PROCEEDINGS

THIRTEENTH ANNUAL

SOUTHEASTERN TURFGRASS CONFERENCE

TIFTON, GEORGIA

APRIL 6 – 8, 1959

P R O C E E D I N G S

Thirteenth Annual

S O U T H E A S T E R N T U R F G R A S S C O N F E R E N C E

Tifton, Georgia

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Sponsored By

UNIVERSITY OF GEORGIA COASTAL PLAIN EXPERIMENT STATION

In Cooperation With

UNITED STATES GOLF ASSOCIATION GREEN SECTION

and

SOUTHERN GOLF ASSOCIATION

F O R E W O R D

It is difficult to realize that this Station has participated in 13 Annual Turf Conferences. But that is what the record shows and, as I review the progress that has been made in turf work during that period, I am amazed at what can be accomplished by the wholehearted and sincere cooperation between the several groups of people who are interested in producing and promoting good turf.

Grasses are becoming more important in man's life and, certainly, an increasingly important segment of grasses' contribution to mankind is related to that phase associated with recreation. Turf can, in the form of a golf green, athletic field, or a beautiful lawn, make an important contribution to the production of a pleasing and relaxing surrounding.

The administration of this Station, along with the members of our Grass Breeding Department, express our sincere appreciation to all of those who helped make this Conference profitable and enjoyable. We know that without the efforts of a great many individuals and the cooperation of such organizations as the U.S. Golf Association, the Southern Golf Association, and commercial concerns too numerous to be listed here, the turf work of this Station would not be possible. We appreciate your support and trust that the papers presented herein and the things you saw and heard at the Turf Conference will justify your continued support of this program.

Frank P. King, Director
Georgia Coastal Plain Experiment Station

C O N T E N T S

1958 TURF ROUND-UP

O. J. Noer 1/

One of my friends said that Herb Graffis called me a "parapathetic agronomist." I had to go to the dictionary to find the meaning of that word and find out the kind of fellow I am. I have been called many things, but nothing like that. It's up to you to do as I did and go to the dictionary if you want to know what Herb meant.

I always enjoy coming to Tifton, and participating in the programs at other places as well. I have a selfish motive because I expect to learn something at each of these meeting; otherwise, I feel that my time has been wasted. Tifton typifies the tremendous advances which have occurred in the South. Tifton has been a pioneer, followed by Florida, Texas, southern California, and even New Mexico and Arizona. I hardly need tell you what has happened in the South. With the urban development throughout the United States, we find the experiment stations everywhere much more interested in problems associated with turf management and urban landscaping.

Seasonal weather during 1958 was freakish. The Southeast had the worst winter in my experience, which goes back a little more than 30 years. Based on weather, I don't think any one grass or any one maintenance method should be condemned. However, the weather may reveal desirable features also. In the North, the summer was a bad one, but it was spotty. Hot, wet, humid weather was the reason for trouble in areas such as Kansas City, Philadelphia, parts of Ohio, and Kentucky. On the other hand, Milwaukee, for example, where I live, had the dryest season in 18 years. Minnesota was even dryer than Wisconsin. They have not had appreciable moisture up to now. There are cracks in the greens in that area that are about two inches wide due to extreme drought and lack of snow cover this winter. Toronto was dry, yet nearby Cleveland was overly wet. The province of Quebec was so wet that some of the new golf courses started in the spring did not get seeded last fall. That job is ahead of them.

1/ Agronomist, Milwaukee Sewerage Commission, Milwaukee, Wisconsin.

The Pacific Northwest had a bad time last summer. Normally, their grass is good. I tell them all they need, because of their very favorable climate, is a good sharp mower and a strong back. But last summer, their weather was warmer than usual. Temperatures and humidity were high. I saw many bad greens that I know superintendents in Kansas City would not have lost. They take hot, humid weather in stride because that's the type of summer weather to which they are accustomed. Many troubles occur during times of unusual weather, the kind we aren't accustomed to experiencing. The troubles of last summer emphasized the importance of good drainage, the right grass, a favorable soil, sensible fertilization, and good water practices. Good drainage includes rapid surface run-off, quick downward movement of soil water, and provision for air movement across the green surface. The courses that had greens with these things generally fared better than others, provided there was a uniform profile of sandy loam type soil. Personally, I dislike layer-cake greens because they are troublesome in hot weather.

The grass should be suited to the climate and to the type of likely local weather. For example, we never promote the use of seaside bent in Canada because it is susceptible to snow mold. There are other better grasses for that area. Yet, in the Southwest, in New Mexico, in Arizona, and in southern California, where daytime summer temperatures range from 105 to 120, seaside performs exceptionally well. The dry weather minimizes diseases of all kinds.

Then comes sensible feeding, with particular emphasis upon nitrogen. Some superintendents got into trouble because the grass was too soft due to excessive amounts of nitrogen in the soil.

We cannot overemphasize water usage, particularly with the cool-season grasses. I presume common Bermuda tolerates plentiful water, but with the finer-textured Bermudas, water management will be more important.

And finally---good management. I like to spell the first three letters of that word in capitals, MAN. Possibly, we should spell the next three in small capitals,

AGE, because experience plays an important part in good turf maintenance.

Climate determines the choice of grass. In the North, it is best to use cool-season grasses; and in the South, the warm-season grasses. Yet, in the transition belt, from Philadelphia across to Kansas City, Bermudas and the Zoysias are being used more and more for tees and also for fairways. In that section, U-3 is the one favored most. However, at West Point Military Academy and in Philadelphia, common Bermuda from seed is being used very much as you use the cool-season grasses in the winter to provide cover at that time of year. I don't see why we can't do the same in summer with Bermuda and with fewer headaches than trying in Philadelphia, for example, to struggle with Northern grasses for athletic-field use, as will be explained later.

The bentgrasses are moving south. Charlie Danner has 18 wonderful bent greens at Nashville. Last June, all the Bermuda in the area was terrible but Danner had 18 beautiful bent greens. He played a dirty trick on all the other clubs by having the qualifying rounds for the PGA played at his course. Besides that, Belle Meade members and others played Richland in preference to their home courses. I made this remark to Danner: "Charlie, you better not die because God in heaven hasn't got it nearly as good as you have at Richland right now." So, his problem is one of keeping it that way from now on, as I see it.

There are bent greens in the Atlanta area. With the right kind of management, bent can be grown there. Charlie may be right about bent in the Nashville, Atlanta areas. He may have some trouble in the hot summer weather, but he should have good greens during the transition period in the spring and fall and that, of course, is the time when the play is greatest.

I feel that we will see a change with respect to the types of warm-season grasses used on greens. There will be a switch from common to the finer-textured Bermudas such as 328. I am in favor of these superior Bermudas despite the fact that many

superintendents resist their use. They think common Bermuda is good enough. I'm going to go on record and say that the players are going to decide that question for you and that 328 or possibly better Bermudas which are apt to come will be used on greens and possibly tees throughout the South. Even selected hybrid strains may replace common Bermuda in fairways.

I do not like rye as the cool-season grass in these finer-textured Bermudas for winter play. I think rye is a very fine grass with common Bermuda. We need bent, red top, or some other fine-textured grass for use with finer-textured Bermudas. In Atlanta, there are some good greens overseeded with seaside bent and red top. I saw other good ones last week at San Jose in Jacksonville. There are 18 very good ones at Ponte Vedra. I stopped there purposely before coming here so that I could speak from experience instead of from hearsay. When changing to these kinds of grass, you are going to change your methods of introducing the grass into the greens. Ryegrass seed is large. You top-dress rather heavily over it, which is good practice. With the bents and with other cool-season grasses of the finer-textured type and smaller-sized seed, it will be necessary to thin out by verticutting, cross-aerifying, and spiking the mat of Bermuda, then to top-dress and seed on top rather than under the top-dressing. If you top-dress afterward, not over a half-year is needed per green so that the grass seed will not be buried deeply. That is how bent was introduced into the greens at San Jose and also at Ponte Vedra. With bents, the big problem is early-season play. The bents germinate as fast as any other cool-season grass but then the bent will stand still for three to four weeks. It may be late winter before greens are good. I have hoped red top would cover quickly for early-season play. Whenever we have a bad winter in the North and winterkill is severe, red top is used liberally and in no time, greens are back in play. The red top does not persist but is useful until such time as the bent recovers.

Maybe greens should be overseeded with bent first after it comes up and gets off to a good start. A little rye, or possibly bluegrass, can be seeded for early fall play. The bent from January on will be wonderful and will provide exceptionally good putting surfaces. I favor seaside, which is a creeping bent, whereas in Texas, the boys lean toward the use of highland, which is a colonial type of bent. Where I have seen it seeded into the greens down in the Southeast, it has been much slower to provide cover than seaside. It is used in Texas because they feel that it goes out a little quicker in the spring when the Bermuda is coming back.

Today I am not being too specific. I'm just laying the groundwork of some things that may be in the offing. I hope I live long enough to see some of these things happen. I am encouraged with what I've seen in Atlanta and in Jacksonville during the past week.

Texture of topsoil for greens is creating a great deal of interest. I presume many of you are familiar with the work that is being done in southern California. They recommend 85.0% sand, 7.5% clay, and 7.5% organic matter. These ratios are by volume. Out there, this type of mixture is doing very well. In fact, the greens out on the desert are mostly sand, anyway. I don't think texture matters much because with no humidity and temperatures running 110 to 120, you're going to water greens every night and come back every noon to give the bentgrass a drink or it is going to wilt and die. In the past, we have used too little sand and, in many cases, too much fine sand. The pendulum is going to swing toward the use of more sand but I hope it doesn't go all the way to the other extreme. The logical approach which is being followed in some other sections is this: Assemble the possible sources of sand, soil, and humus. Then find out the proper proportions to make a mixture which will resist compaction and provide a rapid infiltration rate for water. When we can accomplish this, I'm sure it will

simplify problems of subsequent maintenance because compaction is a big problem with the heavier traffic and with the modern power-driven types of equipment now in use.

I shall make a few concluding remarks about the Philadelphia Stadium. Then I'm going to use slides because time is running out. Last year, Navy and Notre Dame football teams beat the Army. It upset Colonel Blaik, the Army Coach. He blamed the knotweed in the field. The Army Athletic Authorities wrote Mr. Crawford, Director of Recreation for the city of Philadelphia, complaining about the field. When Mr. Crawford talked to the man in charge of the field, he was told: "What is the Army kicking about? All they do is rent the field." So Mr. Crawford wrote that to the military academy. Colonel Blaik and Colonel Reeder were not satisfied with his answer. They got General Davidson, the Academy Superintendent, to write to the mayor. That brought results. It wasn't long before I got a call and was asked to help solve the problem. I went to Philadelphia, looked the field over, saw that there was going to be plenty of knotweed, and suggested that they kill the knotweed by spraying four to five times with sodium arsenite, then to aerify generously, fertilize liberally, and seed with pregerminated Bermuda seed.

This was done. The common Bermuda seed---there were 120 pounds of seed for 2 acres---was mixed with vermiculite, kept just barely moist for four days, then it was mixed with enough activated sludge to dry the mixture so that it would go through the seeder. The field was aerified in several directions, it was spiked, 400 pounds of 10-10-10 per acre was applied immediately before seeding, along with a ton of activated sludge per acre. Since I work for the Sewerage Commission, it had to be Milorganite.

Seeding was on June 16. By mid-July, the field was covered with a very find stand of Bermuda. The field got a ton more of activated sludge in late July, and the last ton in mid-September. In other words, there was a total of about 400 pounds actual

nitrogen used to the acre for the season. When I visited the Stadium on September 15, there was an excellent cover of grass. On the 17th, I was at the Military Academy and told Colonel Blaik: "Colonel, you're going to have a good turf, so you can't use knotweed to alibi a defeat. It's up to you to produce the team." He did just that. While we wanted to use U-3 Bermuda, I am inclined to think that we stumbled onto a better way for that area. We didn't have time to plant U-3 and couldn't get the money to buy the sprigs. Using seed is a better way for them. It will make a tight-enough turf and if it's necessary to overseed with a little ryegrass for color, it's easier to do it in seeded Bermuda turf than it would be in the more dense U-3. Incidentally, I had a letter from Colonel Blaik after the Army-Navy game in which he told me that his team had never played on a better turf than was on the Philadelphia Stadium that day.

-- SHOWING OF SLIDES --

QUESTION-AND-ANSWER PERIOD

Q. O.J., one question on that green that we saw there in November, just the Bermuda-ryegrass combination. The Bermuda certainly was brown at that time, was it not?

A. Oh, yes; you mean the one in Atlanta?

Q. No, I'm talking about the football field in Philadelphia.

A. Oh, the Bermuda still had quite a little color and I think that was because of the heavy rates of fertilization in late September used then to keep the Bermuda vegetative as long as possible. Another thing that I feel very strongly about so far as those fields are concerned, it is necessary to cut them close. We try to get them to cut at between 1/2 and 3/4 of an inch. If that is not done, the player cleats will tear up great big stringy stems of Bermuda. These stems make the field look brown for the next game, that is, if you play more than one game on it. And, as Colonel Blaik says, long stems are somewhat dangerous, since they might get into the nostril of a player.

PLANTING THE NEW GRASSES ON NEW AND OLD GOLF COURSES

E. R. Jensen 1/

Years ago, when the South was on its back because of the depression, two far-sighted men, the recently appointed Secretary of Agriculture, Henry A. Wallace, and the Director of the Georgia Coastal Plain Experiment Station, S. A. Starr, met not far from here, in Mr. Starr's office. One conclusion reached by these men was that if Southern agriculture was ever to be on a sound basis, a definite improvement in feed and forage was needed. Not long after this, dynamic projects in corn and grass breeding were underway at this Station. Both projects yielded fruit and opened the door to greater developments.

Coastal Bermuda was the major result of the grass breeding effort; but improvement of the turf Bermudas, which may be byproducts of the big Bermuda, may some day prove as significant as the forage effort. Everyday, the need for turf to relax our teeming millions increases. Though we may someday get nourishment out of a capsule, woe be unto us if we get our exercise and recreation from such a source. Actually, the progress in turf for golf greens may have advanced as far as other grass improvements. In Coastal Bermuda, there is about a 4 to 1 improvement. Common Bermuda yields about 125 pounds of beef per acre per year, whereas Coastal Bermuda yields over 4 times this much. Looking at Latham's and Robinson's data on various turf Bermudas, we find about a 5 to 1 improvement in the turf quality of Tifton 328 over common Bermuda.

On golf greens, the improvement has been obvious and quite dramatic. For this reason, in the South, new golf greens or greens being changed for one reason or another are being planted to Tifton 328 except in the most unusual cases. To plant a hybrid Bermuda, whether it be a natural or synthetic hybrid, it must be done vegetatively. And the wise

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1/ Agronomist-Turf, Southern Turf Nurseries, Tifton, Georgia.

will inquire into the genetic purity of this vegetative material.

Where 328 is unquestioned for greens from Little Rock to Miami and Norfolk to Houston, there still exists some question about the grass for fairways. The main grasses in use on fairways in the South are common Bermuda, carpetgrass, centipedegrass, 328, Ormond, Tifton 127, Tifton 57, and U-3 Bermuda. Though the hybrids suffer some criticism, you will invariably find better fairway turf where they are used. Tifton 328 on stronger soils, Tifton 127 on soils of moderate fertility and moisture capacity, and 57 on the deep sands where a deep-rooted grass is a necessity. In the cooler areas where winterkill is a problem, U-3 and south of Tallahassee where winterkill is no problem, Ormond Bermuda is being favored. There is room for improvement in fairway grasses and we hope progress is being made in this direction. But definite progress has been made to date.

For athletic fields, turf tracks, polo fields, and areas of severe traffic, Tifton 57 is king. It will probably tolerate more abuse than any other grass. For lawns and industrial sites, as for fairways, the locality and the soil type will enter into the decision of which grass, but any of the hybrids will out-perform and provide far superior turf than will common seeded Bermuda.

Land Preparation

Old greens may often require such a revamping they will be new greens before the change is completed. There are a number of reasons for changing an old green---it may be compacted due to improper soil mixtures, hopelessly infested with weeds, poorly drained, ill designed, or heavily infested with nematodes. Many greens are being changed over just for the need of a better grass and, in some cases, for a grass-period.

If the green has no other need than that of a new grass, it is unnecessary to go to the work and effort of breaking up the soil on the green, raking all the old grass out, and dressing it down again. The new grass can be introduced into the green in a variety

of ways. The most prominent is to kill the old grass and weeds with a soil fumigant and replant directly onto the old sod. This job is best done with either methyl bromide or vapam.

With slides, I will give examples of using methyl bromide:

B. P. Robinson has used vapam, drenching it in in the usual way, and then using a cover laid flat over the treated area. I'm going to ask him to give us some idea of this procedure and what his results have been.

Another treatment has been to verticut and aerify a green quite severely and then broadcast Tifton 328 stolons heavily over the old sod and top-dress. This was done at the Carmel Country Club in Charlotte and quite successfully, I think.

Contact herbicides are being considered to dispose of the old Bermuda also. Spray a green with a material such as dalapon, allow it to remain in play for a day or two while the grass is dying out, then give the green a good soaking to leach out as much of the salt compound as possible. Top-dress and broadcast the new stolons, then top-dress again. The theory is that the dalapon will dissipate before the roots of the 328 have penetrated the first top-dressing. This is a simple and economical treatment. One test we have going on it now indicates it will work. Before endorsing it, however, we will need more proof. Dalapon does not kill broadleafs, nor does it have any fumigating effects. Other compounds are being developed and some are presently on the market, but methyl bromide, vapam, and dalapon cover the ones with which I have worked.

At this point, let us consider the need for fumigation or treatment of new seedbeds. If the soil is suspected to contain nutgrass, common Bermuda, crowfoot, crabgrass, or anything noxious, fumigation should be considered. If nematodes are severe, fumigation will generally pay. In any case, grass is likely to grow off quicker and be generally healthier in the long run where the soil has been treated before planting. Whether or not to fumigate may be left with the Finance Committee, but it is often a necessity. Applying methyl bromide will approximate 1½¢ per square foot where 1 pound of gas per 100 square

feet is used. It will give from 90 to 100% control if properly applied. The use of vapam costs us .8¢ per square foot and we get about 90% control. Nutgrass and common Bermuda are not controlled too well by vapam. Eptam, a new compound, shows promise as a growth retardant. TAT-42 and Crag-1 as pre-emergence sprays over new vegetative plantings. These compounds are much cheaper than pre-planting fumigation.

All fumigation work should be done after the major tillage of the soil has been completed. Minor raking and softening of the seedbed can be done after fumigating, but deep cultivation may bring up more seeds and nullify the effects of the fumigation.

Going back to land preparation, too often seedbeds are prepared with implements that do not go deep enough to break compacted layers in the root zone. Clays are often found at 6 to 10 inches and we do not want to turn these up to have at the surface of the soil profile. A clay texture of the surface retards infiltration, but this subsoil should be loosened when it is so near the surface. For this reason, cultivating tools like the field cultivator can be used to stir the soil to a depth of 12 to 18 inches. Then the light disk harrow can finish the job. Large disks will go deep without turning up clay or subsoil, but soil conditions must be favorable for their operation.

You greens superintendents will consider this elementary, but it is surprising how little respect is found for smooth, movable surfaces. Get the seedbed smooth so the mower repair will be reduced and a smooth, even cut can be made. It is hard to plant a fairway where there are roots, rocks, and clods and if it is hard to plant, it is going to be hard to maintain.

In the process of land preparation, drainage should be taken into consideration. This is a foregone conclusion on greens, but it is often overlooked on lawns, fairways, and athletic fields. Where there is a dense sod of grass, surface runoff is slow. So a greater degree of fall is needed here than on bare ground for a good surface drainage. Athletic fields, for example, should have a 12- to 24-inch crown.

Planting

There are many ways to plant vegetative grasses. All that I know of involve hard work and none of them are foolproof. After many disappointments and much sweat, I have come to the conclusion that the simplest and fastest way of planting that gives the earliest possible coverage leaves everybody happier and healthier. In 1956, we spent three months planting the fairways on a 9-hole course. We were using a tobacco transplanter. It was faster than hand sprigging and it brought fair results. In 1958, we planted the fairways on an 18-hole course in three weeks, and a 9-hole, par three in four days. Coverage on the faster planting method was much quicker than by the slower method.

Examples of these plantings will be shown by slides in a few minutes.

On replanting greens where the old grass has been killed out, but where the surface has not been disturbed, the new stolons can be shredded and broadcast or they can be sprigged in the green. The broadcasting method should be much easier and should give quicker coverage.

When broadcasting shredded stolons on greens, a minimum of 5 bushels of shredded material should be used if you are interested in quick results. Ten bushels per 1,000 feet will give coverage in less than 5 weeks in the growing season and 5 bushels in less than 8 weeks. This is assuming good production management is practiced. I have known greens to be in play five weeks after planting with five bushels per 1,000 square feet, but this is unusual. When top-dressing shredded stolons, about $\frac{1}{4}$ of an inch of clean topsoil should be applied.

We seldom have top-dressing supplied us that will go through a top-dresser. For this reason, we nearly always wind up using shovels. In this case, a smoother distribution can be obtained if a coarse screen is used. The screen can be laid over the broadcasted stolons and the top-dressing spread over the screen. The top-dressing can then be spread without disturbing the stolons.

Watering

Fresh plantings need water immediately. It has been said, "If a man knows how to water grass, he has half the battle won of becoming a good greens superintendent." Lou Vickers, at Metairie in New Orleans, assigns a man to a green for three days after it has been planted, just to keep it watered. Watering is the most important single factor in getting a stand of grass, and getting a good stand is necessary to get quick coverage. Three light applications a day are best and one a day as the minimum. As the grass takes root, the frequency can be reduced and the amount per application increased; finally reaching ½ to 1 inch per application applied every second or third day. Where extra rapid coverage is desired, as is the case on greens, continued frequent waterings will probably hasten coverage.

Fertilizing

Grasses must eat as well as drink if they are to grow. I don't like to hear someone refer to "feeding" grass as the soil's job. We fertilize the soil, and the soil processes the fertilizer to feed the grass. But call it whay you may, the grass must be fed if it is going to grow. If you are east of Dallas and south of the Mason-Dixon line and not much fertilizer has been applied to your soil, there is little opportunity for the plant to be fed unless you fertilize. New ground in the South is generally poorer than used ground, and some of the rich-looking soil most likely has a little organic matter and few available plant-food elements. To produce healthy, rapidly-growing Bermuda turf, adequate nitrogen, phosphorus, and potash are necessary. Nitrogen, of course, is the main growth element. A seedbed needs at least 100 pounds of actual phosphorus and potash per acre and 30 pounds of nitrogen. It is best to assume there is little, if any, plant food elements in the soil unless you have a soil test that proves to the contrary or a record of the fertilizer previously applied. One thousand pounds of a 4-12-12 per acre will give 120 pounds of phosphorus and potash and enough nitrogen to get the grass started. Ten

days after planting, top-dress with 70 pounds per acre of actual nitrogen. Inorganic nitrogens leach rather rapidly and are also a little "hot" in the new seedbed for newly planted grass. The top-dressing with nitrogen then results in better use of the nitrogen and reduces the possibility of killing some of the freshly planted roots. Another top-dressing with nitrogen should be made in another ten days. After this, a maintenance fertilizer schedule can be set up. A 4-1-2 ratio for all but 328 is recommended and a 4-1-3 for 328. The degree of growth and color desired will, to a large extent, determine the amount of fertilizer required. Some like 2 pounds of nitrogen per month per 1,000 square feet on greens, others slightly less. To maintain Tifton 57 fairways, 40 to 60 pounds of nitrogen per acre per year is adequate on most soils, but 328 would need 150 to 200 pounds per acre for good performance.

Insects

Newly planted grasses often get worked over by worms. When they are in the tender stage of near coverage, they are most palatable and susceptible to worms and mole crickets. In this stage, they can also suffer quite a setback from either of these bugs. Spraying or dusting is too simple to allow the loss or delay in coverage they can create.

The seven most important steps in planting vegetative hybrid Bermuda grasses are:

1. Use certified planting stock that has been well fertilized.
2. Have a well-prepared and well-fertilized seedbed.
3. Get the plants within ½ to 2 inches deep.
4. Water frequently, beginning immediately after the planting and keeping the soil moist for at least 10 days. This is the most important single practice in getting a good stand and if you don't get a stand to start off, you are lost before the journey is begun.
5. Nitrogen top-dressing.

6. Weed control - with soil fumigants, post-planting herbicides.

7. Insect control.

SLIDES

1. Deeper rooting system of Tifton 57 as compared with Tifton 127. Roots of Tifton 57 are almost four times as dense and three times as deep as those of 127 on deep beach sands.
2. Textural variation of Tifton 328 and common Bermuda.
3. What a severe winter did to St. Augustine, Emerald, and matrella. Emerald is green, matrella frosted out, and St. Augustine is nearly all dead.
4. Tifton 328 and common Bermuda on the same green under the same treatment. Tifton 328 shows much greenness and is coming out of the winter much quicker.
5. Green of 328 at Lakeland, Florida. Pete Cooper is putting.
6. W. L. Eubanks inspecting fields for certification.
7. Starting work on revamping a green with double-section harrow.
8. Drag harrow to loosen soil from roots.
9. Debris to be raked up and burned, or hauled away.
10. Gator Bowl.
11. Gator Bowl as it looked in February.
12. First, harrow old turf.
13. Then work deep with a cultivator.
14. A better view of the field cultivator and idea of depth of reworking.
15. Harrowing and raking.
16. The rake leaves a good seedbed and removes old turf very efficiently.
17. Raking - more than 100 loads of old rye and Bermuda turf were removed.
18. To fumigate an athletic field with methyl bromide is a major operation.

19. Two men can lay a cover in one hour under average conditions. It takes 30 minutes to "flop" this cover.

20. Sand bags, or loose sand, can be used to hold covers down on old turf.

21. Bottles or burlap bags filled with hay support covers.

22. Results after gassing old turf.

23. Benefits of fumigation show up in this slide.

24. There are many ways to plant — this is slow, hard work.

25. Watering it as it is planted with a tobacco transplanter.

26. Wing-type hand plow for furrowing before planting.

27. Planting in old sod or ryegrass sod.

28. Broadcasting at the Charlotte Country Club in 1958.

29. Before Mr. Harkey could change clothes, the green was covered and ready for play.

30. Broadcasting ahead of straight-disk planter at the rate of 5 bushels per 1,000 square feet.

31. Straight-disk planter works on anything with soft seedbed.

32. No. 3 green at Augusta National's new par 3 planted in September, 1958.

33. Five weeks after straight-disk planter at 5 bushels per 1,000 planting rate.

34. Top-dressing over shredded stolons.

35. Example of cutting in with disk harrow. This leaves the seedbed quite rough.

36. This is the example of planting directly over old Bermuda sod at Carmel Country Club. You can see where the common Bermuda was left in a triangle.

37. Example of winterkill on common Bermuda in 1957-58 at Charlotte Country Club.

38. Too often, fairways and land are allowed to set too long after they have been prepared before they are planted. The newly worked areas ought to be planted as soon after working as possible.

39. Some of you may be interested in the process of incorporating sand and peat in a green.

40. This was disked thoroughly after it was spread.

41. Planting an 18-acre turf track, salt problems.

42. Need for water is obvious from results of stand where twice as much water was applied to area at right. You can see the outline of sprinkler.

Panel Discussion
on

GOLF-COURSE MAINTENANCE

Mr. James Latham, Discussion Leader 1/

All of you, I'm sure, have your own specific way to maintain a golf course and we do many little things but there are a lot of ways to do things. These men are going to describe some of the things they do to make their jobs more interesting, less complicated, and we hope that you will ask some kind of questions when they get through. The panel consists of:

Mr. T. M. Baumgardner, Vice President of the Sea Island Company in Sea Island, Georgia.

Mr. Charlie Danner, Pro-Superintendent of the Richland Country Club in Nashville, Tennessee.

Mr. J. W. Dudley, Chairman of the Greens Committee at the Athens Country Club, Athens, Georgia.

Mr. Herb Greene, Superintendent of the Brentwood Golf Course, Jacksonville, Florida.

Mr. B. P. Robinson, one of the boss men of Kilgore-Robinson Supply Company in Birmingham, Alabama.

Mr. Everitt Shields, Superintendent of the Capitol City Country Club, Atlanta, Georgia, and

Mr. Harry Wright, Superintendent of the Peachtree Golf Club, Atlanta, Georgia.

Each one of these men will discuss a separate item in the maintenance of a golf course.

1/Southeastern Agronomist, U. S. G. A. Green Section, Athens, Georgia.

MAINTENANCE OF RYEGRASS-BERMUDAGRASS GREENS

T. M. Baumgardner 1/

If I were asked to talk on this subject a year ago, I might have been in a little better position to do so or think I knew a little something about it and would have stressed the importance of different factors than I would right at the moment. Our rainfall is much over normal in most areas and twice the usual rainfall the first three months of the year. I would say today that the most important thing in ryegrass management is probably drainage, surface and otherwise. I've seen it happen in more places than one and particularly in our place this year, where we have two or three greens with mediocre or bad drainage conditions and have lost ryegrass where other well drained greens have come through very nicely. Therefore, it seems to me that one of the most important times to start good ryegrass management is in the summertime. Try to improve drainage conditions to meet these requirements in times of abnormal rainfall by aerifying and getting the top 3 or 4 inches of the green in good condition to take the water and percolate the water through as well as good surface drainage in the beginning. But you can't always control that.

In looking over the display yesterday, I was struck by the amount of equipment and new gadgets that were developed particularly for cultivation purposes on golf greens and relief of compaction. About two-thirds of the new equipment that is coming out was designed for that purpose. I can remember, and I think most of you can also, maybe six or eight or ten years ago that we thought whenever we got on the rye greens in the winter, we could just almost loaf during the rest of the winter. We had no troubles. You'd go out there and put a little fungicide on every 10 days or two weeks and that was the only thing that could happen to ryegrass. You'd mow it and then you were through. Of course, you fertilized

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1/Vice President, Sea Island Company, Sea Island, Georgia.

it but you didn't have the trouble with disease and all these other things that everybody's experiencing with ryegrass, particularly along the coastal areas and particularly on a course with heavy play. I don't know what the reason is; I've heard it blamed on the seed. Personally, I don't think it's that and all these other things--the prevalence of new diseases, etc. Maybe it's just heavier play, shorter cutting, more compaction that is making it more and more difficult to grow ryegrass. The ryegrass is weaker and the disease attacks it more. Maybe we don't have any more disease; maybe it's just the attacking of it more readily because of these other problems. We have to set about the correcting of these problems, I think, if we are to grow a good ryegrass-Bermudagrass combination.

I've heard several people say, golf-course superintendents among them, that you can't grow ryegrass well on 328 greens. Well, I doubt that; I don't know what the reason would be because you can get, by your Verticut and various management practices, your seed in contact with the soil as well in 328 as you could in your other grasses. Maybe they have something there but I don't know that it's ever been proved.

Many people that you know are going over to bent and I think they will find that they will have many of the same problems with the overseeding of bent that we have with Bermuda. I don't think bent would perhaps be any less resistant to disease under bad drainage conditions, for instance, than would rye. I think in many sections and under many conditions, the bent would perhaps be a much better grass than rye to overseed. Where we have tried it experimentally in years past and again this year, we find that we don't get enough growth early enough in the fall to give us color in December and January and we have to compete with Florida resorts that have real good, green grass. People are coming up our way after being down there and if we don't have good, green grass, we just don't look good. Maybe we don't know how to do it. That's entirely possible, but we haven't been able to get bent good enough for December and January to give good color in our

section. It comes on good later and gives you a fine color this time of year and a fine putting surface. There again, maybe better management practices would do it.

I've just had time to mention a few of the things that are probably most important and that we have found under our conditions of ryegrass planting and maintenance. Of course, the preparation of the seedbed and the timing, the rate of seeding, disease control, fertilization and last, but certainly not least, the weather all have to come into the picture. They all vary, of course, from locality to locality and from course to course. There are no set rules that have to be followed in each case. In our case, we have very heavy play up to October and into November and it's just almost impossible for us to seed before the middle of November. We'd like to do it a little sooner. This year, we averaged 130 players a day 7 days a week, even in November, and we have to keep right on playing with our ryegrass seeding going on. From the St. Augustine area up as far north as Savannah, it seems the people who have the best luck with rye are the ones that keep the turf high during the early growing period and germination period of rye. Wherever they can do that and get the rye strong by cutting a little higher, they seem to have better luck. They have less trouble with Pythium seemingly because they have a better root system due to the higher cut. On many courses where you have exacting play right on through, you just can't do this. That's one reason that we say it's harder to grow than it used to be. We were cutting higher 6 or 8 years ago than we are now.

We like to start preparation or renovation, we used to call it, about three weeks ahead of our proposed seeding date. When we can set up a date that we want to seed on, weather permitting, we go out about three weeks earlier and aerify the greens--Verticut them first rather--in at least two directions, the severity depending upon the amount of thatch or mat that may have built up, and then

follow it with the aerifier. Of course, the more times over the better, if you could afford to do it and get by with it with your players.

We then top-dress them and by the time you're ready to seed three weeks later, you have your aerifier holes healed over so the seed will not come up more profusely in them. We feel that we have a good enough turf of young Bermuda there without grain and without mat that will form a cushion for play, which continues right on while your ryegrass is tender coming out. We also, when we top-dress three weeks ahead, use a mixed fertilizer with high potash and a medium application of nitrogen. It's also our practice to use at this time 5 to 8 pounds of arsenate of lead per 1,000 square feet, which we feel helps us with Poa annua control if done every year and also with other weed control. We top-dress with about 1/3 of a yard of soil per 1,000 square feet on our 328. We don't top-dress as heavily as we used to with the common.

When we're ready to seed, we take the Verticut and go over it at least once in each direction, again the severity and depth depending upon conditions at that time. It's our practice to seed about 40 pounds per 1,000 square feet of ryegrass. Many people seed more than that and some less at the first seeding. We use no fertilizer at the time of seeding. When we have tried it, we got a tender growth of grass, which is easier bruised and easier damaged by play, particularly in wet periods. We top-dress, of course, over the seed with about a third of a yard to the 1,000 square feet of top-dressing and try to hold the cut up to 3/8 to 1/2 an inch for about three weeks if we can. It is not always possible to do it.

Immediately after we top-dress, we start treating for Pythium. This year and for a number of years, Dr. Homer Wells has been experimenting and we have been cooperating with him trying to experiment with some different materials for the last three years. In his laboratory work last year, Captan and Phygon seemed to be the two best materials and we tried them, using Phygon on half of our greens and Captan on the other half. By seeding late in the season, we did not

get much Pythium, so I don't think we got much indication of which material might have been best in actual practice. We did start under Dr. Wells' direction the 1st of September, a plot on which we used a number of materials just on an experimental basis. We knew we would get planty of Pythium that early. Both the Phygon and the Captan materials, when used as high as 1 pound, 1½ pounds, to 2 pounds per 1,000 square feet, definitely did a lot of good. We had a very heavy Pythium infestation and got good control. The weather stayed good for Pythium growth for about 3 or 4 days and finally, it looked like nothing was doing too much good. So I don't know what we proved. We did prove, of course, that both Phygon and Captan were doing the job up to a certain extent. I don't know how far; maybe we did not apply it often enough.

USING BENT AS A PERMANENT GRASS FOR GREENS

Charles Danner 1/

We got started with the bent up in the Nashville area because we just simply got sick of all that work that we have to do twice a year during the transition period, particularly in the spring when the rye would go out and all that top-dressing we seemed to have to do every summer on the Bermudagrass. We talked with O. J. Noer and Fred Grau back some ten years ago about the possibilities of growing bent. We discussed it quite a bit with them and were advised to try it, so first, I put in a 1,000-foot nursery and fooled around with that for a year. It seemed I didn't know too much about fungicide treatments or anything of the sort, so I just let it go. Oh, I'd water. I thought I knew something about watering, so I'd water every time I thought it needed water, but it got no fungicides and I noticed that the grass got pretty well diseased that first summer in the nursery. That fall, I noticed the grass had recovered. I had three different strains of grass and the Arlington C-1 recovered solid. The C-19 that I had at the time was practically gone. Another strain, C-7, had disappeared completely. The Arlington recovered completely with the coming of cooler weather.

I decided that it was worth a further trial, so I planted a half of my old No. 6 green. At that time, I didn't know too much about drainage or the important things of raising bentgrass, just feeling along. The same thing happened on this half green. I'd have a lot of trouble in the summer. We just simply put it on an old green that had been there for 50 years and it wasn't very well pitched for surface drainage. At the time I put the grass in, I did provide for subsurface drainage but that just wasn't the answer. I found out the answer was surface drainage and that's the No. 1 answer. The following year, we made that green 100% bent and we'd still have trouble in the summer. It would come back in the fall with cool weather and give us no more trouble until the following

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1/ Pro-Superintendent, Richland Country Club, Nashville, Tennessee.

summer. We began to realize then that the way the green was constructed had a lot to do with it. It simply didn't have any surface drainage.

We liked putting on the bent, even though it was bad in the summer time compared to putting on the old Bermuda greens, so we decided to put in five more greens. We built those in the summer of 1952, so that summer this original No. 6 went out completely. We felt that we knew a few more of the answers, so on this next five, we put in sub-surface drainage and we also tried to put in good surface drainage and since then, we've come through fine. The real answer is good surface drainage. That second five greens have never given us any trouble, that is, until last summer when one of the original five did become a problem. In 1953, we put in seven more greens. We finished the job in 1954.

We learned more and more as we went along. The one thing that kept popping right back at us was surface drainage. We never had any trouble except in places where the water wouldn't get off the green fast. There was one green on which the water was channeled. It lay in such a way that the water would flow in from both sides and then go off in a narrow area. A little Bermuda fringe in front of that green built up enough mat to act as a dam in that channel area every summer and we'd have Pythium.

Up until last summer, we didn't have too much trouble keeping Pythium controlled and keeping it from spreading.

Another green sloped down to a flat fairway and the water would come off the green all right, but it had no place to go after it got there, so that gave us trouble. The water would just back up into the green.

It seems like water will not move through the soil fast enough. You have to get rid of the water the quickest way and that's through good surface drainage. Another green sloped to a wide shoulder on the right side of the green. It would also get soppy and water would back up in the green.

The summers before when the weather was mildly dry, the Pythium we got in those soppy spots could be kept under control easily. Last summer though with 16 inches of rain in a 2-month period, those three soppy greens gave us a lot of trouble. We really had to fight to nurse them through the summer but we did nurse them through and with the coming of cool weather, they recovered rapidly. In two weeks, one green was back in A-1 shape and another one took three weeks, and another one was back in good shape within a month. The other 15 greens on the course had drained well and just didn't seem to give us any trouble.

The upper 10 inches of topsoil on those greens was a mixture composed of 60% sand and 25% loam, and 15% peat. I got the loam off the old greens and it was bound to have had a large sand content, so maybe the sand content on the new greens was up 70 to 80%. Every pound of those materials was mixed with a concrete mixer. We did that for one reason. We have been told that no matter what you used or what kind of a mixture you used, it must be uniform from top to bottom. I built those greens and I knew that after I built them, I was going to have to look after them, so we mixed every pound of it.

We mixed the materials at the side of the green and one year, we mixed the materials over at the barn. If I had it to do over again, I'd do it all at the side of the green. We ran the components through the mixer and then wheeled the mixture onto the green in wheelbarrows. This was packed down and smoothed, ready for planting.

Arlington C-1 bentgrass was used at the rate of 1 bushel for each 100 square feet. These greens were all built in the fall and we tried to get them in by the middle of October. With the stolons, it would take from the middle of October to the following spring before we would get them into play. I understand now, with the Penncross bent, that you can seed a green and only use a pound per 1,000 square feet and get it into play in 2 months.

We had the turf the following spring and we had to take care of it, so we began to sort of grope up around in the dark for the chemicals we were going to use. We settled on Tersan as a base chemical (at the rate of 3 ounces per 1,000 square feet). With that, we would mix 1 ounce of a mercury-containing fungicide. I spray once a week and each time, I use Tersan. If I use Calo-Clor this week, the next week I use Semesan, the following week I might use Calo-Cure. I keep switching those mercurials. Whether that has anything to do with it, I don't know. There's a lot that I don't know and that's why I keep coming to these places. I'm like O.J.; I feel like I learn something every place I go.

So much for our fungicidal program. Of course, when we do run into a disease, that once-a-week thing goes out of the window and we spray immediately. If I go out in the morning and I see brown-patch, I start that spray going just as soon as I get to the barn. If we have a comparatively dry summer, we can keep Pythium under control with our regular spraying. We just spray a little more often. But last summer, it got so bad until I used everything in the book. I'm a great believer in doing something, even if it's wrong. Actually, I would spray every day and I'd use something different. Finally, I increased the rates of the old things I had been using; the Tersan went to 4 ounces, and the mercurials went to 2 ounces (and, by the way, the 2-ounce rate didn't burn the greens). With that, I mixed 1 ounce of Cadminate and the mixture seemed to do more good than anything I tried. Some of the other things, I think, did more harm than good and the cure just wasn't worth it. I burned the greens. I think I'll stick to my old things unless something comes out that is proven to be better.

One of the most important operations to me is the way I fertilize those greens, particularly in the summer time. In late fall and early spring, we give them a heavy application of a complete fertilizer. In the spring, if they show need for lime, we'll put on magnesium limestone. A little later on, we give them another application of complete fertilizer or if the weather has been severe

and they've been off color in the winter, we'll start them out with a shot of ammonium nitrate, then follow that up with complete fertilizer. After that, we use Milorganite and potash once a week and I am thoroughly sold on it. I mix 5 pounds of 60% muriate of potash to a 100-pound bag of Milorganite and apply the mixture to the greens with a Cyclone seeder. We'll fill up the seeder bag and the operator walks at a steady rate. On some of the larger greens, the bag won't completely cover the green. With some of the smaller greens, a bag full is too much. This is done once a week religiously. It's got to be something out of the ordinary if we don't fertilize once a week, since we feel that well-fed grass is much more able to withstand disease than starved grass.

OVERSEEDING WITH BENTGRASS

J. W. Dudley 1/

Our greens were overseeded with 4½ pounds per 1,000 square feet of seaside bentgrass seed October 1 of last year. The usual preparation was done, which included spiking two weeks prior to planting so that holes created would cover over, application of a complete fertilizer (8-8-8) with trace elements, verticutting (this had been done weekly since Bermuda had started growing), and seeding. The seed were sprayed with 1 pound of Captan per 1000 square feet and this was repeated at weekly intervals for pythium protection.

The seed germinated in approximately 10 days and even though our Bermuda continued to grow for the next two or three weeks, our putting surface was good and continued so until December 10, at which time our first hard freeze knocked both off color. In spite of this, the surface was still smooth and in good putting condition until March 1, when Poa annua started to seed out. This condition was corrected in about 20 days, when bent started to grow again. Our greens were in good shape again by March 20.

I would say that, as a whole, our members have been well pleased with bent this year.

Advantages of bent over ryegrass:

1. Produces better putting surface
2. Members are not inconvenienced by increased cutting heights necessitated by seedling ryegrass
3. Cost of this grass this year at 4½-pound rate was $5.00 per 1000 square feet; at $1.20 per pound vs. $7.20 per 1000 square feet at 60-pounds per

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1/ Chairman, Greens Committee, Athens Country Club, Athens, Georgia.

1000 square feet rate, based on 12¢ ryegrass (Actually, at the above rate, we planted 36 million bentgrass seed per 1000 square feet vs. 15 million ryegrass at above rate).

Disadvantages of bent over ryegrass:

1. During the early spring growth surge, bent does not seem to be as compatable with Poa annua as ryegrass. Consequently, when our early spring growth started (this year approximately March 10), our greens were bumpy until the bent started growing vigorously around March 20. However, at the present time, the greens are smooth and fully covered in spite of approximately 60% Poa annua growth on some of them.
2. Bentgrass did not do well for us as a fringe grass. This, we attribute to the heavy, matted growth of 127 on our fringes.
3. Bent, in heavy traffic (that is, the front side), did not do as well during critical months of January and February as the back side. However, it was as good as our average ryegrass.

Changes we plan to make next year:

1. Lessen rate of bent from 4½ to 3 pounds and add 2 pounds of redtop per 1000 square feet.
2. Use maleic hydrazide as growth retardant on Bermuda.
3. Berticut heavier, possibly three times instead of one.
4. Plant fringes in ryegrass.

METHODS OF OPERATION (CUTTING, AERIFYING, TOP-DRESSING, VERTICUTTING AND FERTILIZING) FOR A GOLF COURSE UNDER HEAVY PLAY.

Herb Green 1/

First, let me say that the operations I will outline below are to meet the specific needs of this one course and they may not work on other courses, especially that for a private club. This, I know because I came to Jacksonville from a private club.

All our city labor is under Civil Service and we can work them only 40 hours per week. My course is open for play from sunup to sundown every day and in 1957 and 1958, we averaged over 1,300 rounds of golf (18-hole rounds) each week. Broken down, we play about 140 to 150 golfers per day Monday through Friday and 300 or more on Saturdays and Sundays.

1. Watering:

As you will note from the above play, all our watering (except when fertilizing) is done at night because we must start cutting greens, tees, and fairways before sunup in order to get ahead of players.

2. Mowing greens:

We start cutting greens as soon as it is light enough to see the line on greens, and dew is either poled off or knocked off with hose before cutting. We have three cutters and three men at least 10 minutes in front of cutters poling or wetting dew off greens. It usually takes 7 to 9 minutes per green for either poling or sprinkling off dew, so the cutters are always a green or two back.

3. Mowing fairways:

We start on fairways as we do on greens, and skip around to avoid players as much as possible so that mowers can keep moving. We can cut all fairways in 1½ days and we usually cut them twice each week in the growing season, using 7-gang Blitzer units.

4. Tees and borders:

We cut tees and borders two to three times a week or as needed, and we start

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1/ Golf-Course Superintendent, Brentwood Golf Course, Jacksonville, Florida.

early on these as in other cutting operations.

5. Fertilizing:

I know this phase of my operation is going to draw some fire because I do this wrong, according to all recommended procedures. I fertilize (using all chemical fertilizer) greens every three weeks in the summer and as needed during the winter. I start my fertilizing at first daylight with dew on greens and follow immediately with water, being sure that all fertilizer is washed off grass blades, and I get No Burn. I fertilize one 9 one day and the other 9 next day, having players start on 9 not being fertilized. Then I am out of their way with fertilizing and watering by the time golfers make the turn. Tees and approaches are fertilized the same as greens except every other time (about 6 weeks). Fairways are fertilized twice a year if fertilizer is available. I fertilize and water 4 fairways in the morning, and about 4 to 6 after the grass is dry and water in at night. I usually get all fairways in two days.

6. Aerifying, verticutting, top-dressing:

These are all carried out by working one 9 one day and the other 9 the next day, starting play on 9 not being worked. I try to aerify and verticut once a month during the summer and top-dress twice in summer and only once when I plant rye in the fall, or as is necessary---sometimes up to 4 or 5 times a year.

Our trap raking, rough cutting, etc. are carried out after the work of cutting greens, etc. is completed each day.

MAINTENANCE OF MACHINERY

B. P. Robinson 1/

When I first came to Tifton to start work in the turfgrass industry, I think it took about anywhere from 5 to 10 years before we were considered an expert in the turf field and I know it took more than two years here before I felt I was qualified to answer a lot of your questions that you popped at us when you came down. So being in the equipment business for about two years, I don't think I am actually qualified to answer a lot of your maintenance questions. I know a lot of you do a tremendous job in my section and all over the South in maintaining equipment. A lot of you I would like to have in my business myself if I could afford to hire you or some of your mechanics, so I have plenty of experts here than I can appoint to numerous ones who could answer your questions and I think we're on both sides of the fence. We have representatives from both types of major equipment here, so we can have just a round-house discussion but one of the things that hit me right in the face when I first went in business was the time we got in a fairway unit, I think it was either a 5- or 7-gang unit. It came in for repair and I was out doing something else and when I came in, Miss Hill, the secretary, shoved a bill under my nose and went out. The unit hadn't been repaired or it hadn't been into our place for about two years, a two-year-old piece of equipment, and so far as we knew, no one had worked on it except the local people and they were unfortunate and did not even have a mechanic. Those people would have been just about as well off to have gone out and bought a new unit as they would have been for us to send that bill back. I hated to send it back because I thought I was going to get shot right between the eyes, but it so happened that it turned out all right.

I was also surprised at the price of parts for maintaining equipment. You can put some of the parts in this container up here. You could lift it and walk

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1/Kilgore-Robinson Supply, Inc., Birmingham, Alabama.

out with it and you've got several hundred dollars worth or there might even be a thousand dollars worth, so maintaining this stuff can be quite expensive.

One of the crying needs, or one of the most crying needs that I've seen, in the South as far as maintenance of equipment has been is for barns. We've mentioned this to several golf committees and the presidents of golf clubs and tell that that, well, you have a plant here and lot of them do, that's worth from a million to 2½ million dollars. All your facilities are nice and you have an old shack setting down here where you expect to maintain your equipment and expect to store fertilizer, insecticides, and what-have-you. When those parts bills come in and repair bills though, it's still another story. Yet they can't see this thing of having adequate facilities for repair and most of the clubs do have fairly good mechanics.

----SHOWING OF SLIDES----

This is one of the major needs that we were speaking of, good facilities. You need good facilities for maintenance and repair just as you need a good green or good fairways or a good clubhouse.

I think this is a very good motto if you can read that. Our motto: "A place for everything and everything in its place." There are some very good equipment-maintenance people and some good maintenance barns in the South. I know of one that is not too far away from here where the man does an excellent job. He does such a good job, according to this motto (and this is not his, by the way), that a cockroach wouldn't dare run across his floor unless he first went through a footbath. That's just how clean he keeps it.

The next thing is, of course, cleaning up your equipment. Now there are different ways of cleaning it. Some of you know of the cleaning fluids car dealers use. I think some of them call it "gunk" or something like that which can be put on and then you can wash it off. There's a new one that's come out that

you can actually spray on like Aerosol, let it set a few minutes, and wash off.

This is showing one of the methods of cleaning,and that should be done after daily use, but I'd like to point out that you should not use force in washing, just normal pressure without a nozzle.

And, by all means, pay a little attention to the people who operate equipment. At least, look over the manuals and give the operator a little schooling before he starts using the equipment. It will pay off in the long run.

Then watch these little things about adjustments. You would be surprised how much some of these clutches cost us. Some of these little adjustments really pay off if you'll pay a little attention to them.

Than this thing of annual pickup we were talking about--this shows a unit on the right that has not been repaired and one on the left that has been taken into a shop and worked on and been repainted. As I say, most of these facilities are available if you do not have them or do not have personnel to do them yourself.

GOLF-COURSE RECORDS

E. A. Shields 1/

The importance of keeping up-to-date records for your golf-course operation cannot be too strongly stressed. It is true that you may never need them, but then if you do, you may need them very badly. I think records should be individualistic, as each person should recognize what might be important to him at a later date. Each person's requirements will vary and can be expanded should circumstances warrant. I am told that my present records are too elaborate. Possibly so, but I have been keeping records for a number of years and feel that my time spent recording what I have done has helped me many times.

Being in charge of my Club's property, I know it is my job to give them as good a golf course as possible as efficiently and economically as I can. The money allotted for the budget is not my money. Therefore, I attempt to keep up with how the money is spent. It has been my practice for several years to ask for bids on competitive products and machines. The quantities I buy should warrant some consideration with the suppliers. I feel quantity users should get a better discount than small users. Just because we work for a country club does not mean that we have money to throw away. Lest I am misunderstood, let me state clearly again: I do not expect something for nothing. But since I am spending my Club's money, I want it spent where there will be a minimum of questions about it.

The records I now keep are as follows:

1. A card index on all major equipment.

In this, I keep a record of price of equipment when purchased and the dealer. I also note purchase date, serial number, motor number, and any other information that

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1/ Golf-Course Superintendent, Capital City Country Club, Atlanta, Georgia.

seems necessary. Traded-in equipment cards are balanced out as above and card is kept.

2. Letter file.

In this, I file letters and circulars that I might need later. Letters pertaining to Club policy or orders are properly handled and filed for permanent records, as are my monthly budget expenditures and statements. Questionable orders are answered in writing and copies filed for permanent record. All parts books are filed so I can find them when needed.

3. Monthly gasoline report.

This is expanded to a yearly gallonage. This report is very beneficial in recommending equipment at a later date. It is an easy matter to get an estimated yearly mileage on equipment not having speedometers.

4. Yearly calendar pad and notebook.

The calendar pad is used to keep up with most everything done to my course, especially my greens, tees, and fairways. It is an easy matter to transfer this information to a loose-leaf notebook, which gives me an immediate insight as to what has been done in the event I run into trouble. Extreme weather conditions are often noted also.

5. Hourly work sheets.

Last year, we started individual work sheets which the men fill out daily. These are run from the 1st to the 16th and from the 17th to the last day of each month. These individual sheets are cross-balanced, which gives us the yearly number of hours on each operation on our course. My man hours on the course last year were 21,872. Labor cost was $25,747.00, which was 67% of my budget.

6. Recapitulation.

At the end of the year, I run a complete recapitulation using my calendar pad and notebook as a guide. It would be an easy matter to learn fairly accurately what my product expenses were for any one of my operations. On this report, I index products used and their prices. Also I keep notes of extraordinary expenditures for the year.

7. Reading materials.

In my office, I have many reference books -- GOLFDOM, GOLF COURSE REPORTER, Turf-conference reports, USGA JOURNAL, and miscellaneous reading.

By now, most of you probably agree that I keep too many records. Most of my records are copied from other successful superintendents, though modified to what I feel are my requirements.

To my way of thinking, time spent keeping records of what I have done and how much it has cost my Club to do it is time and effort well spent. You owe it to your employer to be able to intelligently advise him of what is being done and how it is done. The average member does not realize the work and effort going into a successful golf-course operation. The best way to educate him is to show him the facts and figures. At any time during the year, I can justify any expenditure should my Chairman wish the information. At Board meetings, my Chairman can talk with authority, as he has records available which will make his position offensive rather than defensive.

FAIRWAY MAINTENANCE

Harry Wright 1/

This subject can be divided into four or five parts, depending on the particular golf course:

1. Aerification
2. Fertilization and lime
3. Cutting
4. Weed control
5. Watering, if a system is available

There are many good men in this business who feel that good turf can be produced without a fairway watering system. Personally, I won't say it can't be done, but at our place (which has a system that doesn't have complete coverage), there is a definite difference in the turf that gets water during dry spells and the turf that receives none. That discussion could go on and on.

Aerification

The first on my list is aerification--when to aerify and how often--depends on several things, your location geographically and the condition of your soil, to name two. What tool to use --- any tool that will loosen the soil and let fertilizer and water get deeper is a good tool. We prefer a spoon type that brings up a core of soil. This soil is spread with a drag made of chain-link fence attached to the aerifier. The soil acts as a light top-dressing. The more often you aerify, the more soil for top-dressing. At Peachtree summer before last, one man did nothing but aerify all summer and it did wonders for our turf because we are in a heavy clay soil that needs loosening very badly. As you know, Bermudagrass has a hard time running on hard ground. Let me say here, I am not recommending that you aerify all summer, but I would recommend

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1/ Golf-Course Superintendent, Peachtree Golf Club, Atlanta, Georgia.

aerifying before each fertilization especially. I'm convinced that we get better results from our fertilizer. After spending nine years working with sandy soils, I ran into some troubles when I moved to the clay-soil area, troubles in the actual operation of aerifying. If you start a spoon-type aerifier in the morning when dew is heavy and are using a drag behind your aerifier, your mat will get heavy with wet soil that even chains won't hold, besides putting an extra strain on your tractor. You may be saying here that you should drag later---well, that takes another man and tractor and too, if those plugs dry for two hours, they'll be like bricks and won't break up until the next gully-washing rain. So we decided that by waiting until the dew was gone and using a drag and cutting behind with a rough mower set at fairway height (to save our good units), we did a very neat job with a minimum of play inconvenience.

Leaving a clean, neat job after aerifying is very important to your members. They do not want to play over a course loaded with soil cores.

Fertilization and Lime

I will not attempt to suggest when to fertilize or how much of what to use. The experts will tell you that. I'm supposed to talk about a good way to go about the operation. First, spreader calibration is important, to know how much you are applying. Have your machine calibrated the day before you are to start your fairway fertilizing. Run your spreader over a 1,000 square foot area:

8 feet wide spreader - 125 feet

10 feet wide spreader - 100 feet

The speed you travel will play an important part here, so travel at the speed you'll travel when you are on the fairway. Before starting your trial run, tie some sort of catcher under the spreader---cloth, canvas, etc.---to catch your fertilizer. Some spreaders come equipped with a calibration pan. After the run, weigh your catch

and multiply by 43½ and you will have the number of pounds per acre that you will be applying.

As you can see, a couple of runs may be necessary to get the desired rate. After this operation, you know just exactly how much fertilizer you are applying. Only a mechanical failure can change the amount a great deal. Your operator should check the spreader setting often to see that it is still in place, as well as trying to maintain a set speed.

If you are using a non-burning fertilizer, load your truck the afternoon before so you can get an early start the next morning. We want to complete this operation as soon as possible because play can interfere quite a bit and the most lost motion we can eliminate, the better. If you use a spreader that can be opened and closed from the pulling unit, only two men are needed.

Park your loaded truck about midway the length of your fairway in the rough. The truck driver will need a wheelbarrow and cyclone seeder. He will keep the spreader supplied with fertilizer by hauling it to the spreader rather than having the spreader come to the truck at each filling. With the cyclone seeder, your truck driver can catch the little corners around greens and traps that your spreader cannot reach and he can refill the truck when the tractor operator gets to short runs and filling is not needed so often. To help in this operation, the fertilizer could be spotted at each fairway ahead of time, possibly the day before, if weather is good and covers are available.

After a fertilization or two, you'll know about how many bags each fairway will take. Having the fertilizer on the spot keeps the operation going without any delay.

The things I have mentioned will work with a hot material as well. Unnecessary tractor tracks over applied hot fertilizer will, of course, give unnecessary burns. If you have a fairway watering system, most of your burn can be eliminated by watering quickly after the material has been applied. On longer fairways where more time is consumed, it is good to do half the fairway and water, then the other half and water.

A 15- and 20-minute setting will, in most cases, eliminate any severe burn. Your rate would determine this. The more fertilizer you apply, the more chance of a burn. Incidentally, I was told that plain 20% superphosphate would not burn. The phosphate may not have burned, but something sure had my fairways looking like a zebra for a few days. It was not serious, but it did burn. When it is at all possible, we should try our best not to have discoloration.

Liming

This should be done when needed, as shown by soil tests. With the present-day spreader trucks, it is a very simple operation. Just call a lime company and they will usually do the rest.

What you use depends on cost and availability. On the Coast, oyster-shell dust comes cheap. Around Atlanta, dolomite comes pretty cheap. The experts favor dolomite because of the magnesium expressed as the oxide. Incidentally, these trucks can usually do 18 holes in a day with an early start. A good plan that has been followed is to lime 6 fairways each year; this gives your whole course a complete liming every three years. This doesn't make such a big dent in your budget all at one time. There may be cases, of course, where lime won't be needed that often. Your soil tests will show this. When figuring how much lime to put on, consult Jim. Usually a ton to the acre is a good rule to follow.

Fairway Cutting

Now this sounds like a very simple operation. Just pull your gang mower over them and that's all there is to it. Believe me, for really good fairways, there is more. Pulling your mowers in the same direction every cutting will eventually leave ridges where your tractor wheels press the grass down and it does not get cut quite as close as the other. This can be helped by:

1. Changing directions
2. Setting unit in
3. Raising unit
4. Cross-cutting once each month

Schedules should be arranged where fairway cutting does not start until after the dew is gone. Your fairway cutter can very easily spend his morning hours cutting roughs, which are not as important. We have 100 acres in fairways and by starting two 7-gang units at 10 o'clock, we can cut all fairways in one day. If acreage isn't so large, two 5-gangs can do the job, or one 5 in two days. When fairways are really growing, sometimes three times a week is necessary.

How many times a week you cut depends on the growth or how slick your members want them. A good rule to follow is to try very hard to get all fairways cut on Friday, so all the golfers will be happy on Saturday and Sunday, the time when most private clubs have their heaviest play.

One thing to remember is to never let your operator drive so fast that the rear rollers on your mower start bouncing. I've seen that cause bad corrugations which are hard to eliminate. Actually, at high speeds, you'll be cutting grass only now and then. Four to five miles per hour seems to be the best speed.

Weed Control

This subject could take up much more time than any of us have. One of the problems that came up last year was getting our sprayers to put out the number of gallons of water recommended by the weed-killer manufacturers. They wanted 80 to 100 gallons of water per acre, which meant many of us had to travel much slower than we would if applying 40 to 50 gallons and we even had to cut boom width down, which made the operation slower. Calibration again comes into the picture - it's not too hard to do. Fill your tank to a definite gallonage level and run over a measured acre at the speed you wish to travel. Then using a 5-gallon can, fill your tank to the starting level, counting the

gallons and you'll have the number of gallons per acre.

Knowing the number of gallons per acre, you can then add the amount of material recommended for an acre. If your tank holds 100 gallons of water and you put on 50 gallons per acre, then you'll cover two acres with that tank. If the label says "One gallon per acre of material," then you put two gallons in your tank. Incidentally, I ran some tests with one of the disodium materials, where the manufacturer recommended 80 to 100 gallons of water per acre, and feel almost certain that good results can be obtained with 40 to 50 gallons of water per acre. As you can see, we get the job done much quicker using less water because our tankful goes farther.

Best results can be obtained with low pressures, just enough to form a spray. High pressures tend to put heavier concentrations on the outer edge of either a cone or fan-type nozzle, consequently, we wind up with a streaked fairway caused by a heavier burn than we want. At Peachtree, we had good results with only 80 to 90 pounds of pressure on the tank.

Watering Fairways

If you have the system, it usually has to be done at night. A regular rain gauge set under your sprinkler will tell you how much you're putting on and from this, you can determine just how long to leave a sprinkler to get the amount you want. On heavy soils, one inch per week will do a good job. Light soils may take more. Watering is very flexible, some spots on your course need more than others. One thing my ex-boss taught me (I think) is that grass suffering from over-watering is much harder to revive than that suffering from lack of water.

Jim Latham You have heard from these seven distinguished gentlemen and now, it's your turn. We've covered everything from budgets to bent grass and all these things that we have covered, including what we think is as much as we can crowd into one small section of this program, and we certainly at this time invite any questions or comments that anyone here would care to make concerning anything these gentlemen have talked about. You can just think about your golf course and think of a problem you have and certainly among these seven, you can become more thoroughly confused. So, if there is anyone here who has a question, let's start now or we welcome any comments you might care to make.

QUESTION AND ANSWER PERIOD

Q. Concerning potash, is that available potash or is it muriate of potash?

A. Danner 60% muriate of potash. This is mixed, 5 pounds are mixed with a 100-pound bag of Milorganite and the Cyclone-seeder bag holds 20 pounds. An average-size green takes about 20 pounds. We'll say a 5,000-foot green, so that's about 4 pounds per 1,000 feet we're using. A larger green might take a little more than a bag or for a smaller green, one bag is too much.

Q. Do you spike or use any other cultivation preparations at all?

A. Danner No, sir, not with my fertilizer practices. As I say, we keep this going all summer. We keep the grass growing at a steady, constant rate and we'll run the fertilizer in this direction one week and the next week, we go across the green in that way. I don't see any lush spots where the old-type fertilizer spreader overlapped and I don't see any thin or yellow spots where the operator might have missed. By criss-crossing and putting on a light rate once a week, it seems we keep that grass growing at a steady constant rate and I believe if I

had Bermuda greens, I'd feed them the same way.

Q. Do you have any idea of the total nitrogen you use a year?

A. Danner I'm using at least 10 or 12 pounds of nitrogen a year.

Q. Charlie, do you overseed your bent greens at all?

A. Danner No, sir. The grass stays green the year around. I'll get a severe frost in the winter time and it will knock it off color a little bit. You know, it took me 3 years to complete that program and I've had freezes or sudden cold spells and I've seen it knock the rye completely off color long before it would the bent.

Q. What about the height of cut?

A. Danner In the summer, I may go up to 5/16ths. I cut at 1/4 inch most of the year, but in the summer, I may go to 5/16ths.

Q. You never go below that?

A. Danner Hardly, if ever. I may have a tournament where the players might want the greens a little faster and then I'll go to 3/16ths but that's a rare thing. I keep those mowers set at a quarter and my members are always the devil if the greens get fast.

Q. Do you have any Poa annua problems?

A. Danner Up to now, I haven't had any. It's all over the golf course but the greens were sterilized with methyl bromide when I put them in and I think that's kept the Poa annua out up to now. Two years ago, on the advice of O.J., I started applying arsenate of lead. Two years ago, I put on 10 pounds to a 1,000 feet in the fall. I followed that the following spring with 5 pounds and put on 10 pounds again last fall and 5 pounds this spring. On the advice of O.J. and a lot of fellows who have done this, I think it's going to keep it out of there.

Q. How was the lead arsenate applied.

A. Danner I mixed it with Milorganite, which is a job my men really hate, but I feel that Milorganite is a good carrier, so we do it that way. We figure out about how much we're going to apply and then mix it.

Q. Charlie, this past summer, did your No. 6 green brown off and was there just certain spots where it looked bad?

A. Danner No, 20% of the green got spotty and I guarantee you what was left would put better than any common Bermuda green. Let me say that while I'm here at Tifton, Georgia.

Q. What about your fringes, Charlie, do you have any Bermuda encroaching on them?

A. Danner I do. O.J. had some pictures here this morning. Now the only other important thing to me in keeping bent greens in the summer time is the water. It's the way we water the greens. At Richland, I'm set up to where I have Buckner valves spaced about 35 feet apart around the greens and some of the greens have as many as 8 valves. When I water, I use only 4 of those valves but, depending on the way the wind's blowing, I might use 4 over here, 4 over here, or 4 over here and so, we start out two men early in the morning. In the summer time, we come to work about 6 o'clock and the first thing I do in the morning, if it's the day to mow, is to mow the greens. I don't brush the dew in, or pole it in, or anything of the sort. If I don't need to water that day, I just ignore the dew. Now I've had a lot of fellows to tell me to brush the dew in, and I've had a lot of them say, "Well, just don't pay any attention to it," so I just don't pay any attention to it, but I mow the greens first. The men leave the barn at whatever hour we come to work, if it's 6 o'clock, then they start out mowing, only two men. I have two men who come behind them watering and with my 4 sprinklers

going at one time, 15 or 20 minutes is all we need on a green to complete the watering and get a complete, thorough soaking into it as much as we need.

Sometimes we water more than others, it all depends on the weather but there's one thing that we watch for every day and that's for wilt. Two summers ago, we had to water 20 times in the afternoon. Last summer, we had to water 8 times but we watch every day and we know at 10 o'clock in the morning if it's that kind of day. We can just feel it; the wind's hot and dry and the humidity is low, the wind gets up to where it's starting to move around, so we know that we better watch out for wilt that afternoon. The first thing after lunch, I'm out there and, of course, my foreman and the other men on the course. We've tried to train every man that works there to watch for a green turning a bluish cast or if he walks across it and looks back and sees his footprints. We know it's wilting then, so we give it a little water immediately. If we don't let it go too long, we don't lose a blade of grass. If we let it go for a whole afternoon and maybe the next day, we're going to lose a lot of grass. I think a lot of bent greens have been lost because they wilted.

My men (hired labor) don't like to work Saturday afternoons, so it's all up to me then--Saturday afternoons and Sunday afternoons. When I feel like it's a wilty afternoon, I get a couple of caddies and an electric cart, put the sprinklers on the electric cart, and start out. Many times, with 100 golfers on the course, I've watered 18 greens in around 2 hours. The caddies go on the greens and put the sprinklers in and I go over to the valve, turn the water on, and let the sprinklers run about a minute (not over 2 minutes ever) and that's enough water.

I turn the valves off, they get the sprinklers out, and away we go to the next green, just ducking around among the golfers. To me, a very important thing in growing bentgrass is to watch for wilt because I know you can lose a green in a short time.

Another thing we use is a tree-root pruner made by Jim Haynes in Denver. We run that around the greens once a year; Jim says I ought to do it twice a year. That's a big help.

Q. That watering program that you do in the day time, it doesn't interfere with the play? Do they accept it?

A. Danner They accept it. They know that I'm not out there beating those greens for nothing. They know that I'm proud of them and so are they. When they see me out there doing anything, they say, "Oh, that's all right. Let's wait until he gets through." And they do. I've seen a foursome come up and pick up themselves a couple of shots to a par-5 hole and then just walk up there and stand around and talk to each other until I get through. They don't seem to mind it and I've never had one single player to get on me in the clubhouse about watering the greens in the afternoon.

Q. Charlie, we would be interested in knowing what's happened to your greens fees since you've switched.

A. Danner Play from non-members increased 500% principally during the spring transition periods.

Q. I'd like to ask Charlie why he has valves on his greens. What is the advantage in having a master valve?

A. Danner When I put that system in, I just didn't know how they would work. I was in quite a hurry to do it and felt that there might be times when I would want to do some spot watering. I could make up a hose for the valve, a short hose for just watering the spots around the greens. I've

found that I can count on the 4 valves and generally water the whole greens and that seems to take care of them.

Q. You don't use pop-up sprinklers?

A. Danner No. I put those in first, but they weren't effective. They put too much water over there on the other side of the greens and from there, I went to Buckner valves and jet sprinklers that we could adjust to what we wanted. We could make it go 360 degrees or part circle.

Q. You said you had a master valve at each green to cut the water on. What is the advantage of that when you already have a quick-coupling sprinkler there?

A. Danner When I first put in these pop-ups, you see, we had to turn on the master valve. But I dug those up and changed over to the snap valves.

Q. Where has bentgrass overseeding been successful?

A. Latham In case you happen to be going through some of these areas, the good bent greens that I have seen or heard of that were overseeded on the Bermudagrass were at San Jose, Ponte Vedra, and the Augusta Country Club. The one I am most familiar with is at the Augusta Country Club and they are absolutely beautiful.

Q. Did they use bent alone?

A. Latham No, sir, he used a redtop and seaside bent combination.

Q. How has the seeding of bentgrass worked out elsewhere?

A. Henson Maples We tried the seeding of bentgrass on some of the greens at Pinehurst for two years and I don't think our conditions are comparable to a lot of other places. We have such tremendous play there in October and November, when the grass is coming up, and although we had a good stand of it, it wasn't really successful until the spring of the year. There was so much traffic on the grass when it was young and we had disease

trouble, too, that it spotted. Winter before last, you all know that it was really cold, and it was about April 1 before it covered completely. In order to get some of the spots covered, we seeded some ryegrass in there and spiked it into the ground to help out with it. This past fall, we again tried the seeding and it didn't look like it was doing any better than it did the year before and rather than take a chance, we went ahead and put some ryegrass down. So we have rye and bent in there. It's not solid bent.

I would like to make a comment to any of you fellows who might want to try to convert over to bent, seeded bent, that is. As long as your soil is in good condition, you don't need to tear the green up. I did this at Pinehurst in 1956 and I did another one last fall. I gassed out the green with methyl bromide in September and then overseeded it with bent. Then you can either spike those seed with a light spiking to mix them up or top-dress them a little bit, get that germinated, and then go ahead and overseed them with ryegrass and by the following spring when your ryegrass goes out, you have the no-transition period when your bent covers over. I have two greens like that now and you can keep playing on it, too. The first one I put in was Astoria, which isn't a good bent, I'd say. The first green I did this past fall, I seeded a 5,000-foot green with seaside and half of it with Penncross and overseeded it with rye. We also have another test area there. Through the help of the U.S.G.A. Green Section's Jim Latham here, we put in a number of stolon bents. We have the Nimisila from Bill Lyons, the Penncross, C-7, C-1, C-19, a combination of C-1 and C-19, and Old Orchard. They have all completely covered now and it's just a matter of seeing what they will do in the summer time.

And, too, talking about opening your mouth and sticking your foot in it, I suggested to Mr. Tufts that instead of gassing out another course up there like we had been doing and planting 328 Bermuda, that we gas it out and seed it in Penncross bent this fall and then overseed it with ryegrass. He took me up on the proposition, so we're going to try that next fall on our No. 1 course.

Q. How has Uganda grass performed in this area?

A. Latham We have one example here and I would like for Mr. Baumgardner to state it.

Baumgardner Well, I haven't had much experience, only a little, w h e n we changed our greens over to 328. On our No. 12 green, we had fumigated, killed everything out, and put the grass in by scattering the stolons on top of the old sod after aerifying. On a plot, I would say, probably 12 or 15 feet long by about 6 or 7 feet wide, we put Uganda grass in instead of 328. It grew off beautifully; it spread, if anything, a little faster or as fast as 328 and looked beautiful until we started to mow it. We were mowing that green in a little less than 4 weeks. We mowed them a little high at first, I guess at 5/16ths or above. I know we weren't as low as 1/4, but may have been 1/2 inch the first few times, and it browned out and you could see it for two years in that green. This plot of Uganda grass got smaller and smaller. It's a 200 and something yard hole and you could pick it out from the tee and farther from just the brown streak in that green. It got smaller and smaller and now, it's altogether gone. The 328 crowded it out.

Q. Did you find it would hold a good wedge shot going into a green?

Baumgardner I don't know. We didn't have enough on that, you couldn't hit it with a wedge. It wasn't big enough probably. It may do fine some places. I think it was Dick Wilson who told me that he saw a par-3 course out

in Arizona, I believe it was, that had the most beautiful greens he ever saw and they were of Uganda grass and were supposed to be good the year around. But for us, it was brown all summer long and I think they had the same experience here with it at the Experiment Station. With close mowing, it wouldn't have any color in the summer, but was fine in the spring and fall.

Herb Green I brought Dr. Grau back from Gainesville last September was a year ago from the Gainesville Conference and took him to Jacksonville to catch the train the next morning. I got one bushel of his Uganda grass from Baker at Miami. I cleaned off a nursery plot next to my 328. Last spring, I was rebuilding the back 9 greens and about May 25th, I got enough grass out of that one bushel of Uganda to plant a 6,800-square-foot green on my No. 10 hole. It had spread that much during the winter to May 25th. It is complete in Uganda and it's the prettiest green I have on the golf course today. It stayed that way all last summer. Everyone of the golfers, when they get to it, notice it and ask what kind of grass it is. One lady came in there and asked Mr. Perkins, who is over the golf courses under the commissioner, why we didn't get some of that "goosey-gander" grass and put it on our other greens.

QUIZ THE "EXPERTS"

Members of the Experiment Station staff answer questions on turf research:

Burton I would like to begin by telling you something about the organization that we use to do our turf research. I am a joint Federal-State employee, but most of my salary is paid by the U. S. Department of Agriculture. My superiors have indicated that if they can ever get Congress to appropriate some money for turf research, they intend to put a turf specialist at this Station, a man who would be able to direct all of our turf research. At the present time, we are not getting enough money in the form of grants to pay one well trained man in the field of turf research. The grants that we receive from commercial companies and from the U.S. G.A. and Southern will permit us to hire one or two graduate students and we are currently trying to carry our turf program with their help. Elwyn Deal is one of these graduate students on a two-year basis. We are paying him $2,000.00 a year. Under this plan, he will complete his Master's work in two years. He'll go to the University of Georgia in Athens full time for three quarters and for the rest of the two years, he will work full time on our turf research here at Tifton. He will conduct the research for his thesis at Tifton as a part of our turf-research program.

The men that you see before you on this panel are specialists in various phases of agricultural research at the Experiment Station here at Tifton. These men have their own work to do, but can devote a little time to the direction of turf research in their field.

Dr. Good, for example, is a Federal Nematologist, who must work with nematodes on all crops. Thus, he has little time for turf-nematode research. With the help of a man like Elwyn Deal to do most of the work, however, Dr. Good can direct some nematode research on turf and answers

to some of our turf-nematode problems can be found.

Dr. Wells will direct our turf-disease research.

Mr. Beck, any research that we may do on insects, etc.

If we are able to find good graduate students, I believe we can do a creditable job on turf research in this way. Actually, it's about all we can do until we get more funds for turf research.

Now, we'll let you quiz the "experts." There are a nice group of Experiment Station specialists here in the front of the room that we are calling "experts," but I'm going to consider anyone in this room who can answer a question an expert. You ask the questions and I'll try to find answers for them. Who wants to be first?

Latham I have a question I'd like to ask Mr. Beck. In the northern part of the South where bentgrass is being grown on greens, some of the superintendents this year are using chlordane at 4 pounds per acre as a herbicide to control Poa annua. Will application of this type control sod webworms?

Beck Is this going to be applied and worked into the soil? We have found that the chlorinated hydrocarbons don't move very far into the soil, so I would expect it to remain in the surface pretty well. They don't leach out as much as people might think and we can expect that chlordane would last a good many years. I see no reason why it shouldn't help in holding your sod webworms in check, especially at that dosage. Dieldrin would persist much longer but, of course, you wouldn't get the herbicide effect with Dieldrin. Both chlordane and Dieldrin are quite persistent and I should think would give you good control over a long period of time. I believe there are some cases, however, where we would find a very heavy mat and the sod webworm will not get too close to the soil. In that case, it might not be too effective but if that mat isn't too heavy, I believe you'll get control.

Danner Will Phygon control Pythium on bentgrass?

Wells So far as I know, there have not been any experiment to see whether or not it is compatible. I believe it's a hydroquinone and on bentgrass, in which you would be interested, it's rather phytotoxic. If I had bentgrass, I don't think I'd put it on it because some of the people who have applied it, at rates high enough to give them much disease control, have found that it would burn up their bentgrass. If you have bentgrass, I wouldn't try to answer your problem with Phygon.

Burton Mr. Baumgardner has just asked a question about taking soil samples. Bob Carter, our Station Soil Scientist, suppose you come over here and give these fellows a rundown on what is involved in soil testing.

Carter Well, Mr. Baumgardner, you've done more sampling I know personally than anyone else because we work pretty closely with you, so maybe between the two of us, we can answer that question. In general, on your fairways, we have taken this position--probably a 3-inch-depth sample is sufficient. In other words, there is no need to go down as far as 6 inches. Now in pasture work, we do it differently but in the case of lawns and fairways, 3 inches is sufficient to go on depth. On your greens, I would say that you wouldn't have to go even quite that deep, a 2- or 3-inch sample, not any more than 3 inches, of course, on a green, I believe. Of course, I believe our best, most valuable contribution so far as soil testing has been on fairways, where you are in a more normal soil situation. When you get to greens, as you know, you are not working with soil quite as often. You have a condition that you achieve there and quite often, we don't get it but I would not take real deep samples. I don't think it's necessary.

Q. Can you tell us a little bit about the soil-testing fees?

Carter I might just repeat a little of what Glenn said. In general, for any

golf club or organization operating in the state of Georgia, military stations included, the soil-testing service is available without charge. At least, at the present time, it is a free service and if you have special problems, especially on golf courses, the way we like to work it is if Jim Latham visits your club or if you are working with Jim, you might have the soil sample sent to us. If there is any special question about it when Jim has visited your club, we will furnish him the information and between the two of you, perhaps you can arrive at a solution to your problem. Quite often, we have them come here and if I don't know the answer to a question, I just get with Glenn or whoever else is around of this group and between all of us, we try to work out the answer on soil testing. If you want to do that, the service is available, as I say, at any time at no cost.

I think the most useful place for a soil-testing service so far as you are concerned would be with your areas other than your greens, which, of course, are special problems. Fairways and lawns are incidental to other things. We've done some work with the Army engineers on the installation that they had at Brunswick on their disposal area there for their ammunition dump. They were growing grass on those dunes over there, bunkers that they had, those sort of things, but the service is available and any time anyone wants to send in samples, they are perfectly free to do so. I would suggest this--when you send in samples, don't just send us samples from fairways 1 to 9 or 9 to 18 and don't say anything else. Give us some idea of what you have done to it, for example, Baumgardner always writes me a long letter and tells me everything that he did to those fairways, which is information I need to know. When I have this, then maybe between him and me and Glenn and me, we can all get together and work out

a solution. For several years, Sea Island has checked its fairways and we have worked out recommendations, so I would be glad for Mr. Baumgardner to say whether or not our suggestions proved to be effective.

Baumgardner We think they have been very valuable.

Carter Well, one of the things that show up on fairways on real sandy soils (and that's Mr. Baumgardner's problem) is the potash level. You keep your phosphate and nitrogen level up but quite often, you forget the potash. It will not stay up in these sandy soils and on your fairways, you had that problem, so we suggested that you up your potash applications a little. I believe from what you told me, that helped correct some of your maintenance problems on a lot of those and, as a matter of fact, I have those samples here. I had them in case somebody asked me about them, to show what was done. Are there some other general questions?

Q. On greens, I know that you're familiar with this. In almost every case, the phosphate level on the green is extremely high and the potash level is generally always low. How should the potash application be included?

Carter In the green? In the early spring, I'm sure most every course does. In some instances, I know you are getting special mixtures made up and if in the greens that you're working with, you know that the potash level is low and have had some soil tests or some other reason to suspect this, it seems to me that you can make a mixture that would include enough potash to maintain that at the time you are applying it. In other words, instead of just applying nitrogen, maybe you could apply nitrogen and potash together. If your phosphate level is up there so high that you are not worried about it, then maybe you can make a mixture. I know that Mr. Baumgardner uses 10-0-10 or 14-0-14 or some such mixture as that to apply to those in order to correct that particular situation. In other words, apply potash at the time the nitrogen is put on.

Q. Do you apply 1, 2, or 3 applications of heavy rates of potash or should it be dribbled along all the time?

Carter I think that it should go along just about like your nitrogen application does. It would be better to split both of them during the year than to put it all out at one time because these are both very leachable. In other words, potash will leach out very quickly and, of course, as you are watering your greens regularly or having heavy rainfall, it is going to leach out rather quickly. Now it is true that the grass will take up more potash than it needs when you put on extra potash, but if you should happen to let it go too far the other way, we have run into potash deficiencies. By the way, I've never heard of it on a green. Nitrogen and potash together are the key, I think, to the growing of these grasses. We found that out on pasture grasses and it certainly is true of the ones you grow on fairways and greens also.

Wells When they have followed your recommendations, their disease troubles have usually cleared up, haven't they, especially on Bermudas in July and August?

Carter Well, that's what we hope. We have very definitely shown this on pasture grasses and it should be true on your fairways and greens. These Bermudas do have to have some potash as well as nitrogen and the more nitrogen you apply, the more likely you will have to add potash.

Q. Should one sample in a number of different places?

Carter Let me say that if you have nine fairways, there should be a representative sample from each fairway, once you have started out. Once you have started your program, I believe you might be able to take composite samples and combine some of your fairways where they are adjacent as they often are, but you need only a half-pint pile of sample. Now you can take more than that, but don't send it in to the soil-testing laboratory. I know that in

North Carolina, it's the same as here; you don't need more than a half-pint.

Burton I would just like to emphasize the need for potash in Bermudagrass. As Homer has just said, most of the disease problems that have been reported on Coastal Bermuda (and it is also true on Tifgreen) have been due to low potash. It is very easy for potash deficiency to slip up on you. As a matter of fact, it came close to slipping up on us on some of our turf plots. You can make a good case for using a fertilizer material carrying all three of the major elements in about the right proportions. This would help you to avoid the development of such deficiencies. A good many of you fellows are getting wise to this and if you are using Milorganite, for example, you're mixing a little potash with it. That's good business.

Mascaro I'd like to hear a discussion on lime.

Carter That is always a good question, Tom, and it is as true in the agricultural field as it is in this one. The majority of the samples that we have tested for golf clubs, in general, have used lime so that the pH's are usually somewhere around 6, but we occasionally run into a situation where they are extremely low and that would be the case, of course, where you are using a nitrogen material that lowers your pH. As much as you use, especially on greens and even on some fairways, you can with ammonium nitrate as the source of nitrogen, drop your pH considerably over a period of years and we have found that most of the Bermudas that we grow will grow over a wide range of pH. It has grown pretty well from 4.5 to 7 and we find that they will tolerate that. Now if you go to other grasses, you may run into some other problems. That probably is true farther north as you go to some of the others, so we feel like that all the grasses would probably do best if they were maintained somewhere at a pH level of 6 or close to that. At

least, don't let it drop below that and if you are continuing to add some nitrogen material that will continue to drop it, then you must continue to correct it by adding lime. I believe I'm correct in saying that, Baumgardner, you are using lime more or less regularly in your program, are you not? In other words, about every third year, he comes in and limes and that keeps his pH from dropping too low with the nitrogen materials he is using. I think that is a good practice, in general, for grass both on the fairways and possibly on the greens as well because once you let it drop below 5, you can run into a number of deficiency problems. You should never let your pH drop that far. There again, a soil test simply for pH will show you whether or not you are at a level of 6 or above and if you are in that neighborhood, you are usually all right. Regular maintenance with lime, whether or not you are using nitrogen materials, I think, is a good practice.

Burton Thank you, Bob. We're doing a little work on the effect of pH on Coastal Bermuda and I think what will happen with one Bermuda will probably happen with all of them. I'm going to ask James Jackson to tell you just a little bit about that, if he will.

Jackson We have been interested in this pH factor for some time on Bermudagrass-Coastal Bermudagrass--and I think, as Dr. Burton indicated, the results with one type of Bermuda would, in general, hold true with all types. I was just talking to Elwyn Deal over here and he said they recently sampled some soil on their greens area out here that had been fertilized with rather heavy applications of ammonium nitrate for a number of years. He said they could tell something was wrong with the grass growing there and checked the pH, which was down around 4.3. This is getting down to the critical level for even Bermudagrasses and, I am sure, perhaps even more so for

some of the other grasses at other locations. We have applied rather heavy applications of lime to Bermudagrass. We started one test with Coastal Bermudagrass on a Tifton soil, which is a rather sandy soil with some clay in it, trying to adjust the pH to get optimum production, which of course would be under those conditions when deficiencies do not exist. We have applied lime to raise the pH and applied regular dusting sulfur to lower the pH. We have applied as high as 12,000 pounds, or 6 tons, per acre (this is on a per-acre basis of hydrated lime) and have changed the pH from about 5.6 to 7.1 and 7.2. Even at the high rate of 7.2, we have not hurt the Coastal Bermuda. We have applied sulfur and obtained pH's of 4.5 and 3.5; at 4.5, we have not had any noticeable reduction in our yield. However, when the pH drops to somewhere around 3.5 or 4, we can say in general that we do get rather severe injury on Coastal.

Burton Thank you, Jimmy. Someone wants to know if lead arsenate will last longer than chlordane.

Beck I know nothing about lead arsenate and I don't know how to answer that question, but I believe that it is very persistent when you once get it in the soil. I would guess, if you will let me do that, that the lead arsenate would persist longer than the chlordane, but we have not had lead arsenate in our program so far, so I don't know.

Burton Is there anyone here who would be able to answer that? Charlie Danner? The question of the compatibility of lead arsenate and chlordane.

Beck I believe I heard Jim Latham discussing lead arsenate. Weren't you discussing it in here this morning, some experiences you had had with it? Lead arsenate went out a long time ago because of the toxicity hazards. The lead is accumulative in the human system and so on; it is still being used in some work but there is just no place for lead arsenate in our programs on forage crops, so I'm not familiar with it and its reactions. I'm

sorry, but that's the case.

Burton Dr. Wells and Dr. Good have a very interesting experiment on the effect of soil treatment on the growth of ryegrass. Dr. Good, suppose you tell us what it means.

Good This particular case is from a soil in the turf nursery here at the Station. This is a ryegrass which, of course, was in this area injured by stubby-root nematodes, Trichodorus. Those of you from Florida are familiar with that term, I'm sure. We took soil samples of the greens area and it was perfectly clean. The yellow, poor-growth area contained quite large populations of stubby-root nematodes. These nematodes pruned the roots, as is true of most nematodes that attack and do any appreciable amount of injury to grass. They prune, or cause a root decay of, the grass. This area was treated with methyl bromide, as Dr. Wells mentioned, I'm sure. On our nursery here, we have other nematodes, the sting nematodes probably do even more damage than the stubby-root, but the two are principally involved in turf decline.

Burton We have a little study out here that we just sampled where we have been using different nitrogen sources for several years and there has been a little work in Florida that would indicate that nitrogen source might affect the increase or decrease of some of free-living nematodes. Ectoparasites--the kind that do not require a special host plant in order to live. We have taken samples from these plots, but Dr. Good has been too busy to get the nematodes in them counted. When he can make these counts, we will know whether or not nitrogen source does affect the populations of these nematodes under our conditions here. Someone wants to know if we have tried Nemagon to control nematodes.

Good If any of you have been out to the local Country Club here, the No. 9

green was badly infected with the sting nematode and has not responded in the last several years. About 4 weeks ago, I went out and put a treatment on it and there is quite an improvement in one area where trees are growing. Nemagon does work and I understand down in Florida, it's been working quite well also according to Dr. Nutter and Dr. Christie. They got excellent control. It's a good material, along with VC-13, made by Virginia-Carolina. The dosage rates vary. I think here in this area, which is a little higher on the Coastal Plain, you don't need as much chemical as they do, say in peninsular Florida or on the eastern coast. I would say, for Nemagon, from 6 to 10 or 12 gallons of the 50% by volume material on a per-acre basis. Four to five gallons of technical material in this area and maybe 5 to 6 gallons of technical material in the wetter areas where you have better conditions should be sufficient for control. What we have seen in Florida and here at the higher maintenance levels (by that I mean good fertility practices, soil and moisture requirements) would indicate that you are setting up conditions that are ideal for nematode development. That's one reason we see more trouble on the golf course greens than elsewhere and it's not common. We've seen this situation even in the New England States and Jim has probably seen some of it up in that area, too. Golf course greens seem to be particularly susceptible. I believe the mowing practices put stress on the plant and when you have an injured root system, with the close clipping your plant is just going to decline.

Q. Did you say that Nemagon and VC-13 are the same material?

Good No, they are different materials. I was looking at some recent literature on work that was done with VC-13 in Florida. They have now lowered the rate to 2 quarts of VC-13 to 5,000 square feet. This has a Virginia-Carolina label and they have gradually come down through the years to

this rate, suggested by the people working in Florida. When they started out down there, it was quite higher and, of course, the chemical itself has come down in price.

Q. What sort of equipment have you used when applying it on the green?

Good I have used a hand gun. I want to make sure we do a good job. Of course, you couldn't do it that way. We wanted to treat a small area and I set up a hand gun; that was the easiest way for injecting, but we have obtained good results and, as you know if you have talked to nursery growers around over the state, that several of them have cleaned up bad infestations with Nemagon and the drench method, the customary method used in Florida for treating greens down there. I don't believe too many greens have been treated in this area, although I think at one of the biggest estates on Sea Island, they treated several hundred acres with this material and were apparently successful in achieving control.

Jensen Joe, do you have any data on the use of granules as compared with the liquid Nemagon?

Good I believe the best method (now I'm speaking not from work with turf, but from comparing methods of application, which shouldn't vary whether you are using corn or vegetables or turf as far as killing the nematode goes) is a liquid method, which gives you more assurance of good incorporation than a granule spread on the surface and watered in. Now if you can disk harrow a granule in, it will work pretty good in establishing a green but actually there, your rates will be a little higher than if you use a liquid, according to what we have on the methods of application of this material, maybe 20% higher.

Latham If you apply one of these materials, how soon would you have to reapply? Would that be necessary?

Good On a golf course? We saw it stand up here; one plot was treated about the time I came here in 1955. The greenhouse is setting on it now, in an area where we can't follow up on it, but we did follow it for 18 months and we had pretty good control then at the end of that time. I suspect on a green where the men are trampling with feet out on the apron onto the green that they will recontaminate and a yearly application will probably be the answer. I'd say that 5 gallons of active material twice a year would give you excellent conditions if you have trouble with the turf declining or melting out.

Q. Do these materials affect bentgrass?

Good You mean by toxicity? You can go high enough to injury it, but you have a big safety margin. We have gone up, I think to as high as 20 gallons of technical material per acre and it did not injury bent. That was in Florida, but you have a big safety margin if you make a mistake. You don't have as much safety margin with that chemical on some other crops as you do on grass. I am familiar only with the soils in this lower Coastal Plain area where I have been working. I think you will have to go up and under high moisture conditions; it may take a little more material took then. In peninsular Florida, for instance, it takes a little more chemical than it does here. They believe it is because of the excess soil moisture that they usually have down there, which makes the chemical less effective. On the heavier soils, I believe, from what I have read, that they too have to use a little more. Do you have any information on that, Jim?

Latham That's true of your other nematicides when you go to your clay soils and I'm pretty sure it would be true of this chemical.

Good I think it is well to have an establishment treatment, using methyl bromide

Vapam, or whatever you might care to use. If you can knock those nematodes and other disease organisms down to start with and get a healthy grass established, they can withstand later a pretty heavy attack without the grass declining. Apparently, that is what has happened. You have a root system established and the nematodes build up to their full potential. Here in Georgia, we have had more success than the people in Florida for some reason and when I left there in 1955, I wasn't convinced at all that we could do anything with these chemicals on grasses, just in that test you were talking about. But up here, we have had a little more success. It may be the weather conditions. When we treat, we knock the nematode populations down and the grass comes back. Down there, something is due to the weather conditions and it has been a little more erratic than up here in the tests that I've seen.

Wells As regards drying off with lime every night, I don't know if that will give adequate drying or not. Most of the time when we have cottony blight, it's moist about 50 feet up to 100 feet above the turf and all the way from the sky on down. Moisture is continually being deposited, so I don't know if we could get enough lime to actually give adequate drying or not. Give us two or three of those slides then, Dr. Burton.

This shows the effectiveness of some of the different materials that we used last year. I might say that the temperature on the outside was 10 to 15° F. lower than that in the greenhouse.

This slide shows Captan alone and Acti-dione alone and the synergestic effects of combining the two.

This is a Phygon slide that shows different rates. You see, if you go up to high rates of Phygon, you can almost completely control Pythium, whereas if one goes back down to the lower rates, you see some bare areas.

The quantity of fungicide one may need to use depends on how warm the weather is. If it's real warm, you will have to go up to the high rate of fungicide; if the weather is cooler (just warm enough for Pythium to do some damage), perhaps we can use less fungicide and have all the control that is necessary.

Burton Ground pearl is one of the turf insects that is hard to control. It has affected my lawn and it has a good many other centipede lawns as well. Mr. Beck has been doing some research on it and I have asked him if he would mind giving us a review on what he has on it. Mr. Beck, will you do that at this time?

Beck I would be interested to know if any of you are having ground pearl trouble. Do any of you use centipede in your fairways and other parts of your grounds? It doesn't appear to be a very important problem, but you may have it and not realize it. This insect spends its entire life in the soil. It is a scale insect, but it doesn't attach itself to the plant in the same way that most of our scales do. It is more or less free in the soil, but has some rather long, slender mouth parts which it can extend and feed on the roots. We think it is primarily important in dry weather. Lawns that are properly fertilized and have plenty of moisture can support a tremendous population of this insect. I think Glenn has broken the record with something like 100 per cubic inch; I've forgotten the exact figure. You just can't believe how many good grass will support, but when dry weather comes along, then the effect of these things becomes noticeable. The grass in infested areas will begin to dry up and look sick and suffer much more than others from dry weather. I have actually seen some areas where I thought the ground pearl had killed out the centipede but there again, if those areas had been properly watered, the grass would still support a

tremendous population of this insect. We have found them down to a depth of 12 or 13 inches, which means that surface application is not going to be very effective, as we found out because we have run a number of experiments trying to control it with surface applications. We are going into systemics now, but we don't have much hope of any of the systemics moving downward into the soil sufficiently to kill them and our latest approach to this problem is to attempt to develop a method where we can mix the insecticides in the soil where we are reworking a heavily infested and badly damaged lawn in hopes that some of our more persistent materials, like Dieldrin and chlordane and perhaps some of the others, will clean them up. However, we run into another problem when we think of approaching it this way. These insects, like most all scales, are encased in a waxy covering and insecticides are not going to penetrate that waxy covering. Since they are sucking insects, they are not going to pick up much of the insecticide unless it is in the root. These insecticides that we are using, or planning to use, are contact insecticides and there's one stage in which it ought to be susceptible, two stages rather--the adult female and the newly hatched larva. We find the newly emerged females occurring in this neighborhood beginning about May 15 until about the middle of June. It would be in that period that we would have to kill the female. She lays her eggs in a mass of little waxy filaments. In the laboratory, it takes about 60 days for these eggs to hatch. I suspect that in the lawn or in the soil, it takes somewhat longer. We haven't worked that out completely, but the larvae, the little crawlers, again ought to be susceptible to contact insecticides. But you see, that comes again later in the year. Females emerge in May and if the eggs are laid in June, it would be August before the crawlers would be present in any numbers and therefore, you must have something

that will persist at least that long. We run into another problem and that it the fact that the insect has a long life cycle. Our present studies indicate that it takes them three years to complete a life cycle, so anything we put in the soil must persist for three years. We think we have some insecticides that will persist that long. This is one of the most interesting insects I've worked on but it has also proven to be one of the most difficult to bring under control. If any of you should have problems with the ground pearl, we would be happy to know about them because we are trying to follow up damage reports by this insect and determine just how much of a problem it is. Incidentally, in our work, we have run across a second species in this vicinity and there may be more. I think it is a new species, at least we have sent some specimens in and they have not been able to identify them, so as with most problems, the more work you do on them, the more difficult the problem becomes. If we find a control for this one, we may have to work out an entirely new or different control for the second species. Mr. Jeffords?

Jeffords Does the ground pearl damage other grasses?

Beck We have found it attacking other grasses, Bermuda, for example, and have found it associated with quite a number of grasses. I say "associated" because I'm not sure that it's actually living on these grasses, but I haven't seen any grass other than centipede that I thought it was damaging.

Q. Iron sulfate is applied to centipede in some fairways. Does it also control ground pearl?

Beck Iron sulfate is ferrous ammonium sulfate. That's news to me and I'm glad to know about it. The ground pearl is just as round as a pearl and when it's dry, it has a lustre. The waxy scales have a lustre to them much like a pearl. That's where they get their name. They are about the size of a

small shot. You won't see this fuzzy little mass unless the females are laying eggs. When the female becomes immobile--it's active just for a few days--then it forms a little cell and secretes waxy filaments which line this cell. She lays her eggs in that. Now if you saw that sort of thing and actually saw an egg in there, it could have been the ground pearl but I would guess not. Loy, what's the name of this other animal that gets in the soil and forms little waxy tufts? I can't think of it at the moment.

Morgan There are several species of aphids that sometimes occur in areas like this that do have a waxy secretion around them and also some mealybugs.

Beck Mealybug, that's what I was trying to think of. Chances are you had that, but if you would like to send in some specimens, we would be glad to take a look at them.

Q. Would that also apply to your centipede yellowing?

Beck I haven't seen yellowing caused by the pearl, but sometimes the grass turns a little bit yellowish as it dries. Now grass, if it just ordinarily dries up, doesn't turn yellow. Centipede, in particular, becomes a very light green and has sort of a grayish color. I wouldn't ordinarily say it was a yellowing effect. You've seen centipede dry up. It'll turn almost a gray color and stay that way quite a while. But as soon as it gets a little moisture, it comes right back and is nice and green.

Burton Every spring, heavily fertilized centipede lawns develop iron chlorosis unless iron salts are included in the fertilizer. If it does develop, the application of some ferrous ammonium sulfate (about 1 pound per 1,000 square feet) will usually correct the deficiency. I think ferrous ammonium sulfate is probably as good or better than anything that we've seen tried. Correcting iron chlorosis seems to enable centipedegrass to tolerate a few

more sucking insects such as ground pearl working on the roots. Dr. Wells just called to my attention the fact that he had brought over Leaflet No. 16, which deals with Southern turfgrass diseases and their control. This was prepared a year ago. If you would like to come by and pick one up before you leave, you might find something here that would be helpful to you. It describes the main turf diseases and he has some recommendations on control measures that you might find helpful. Are there any other questions?

Q. I'd like to ask one more question. How can you control chinch bugs?

Morgan Are you referring to chinch bugs on St. Augustine? I think that we have tried every available material that we know of and the chinch bugs, as we know now, are resistant to all of the materials that formerly would work but Dr. Good mentioned this material, VC-13. We have some material on hand that we plan to try if we get chinch bugs. We usually have several annual infestations here in Tifton and hope to get some tests in this year. VC-13 has been used in Florida now for some time and has, at least made the grass greener and much better after it is used. The rate for grasses recommended by the manufacturer says application is equal to 2 quarts of VC-13 per 5,000 square feet. That is the material as it comes from the manufacturer. That would be a rather expensive treatment, but these manufacturers hope that it will become in widespread use and the cost will go down. That seems to be the most promising thing that we have at the present time.

Q. Will Dieldrin kill chinch bugs?

Morgan They are harder to kill with that material or have been in the last year or two. The Dieldrin definitely won't work in this area because I saw 10 pounds of actual material put on about 1,000 square yards and I think it

just fattened the chinch bugs.

Q. How can I get rid of a broadleafed grass in my fairways? It looks a little like Dallisgrass, but isn't.

Burton I'm guessing the weedy grass is a Paspalum. Are your fairways in Bermudagrass? If they are in Bermuda, I think you could use some one of the arsenites and do a good job if you used enough of them. Disodium methyl arsonate did a very good job on three different Paspalums for us last year. I don't know whether the arsenicals would kill the grass you have or not, but on the basis of our limited experience, I would say that it ought to work on any of them. Amine methyl arsonate, a new material, looks like it's as good, or maybe a little better, than disodium methyl arsonate and sodium arsenite and will do the job if applied properly. I don't think you would get quite as selective a control with sodium arsenite, but it would cost you less money.

Latham I'd like to hear a summary on planting Zoysia on slopes in Atlanta.

Forbes This is in Atlanta on a clay soil? I'd say rather than telling the man not to plant the Zoysia, I'd tell him not to terrace it. I don't know what the situation is, but are those terraces really necessary?

Latham Well, they want to use 3 or 4 tables and chairs, etc. out on the terrace.

Forbes Oh, I see. Well, you put any grass under a disadvantage when you put it on a steep slope. Naturally, you have a moisture problem there. I have seen Zoysia hold terraces and in the Washington area. That is further north and maybe the moisture stress isn't as great there as it is in Atlanta. What is the steepness of the terrace?

Latham Oh, I imagine it won't be over a 4-1 to 5-1 slope.

Forbes I believe Zoysia would do all right there if they are prepared to irrigate during dry weather. Of course, some strains of Zoysia matrella are

particularly susceptible to a disease which attacks in the winter. Dr. Wells here has looked at those areas and I'll leave it up to him to decide whether you have that disease.

Wells Helminthosporium was on it down at Sea Island.

Forbes A certain strain of Z. matrella which we have had on our turf plots growing in comparison with Emerald Zoysia for several winters was killed out in patches during the winter. In one case, we lost the whole plot.

Q. Do you have any control?

Wells Well, about any of the fungicides, mercuries or any of them, will control the Helminthosporium if you put it on; I'd say you have to keep the leaves covered. Zoysia doesn't grow very fast, so if you put it on once every two weeks to a month, I believe that would be adequate.

Forbes That would be in the winter time, since that is the only time we've seen damage from the disease, wouldn't it?

Wells Yes.

Forbes And we are not certain that it was the Helminthosporium that actually did the damage, are we?

Wells Well, that was the organism present on it. Whether or not that was doing the damage or if it suffered from drought out here, we never did figure for sure.

Latham Homer, would you like to tell us about some of those other diseases?

Wells We have found Rhizoctonia or Curvularia and Fusarium all three. If Rhizoctonia is in a moisture area where it wilts, it will clip Zoysia off just like Bermudagrass if conditions are right for it, but mercuries will also control these. Also any of the fungicides at a fairly heavy rate will do a pretty good job on Rhizoctonia. Mercuries last a little longer and you don't have to apply them quite so often.

Panel Discussion on

WHAT DOES THE FUTURE HOLD?

Discussion Leader - Dr. O. J. Noer 1/

Panel Members - Dr. W. W. Rennie 2/
- Mr. Tom Mascaro 3/
- Mr. Art Thorsberg 4/
- Mr. R. W. Billett 5/

Noer Jim Watson sends his regrets. It was necessary for him to stay in Minneapolis for a Toro meeting. I guess he had orders from the top that he couldn't leave town, so I agreed to take his place. Ben Reemelin was supposed to do his job on the program, but Ben walked out this morning and so, we may substitute Art Thorsbert because I am not competent to talk about mowers, mowing equipment, or anything in that line. About all I do is kick about front rollers, the power-driven drums, etc. I propose to use panel members first and then if there is time, I shall cover briefly subjects discussed at other spring meetings.

Pre-emergence weed control was discussed in Pennsylvania, Massachusetts, and several of the other conferences. Time permitting, I will tell you about semi-automatic and automatic water systems which impressed me when I saw them on the West Coast last fall. Water is much more important with them than here. In California, they spend as much money on water as your over-all expense for maintenance. You can see why the water system is so important.

Will Dr. Rennie and Tom Mascaro please come forward to the roster? They should be joined by Art Thorsberg of Toro and Billett of Linck's. I want Billett

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1/ Agronomist, Milwaukee Sewerage Commission, Milwaukee, Wisconsin.
2/ DuPont Company, Wilmington, Delaware.
3/ West Point Products Corporation, West Point, Pennsylvania.
4/ Toro Manufacturing Corporation, Memphis, Tennessee.
5/ O. E. Linck Co., Inc., Hialeah, Florida.

to talk about pre-emergence weed control. We want Mr. White, of Mallinckrodt, to make a few remarks about advances in the fungicide field. Now I will call on Dr. Rennie. I imagine he is going to talk about fertilizer and, more particularly, nitrogen. Dr. Rennie, we will turn the meeting over to you for about 10 minutes.

Rennie Now I'd like to show four slides. I'll start with the first one, if I may. This is what we are heading for and, frankly, I'm amazed at what we've got here, where we are able to take pure, white sand as soil for golf courses. We've come a long way from where we tried to make new soils by taking sandy areas and putting in clay, ending up with some of the thickest cement you ever saw. I'm glad we're moving in the direction of allowing Bermudagrasses to grow more or less in the areas as you find them so often, some of those beautiful Bermudagrasses growing natively on pure sands all along our coasts. I think we can overdo the sand trend, but it has certainly been good to see clubs get better drainage for better grass performance.

I don't believe that potash leaches to the extent mentioned this morning. It is very difficult to get appreciable amounts of potash in the leachate from soils as we have on these greens. I'm quite sure that it would be pretty tough to get a substantial amount through, particularly with the exchange complex in most golf-course soils. I've been scurrying around the country for the last couple of months, actually in the last 20 months, trying to find out what the experts feel is the amount of nitrogen, phosphorus, and potash that you should have for a good Bermuda green. There is a little argument but I think somewhere close to a 4-1-2 ratio is beginning to look more and more desirable. I'm sure I'd need agreement among the different experts, but I compiled all the recommendations that I received from different experts from time to time and I came right back with a 4-1-2 ratio. So I think that's probably about it.

I don't think that pH affects the availability of copper so much as does the ratio of calcium, magnesium to copper in that area. The balance of minor elements is important. Copper, being involved with a ratio of copper, calcium, probably manganese, and magnesium being involved in this thing, I doubt seriously that unless you had a fairly low pH where your soil was wet, that copper would be too much of a problem. I found out here though that you throw away a lot of fertilizer if you get down below a pH of 6 and phosphate drops below a point there. In other words, in the past, my old professor at Wisconsin, contemporary of O. J. here, Emil Truog, always said the cheapest way to get phosphate is to plow lime into soils that have a residual of phosphate in them. You can see that when lime brings pH above 6, all of a sudden phosphorus that has been unavailable becomes available to the plant. So in spite of the fact that the Bermuda will grow all right down at 4.5 to 5, you can see that all elements at a pH of 6 or 6.5 are available in their greatest abundance to the plant. Keep that in mind in terms of planting. Now I might point out the effect of fertilizer reaction on sandy soils of Florida. Down there the last two or three years, experimental applications of 36 pounds of nitrogen per 1,000 square feet have been made. If the fertilizer has an acidifying effect, it is really going to be accentuated. Soils that were 6.5 two years later dropped to 4.2 with ammonium nitrate. If you used 24 pounds of nitrogen, you could expect it to go down pretty fast. Now these results were on freshly constructed greens with soils of good combination of soil, peat, and sand. I want to suggest that we keep these pH's up where they belong and if there's any soil test which is reasonably reliable and easy to make, it's the one for soil pH. Some of the others are questionable---you can test for phosphorus and you sometimes don't know what you have; you can test for potash and you don't know what you have either. I don't mean to depreciate the value of phosphate and potash tests.

The third slide, please? In the fertilizer field, we need good men. There is Glenn Burton working here and in Florida, I don't know right now, since Gene Nutter joined the Golf Course Superintendents. We have two good men there though. We have very few good men working on fertilizers and fertility and they are so limited on the amount of money available to them that the chances of our getting so that we can correlate the fertilizer experiment with soil tests are small. At the rate we are going, it will be years before you can run soil tests as is being done on corn fields and write a prescription without actually going out and spending a lot of time in the field. I'm putting in a plea for somebody to devise a set-up like they have in Florida and parts of the Southeast for agricultural crops. Then when a fellow sends a sample in to have a soil test, accompanied by a good description of what his grass looks like at that time, what grass is there, with a little of the past history, workable recommendations can be made. Then he should let the people here at the College know whether or not it worked. If it didn't work, just don't say, "Well, those people don't know what they are talking about," and not reply. Give them some information, so the next time you send a soil test in, they will have more information and can give you a better answer. These people are at a terrific handicap. You figure that with all the work done on corn in the United States, literally millions of samples taken and correlations, they still have difficulty in giving you a real prescription for corn and that's the thing that makes anybody who runs an analysis on a golf green do it with reservations because there has not been the amount of money and expenditure necessary. I might point out that it seems like turf research always hangs by a thread, it keeps on going but financially, it is a shaky business. We are not able to hold a good man in this field. You find a few dedicated souls, but there are not many of them, and it looks like there is going to be fewer of them at the rate they're going right now because the graduate-student numbers are increasing in certain areas, but the lucrative jobs outside of research for these people are absorbing them.

I think it's up to you fellows who have all the capital investment in your golf courses to give all the support that you can to Dr. Burton. I might point out that to run a simple project here, very simple, costs $3,000.00 a year or approximately that just to get it started. I remember that the first year is about $3,000.00 and then I didn't have quite enough money to go a little bit further, but this is just to check one simple little thing through. You can think of hundreds of questions asked here today and to do just one of those is going to cost a lot of money. If it were not for the federal government and these dedicated men bootlegging their time, we just would have that much more to do. We'll never get any answers with the expenditure that you're spending, so I'm asking that you think seriously to see if we can't develop the prime questions that need answers. Let the fellows here know what is your top priority. Then give some financial stimulus to make sure that the projects get attention.

I would like to remark about the things that are coming in the future---I have 2 or 3 more minutes here---let's talk about fertilizers briefly. I believe we're going to have suitable potash forms that will release potash gradually without being so alkaline. Right now, most of these slowly-available potash forms which will turn out enough to be quite useful tend to be alkaline in nature and some of them are excessively so. I have seen them used in greenhouses from time to time recently so the pH inchrysanthemum beds was 9.5 because they had had a good dose of a burned calcine potash-type material. But they are coming. With combinations of these and skillful uses of natural organics and urea formaldehyde, I believe that you are going to use fertilizers that will give you a graduated release of plant food throughout the year, to do just what Charlie Danner was talking about the other day. He goes out there every week and puts his fertilizer on. Now that's a nice luxury, but with the price of

things going up, I doubt that if you can afford to go out there every week on that routine with your supervisory problems that you have. In the future, I believe that you're going to see that this is going to be made easier for you.

Now let's go to things that are on the horizon. Today there are chemicals existing which will influence the amount of phosphorus uptake by roots in very small quantities applied to the tops of the plants. There are also chemicals in existence that are undisclosed that will affect the amount of nitrogen taken up by a plant. Some day, you'll be able to apply these and get a much higher efficiency of the fertilizer that you're using and these will be sold to the public and they will be handled in different ways. They are coming and you will see them before you die, I'm sure. I surely hope I do because I'll be richer as a result.

Next thing, we have been denying bentgrasses and other grasses from having true hybrids. Today there are Bermudacides available with which we can spray a row of grass with a chemical that will prevent the male pollen from being produced. You see, every grass has male pollen and female organs in the same flower. The problem is when you want to make any hybrids, Glenn Burton has to go out with a little brush and pick every flower. He has to do one, then the other, then put a little bag over each one of them to keep each one from fertilizing itself. He takes his knife and cuts out the male portions, leaving just the female portions. On these, you can never have a hybrid, like you have a mule or like Coastal Bermudagrass or 328, which are vegetatively propagated but on Bermudagrasses or bentgrasses that are spread by seed, it is very difficult to get a good hybrid. These Bermudacides are available and for the immediate future, I would say. The U.S.D.A. is working at them like mad and many of the chemical industries are working at them. People can spray one row of grass with something that will kill the male pollen but not kill the female portion of it and we'll put next to it on both sides a superior type of the male plant. This will deal with the hybrids involving a true hybrid in

which you could have resistance to Helminthosporium in one and pythium in the other and put them together. This is coming and it's not far off.

The third thing, weed prevention. We have a time, particularly with Poa annua today because it wants to go to seed eternally. It has many other detrimental properties also. There is no question but that there are chemicals available today. However, they are extremely expensive, but they will become less expensive. Put on grasses, they prevent some of the terminal growth. Perhaps some of you will say it is fantastic, but if you had said 25 years ago that you could put on something like Tersan and Caloclor or some of these things and prevent diseases, people would have felt that you were wrong.

The next thing I want to say about what's going to come in the future is that there are going to be new soil stabilizers. Today we get a green and we put in organic matter, peat moss, and sawdust. Slowly but surely, they break down and disappear and you don't have the soil you had when you began. You may have top-dressed in the meantime, trying to keep the soil. As Glenn said yesterday, fertilizing like mad produces natural organic matter, but what would be ideal would be if you could get an organic or an inorganic type of material that would not break down. Then 10 years from now, you would still have the same structure that you started out with, as good internal drainage as you had then also. These materials are being worked on with a large number of all these polyamine compounds. The surface has not been scratched. Some day when you build a green, you'll put in maybe 1% of these compounds, which are not attacked by bacteria, and they will hold the soil just like you had it in the first place. So, there are things in the future which are going to make your jobs easier.

In conclusion, I'd like to say this. Each time that you improve your greens, golfers will want them a little bit better. I don't think that there is anything that the chemical industry can do that will allow you to go fishing more frequently. All we can do is to help you satisfy the increasing demand by the people who are growing grass and using the grasses that you are growing.

Noer This past year, in cooperation with Jim Hamner at Memphis, we have gotten the yields of 328 Bermuda on a green. Our laboratory reduced yields to a dry basis and analyzed clippings for the major plant-food elements and for all the mineral constituents. From sometime in April until mid-October, the dry grass yield was 119 pounds or roughly 120 pounds per 1,000 square feet. The nitrogen was almost 5% on the dry basis, the phosphorus as phosphoric acid was a little bit under 1.5%, and the potash somewhere near 2.25%. I'm quoting from memory. The amount of sulfur was approximately the same as phosphorus. We emphasize phosphorus and say nothing about sulfur because in the old days, you just got plenty of sulfur without paying for it. It came in the ammonium sulfate and as calcium sulfate in the ordinary grades of superphosphate. With the trend toward ammonium nitrate, these high-analysis phosphates and ammonium phosphates, the time is coming when we must think about sulfur. The striking thing about potash is the lower content of Bermuda as compared with bent. Potash content of bentgrass at Brynwood in Milwaukee was 2% more than the Bermuda at Memphis. These results will be made available and probably will appear in an article in GOLFDOM or some other publication. In passing, I thought you might be interested in the data.

Rennie That's pretty close to that 4-1-2 ratio, isn't it?

Noer Yes.

Rennie What was the laboratory cost of making the analyses?

Noer I didn't even ask the laboratory because I don't want to know.

There are very good labor records at Beverly in Chicago. Thirty years ago, the work force was 30 to 35 men. Today, the Course is in better condition and the labor force is approximately 7 men. The labor cost has stayed rather stable despite tremendous increases in the hourly wage rate and that, no doubt, is due to the mechanization which has taken place. I shall ask Art Thorsberg to substitute for Jim Watson. Maybe he can tell you about improvements and developments in mowing equipment.

Thorsberg Thank you, O.J. I want to apologize for Dr. Watson's inability to be here today. I'm at a slight disadvantage. This presentation has been kicked around, let's say quite profusely. The assignment was given to me about 10 minutes ago. I have three different written presentations. I'll cover them as closely and as clearly as possible and try to get three men's ideas over at the same time. My friend, Ben Reemelin, was scheduled for this, but he had to make a fast trip to Jacksonville this morning. So, without further adieu, I'll get into this presentation and will follow their outlines.

The topic is "What Does the Future Hold for Maintenance Equipment?" We have found since the war that our engineers have more time to spend on the development of new products in the line of maintenance equipment. As you have heard many times at this Conference, the big factor in maintenance today is the tremendous labor cost. Most of our products and other manufacturers' products along the turf-maintenance line are aimed at cutting costs and speeding up maintenance time due to the more or less crowded conditions of your golf courses and your parks. Here, we are primarily interested in golf courses. Our equipment also is designed to do a better job, especially in mowing equipment. You get a finer cut. Fertilizer spreaders provide better and faster distribution. Today, you get speeded-up products or products that are labor-saving and time-saving all through the maintenance equipment, your aerating and watering equipment, etc. Factors considered in design of present-day maintenance equipment---I covered most of those right there. There is one thing that I didn't stress and that is the necessity for a reasonable profit, both for the manufacturer, and the distributor. That has to be considered in pricing these units so that they do develop a profit because that's what our economy is built around. Without a profit, your economy more or less deteriorates. New equipment is developed as

new markets open. Freeways, expressways, and highways are one example. A hydraulic seeder has been developed for slopes which can be used as a seeder and a fertilizer spreader. It also applies mulch. The quality and durability of equipment----its design permits continuous operation with a minimum of maintenance in down time or periods of inoperation. Good design makes it easier for repairs and increases life expectancy. You get a better machine for your money. Mechanization and power speed-up are supplanting hand operations, which were more or less time-consuming and costly. The first one is fertilizing. Now we have broadcast spreaders, which will cover a 50-foot swath, using a new type granular fertilizer. The Lawn Beauty 36-inch power spreader was on display here Monday. It's about four times as fast as a manual spreader and does a much better job, giving you better and evener distribution of fertilizer. This machine is also used as a top-dressing machine, mainly it's a power spreader.

You've got power shredders, hydraulic tractor scoops (common now throughout the golf-course trade), and for trimming, we've come up with power trimmers. For pruning, you have your power saws; for spiking, you have power spikers. My good friend here, Tom Mascaro, has his Verticut and his aerifier with attachments, which make it a multiple-type machine. We have thatch-removing machines, which are now much more efficient and are available for use on large areas. For the maintenance of traps, there are power tillers and drag-tooth rakes; we have our automatic or semi-automatic sprinkling systems. Going back to mowers, which is our primary interest, these are the factors that we take into consideration in developing new pieces of mowing equipment. We make surveys to determine the need for different types of mowing machines or lawn mowers. Then comes the type of cut. The machine that would be adaptable to cemetery use might not be a good one for golf-course or park use. We consider the width of cut, the type engine to use, whether we'll use a heavy-duty engine, the price factor----what we can put into the machine to provide a reasonable profit at a price where the individual using the machine can afford to buy it. In the

cemeteries, you might want an 18- or 20-inch heavy-duty machine of the reel type. They also have larger rough-cutting machines which would be of the rotary type. We must find out if the area is adapted to speed because in some areas, it is impossible to get much speed with mowing equipment. Then there is the matter of transport speed from green to green, or park to park, and the type transport to use. The maneuverability of the machine, size, the trim ability must be considered----some areas require machines for trimming. In other areas, they are not interested in a trimming machine. The riding machine, for areas where they can ride; the ability to climb slopes, and last but not least, our quality of cut----there are about 8 or 9 factors that we take into consideration there when we feel or think about designing a new piece of equipment.

If there are any questions, I'll be glad to take them up during the panel discussion. Thank you.

Noer Thank you Art. Now on machinery, we're going to go right along to Tom Mascaro, so we can stop at 12 noon. I imagine we'll speak to empty seats if we don't do that. So, Tom, please take over.

Mascaro The superintendent is interested in more money and how he's going to get it. Well, it's a simple formula, it's been used quite often. The answer is education. When a man learns how to grow grass, the first thing that's going to happen is that he's going to get a better class of member. Charlie Danner remarked about this the other day. When you get better members, the next thing that's going to happen is that they're going to want better equipment. Now when they get better equipment, they're going to need better buildings to house the equipment. When they have all that, they're going to get a better class of men to do the job and after they have a better class of men, one of two things is going to happen---the superintendent is going to get more money or they're going to fire him and get somebody who can do the job.

I like some of the crazy thoughts about equipment and maintenance and to project them into the future. I think we are still in the horse-and-buggy days when it comes to equipment. Certainly, a lot of the jobs that are being done on golf courses today are being done very much like they have been done for a number of years. Art, I don't see why we can't have mowers that will go 30 miles an hour. It is certainly possible if we can make something go up past the moon, we certainly ought to have equipment that will do a faster job. Many of the jobs we are doing are still about the same. Many of these thoughts, ideas about doing things faster, come from you men yourselves.

Superintendents have developed many of their ideas. They have improved things because they are always on the job. Jim Haynes, out in Denver, made the power tree-root pruner. It is being used widely over the country. Many of the things that you see today really stem from the superintendent because he was dissatisfied. He is the one who raises cain and gets something done.

Here's a new Toro greens mower and that's certainly a step forward, producing a machine that's really going to do the job. There are a lot of ideas built into it. I'm sure it's going to work out all right but I just wonder if that's the last word. It's still a small machine. Maybe we're going to see machines, three and four hooked together in a gang on a green. The old Worthington Overgreen had three green mower units. Maybe we'll see the day when we have five or six units and make one sweep around the green and finish it. Here is chemical control of grass around trees. We see an awful lot of that including weeds in sand traps. We are still using hand methods there, but certainly there's a lot of room for improvement, both in chemicals and equipment and how to do it, to cut down hand labor.

Here's another big advance in mowing equipment. Art told about this. This is a Toro unit that's all hydraulic and right beside it is the original Toro tractor, front-end push-type, how many years ago was that, O.J.?

Noer Oh, 30 or 35. The push type was in general use 35 years ago.

So, we're making a lot of progress but we haven't made enough yet. I heard the remark yesterday that it takes a man 1½ days with a 7-gang unit to mow his fairways. Well, why can't it be done in a half-day? That's going to come, that's for sure. We're going to see a lot of things imported. After all, all the ideas aren't thought of here in the United States. This is only a small country. Other countries are hard at work and we are beginning to see a lot of things coming out. This happens to be a blower unit from Germany. It's about the most efficient thing I've ever seen. I don't know the name of it. It has no motor. The liquid that is mixed with the insecticide or whatever you're going to use is to propell it and it works on a jet principle. It's got a slight hum. It really can sing and it can lay out a blanket of fog that's really fantastic. Well, that could be developed into a larger unit and really cover a tremendous area.

Here's another machine, the Atco mower, from England. Again, it's a type of steel that lasts and is another improvement, nothing like as good as Toro's but it's another step forward.

We have soil-working equipment. This is the Royer and they're doing a lot of work developing bigger and better machines. Certainly, top-dressing is one of the toughest jobs on a golf course and with lots of labor involved, but we are still in the horse-and-buggy days, really. I mean these are a compromise to what could be done. We're going to see a lot of equipment that's going to handle soil the way it should be. For the amount that's used on a golf course, this is just peanuts.

We talk about drying greens and the next slide shows how to do it. Of course, that is in the future, too, but the reason we think in terms like this is that more and more golf courses have gone into night maintenance. We're seeing lights on tractors and they're mowing greens in the dark. Too many golfers are on the course in the daytime and the members don't want workmen out there. The women are playing and they're starting at 8 o'clock in the morning and they're getting fed up with all the men doing work on the golf courses. So in the future, we're going to see more and more night maintenance.

There is the matter of thatch or removing excess growth. At these conferences, you learn how to grow grass. Then you grow too much and have to get rid of it. So, you're going to see a tremendous amount of work being done on the removal of thatch. Some comments were made this morning on the use of lime and cultural practices certainly are good. They are going to do an awful lot. We're going to see a lot of equipment such as this Smith machine made up in New Jersey that digs right down into it and pulls a whole lot of stuff out. These are the tools that we're developing, the Verticut and the Tri-plex unit and then if you really want to get fancy, go to this, where you can Verticut it, suck it up, pull it up into a double bagger, and sell it for feed. So, we're going to see an awful lot of this vacuum-cleaning the fairways.

And this is the last picture for "What Does the Future Hold?" We're getting so awfully complicated, we don't know which way we are going. A superintendent developed this little catcher supposedly for extra gas. It is a little box bolted to the greens mower. When I was out there the other day looking around, I took some pictures. Then I looked at the bottle. The contents didn't look like the color of gas. I unscrewed the bottle and, by gosh, it was full of whiskey.

Noer Tom, there's only one trouble--your soft bedside voice and manner. You ought to speak up a little more. Billett, we'll let you do a little bit of talking about herbicides of the future.

Billett I think I'm at a little disadvantage, since I didn't know I was going to be up here. This subject is quite large and you could go into quite a few details. Are we having a question-and-answer period after this? It might be better to wait for that and then get into some of the aspects of the other chemicals and cover any particular problems dealing with the disodium materials. After that, I can discuss this other material. I think it might be better that way, since I don't have anything prepared.

Noer I always thought you could talk on anything. Mr. White, what about fungicides?

White I'm in the same boat about being prepared, but I would like to give this one thought to you gentlemen. If you have, or will, follow all of the good points of management that have been put before you these last few days, I would be out of business. You would not need a fungicide to control diseases. The picture of the water here on the green is a perfect example of what keeps me in business to try to sell a fungicide. If that green were properly watered, you might not need fungicides. Our business, of course, is to sell them but your business is to retain your greens in such a fine shape that you minimize the need for them through proper fertilization and other good management practices. A low pH is one of your worst enemies. Keep your pH up, not below 6, I would say. Occasionally, some one will call me and say, "I have a terrible green. This stuff is no good. It doesn't control it." If I've been to that course several times, I can usually picture that green---it's a drainage problem or an acid problem and a little lime will aid. Also within your fertilizer, you'll find that

small applications of iron sulfate, even though it is acid, will release and tone up the quality of the greens. Basic research on controlling the diseases is needed because diseases are getting ahead of us in one respect, as Dr. Homer Wells knows, on this cottony blight. We are working on it and other friends are working on it. The complete answer has not been found. Some products tend to control this specific fungus, but research is going on. We at present are doing some work on this specific fungus and it happens to be in Rhode Island at the present. We don't know if we have the answer, but results look good. If it does, then as Dr. Rennie brought up, it will take at least two years of research and trials out in the field before the product can be put on the market. Mr. Savage did some field work for us in Virginia on these fungicides and Henson Maples is doing some at Pinehurst. This work must be continued too before we can find the perfect fungicide. One other point I'd like to bring out in the use of fungicides irrespective of the manufacturer. Read the label and follow the directions. The use of a fungicide is similar to insurance--you can't buy fire insurance after your house has burned down, so when you suspect disease or go to an area of high humidity and water, put it on then. Your greens may look beautiful, but put it on especially in the fall as you go through transition from Bermuda to ryegrass. Start your applications at least 3 weeks before you put down your ryegrass seed. You'll get your soil in condition so that it will not be so susceptible to disease. Thank you.

Noer I think Mr. White feels that we're going to see developments along the line of these so-called "Broad spectrum" fungicides that will take care of most kinds of diseases. With proper maintenance, fungicides will do the job expected of them and the superintendent is going to say that your fungicides

are all right. I recall being in St. Louis, where I think your firm's headquarters are, in the late 1920's. I was asked to come down there by Mr. Eberhardt Anheuser, who was chairman of Sunset. When I got there in mid-July, I didn't see greens; I just saw browns. He said, "O.J., we've spent $5,000 up to now on fungicides. We've tried everything in the book and they are all no good." I decided to find out what they had been doing. I learned that they were applying 5 pounds of ammonium sulfate per 1,000 square feet every Monday morning. When I asked why that was being done, I was told that they were trying to get the soil acid enough so they wouldn't have any weeds. Well, all they did was to make the grass so soft that it became susceptible to every disease. After their grass died, the only thing that survived was weeds. The next year, we got them on a sensible program. I came back in July. Mr. Anheuser lived alongside the golf course. In greeting me, he said, "O.J., last year I didn't dare look out the window when I got up in the morning but this year, I have no fears about getting up and looking out over the golf course because we've got the grass." The fungicides were doing what was expected of them because the turf was healthy. Sometimes we expect the fungicide to do the impossible, but we make conditions so bad that won't work. I'm not going to tell you anything about pre-emergence weed control or my thoughts about the semi-automatic water systems because I'm sure, in the last 15 minutes, many of you have some questions that you would like to direct toward the members of this panel. If not, I will tell you about those two things, but will stop at 12 o'clock exactly.

Noer Thank you. Pre-emergence weed control was discussed at several conferences by Daniels, DeFrance, and Engel. I presume that many of their results and a lot of their work may apply up North more than down here.

Engel showed good control of crabgrass and goosegrass with chlordane at rates in the range of 60 to 80 pounds of actual chlordane per acre. At those rates, I don't imagine you can afford to use the material on fairways, but you can afford to use it on tees and maybe on the sprons around the greens. Engel's results were better with dry applications than with sprays. He hasn't yet found out the reason but for several years, the dry applications have been more effective than the wet ones. Daniels is, of course, very much in favor of, and is pushing, calcium arsenate. I have seen some very good results with calcium arsenate used for pre-emergence control of crabgrass. I'm a little fearful of it because I tried using it 30 years ago, thinking we would substitute it for lead arsenate to control grubs. It worked fine, but every now and then, we got severe injury to the grass and so, I dropped calcium arsenate. I have the feeling that in those instances where soils are quite acid and the amount of calcium in the exchange material is very low, that the calcium in the calcium arsenate is being grabbed by the exchange complex with the release of arsenic acid, which is very toxic. I hoped Billett would tell you something about their new 42, which is being advocated for use down here. My own personal feeling about pre-emergence materials is this. I think they would be fine on my own lawn because I only have a scattered plant of crabgrass, so with good grass, it's just a matter of final clean-up. But what will happen in an area where there is nothing but crabgrass? I would rather have crabgrass than bare ground until midsummer and then inaugurate a program to kill the crabgrass and substitute a good grass. After that, we might consider using pre-emergence materials.

I'll take a couple of minutes to tell you about semi-automatic water systems. I spent about 5 weeks on the West Coast last October and November. My feeling before I went out there was that I didn't like the idea of semi-automatic or automatic water systems because I didn't feel there was enough flexibility for controlling the application of water. I saw some fully automatic systems on golf courses that were a

curse instead of a blessing. They were doing a fine job on schoolyards, athletic fields, and areas of that kind, but not on golf courses. However, I was impressed with the semi-automatic systems. The Presidio Club, which is on the military establishment at Presidio just at the entrance to Golden Gate, is doing a very fine job with a semi-automatic system. The man in charge there told me that he has saved the cost of the entire water system several times over in labor and in the actual amount of water that was used. On that course, there are three loops and he uses snap valves. The workmen set the sprinklers out in late afternoon. They are told where to put them. The Superintendent sets the clock and knows that if he wants sprinklers to operate for 45 minutes, that it's going to be 45 minutes. He is not dependent upon his laborers. They might water for 30 minutes or for 1½ hours. There is an extra pump so that during the daytime if it's necessary to syringe off a green, it can be done. The semi-automatic has the flexibility of an independent system. I don't imagine any of you can install that kind of a system very well on an established course. However, I believe that we are going to see more systems of that kind used on new construction jobs. It is now 11:55 and I want to say this. I have enjoyed being here and I have, as I said the other day, a selfish motive. I feel that I have learned something here and I expect to learn something at every other conference I attend. With me, my vocation is my avocation and I've enjoyed it through the years. Even as we get older, we must always remember that the impossible of today becomes the commonplace of tomorrow. We should always be willing to accept better things and ways, but I don't think we should discard something we're doing successfully for something entirely new until we test it to see that it's better than the thing that is giving us decent performance. And so, Glenn, I will turn the meeting back to you.

Summary

THIRTEENTH ANNUAL SOUTHEASTERN TURFGRASS CONFERENCE

Tifton, Georgia
April 6-8, 1959

TOTAL REPRESENTATION FROM EACH STATE:

Alabama	24	
Bahamas	1	
Delaware	1	
Florida	21	
Georgia	55	
Kentucky	1	
Mississippi	1	
New Hampshire	1	
New York	1	
North Carolina	14	
Pennsylvania	1	
South Carolina	3	
Tennessee	6	
Virginia	3	
Wisconsin	1	
TOTAL		134

ATTENDANCE ROSTER

Name	Affiliation	City
ALABAMA		
Allen, Cpt. George W.	Redstone Arsenal Golf Course	Redstone Arsenal
Anderton, Wayne J.	Yielding Brothers Company	Birmingham
Berdeaux, A. G.	The Elmwood Corporation	Birmingham
Floyd, Stacie	Andalusia Country Club	Andalusia
Ghioto, Telfair	Dothan Country Club	Dothan
Godwin, G. E. "Ed"	Selma Country Club	Selma
Lawrence, Grafton E.	Maxwell Golf Club	Montgomery
Horder, Edward J.	U.S. Army Engineer District	Mobile
Kennedy, W. T.	Montgomery Country Club	Montgomery
Kincaid, E. E.	Kilgore-Robinson Supply	Birmingham
King, Aubrey	Musgrave Country Club	Jasper
Lang, Boots	Skyline Country Club	Mobile
Ledbetter, Gene	Coosa Pines Golf Course	Coosa Pines
Moon, William M.	U.S. Govt. R. S. A.	Huntsville
Moore, Jim	Vestavia Country Club	Birmingham
Nordan, William W.	Nordan's Grass Farms	Abbeville
Norrie, William M.	Mobile Country Club	Mobile
Ostberg, Ward M.	Vanity Fair Fdn. Golf Course	Monroeville
Robinson, B. P.	Kilgore-Robinson Supply	Birmingham
Tompkins, Robert L.	Clarke Mills	Jackson
Webber, Charles S.	Vanity Fair Fdn. Golf Course	Jackson
Whitaker, Gilbert Z.	U.S. Govt. Redstone Arsenal	Redstone Arsenal
Wildmon, Joe	Birmingham Country Club	Birmingham
Womack, M/Sgt. H. W.	Redstone Arsenal ACA	Huntsville
BAHAMAS		
Yancey, Jim	Lyford Cay Club	Nassau
DELAWARE		
Rennie, Dr. W. W.	DuPont De Nemours & Co., Inc.	Wilmington
FLORIDA		
Billett, Robert W.	O. E. Linck Co., Inc.	Hialeah
Bryant, Al	Orlando Country Club	Winter Park
Cocoris, Nick J.	3553 Boone Park	Jacksonville
Davis, L. A.	Johns Manville Company	St. Petersburg
Derzypalski, Marion S.	Capitol City Country Club	Tallahassee
Dilsaver, Carl E.	PGA Golf Club	Dunedin
Dumphy, C. T.	Seminole Club	Riviera Beach
Greene, H. E. "Herb"	Brentwood Golf Course	Jacksonville
Hall, E. T.	Bobby Jones Golf Course	Sarasota

FLORIDA (Cont.)

Name	Affiliation	City
Hall, Joe M.	Hall and Thomas, Inc.	Lake Harbor
Hay, Sonny	Zaun Equipment, Inc.	Jacksonville
Johnson, Robert	Bradenton Country Club	Bradenton
Kelley, C. C.	421 Flamingo Drive	West Palm Beach
Lee, George E.	Bobby Jones Golf Course	Sarasota
Reemelin, Ben	Zaun Equipment	Jacksonville
Ross, Edge	Eglin A.F.B. Golf Course	Eglin A.F.B.
Russell, Henry H.	Porter-Wagor-Russell, Inc.	Perrine
Schaefer, Harry W.	Bobby Jones Golf Club	Sarasota
Shaw, C. C.	Hector Supply Company	Miami
Watson, T. C.	Seminole Club	Riveria Beach
Wilson, Dick	Golf Course Architect	Del Ray Beach

GEORGIA

Barnhart, George E.	Cherokee Town & Country Club	Roswell
Baumgardner, T. M.	Sea Island Company	Sea Island
Beck, Elmer	Ga. Coastal Plain Experiment Station	Tifton
Beckmann, Richard	Valdosta Country Club	Valdosta
Booterbaugh, E. E.	Druid Hills Golf Club	Decatur
Burnam, Joe W.	Evans Implement Company	Atlanta
Burns, Chuck	Canton Golf Club	Canton
Burton, Glenn W.	Ga. Coastal Plain Experiment Station	Tifton
Carter, R. L.	Ga. Coastal Plain Experiment Station	Tifton
Cordell, Tom	Abraham Baldwin Agric. College	Tifton
Daniel, James T.	Ft. McPherson Golf Club	Ft. McPherson
Deal, Elwyn	Ga. Coastal Plain Experiment Station	Tifton
Donaldson, George P.	Abraham Baldwin Agric. College	Tifton
Doeglas, Lawson E.	Augusta Golf Club	Augusta
Dudley, J. W.	Athens Country Club	Athens
Fleming, T. E.	Ga. Crop Improvement Association	Athens
Forbes, Ian	Ga. Coastal Plain Experiment Station	Tifton
Goldthwaite, Howard	Toro Turf Supply Company	Atlanta
Good, Joe	Ga. Coastal Plain Experiment Station	Tifton
Green, Doc	Okefenokee Golf Club	Waycross
Greene, Robert O.	Golfland, Inc.	Macon
Haskins, Fred	Country Club of Columbus	Columbus
Inglis, Hugh A.	Agricultural Extension Service	Athens
Jackson, James E.	Ga. Coastal Plain Experiment Station	Tifton
Jensen, E. R.	Southern Turf Nurseries	Tifton
Johnson, Dewey W.	Evans Implement Company	Atlanta
Keeble, Vachel L.	Armour Fertilizer Works	Tifton
King, Frank P.	Ga. Coastal Plain Experiment Station	Tifton
Kraft, Art	Warm Springs Country Club	Warm Springs
Lambert, Jimmy	Evans Implement Company	Atlanta
Land, H. N.	Augusta Country Club	Augusta
Latham, James	U.S.G.A. Green Section	Athens
Lawrence, Lester	Fort Benning Country Club	Fort Benning
Mangham, J. W. "Jim"	H. D. Hudson Manufacturing Co.	Decatur
Morcock, Cooper	Allied Chemical & Dye Corporation	Atlanta

GEORGIA (Cont.)

Name	Affiliation	City
Morgan, Loy	Ga. Coastal Plain Experiment Station	Tifton
McClure, George W.	H. G. Hastings Company	Atlanta
McKendree, Marion	Sea Island Golf Course	St. Simons Island
Parker, Ed M.	Spencer Chemical Company	Atlanta
Patrick, Frank	Toro & Turf Supply, Inc.	Atlanta
Prince, Larry	Stauffer Chemical Company	Tifton
Rambo, Sam	Merrybrook Turf Farm	LaGrange
Scott, Milton	Stauffer Chemical Company	Cedartown
Shields, E. A.	Capital City Country Club	Brookhaven
Skinner, R. E.	Russell Daniel Irrigation Co.	Athens
Smith, Joe W.	Evans Implement Company	Atlanta
Strong, John J.	Southern Turf Nurseries	Tifton
Thompson, Ashton A.	Ansley Golf Club	Atlanta
Thomson, Dick	Gold Nugget Products	Cairo
Todd, Leamon W.	Glen Arven Country Club	Thomasville
Walls, Carroll E.	E.I. DuPont De Nemours & Co., Inc.	Atlanta
Ward, Joe	Idle Hour Golf & Country Club	Macon
Wells, Homer D.	Ga. Coastal Plain Experiment Station	Tifton
Williams, Jack	Toro & Turf Supply, Inc.	Atlanta
Wright, Harry	Peachtree Golf Club	Atlanta

KENTUCKY

Capps, H. J.	Worthington Mower Company	Louisville

MISSISSIPPI

Bryant, Harry R.	Gulf Hills Dude Ranch	Ocean Springs

NEW HAMPSHIRE

Mitchell, William F.	Golf Course Architect	No. Sutton

NEW YORK

Chapin, William C.	U.S.G.A. Green Section	Rochester

NORTH CAROLINA

Cochrane, Donald	1209 Harding Pl.	Charlotte
Floyd, Verne	4642 Addison Drive	Charlotte
Harmon, Linwood E.	Carolina Country Club	Raleigh
Mann, W. E.	Camp Lejune	Jacksonville
Maples, Henson E.	Pinehurst Country Club	Pinehurst

NORTH CAROLINA (Cont.)

Name	Affiliation	City
Maples, Palmer, Jr.	Charlotte Country Club	Charlotte
Merchant, Garland E.	Myers Park Country Club	Charlotte
Miller, Doug	E. J. Smith & Sons	Charlotte
Phillips, Moran	Catawba Country Club	Newton
Sapp, Ralph	Old Town Club	Winston-Salem
Schauble, Carl E.	E. I. DuPont De Nemours & Co., Inc.	Charlotte
Spencer, Jim	E. J. Smith & Sons Company	Charlotte
Welch, Jim	E. J. Smith & Sons Company	Charlotte
White, R. L.	Mallinckrodt Chemical Works	Charlotte

PENNSYLVANIA

Mascaro, Tom	West Point Products Corporation	West Point

SOUTH CAROLINA

Jeffords, Mitt	Southern Golf Association	Orangeburg
Ripley, C. R.	3304 New Park Road	Anderson
Thurston, Herbert	Fort Jackson Golf Club	Fort Jackson

TENNESSEE

Baldridge, Cooper	H. D. Hudson Manufacturing Co.	Memphis
Boyd, A. Pollack	Chattanooga Golf & Country Club	Chattanooga
Boyd, Llewellyn	Chattanooga Golf & Country Club	Chattanooga
Danner, Charlie	Richland Country Club	Nashville
Thompson, Charles E.	Chattanooga Golf & Country Club	Chattanooga
Thorsberg, Arthur D.	Toro Manufacturing Corporation	Memphis

VIRGINIA

Maples, Ellis	Chatmoss Country Club	Martinsville
Savage, Hurley	James River Country Club	Newport News
Somerville, A. M.	V-C Chemical Corporation	Richmond

WISCONSIN

Noer, O. J.	Milwaukee Sewerage Commission	Milwaukee