oz.) gave the best control, followed by Special Semesan (@ 4 oz.), Tersan (@ 5 oz.), and Cadminate (@ 1/2 oz.). The last two materials appeared to control the disease during mild attacks, but failed during severe ones. At a 2-oz. rate PMAS severely scorched the green, PMAS at 1 oz. and Special Semesan (@ 4 oz.) caused some slight scorching, mostly during warm weather.

On September 10, 1956, another test was started in cooperation with Milt Bauman on an adjacent pitching green. All of the materials included in this experiment have appeared promising, but the disease attack has not been sufficiently severe yet to show differences. Materials being tested at two-week intervals are: Calocure (@ 1 1/2 oz. and 3 oz.) PMAS (@ 1/2 oz.) with and without iron sulfate @ 1/2 oz.), Semesan (@ 2 oz.), and Mycostatin (@ 4 oz.).

Another experiment was started on the experimental green at the Western Washington Experiment Station in the summer of 1957. However, warm, dry weather prevented development of the disease.

Based upon the results at Overlake, an experiment was started on September 4, 1957, on a putting green at the Broadmoor Golf and Country Club (Seattle) in cooperation with the Superintendent, John Jaslowski. This test had three main objectives: (1) To compare the effectiveness of PMAS and Caloclor types of mercury compounds; (2) to determine which intervals (of 2, 3, or 4 weeks) of application of these materials were most desirable; and (3) to test the effectiveness of two new fungicides. The treatments under test are: PMAS (@ 3/4 oz,), every 2, 3, or 4 weeks; Caloclor (@ 1 oz.) every 2, 3, or 4 weeks; Caloclor (@ 2 oz.) every 4 weeks; Calocure (@ 2 oz,) every 2 weeks; PMAS (3/4 oz.) alternating with Caloclor (1 oz.) every 3 weeks; Kromad MF-18 (@ 2 oz.) every 2 weeks and Ceresan 200 (@ 1/2 oz.) every 2 or 4 weeks. The most effective treatment during the first month was PMAS (@ 3/4 oz.) applied every 2 weeks. This and other tests are continuing.

Recommendations. Based upon the results to date, the following suggestions are made for control of Fusarium Patch on golf greens:

(1) Be sure that the green has good air drainage. The disease is most serious on greens with poor air movement, since the grass stays wet longer.

(2) Many diseases caused by Fusarium fungi on other crops are made worse by the heavy use of nitrogen. Therefore, avoid excessive applications of nitrogen until more can be learned about its effect on this disease of turf.

(3) Use PMAS (@ 3/4 or 1 oz. in 10 gal. of water per 1000 square feet) for rapid control.

(4) Use PMAS (@ 1/2 or 3/4 oz.) or Calocure (@ 2 to 4 oz.) for regular treatment.

(5) Treat every two weeks in Fusarium weather (cool and moist); otherwise treat every four weeks.

(6) Treat shoulders as well as greens in order to remove a major source of reinfestation.

Conclusion

The type of studies described above will be continued until (1) we have obtained a reasonably complete picture of turf diseases in western Washington and (2) we have found suitable controls for the most important ones. However, for the most effective control program, we need to know many additional facts about these fungi, for instance; how they attack grasses; the optimum temperature, moisture, and pH for infection; how they overwinter and spread; and whether or not different strains exist. With this knowledge we should be able to develop more effective and less costly control measures. We will undertake their study as rapidly as time and facilities permit.

My appreciation for assistance in this work goes to my associates and the cooperators listed and also to the Northwest Turf Association for their generous financial help.

Trade names of the materials tested have been used in this article to simplify the presentation and also to specify the materials used. However, similar types with different trade names should give as effective control.

TURFGRASS ADAPTATION STUDIES IN WESTERN WASHINGTON

H. M. Austenson, Assistant Agronomist
Western Washington Experiment Station

Observational plots of common turfgrass varieties have been established at experiment stations at Vancouver, Puyallup, and Mount Vernon. Merion Kentucky bluegrass has shown good adaptation at all locations. It has had darker-green color than common Kentucky blue, especially during the cooler months. Resistance to weed invasion has also been superior. Leaf rust has been common on Merion but has not caused any noticeable damage. When planted in midsummer Merion has not been slower in establishment than common Kentucky blue.

Certain warm-season grasses and ground covers have recently been promoted by various commercial interests in western Washington. Zoysia and bermudagrass varieties made satisfactory summer growth at Puyallup in 1957. Dichondra became established easily at all three locations. Mondo plants remained alive but made almost no growth during the summer. The winter survival of these species will be noted.

The colonial bentgrass seed, including Astoria, currently available is an unselected mixture which produces a nonuniform turf. Some of these types have been cloned, and a wide divergence in plant types has been noted. Some of the more desirable appearing plants have been isolated for a further study of their progeny.

In addition to these studies, the Agronomy Department has cooperated with Dr. C. J. Gould, Plant Pathologist, in his work on the control of fairy ring, red thread, and pink snow mold in turfgrass.

BUDGETS

Sam Zook, chairman, Glen Proctor, Cliff Everhart and Henry Land, Sr.

Land. The most important thing is for every clubhouse to have a budget. For example the life of a Ford tractor, which lasts in good shape for about 10 years and then is scratched off. The club knows that the end of that time they will have to replace equipment. Mowers are usually used on the golf-greens for a 4-year period, aerifier - 10 years, fairway mower - 10 years. Then both the seller and the company know that it must be thrust aside for replacements. They plan to cut on labor this year. They are planning on cutting it down to about $30,000 per year. Below is the estimated budget (total 42,650)

Labor (4 men and supt.)	$30,000
Gas and oil	13,000
Fertilizer for greens	12,000
Maintenance	1,300
Fairways	2,000
Fungicides	500
Weed killer	500
Sand	250
Shop supplies	200
Maintenance and water system	250
Flags	200
Repairs	1,200

Water system could be additional $1,000, new equipment about $2,000. Emergency budget--$500. The club furnished $250 for travel expenses, 5 cents per mile for trips around town. They pay my dues to all meetings--this was proposed to them by Charlie Wilson and was adopted.

Proctor. Prices keep raising and so do homes, etc. Last year my budget went up $4,000 to a total of $47,000.

Labor	$32,988
Fertilizers	2,000
Gas and oil	1,000
Equipment repair	1,000
Sand and gravel	500
Top soil	500
Weed killer	300
Fungicides	400
Turf research	100
Irrigation	500
Water expenses	360
Expense account	250
New equipment	3,400
Water system addition	4,000
TOTAL	$47,298

I think that in making out a budget that it can be possible to get one that is way too low. Our members don't appreciate us being scotch; if we don't spend it, the club will.

Members appreciate what we can get them, and they have never cut our budget. Remark from floor. The feeling is that some people don't realize how much money is going in on the clubhouse. Do you have carts at your club? I was wondering if there was a charge for carts.

Proctor. Yes, the charge for carts is $10 per month.

Cliff Everhart: I make up what I will spend the next year and that way have the job done for two years. My expenses last year were:

Labor	$14,600
Water	7,000
Fertilizer and sand	2,050
Maintenance	1,000
Gas and oil	650
Power (electricity, etc.)	700
Parking lots, misc.	750
TOTAL	$26,750

Question. Do you have any breakdown in labor? How much is it for labor for sprinkling to be done each month?

Everhart. I imagine now it is about $350-360 per month during the watering season. In the month of August, $2,078 was paid out for 30 days of work.

Question. Have you any idea how many cubic feet you use each year?

Everhart. Approximately 65-80 million cu. ft.

Land. I think on the coast our water is about $15,000 a year, we have one man who does all the watering.

Zook. Comparisons can't be made as every club is different.

Proctor. Help is hard to get as they can go to Boeings Aircraft and make $2.05 an hour. We pay $1.85 an hour and it is a 6-day-week job.

Land. My office gives me monthly reports on what to spend.

Proctor. I never hear about it until the end of the month.

Question. Slot machines were quite a blow when they were taken away, has everyone recovered from that yet?

Land. I think it has, and we're getting along a little better off without them. The club is now self-supporting.

Question. I had heard the slot machines helped build private courses in Spokane.

Zook. There are course planning record books that are put out by DuPont. They schedule everything down, budgets, etc. As I see it myself I have tried using it, but it involves too much bookkeeping. I would have to hire a bookkeeper to keep this book. My own budget ($47,500 without capital expenses) is similar to theirs, but I have to submit monthly reports and give total

breakdown of mowing greens. It does involve a lot of work, and I just wondered if they are not getting me involved in too much paper work and then I have to spend too much time in the office.

Land. They have daily work sheets which they prepare that are very simple. The men feel these work fairly well. It has every item mentioned on the golf course, and they check them.

Question. What are the fertilizer costs for next year going to be?

Law. Total list that Henry keeps that tells when machinery depreciates is a very good idea.

Zook. Labor supply - 5 men
3 water men
As high as 10 men during the day, 142 sprinklers.

Question. What's your labor cost?

Zook. $30,000.

Question. Is there any way of telling how many cu. ft. of water to use? An. --No.

Zook. Pumps are centrifugal-force type, and we have about 150 ft. of pipe with a lift of about 25-30 ft., and the effectiveness is way off.

Question. Has your fertilizer bill gone up since they have tried to clean up the Willamette Valley?

Zook. Yes it has.

Question. How do you budget new equipment this year?

Everhart. New equipment is capitalization.

Zook. The clubs are wonderful about buying fertilizer and they never question the need for this.

Law. I was wondering if you fellows from Victoria and British Columbia have budgets that compare with these.

Answer. No two courses can run alike, but I can say that the budgets in Canada are similar to those in the U. S. Labor per hour is about $1.70 (union) which doesn't compare adversely with the U. S. 's $1.65-1.85 an hour. Equipment is much more costly in Canada. We have only been unionized about two months to two years in some of them. Operation under unions is more difficult.

Question. Do the men in the union have specific jobs to do in Canada?

Answer. That $1.70 covers all employees, it doesn't mean that they can only work on one job all the time. They can be moved around to any job.

Floor from Seattle. In Seattle you can't move a worker around, you have to stick to the job which you are assigned and it makes it much more costly. It takes a lot of planning to make it come out evenly.

Joe Ward. We had unionized help at Sun Valley that could change from job to job. Rate was $1.90 an hour. Very short season of 4 months only. Labor lasts from 7-8 months, however.

FAIRWAY RENOVATION

Ken Putnam, Superintendent
Seattle Golf Club

The Seattle Golf Club was built in 1906 and was cut out of virgin fir timber. After the stumps were blown the holes were filled by scrapers pulled by teams of horses. None of the heavy equipment we use today could be used to advantage. The results were the same to a point, that is the holes were filled and the fairways were smooth and true but not compact.

In the ensuing years the stump holes have settled, some so bad the fairway mowers do not reach the bottom. Also the fertilizer and water collects in the sunken areas producing a thick, lush growth of grass that the mowers do not reach. This was not the cause of too much complaining until the introduction of the electric carts. The ride was just too rough.

After many futile attempts at truing up the fairways by patching the individual holes, it was decided to do a more complete job. We tried to obtain some information on costs and methods of complete renovation, but since a job of this size had never been done before, none was available.

Since the big cost would be the handling of the sod, we tried to figure out some way to eliminate as much of that as possible. The result was the use of pallet boards. We cut the sod with a Ryan sod cutter and with an automatic cut-off. The sod was cut 1 1/2 inches thick, 15 inches wide, and 36 inches long. The pallet boards were 48 by 40 inches allowing us to place the sod 3 wide and to a height of about 4 feet. The top few rows were layed crosswise to tie the pile together. The pallet boards were moved with a fork-lift attachment on a Ford tractor. The first eight to ten rows on each were piled on the edge of the rough. After removing the sod we loosened the ground with a set of cultivators to a depth of about 10 to 12 inches, then disked it twice, and finished leveling with a Roseman Tiller rake and a float. While this was going on, the rest of the crew was picking up rocks and depositing them along the sides to be hauled away later.

After the fairways were leveled to our satisfaction we put on three tons of limerock flour and 1,000 lbs. of 6-20-20. This was determined by a soil analysis.

We do not think it advisable to lift more sod than can be replaced in a week. The area to be done depends on the size of the crew. The first fairway we attempted was three acres. We split it down the middle and started cutting sod on a Monday and had the sod back down Friday night. This is about all a crew of nine men can do in a week with favorable weather. We then tried doing three acres which took us about ten days, but the sod was quite discolored from heating.

After removing the sod we found a layer of organic matter about two inches thick which was so hard a disk would not touch it, so we then had to resort to cultivators. This layer also explains why there was no water or root penetration. One fairway had two spots of fairy ring, and the sod from these spots was discarded and, now, a year later, there is no sign of the fungus. Whether this means anything or not remains to be seen. To date we have renovated a total of ten acres at a cost of $479 per acre. We feel the results

more than warrant the expense, and the club plans on continuing the work until all the fairways have been completed.

This work is due mainly to the efforts of Mr. Ed Dunn, our Greens Chairman the past two years, whose sincere interest and long-range planning is responsible for many major improvements at the Seattle Golf Club.

Question. In laying the sod, was any contour leveling done?

No, the golfers didn't want the contour of the land changed.

Question. Did you have any trouble with compaction during the wet weather?

We didn't, but haven't had time to know what may happen yet.

Question. How did you handle the 30'' cuts.

Three rolls of sod just fit in the 30'' way. 4-way pallet boards were used and spread under turf.

Question. What species of grass do you have in the fairways?

Annual bluegrass and bentgrass.

Question. What kind of roller was used?

An old piece of smokestack filled with cement weighing about two tons.

Question. Can we use one of these rototilling machines for contouring and rototilling greens?

Yes, you can travel at a certain rate of speed with it and can travel the same speed all the time. After the turf was laid, cart traffic was kept off from it for a considerable length of time.

Question. Did you notice where stumps had been and had been blown over?

Hardly any at all, no holes were found.

Charlie Wilson. There are eight facts that influence what makes any plant grow. These can be used as a check-up list and if followed precisely, you won't have any trouble.

1. Select grass favorable to temperature of that area.
2. Good soil environment.
3. Texture of soil, depth (uniform depth).
4. Enough light.
5. Adequate water.
6. Fertilizer and plant food must be added--especially nitrogen.

7. Protect from injury (insects, diseases, weeds, etc.)

8. Soil with favorable soil reaction.

Considerable attention should be given to liming of soils, influence of disease, and drought resistance. pH of soil runs to pH 6.0 to pH 7.5. I think any soil reaction that falls below pH 6.0 should be given some lime or dolomitic limestone.

A scalded green should have fans. You do need to consider tree pruning so you can get some air movement. Sometimes new plugs have to be cut for good watering practices and the turf will wear out. You can detect dry spots in bentgrass by getting up in the early morning, that is when they show up the best. There's no guttation water on the dry areas.

"I defy any irrigator doing a proper job of irrigation where there are deep roots (tree) running into the ground underneath." The water will always run off, but trenching can be used. Dry spots are bad because they get little water, but they seem to always come back. Big problem in all watering is to make sure to get the moisture all the way down. To help this problem it can be aerified by punching holes in the course.

A REPORT ON THE INSTALLATION OF RECENT TURF SPRINKLING SYSTEMS

Don Hogan (H. D. Fowler Co. Inc.)

My presentation this morning will be limited to comments on some slides I have to present that were taken of some recent turf sprinkling installations.

First we have a picture of the Tyan Sod Cutter that has been very successful in the removal of sod prior to trenching. There you see Henry Land, Sr., of Tacoma Country Club, running the machine, and George Lawton, presently of Elks Allen-Moore Golf Course, Tacoma, Washington, who is removing the sod from the earth.

Next we have a picture of the fairway piping as spotted along the trench side prior to installation. You might note that one coupling has been made on each length of pipe, and the pipe is so positioned that it can be reached by workmen in the trench.

Here we show the same area with the pipe installed in the trench. You might note the considerable amount of large rocks that were excavated in this project at the Tacoma Country Club. Particular care must be exercised when backfilling material that has such a high percentage of large rocks.

Next we have a connection to one of the fairway pipings showing a ductile iron saddle connection. This type of connection has the advantage that it can be placed anywhere along the line permitting exact placement of the sprinkler outlet. You also can see the swing joint installation which is installed both to assure a completely vertical riser as well as to protect the pipe from surface loading.

We here have a picture of a couple of large fairway sprinklers operating at the Tacoma Country Club. You might note that this particular sprinkler is not only throwing the full width of the fairway, but also is watering approximately twenty (20) feet into the rough.

This next shot shows the narrow area of the fairway in front of the #16 tee at Tacoma Country Club. In areas of this nature smaller sprinklers are used so as to not waste water in areas of rough that are not maintained.

Lastly, in this group of slides from the Tacoma Country Club, we show the method of testing the pipe installation for pressure. In this case we made an adaption to the pipeline, and a pump was hooked on to Henry Land's tractor to build up the pressure in the line. The suction from this pump went to a 50-gallon drum that is placed adjacent to the tractor. It was possible to measure exactly the amount of water loss over a given length of time, and thus determine the exact amount of loss in the system.

This next group of slides was taken at Foster Golf Course in Seattle, Washington. This particular area was installed with 100% Kralastic material from 3 1/2 " diameter down to 2" diameter. This particular system is designed to water 100% of the fairway between the limitations of the property line as they mow both fairways and rough areas alike at Foster Golf Course. This enables them to speed up play since they are a public golf course.

The first slide shows 3" piping spotted along the main line prior to installation. The second picture shows the ease with which this pipe can follow tight curves, both on the fairways and adjacent to the greens. You might note that the 3" line has already been completely made together on top of the ground, and will then just be placed into the trench in its entirety.

This next picture shows Les Frank who took the contract for installation only of this material. The golf course dug their own trenches, and Mr. Frank then came along and installed the pipe. It took him approximately two (2) hours per day to lay the pipe in the trenches that were opened up in an entire day by the excavation crew. Therefore, we here see Les with the 12-pound steelhead he caught in the river adjacent to the golf course while waiting for the crew to open up more trench for him.

This next picture shows the cutting of 3" pipe, whereby the installation crew is just using a plain cross-cut handsaw.

And this last picture of Foster Golf Course installation shows the workmen applying solvent and cement to make together a pipe joint.

This next group of slides was taken at the Portland Golf Club in Portland, Oregon. The first picture shows the trenching machine that was used on this project. This is a Ford tractor with a continuous chain-type digger attached to the rear. This particular piece of equipment did not damage the course in any way. There is one disadvantage to this digger, in that it does not distribute the dirt far enough from the trench side, and therefore makes it rather precarious to install the pipe.

Next we have fairway piping spotted along #6 fairway prior to installation. You will note that the excavated material is placed to one side of the trench and the pipe and sod to the other side. This permits handling of the pipe without knocking an excessive amount of material down into the trench. Also, in this manner, the mechanical equipment can backfill without running over the sod that has been lifted.

Next we show asbestos cement pipe installed in a trench on a curved area of the fairway. It is obvious that even with 13-foot lengths of rigid pipe there is enough deflection at the couplings to make a very nice, even curve.

In this picture we show the backfill crew preparing a trench that has already had the pipe installed. The sod has not been placed back, but the excavated material has been backfilled, and the crew is presently tamping it prior to placement of the sod.

This next picture shows the same area on #17 tee at Portland Golf Club where they are cleaning up the last bit of excess material. You might note in this picture that it is almost impossible to tell where the trench was, although it is just a single day after the ground was originally opened up.

Lastly, in this group from Portland Golf Club, we show a couple of fairway sprinklers operating on #9 fairway in front of the clubhouse. You can see from this picture that the sprinklers are throwing well beyond the extremity of the fairway edge and are giving an approximate diameter of 200 feet.

We are now showing a few slides on the construction work that was accomplished this summer at the Yakima Country Club in Yakima, Washington, namely with the installation of their new nine holes.

The first slide shows the trenching machine operating on the old nine holes, part of the course where they also installed a brand-new sprinkling system in conjunction with the other work they are accomplishing. This particular digger is a continuous type of digger with a large wheel around the perimeter of which there are installed a number of buckets which dump the dirt on to a conveyor belt which deposits it in turn along the trench side. You can see that this trenching machine is operated on large tracks similar to that of a bulldozer. Although it appears in this picture that the tracks are marking the fairway, this grass healed over in approximately fourldays after the trenching machine had gone by.

Next we show the installation of a main line in the new construction area. You might note how completely dry this soil is. This area had not been irrigated for a year or so, and therefore it made it very, very difficult for the workmen to work when any wind came up. This can be shown emphatically in the next picture of earth-moving equipment working on the fairway, distributing soil around the golf course. You can see a large cloud of dust moving across the golf course after being disturbed by this equipment.

Next, we show a general information shot of the new nine holes at Yakima Country Club prior to final grading. This shows the area around #5 green, #6 fairway, and #7, #8, and #9 fairways.

Lastly, in this group from Yakima Country Club, we show the large fairway sprinklers operating on the new nine holes prior to seeding. Although there is quite an amount of area that lies between the fairways not being sprinkled, we found that upon getting the new sprinkling system into operation, it practically solved the dust problem for us. There was enough drift from the fairway sprinklers into the rough areas between the fairways to keep wind damage to a minimum.

We are now showing a few slides that were taken at Broadmoor Golf Club in Seattle, Washington. This first slide shows the installation crew starting to lay the first bit of the main line, as well as the superintendent, John Jaslowski, conferring with his president, Mr. Yeakel, while they discuss the plans of the sprinkling system.

Next we have an interesting picture of a section of the old steel main line which was removed. You might note the internal build-up of corrosion which has caused this pipe to be very inefficient in its waning years. This slide shows the installation of the 4" automatic controlled valves that operate the various fairways at Broadmoor. Through the use of this type of equipment a night waterman is not required.

Next we have a picture of a quick coupling valve that has installed upon its lid a permanent acrylic plastic numbered top. This permits us to transpose into the field the operating instructions as outlined on the design drawings.

The last slide of this group at Broadmoor shows a large fairway sprinkler operating in front of #9 green. Standing behind the sprinkler is John Jaslowski, the Superintendent. You might note the three-wheel scooter he has parked nearby. An interesting sidelight of this scooter is the manner in which John was supplied with this piece of equipment. During the construction of this project John Jaslowski, Mr. Yeakel, and I were discussing various situations at John's shop. We got on to the subject of how to handle the sprinklers, and it was suggested that a small rack be made for these sprinklers, which in turn could be

removed or placed on to such a piece of equipment as this scooter. Mr. Yeakel thought that the idea of procuring such a scooter was good, in consideration of the fact that it also could be used during the day for various errands around the golf course. Mr. Yeakel then got in touch with other members of the Board, and a scooter was delivered to John two days later. This just points out what excellent cooperation can be achieved between a superintendent and his president or greens chairman if they work together as a team.

Finally, this last group of slides was taken at Waverley Country Club at Portland, Oregon.

First we have a picture again of the crew starting to lay the first part of the main line. In this picture we see the trenching machine approximately 50 feet ahead of the pipe-laying operation, with the workmen following right behind, laying the pipe, as it is excavated. In the lower right-hand corner we see the Superintendent, Mr. Sam Zook, and his Greens Chairman, Mr. Richard Stanton, conferring over the plans as this construction begins. In the background to the left we see an indication of a problem that is always plaguing us during construction period; that is, a foursome of golfers who are cutting right across the fairway where we are working. This particular problem has to be considered locally for each various project.

Next we have Sam Zook standing behind the permanent type of sign that was constructed to close various holes during construction. You might note that the hole number that is being closed, as well as the hole to which to proceed, is so designated with a removable number so this sign can be utilized during the entire project. In this particular picture the sign says "Sorry, Hole #6 Closed Due to Irrigation Construction. Please Proceed to #7 Tee."

In this next picture we show the main line of 8" pipe as it is being layed across #7 fairway and then into #8 fairway. The pipe has been layed in the trench, and the backfill process is going on. Adjacent to the trench is the control tubing for operating the automatic valves. This pipe has all been made together and need only be placed in the trench after the initial backfill around the main line piping.

In the next picture we show the same exact location, approximately three days later, across #7 fairway and #8 fairway. In this picture you can see that there is hardly any visible evidence of any construction work being accomplished in this area. Sam's crew did an excellent job of handling the turf and getting it back promptly before it turned brown.

The picture we are now showing was taken on #6 fairway at Waverley. You can see that the soil is extremely dry, as there has been no attempt to water this fairway in the past.

Next we have a picture of the same #6 fairway again, seven days after the sprinkling system was put into operation. You can see that the areas, as shown in the preceding picture which had no turf established whatsoever, are now starting to turn green.

Here again is another picture of #6 fairway, showing the large fairway sprinklers throwing water on the adjacent hillside. This area in the past has been a terrific eyesore for people driving on to the golf course, and it was of great satisfaction to the Greens Committee to be able to get an installation that would keep this area attractive.

On the screen now we have a picture showing the various control tubings that are running to the automatic valves placed in the field. Each one of these control tubings has been marked with a color so it could be easily identified at any point.

Next we are showing #3 fairway at Waverley prior to the installation of the new sprinkling system. Here we have six sprinklers operating in the fairway area in front of the green. Please note the very decided brown line along the edge of the fairway leading to the trap on the right.

Now in this next picture we are showing the same area with a single large fairway sprinkler throwing entirely across the width of the fairway. Also please note, in the lower right-hand corner next to the trap on the right, there is greening beyond the edge of the fairway and around the trap area. This picture can emphasize the efficiency of a single, large sprinkler as against a multiple number of sprinklers operating on a hose-type system.

Here we have a shot of #7 fairway, showing the overlapping of two fairway sprinklers as they are operating automatically. The hillside in the background is an embankment which supports the Portland Traction Company's railroad tracks. With this new system we are able to supply water along the entire length of this bank, thus permitting some type of beautification on this eyesore.

In this next picture we see Sam Zook as he has placed a large sprinkler in the very front lip of #3 green. Although in this particular sprinkling system we have multiple outlets around each green, we also have incorporated one large sprinkler on the front face of each green. This permits a quick sprinkling of any green on the golf course with a single set. Normally this would not be accepted practice because large sprinklers are notorious for not adequately breaking up the stream of water. However, with proper pressure, as you can see in this picture, a very even, fine curtain of water can be distributed over the entire length of the stream. Therefore, it behooves us to be sure that any sprinkler that is operating is being held within the tolerances of pressure for which it is designed.

In this picture we see five large fairway sprinklers operating in the background across #3 and #4 fairways at Waverley. These sprinklers are being operated automatically, as they have just come on. In the foreground it shows a large fairway sprinkler on part of #3 fairway that is presently just shutting off due to the control from the automatic equipment. This type of installation permits Sam to have positive control of all the watering on his golf course without the problem of retaining a night waterman, although all of the fairway watering is done at night.

These next three slides show the automatic controller that operates the automatic valves at Waverley Country Club. First we have Sam Zook standing next to the controller with the front panel off. Secondly, we have a close-up of the clock which actually does the automatic control work. Thirdly, we have the pedestal mounting shown with the front lid closed and the padlock in place to prevent any tampering with the equipment.

The last slide I have in the entire group of pictures shows an excavation in front of #6 green at Waverley Country Club. Here you can see the various layers and stratifications that have been caused by both top dressing and also the sand that has been forced out of the adjacent trap. Sam and I made a few

holes immediately adjacent to this excavation; however, upon filling them with water, it was impossible for us to get any water to move either laterally or vertically through this strata. Sam remarked that it was no wonder he was having difficulty maintaining turf on this heavily travelled apron approaching this green.

That completes the presentation of these slides, and I sincerely hope that there were a few slides among this group that proved of interest to you all.

PANEL ON FERTILIZERS FOR TURF AREAS

Paul Brown (Evergreen Cemetery)

Everything about us is taking on a little different appearance. We have been running some tests in slow-acting nitrogen and urea with the objective of determining the growth and longevity of the reaction by the use of these different ureas. We used uramite and Bordens 38. We were able to measure the height of growth at the time of mowing only as we had no method of clipping individual plots. The first application was made on June 6 when we were still having cool weather.

We could still see the borderline, but the grass with the 5 lbs. of urea really got a bounce!

Crab and shrimp meal both gave good results with a lasting effect. Shrimp meal was better than crab. Most sea foods have good nutrients. Analysis--6 to 7% of nitrogen gave a good color of green and is quite lasting. We ran other tests with different formulas, but the addition of FTE to any of our formulas gives better results on grass than if it were left out.

Getting started on something in the delayed action type is the hardest. If we could only arrive at something that would give color instead of growth. That is what we are striving for now. In our cemeteries they are getting so they have markers instead of large headstones, so mowing is made much easier.

First Series -- June 6th:

Plot 1.	Borden's 38 - Ureaform	10# per 1000 sq. ft.
Plot 2.	Borden's 38 plus 1# conventional urea (repeated Aug. 15th)	1# per 1000 sq. ft.
Plot 3.	Crab Meal	40# per 1000 sq. ft.
Plot 4.	Organic Base 5-2-1	20# per 1000 sq. ft.
Plot 5.	Organic Base 8-2-1	20# per 1000 sq. ft.
Plot 6.	Organic Base 10-2-1	20# per 1000 sq. ft.
Plot 7.	Conventional urea	5# per 1000 sq. ft.
Plot 8.	DuPont Uramite - ureaform	8# per 1000 sq. ft.
Plot 9.	Scott's Western 20-10-5	5# per 1000 sq. ft.
Plot 10.	Lilly's Super-Rich 10-3-5	25# per 1000 sq. ft.

Second Series -- August 8th:

Plot 1.	Borden's 38 - Ureaform	12# per 1000 sq. ft.
Plot 2.	Uramite 38 - Ureaform	12# per 1000 sq. ft.
Plot 3.	Conventional urea	5# per 1000 sq. ft.
Plot 4.	Urea-Sulpomag-Tracin	10# per 1000 sq. ft.
Plot 5.	Urea-Sulpomag-Tracin	10# per 1000 sq. ft.
Plot 6.	20-5-5 with FTE	10# per 1000 sq. ft.
Plot 7.	Hynite 10% Nitrogen	20# per 1000 sq. ft.
Plot 8.	Shrimp Meal	30# per 1000 sq. ft.
Plot 9.	Park and Green 5-3-3-2	40# per 1000 sq. ft.
Plot 10.	Agro 8-3-3	20# per 1000 sq. ft.
Plot 11.	Agro 5-2-2	40# per 1000 sq. ft.
Plot 12.	Fe Tracin plus Gypsum	4# per 1000 sq. ft.
Plot 13.	Hi-12	6# per 1000 sq. ft.
Plot 14.	Ferro "All insoluble" 10-10-10	18# per 1000 sq. ft.

The original principle objective in these tests was to differentiate between slow-acting and conventional fertilizers, particularly nitrogen.

Let us first consider the two brands of ureaform, namely, Bordens and Uramite, used according to instructions. In the first series, June 6th, the weather was still quite cool and remained so for several weeks. We found that Bordens was more available at this temperature than was Uramite, which made very little showing if any. In the second series, August 8th, the weather was much warmer, and there was very little difference between the two forms; however, there was an increase in the application of each. Where urea was added to Bordens there was a much more rapid growth of grass, but no more rapid than plots 7 and 3 of the 1st and 2nd series.

Both Crab and Shrimp meal gave good results which were quite lasting. For a cemetery the odor was a decided objection, and the cost per acre was high. Sea food products have a well-balanced analysis including trace elements and make a good material for an organic base.

There wasn't enough difference between plots 5 and 6 of series one to evaluate the difference in nitrogen; however, these higher nitrogen fertilizers did give a good response.

Plot 9, series one, gave very little response at the application recommended, while plot 10 gave too much response and could have been applied at half the recommended rate.

In the second series there was a definite response from the formulas which included FTE as a form of trace material. FTE actually improves the texture of the grass. Plot 6 at 10 pounds per thousand gave a good color and growth with good texture. There was little difference between plots 9, 10, and 11. Plot 13 was badly burned at the rate of 6# per thousand. Plot 14 was very slow to start but soon began to show color and will continue to do so for the rest of the season. The nitrogen content of this was ureaform with phosphate and potash being fritted.

(These tests were made with the cooperation of Roy Goss, Research Assistant Washington State College; Dr. J. K. Patterson, Executive Secretary, Pacific Northwest Turf Association; with Paul D. Brown, Horticulturist, Evergreen Cemetery Company and Lee Fryer, Research Specialist, Pacific Agro Co. preparing the formulas and plots.)

PANEL ON FERTILIZATION FOR GOLF COURSES

Henry Land, Jr. (Sandpoint Golf and Country Club)

To set up a fertilizer program a great deal of consideration has to be given to different types of soil structures, kinds of grass, drainage, and climatic conditions. Regardless of the turf condition it is always helpful to take a soil test at least once a year to determine the percentage of nitrogen, phosphate, potash, pH and trace elements, but soil testing should not be relied on alone to determine a fertilizing program. In the Puget Sound area rainfall is excessive and temperature moderate (80-degree temperature is considered high in this area which we do not experience very often). So, consequently, we find the use of 50% organic notrogen and 50% chemical nitrogen the most desirable because of excessive rainfall and lower temperatures than most parts of the United States.

We have found in this area grass does not experience a true dormant season through the winter unless we have a n unusual year. Under these conditions, leaf feeding with small amounts of nitrogen, potash, iron sulfate was very helpful in maintaining better turf for our ever-increasing winter play. Greens were fertilized with a 9-5-7 mixture consisting of 1,400 lbs. of Bloodmeal, 300 lbs. of steamed bone meal, and 300 lbs. sulfate of potash per ton. All phosphates used on the greens were from steamed bone meal: the reasons being bone meal seems to have immediate crop-producing powers over other forms of phosphate possibly because of its physical characteristics and its organic origin.

"Phosphates were held to a minimum, reasons being it is an aggravating factor towards iron chlorosis which we have experienced and also high phosphate encourage Poa Annua which is an undesirable grass for golf greens" (1955 Turf Conference O J. Noer.) The fertilizing program we have followed during 1957 on our greens, figured in pounds per acre for the total year, was 400 lbs. nitrogen, 129 lbs. phosphate, 300 lbs. potash, 53 lbs. iron sulfate, and 53 lbs. magnesium sulfate. During six months of the growing season greens were fertilized twice a month, once with the 9-5-7 at a rate of 10 lbs. per 1000 square feet and (once) with 1 lbs. Urea, 2 oz. iron sulphate, 2 oz. magnesium sulfate.

During four months of the winter, greens were sprayed twice a month, once with 3/4 lbs. Urea, 2 oz. iron sulfate and 2 oz. magnesium sulfate. The second application was 1 1/2 lbs. per 1,000 square feet of sulfate of potash well watered. Fairways and tees were fertilized with a 10-10-10 50% of the nitrogen from bloodmeal. Tees were fertilized three times during the year using 12 lbs. per application per 1,000 square feet.

Fairways were fertilized once in the spring using 15 lbs. per 1,000 square feet. Limestone was applied twice a year with top dressing to maintain a pH of 6.5. Fritted trace elements were applied once a year at 50 lbs. per acre on the greens.

Total cost per year for fertilizer, lime, and trace elements was as follows:

	1,000 sq. ft.	Acre	Actual
Greens 80,000 sq. ft.	4.25	182.75	340.00
Tees 1 Acre	1.55	66.65	66.65
Fairway 61 Acres	.65	27.95	1700.00

The enclosed fertilizing program along with other contributing factors has given us good dense turf on our course in 1957.

Question. What about soluble phosphates that are out now?

Answer. There is a firm making a liquid now with 10-10-10, but I don't know whether it is soluble or not. Hi-12 is being used.

Goss. To keep good green color and good turf one has to keep the grass producing and growing well.

PANEL ON WEED CONTROL FOR TURF AREAS

Tom Muzik

One of the most interesting effects of raising turf grass is weed control. It has only been 10 to 15 years ago since we didn't have 2,4-D, and since that time we have a lot of new chemicals and a lot of new ideas. In England they plan a turf program, follow it carefully, and after 200 to 300 years, they end up with a good turf.

Bill Senske. We have four trucks equipped to spray weeds this year. We've sprayed some 5,000 lawns to date. We have three bread and butter weeds--dandelion, plantain, and thistle. We are looking for weeds that will bring in income so I'll really talk about weeds of this type. After ten years, Adolfe Lange and I went out and gathered samples of weeds (20 samples were displayed). To start with is the dandelion which can be easily killed by 2,4-D amine, also plantain + thistle takes 30 days for them to die and disintegrate. Mouse-eared chickweed can be controlled with 2,4-D amine by two sprayings 10 days apart. I applied 4 lbs. of amine to the acre; this seems high but is what my figures show. Most of the 5,000 lawns I sprayed in 1957 were blue-grass lawns.

For Veronica, amate can be used at 3 lbs. to the 1,000 sq. ft. with 80-90 gallons of water to the acre. The more liquid we put on the wetter it makes the ground, thus making the treatment more effective. We spray from spring to late fall. We usually try to spray in the fall though. On our bread and butter weeds we spray from snow to snow. Our jelly weeds are controlled only by tackling them during the summer.

Question. What will kill yarrow?

Answer. 2,4-D will do a pretty good job.

Putnam. We have considerable experience in dealing with problems of killing swamp grasses, cattails, etc. Sodium arsenite has been used after the pond has been dried up. It was sprayed twice, but we had difficulty getting all the plant life killed.

Ox eye daisies is a problem in many areas. 2,4-D, sodium arsenate, etc. have all been used. I have found that by using 2,4-D amine you will get good results, and we are getting good results now. Good results can be obtained in the fall as well as in the spring of the year.

Senske. Everything in Spokane turns to quackgrass. Aminotriazole has been used, but the quackgrass still needs plowing about two weeks after treatment or it will green up again.

Charlie Wilson. Sodium-arsenate has been used on chickweed, and very good results were obtained. You should work the spraying of 2,4-D into your plans before seeding. If it is on the dry side you seem to stand more chance of damaging the grass. The best weed control is to grow a good crop of whatever you are trying to grow.

Question. Did sodium-arsenate make any difference to the amount of water?

Answer. I think higher rates of water are better, but as long as it is wet, that is the most important.

Wetting agents are used to help control local dry spots. I haven't seen much real experimental work done on this. It depends on how fast the grass is growing.

Goss. How much arsenate should be used?

Answer. Courses in this country have used this for the last 30 years at about 10-30 lbs. per acre. It is a touchy situation, but has been used for years and is very good now. To get best results, it should be done in the late fall.