PROCEEDINGS

TENTH ANNUAL

SOUTHEASTERN TURFGRASS CONFERENCE

TIFTON, GEORGIA

APRIL 9, 10, 11, 1956

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Tifton, Georgia

April 9, 10, 11, 1956

Sponsored By

UNIVERSITY OF GEORGIA COASTAL PLAIN EXPERIMENT STATION

In Cooperation With

UNITED STATES GOLF ASSOCIATION GREEN SECTION

and

SOUTHERN GOLF ASSOCIATION

FOREWORD

We are happy to present herein copies of the talks presented at the Tenth Annual Turfgrass Conference which was held April 9, 10, and 11 at the Georgia Coastal Plain Experiment Station. These conferences have grown in importance as people in turf work everywhere have come to recognize the quality of the reports made each year.

I am sure that those of you who are devoting your life and energies to turf work, as well as those who use turf production as a hobby, will find herein much of the very latest information which will help your work--or your hobby, as the case may be--to be more productive. Each year we attempt to bring together outstanding speakers who are qualified to deal with the most pressing and important problems of turf. We feel that this was very successfully done this year. The members of our Grass Breeding Department have been primarily responsible for the details of arranging the program. As always, however, they have been ably and cheerfully assisted by many people who are interested in promoting better turf. We would like to express our appreciation to all those who helped make this conference profitable and enjoyable, and would like to dedicate this Tenth Annual Proceedings Number to all people interested in promoting turf. We would also like to express our gratitude to the United States Golf Association, the Southern Golf Association, and the large number of commercial concerns which have continued to support the turf research work at this station.

Frank P. King

Frank P. King, Director
Coastal Plain Experiment Station

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BREEDING BERMUDAGRASS FOR TURF

Glenn W. Burton 1/

Plant breeding is largely testing and the success of the breeder is determined, in no small measure, by the volume of material that he can effectively screen. Before the first crosses are made, the breeder must have looked at and tested many possible parents, looking for those that would seem to carry the traits that he is looking for. Sometimes he finds what he is looking for in this first screening effort and need not spend time with the tedious business of making crosses. Usually, however, he does not find all of the characters he wants in one plant. One may be disease resistant, but coarse and unsuited for quality turf. Another may be very fine, but so susceptible to disease that it will make very poor turf during warm humid weather. In an effort to combine the desired characters of these two plants, the plant breeder hybridizes them. In Bermudagrass, no two of these hybrids will be alike because the parents are so variable. The plant breeder's job then becomes one of trying to find the best plant through a testing program. Since Bermudagrass can be propagated vegetatively, he need only be concerned with the problem of finding the best plant.

Most of the inferior plants can be eliminated by planting them in replicated small plots where they may be compared with each other. Actually, such important characters as disease resistance, frost resistance, drought resistance, fineness, weed resistance, color, seedhead production, rate of coverage, recovery from ryegrass overseeding, etc. can best be measured in small plots growing side by side and treated in the same way. It is fortunate that this is true, for it would be extremely difficult to find land and money enough to plant and maintain a full-sized green or fairway of each of the hundreds of Bermudagrasses that have been tested at Tifton. Tiflawn (Tifton 57), Tiffine (Tifton 127), and Tifgreen (Tifton 328) Bermudagrasses were all screened for these important characteristics in small 8 x 8 or 6 x 12 foot plots. These tests revealed, among other things, that more than one year is required to evaluate turfgrasses. Very often, grasses that looked good the first year or even the second year failed in the third because of disease or some other weakness that only time could uncover.

It is not enough, however, to have the results from small plot tests. The best grasses from these tests must be tested on the job. If they were designed for golf greens, they must be tested on golf greens under different playing conditions and on different soils and under different management practices. Golf courses, for example, that had followed a practice of fertilizing their greens heavily soon reported that Tiflawn made too much growth, made a mat and, as a result, made a very poor putting surface. Clubs that had little money for fertilization or maintenance, however, reported that Tiflawn for the first time had given them grass on their greens. They were pleased.

1/ Principal Geneticist, U. S. D. A., A. R. S., Field Crops Research Branch, University of Georgia Coastal Plain Experiment Station, Tifton, Georgia.

Out of this observation from golf courses came the realization that Tiflawn could be fertilized less than common Bermuda and still make a very satisfactory turf.

Further testing revealed that Tiflawn is tops for tees, fairways, football fields, and parks, but is inferior to other Bermudas now available for golf greens.

Small plot tests conducted from 1952 to 1954 had suggested that 328, out of the cross Charlotte Country Club selection x Cynodon transvaalensis, should be the best of the Bermudas developed for putting greens at the University of Georgia Coastal Plain Experiment Station. Greater confidence was placed in these tests after the majority of the golf pros attending the Southeastern Turf Management Conference in 1954 had rated it above all other Bermudas in the test in putting quality. Not until most of the sixteen greenkeepers in nine states had reported that it was superior on their courses, however, was this selection named and officially released. It is believed that this type of testing program will isolate the best plants from future hybridization efforts and make available turf Bermudas better than the best 1956 models.

THE DESIRABILITY OF BUYING CERTIFIED TURFGRASSES

Hugh A. Inglis 1/

It is important that you plant high-quality grass on your lawns or putting greens at golf courses. Your most dependable source of stock is one certified by a legal certifying agency, such as the Georgia Crop Improvement Association.

We first might ask this question. What was the policy of the Experiment Station in releasing Emerald Zoysia and Tifgreen Bermuda and what do we mean by certified sprigs? The policy of the experiment station was to release them through the Crop Improvement Program to only those people who would have them certified, This procedure was followed from Maryland across to Arizona and a great number of applications were handled in this manner.

Now, what do we mean by certified sprigs? Growers, who are members of Crop Improvement Associations and who have had their land inspected to meet high standards, are now selling certified turfgrasses (Emerald Zoysia, Tifgreen, etc.) with official seals and tags bearing the name of the Crop Improvement Association. No one should have non-certified Emerald Zoysia or non-certified Tifgreen Bermuda before now.

The standards on Tifgreen Bermuda, which was released on April 11, 1956, are the same as for Emerald Zoysia.

Under land requirements, a field to be eligible for the production of certified sprigs, must have been throughly inspected twice at approximately six-week intervals and must have been free from all perennial grasses and noxious and objectionable weeds. This includes such things as nutgrass, plantain, common Bermuda and many others not wanted.

Under field inspection, the trained inspector visits the field during the growing season and if these mixtures are found, the nursery covered by this inspection is rejected.

Under field standards, the entire acreage at the time of inspection must be mapped and reported to certifying agency. It must be six feet away from any other grasses unless divided by a wall. The planting stock must have a minimum of 90% pure living sprigs. There cannot be over 5% other living plants. In certified sprigs, no noxious weeds are allowed.

Now, when you buy non-certified sprigs of these two varieties, you buy from people who have not cooperated with the program as described above and you also buy from people who set their own

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1/ Extension Agronomist, Seed Certification, University of Georgia College of Agriculture, Athens, Georgia.

standards. They may or may not meet such standards as our Crop Improvement is enforcing. It is more likely that you will get something misbranded or containing a mixture of other plants when you buy non-certified sprigs. In certified sprigs, our growers quarantee that he will meet our published standards as described in this article.

The newspapers have carried ads this spring claiming Zoysia No. 13521 spreads twice as fast as any other Zoysia. According to our tests this is false. This Zoysia properly designated is USDA FC 13521.

Emerald Zoysia was tested at the Coastal Plain Experiment Station of the University of Georgia College of Agriculture and released there in cooperation with the United States Department of Agriculture and the United States Golf Association. The turf quality, when the lawn is well cared for, is seldom excelled by any other summer lawn grass in the South. It is a perennial and when once established the dense turf is highly weed resistant. The grass runners spread slowly and do not require much mowing. It will grow in the shade. It will take a lot of foot wear and traffic. No serious damage has been reported by diseases or insects. If other Zoysia had been equal to or superior to Emerald, they would have been recommended for certification also.

Tifgreen Bermudagrass is a fine-textured, low-growing turfgrass tested and released in the same manner as Emerald Zoysia. Tifgreen has a forest green color, fine-textured leaves and stems and a low, spreading, dense-growth habit which produces a compact turf that reduces weed invasion. It is an ideal permanent grass for overseeding in the fall with ryegrass to produce a year-round green turf.

Bermudagrasses will not grow in the shade. Both of these grasses respond to good treatment by feeding them with fertilizer and water.

Write the Coastal Plain Experiment Station, Tifton, Georgia, or the Georgia Crop Improvement Association, Athens, Georgia, if you want more information. Ask your local seed dealer or nurseryman to get these grasses for you and do not take a substitute for the reasons pointed out above.

Now that you have the standards right out of the book, it is up to you to be an intelligent buyer.

VEGETATIVELY PROPAGATED TURFGRASSES
CERTIFICATION STANDARDS (1956)

I. Application and Amplification of General Certification Standards:

1. The General Seed Certification Standards as adopted by the International Crop Improvement Association are basic and, together with the following specific standards, constitute the standards for certification of this grass.

2. Only those fields planted with Tiflawn, Tiffine, Tifgreen, and Emerald Zoysia foundation sprigs of turfgrasses will be eligible for certification. The Georgia Coastal Plain Experiment Station will produce all foundation planting stock of this grass.

II. Land Requirements (Rules Covering Land Prior to Planting):

1. A field to be eligible for the production of Certified (Blue Tag) stock must have been thoroughly inspected twice at approximately six-weeks intervals, and must have been found free of all other perennial grasses, noxious and objectionable weeds.

III. Field Inspection:

1. Handling the Crop Prior to Inspection:

A field must be rogued sufficiently during the growing season to remove any other perennial grasses or other undesirable plant mixtures.

2. Time of Inspection:

An inspection must be made during the growing season at a time when there is sufficient growth to make the identification of all perennial grasses possible.

IV. Field Standards:

1. General

(1) Restrictions on number of varieties per farm:

Where certified planting stock is being produced, no other variety or strain of the same species shall be grown for planting stock production except by special permission from the certifying agency.

(2) Unit of Certification:

The entire acreage standing at the time of inspection must be subjected to inspection as a unit.

(3) Isolation Requirements:

A field to be eligible for the production of certified planting stock of vegetatively propagated turfgrasses must be isolated from any other perennial grass by a strip at least 6 feet wide to preclude any possibility of mixing planting material during the digging operations.

2. Specific Requirements:

Factor	Maximum permitted in each class: Foundation	Certified
*Other Varieties	0%	1 plant per 50 sq. yds.

*Other varieties shall consist of all other perennial grasses that can be differentiated from the variety that is being inspected.

V. Planting Stock Standards: (Percentages to be determined by count)

Pure living sprigs (Minimum by count)................ 90.0%
Other living plants (maximum by count)............... 5.0%
Noxious Weeds (maximum)................................ None
Objectionable weeds (maximum).......................... None

NOXIOUS WEEDS: Bindweed (*Convolvulus* spp.), Nutgrass (*Cyperus rotundus*), Wild Onion and/or Wild garlic (*Allium* spp.), Johnson grass (*Sorghum halepense*), Dodders (Cuscuta spp.), Blue weed (*Helianthus ciliaris*), Bermudagrass (*Cynodon dactylon*), Cheat or Chess (*Bromus secalinus*), Darnel (*Lolium temulentum*), Corncockle (*Agrostemma githago*), Horsenettle (*Solanum carolinense*), Purple nightshade (*Solanum elaegnifolium*), Buckhorn plantain (*Plantago lanceolata*), Bracted plantain (*Plantago* aristata), Curled Dock (*Rumex Crispus*), Broadleaf Dock (*Rumex obtusifolius*), Sheep sorrel (*Rumex acatosella*), Wild Turnip or Mustard (*Brassica* spp.), Wild Radish (*Raphanus raphanistrum*).

OBJECTIONABLE WEEDS: Perennial or annual sedges other than nutgrass, and Dichondra spp.

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1. Sampling and Packaging of Planting Stock:

(1) A representative two-pound samples of the planting stock in condition for sale shall be taken at some time during the diggingseason by an authorized representative of the certifying agency at the time that the material is being packaged. Visits of the inspector shall be unannounced.

(2) Special moisture-proof bags are required to ship certified turf grass stolons to out-of-state locations. This will insure delivery of satisfactory stolons which would otherwise dry out in hot weather.

RESULTS OF THE TURFGRASS SOIL FERTILITY TESTS

James M. Latham, Jr. 1/

One of the pet projects of any experimental worker is the fertilizer tests. In any crop you can name everyone who has ever worked with it has, at one time or another, conducted a fertilization test. The same is true with turfgrasses. The reason for so many seemingly repetitious tests is that results have been variable. The variations occurred due to soil variations, climatic differences, and manufactureres changes, not to mention the previous land usage and the new grasses being released by Experiment Stations throughout the country. We all know that fertilization is carried on to make green plants grow. What else besides fertilization is required?

1. Size and condition of plant, efficiency of variety, defoliation and insect and disease damage.

2. Water.

3. Air.

4. Light.

5. Temperature.

6. Fertilizer elements as nitrogen, phosphorus, potash, calcium, magnesium, sulphur, and minor elements.

This brings in the law of the minimum. "The amount of plant growth is regulated by the factors present in the minimum amount and rises and falls accordingly as this is increased or decreased in amount."

Green plants manufacture their own food from the above mentioned "raw materials". The rate of growth can be no faster than food manufactured so if one factor is lacking, plant growth will be reduced by that amount.

To what extent does fertilization fit into this picture? We know that fertilizers must be added. Now we want to know the amount to apply and the frequency of applications. To arrive at a partial answer, a soil test is necessary. This shows general fertility condition of the soil. In the Georgia test, analysis is made for soil acidity, the available potash, phosphate, and calcium in the soil. No test is known that will satisfactorily indicate the true amount of available nitrogen as it will vary from day to day and hour to hour. Taking these into consideration, now let us find out what produces high quality Bermudagrass turf.

1/ Former Assistant Turf Specialist, Georgia Coastal Plain Experiment Station, Tifton, Georgia, now Assistant Agronomist, United States Golf Association Green Section, Northeastern Region, Rutgers University, New Brunswick, New Jersey.

Table I will give us the partial results of a fertilizer factorial conducted in Tifton, from September 1954, to April 1956. Nitrogen, phosphate, and potash were applied at monthly intervals during the growing season at 1/4, 1/2, and 1 pound per 1,000 square feet in all combinations. Certain two-pound rates were applied in order that we may obtain a very high nitrogen source, phosphate source, and potash source. Table I will give the turf quality ratings as effected by each material when both the others were present in varing amounts. You will notice that the potash and phosphate had very little to do with the turf quality as their rates increased. But from 1/4 pound of nitrogen to 2 pounds of nitrogen per 1,000 square feet per month you will notice that the ratings went from 3.3 to 1 or slightly over 1. These ratings are based on a standard of 5 for very poor, and 1 for excellent turf quality. No yields are recorded - only the quality of the turf which includes color, density, etc. The no-fertilization plot was very thin, had a poor color, and was generally of very poor quality.

Table I. Turf Quality of Tifgreen Bermudagrass As Effected by Fertilization.

Rate of Nutrient per Month	Average Rating*	
	June 1, 1955	October 31, 1955
1/4 lb. Nitrogen	3.3	3.3
1/2 "	2.7	2.5
1 "	1.7	1.4
2 "	1.1	1.0
1/4 lb. Phosphate	2.7	2.3
1/2 "	2.4	2.5
1 "	2.6	2.5
1/4 lb. Potassium	2.6	2.4
1/2 "	2.6	2.6
1 "	2.5	2.4
No Fertilization	5	5

* 1 = excellent, 5 = poor

We have said that phosphate and potash had little to do with turf quality. Let us look at the influence of phosphate and potash on turf quality when compared to plots which had no phosphate or potash applied. Table II will give this information. We have two ratings here comparing the June 1, rating with the October 3, rating. You will notice that in June the presence of phosphate and potash had little to do with the turf quality. But after it had gone through one complete growing season, look at the difference in the October ratings. Where phosphate and potash were available, the turf quality increased proportionately to the increase in nitrogen. Without phosphate and potash turf quality remained average or poorer than the above mentioned June ratings. This is due to the exhaustion of phosphate and potash in the soil after a complete growing season had gone by. This will indicate to the persons producing good turfgrasses that he must not only supply a high amount of nitrogen but the fertilization must also be balanced in such a way that an adequate supply of phosphate and potash will be present at all times.

Table II. Influence of Phosphorus and Potash on Turf Quality.

Rate of Nitrogen	Average ratings*	
	With P & K	Without P & K
June 1, 1955		
1/4 lb./1,000 sq. ft.	3.3	3.3
1/2 "	2.7	2.6
1 "	1.7	2.6
2 "	1.1	1.0
October 3, 1955		
1/4 lb./1,000 sq. ft.	3.3	3.0
1/2 "	2.5	2.3
1 "	1.4	3.3
2 "	1.0	3.0

* Ratings: 1 = excellent, 5 = poor

A sideline to turf quality is the production of seedheads. On Tifton 127 (Tiffine Bermuda) a large amount of criticism has been voiced because it produces seedheads. Tifgreen Bermuda (which will be released at the end of this Conference) will also produce seedheads. Let's look at a particular aspect of seedhead production. Table III shows the seedhead production in comparison with the fertilization rate applied. Notice that the no fertilization plot had a rating of 4. This was on the objectionable side and showed quite a number of seedheads. However, the 2 pounds of nitrogen per 1,000 square feet per month had very few seedheads present on a 5 x 10 plot, which would not be objectionable in any stretch of the imagination. Phosphate and potash had very little to do, if anything, with seedhead production.

Table III. Seedhead Formation on Bermuda as Influenced by Fertilization.

Rate Nutrient per month	Average Rating *
1/4 lb. Nitrogen	3.3
1/2 "	3.0
1 "	1.6
2 "	1.1
1/4 lb. Phosphate	2.4
1/2 "	2.7
1 "	2.8
1/4 lb. Potash	2.6
1/2 "	2.9
1 "	2.4
No Fertilization	4.0

* Ratings: 1 = no seedheads, 5 = very objectionable number

In Table IV we see what happenedto the seedhead production when we had phosphate and potash and when we did not. With P and K present an increase in nitrogen reduced the number of seedheads. Without P and K we also got a reduction in the number of seedheads, but it was not as striking as when the phosphate and potash were present. So there we see that the amount of nitrogen is the primary controlling agent of seedhead production.

Table IV. Influence of Phosphorus and Potash on Prevention of Seedheads.

Rate of Nitrogen	Average ratings *	
	With P and K	Without P and K
1/4 lb. per 1,000 sq. ft.	3.3	3.3
1/2 "	3.0	4.3
1 "	1.6	3.6
2 "	1.0	1.3
0 "	4.0	

* Ratings: 1 = no seedheads, 5 = very objectionable number.

Now then to consider this fertilization from another angle. Let's say something about the pH of the soil. Table V shows what happens to soil when any change in the natural pH occurs. In 1947 Mr. Robinson attempted to change the acidity level of the Tifton soil which was usually around 5.5 to 6. He applied quite a lot of sulphur, a little bit of lime and a whole lot of lime to this soil and ran a soil test after the soil had recovered somewhat from the treatment. Note the pH of the sulphur-containing soil was 3.8 and the natural soil was 5.6, low lime 6.0, and high lime 7.0. But look at 1948, what one years change had occurred. The sulphur containing area or the acid soil had risen in pH by .6. The high lime soil had lowered in pH by .6. This will indicate the buffering action of the soil, i.e. the tendency for soil to go back to its natural acidity level due to certain activity in the soil solution. This will illustrate one reason why we must maintain a periodic soil testing on all our lawns, putting greens, fairways, etc. to maintain the correct soil acidity.

One treatment is not sufficient and must be repeated every two or three years to maintain the proper acidity level for the grasses to be grown.

Table V. Buffering Action of Tifton Sandy Loam Soil.

Treatments	Average pH Levels 1947	1948
Sulphur	3.8	4.4
Natural Soil	5.6	5.7
Low Lime	6.0	5.9
High Lime	7.0	6.4

Another aspect of soil acidity is the action of the nitrogen fertilizer sources on the pH. Table VI will show the effect of nitrogen source on soil pH. In this test two sources of nitrogen were applied at the rates of 1, 2, and 4 pounds per 1,000 square feet, and reapplied as indicated by the plot which had been supplied the lowest rate of nitrogen. You will notice that as the nitrogen application was increased by ammonium nitrate, the soil pH was reduced. Milorganite, however, showed no appreciable effect on soil pH. This is true of ammonium sulfate, as well as ammonium nitrate, These two fertilizers especially show a tendency to produce an acid soil. Nitrate of soda, on the other hand, will have the reverse action. It will produce a basic condition in the soil due to the sodium present. The Milorganite and the organics seem to have very little effect on soil pH. Here is something else that we might consider while we are talking of soils in relation to fertilization. We have noted in the past that the fertilization of grasses has a definite effect on the potash content of soil, especially this is true primarily when the clippings are removed.

Table VI. Effect of Nitrogen Source on Soil pH.

Lbs. Nitrogen Per 1,000 square feet	Ammonium nitrate 1950	Ammonium nitrate 1951	Milorganite 1950	Milorganite 1951
1	5.8	6.1	6.0	6.3
2	5.7	5.8	5.9	6.2
4	5.1	5.3	6.5	5.9

The next table (Table VII) will show the effect of the three nutrients on the potash level of the soil. Notice that as potash applications are increased, the potash level in the soil is increased. This is a natural assumption that must be made. Going back up the list, notice that phosphate applications have very little effect on the soil potash except when phosphorus is applied only at the lowest level. The striking thing is the effect of nitrogen on potash level of the soil. Notice as the nitrogen is increased the potassium level is decreased. This is probably due to the increased growth of the plants causing greater potassium uptake and as the grass clippings are removed from the soil there is no addition, hence, the reduction in the soil potash level. Some of our fertilizer recommendations have completely eliminated phosphate from the soil because it does remain there more than potash and has very little leaching potential. Potash, however, is utilized quite readily by the plant. It is also leached from the soil and unless it and nitrogen are applied, there will soon be a deficiency showing up within the plant. We have said that there was leaching and that potash was taken up by the plants quite readily.

Table VIII will show the effect of ammonium nitrate and Milorganite on the potassium content of grass clippings. (This is from some of Mr. Robinson's work in 1952.) The treatment on the left were potassium content of the clippings. These figures come from a chemical analysis of the clippings. Note that as the ammonium nitrate was applied with the various levels of potash, 0, 50, and 100 pounds per acre, the potassium content of the clippings was increased. But very little is seen in the Milorganite. They are all high and remain that way. This is possibly due to the increased amount of clippings coming from the ammonium nitrate source. We have seen in some of our test that ammonium nitrate will cause a tremendous surge of growth at which time the potash is removed rapidly from the soil.

Table VII. Effect of Nitrogen, Phosphorus, and Potassium on Potassium Level of Tifton Sandy Loam Soil.

lbs. per 1,000 square feet	lbs. Potassium per acre
Nitrogen	
1/4	51.7
1/2	45.5
1	36.7
2	35.1
Phosphorus	
1/4	51.1
1/2	41.0
1	42.8
Potassium	
1/4	25.0
1/2	39.0
1	71.0

Table VIII. The Effect of Ammonium Nitrate and Milorganite on Potassium Content of Grass Clippings (1952).

Treatment	Potassium Content of Clippings (percent)
Ammonium nitrate plus	
50 lbs. K per acre	1.53
100 lbs. K per acre	1.55
No Potash per acre	0.98
Milorganite plus	
50 lbs. K per acre	1.68
100 lbs. K per acre	1.73
No Potash per acre	1.44

Milorganite, however, will have a more prolonged type growth of usage by the plant. It will not become available as rapidly as the ammonium nitrate and will probably not produce the surge of growth that is caused by the ammonium nitrate, therefore, it will maintain the potash level in the grass and in the soil for a longer period of time.

There is one thing that we should add to this. In 1954 which was our drought year in Tifton, we established the test using seven different types of nitrogen fertilizers - ammonium nitrate, sodium nitrate, Milorganite, Guanidine nitrate, urea, Uramite, and calcium cyanamid. In this test three pounds of nitrogen were applied at one time and no further nitrogen was applied during that growing season. Part of the test was irrigated and part was not irrigated. The results we obtained were based on a clipping basis only, i.e. no ratings were made for color, sod density, weed control, or any of the turf quality factors which we know to be important. It was strictly on yield of clippings per plot basis. The data indicated that the inorganic types, i.e. ammonium nitrate, nitrate of soda, and urea fertilizers produced a very rapid utilization by the plant. They gave a great surge of growth immediately and then began slowing down in their activity. The organics(and the synthetic organic types) did not give this tremendous surge, but did begin slowing down in growth about the same time that the inorganic types did. At the end of nine weeks, there was no more growth on any of the fertilized plots than in a check plot which had received no nitrogen whatsoever. This type of results was obtained not only on the irrigated area but also on areas which received no water whatsoever during that dry spell and the fertilizer was not even watered in. Of course, the unirrigated areas did not produce nearly the amount of growth that the others did, but the trend was the same. Now we do not say that this is what happens in this area all the time. The results were so astounding,in fact, that we are preparing at this time to establish a test using each of the general types of nitrogen fertilizer, that is an inorganic and organic and a synthetic organic. In this test we will attempt to measure the factors which will make-up turf quality. Clippings will also be taken. This will be maintained as a putting green, home lawn, and fairway. We hope to carry this test over a three-year period if we have proper support for the program. With results from this test, we will be able to report something on the action of nitrogen fertilizers and be able to go into more detail. So now what do we have as far as fertilization is concerned? We know that the soils must be checked at regular intervals to make sure that the pH has not reverted to the natural acidity of the soil. We know that the changes will vary according to the source of fertilizer nutrients.

We know that nitrogen is a must for producing high quality turf. We also know that without phosphate and potash, the high nitrogen can produce disasterous results not from burning but from deterioration of the turf due to lack of balance in the fertilizer mixture.

We know that in some instances the organics and synthetics will produce the desired results, and that other times the inorganic type will give almost the same long-lasting results so now we are right back where we started. We have variations and cannot say for sure that a certain thing is going to be true next year like it was this year, so we go back to our saying when we started that people will be conducting fertilizer tests with turfgrass for a good while to come.

Our only request is that soil tests be made. This is the only way we can be sure that the soil contains enough phosphate, potash, calcium, magnesium and other necessary elements, and that the acidity level is not low or high for the grasses desired.

Nitrogen levels should be applied at regular intervals so that a regular pattern of grass growth is obtained. In this way, the maintenance program can be better designed to take care of the clipping of the grass and other maintenance practices. If the nitrogen level is allowed to reduce drastically, there will be an increase in weed invasion. The turf will be thin, poor, and more subject to disease. If then, nitrogen is applied and you get a tremendous surge of grass, there is a soft succulent type of growth which is also suceptible to disease and will work the "daylights" out of a man on a mower. If, however, an adequate supply of nitrogen is applied at regular intervals, maintenance can be carried out on a regular schedule and the grass growth can be fairly well handled, producing a dense, well-colored growth which will be less suceptible to disease or to weed invasion.

SOIL STERILIZATION PRACTICES IN TURF

Gene C. Nutter 1/

The control of soil borne pests is becoming one of the most critical problems in turf management (5). The propagation of turfgrass nurseries, the construction of golf greens and tees, and the establishment of improved lawns are examples of situations where these pests are threatening. Soil sterilization practices hold the answer to such problems in many cases and should be more widely utilized as a turf production tool.

WHAT IS SOIL STERILIZATION?

At one time soil sterilization referred largely to the control of weed pests (7). Today, this field has been broadened to include eradication or control of any major class of soil borne pests. Included would be weeds, weed seeds, nematodes, insects, and plant diseases as they occur in the seed or plant bed prior to planting. The control of nematodes or broadleaf weeds in established turf would be considered as nematocidal and herbicidal rather than sterilization problems.

Soil sterilants may be classified as selective or non-selective. Selective type materials are effective against only certain kind (or kinds) of pests. For example, some chemicals will control weed seeds in the soil but not nematodes. Some sterilants are even more specific, being effective against broadleaf weeds, but not grasses. On the other hand, non-selective materials render the soil sterile to all forms of living matter. There is need in turf for both selective and non-selective types of sterilants depending upon the proposed use of the turf and the particular pests involved.

Sterilants may be classified further as temporary or permanent. A temporary sterilant will kill the pests involved in short order. Soon thereafter the material will lose its effectiveness through decomposition, vaporization, leaching, or soil fixation. On the contrary, the effect of the permanent soil sterilant is retained in the topsoil for a long time. This long period of residual sterility renders the soil unfit for use for such an extended period that this class of sterilants is usually impractical where efficient turf propagation or production is involved. As a result this discussion will deal only with the temporary class of sterilants.

WHERE IS SOIL STERILIZATION NEEDED?

Obviously sterilization is not needed everytime a new turf is planted. It would not be practical to recommend methyl bromide sterilization of a forty-acre nursery of Zoysia or Bermudagrass if broadleaf weeds were the principal pests. One of the 2,4-D type herbicides applied after planting would offer by far the simpliest

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and cheapest control. There are many cases, however, where the problems are more complex and where soil sterilants are needed.

In fact, sterilization should be considered in planning for the development, and construction, or renovation of any turf project. If after careful examination no serious pest problems exist, or if anticipated problems can be satisfactorily handled otherwise, sterilization will not be needed. Care must be taken, however, to see that the need for sterilization is carefully studied. The "ounce of prevention" afforded by sterilization may seem costly. Nevertheless, if this process is omitted and serious pest problems later develop, other corrective measures may prove far more expensive in the long run, and turf quality may never reach its potential.

Weed control is probably the primary need for soil sterilization in turf. Common Bermudagrass, nutgrass, Dallisgrass, and other Paspalum species, pennywort, water sedge, and dichondra are major noxious weeds in turf. All are more or less difficult to control. Most of these are perennials which spread from both seeds and vigorous growing rhizomes. In addition there are many common, but less serious weed pests which will be controlled incidentally by suitable sterilization measures. Where these and other serious weed pests occur, soil sterilization should be considered an essential part of the propagation program.

Nematodes are now recognized to be serious parasites on turfgrasses in the Lower South. The well-known "root knot" group of nematodes has been a serious parasite on many kinds of plants for years, but has not been a problem in turf. Recent work in Florida (1) (3) (4) (6) has shown that Sting (Belonalaimus gracilis), Stubby-root (Trichodorus spp.) Lance (Hoplolaimus coronatus), Dagger (Xiphenema americanum) and Ring (Criconemoides spp.) nematodes are encountered frequently in areas of damage or reclining turf. All major species of turfgrasses appear to be susceptible to damage. Undoubtedly other parasitic species will be found as this new field of turf investigation continues.

In areas where proper diagnosis has established nematodes to be parasitic on turfgrasses, it may be futile to attempt turf reestablishment without nematode control. Fortunately a number of good nematocidal type sterilants are available. As nematode damage becomes more extensive, more consideration will need to be given to the use of such materials. While information is relatively limited as to the ecology of these worm-like microbes, it is known that they may be readily disseminated by the movement of topsoil and topdressing materials, sod, and other forms of turf and equipment.

Normally insects are not considered important in the consideration of soil sterilization in turf. In general, most insect pests can be controlled by routine insecticide measures. Nevertheless, certain soil borne insects are becoming of considerable importance in turf propagation. Ground pearls are becoming more prevalent and damaging centipede and Zoysia grass turf in Florida, Georgia, and Alabama. Since conventional insecticides have not given control of these subterranean scales, soil sterilization is being considered. In cases where St. Augustine grass is being replanted in areas formerly destroyed by chinch bugs, soil sterilization may be used as a safeguard against reinfestation.

Plant diseases are not known to cause serious concern in turf propagation at the present time. Accordingly, disease control does not compel serious consideration in the selection of soil sterilants although some of the materials effective on other classes of soil borne pests are also good fungicides.

SELECTING THE STERILANT

Since a number of soil sterilants are available (and the number is increasing steadily) and since these materials vary greatly in properties and usefulness, the choice of the best sterilant for a given situation may become a problem. A number of factors may enter the matter of selection. Among them would be (1) toxicity, (2) adaptability, (3) cost, (4) residual period, and (5) hazard.

1. Toxicity

As mentioned, sterilants vary widely in their chemical and physical properties, mode of action, and degree of selectivity. These and other factors determine the toxicity of a given material. Some chemicals are toxic in their natural forms, (allyl alcohol, methyl bromide, D. D., etc.). Other materials depend on decomposition products for sterilization properties (Vapam). With still other materials the decomposition products may be retained in the soil for considerable periods as harmful residues to certain crops (calcium cyanamid (2). A change in the physical state of a chemical may improve the effective toxicity. Methyl bromide is formulated as a liquid, but when the pressure in the container is released, it reverts to the gaseous form and readily penetrates the upper soil layer.

The range and degree of selectivity is of paramount importance in selecting a sterilant. Within the herbicidal class of sterilants, materials are quite specific in the degree of control of certain weeds. Some species of nematodes react differently in their susceptibility to D.D. and E.D.B.

To avoid useless expenditure of money and labor for soil sterilization, it is necessary to have a thorough knowledge of the toxic properties of the material. In case of experiment materials, where general recommendations are not available, it would be wise to carefully test the materials under local conditions before attempting extensive usage.

2. Adaptability

Some sterilants are more adaptable to one kind of operation than another. Because of chemical cost, equipment involved and time and labor required, it is not practical to consider some sterilants for extensive field work. On the other hand these same materials may fit readily into a soil bin or compost operation. The physical state or condition of the sterilant may render it more suitable for a particular kind of operation. For example, fumigant type materials such as steam or methyl bromide are most effective for compost or bin sterilants. Here the higher operations cost is justified by the quick, effective job accomplished. For some types of compost sterilization, solid materials such as calcium cyanamid and uramon are used. However, these materials are not effective on the more serious southern weed pests such as nutgrass and Bermudagrass. In general, liquid materials are more suited for field sterilization than for bin or compost work.

Ease of application is another factor to be considered in adaptability. Some sterilants require complex and lengthy procedures such as covering the soil or applying a water seal. Other materials need specialized equipment such as release adapters in the case of gasses, and drop or plow sole applicators in the case of liquid materials. With still other chemicals only a simple spreader or sprayer may be required for application. Some liquid materials are now being applied through irrigation systems. Where adaptable this latter method is probably the simplest and least expensive means of applying sterilants.

3. Cost

Chemicals, labor and equipment must all be considered in estimating the cost of a sterilization operation. The cost will vary widely according to the chemical used, the size of area treated and the nature and degree of pests involved. Since sterilization may affect production costs considerably, it is important to carefully evaluate this practice in terms of the value and importance of the end product. In the case of turfgrass nurseries, putting green construction and lawns planted to the more expensive grasses, sterilization costs are usually justified if the sterilant is carefully selected and effectively used. In many cases the initial cost of sterilization will be returned several fold in the form of improved turf quality and reduced maintenance costs.

4. Residual Period

This term refers to the waiting period required between treatment and planting to allow for dissipation of the sterilant. This time factor is of great importance in field sterilization because of the cost and inconvenience involved in holding extensive areas out of production during the sterilization operation. Similarly, storage space may become a factor in bin or compost sterilization if the residual period is unreasonably long.

Residual periods vary from a few hours in the case of steam to several months with the slower materials. Soil type, temperature and the method of application are factors which may affect the residual period of any given sterilant.

The residual period for the given soil and climatic complex must be thoroughly known for each chemical. Valuable turf may be killed if planted before the toxic properties of the chemical are allowed to dissipate. On the other hand, there is no point in holding up propagation any longer than necessary. Periodic planting of susceptible crops such as radishes or tomatoes in the sterilized area will indicate when planting may be started safely.

5. Human Hazard

Toxicity to man and/or animals may be the deciding factor in choice of a soil sterilant. Some materials are too hazardous for use in public areas, but may be adapted to isolated field operations where specialized application equipment can be used. Allyl alcohol is such a material. It is a sever lachrymator (tear producing substance), and is a deadly poison. Complete protective clothing should be used whenever allyl alcohol is handled. Methyl bromide is also a serious poison but it is merchandized in such a form that the risk to the user is greatly reduced if normal precautions are followed. Other materials such as D.D. and E.D.B. do not offer use hazards if reasonably handled.

SOIL STERILANT MATERIALS

While none of the available sterilant materials meet all of the desired requirements, some offer certain features which should render them useful in the turf management operation. Table I summarizes some of the comparative characters of a number of sterilants, new and old.

Since soil sterilization has been largely overlooked as a turf management tool in the South, information is lacking on adaptability and effectiveness of many of these materials. To avoid serious turf damage or useless expenditure of money and labor it is necessary to have a thorough knowledge of soil sterilization principles and materials. When complete information and recommendations are not available, it would be wise to carefully test under local conditions any contemplated soil sterilization practices before attempting extensive usage.

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Table I. Comparative Characteristics of Soil Sterilants for Turf

Gene C. Nutter

Sterilant	Relative Toxicity: Weeds — Bermuda Nutgrass Paspalum spp.	Weeds — General Broadleaf Types	Weed seeds Miscellaneous	Nematodes
Allyl Alcohol	Questionable	Fair	Fair to good	No
Calcium Cyanamid and Uramon	Poor	Fair	Fair to good	Questionable on turf nematodes
Chloropicrin	Very good	Good	Good	Very good
D.D.	No	No	No	Good
EDB	No	No	?	Good
Methyl bromide preferably with Chloropicrin as warning agent	Very good	Very good	Very good	Very good
Steam	Very good	Very good	Very good	Very good
Dalapon	Promising but needs more research	No	Research needed	No
Vapam	Promising but more research needed	Promising but more research needed	Promising but more research needed	Promising but more research needed
Nemagon	No	No	No	Ditto
VC-13	No	Not generally	No	Ditto
Alanap	No	Not generally	Promising but more research needed	No
SES (Craig Herbicide I)	No	No	Promising but needs more research	No
Craig 974	Promising but more research needed	Promising but more research needed	Promising but more research needed	Promising but more research needed

Table I. (Continued)

Sterilant	Residual Period	Form and Ease of Application	Adaptability: (Field, lawn, or compost)	Relative cost	Human Hazard
Allyl Alcohol	10-14 days	Liquid-requires water seal	Field	Moderate to high	Very toxic-Difficult to handle
Calcium cyanamid and Uramon	2-6 months	Dry spreader	Field, Compost or Lawn	Moderate	Non-toxic
Chloropicrin	7 days	Liquid-requires air-tight cover or water seal	Field	Very high	Poisonous (Tear gas)
D.D.	14 days	Liquid-requires air-tight cover or water seal	Field Lawn	Cheapest	Not serious
EDB	10-14 days	Liquid-plow sole application or injection	Field Lawn	Cheap	Not serious
Methyl bromide preferably with Chloropicrin as warning agent	2-4 days	Gas-requires air-tight cover and special adapters	Compost-Intensive field operations	Very high	Poisonous
Steam	4-6 hours	Gas-requires special equipment -Laborious	Compost Limited field use	Very high for initial equipment	Non-poisonous
Dalapon	14-28 days	Spray	Field, lawn	Moderate?	Not serious
Vapam	14-21 days	Spray	Field, lawn	High	Irritating to eyes
Nemagon	0	Spray	Field, lawn	High	Not serious
VC-13	0	Spray	Field, lawn	High	Not serious
Alanap	? Research needed	Spray	Field, lawn	Low	Not serious
SES (Craig Herbicide I)	? Research needed	Spray	Field, lawn	Low	Not serious
Craig 974	14-21 days	Dry spreader	Field, lawn	?	Not serious

A REPORT ON PLANT INTRODUCTION

J. L. Stephens 1/

Color slides selected to illustrate grass collections and introductions from several foreign countries, through the office of the Plant Introduction Section, United States Department of Agriculture, were shown.

The purpose of plant introduction is to bring in desirable economic plants. There are also responsibilities of not bringing in pest plants, diseases or insects.

Field collections are made of seeds or plants which pass through quarantine upon arrival.

Notes accompany all introductions describing plants, location of collection, soil, climate, and other information that may be pertinent in cataloguing the plant's usefulness.

Plants in general are easier to move away from the tropics than toward the equator because with the former, temperature is the main limiting factor, while with the latter, many factors are involved including temperature, increased diseases and insects, also weed competition.

Most of the grasses of economic importance in the Southeast are introductions — Carpetgrass from West Indies, Bahias from South America, Bermudas from Africa and India, Zoysia from The Orient, etc.

One of the purposes of early exploration by man was to bring together more food plants, indeed, present civilization's high standard of living and varied diet depends on the great number of economic plants available.

Introductions of variations within the same genus and even species is valuable for plant breeders in shaping varieties for special requirements.

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RESULTS OF TURF DISEASE SURVEY AND CONTROL STUDIES 1/

Homer D. Wells 2/

While attending your Sixth Southeastern Turf Conference in the spring of 1952, it was surprising to learn that there were only two commonly recognized turf diseases. These diseases were fairly clear-cut and distinct and could readily be recognized. The first of these diseases was called "DOLLAR SPOT", which was characterized by causing a spot in the turf about the size of a silver dollar (plus or minus fifty cents). The second of these diseases was "BROWN PATCH", which caused a spot in the turf larger than that allowed for "Dollar spot." Even more surprising was the fact that these diseases did not always respond to treatments known to be effective against them.

Since 1952 the general knowledge about turf diseases in the South has increased significantly. This information has come from various sources including disease-survey work and fungicidal evaluation studies. The disease-survey work has included a study of numerous diseased turf samples received from golf courses, grass nurseries, professional gardeners, and home owners from Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, North Carolina, and South Carolina. The fungicidal evaluation studies have included a wide variety of fungicides on some of the most destructive turf diseases under experimental conditions at Tifton and Sea Island, Georgia, as well as the effectiveness of recommendations for the control of known diseases throughout the Southeast. On the latter phase of this work, generous use of the back-log of research information available from other sections of the country on the control of specific diseases has been used as a basis in making recommendations.

1/ Cooperative investigation at Tifton, Georgia, of the Field Crops Research Branch, A.R.S., U.S.D.A., the University of Georgia Coastal Plain Experiment Station, and the U.S.Golf Association.

2/ Agent Pathologist, Field Crops Research Branch, A.R.S., U.S.D.A., Tifton, Georgia. The author wishes to acknowledge Mr. B. P. Robinson, Regional Director, U.S.Golf Association, and Mr. J. M. Latham, former Assistant Turf Specialist, University of Georgia Coastal Plain Experiment Station, who are responsible for a large portion of the work reported herein. The author also wishes to acknowledge the Upjohn Company and the W. A. Cleary Corporation for grants-in-aid which made possible the investigations on disease control.

DISEASE SURVEY

In Table I is presented the 10 most common turfgrasses used in the South, along with the number of diseases known to attack each grass in the United States and the number of diseases which cause serious damage to the turf. Although a number of factors enter into the use of the different grasses for turf, susceptibility to disease is frequently a limiting factor in the use of an otherwise useful grass.

Following is a list of the turfgrasses, along with their most serious diseases and the importance of the disease in the South:

1. Centipedegrass

There has been no serious disease damage reported on this grass. However, samples have been received which were attributed to Pearl bug damage but the Entomologist could not find a sufficient number of insects to diagnose Pearl bugs as the major source of damage to the root system. This suggests that a root-rotting fungus or nematodes may be a serious post of Centipedegrass in some instances.

2. Carpetgrass

A number of organisms which are damaging to other turfgrasses have been reported as occurring on Carpetgrass, however, they do not cause noticeable damage to turf.

3. Bahiagrass

Common Bahiagrass is susceptible to Helminthosporium "eyespot" and "culmrot", which may result in a very unsightly turf.

4. St. Augustinegrass

The most prevalent disease of St. Augustinegrass is "gray leaf spot" caused by *Piricularia grisea*. This disease is omnipresent on St. Augustine. The disease may be of only passing interest, in some instances, whereas it is frequently responsible for unsightliness and loss of turf over large areas. St. Augustine is very susceptible to *Rhizoctonia solani*, causal organism of "Rhizoc" or "brown patch", and cannot be successfully grown on soil infested with this organism without following a rigid spray schedule.

5. Tall fescue

The most common disease on tall fescue is "net blotch" caused by *Helminthosporium dictyoides*. This disease has been observed killing out large areas of seedlings during the fall. Another Helminthosporium *H. sativum* has been observed as causing "culmrot" on tall fescue turf and completely killout out numerous small areas. Tall fescue is extremely susceptible to "Rhizoc" or "brown patch", and this disease is a major factor limiting the desirability of tall fescue for turf in the South.

6. Bermudagrass

Three Helminthosporium diseases, caused by H. rostratum, H. cynodontis, and H. triseptatum, have been observed causing considerable damage as "leaf spot" and "turfspots" on different strains or varieties of Bermudagrass grown for turf. Nematodes are serious pests of Bermudagrass turf and represent a number of distinct diseases but are (for convenience only) treated as one disease at this time. Four diseases have been listed as serious on Bermudagrass. The recent release, however, of a new variety of Bermudagrass called "Sunturf", which is extremely susceptible to "rust", makes it necessary to mention "rust" caused by Puccinia cynodontis as being a potentially very destructive disease of Bermudagrass turf.

7. Zoysia

It may be noted in Table I that 8 diseases are reported as occurring on Zoysia and that a question mark is placed for number of serious diseases. The 8 diseases represent different organisms which have been associated with localized dying of Zoysia turf and may or may not become major pests as the acreage of Zoysia is increased throughout the South. These organisms include: (1) Helminthosporium spp., (2) H. triseptatum, (3) Curvularia lunata, (4) Fusarium moniliforme, (5) Rhizoctonia solani, (6) Papulosporia sp., (7) Sclerótenia homoeocarpa, and (8) a number of distinct species of nematodes. "Dollar spot" has been observed on Zoysia in the vicinity of Beltsville, Maryland, but has not been found in the Tifton, Georgia, area on Zoysia or any other turf species.

8. Ryegrass

The following 5 diseases are considered serious on ryegrass turf: (1) "cottony blight", which is a seedling disease during the warm humid fall season, (2) "brown patch" or "Rhizoc" which may attack the ryegrass at any stage of growth when temperatures are 70° F. or higher, (3) "crown rust" which is especially destructive of ryegrass at lawn height during the late spring, and (4 and 5) the two "Helminthosporium leaf spots and turfspots" which usually are prevalent from January on throughout the ryegrass season.

9. Kentucky Bluegrass

More diseases (a total of 47) have been reported on Kentucky bluegrass than on any other turf species. Since bluegrass is not usually subjected to the intensive management of some grasses used for golf greens, certain diseases that are serious on other species are not considered as serious diseases of bluegrass turf. The 6 serious diseases are: (1) "brown patch", (2) "dollar spot", (3) "*Fusarisum* root and culmrot", (4) "*Helminthosporium* leaf spot and melting-out" and (5-6) two "rust" diseases. The three most damaging of these diseases in the South are: (1) "brown patch", (2) "*Helminthosporium* leaf spot and melting-out", and (3) one of the "rust" on Merion bluegrass.

10. Bentgrass

Bentgrass has 36 diseases (11 less than Kentucky bluegrass) which include the following 10 that are considered to be serious: (1) "*Curvularium* melting-out", (2) "*Helminthosporium* leaf spot and melting-out", (3) *Fusarium* culmrot and snow mold", (4) "rust", (5) "copper spot", (6) *Pythium* "spot blight" and "cottony blight", (7) "brown patch", (8)"dollar spot", (9) "snow scald", and (10) "fairy ring". The diseases that have been sent to this laboratory for diagnosis include: (1) "brown patch", (2) "*Curvularia* melting-out," and (3) "*Fusarium* snow mold", and (4) one outbreak of "cottony blight" in experimental plots here at Tifton.

Table I. Significance of diseases on the different turfgrasses.

Turf Grass	No. of diseases	No. of serious diseases
1. Centipedegrass	4	0
2. Carpetgrass	14	0
3. Bahiagrass	8	1
4. St. Augustine	10	2
5. Tall Fescue	23	3
6. Bermudagrass	28	4
7. Zoysia	7	?
8. Ryegrass	20	5
9. Kentucky Bluegrass	47	6
10. Bentgrass	36	10

EVALUATION OF FUNGICIDES FOR THE CONTROL OF COTTONY BLIGHT AND *HELMINTHOSPORIUM* TURF SPOTS ON RYEGRASS

1. Cottony Blight

In October of 1953, a fungicidal evaluation study was initiated using the fungicides and rates listed in Table 2. The original design was to spray the plots at 14-day intervals throughout the ryegrass season, however, with the outbreak of "cottony blight", the plots were sprayed two days in succession. None of the treatments prevented destruction of the turf. Control plots were divided in half and treated with two additional materials. Dithone plus Salicylic acid appeared to give some control of the organism but was extremely phytotoxic to the ryegrass. Another area was seeded to ryegrass for an Actidione rate-and-frequency-of-application study. This test also became infected with "Cottony blight" and the different rates of Actidione (0.6 and 1.2 grams per 1,000 square feet) were applied at one and two day intervals over a period of 8 days. There appeared to be no difference in disease development as the result of different rates. As can be seen in Figure 1, every-day application was superior to every-other-day applications which, in turn, was superior to the untreated. Considerable tip-burn was associated with Actidione. The every-day application caused much more tip-burn than every-other day application regardless of rates. The heavier rates, however, caused more tip-burn than the lighter rate. The temperature-disease relationship presented in Figure 1 shows the desirability of delaying the time of seeding until onset of cooler weather, whenever possible.

During the winter of 1953-54, greenhouse tests using naturally infested soil, untreated and treated with heavy rates of methyl bromide, proved that methyl bromide was an effective soil fumigant for removing the "cottony blight" organism from infested top-dressing soil.

Since it has been proven that methyl bromide was effective in preventing the introduction of the "cottony blight" organism in top-dressing soil, the next problem was to determine methods of controlling the organism where it was already present. The "cottony blight" organism was grown on ryegrass seed, then broadcast over an experimental area, worked into the turf with a vertical mowing machine, and overseeded with ryegrass at the rate of 60 lbs. per 1,000 square feet. Top-dressing soil was mixed with the fungicides at rates shown in Table 3. A total of five plots received each treatment. The plots were established on October 10. Cool weather prevailed during most of the time after establishment and the cottony blight failed to develop to the extent seen the year previous. There was some disease development and a count of the number of disease spots per plot was taken on October 31. Table 3 shows that all treatments gave a significant amount of protection when compared with the control and that Capten 50-W gave the best control.

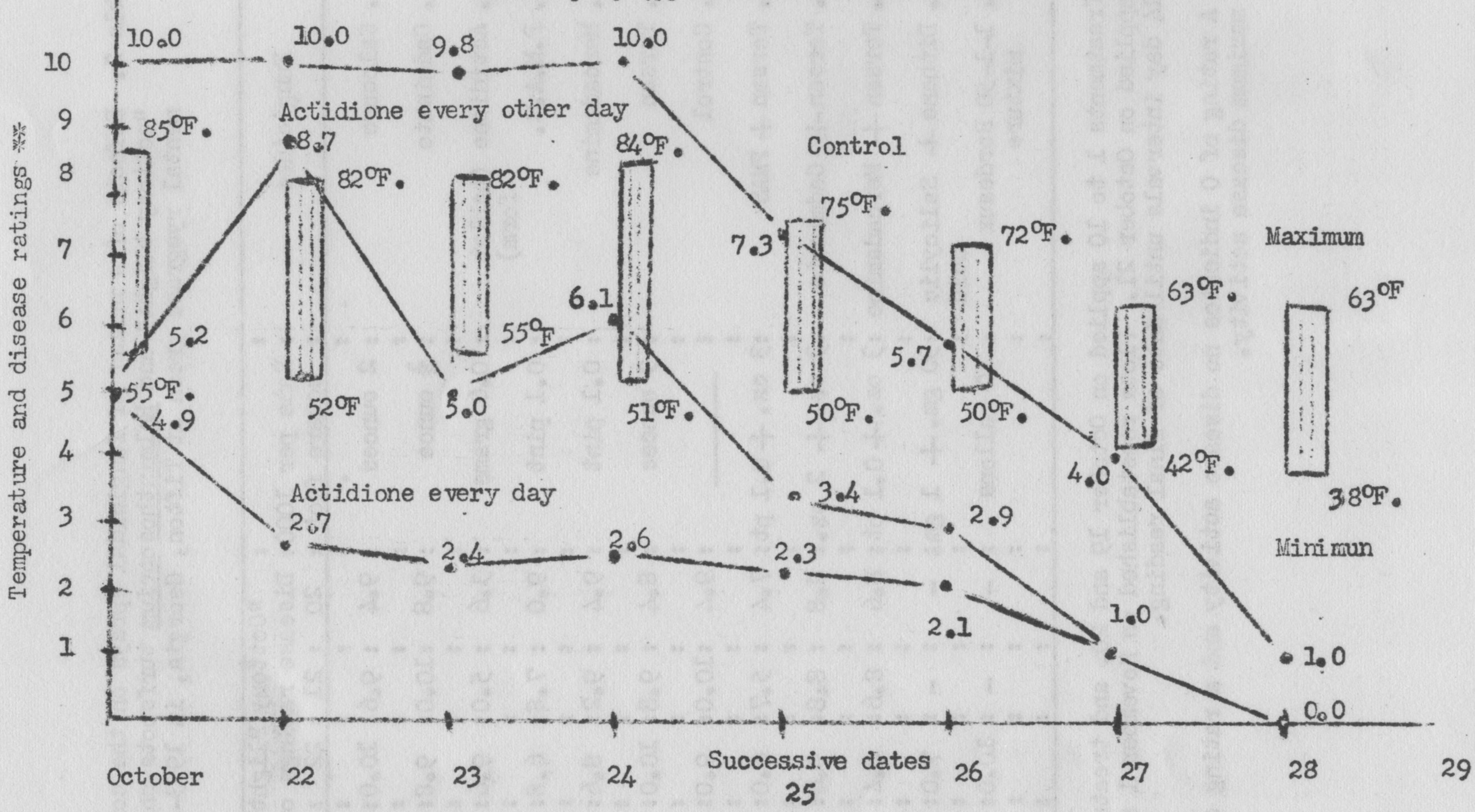
Table 2. Effects of a number of fungicidal sprays on the control of "cottony blight" and *Helminthosporium* turfspots on an experimental ryegrass green at Tifton, Georgia, in 1953-54.

Fungicide*	Rate per 1000 square feet	"Cottony Blight" Disease ratings on Oct.** 20	21	22	23	*H.* turfspot rating on 4-6-54
1. Calocure	2 ounces	9.4	9.6	10.0	9.8	3.2
2. Cadminate	½ ounce	9.8	10.0	9.8	10.0	5.4
3. Actidione (tablet form)	0.6 grams	3.6	5.0	9.6	7.2	4.6
4. P.M.A.S.	0.1 pint	9.0	7.8	6.8	7.0	2.8
5. Mercadamine	0.1 pint	9.4	9.2	8.6	10.0	3.4
6. Tersan	3 ounces	8.4	9.8	10.0	10.0	4.4
7. Control	______	9.4	10.0	9.0	10.0	7.0
8. Tersan + PMAS	3 oz. + 0.1 pt.	7.4	5.7	6.0	6.4	3.6
9. Tersan + Cadminate	3 oz. + 2 oz.	8.8	8.8	9.6	10.0	4.0
10. Tersan + Mercadamine	3 oz. + 0.1 pt.	8.6	8.6	8.4	9.6	3.2
11. Dithane + Salicylic acid	30 gm. + 1 gm.	-	-	7.0	2.0	-
12. 1-1-50 Bordeaux mixture	10 gallons	-	-	10.0	10.0	-

* Treatments 1 to 10 applied on October 19 and 20, and treatments 11 and 12 applied on October 21. Plots reestablished on November 1 and treated at 14 day intervals until date of final reading.

** A rating of 0 indicates no disease activity and a rating of 10 indicates maximum disease activity.

Figure 1. Effects of the frequency of application of Actidione on the control of "cottony blight" of ryegrass on 10-day old ryegrass seedlings. Seeding made on October 12, 1953, with first spray application on October 21.*



* Actidione at rates of 0.6 and 1.2 per 1,000 square feet.

** Rating of 10 indicated maximum amount of disease activity and a rating of 0 indicated no active disease development.

Table 3. Effectiveness of fungicides for the control of "cottony blight" when applied by mixing with the topdressing soil in 1954.

Fungicides	Pounds of fungicide per ton of soil	Ave. no. of spots per plot 21 days after planting
1. Captan 50-W	2	1.25
2. Actidione	1	1.50
3. Crag 531	2	2.50
4. Tersan 75	2	3.50
5. Control	-	8.75

In the fall of 1955 another experiment, similar to the 1954 test, was set up. Rather than mixing the fungicide with the topdressing soil, the seed were broadcast and sprayed with the fungicides at rates listed in Table 4 before topdressing. The plots were topdressed with methyl bromide-treated soil. Plots were subsequently sprayed at 10-day intervals throughout the season at rates listed in Table 4. Plots were established on October 29, 1955, and very little weather favorable for cottony blight occurred after that date. Some disease activity occurred and a count was made on the number of spots per plot 18 days after seeding. The two best treatments consisted of (1) Captan 50-W plus Actidione, and (2) Captan 50-W. Additional compounds in order of effectiveness were (3) Zineb, (4) Actidione (2.4 grams per 1,000 square feet) (5) Vancide 51, (6) Caloclor, (7) Tersan 75, (8) PMAS, (9) Upjohn 2468 WK 34 A, (10) Upjohn 2468 WK B, (11) Kromad, and (12) Actidione (1.2 grams per 1,000 square feet). Some materials were not effective when compared with the control. On the other hand, PCNB resulted in about twice the amount of disease activity encountered on the untreated plots.

During 1954 and 1955 cooperative tests were conducted at Sea Island Golf Club, Sea Island, Georgia. A number of different fungicides were used to treat one-half green per fungicide and the remainder of the greens (with the exception of appropriate checks) were treated with Captan 50-W.

Table 4. Effectiveness of different fungicides for the control of "cottony blight" of ryegrass caused by *Pythium aphanidermatum* and "*Helminthosporium* turf spots" of ryegrass caused by *H. sativum* and *H. siccans* on experimental plots at Tifton, Georgia, during 1955 and 1956. ("Cottony blight" from artificial epidemic. "Helminthosporium turf spots" from natural infection)

Fungicide	Rate per 1,000 sq. feet * First application sprayed on seed	Subsequent application sprayed on turf	Ave. no. of disease spots per plot 18 days after seeding	April 2, 1956 ** Ave. disease rating	Ave. turf rating
1. Control	-	-	14.0	8.8	6.0
2. Kromad	8 oz.	4 oz.	9.2	5.2	2.8
3. Caloclor	4 "	2 "	6.4	6.2	4.4
4. PMAS	3 "	1½ "	7.2	6.6	3.8
5. Cleary's (Exp.)	16 "	8 "	16.2	Discontinued	-
6. Vancide 51	24 "	12 "	6.2	3.0	1.6
7. Tersan 75	12 "	6 "	7.8	4.6	2.6
8 Zineb (z-78)	12 "	6 "	3.2	4.8	2.4
9. Captan 50-W	16 "	8 "	2.0	4.8	3.2
10. Actidione A ***	1.2 gr.	0.6 gr.	9.6	9.2	7.4
11. Actidione B	2.4 gr.	1.2 gr.	5.2	9.0	5.8
12. Captan 50-W plus Actidione	16 oz. + 1.2 gr.	8 oz. + 0.6 gr.	0.4	6.0	4.6
13. Actidione dust (1%)	120 gr.	60 gr.	16.9	8.8	6.0
14. Upjohn Exp. 2468 WK34 A	80 gr.	40 gr.	7.8	9.8	7.0
15. Upjohn Exp. 2468 WK34 B	160 gr.	80 gr.	9.0	9.8	7.8
16. PCNB	12 oz.	6 oz.	30.4	10.0	9.4

* First application on date of seeding. Subsequent rate at 10 day intervals.

** One represents desirable rating and 10 represents most undesirable rating.

*** Actidione A and B are tablet form and differ only in rates. Indicated rates of Actidione A and B are rates of active materials. Rates of all other compounds are rates of formulations.

The disease was very severe and no treatments gave satisfactory control during 1954. Vancide 51 and Captan 50-W were the two most promising treatments in 1954. Due to a shortage of other materials, Captan 50-W was used as follow-up sprays on all treatments, thus limiting the value of the test. In 1955, Phygon XL, Captan 50-W, and Vancide 51 were effective with Phygon XL apparently giving the best stand of ryegrass. During 1955 all of the more effective compounds were used throughout the fall season. Mr. Baumgardner, Vice-President of the Sea Island Company, stated that the fungicides are unquestionably a significant help in establishing a satisfactory stand of ryegrass but there is tremendous room and desirability for a fungicide which is more effective in controlling the "cottony blight" disease.

During the winter of 1955-56, a number of new experimental fungicides were compared with Captan 50-W and Captan 50-W plus Actidione dust for effectiveness in controlling "cottony blight" in 4-inch clay pots in the greenhouse. Infested soil was placed in the bottom of the pots and then seeded to ryegrass at a uniform rate. The topdressing soil was treated with methyl bromide and mixed with the fungicides at rates shown in Table 5. Each of the new compounds was more effective than Captan 50-W and Captan 50-W plus Actidione, our most effective compounds available for use. P-113 (a 2-Mercaptopryidine-1-oxide, zinc salt with the tradename "OMADINE") appeared to be especially promising and the manufacturers have agreed to furnish a sufficient quantity to do extensive plot tests as well as limited tests on a diseased golf course during the coming year.

2. Helminthosporium turfspot

After "cottony blight" had destroyed the ryegrass stand in 1953, the plots were reestablished and treatments as outlined in Table 2 were applied at 14-day intervals throughout the ryegrass season. Two pathogens, *Helminthosporium siccans* and *H. sativum*, causal organism of "*Helminthosporium* turf spots", were active from about the middle of December on through April. The effectiveness of these compounds for the control of "*Helminthosporium* turfspots" of ryegrass is shown in Table 2. All compounds showed some effectiveness with their relative order of effectiveness being PMAS, Caloclor, Tersan 75 plus Mercadmine, Mercadmine, Tersan 75 plus PMAS, Tersan plus Cadminate, Tersan 75, Actidione, Cadminate, and the untreated. The Actidione rate-and-frequency study was also continued throughout the season for the control of "*Helminthosporium* turfspots". The different formulations were applied at rates-and-frequencies outlined in Table 6. As shown in Table 6, the heavier rate was more effective than the lighter rate, and the 7-day frequency of application was superior to the 14-day frequency. Actidione at all frequencies and rates was superior to the untreated control plots.

Table 5. Effectiveness of experimental fungicides for the control of "cottony blight" in small pots in the greenhouse.

Fungicide	Pounds of fungicide per ton of soil	Stand	Percent of pots showing disease after 16 days
Ethyl Corp.			
B-856	1	Excellent	100
"	4	"	70
Olin Mathieson			
P-112	1	"	100
"	4	"	90
P-113	1	"	100
"	4	"	10
Captan 50-W	1	"	100
"	4	"	100
Captan 50-W + Actidione (dust)	1	"	100
Control	-	Practically no stand	100

Table 6. Effectiveness of Actidione formulations, rates, and frequencies for control of "*Helminthosporium* turfspots" during the 1953-54 ryegrass season.

Formulation	Rate per 1,000 sq. ft.	Frequency of application in days	Disease ratings April 6, 1954
1. Ferrated	0.6	7	3.3
2. "	0.8	14	4.5
3. Tablet	0.6	7	3.8
4. "	1.2	14	4.5
5. "	1.2	7	2.8
6. "	1.2	14	4.3
7. Control	-	-	8.8

The 1955-56 fungicidal program outlined in Table 4 was continued throughout the ryegrass season. Plots were not reseeded after the "cottony blight" outbreak. Thus, the disease and turf quality ratings reflect the combined effectiveness of these compounds against the "cottony blight" outbreak in the fall and the "Helminthosporium turfspots" infestation during January, February, and March. Since the fall rating took into account only the number of spots per plot and not the size of the spots, along with the fact that some "cottony blight" activity continued after the fall rating, the differences between fall and spring ratings for effectiveness of compounds do not necessarily reflect effectiveness for the control of "Helminthosporium turfspots." However, it is to be assumed that compounds receiving a good rating in the spring did give a high degree of protection against both diseases.

It is interesting to note that Tersan was a very poor fungicide in the 1953-54 season but appeared to do much better during the 1955-56 season. A glance at Tables 2 and 4 will show that in the 1955-56 season, Tersan was applied at 4 and 2 times the rate used in 1953-54, which is perhaps the factor making the difference. On the basis of the first years results (1953-54), the mercury-containing fungicides were superior, but the results obtained from the heavy rates of application of Tersan, Vancide, Zineb, and Kromad suggest that further experimentation along this line is desirable.

3. Recommendations for Control of the more Common Turf Diseases in the South

Recommendations for the control of the more common turf diseases in the South are based on: (1) the identity of the disease-producing organism, (2) results of experimental fungicidal evaluation trials at Tifton and Sea Island, Georgia, (3) information obtained from other workers on the control of specific diseases, and (4) the successfulness of previous recommendations for the control of specific diseases. Some of the more common diseases and recommended control practices are presented in Table 6.

It can be seen from the number of different diseases and the selectivity and lack of selectivity of the different fungicides for the control of various diseases that none of the fungicides on the market at present warrant an across-the-board recommendation. On the-other-hand, an individual should find out what disease is causing trouble and apply protective measure which is most effective in correcting his specific problem. This may require a supply of more than one fungicide in a turf program just as it is necessary to carry and use a variety of clubs to dispose of another golfer.

Table 7. Suggested practices for the control of the more troublesome Southern Turf diseases.

Disease	Recommended Control
1. "Brown Patch" or "Rhizoc"	Mercury-containing fungicides every 10 to 14 days while temperature is above 70°F.
2. "Gray leaf spot" of St. Augustine	Mercury-containing fungicides as needed.
3. "*Helminthosporium* leaf spot and turfspot"	Mercury-containing fungicides-heavy rates of Tersan, Vancide 51, Zineb and Kromad also look good and may prove desirable. Use the latter compounds at 2 x recommended rate.
4. "*Curvularia* leaf spot and melting out"	On bentgrass Actidione and Mercury-containing fungicides-on the strictly Southern grass we prefer to recommend only mercury-containing fungicides.
5. "Cottony blight"	Captan-50-W (1 pound per 1,000 sq. feet at time of seeding and additional applications as required by disease activity of ½ pound per 1000 square feet) Actidione plus Captan, Phygon XL, Vancide 51, and Zineb are to be considered. Actidione at 0.6 mg. per 1,000 sq. feet and other at rates recommended for Captan 50-W.
6. "Nematodes"	The new low-phytotoxic nematicides look like the answer.
Microorganisms which are troublesome but aren't strictly disease producers	
7. "Slime Mold"	Remove with a heavy stream of water-any good fungicide will aid in control.
8. "Algae"	Good turf is best preventative-2-5 lbs. of hydrated lime per 1,000 sq. feet will kill Algae-any good fungicide.
Minor element deficiencies	
9. "Chlorosis" or "yellowing" (primarly Centipede)	Foliage spray with ferrious sulphate or chelated iron for temporary relief-for permanent relief have soil tested, adjust pH, and add iron, and so forth as recommended.

SUMMARY AND CONCLUSION

1. Southern turfgrasses are subject to many diseases, a few of which are frequently very serious.

2. No satisfactory control has been found for cottony blight. At present, the most effective compounds appear to be Captan 50-W, Captan 50-W plus Actidione, Phygon XL, Vancide 51 and Zineb. Some new experimental compounds show promise and may prove satisfactory. Treating topdressing soil with methyl bromide will prevent the introduction of the pathogen in the topdressing material.

3. Information suggests that Helminthosporium turfspot can be controlled by mercury-containing fungicides Vancide, Zineb; Kromad also looked good during the past year.

4. Experiments and effectiveness of recommendations show a need for knowing the cause of disease before treatment and using the the treatment which is most effective against the specific disease.

A SUMMARY OF TURFGRASS WEED CONTROL TESTS

B. P. Robinson 1/

Approximately fifty materials have been tested for weed control in turfgrasses at Georgia Coastal Plain Experiment Station, Tifton, Georgia. Testing of the materials has occurred over a period of ten years. Thus, only a few herbicides were screened for weed control each year. Many herbicides were not satisfactory for turfgrass purposes and were discarded. It has not been possible to test all chemicals or formulations produced by industry. This summary should not, therefore, be used as a recommendation for a given herbicide, but as a general guide for weed control in turfgrasses.

CAUSES OF WEED INVASION

Someone has said that "if weeds occur, there is a reason why". Let's look at the causes of weed invasion. The many things which may be listed can be classified as:

<u>Adaptation causes</u> -

Nature in all areas produces a balanced mixture of plants and not a pure stand of grass, shrubs, etc. Whenever man disturbs this balance by trying to produce only one plant over a large area of land, nature is constantly striving to invade the area with other plants which are generally undesirable.

Turfgrass producers have the problem of fitting grasses to an environment. Grasses and other plants produce their best growth in areas to which they are adapted and less weeds will appear when a grass is used which fits the locality.

<u>Management causes</u> -

Weeds often invade turfgrass areas because of such unsatisfactory management practices as, poor construction, physical condition of soil, inadequate drainage, too much shade or tree root invasion, misuse of water, failure to prevent contamination from weed seed, damage to turfgrasses, low fertility standards, no chemical weed control program, etc.

1/ Director, United States Golf Association Green Section, Southeastern Region and Turf Specialist, University of Georgia Coastal Plain Experiment Station, Tifton, Georgia.

WEED CONTROL METHODS

Methods of weed control may be classified as follows:

<u>Mechanical</u> -

Mowing devices and other equipment to decrease competition and Hand weeding.

<u>Biological</u> -

The right grass for the location well-managed and
The use of improved grasses which will compete with weeds.

<u>Chemical</u> -

Removal of existing weeds with herbicides and
Prevent establishment of weeds by prevention of seed germination in turfgrass or compost and preventing seed formation on weeds.

EFFECT OF SOIL PROPERTIES ON ACTIVITY OF HERBICIDES

Turf producers have often had the experience of applying materials as recommended without satisfactory results. The same materials, however, when applied in other areas give good control. This discrepancy may be due to several factors, but the effect of soil properties on herbicides is often very important. High herbicide activity generally means good weed control. In general herbicidal activity on a given soil type will vary according to the following: *

Soil Type.

<u>High Activity</u>	<u>Low Activity</u>
Low organic matter	High organic matter
Low pH	High pH
High moisture	Dry soil
Medium temperature	High temperature
Low volatility	High volatility

Although it is difficult to control soil properties which effect herbicides, the turfgrass producer may increase the effectiveness of materials used for weed control by:

1. Applying recommended amounts of herbicides to given areas
2. Using additives such as wetting agents, etc.
3. Using enough spray solution for various materials
4. Making sufficient applications spaced correctly

* Recent Advances In Weed Control In the United States. W. C. Shaw.

The following tables are presented as a summary of the weed control tests conducted at Tifton, Georgia, since 1946. Only those materials are listed which have been tested and which have given satisfactory control. Since Dr. Nutter has discussed soil sterilants, no mention is made of materials used for this type of weed control.

Table 1. Materials Tested For the Control of Annual Summer Grasses Growing in Turfgrasses.

Material	Rate per 1,000 square feet	Injury to Bermuda Turf
Sodium arsenite	1/2 to 2 oz.	Temporary browning
Lead arsenate	10 to 20 lbs.	None
Organic arsenates	1 to 2 oz. (actual)	Slight Discolor
P M A S	2 1/2 to 5 oz.	Slight Discolor
Potassium cyanate	3 to 4 oz.	Temporary browning
Dinitro	1 1/2 to 3 oz.	Temporary browning
Calcium cyanamid	20 - 30 lbs.	Temporary browning
Inorganic nitrogens	2 to 3 lb. N dry 1 lb. gal. H_2O, 4 gal. per 1,000 wet	Temporary browning

Use wetting agent, apply every 7 days (cyanate every 2) and add 1/2 ounce approximately 40% 2,4-D per 1,000 square feet.

Table 2. Materials Used for the Control of Sedges * In Bermudagrass Turf.

Material	Rate	Injury to Bermuda Turf
Dinitro	2 - 4 lbs/ Acre	Temporary browning
M C P	1 1/2 - 3 lbs/ Acre	None - slows growth
P M A S	3 - 6 oz/ 1,000 sq. ft.	Temporary discoloring
Sodium arsenite	1 - 2 oz/ 1,000 sq. ft.	Temporary browning
Organic arsenates	1 - 3 oz/ 1,000 sq. ft.	" discoloring
Inorganic nitrogen	3 - 5 lbs N per 1,000	" browning

* Sedges are known as watergrass, swampgrass, etc.
Use wetting agent, apply every 7 days, and use 2,4-D in spray solution at 1/2 oz. approximately 40% per 1000 sq. feet.

Table 3. Materials Used for the Control of Spotted Spurge *

Material	Rate per 1,000 square feet	Injury to Bermuda Turf
M C P	3/4 - 1 1/2 oz.	None
P M A S plus 2,4-D**	4 - 6 oz.	Slight Discoloration
Potassium cyanate plus 2,4-D	3 - 4 oz.	Temporary browning
Sodium arsenite plus 2,4-D	1 - 2 oz.	" "

* Spotted spurge is also know as carpet weed, milk weed, etc.
** One (1) oz. 2,4-D containing 4 lbs. per gallon applied per 1,000 square feet with first applicati0n.

Table 4. Materials Used for Pre-emergence Weed Control in Established Bermudagrass Turf.

Materials	Rate per 1,000 square feet	Injury to Bermuda Turf
CI PC	1/2 - 3/4 oz. actual	None
Dinitro	1 - 2 oz. actual	Temporary discoloring
C M U	1/5 - 1/3 oz.	Over dosage dangerous
P M A S	1 - 2 1/2 oz.	May discolor
2,4-D	1/2 - 3/4 oz. actual	Temporary checks growth
Crag Herbicide I Ses	1 - 2 oz.	" " "
Crag Herbicide I Natrin	1 - 2 oz.	" " "
Alnap 1 F	4 lbs.	None

Table 5. Materials used for General Weed Control.

Materials	Rate per Acre	Plants Controlled
2,4-D formulation	1/2 - 1 1/2 lbs.	Pre-emergence broadleaf weeds, clover, wild onion and garlic, prevent seedheads
2,4,5-T	1/2 - 2 lbs.	brush, clover
Maleic hydrazide, MH-40	2 - 6 lbs.	wild onion and garlic, prevent seed-heads
Naphthaleneacetic acid	1 - 3 lbs.	prevent seedheads
Dalapon	10 - 30 lbs.	grass killer, edging, cattails and reeds
Amino triazole	16 - 24 lbs.	" " " " "
T C A	60 - 120 lbs.	" " " " "
C M U	5 - 10 lbs.	" " " " "

ATTENDANCE ROSTER

TENTH ANNUAL SOUTHEASTERN TURFGRASS MANAGEMENT CONFERENCE
Tifton, Georgia
April 9, 10, 11, 1956

ALABAMA

Name	Club	City
Berdeaux, C. G.	Elmwood Cemetery	Birmingham
Boyd, Frank, (Rep)	V-C Chemical Co.	Montgomery
Carnes, R. H. (Supt)	Roebuck Golf Club	Birmingham
Dugger, Marshall		Tuscumbia
Epperson, I. E. (Supt)	No. Birmingham Golf Club	Birmingham
Garrett, M. (A'sst. Supt)	Roebuck Golf Club	Birmingham
Grafton, L. D. (Supt)	Maxwell A.F.B. Golf Club	Maxwell A.F.B.
Hartwig, L. H. (Rep)	American Chemical Paint Co.	Union Springs
House, Lee (Supervisor)	City of Birmingham	Birmingham
Johnson, Mike (Salesman)	Yeilding Bros. Co.	Birmingham
Kennedy, W. T. (Supt)	Montgomery C C	Montgomery
Martin, M. P. (Main.Mec)	City of Birmingham	Birmingham
Moore, J. F. (Supt)	Vestavia C C	Birmingham
Nordan, W. W.	Nordan's Grass Farms	Abbeville
Norrie, W. M. (Supt)	Mobile Country Club	Mobile
Todd, Sylvan J. (Supt)	Maxwell A. F. B. Golf Club	Maxwell A.F.B.

DELAWARE

Rennie, W. W.	DuPont Co., Polychemical Division	Wilmington

FLORIDA

Blackledge, J. L. (Owner)	Barco, Inc.	Lake Worth
Bryant, Al (Supt)	C C of Orlando	Orlando

FLORIDA, CONT'D.

Buglione, A. R.	Naval Air Station Golf Club	Pensacola
Burke, R. E. (Salesman)	DuPont Co., 1550 Elm Ave.	Winter Park
Collier, Barrett (Field Specialist)	Dow Chemical Co.	Casselberry
Cook, E. E. (Supt)	Ponte Vedra Club	Ponte Vedra Beach
Cusick, Andy	Box 319	Altamonte Springs
Dorr, H. E. (Supt)	Melbourne G & C C	Melbourne
Duguid, Bob	Timuquana C C	Jacksonville
Dunn, J. L. (Parks Supt)	City of Sanford	Sanford
Freeman, J. E. (Ass't. Plant Path.)	Fla. Agri. Exp. Station	Gainesville
Greene, Herb (Pro-Supt)	City of Jacksonville	Jacksonville
Hall, E. T. (Supt)	Bobby Jones G C	Sarasota
Harvey, Jack (Pro)	U. S. Naval Air Station Golf Club	Jacksonville
Hogg, J. W.	House of Plant Foods (Garden Supply Dealer)	Daytona Beach
Jackson, A. R. (Supt)	City of Jacksonville	Jacksonville
Jones, R. F. (Salesman)	Wilson-Toomer Fert. Co.	Jacksonville
Konwinski, Joe (Supt)	City of Lake Worth	Lake Worth
Maxwell, Lewis S. (Entomologist)	Jackson Grain Co.	Tampa
Möhle, F. B. (Mgr)	Evergreen Cemetery	Jacksonville
Musser, H. E. (Supt)	St. Regis Paper Co. G C	Cantonment
Nutter, Gene C. (Ass't. Agronomist)	Fla. Agri. Exp. Sta.	Gainesville
Oliver, J. B. (Salesman)	Zaun Equipment Co.	Jacksonville
Parker, J. L. (Supt)	Fla. State Hospital	Chattahoochee
Reed, J. A. (Owner)	John Reed Nursery	Deland

FLORIDA, CONT'D.

Ward, Frank (Supt)	Bradenton C C	Bradenton
Willis, Robert T. (Supt)	Mayfair C C	Sanford
Witherspoon, Al (Turf Specialist)	University of Florida	Gainesville
Reemelin, B. G. (Pres)	Zaun Equipment Co.	Jacksonville
Simpson, S. C. (Owner)	Simpson Nursery	Monticello
Woods, W. T. (Salesman)	Culp Lawn Equip. Co.	Jacksonville

GEORGIA

Baumgardner, T. M., (V. P.)	Sea Island Co.	Sea Island
Beck, Elmer (Entomologist)	USDA, Experiment Station	Tifton
Beeland, Pope (Mgr)	Griffin G C	Griffin
Boswell, Fred (Ass't Mgr)	City of Atlanta, Dept. of Parks	Atlanta
Bruner, J. C. (Mgr)	American Legion G C	Albany
Burnam, Joe (Supt)	East Lakes C C 2306 Glenwood Ave. SE	Atlanta
Burton, G. W. (Prin. Gen)	USDA, Experiment Station	Tifton
Bush, Don (Pro)	Tifton Country Club	Tifton
Cordell, Tom (Dean)	ABAC	Tifton
Corry, John (Pres)	Tiftco, Inc., Box 221	Tifton
Crawford, Arthur (Salesman)	Woodruff Seed Co. 695 Glenn St. SW	Atlanta
Daniels, Eston (Ass't. Agronomist)	USDA, Experiment Station	Tifton
Dollar, C. A.	Glen Arven C C	Thomasville
Douglas, L. E. (Pro)	Augusta C C	Augusta
Dudley, J. W. (Green Committee)	Athens C C	Athens
Duke, James T.	Standard Town & C C	Brookhaven

Evans, Thurlow, Jr. (Salesman)	Evans Implement Co.	Atlanta
Fleming, T. E. (Inspector)	Ga. Crop Improvement Assoc.	Athens
Forbes, Ian, (Agron.)	USDA, Experiment Station	Tifton
Freeborn, W. E. (V.P.)	H. G. Hastings Seed Co.	Atlanta
Griffin, Avalon	Parramore & Griffin	Valdosta
Hall, D. L. (Supt)	Savannah Golf Club	Savannah
Hodges, Glen G. (Ass't. Supt)	Ft. Benning Club	Ft. Benning
Holbrook, H. F. (Pro)	Ft. Benning Club	Ft. Benning
Holliman, John (Salesman)	Dow Chemical Co.	Atlanta
Inglis, Hugh A.	Ga. Crop Improvement Assoc.	Athens
Jackson, Jimmy (Ass't Agron)	USDA, Experiment Station	Tifton
Jensen, Ray	Southern Turf Nurseries	Lakeland
Jones, J. H. (Owner)	Nat'l. Zoysia Grass Nursery	Cartersville
Kaufman, James (Mgr)	Toro Turf Equip. Co.	Atlanta
King, Frank (Director)	Experiment Station	Tifton
Kohlhase, C. E. (Pres)	Americus C C	Americus
Kunes, G. G. (Chm)	Tifton C C	Tifton
Laite, W. E., Jr. (Field Rep)	Trianglle Chemical Co.	Macon
Lam, John	Box 433	Rome
Lambert, J. H.	Evans Implement Co.	Atlanta
Land, H. N. (Supt)	Augusta C C	Augusta
Latham, J. M. Jr. (Ass't. Turf Spec.)	Experiment Station	Tifton
Lavin, Paul D. (Pro)	City of Atlanta	Atlanta

Lawrence, Lester (Supt)	Ft. Benning Club	Ft. Benning
Lee, Fred E., (Mgr)	Summit Hall Turf Farm	Valdosta
Luther, J. P. (Sec)	Chamber of Commerce	Americus
Mays, S. W. (Chm)	Glen Arven C C	Thomasville
McClure, Geo. (Ass't. Sec)	H. G. Hastings Seed Co.	Atlanta
McGowan, Albert F.	C C of Columbus	Columbus
McKendree, Marion (Supt)	Sea Island G C	Sea Island
McLain, Mark H. (Pro)	Radium C C, Box 1045	Albany
Megabee, L. H.	Glen Arven C C	Thomasville
Moore, C. D.	Tifton C C	Tifton
Moore, H. M.	1506 7th Ave.	Albany
Morcock, J. C., Jr. (Agronomist)	Nitrogen Division Allied Chemical & Dye Corp	Atlanta 3
Pinckard, J.A. (Rep)	Shell Chem. Corp.	Atlanta
Pond, T. W. (Mgr-Supt)	Pine Hills C C	Cordele
Prince, Larry (Rep)	Stauffer Chem. Co.	Tifton
Pulliam, R. D.	Pulliam & Son Landscape Service	Decatur
Robinson, B. P. (Dir., USGA)	USGA, Experiment Station	Tifton
Roquemore, W. W.	Patten Seed Co.	Lakeland
Sanders, R. W. (Eng)	Custer Terrace, Inc.	Ft. Benning
Shearouse, H. S.	1537 W. Medlock Road	Decatur
Sitz, Frank, Jr. (Pro)	Coosa C C	Rome
Sizemore, B. T. (Eng)	Custer Terrace, Inc.	Ft. Benning
Stephens, W. E. (Mrs.) (Reporter)		Tifton

GEORGIA, CONT'D.

Stone, Lee (Supt)	C C of Columbus	Columbus
Thomas, LeRoy (Salesman)	Stauffer Chem. Co.	Baconton
Thornton, R. L. (Path)	Olin Mathieson Chem. Corp.	East Point
Torbert, Horace E. (Pro)	Thomaston C C	Thomaston
Touchstone, Jack	Tifton C C	Tifton
Wages, R. M. (Supt)	Athens C C	Athens
Ward, Burt B. (Pro)	USAF, Spence Air Base Box 635	Moultrie
Ward, Joe (Supt)	Idle Hour Golf and C C Box 884	Macon
Wells, H. D. (Path)	Experiment Station	Tifton
Wells, W. W. (Rep)	Fla. Agr. Supply Co. 209 Fulwood Blvd.	Tifton
Wheatley, J. R. (Rep)	Carbide & Carbon Chem. Co. 110 Woodruff Avenue	Tifton
Whitehead, Bill (Rep)	Shell Chem. Corp.	Atlanta
Wright, Hoha (Supt)	Peachtree G C	Atlanta

ILLINOIS

Darrah, John	W. A. Cleary Corp.	Chicago
Duguid, Bob (Mgr)	Roseman Mower Corp.	Evanston

KENTUCKY

Mattson, Ed (Pro-Supt)	Hopkinsville G & C C	Hopkinsville
Sicks, Evan (Pro-Supt)	Ft. Campbell G C	Ft. Campbell

MARYLAND

Henson, Paul (Agron)	USDA, Plant Industry Sta.	Beltsville

MARYLAND, CONT'D.

Juska, Felix V. (Agron)	USDA, Plant Industry Station	Beltsville
Kreitlow, Kermit (Path)	USDA, Plant Industry Station	Beltsville
Lee, Henry S.		Gaithersburg

MINNESOTA

McLaren, M. R.	Toro Manufacturing Corp.	Minneapolis

NEW YORK

Mueller, J. D. (Rep)	Carbide & Carbon Chem. Corp.	New York 17

NORTH CAROLINA

Baker, Marshall (Salesman)	E. J. Smith & Sons	Charlotte
Bowers, H. P.	Duke University	Durham
Burgin, Geo.	Cherryville C C	Cherryville
Cochrane, Donald, (Rep)	E. J. Smith & Sons	Charlotte
Daniels, Selby (Salesman)	"	"
Edwards, A. D. (Supt)	Green Valley G C	Greensboro
Edwards, Jimmy (Supt)	Greensboro C C	"
Edwards, Virgil (Supt)	Gillespie Park G C	"
Fraser, E. E. (Salesman)	Henry Westall Co.	Asheville
Garrison, Ira (Supt)	Pine Needle G C	So. Pines
Hamm, Gene (Supt)	Duke University	Durham
Harmon, Linwood E. (Maintenance)	Kinston C C	Kinston
Harris, C. J. (Pro-Supt)	Dogwood G C	Mebane
Hayworth, J. C. (Supt)	Sedgefield Club	Greensboro

NORTH CAROLINA, CONT'D.

Hobart, F. D. (Supt. of Bldgs)	Davidson College	Davidson
Kelly, C. B. (Supt)	Alamance C C	Burlington
Mann, W. E. (Supt)	Camp Lejeune G C	Camp Lejeune
Maples, Henson E. (Supt)	Pinehurst, Inc.	Pinehurst
Oakley, H. F. (Supt)	Carolina C C	Raleigh
Phillips, Moran S. (Supt)	Catawba C C	Newton
Robertson, Jack (Supt)	Reynolds Park	Winston-Salem
Sherrill, L. C. (Supt)	Lake Hickory C C	Hickory
Smith, Wayne B. (V.P.)	E. J. Smith & Sons	Charlotte
Spencer, Jim (Salesman)	E. J. Smith & Sons	Charlotte
Spicer, John (Salesman)	Du Pont Company	Goldsboro
Westall, Bill (Mgr)	Henry Westall Co.	Asheville
Westall, Henry	Henry Westall Co.	Asheville
White, R. L. (Rep)	Mallinckrodt Chem. Works Rt. 332, Box 139	Charlotte
Williams, H. E.	Asheville C C	Asheville

OREGON

Washburn, H. G., Jr.	Jenks-White Seed Co.	Salem

PENNSYLVANIA

Mascaro, Tom	West Point Products	West Point

SOUTH CAROLINA

Batson, John T. (Supt)	Columbia C C	Columbia
Briggs, Mac	C C of Orangeburg	Orangeburg

SOUTH CAROLINA, CONT'D.

D'Angelo, Jimmy (Pro)	Dunes G & Beach Club	Myrtle Beach
Goss, Frank (Pro-Supt)	Sweetwater C C	Bonwell
Hill, Kin	Dunes G & Beach Club	Myrtle Beach
Jeffords, M. K., Jr. (Pres. Southern Golf Association)	C. C. or Orangeburg	Orangeburg
Lachicatte, A. H.	International Paper Co.	Georgetown
Ripley, C. R. (Supt)	Anderson C C	Anderson
Joe Schotta	Greenville C C	Greenville
Williams, R. H. (Eng.)	International Paper Co.	Georgetown

TENNESSEE

Grandison, Pete (Pro-Supt)	Woodmont C C	Nashville 5
Howell, A. B. (Pro-Supt)	Clarksville C C	Clarksville
Underwood, J. K. (Assoc. Agron)	Univ. of Tenn. Agr. Exp. Station	Knoxville

VIRGINIA

Harper, J. C., II	Lawn Grass Development Co.	Vienna
Means, G. C.	"	"
Savage, Hurley (Supt)	James River C C	Newport News
Werth, Bogardus (Sales)	Va-Carolina Chem. Corp.	Richmond
Young, V. H., Jr.	"	"

WISCONSIN

Wilson, Charlie	Milwaukee Sewerage Commission	Milwaukee