PROCEEDINGS

TWELFTH ANNUAL

SOUTHEASTERN TURFGRASS CONFERENCE

TIFTON, GEORGIA

APRIL 7 AND 8, 1958

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Twelfth Annual

SOUTHEASTERN TURFGRASS CONFERENCE

Tifton, Georgia

April 7 and 8, 1958

Sponsored By

UNIVERSITY OF GEORGIA COASTAL PLAIN EXPERIMENT STATION

In Cooperation With

UNITED STATES GOLF ASSOCIATION GREEN SECTION

and

SOUTHERN GOLF ASSOCIATION

FOREWORD

The staffs of the Turf and Grass Breeding Departments of the Georgia Coastal Plain Experiment Station have been happy to participate in the Twelfth Annual Southeastern Turf Conference. This Conference has provided an opportunity for us to review with a large number of people the progress being made in this phase of our work. The suggestions and comments made at the Conference will be of great value in helping us strengthen and broaden our research program.

The turf work we have done at this Station has been generously supported by many organizations and individuals. Especially fine support has come from the U. S. Golf Association and the Southern Golf Association. We are very appreciative of the support of these fine associations and their contribution to our work. Many manufacturers of machinery, fertilizer, and other chemicals used in the producing of fine turf have supported our research program wholeheartedly in supplying us with needed materials and helpful suggestions. Over the years, our cooperation with a large number of golf clubs has made it possible for much of our research work to be tested in a more or less preliminary stage. This has enabled us to take a rather critical look at a good many results of our research work before they were released for general use. This has been most helpful in keeping us on a sound research program.

We have been most happy to have our many friends interested in turf in the Southeast visit with us at this Twelfth Annual Conference.

Frank P. King, Director
Georgia Coastal Plain Experiment Station

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COMMERCIAL PRACTICES IN LAWN ESTABLISHMENT

E. R. Jensen 1/

Since I accepted the invitation to appear on this program, I have been involved in the development of some new lawns having more problems than usual. The problems encountered on these, as well as on many preceding jobs, have made me wonder if I am the right person for this assignment. In general, we encounter more difficulty on a half-acre lawn job than we do on the gassing and planting of 9 greens on the average golf course. Yet, the problems involved in developing lawns in Tifton are much simpler than those of other areas. We have ideal soil conditions, the topography is gentle, there is rarely any question about the type of grass to use, and the people are very agreeable to work with. Atlanta, Birmingham, Charlotte, Jacksonville, and Miami cannot compete in these departments because of harsh slopes, sterile sands, red clay, and a conglomeration of ideas about different grasses. But "fixing a yard," as my colored co-workers call it, can be a pleasure. The results can give you much satisfaction and enable you to develop good friends who think of you every time they look out of their window or step outside their door. It can bring you disappointments and enemies, too, if you are unable to eliminate some basic problems in the business.

During the war, there was talk about the lucrative construction business, and I remember seeing a cartoon showing a group of prematurely retired men in the hobo jungles. One bum was expounding on the money the contractors were making, and another, the most ragged of the bunch, replied that "he used to be a contractor and was the lowest bidder on every job."

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

Price is the greatest problem in the landscaping field, but is the principle item in doing a good job. After a couple or family puts $20,000.00 into a structure, either by going into debt or by means with which most of us are unfamiliar, they are in an economy if not a niggardly mood. The cream is gone. So the first responsibility of the commercial landscaper is to convince Mr. Homeowner of the importance of a well landscaped home. It is a selling job involving the employment of technical information, patient explanation, comparisons, and displays. Too often, we are prone to take the easy way out, bid low and give low quality, or issue a reasonably priced bid without adequate explanation of the amount of work and materials involved. A procedure I have begun to like is a three-price bid. After these quotations, I explain just what results can be expected from each. In most cases, you can steer them to the type of job you think each individual should have.

To help us with selling a better job, we have various official publications and releases. These can give the customer some idea of what is involved in doing a good job. Too many people assume there is a very little to building a new lawn. In fact, it is a very non-exclusive profession. So we must go into detail to convince the citizens of our proud community that it takes work, equipment, materials, experience, and knowledge to provide the lawn that will enhance the beauty of his home. Though he may be satisfied with a "quickie" job, he can be made to think bigger and better. Get him the message that for every person entering his home to view elaborate drapes or clever dens, thousands go by and pass judgement on the exterior and that his yard can provide many hours of economical pleasure and relaxation.

Better public relations for commercial landscapers needs help and more extension work in the lawn and turf field is needed, too. The South is going from a rural to an urban society with many more suburban and city homes than farms, and I

wonder if we fully appreciate the value of these miniature farms to our growing population and industrial society. Without research, of course, the need for extension is lessened, but strong is the need for both at this time.

With slides, I should like to show some points in developing and selecting a lawn:

Slide 1. We have here a new home completed and ready for work to begin on the yard. If possible, wait until the house has been completed before undertaking the grassing job. Heavy trucks and construction activity inflict considerable damage on newly planted lawns as well as well established grass.

2. The first step is cleaning off the topgrowth, briars, bushes and wild grass, and trimming the trees. Too many trees are hard on both old and young grass. They also make lawns difficult to mow. Pines should be spaced at least 6 feet apart for small trees and 16 feet for 10-inch trees, hardwoods much wider. Trees must be taken out by the root, which entails quite some work and expense if the trees are of any size. If at all possible, avoid the use of bulldozers in a yard. They will often do irreparable damage to the trees and leave the ground rougher and very difficult to smooth out.

3. A roto-tiller or disk are good tools for working up the soil. Plows will damage tree roots and are difficult to follow in smoothing the ground. Here again, heavy equipment is out of place.

4. After the machinery, particularly where there are trees, hand work is required for smoothing and levelling.

4a. A blade on a tractor or various types of rakes can assist in establishing the grade and wherever possible, the slope should be from the house to the street. Often, this can be accomplished by moving the soil toward the

house. Additional topsoil may be needed to fill in low places and get the proper grades.

5. The topsoil should be topsoil and not clay. It should be reasonably free of weeds and grasses and particularly native Bermuda.

6. After the yard is levelled, the seedbed should be fertilized with a combination of nitrogen, phosphorus, and potash. This is the best opportunity to get some nutrients in the soil, particularly phosphorus and potash. Nitrogen leaches rapidly and except in the case of Bermuda, newly planted grass does not get started off rapidly enough to get much advantage from the nitrogen applied to the seedbed. Light top-dressings of nitrogen fertilizers should be applied several weeks after planting. For the home-owner, the less caustic forms of nitrogen are recommended. The seedbed should have at least 3 pounds of actual phosphorus and potash per 1,000 square feet. One pound of nitrogen is generally sufficient to start off. To get this, apply 25 pounds of 4-12-12. This is also true for new seedbeds on greens, tees, and fairways. Now is also a good time to get a residual insecticide in the soil and 1 pound of dieldrin per 1,000 square feet mixed with the fertilizer will do a lot to decrease the activity of many insects. I don't think it would help much against chinch bugs.

7. The selection of grass should have been made by now. In this area, the choice of grass can be narrowed down to three: Centipede, Zoysia, or Bermuda.

7a. Emerald is the best Zoysia and for lawns around here, Tifton 127, 328, and

7b. Ormond are probably our best Bermudas. Centipede has only two variations of which I know.

7c. The red-stemmed is the dominant and best type.

8. This is the main reason I cannot include St. Augustine in the list. Nearly all this lawn has been completely destroyed by chinch bugs. The green is patches of centipede. I do not remember the figure Gene Nutter gave on what the Florida Plant Board estimated St. Augustine lawns were costing Florida home-owners due to chinch bug damage, but it was a fantastic amount.

9. Why Emerald rather than matrella. This is a matter of year-around average superior appearance but this slide (just 3 weeks old) illustrates the

9a. Difference in the effect of our late March frost: Emerald is green, matrella browned back again.

Many things should be taken into consideration in selecting a grass. It is a big subject in itself and sometimes a controversial one. Don't be unhappy if the majority of your friends disagree with you on this subject. I will say that the home-owner's habits and characteristics should be taken into consideration before we apply guidance or sales pitch.

10. The people on this street have no business with a Bermuda lawn. I know each one of them personally. Yet, they do very well with a low maintenance grass.

11. This is the lawn of a man in semi-retirement. He likes working in his yard, has the time, patience and powerful mower to have a very beautiful lawn, and he will have it with this Emerald Zoysia.

I've digressed from getting the lawn planted and this is one of the don'ts in commercial landscaping. Try to finish a job as quickly as possible without interruption.

12. After the yard is ready for planting, we must either seed it or sprig it. I'm sure you are familiar with this scene--one-foot rows that actually measure 16 inches.

13. We are getting better methods of planting which should reduce costs. This planter does a good, smooth job on Bermudas.

14. Zoysias grow off faster it seems when sprigged than when plugged and do not leave so much of a "rippled" effect in the lawn. Sprigs are a little more difficult to maintain during the first two weeks.

15. This is a good method of planting the slower-growing grasses and I look for a lot more Zoysia sodding to be done in the future. Two things to consider here: Is the soil in the sod compatible with the soil of the lawn and does it have a high infiltration rate; Second, do you realize that the average soil one foot deep will hold only about $1\frac{1}{2}$ inches of water, so an inch of sod will hold less than .15 of an inch at its peak or field capacity. Turf grasses transpire and permit evaporation of 1/4 to 1/3 of an inch of water on a hot day, so you must apply at least 1/4 inch per day to give the laid sod a good chance in the early stages.

16. Seeding can be done south of here most anytime, as can sprigging. The most critical months are September, October, and November, when the seedlings may germinate and then suffer winterkill because the roots were not well enough established. Here, we seeded 6 ounces of centipede with $1\frac{1}{2}$ pounds of rye per 1,000 square feet in January. The following September, these folks were awarded the garden of the month. The rye was thin,

17. Like this, but it gave a good green cover through the winter and spring making a better situation for the new home. The rye is kept hungry and mowed close to avoid too much competition with the permanent grass. As it goes out in May and June, the permanent grass begins to progress. This also can be done successfully on sprigged grasses with the possible exception of Zoysias. Stay under 2 pounds of rye per 1,000 square feet on seeding and 4 pounds on sprigging.

18. These centipede seedlings planted in late June are 4 weeks old. This was a low seeding rate, but covered in one season.

19. These Zoysia sprigs planted in late March are 3 months old. The lawn is now nearly solid.

Zoysia plants quite well the year round. This year, we had winterkill on Ormond planted in September, Tifton 57 in October, and a little on 328 planted in October of last year. We have had winterkill on St. Augustine for three consecutive winters, with both early and late plantings. Spring and summer may be the best times to plant, but you cannot always choose your time of planting. Home-owners should always be familiarized with hazards of off-season planting.

20. So you can see, we seeded this yard and it is now in the hands of the owner.

21. His job is half done. If he fails to maintain it, he will be slow bridging the gap.

22. The Bermuda in the foreground received only half the water of that on the right. So you can see that water is very important in getting a stand and quick coverage.

23. Two negative and one positive and I'm through -- This is a seed commercial mixture after three years (Bunches of Kentucky 31 fescue).

24. This is what happens when Zoysia gets mixed with Bermuda (Slide showing Zoysia overcome by Bermuda).

25. And this is one way to avoid getting Bermuda mixed with Zoysia (Slide showing Georgia Crop Improvement Association inspector looking over the Emerald Zoysia.

GROWING TURFGRASS THE HARD WAY

Tom Mascaro 1/

If I were asked what the major turf problems were, I would say that they are problems over which the superintendent has little or no control. They are problems caused by employees, committees, and nature.

Problems created by employees would perhaps take the No. 1 place. There are many cases of improper mowing practices, improper use of equipment and improper use of fertilizers and chemicals. Most all of these are caused by misinformation or lack of competent help.

Take, for instance, a golf green: Incorrect mowing can upset the most perfect greens program. Green design is changed by workmen, who, rather than follow original contours, will chop straight lines in order to get done faster. Turning of the mowers is done on the green rather than on the collars, creating problems. Poorly adjusted and dull mowers on both greens and fairways create many problems.

Then we have the misuse of fertilizer. Spreaders may be incorrectly calibrated or get out of adjustment. Too much or too little fertilizer may be applied. The misuse of chemicals is quite evident, especially the weed-control chemicals. Workmen who are not familiar with the potency of some of these products are left to apply them without regard to their effect on the good grasses.

The superintendent also is faced with watering problems. Workmen who receive careful instructions suddenly decide they know better than anyone else and apply water their own way. Areas that badly need irrigation

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1/ President, West Point Products Corporation, West Point, Pennsylvania.

sometimes are skipped because the man happens to be just too tired to do it.

The superintendent who grows grass the hard way also is faced with players and committees. Each, in turn, has his own theory as to what is best for grass and is constantly badgering the superintendent with ideas. Trees are to be planted and trees are to be removed; traps should be dug and traps should be filled; benches should be constructed and benches are an eyesore. If a club has 350 members, then the superintendent should mow turf at 350 different heights.

Then to top it off, the superintendent is faced by acts of nature, such things as floods, lightning, wind storms, skunks, worms and, of course, people.

It is a tribute to the superintendent when one sees the good turf they manage to come up with in spite of these many problems.

TURFGRASS WEED CONTROL

John E. Gallagher 1/

Interest in the control of weed problems in Southern turf grasses has shown a positive upturn during the past two years. This interest can be associated with the development and widespread use of the newer selections of Bermuda and Zoysia grasses, and the introduction of disodium methyl arsonate for selective control of Dallis grass in Bermudagrass turf.

Let me quote from the 1958 Southern Weed Control Conference. The turf section, made up of research people from North Carolina to Texas and Oklahoma, was in agreement on the following point. "The most important new information has been the widespread success with disodium methyl arsonate for the control of weedy grasses. Considerable work has been done in Texas on Bermudagrass turf for the control of Dallis grass and throughout the South for the control of crabgrass (Digitaria spp.), silver crabgrass (Eleusine indica), Egyptian crabgrass (Dactyloctenium aegyptium), foxtail (Setaria spp.), and various Paspalum and Brachiaria species. Bermuda and Zoysia grasses are reasonably tolerant of this chemical, but centipede and St. Augustine appear quite susceptible."

Dallis grass has long been considered by most turf grass people to be the major weed pest of Bermudagrass turf. Many of you will recall the drastic measures used to control Dallis grass--diesel oil, TCA, sodium arsenite, soil sterilants, and even actually digging out the plant.

Since 1955, when Dr. Holt of Texas A & M first began to work with disodium methyl arsonate, its apparent specificity for Dallis grass was obvious. The fact that Bermudagrass tolerated rates much higher than

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1/ Research Department, Agricultural Chemicals Division, American Chemical Paint Company, Ambler, Pennsylvania.

those needed to kill Dallis grass made this an even more striking development. For the first time, there was a truly selective chemical for the control of Dallis grass in Bermudagrass turf. Additional tests throughout the country have proven this. The newer Bermuda strains of Tifton and Texas now seem to show the same tolerance to disodium methyl arsonate.

Using Disodium methyl arsonate

As each new chemical having desirable weed-killing characteristics and species tolerances is developed, many questions arise concerning application methods. We want to know what happens when different additives (wetting agents), volumes of water and other weed-control chemicals are added to the spray solution. Results of 1956 and 1957 tests conducted by Dr. Holt and John Long of Texas A & M resolved some of these questions. It was shown that adding a wetting agent produced better control, that the best control was achieved when volumes of water of 80-160 gallons per acre were used, that small amounts of 2,4-D and ammonium nitrate were compatible but did not enhance the activity of disodium methyl arsonate once a killing rate was reached. If a broadleaf weed problem is present, these materials can be mixed with disodium methyl arsonate and applied in the same operation.

Cultural factors such as temperature and soil moisture affect the action of most herbicides. Disodium methyl arsonate is no exception. High temperatures seem to increase injury and produce poorer control. The best treatment period of the Texas test was during May. Soil moisture, through its effect on general plant condition, can change the response of plants to weed-control chemicals. Weeds in a drought-hardened state are more difficult to kill. Turf grasses growing with ample soil moisture recover more readily from any herbicidal setbacks.

Proper rates of application, interval between treatments, and number of treatments have been worked out. In general, 10 pounds of active ingredient per acre will control Dallis grass. Work last year suggested that 2 applications of lighter rates, or 1 application at 10 pounds per acre followed up with spot treatments would be more satisfactory. In many areas, 3 applications at 10-14 day intervals have given excellent and safe weed control.

In other regions, the maximum rate of chemical applied is determined by the amount less tolerant turf/grass species, bents and bluegrass, will stand without being injured. In this area, the rate used for Dallis grass control in Bermudagrass turf is more than enough to control crabgrass, silver crabgrass, foxtail, and other annual weed grasses. As with most annual weed species, chemical control measures are applied most efficiently and economically when the weeds are in the seedling stage.

Pre-Planting Weed Control

The increasing use of the improved Bermuda and Zoysia strains has created a greater need for short term "soil sterilants." Chemicals designed to kill existing vegetation as well as dormant seeds and nutgrass nutlets. Methyl bromide has been used most often for this purpose. The advantage of a 24- to 48-hour treatment period greatly offsets the inconvenience of working with an airtight plastic cover and a poisonous gas.

Two newer materials are currently undergoing extensive test, MYLONE and VAPAM. These materials work on the same principle as methyl bromide but are less volatile. A water seal is needed and a 2 to 3-week waiting period must occur between treatment and planting. All materials, if used

correctly, will provide adequate weed control.

Broadleaf Weeds

Most broadleaf weeds can be controlled with 2,4-D or 2,4-D/2,4,5-T combinations. Two weed species, clover and chickweed, actually have specific chemicals available for their control. Clover is readily controlled with 2,4,5-T acetic and the chickweed species are easily controlled with 2,4,5-T propionic.

From the viewpoint of someone outside of the Bermudagrass area, the cautions suggested for using 2,4-D seem unnecessary. Active, well-established Bermudagrass turfs can tolerate high rates of 2,4-D without injury. Only when Bermudagrass is breaking dormancy--when it is comparable to a new seedling--is it sensitive to 2,4-D. Low-volume applications should be used during this sensitive period.

As new vegetative plantings are made, conditions are set up for the rapid development of broadleaf weed seedlings. This rapid weed development produces strong competition for starting Bermudagrass. The present method of high-volume applications kills the weeds but, at the same time, permits enough herbicide to reach the root zone of young Bermudagrass plants; roots can absorb 2,4-D and since 2,4-D is a systemic herbicide, it will move throughout the plant-producing complete kill. If low volumes are used---10-15 gallons per acre---the solution is more concentrated and the protective canopy of weeds will intercept most of the spray. Any small loss of Bermudagrass caused by chemical injury would be more than offset by the more rapid growth made possible by reduced weed competition.

WEED CONTROL RECOMMENDATIONS - TIFTON CONFERENCE

Weed problem	Herbicide	Rate per acre Active ingred.	No. treatments	Vol. water Gal./acre	Recommendation
Dallis grass in Bermuda turf	Disodium methyl arsonate	10#	1 - 3	80-160 gal.	Treat when Dallis grass is small
Silver crabgrass in Bermuda turf	Disodium methyl arsonate	4-8#	1 - 3	80-160 gal.	Treat in seedling stage
Common crabgrass	Disodium methyl arsonate & phenyl mercuric acetate-10%	5-4-8#s.	1 - 3	40-160	Treat in seedling stage
		5-7 pts.	3 - 5	40-200	Treat in seedling stage
Clover spp.	2,4,5-T	2-1	1 - 2	10-100	Late fall to early spring
Chickweed spp.	2,4,5-TP	1½	1 - 2	10-100	Late fall to early spring
General broadleaf weeds	2,4-D	¼-1#	1 - 2	10-100	Suggest low volume be used
Preplanting seedbed weed control	Odorized methyl bromide	1-2#/100 sq. ft.	1	-	Soil should be moist
	Vapam	150 gallons	1	-	Apply as a drench; water immediately to provide water seal; wet to 4-inch depth.
	Mylone	400#	1	-	Spread dry; then water heavy to wet to 4-inch depth.

ZOYSIA MANAGEMENT

Ian Forbes 1/

Zoysia spreads solid in the shortest period of time if planted just after the last spring frost or in the early summer, although it may be planted in late summer also. Kill all existing Bermudagrass which may be present in the lawn by fallowing the soil or by chemical treatments. (Consult your county agent on chemical treatments.)

Establish the grade of the lawn. Prepare the lawn area as for a garden and apply lime to the soil if a soil test indicates its need. A soil pH of 6 to 6.5 is desirable. Broadcast 20 to 30 pounds of a complete commercial fertilizer such as an 8-8-8 per 1,000 square feet and mix it into the soil. Smooth the seed bed with a rake.

Before planting, be sure the soil is moist, watering it artificially if necessary. The sprigs should be fresh and not wilted. Water each row as you plant it. Each sprig should be a minimum of 3 inches long. A square yard of mature Emerald Zoysia sod will make about 4,500 sprigs of this size. Plant the sprigs in 6-inch rows with sprigs 6 inches apart in the row for quickest coverage. These planting distances may be increased to 12 inches if limited planting stock is available. When planted, one end of the sprig should be at least 2 inches below ground, but some part of each sprig should be aboveground (preferably a joint with some leaves, but a naked joint will do if the stolon piece has no leaves). The newly planted lawn should be kept moist until active growth of the sprigs is observed. Watering should then be done every week in which no good rains occur. Three pounds of ammonium nitrate or six pounds of nitrate of soda

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1/ Research Agronomist, Crops Research Division, ARS, USDA, Tifton, Georgia.

per 1,000 square feet should be applied to the lawn weekly, biweekly, or monthly to encourage spread of the runners.

It is recommended that chemical weed control begin as soon as the grass is planted and the treatment repeated every time numerous weed seedlings begin to sprout. The spraying rate should not exceed one pound of active ingredient of 2,4-D per acre and treatments should not be closer than two weeks apart as injury to the grass may otherwise result. Some hand-weeding will be necessary if weeds are present which are not susceptible to 2,4-D in the seedling stage, or if the weeds get a head start before 2,4-D is applied. Volunteer Bermudagrass seedlings should be removed as soon as they are observed, as they spread rapidly. Any hand-weeding or mechanical treatment which breaks off or uproots the runner tips of Emerald Zoysia will reduce the speed of the grass' spread, so care in such operations is desirable. In the absence of chemical weed control, mowing at a 3/4-inch height will reduce weed competition.

Caution should be exercised when spraying with 2,4-D near ornamental plants in the lawn area. Spray only when the air is still and cover the ornamental plants with newspapers to prevent the spray from drifting onto the foliage. The amine and salt forms are safer than the ester form of 2,4-D to use near ornamental plants.

The closer sprig spacing, the more frequent watering, the more frequent fertilizer top-dressing, and the better weed control equal the fastest spread of runners.

Establishment From Plugs of Sod

The use of 2-inch diameter plugs of sod instead of 3-inch-long sprigs for planting lawns has several advantages. However, the cost for plugs

would be higher, as only 324 such plugs compared to 4,500 sprigs can be obtained from a square yard of Emerald Zoysia sod.

Plugs of sod to be used for planting lawns should be at least 2 inches in diameter, and should include a core of soil and roots 2 to $2\frac{1}{2}$ inches long. The plugs should be kept moist from the time they are cut in the nursery until they are well rooted after transplanting. A hard steel plug cutter is usually used to cut the plugs in the nursery and such a tool may be used for cutting the holes in the lawn into which the plugs are to be planted. The plugs may be planted in rows 12 inches apart with the plugs 12 inches apart in the row. After the holes are cut out, they are filled with water and the plugs are placed in the holes and stepped on to firm the soil around the roots. For best results, the area should be watered heavily after the transplanting is completed. Except for less frequent watering, the first two weeks after planting, the cultural practices described for establishment from sprigs apply to establishment from plugs as well.

Maintenance

Apply 15 pounds of complete fertilizer such as 8-8-8 per 1,000 square feet in the spring after the last killing frost date for your locality. Topdress with 3 pounds of ammonium nitrate or 6 pounds of nitrate of soda every month to 6 weeks during the summer. Spread the fertilizer evenly and water it in to prevent burning the grass. For best appearance, mow weekly at 1/2 to 3/4 inch height during the summer, less frequently in the cooler spring and fall weather, and use a grass catcher on the mower to remove the clippings from the lawn. During extended periods of hot, dry weather on sandy soils, best appearance will be preserved if the lawn is sprinkled every week or ten

days to moisten the soil to a depth of 4 to 6 inches. On heavy clay soils, less frequent or no artificial watering may be required in most years.

Every three or four years, the soil in the lawn area should be tested for acidity, phosphorus, and potash, and recommendations obtained for the correction of any deficiency found should be followed.

The fine-leafed varieties (Manila grass and Emerald Zoysia) produce a very dense turf under the high fertility levels which produce the highest quality turf. This makes the grass difficult to mow with small power mowers unless they are sharp and well adjusted. A somewhat thinner, more easily mowed turf may be obtained by reducing the amount and frequency of nitrogen fertilization.

Thus far, diseases and insects have not been very serious on Zoysia. Emerald Zoysia appears to be resistant to diseases which injure Meyer Zoysia and some Manila grass strains in south Georgia.

Zoysia sods, which have developed a heavy mat of undecomposed dead leaves and stems after several years of growth, will be benefited by the removal of the mat to ground level by close mowing or burning in the late winter.

AREA MEASUREMENT AND EQUIPMENT CALIBRATION

James M. Latham, Jr. 1/

I. Area Measurement - by tape, measuring wheel, or pacing.

A. Fairways - Standard unit in acres

1. Consider as a long rectangle

a. Measure the length and width. If the width is highly variable, measure in several places and use the average.

b. Multiply length X width.

2. If hole yardage is used, remember that it is measured from the center of tee to center of green with no consideration of undulations of the terrain.

Table I. Areas, in Acres, of Fairways of Various Widths and Lengths

Fairway Width	Fairway length (yards)							
	25	50	75	100	200	300	400	500
Yards	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
25	.14	.26	.39	.51	1.03	1.55	2.07	2.58
30	.15	.31	.46	.62	1.24	1.86	2.48	3.09
35	.18	.36	.54	.72	1.44	2.17	2.89	3.61
40	.21	.41	.62	.82	1.65	2.48	3.30	4.13
45	.23	.47	.69	.93	1.86	2.79	3.72	4.64
50	.27	.51	.77	1.03	2.07	3.10	4.13	5.16
55	.29	.57	.85	1.13	2.27	3.41	4.54	5.67
60	.31	.62	.93	1.23	2.48	3.72	4.95	6.19
65	.35	.67	1.01	1.33	2.68	4.00	5.37	6.71
70	.36	.73	1.08	1.44	2.90	4.34	5.78	7.22
75	.40	.78	1.16	1.54	3.10	4.65	6.19	7.74
80	.42	.84	1.24	1.64	3.31	4.96	6.60	8.25
85	.45	.88	1.31	1.75	3.51	5.27	7.02	8.67
90	.47	.95	1.40	1.85	3.72	5.58	7.43	9.18
95	.51	1.01	1.48	1.95	3.92	5.90	7.85	9.70
100	.52	1.06	1.54	2.06	4.13	6.21	8.26	10.21

1/ Southeastern Agronomist, U.S. Golf Association Green Section, Athens, Georgia.

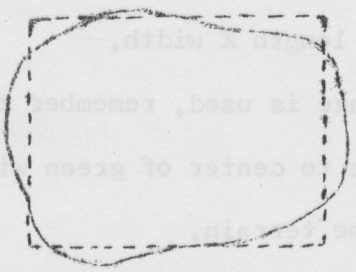
B. Tees - Standard unit in thousand square feet.

1. Multiply the length X width.

C. Greens - Standard unit in thousand square feet.

1. Rectangular

a. Square corners in such a way as to exclude an area equal to the amount of fringe area inside the rectangle.



2. Circular

a. Find average diameter by several measurements - all passing through the center.

b. Divide by 2 (this is radius).

c. Multiply the radius (number found in b.) by itself.

d. Multiply by 3.14.

Table II. Areas of Circular Putting Greens of Various Diameters

Diameter in feet	25	30	35	40	45	50	55	60
Area in square feet	490	706	962	1,256	1,590	1,963	2,375	2,827
Diameter in feet	65	70	75	80	85	90	95	100
Area in square feet	3,318	3,848	4,417	5,026	5,674	6,361	7,088	7,854

3. Irregular - those shapes not easily measured as rectangular or circular greens.

a. Determine long axis of the green and stake a string on this line.

b. At 10-ft. intervals, measure each edge of the green at right angles to the string, using a T square to make sure of the angle.

c. Multiply each measurement by 10 and add them up.

II. Aerial Photograph - obtainable from Soil Conservation Service.

A. Ascertain the scale on the photograph and convert measurements with ruler to acres or thousand square feet.

III. Equipment Calibration

A. Dry material

1. Jack up one end of the spreader - the driving wheel is preferable.
2. Set distributor indicator to opening for the amount desired per A.
3. Tie a rope to the outer end of one spoke and make a chalk mark on the rim where spoke is welded to the rim.
4. Measure the circumference of the wheel and the width of the spreader.
5. Empty two bags of fertilizer into the hopper.
6. Spread a tarpaulin or fasten a rain spout beneath the spreader board to catch the fertilizer material.
7. Turn the wheel of the distributor with the rope, using the chalk mark to guide you as you count each revolution. The number of revolutions should be figured on the basis of the formula given below for the determination of the amount required for 1/10 acre.

a. To find the number of wheel revolutions needed to cover 1/10 acre, divide the area to be covered by the wheel circumference X spreader width or:

$$\text{Number of revolutions} = \frac{4{,}500 \text{ sq. ft.}}{\text{Wheel circumference} \times \text{spreader width}}$$

All measurements must be in feet.

For example, if the wheel circumference is 10 feet and the spreader width is 8 feet, the

$$R = \frac{4500}{8 \times 10} = \frac{4500}{80} = 56.$$

Therefore, when the wheel has turned 56 times, 1/10 acre has been covered.

8. Weigh the material which has passed through the distributor to determine whether the indicator should be opened to increase the flow or further closed to reduce the flow.

B. Notes on application of dry materials.

1. Be sure that some type of baffle board is in place to break up the stream of material coming from the holes. This will prevent streaking.
2. To prevent skips or overlaps, some form of marker should be used -- either a lime compartment, drag, or marker on wheel.
3. Good maintenance requires thorough washing and oiling the spreader after each use.

C. Liquids

1. Application rate is determined by pressure, nozzle size, and travel wheel. If possible, a governor for a tractor provides the best possible speed control.
2. Most widely used application rates -- either 50 or 100 gallons per A.
   a. Measure off one acre.
   b. Put 100 (or 50) gallons of water in tank
   c. Spray the acre at desired pressure and travel speed
   d. If tank is empty before covering the area, either increase travel speed or decrease pressure. In some cases, it may be necessary to change nozzles.

e. If some amount of water is left in tank after the area is covered, measure it and make a note of the amount applied per acre. If a specific amount is desired, slow down tractor or increase pressure and try again.

IV. Notes on Sprayers

A. Always check with manufacturers' technicians before making a radical change in equipment.

B. About one tablespoon of Auragreen or similar dye per 100 gallons of water gives enough color to check spray pattern and prevent skips and overlaps.

C. A trial spray on pavement helps set height of boom and prevent skips and overlaps in spray pattern.

D. Make sure all nozzles are clean and fan nozzles are properly aligned.

E. Keep close watch on nozzles during operation to catch any stoppages.

F. Always wash thoroughly after each use.

V. Additional Information - Most of this information is well known but the following table may be of assistance in planning certain operations.

A. Conversion Factors

1 square foot = 144 square inches

1 square yard = 9 square feet

1 acre = 43,560 square feet = 4,840 square yards

1 cubic foot = 1,728 cubic inches

1 cubic yard = 27 cubic feet

1 gallon (liquid) = 231 cubic inches

1 bushel = 2,150.4 cubic inches

1 gallon of water weighs about 8.34 pounds

Other conversion tables of this type are found in Turf Management by H. B. Musser, published by the U. S. Golf Association.

Table III. Units of Materials Needed for Areas of Various Sizes in Applications at Given Rates for 1,000 Square Feet

Size of area in square feet	Rate of application in given units (ounces, pounds, gallons, cubic yards) to 1,000 square feet							
	½	1	2	3	4	5	10	15
	Units needed							
500	.25	.50	1.00	1.50	2.00	2.50	5.00	7.50
1,000	.50	1.00	2.00	3.00	4.00	5.00	10.00	15.00
1,500	.75	1.50	3.00	4.50	6.00	7.50	15.00	22.50
2,000	1.00	2.00	4.00	6.00	8.00	10.00	20.00	30.00
2,500	1.25	2.50	5.00	7.50	10.00	12.50	25.00	37.50
3,000	1.50	3.00	6.00	9.00	12.00	15.00	30.00	45.00
3,500	1.75	3.50	7.00	10.50	14.00	17.50	35.00	52.50
4,000	2.00	4.00	8.00	12.00	16.00	20.00	40.00	60.00
4,500	2.25	4.50	9.00	13.50	18.00	22.50	45.00	67.50
5,000	2.50	5.00	10.00	15.00	20.00	25.00	50.00	75.00
5,500	2.75	5.50	11.00	16.50	22.00	27.50	55.00	82.50
6,000	3.00	6.00	12.00	18.00	24.00	30.00	60.00	90.00
6,500	3.25	6.50	13.00	19.50	26.00	32.50	65.00	97.50
7,000	3.50	7.00	14.00	21.00	28.00	35.00	70.00	105.00
7,500	3.75	7.50	15.00	22.50	30.00	37.50	75.00	112.50
8,000	4.00	8.00	16.00	24.00	32.00	40.00	80.00	120.00
8,500	4.25	8.50	17.00	25.50	34.00	42.50	85.00	127.50
9,000	4.50	9.00	18.00	27.00	36.00	45.00	90.00	135.00
9,500	4.75	9.50	19.00	28.50	38.00	47.50	95.00	142.50
10,000	5.00	10.00	20.00	30.00	40.00	50.00	100.00	150.00

SOUTHERN TURFGRASS DISEASES AND THEIR CONTROL

Homer D. Wells 1/

Every year, diseases cause unsightly areas in Southern turfgrasses. Much of this unsightliness could be prevented or minimized if turf workers were acquainted with the symptoms and control measures for the more destructive diseases.

This talk consists of three tables: Table 1 is a key to be used for identifying the more common diseases of turfgrasses in the South. Table 2 shows the relative importance of the common diseases and Table 3 lists the best practices for controlling some of the diseases and related turf difficulties.

1/ Pathologist, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Tifton, Georgia.

Table 1. A Key to the More Common Southern Turfgrass Diseases

I. Leaf Spots

A. Orange, red, or black pustules erupting from leaf surface during late spring and summer.....RUSTS

B. Gray, dirty-yellow, or ash-colored spots with brown, purple or water-soaked borders occurring during warm season..... .....GRAY LEAF SPOT

C. Leaf spots varying in color from light gray to dark brown and ranging in size from small flecks to large, circular to reticulate lesions in all seasons when grass is growing..... .....HELMINTHOSPORIUM LEAF SPOTS

II. Turfspots

A. Small, white, cottony spots or water-soaked, blackish to brown spots with white cottony margins. Spreads very rapidly during warm, foggy weather .....COTTONY BLIGHT

B. Well defined, small circular dead areas or irregular, discolored and thinned-out areas with margin showing typical Helminthosporium leaf spots throughout the year when grass is growing.....HELMINTHOSPORIUM TURFSPOTS

C. Circular to irregularly circular patches (brown in bentgrass, bluegrass, ryegrass, and Bermudagrass and white in tall fescue and St. Augustine) varying in diameter from a few inches to a foot or more and bordered with a smoke-colored mat of fungus mycelium extending into the living turf during any season when temperatures are above 70° F.....BROWN PATCH

D. General leaf blight and dying out of turf in midsummer during hot weather.....CURVULARIA MELTING-OUT

E. Small spots that rapidly enlarge to 12 inches or more in diameter and become covered with a mass of salmon-pink fungus spores following cold, rainy weather during winter months... .....FUSARIUM SNOW MOLD

III. Aboveground growth of turf generally spotty and unthrifty. Roots may be coarse, stubby, swollen, blackened, and shallow. The damage is most pronounced during late summer.....NEMATODES

IV. Blue-gray or slate-colored spore masses covering the otherwise healthy turf during warm, rainy weather.....SLIME MOLDS

V. Greenish crust or scum on soil or thinned-out turf.....ALGAE

VI. Yellowing of turf, primarily during early spring.....CHLOROSIS

Table 2. Occurrence of Eight Common Diseases on Ten Turfgrasses

Disease / Grass	Centipede grass	Carpet grass	Bahia grass	St. Augustine grass	Tall fescue	Bermuda grass	Zoysia	Rye-grass	Kentucky bluegrass	Bent grass
1. Brown patch	0	+	0	++	++	+	++	++	++	++
2. Cottony blight and other *Pythium* diseases	0	0	0	0	+	+	0	++	+	++
3. *Helminthosporium* leaf spot and turfspot	0	+	+	+	++	++	++	++	++	+
4. *Curvularia* leaf spot and melting-out	+	+	+	0	+	+	+	0	+	++
5. Rusts	0	0	0	+	0	+	0	++	++	+
6. *Piricularia* gray leaf spot	0	0	0	++	0	0	0	0	0	0
7. *Fusarium* rots	?	+	+	?	+	+	+	+	+	++
8. Nematodes	++	+	+	++	+	++	++	+	+	++

0 - Does not occur on indicated grass
? - Probably occurs on indicated grass
\+ - Occurs on indicated grass
++ - Occurs on indicated grass causing considerable damage

Table 3. Suggested Practices for Controlling Southern Turfgrass Diseases.

Disease	Recommended Control
1. Brown patch	Mercury-containing fungicides every ten to fourteen days when temperature is above 70° F.
2. Cottony Blight	Captan 50-W + actidione (one pound and 0.6 gram, respectively) per 1,000 sq. ft. at time of seeding and additional applications, reducing the captan to 1/2 this rate as required. Captan, phygon XL, and zineb may also be used at rates recommended for captan (one pound at time of seeding and subsequent applications of 1/2 pound). Apply fungicide in 5 gallons of water per 1,000 sq. ft.
3. Helmintnosporium leaf spot and turfspot	Mercury-containing fungicides such as Caloclor, Semesan, PMAS, and others (according to directions on label); heavy rates (6 oz. of formulation per 1,000 sq. ft.) of tersan, vancide 51, zineb, and kromad.
4. Curvularia leaf blight and melting-out	On bentgrass; actidione and mercury-containing fungicides; on the strictly Southern grasses, we prefer to recommend only mercury-containing fungicides. (Use according to recommendations on label)
5. Rusts	Resistant varieties, actidione, or phygon XL (Use according to directions on label).
6. Gray leaf spot of St. Augustine	Mercury-containing fungicides as needed (Apply according to recommendations on label).
7. Fusarium rots	Mercury-containing fungicides (Apply according to recommendations on label).
8. Nematodes	Nemagon and VC-13 (according to recommendations on the label).
Microorganisms that are troublesome, but do not cause diseases	
9. Slime Molds	Remove mechanically by mowing, brushing off, or spray with a strong stream of water; any good fungicide will aid in control.
10. Algae	Good turf is best preventative; 2-5 lbs. of hydrated lime per 1,000 sq. ft. Any good copper fungicide (Use according to recommendations on label).
Minor Element Deficiencies	
11. Chlorosis or yellowing (primarily centipede)	Spray with 1 to 2 pounds of ferrous ammonium sulfate per 1,000 sq. ft. in sufficient water to wet the foliage or use chelated iron according to recommendations on the label.

Summary

TWELFTH ANNUAL SOUTHEASTERN TURFGRASS CONFERENCE

Tifton, Georgia
April 7 and 8, 1958

TOTAL REPRESENTATION FROM EACH STATE:

Alabama	21
Delaware	1
Florida	30
Georgia	48
Louisiana	3
Michigan	1
Mississippi	2
Missouri	1
Minnesota	2
New Jersey	1
New York	1
North Carolina	11
Pennsylvania	3
South Carolina	8
Tennessee	6
Virginia	1
Wisconsin	1
TOTAL	141

ATTENDANCE ROSTER

Name	Affiliation	City
ALABAMA		
Amrich, D. C.	Parks and Recreation	Birmingham
Berdeaux, C. G.	The Elmwood Corporation	Birmingham
Booterbaugh, E. E.	Lakewood Golf Club	Point Clear
Epperson, I. E.	Roebuck Golf Course	Birmingham
Hartwig, L. H.	American Chemical Paint Co.	Union Springs
Hill, Tommie	Parks and Recreation Board	Birmingham
Horder, E. J.	Army Corps of Engineers	Mobile
Kennedy, W. T.	Montgomery Country Club	Montgomery
Lang, J. D.	Skyline Country Club	Mobile
Lawrence, Doyle	Maxwell Golf Course	Maxwell A.F.B.
Ledbetter, D. E.	Coosa River Newsprint Co.	Coosa Pines
Martin, M. P.	Parks and Recreation Board	Birmingham
Metcalf, H. J.	Herb Metcalf Company	Dothan
Moore, J. F.	Vestavia Country Club	Homewood
Nordan, W. W.	Nordan's Grass Farms	Abbeville
Ritter, T. R.	Maxwell Golf Course	Maxwell A.F.B.
Robinson, B. P.	Kilgore-Robinson Supply	Birmingham
Wildmon, Joe	Birmingham Country Club	Birmingham
Wilson, C. M.	U.S. Steel Corporation	Fairfield
Scott, Milton	Stauffer Chemical Company	Decatur
Sturkie, D. G.	Ala. Agr. Experiment Station	Auburn
DELAWARE		
Rennie, W. W.	DuPont Company	Wilmington
FLORIDA		
Baker, Chan	Baker Grass Industries	Miami
Billett, R. W.	O. E. Linck Company, Inc.	Hialeah
Bryant, Al	Country Club of Orlando	Orlando
Byrd, G. E.	Miami Shores Country Club	Miami
Collier, B. L.	The Dow Chemical Company	Fern Park
Cook, Ed	Ponte Vedra Golf Club	Ponte Vedra
Cruse, S. F.	Pursley Zoysia Grass Company	St. Petersburg
Greene, Herb	City of Jacksonville	Jacksonville
Hall, E. T.	Bobby Jones Golf Club	Sarasota
Hall, J. M.	Hall and Thomas Ins.	Lake Harbor
Hay, Sonny	Zaun Equipment	Jacksonville
Hendry, D. D.	P.G.A. Nat. Golf Club	Dunedin
Jackson, A. R.	City of Jacksonville	Jacksonville
Johnson, R. W.	Bradenton Country Club	Bradenton
Masgay, Stan	N.A.S. Golf Course	Jacksonville
Mattson, Ed	Fernandina Beach Golf Course	Fernandina Beach
Meyers, Bob	Riviera C.C. & Driving Range	Daytona Beach
O'Neil, J. B.	American Cyanamid Company	Brewster

Name	Affiliation	City
FLORIDA (Cont.)		
Perkins, E. W.	City of Jacksonville	Jacksonville
Reemelin, Ben	Zaun Equipment	Jacksonville
Ritty, P. M.	The Dow Chemical Company	Fern Park
Ross, Edge	Eglin A.F.B. Golf Course	Eglin A.F.B.
Schaefer, H. W.	Bobby Jones Country Club	Sarasota
Shaw, C. C.	Hector Supply Company	Miami
Simpson, S. C.	Simpson Nursery Company	Monticello
Sincerbeau, Vern	Rocky Point Golf Club	Tampa
Sudbury, Clarence	Sarasota Bay	Oneco
Thomas, M. R.	City of Jacksonville	Jacksonville
Ward, Frank	Bradenton County Club	Bradenton
Williams, H. E.	Daytona Beach Country Club	Daytona Beach
GEORGIA		
Baumgardner, T. M.	Sea Island Company	Sea Island
Beck, Elmer	U.S.D.A., Experiment Station	Tifton
Betsill, G. S.	Sea Island Company	Sea Island
Branch, D. J.	Main Officers Golf Course	Ft. Benning
Burnam, Joe	Evans Implement Company	Atlanta
Burton, G. W.	U.S.D.A., Experiment Station	Tifton
Cabney, Frank	Augusta Country Club	Augusta
Chandler, W. E.	W. E. Chandler and Sons	Tifton
Dudley, J. W.	Athens Country Club	Athens
Faust, F. B.	Associated Seed Growers, Inc.	Brookhaven
Fleming, T. E.	Ga. Crop Improvement Assn.	Athens
Forbes, Ian	U.S.D.A., Experiment Station	Tifton
Freeborn, Elbridge	H. G. Hastings Company	Atlanta
Goldthwaite, Howard	Toro Turf Supply Company	Atlanta
Graves, John	Augusta National Golf Club	Augusta
Green, C. M.	Okefenokee Country Club	Waycross
Griffin, Avalon	Parramore & Griffin	Valdosta
Haskins, Fred	Country Club of Columbus	Columbus
Hearn, Jack	Experiment Station	Tifton
Hollis, H. T.	Athens Country Club	Athens
Inglis, Hugh	Ga. Crop Improvement Assn.	Athens
Jensen, Ray	Southern Turf Nurseries	Tifton
Johnson, Dewey	Evans Implement Company	Atlanta
Keeble, V. L.	Armour Fertilizer Works	Tifton
King, F. P.	Director, Experiment Station	Tifton
King, George H.	College of Agriculture	Athens
Kraft, Arthur	Warm Springs Golf Club	Warm Springs
Land, Sam	Toro Turf Supply Company	Atlanta
Lambert, Jimmy	Evans Implement Company	Atlanta
Latham, James	U.S. Golf Association	Athens
Lovett, W. C.	V. A. Hospital	Dublin
McKendree, Marion	Sea Island Golf Course	Sea Island

Name	Affiliation	City
GEORGIA (Cont.)		
McLain, Marvin	Highland Country Club	LaGrange
McLemore, J. R.	Ansley Golf Club	Atlanta
Morcock, J. C.	Allied Chem. and Dye Corporation	Atlanta
Morgan, L. W.	Experiment Station	Tifton
Nantz, W. A.	Ft. McPherson Golf Club	Ft. McPherson
Petrie, J. F.	Ft. McPherson Golf Club	Ft. McPherson
Rambo, S. L.	Merrybrook Zoysia Farm	LaGrange
Shields, E. A.	Capital City Country Club	Brookhaven
Smith, P. F.	V. A. Hospital	Dublin
Todd, L. W.	Glen Arvin Country Club	Thomasville
Walls, C. E.	DuPont Company	Atlanta
Ward, Joe	Idle Hour Golf & Country Club	Macon
Washburn, Jerry	Jenks-White Seed Company	Atlanta
Watson, T. W.	Piedmont Golf Course	Atlanta
Wells, Homer	U.S.D.A., Experiment Station	Tifton
Williams, T. G.	Agr. Extension Service	Athens
LOUISIANA		
Kane, Charles	Baton Rouge Country Club	Baton Rouge
Peek, J. M.	Southwestern Louisiana Inst.	Lafayette
Vickers, Lou	Metairie Country Club	Metairie
MICHIGAN		
Bertoni, Andrew	Meadowbrook Country Club	Northville
MISSISSIPPI		
Fleming, B. R.	Mississippi State College	State College
Wise, Louis	Mississippi State College	State College
MISSOURI		
Frederiksen, S. A.	Mallinckrodt Chemical Works	St. Louis
MINNESOTA		
Klug, Bob	Minnesota Mining & Mfg. Co.	St. Paul
McLaren, Scotty	Toro Manufacturing Corporation	Minneapolis
NEW JERSEY		
Cleary, Leo	W. A. Cleary Corporation	New Brunswick
NEW YORK		
Lombardo, Ted	Mallinckrodt Chemical Works	New York City

Name	Affiliation	City
NORTH CAROLINA		
Baenen, E. L.	DuPont Company	Charlotte
Cheek, Osborne	Hillandale Golf Course	Durham
Cochrane, Donald	E. J. Smith and Sons	Charlotte
Harmon, L. E.	Kinston Country Club	Kinston
Maples, Ellis	1204 Craig Avenue	Gastonia
Maples, Henson	Pinehurst Country Club	Pinehurst
Maples, Joe	Siler City Country Club	Siler City
Sapp, R. B.	Old Town Club	Winston-Salem
Spencer, Jim	E. J. Smith Company	Charlotte
Welch, Bo	C. C. of Johnston County	Smithfield
White, R. L.	Mallinckrodt Chemical Works	Charlotte
PENNSYLVANIA		
Gallagher, John	American Chem. Paint Company	Ambler
Mascaro, Tom	West Point Products Corporation	West Point
Taylor, S. F.	DuPont Company	Philadelphia
SOUTH CAROLINA		
Adams, J. E.	Municipal Golf Course	Charleston
Hall, J. A.	Ft. Jackson Golf Club	Ft. Jackson
Jeffords, M. K.	Southern Golf Association	Orangeburg
Ridgeway, J. R.	Zonolite Company	Travelers Rest
Ripley, C. R.	Anderson Country Club	Anderson
Rothfelder, R. E.	Zonolite Company	Greenville
Smith, F. H.	Clemson Extension Service	Clemson
Watson, John	Winyah Bay Country Club	Georgetown
TENNESSEE		
Boyd, A. P.	Southern Golf Association	Chattanooga
Boyd, Llewellyn	Southern Golf Association	Chattanooga
Danner, Charlie	Richland Country Club	Nashville
Landers, R. H.	--	Chattanooga
Schroeder, W. F.	Schroeder's Seed Company	Chattanooga
Thorsberg, A. D.	Toro Manufacturing Corp.	Memphis
VIRGINIA		
Savage, Hurley	James River Country Club	Newport News
WISCONSIN		
Wilson, Charlie	Milwaukee Sewerage Commission	Milwaukee