PROCEEDINGS OF NATIONAL TURF FIELD DAYS

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SOILS AND AGRICULTURAL ENGINEERING
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AND

MID-ATLANTIC ASSOCIATION OF GOLF COURSE SUPERINTENDENTS

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WEST POINT LAWN PRODUCTS
West Point, Pa.

INTRODUCTION

Fred Grau, Director
U.S.G.A. Green Section

This sort of thing got started two or three years ago when we had one of our Field Days. Over at the Del-Haven Cabins a few of the boys were sitting around having a drink or two and some of the graduate students were in and it just naturally developed that we began telling something about what each of us was doing. It was such an interesting evening that nearly everyone decided to do it again. So the next year we had it at the Hamilton Hotel and made a rather more formal affair out of it and there was quite a gathering there. It may have been publicized a little differently from what a lot of people thought it was going to be, because a lot of the people that were there at that time are not here tonight. Apparently it is finding its own level. This year we decided that since so many people like to stay at the Cabins out here near the station that we would simply open up the auditorium and have everything here at the station.

This evening's program is devoted to the research workers and to graduate students and anyone else doing research work in turf management. What we want to do is outline progress and to lay plans for the future. We want to assimilate where we have been and try to see where we are going. This is the chance for the people who are doing the actual work at the cooperating stations to say what they have been doing and what they plan to do in the immediate future. This in effect is becoming a national planning conference for turf management and I think it is a very good thing. I hope we can continue to do just this sort of thing.

There is just one more thing I want to get off my mind before I turn the meeting over to Al Radko who is going to handle it this evening and that is that we have not set any dates for the Field Days in 1952. There are two reasons for that. One is that the 6th International Grasslands Congress is coming to the United States next summer. We are not yet quite sure of the time or the place. We may plan to have something in a turf field day for the delegates from foreign countries who will be here at that time. Whether or not that will affect any possible arrangements for the Field Days which we have had in October, we don't know yet. The other reason is that we have had some complaints as to the time and the arrangements of the Field Days and we would like to give you some chance

to say how and when they should be conducted. So during the course of the evening we would like to have you think just a little bit about when these Field Days should be conducted in 1952 if world conditions permit us to hold another such affair. We will not do anything about it at the moment.

Now I will turn this meeting over to Al Radko who is Agronomist for the Green Section and doing a wonderful job in research and particularly in coordinating the National Crabgrass Trials.

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Abstracts from: "EFFECTS OF POROUS SOIL AMENDMENTS ON THE WATER RETENTION CHARACTERISTICS OF SOILS"

Robert M. Hagan and John R. Stockton
Presented by: Al Radko

For the past several years porous mineral materials such as vermiculite, pumice and expanded perlite have been used to a large extent as a plant rooting media and in packaging plants for shipment. Within the last year or two, they have been offered for sale as amendments or conditioners to improve the physical properties of soils. A few are extensively advertised and some extravagant claims are made for them. Among the advantages claimed for the use of these inorganic materials as general soil conditioners are that they "lighten" the soil, making tillage easier, improve soil aeration, retain nutrient elements, and hold water. They have been shown to be helpful where used in very large proportions as in rooting cuttings. However, it is questionable whether appreciable benefits are obtained when they are introduced in smaller proportions as would generally be necessary under field conditions. This study deals only with the effect of general soil amendments on the water relations of soil.

Considerable interest has developed in the possibility of using inorganic soil amendments under turf, especially golf course putting greens. Were it possible to extend appreciably the interval between irrigations on putting greens, the cost of incorporating these materials might easily be justified. Too, the fact that these inorganic materials are relatively inert should afford the advantage of being effective over a long period of time as compared with organic substances. Inorganic soil amendments have no chemical effect on the soil, and probably little influence on the aggregation of soil particles; they merely dilute the soil without altering its inherent structure. Any improvement in the water relations of soils arising from their influence on root growth and water infiltration rates. The effectiveness of a given material will depend upon its specific physical properties, particularly its porosity.

Pumice is a natural glass foam of volcanic origin. Its porous structure was developed by the rapid expansion of entrapped gases when the material was erupted. The pores are often tubular and many are of small diameter; its porosity is about 65% of its apparent volume.

Approximately one-half of these pores can be filled with water, while the remaining pores are sealed or have dead ends which entrap air preventing the entrance of water. As yet it is not known whether plant roots could enter the finer pores of this material, or whether the rate of de-watering would be sufficiently fast to be of importance to plants.

Scorea is a basic, vesicular lava in which relatively large pores have formed by the expansion of gases before the material hardened. Most of the pores are separated by thick walls and are interconnected.

Expanded perlite is often called synthetic pumice. It is made by a process which expands natural perlite (a variety of obsidian) to produce many enlarged bubbles. The physical properties of perlites depend both on the raw obsidian used and on the processing. Two expanded perlites on the market today are "Soil Air" and "Sponge Rok". Most of the expanded perlite now produced is used for light-weight concrete aggregate where it is prized because of its very low moisture and gas absorption. However, it is possible that by suitable processing expanded perlites of quite different characteristics can be produced. Expanded perlites are very fragile and unless great care is exercised in mixing, much of the material is crushed to a fine dust.

Vermiculite has a very unique accordian-like structure with spaces between plates which are easily penetrated by water. It retains more water than the other materials studied; its mechanical strength is low, and if kept wet, it may soon slake down to a pasty mass.

Other products, including slate pellets and haydite have not as yet been examined.

The usefulness of these numerous materials for water retention in soils is largely dependent upon the nature of their porosity. Total porosity is meaningless. What is needed is a measure of the open and interconnected pores. Also information on the size distribution of pores inasmuch as water will not completely fill very small pores unless air is removed under a high vacuum prior to wetting. A newly developed mercury injection apparatus is being used to determine pore size distribution.

To evaluate the influence of amendments on the water relations of soils, consideration must be given to their effect on field capacity, wilting point, and total available soil moisture. Measurements were under-

taken of the field capacities and wilting points for two soils mixed with several amendments. Data are now available for only two expanded perlites ("Soil Air" and "Sponge Rok") and for vermiculite, as each reacted with Yolo loamy sand and Yolo clay.

The water retention data suggest tentatively that the coarser particles of "Soil Air" and "Sponge Rok" have many blind pores. When mixed with a sandy loam soil even in amounts up to 50% by volume, they do little to alter the field capacity, wilting point, or available moisture capacity. Most sandy soils are quite permeable to water and permit deep root growth. Therefore, it would seem that the use of expanded perlites would not extend appreciably the irrigation interval on sandy soils. When added to clay soils, these materials may have little effect on the total available water per unit depth of soil but they may cause deeper rooting and improve infiltration rates. When added in the amounts now recommended, that is up to 20% volume, it appears that perlites would have little influence on the water relations of plants on many soils. Possible indirect amendments should be examined.

In contrast, the use of vermiculite in sandy soils appears to offer a means for enlarging the available water capacity and lengthening the periods between irrigations. Its use in clay soils for this purpose would be less effective. In such soils, its value would probably depend upon its influence on rooting depth and infiltration rates. Unfortunately, when kept moist, vermiculite may slake down into a pasty material, causing poor drainage in high vermiculite-soil mixtures. This property would seem to restrict its usefulness for improving the water relations of turf soils.

It is hoped that these findings may be helpful in interpreting results of plot work. Some plots have been established in Los Angeles by Dr. Stoutemyer and John Gallagher using pumice, scorea, expanded perlite and vermiculite. Additional plots are planned. Anderson in Missoula, Montana, has plots with vermiculite. The plots are essential for investigating such things as the resistance of these amendments to crushing under service conditions, their effect on rooting depth and their influence on the growth and general appearance of the grass.

The other materials now available, especially pumice, will be studied. A better understanding of the pore structure of these products should aid in the selection of the most promising materials for field tests.

In the last analysis the usefulness of these materials will have to be verified under typical field conditions before their value can be ascertained.

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Report from Dr. Verne Stoutemyer

The football practice field on the UCLA campus is a striking example of professional results of a consistent program for turf management. A year and a half ago Mr. Hallowell laid out a program which has been followed faithfully. Originally the field was in exceedingly poor condition. Today it is a beautiful dense turf. On one side many plugs of U-3 bermuda have been established and these are apparently spreading well and taking out the common bermudagrass. This field has attracted the attention of sports writers and has been described by Coach Sanders as the best football turf he has ever seen.

Putting green mixtures using 50% bermuda and 50% bentgrass stolons planted in April, 1950, have performed remarkably well. The mixtures of U-3 bermuda and Congressional bent have been outstanding. The mixtures have stabilized at about 75% bentgrass and 25% bermuda with the exception of Arlington bent which has been losing ground this past summer. Differential fertilizer treatments have not changed the composition of the turf appreciably. Liberal nitrogen feeding during the summer has not resulted in any loss of bentgrass foundation. The U-3 bermuda has been outstanding because it has very little tendency to form seed heads when cut at putting green height. The bermuda-bent mixture should be mowed with comb or brush attachment in order to combat any tendency to graininess. During much of the year this combination has been outstanding.

Studies of methods of changing the composition of turf by plugging have been conducted by Mr. M. Zaki Mahdi, graduate student from Egypt. Spread from plugs has generally been slow in well established type turf of the different species. The removal of competition has given remarkable increases in the rate of spread.

Alta fescue and similar types of tall fescues such as Kentucky 31 continue to be outstanding in health, vigor and year-round green color. When mixed with fine textured grass especially if the percentage of Alta fescue is low, the grasses develop plots having leaves with very coarse texture. Some heavy new seed-

ings of Alta fescue have shown rather fine texture and studies will be made of seeding rates of this grass.

The Flawn strain of Zoysia matrella has been shown to hold considerable winter color in this vicinity. Zoysia japonica does not, at least any strain tested so far and the same is true of ordinary species of Zoysia matrella. This character is being studied on seedling selections of Zoysia matrella of the variety Flawn. Alta fescue appears to mix very well with Zoysia japonica and Z-52 which has been named Meyer.

Cyperus gracilis, a sedge from Queensland, Australia, used for shady lawns in Hawaii, has been shown to have excellent possibilities in southern California. It is much more drought and disease resistant than any of the standard shade grasses, has a beautiful light color, can be mowed with a hand mower and does not discolor under sharp frost. The exact amount of cold tolerance is unknown. It reproduced from plantlets born on the top of the stem.

The Highland strain of Colonial bent has shown considerable tolerance to potassium cyanate weed killers. All other bents in our collection have been damaged severely at ordinary rates of application.

In the soil amendment plots pumice, vermiculite and heat treated diatomaceous earth continue to produce superior quality turf. Perlite and volcanic scorea have not been particularly desirable.

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Report from John Gallagher

I have no specific project at this time, except that of the National Crabgrass Trials. You now have the data collected for the spring trials and should soon have the results of our fall trials. I shall assume that all of the other personnel working on turf at this station will be sending in reports to give you detailed data on the various projects on which they are working.

About all that I can do is mention some of the highlights. Bermuda-bent combinations are producing a fine turf and seem to be able to keep an even balance during the summer months, regardless of the fertilization program followed. A bent turf established on a 12" amendment mixture, was in good condition as far as the

grass was concerned after 10 days without watering. The surface of the green was hard, but the turf was not suffering from a lack of water.

U-3 bermuda cut at 1/4" is maintaining a better turf than U-3 at 3/4". This turf has received one watering of about 1/2" since June 1, 1951.

These are my only observations of the summer. I hope that they can be of use to you.

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Report from Robert Hagan
Presented by Al Radko

In your talk you may wish to comment on our work on water management. Plots of Merion bluegrass have been established to study irrigation practices required for the maintenance of acceptable turf. There are three irrigation treatments, wet (when 1/3 of total available water used), medium (when 2/3 of total available water used) and dry (when approximately all the available water has been used and grass just begins to show wilting). These irrigation treatments will be carried out under two heights of clipping ($\frac{1}{2}$ and $1\frac{1}{2}$ inches) and under two or three levels of nitrogen fertilization. Observations or data will be obtained on the influence of these irrigation treatments (at the two clipping heights and fertility levels) on the general appearance of the two clipping heights and fertility levels, on the general appearance of the turf, growth, summer dormancy of bluegrass, turf density, weed encroachment, disease incidence (particularly brown-patch), root distribution and water requirements.

Another study is in progress to determine the depth of rooting, the water requirements, and the relative drought resistance of Alta vs. K-31 fescue, Merion vs. Kentucky bluegrass, Illahee vs. F-74 fescue and chewings (Penn State) fescue, U-3 vs. common bermuda, and Z-52 vs. Zoysia matrella. We may include Poa annua in this study.

Work is pretty well along on the study of the influence of porous mineral amendments on the water retention characteristics of soils.

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Report from John C. Schread
Presented by Al Radko

I am pleased to report that compounds such as DDT and Chlordane used for the control of grub populations in better turf in 1946 and 1947 respectively, would appear to be as effective in late summer 1951 as at the time the materials were applied to grub-infested fairways. Furthermore, compounds Aldrin, Dieldrin, Heptachlor and Methoxychlor are as effective in preventing the infestation by white grub populations such as Japanese beetle as during the seasons in which they were used, to wit: 1948, 1949 and 1950.

Parathion, of course, loses its toxic properties very quickly, especially at lower dosages. Gamma Benzene-hexachloride and Toxaphene applied to grub infested turf in 1947 have obviously lost some of their toxicity in preventing reestablishment of grubs in 1951.

It is my pleasure to report that two new compounds are now being investigated for control of turf insects of both surface and sub-surface species. These compounds are known only by code numbers - that is, 711 and 269. These two compounds have been developed by Julius Hyman Company, Denver, Colorado. They are reported by the manufacturer to be somewhat more toxic than Aldrin and Dieldrin and consequently may be used at lower levels than the latter two compounds. We have established research plots on one of the fairways at Wepawaug Country Club, Milford, Connecticut, using Compound 269 at the rate of 1/2, 1, 2, 10, 15 and 20 pounds of actual toxicant per acre; also compound 711 at the rate of 1/2, 1 and 2 pounds of actual toxicant per acre basis. Both materials have been applied to mixed grub populations, to wit: Japanese beetle and Asiastic Garden Beetle, together averaging about 5 to 6 grubs per square foot of fairway turf.

We are, to say the least, enthusiastic about 711 and 269 for, as heretofore pointed out, the toxicants may be used, according to information available, at as little as one-half pound of actual chemical per acre to achieve fast action and long residual activity in control of turf inhabiting insects.

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Report from Kenyon Payne

We have our work at Purdue well coordinated but we are engaged in several different phases of research in several different fields.

Dr. Daniel, who came to us from Michigan State last year, is handling the turf management work that was formerly conducted by Dr. Gerald Mott who has been away for a year at North Carolina State College at Raleigh. While Mott will be coming back the first of the year, he does not plan to go back into the turf work, at least actively, and Daniel will be our full-time turf man. He is doing both extension work and research-- about half of each.

As part of Bill's turf management work he has set up a 15,000 square foot putting green on our Purdue campus. He has taken a mall which is a grassed area in the center of a boulevard at the back of the campus and has put that into a putting green and we are using that principally for fungicide trials. We felt that we have had suggestions and criticisms from Fred and O. J. Noer and others that we have too many of our fungicide trials on green areas which do not have any trampling and are more or less babied along and don't have the conditions of a normal putting green. So we have set this up as an actual putting green. We have a sign out with three or four old putters hanging on the sign inviting people to come and use it as a putting practice green. This summer Bill has gotten the green into very good condition and we have had a great deal of play on it. We think as its reputation spreads we will have the play we desire on it. Bill has been using it principally for fungicide trials with different rates of nitrogen. He has tried this past summer the low, medium and very high rates of nitrogen and, as would be expected, he got more brownpatch where he had high nitrogen and less dollarspot.

We also are using part of this mall to study some seeded bents which he has put in in replicated tests and some interesting clones of bents which any greenkeeper will be interested in looking at. He seeded some particular grass and he may use this for some of his Poa annua control studies.

At the east end he has some bermuda. He collected four bermudas which seem of interest and he has them growing down at the east end and with some other bent clones.

Out at our Agronomy Farm Dr. Daniel has started some studies with warm and cool-season grass combinations. Unfortunately, he had a bad winter with his U-3 that was put in first. He established a large area of U-3 bermuda and we let it grow up during the summer. It had such a heavy top growth and growth of weeds on it that we didn't feel that mulching was necessary the first winter. We let it go through without mulching and as a consequence, we lost it all. When Fred and the fellows were out in March the stolons were nice and green and it looked like it would come through but either after that or at that time it was dead and we didn't know it. At any rate we learned our lesson about not mulching the first winter and we certainly won't do that again.

He has an experiment with fescue seedings. He seeded in several strains of fescue including Burt Musser's best one. We have found the same results this summer that Mott had found in the past. We don't yet have a fescue that will stand up under our conditions out in Indiana without supplemental watering during the summer. We don't have anything that will resist helminthosporium satisfactorily.

Again at the farm he has the four strains of bermuda and U-3 has looked the best this past summer.

He has done a little work with crabgrass control there although the main part of our crabgrass control is being conducted in another section. He tried limited studies at the farm this past summer. He tried PMA, Sodium arsenite and potassium cyanate for August control. He wanted to come in in August and see what effect, if any, these particular treatments would have and he found that potassium cyanate apparently did give the best results by attempting to slow down the crabgrass in August.

He got two relatively large replicated patches of L-16 which is one of our better local bentgrass clones and he planted it to start a nitrogen and water study on those replicated trials. We have had several Zoysias both matrella and japonica which we established last summer. We mulched during this past winter and they are filling in very nicely now. They are not completely covered in at the end of this summer because we had a rather cool summer. The Z-52 and M-14 looked particularly good. The M-1 doesn't look nearly as good as the M-14.

Another phase of our work which is principally under Bill Daniel's management is a graduate students prob-

lem in Poa annua control. Graduate student Lawrence Munsinmeyer is starting in this fall in turf management research and he has put out a pilot test of the whole series of chemicals. He is attempting to get some leads on Poa annua control. I won't go through the list but he has well over a dozen here which he has put out as pre-emergent sprays as well as post-emergent sprays. This study is being conducted over at the Lafayette Country Club where they have a little more Poa annua than we are able to scrape up under our conditions where we don't have as much irrigation and moisture.

Our weed control work principally crabgrass control and to some extent the white clover control is directly under Mr. Ed Oyer, a graduate student in Plant Pathology and indirectly under Dr. O. C. Lee who is also of that department. Ed has had his plots out on the #2 fairway of the Purdue University South Course. He has had some interesting results this summer. He ran pre-emergent treatments using six different chemicals-- CMUNTA, Dichloral-urea, Calcium, TCA, and PMA. He found that the dichloral-urea and the TCA and PMA gave very good results. The calcium TCA had only one treatment and it gave very good results considering the fact that only one treatment was used. In addition they are cooperating with the United States Golf Association in their crabgrass control program. He was testing the three chemicals-- PMA, potassium cyanate and sodium arsenite. He didn't give me the results to give you at this time. He has used Endothol and 2,4,5-T for the control of white clover and the results weren't conclusive; they need more work. The Endothol gave very good top burn kill of clover but the areas treated began to be reinfested whereas when they took 2,4,5-T he found that they got more complete kill on the experiments he conducted. Further testing certainly is necessary.

The fungicide trials which normally are under Dr. Eric Sharvelle were run by Dr. Daniel this summer since Sharvelle was over in Europe for the summer and Bill used ten materials and three rates of application. He found that the cadminates generally had the most lasting effect which I think probably isn't anything new.

We had two brief brownpatch attacks this summer and where he had a high nitrogen level, he found that 55% of the area was attacked and where he had a low nitrogen level only about 5% of the area was attacked. There again we see that high nitrogen is more or less contributing to brownpatch development.

In our turf grass breeding work we are working with Zoysia. We have been concentrating up to now on attempting to develop some cold resistant, finer leaved strains. We have selected from several hundred plants five plants which appear to us to be the ones that we want. They have fine leaves and seem to grow rather well. We are taking them into the greenhouse this winter. These had survived temperatures of 10° above zero. We are taking them into the greenhouse this winter and will cross them and pollenate them. We will carry them through the second cycle of this cold testing. We have several individual plants selected from self-crossed pollenated seed of the Zoysia which again we will take in for developing our breeding program.

In bents we are concentrating on attempting to develop fairway and tee creeping types. Just this past week we spent the week in putting out a rather large test of 18 clones which we selected from seedling plants which appear to have quite high tolerance to drought and which were dense and fine leaved and had the other characteristics we wanted. We put these out in 4 x 8 plots in three replications. We also included C-115 and Dr. Musser's polycross seed and the Highland, Colonial and ten Hyde Park plants which Fred, Bill Daniel and I saw down at Hyde Park Country Club in Cincinnati.

In addition to this we have a nursery of 11 families of S-2 plants where we are starting out on a program of breeding to see what will develop in the way of uniformity as we increase these creeping bents.

We have this nursery of 11 families which we replicated three times. These are S-2 plants which we are comparing with the S-1 and the perennial clones. We are testing these plants next year aiming toward the type of thing that Dr. Musser is doing in his polycross nursery. That is, to get uniformity so that we are sure when we put them into synthetic that we can come up with uniform products. That is what we would like to aim at.

Fred, in a letter to me last week, mentioned the fact that at the golf tournament of the National Golf Course Superintendent's Association on September 10 and 11 in conjunction with our Field Day, he had had some comments from some members who had a bad aerating problem from the aerifying machine used. Fred asked me to bring a report on it and I gathered as much information as I could. I found that our golf course superintendent had not used as much discretion as he might have in that he aerified three greens shortly

before the tournament. Of course you had the Aerifier marks showing on the green but I didn't hear a single comment from any player that it affected the putt in any way. I played the course on the first afternoon and had a 78 and I couldn't miss many putts and shoot that in my game. This particular chap who wrote the letter was out observing but he wasn't doing any playing. While the greens looked like they may have been torn up, they weren't affecting the play and we had nothing but very excellent comments from the players. In our fairways the story was similar. There was considerable crabgrass on the fairways but there was just as much where the fairway hadn't been aerified as where they had been aerified. So we have no reason to condemn the Aerifier in any way in this respect.

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Report from Oliver C. Lee

Crabgrass emerged about May 12 in the vicinity of Lafayette. Treatments were made May 12. The following chemicals were applied: PMA, CMU, dichlorol-urea, TCA, dinitro and Napthyl phthlamic acid. The promising treatments include a 10% formulation of PMA at 5 oz. per acre in three treatments, Calcium TCA 4 pounds per acre single treatment, dichloral-ural, 2 applications at 8 pounds per acre and 4 pounds.

Another experiment was started when crabgrass was in the five leaf stage. 12 chemicals were applied according to manufacturers' recommendations. Three applications were made at 10-day intervals. Those showing promise are listed in the order of effectiveness--PMA - potassium cyanate - boronium flourides and sodium salt of napthyl phthalamic acid.

Results were determined as to contact and residual kill. Discoloration was also considered.

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Report from Harvey Lantz

It is a pleasure to be here. I didn't prepare a formal report but I can tell you in a general way that in Iowa we have been laboring with the Greenkeepers Association since 1939 at which time we established a turf garden for doing some work that they were interested

in doing at that time. In Iowa the Greenkeepers Association has been a very active group. They have been in back of our work to a man for a period of about 18 years. For 18 years we have had a short course in March and we have tried to put on a program which is of general interest to everyone and we succeed in attracting greenkeeping superintendents and others interested in turf from the middle west states.

Our turf garden comprises about 8000 square feet and our initial plan in establishing the turf garden was to test a number of the new strains of bentgrasses which came out under C numbers and which were provided by Dr. Monteith. We have had a total of more than 30 strains in the turf garden. We were looking for disease resistance and strains that would come through the winter and summer without too much damage. Three strains have consistently stood at the top of the whole group and those are Arlington, Congressional and Old Orchard. There are several other strains that are very good. Collins has done pretty well. Norbeck is a very vigorous thing but it is extremely susceptible to dollarspot under our conditions and brownpatch. Toronto is another that suffers from dollarspot and brownpatch. A great many courses in Iowa now are looking to us for suggestions in regard to the kinds of bentgrasses they can expect to succeed with. The new courses are planting Arlington and Old Orchard or mixtures of Arlington and Congressional with excellent results.

As the turf garden became older the strains ran together more or less and they have lost their identity in some cases but it has provided quite an excellent opportunity to test the new fungicides that were coming about. So we have accordingly been playing with fungicides for the past three years in cooperation with the National Fungicide program and we have followed this plan of applying identical fungicides on the same plots year after year feeling that it might be a contribution that we could make to determine whether or not a toxic situation might develop where continued applications of any particular type of fungicide has been used.

Our work has shown conclusively for three years that the cadmium compounds are in agreement with results all over the country. It takes fewer cadmium applications than any other type of material we use and the plots that have been treated with the cadmium compounds are excellent. There is just no comparison throughout the season. In the spring we have seen that the plots treated with PMA compounds and Tersan devel-

oped dollarspot fully three weeks ahead of the plots that were treated the year before with cadmium compounds. We made our last application as a rule along the latter part of August and no more applications were made purposely for the purpose of seeing how long a hold each one had. In two years we have come clear through the fall season with the cadmium treated plots with no spots developing at all. I have some pictures that I could show sometime that are very dramatic as to the response in the fall months following the use of cadmium compounds as compared to the other compounds used in the treatments.

This past year we cooperated with the crabgrass control program and we have been interested in studying the effect of the various compounds and seasons of applications. Our season was very wet all season. In fact we have had more rain than we knew what to do with. It rained 3 3/4 inches last Wednesday and Thursday nights on top of a 16 inch surplus. It has been an extremely difficult problem to get some of the work done that we need. In fact the turf garden is not well drained. I am often amazed at the response we get to those bents on that tight silt loam which was not prepared before the grass was planted. In the spring with continuing rains the turf garden got off to a slow start. Our greenkeepers reported the same thing on their golf courses and the result was that we had earlier infections of dollarspot than we had a year ago. Our first applications were made the sixth of July this year. All told nine applications were made. We got three fewer applications of the cadmium compounds and got better control of the dollarspot than we were able to get with the other compounds.

In connection with brownpatch we have had brownpatch on the turf garden but it is never as serious there as it is out on the golf course. We do not have very much conclusive evidence but we have noted that on the cadmium plots brownpatch will develop there when the PMAS and Tersan plots will not show very much infection from large brownpatch. Those test have been interesting. I think we should probably go ahead with the program another two years to see whether or not there is a build up of the toxic materials. We think we saw a little thinning out of the bentgrass in the plots which were receiving continuous applications of PMA materials. We saw another thing for two years in a row and again this year. On the PMA treated plots there are almost no weeds. On the cadmium plots a considerable number of weeds developed. On the check plots we counted as many as 250 dandelions on a plot 44 feet in area.

The crabgrass problem is getting more serious on the fairways all the time. We are getting more questions in regard to what they can do about crabgrass and for the past five years a great many people have been using the PMA compounds some with success and some with complete failure. Last year the greenkeepers reported more results when they used the PMA compounds on the greens than at any time previous to that time. On fairways very few have used any material at all. At the Ames Golf and Country Club on the #6 fairway I daresay we have had as much crabgrass identified as small crab as can be found any place in the United States. On the check plot we counted as many as 258 individual plants on four feet square. On those areas from the first of July to the 9th of July when we put on our first application the bluegrass was completely taken over by the crabgrass. It presented quite a problem. We made our first application of the crabgrass control materials using the various PMA compounds at various rates of application and tested these materials at different times during the season. The first application was put on July 9 and the second was July 18, then again August 8 and August 28. Surprisingly enough good control was secured when the crabgrass was beginning to seed. We are thinking from what we saw this year that probably the best results we have gotten have been those applications made as the seed heads were forming on small crab.

What happened on a good many plots was this. With potassium cyanate within 24 hours you could see 100% kill of crabgrass. The plots turned dark brown. The rates used were 16 pounds per acre, 12 pounds per acre and 8 pounds per acre. We got progressively more burning on the 16 pound rates than lower rates of application and you got correspondingly fewer crabgrass survival as the rate went down. In about ten days the plots would clear up and the bluegrass came in. But within about three weeks after the July 9 application new crabgrass was observed coming in and about September 9 when we made out last counts, big stools had developed. By contrast in the PMA treated plots the seeds formed by the new plants looked very much like they would not be successful in producing new good seed. These plots will be retained next year.

I am not here to tell you that these early applications when the crabgrass is in the early two-leaf stage is good but we did have some very remarkable results. For example in two acres we put on 7 quarts of PMAS per acre on July 6 and I was out there just a few days ago and it was amazing the results secured after one application at that time. That particular two

acres was blue with the crabgrass seedlings. They were all over the area. It is really something to see. So the stage of development is something we want to study again next year.

We have some mixtures of various strains of bluegrass and we have noticed that no matter what the mixture was, whether it was Alta or what not, the native bluegrass seems to dominate the plots at the end of three years. The Merion plots are beautiful. I will take off my hat to Merion out at Ames. We have good bluegrass there. The Merion bluegrass really stands out. It has a darker color and stands up more firmly and stiffly than does the ordinary bluegrass.

We have put in enough U-3 a year ago. We thought we had enough for a good test and it looked like in the latter part of March they would come through. But we waited until June and we never saw a sprig of U-3 this year. So we are a little discouraged. However, Kenny tells me we should have mulched that first year and then give it a chance to get more deeply rooted. We are a little inclined to think that we shouldn't baby it along like that because maybe it won't do under Iowa conditions. But it did make a lovely plot.

Zoysia japonica came through the winter perfectly. There wasn't any kill in the nursery or on the plot but the season was so cool that it made very little growth this past year. It needed more sunshine and more heat than we had in 1951. We had mountain climate all summer and a lot of rain. It wasn't a typical Iowa summer at all and Japonica didn't like that type of treatment at all.

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Report from Chester Mendenhall

We have crabgrass control plots there like the ones you are running and the PMA are the outstanding plots. They are on the campus and can be carried on year after year.

As far as the other work at the college, we have established plots there this spring. We had 41 days of rain and then the floods came. They are pretty well mixed up. It looks like U-3 is going to take the whole garden.

One thing we have out there that you don't have in

many of the other plots is our work with some of the buffalograss and grasses that are adapted to the Plains area. We are not doing any work with putting green grasses, however. The work being done at the college is for grasses of high cut for fairways and tees, aiming at interesting the people in charge of roadsides and airports and cemeteries. We don't have the golf courses out there that you have here so we have to take in practically the whole turf field to get more people interested to support the plots.

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Report from Red Lambert:

I do think we have a very good start at Manhattan. When I first came to Kansas City I saw a lot of beautiful homes and also a lot of lousy lawns. I think we need that work on the lawn grasses, fairway grasses and tee grasses that we are starting at Manhattan. I think in a few years we will have something to show for it.

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Report from Fred Grau

For those of you who don't know Red Lambert and Chet Mendenhall, they have been the powers behind the development in the Central Plains Turf Foundation. In fact those two are largely responsible for the organization of it and for bringing together the many turf interests in that great mid-west area focusing the attention at Manhattan and interesting the officials of the Kansas State College to set up turf experiments. It is very true as Chet said. The college is not doing any putting green work because they are not set up to do it. There are so many other problems much more important than that.

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ZOYSIA GRASS BREEDING AT BELTSVILLE, MARYLAND 1/

Ian Forbes, Jr. 2/

The work that we have been concerned with at Beltsville could be broken down into four main catagories. One is seed yield studies from the genetic standpoint. We have been able to select six heavy seed yielding strains of Zoysia japonica. We have had them under test for about four years and at this point we have four years' data on these Zoysia japonica strains from the standpoint of seed yield. The strains themselves are not superior to common Zoysia japonica so far as turf characteristics are concerned, but they are heavy seed yielders and could be used for domestic seed production. At present there is no domestic seed production of Zoysia japonica and the seed on the market today is imported from the Orient. Imported seed has contained much ergot in the past, and we don't know how long a foreign source might be available. In any event, an adequate supply of domestically produced seed of this grass would be desirable.

With these heavy seed yielding strains, we have set up some turf quality and seed yield trials that are now in the second year of testing. We are comparing these six strains from the standpoint of turf and seed yield from plantings of selfed seed versus polycross seed. The point is that we would like to know which is the best method for seed production and which one will give the best turf. It is considered at present that very soon we will be in a position to release a heavy seed yielding synthetic variety of several of these strains for commercial seed production in the United States. Of course, it would be a few years later before one could buy such seed on the market.

The second major part of the work that we have been concerned with has been a more fundamental type of research on the cytology of the different species of

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1/ Cooperative investigations at Beltsville, Md., of the Division of Forage Crops and Diseases, B.P.I.S. & A.E., Agricultural Research Administration, U.S. Department of Agriculture, and the U.S. Golf Association Green Section.

2/ Research Agronomist, Division of Forage Crops and Diseases, B.P.I.S. & A.E., Agricultural Research Administration, and the U.S. Department of Agriculture.

Zoysia. As you know, there are so far, three species present in the United States. They are Zoysia japonica, Zoysia matrella and Zoysia tenuifolia. We have determined the chromosome numbers of these species. We have hybrids among all three species, and we have studied the hybrids cytologically. We have also grown the hybrids and the second generation (F_2) which is the one in which combinations of the various characteristics of the different species occur.

Some of you might not be familiar with the characteristics of the three species. Briefly, they are as follows. Zoysia japonica is broad-leafed, winter-hardy in this area and much further north and is a heavy seed producer at Beltsville. Zoysia matrella is fine-leaved, fairly winter-hardy in this area most of the time, and further north it will winter-kill. Zoysia matrella is not a heavy seed producer at Beltsville. Zoysia tenuifolia, which is the third species, is very fine-leaved and is not winter-hardy much north of Florida. The main characteristic of Zoysia tenuifolia in which we are interested is its fine leaves. The purpose of making hybrids between Zoysia tenuifolia and Zoysia japonica would be to get a combination which is very fine-leafed, which is winter-hardy in this area and which is also a heavy seed producer. That means getting heavy seed production and winter-hardiness from japonica and fine leaves from tenuifolia. So far, we have hybrids with winter-hardiness and the fine leaves, but we still don't know how well these hybrids produce seed.

Another fundamental study that we are carrying on is the determination of the amount of self and cross-pollination which occurs under field conditions in Zoysia japonica. This is important so far as seed production is concerned. We would like to know whether it would be possible to produce hybrid seed of Zoysia on a commercial scale so that we could obtain the same benefits of hybrid vigor in Zoysia japonica that the corn seed people have obtained through the use of hybrid seed.

A third main division of the work that we are doing has to do with the technique study on methods of selection. In this study we are trying to determine the best height of cut and the best management under which to make our selections of superior Zoysia seedlings. Right now we have a rather extensive planting of Zoysia japonica selections which we have obtained in the past plus a number of interspecific hybrids. We have a total of 100 of these selections. They are growing under three heights of cut with three replications.

They were planted last summer and over-seeded last fall with Kentucky bluegrass. This summer we have rated each of those clones under the different heights of cut, growing with bluegrass, for turf quality and rate of spread. We will rate them at the proper time for compatability with Kentucky bluegrass. There are several types of information that we will get from this study. One is the determination of the best procedure under which to test selections of Zoysia. The other type of information is related to actual turf production. It will be possible to determine the height of cut at which the Zoysia grasses in general provide the best turf and also the height of cut which results in the greatest compatability of Zoysia with Kentucky bluegrass.

There is one last project on which we have been working and that is the study of seed germination of Zoysia. We are still lacking adequate information on seed treatment of Zoysia to get rapid establishment. We have determined in the past that if the seed is hulled with a hammer mill, rapid and high germination is obtained. Actually, getting rapid germination is the more important of the two. If one is going to seed Zoysia japonica in June, one must have seed that will germinate fairly rapidly as crabgrass seed is also germinating at this time and may crowd out the Zoysia seedlings if they are too slow in germinating. We obtained 35 pounds of pure caryopses of Zoysia japonica seed last spring by the hammer mill method, but it took a week and a half of one man's time. We have continued with the seed germination study hoping to find a more efficient method of seed treatment. A combination of sulfuric acid seed treatment followed by hammer milling (which we tried this year) or some other mechanical treatment to remove the softened glumes appears to be a more economical method.

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Report from David F. Beard

I would like to say a little bit about our plans for turf research. It seemed a wise move to move some of our work to Tifton, Georgia, in view of all the work we have in the Division. We are not anticipating and we would not want you people to get the impression that that means either a reduction or a curtailment of turf research work here in the Division. On the contrary, if our plans work out with the Green Section as we hope they will and if our move there with Dr. Bur-

ton develops as we plan, it will mean more rather than less research work in turf.

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Report from Charles Wilson

I'm going to make my remarks very brief. I would like to say a few things about what we are doing here, mostly in the extension aspect of our turf work in this section.

One is a very close and mutual benefit association with the Mid-Atlantic Golf Course Superintendents Association. This spring Al Radko made several plantings of Zoysia at Fairfax Country Club, Congressional, East Potomac, Army-Navy, Argyle and Sligo. The way they did that was to use the Aerifier and made a couple of passes and, where each of those hollow spoons entered the ground, they inserted a seedling. Tomorrow we will see where this was done and on Tuesday you will get to see more of these plantings on the other courses in this region. At the same time we tried to put out some plugs of Zoysia and a rather extensive program of testing some of these newer grasses down at East Potomac.

Another thing that Al and I have had quite a few headaches and perhaps a little pride in is the working up of a News Letter and constructive suggestions report with the Mid-Atlantic group, namely their education committee. We feel that this has been of the utmost benefit to Al and me and it would appear that the Mid-Atlantic group as well has gotten something out of it.

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Report from Al Radko

We have been primarily interested in three projects this year here at the Beltsville station. The first is Zoysia seed production from the standpoint of producing weed free seed and secondly, the effects of boron upon Zoysia seed production in the field and third, we are coordinating the National Crabgrass Trials which in itself has been a rather large project.

First with reference to seed production, as you perhaps know, Dr. Marvin Ferguson, who is on a year's

leave of absence, found in his greenhouse nutrition studies that boron was beneficial to seed production of the Z-52 strain of Zoysia. We attempted this past year to apply this information to seed production in the field and we have laid out several boron treated plots; one on the Z-52 that you will see tomorrow and another on common japonica with which we received some pretty interesting results. We found that in each case the boron aided seed production. However, the area was established from several different strains of common japonica and the differences within each replication gave us no significant difference when we subjected it to statistical analysis. We feel sure when we do analyze our results on the Z-52 and other pure strain areas that we will have some good results to report to you.

Secondly, in cooperation with the United States Department of Agriculture, Weed Control Division, we are attempting to do something about the problem of chickweed and annual bluegrass infestation in Zoysia seed production areas. As you know, they are both cool season weeds and they come on when Zoysia is emerging from or going into dormancy. In managing these areas for seed production, we stop mowing the Zoysia early in May and without mowing chickweed and annual bluegrass become a nuisance. With this in mind we have gotten together with Shaw and Lovvorn and decided to use the following chemicals on this particular area of Z-52-- sodium floarosilicate, boronium fluoride, sodium arsenite, sodium chlorate, PMA, potassium cyanate, 2,4-D and a dinitro formulation. This is more or less a pilot test plot-- one which we hope will provide information for larger scale, replicated trials. We applied the herbicides in two directions so that we are testing each herbicide alone and in combination with most others. As yet we don't have any results to report. We just started this project about three weeks ago but we hope it will develop into something that will help provide weed free Zoysia seed for the future.

The third main project is our role as coordinator of the National Coordinated Crabgrass Trials. As yet we haven't received results from all cooperating, but we've been busy analyzing those that have been submitted. Here at the station, however, in cooperation with Professor Musser of Penn State and working on a grant from the American Cyanamid Company, Bob Elder, graduate of Penn State, was sent down here to do some work on crabgrass control in this area. Part of his work dealt with a crabgrass control project which was part of the National Coordinated effort.

We have used potassium cyanate, PMA and sodium arsenite in these trials which you will see tomorrow. The rates at which PMA was applied were zero, five pints and eight pints per acre. The rates for potassium cyanate were zero, eight pounds and twelve pounds per acre and the rates for sodium arsenite were zero, one pound and two pounds per acre. This year we've had unusually dry weather and we have had quite a bit of trouble in keeping soil moisture conditions at a good level.

In statistically analyzing the different treatments, we found no significant difference between 5 pints of PMA per acre as compared with 8 pints per acre. The same held true between the 8 and 12 pound treatments of potassium cyanate. Our sodium arsenite treatments gave us a rather severe injury on the permanent grasses as well as crabgrass due to poor soil moisture conditions. Other phases of these trials will be reported on tomorrow when we inspect the plots.

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Report from James Tyson

One of the projects we have under way is carrying on various studies of nitrogen, phosphorus and potash on three types of bent under putting green conditions. We are using Arlington, Congressional and Washington. We have Washington in our trials because in Michigan 90% of our greens are Washington and I don't think that the clubs are going to be changing them too fast. We have some Arlington and Congressional, too. For some reason or other on some of our plantings of Congressional and Arlington in Michigan they look very good until they are put under playing conditions and then they begin to thin out. I have the job of finding out why they thin out in Michigan instead of being nice vigorous growing grass like they are supposed to be.

We have a continuation of the project that Bill Daniel worked on for his doctor's thesis-- the irrigation and height of cut studies. We have enlarged it to include Merion bluegrass, Astoria and Colonial bentgrasses along with Kentucky bluegrass and creeping red fescue. So far we have found that we can maintain better turf with much less water than we have been using on a lot of our golf courses.

We have one set of plots that we have started this

year on which we are going to run compaction studies and then aeration or cultivation treatments using the different types of machines.

We have a series of plots for trying out different types of bents and other grasses under different conditions, for putting greens and fairways and lawns. It includes not only trying out the grasses, but trying out fertilizer and cultural treatments along with them to see what types of conditions we need to grow them. A year ago we planted U-3 and Z-52 in rows. They came through the snow looking very nice. Then we had some alternate freezing and thawing weather and in the areas where they had stolons with roots in the ground, the stolons all raised up and died. In the parts that were compacted and knit firmly together, they came through and the U-3 this summer has looked very good and the Zoysia has done very well also. It hasn't been quite the answer to being weed free turf because the season has been fairly cool and it hasn't grown as fast as it does in some places and some of our cool season weeds have come in. We can take care of them, but they are there. I want to try some different treatments in carrying them over the winter to see if we have to cut them or if bedding them will be useful. We have some places where we could use them if we could carry them through and make them work.

We have some strains of bermuda that have been growing on the campus for a long time. The only thing about them is that they shift around. One year they are in one place and the next year they are in another place.

In addition to the work that I am doing, Dr. Grigsby in the Botany Department is carrying on the chemical weed control work including the cooperative crabgrass experiments. Dr. Vaughan and his associates in the Botany Department are carrying on studies of disease control. Most of their work last year and this year has been aimed at the control of helminthosporium on bentgrass greens. They have found two species in the greens and as far as we are concerned, I think the helminthosporium damage to the greens is probably one of the number one problems that we have. We have tried Actidione and it looks very good. The only thing wrong is that the manufacturing company hasn't offered it for sale yet.

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Report from Ralph E. Engel

I. A series of studies on turf cultivation include different intensities, seasons and sites for cultivation treatment. The Aerifier is the principal cultivating tool in use. Some of the preliminary results are as follows:

1. Use of the Aerifier at different seasons and intensities has not created any weed problem.

2. Preliminary results from turf cultivation suggest that it may have no measurable value on areas that do not have a thatch or sod compaction problem. This past year we have established some cultivation treatments on areas having thatch and soil compaction; however, we have no results to report.

II. The effect of fertilization practices on Poa annua is receiving considerable attention. It is hoped that some of the basic fundamentals on rates and time of application can be determined. The preliminary results obtained to date show that fertilizer practices have a profound effect on the comparative amounts of Poa annua and bentgrass. Additional study is being made to determine the reasons.

III. Tests are being conducted on new and standard fungicides. Large brownpatch and copperspot are the diseases most frequently encountered on the tests. The inorganic mercury type has been the most effective on both diseases. Among the new materials, Orthocide 406 has shown real promise for large brownpatch control. It has given considerably better control than Tersan and it has ranked second to the inorganic mercuries only. It has given no discoloration to date which gives it one advantage over the mercuries.

IV. Crabgrass Control

1. Chemical crabgrass control has received considerable attention. It is not expected that the use of chemicals serve as a ready cure for crabgrass. Several phenyl mercury compounds have been found very effective. We have tested potassium cyanate each year since 1948 and we have found it to give good results on the bluegrass type of turf. We have tested a number of experimental chemicals since 1948. Of these several

boronium fluoride compounds, such as S-1998 and S-1840 have been most promising. To date neither of these have been sold commercially. This past season, we have been doing some work on gallonage and dry application of potassium cyanate. As to the future, we believe that the large number of chemicals being developed for herbicidal use may reveal other chemicals of value for crabgrass control.

2. Control of crabgrass by mechanical treatment. In 1951 a comb mounted in front of the mower reel and an arrangement of vertical knives behind the mower were used on crabgrass infested turf. The results obtained indicate that mechanical treatment of crabgrass may be a very useful procedure. The equipment was supplied by the West Point Lawn Products and the financial support was supplied by the U. S. Golf Association.

V. Studies conducted with new grasses. The following studies are in progress.

1. A performance test of Highland bents, Astoria bents and Seaside bent.

2. Trial plantings of U-3 bermuda and Zoysia matrella.

3. A strain test of 15 bentgrasses at $\frac{1}{4}$ inch cut.

4. A test of Merion and other Kentucky bluegrasses. Merion bluegrass appears to be one of the most noteworthy improvements. During the past three years it has shown greater tolerance of the 3/4 inch cut and more resistance to leafspot disease than the other Kentucky bluegrasses used. It appears to make a denser turf than the other Kentucky bluegrasses; however, its density is not nearly as great as the bentgrasses.

5. A study has been started to determine the possibility of growing a well-balanced combination turf of B-27 bluegrass and the Z-52 strain of Zoysia japonica. Different management practices will be used to determine their influence on the balance. The Green Section of the USGA has cooperated with us on this study by supplying planting materials.

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Report from John Cornman
Presented by Al Radko

Our work during the past year has been concentrated on two projects. Gene Nutter has been finishing his thesis problem which is a critical study of the effects of temperature, soil moisture levels, humidity and similar factors upon the phytotoxicity of the crabgrass control chemicals. It will be several weeks before he has this material summarized but we have an assurance that some worthwhile physiological data will come from it as well as some worthwhile development in experimental techniques.

Our other project concerns the use of endothal for clover control. Progressing from the material reported in "Golfdom" and in the New York State Turf Association Bulletin we have gradually worked down the scale and are getting good clover control with one and two ounces of endothal per acre. It seems quite probable that with what we know now we can pick clover out of all types of fairways. Our experiments on putting green turf have met with bad weather in most instances so we are not quite sure what the answer will be here. Rains following several extensive tests have ruined the value of some of our best attempts. We expect to bring all of our observations together this winter.

Concerning the use of endothal I might comment that one of the outstanding difficulties for its use on golf courses would be the lack of the proper machinery for low volume, low pressure application. While ordinary applications with large volumes of water will not kill permanent turf, the large volumes certainly do increase the apparent injury. Hence, casual trials with poorly adjusted equipment or equipment not designed for low volume, low pressure work may not produce the effect we get with our more carefully calibrated sprayers.

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Report from Harry Schoth
Presented by Al Radko

So far as the Western portion of the United States is concerned and perhaps more particularly the Pacific coast, interest in turf and turf problems is increasing rapidly. There are a number of reasons for this. The rapid increase in population and rapid development

of new homes, in turn means many new lawns, demand for more and better parks, recreation areas, etc. There is more highway construction and particularly highway beautification within cities and nearby. In some sections there are increased difficulties in getting ample supplies of water for irrigation with subsequent higher water rates in quite a number of situations.

It is the general opinion of the majority of persons knowing something about turf or being interested in it to think primarily of fine leaved grasses growing under the best possible conditions that can be developed and used mostly in connection with the games of golf and outdoor bowling.

It would seem in line to enlarge this thinking. Why not give more consideration to the realities and possibilities of the coarser grasses, certain legumes and other kinds of plants capable of being utilized for turf for varied purposes under certain management practices and under certain and varied conditions? After all, everyone cannot successfully grow golf green turf because of numerous obvious reasons. On the other hand, many persons can grow the equivalent of turf that will answer their purposes for turf.

It is in line with this that some turf work now being carried on at Oregon Experiment Station, Corvallis, is of considerable interest. After three years it is interesting to observe that rather satisfactory turf development is in evidence for such coarse leaved grasses as orchard, meadow foxtail, timothy and tall fescue providing they are properly fertilized and watered and not mowed too close (1½ inches) and stands are kept dense. They appear to be somewhat easier to keep in satisfactory color throughout most of the year than is the case with fine leaved species. As the plants age, their conditions may change, but so far they look good to the layman. Another point is that this type of plant often lends itself to a much broader turf use than other more refined plants.

There seems to be a feeling that in the future increased emphasis may develop in the use of legumes and miscellaneous plants such as dichondra for turf purposes. Some study on this proposition may be worthwhile.

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Report from C. K. Hallowell

The two impressions that I brought back from the Field Day at Penn State were (1) the importance of the work Burt Musser has done with getting the new bentgrasses for putting greens. That is, the polycross bents are so outstanding that the golf course men would not stay away from them. I am happy to report that some of our seed will be sold this year and it is being tried in different areas.

(2) The compaction studies that are being made there are extensive. They are laid out in triplicate plots in layers where runoff was possible and they will stay there for some time. After the soil has been compacted artificially, the runoff was 80% where the runoff from normal soil was only 15%. Then by aerifying once the results showed, that with the same amount of water applied, they reduced the runoff 50%. In other words, only 30% of the water ran off after aerification.

The work with the seed mixtures with good grasses like Merion, F-74 and good bent for fairways was outstanding.

In the Philadelphia area the work with the Urea-form in comparison to other nitrogens, both organic and inorganic, has been continued at Gulph Mills Golf Club and results will be reported on that at the end of the year. This is the third year that research work has continued.

The funguicide plots have been carried on this year. Details will be reported at the end of the year. We did have a serious outbreak of large brownpatch about the 18th of August in the area. It was perhaps more serious than we have had for a number of years. Most of the fungicides we have were used. My comment would be that hydrated lime used at 5 to 10 pounds per thousand square feet found a proper place in drying out or controlling large brownpatch when it was as serious as it was at that time.

Merion bluegrass is being used in new seedings. In most cases, at least 10% bent is being used with it. We have found that where it has been put into existing turf two years ago, it is now beginning to show up.

Crabgrass control plots are being conducted in that area by Dr. Davis of the American Chemical Company. Due to the severe drought in August, they had to be discontinued.

We used a good bit of sodium arsenite in renovation work. When a complete renovation program is in progress, we use about 1 to 3 applications of sodium arsenite before the seeding was done and then use a heavy application after the seeding is done. Step it up to perhaps two to three pounds per thousand square foot.

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Report from Jesse DeFrance

This work has been accomplished with the help of Jimmy Simmons and Charlie Allen.

1. Chemical treatment of seed beds for weed control and the effect on subsequent plantings of grasses at various intervals after treatment. Cyanamid at 35 and 50 pounds to the thousand square foot gave excellent control of weeds and excellent stands of grass when seedings were made three and four weeks after treatments. Other chemicals show promise when seedings were made at the time of application. Surface applications on level areas appeared as satisfactory as raking in the chemicals.

2. Lime and compost requirements of velvet bent putting green turf. Compressability notes indicated slight differences in the degree of sponginess between the lime and no lime plots. Although evidence is far from conclusive, it appears that limestone is aiding in the decomposition of plant residues that contribute to undesirable sponginess. Compost was found to be a factor also. Plots receiving applications of 1/3 cubic yard per thousand square feet of compost mixtures applied two times during the season were less spongy than plots receiving ¼ cubic yard of compost or plots receiving no compost. Unsterilized compost was a source of crabgrass seed. Increasing the rates of application of limestone increased the crabgrass content of the respective plots.

Limestone had a reverse effect on copperspot disease. The more limestone used, the less copperspot. It is planned to modify this project to study the effect of aerification on sponginess of turf.

3. Water soluble mercurials and other chemicals for crabgrass control. Crabgrass control studies were conducted with water soluble mercurials-- potassium

cyanate, sodium arsenite and some other chemicals and combinations. Phenyl mercury combinations gave excellent control and discoloration of the basic turf grasses was not objectionable at any time. No turf injury was observed. Potassium cyanate and sodium arsenite gave fair control. Maleic hydrazide did not give good control and was injurious to the basic turf grasses. Combinations of phenyl mercury acetate and petroleum products were studied as crabgrass herbicides. The materials in combination form were superior in the control of crabgrass than the petroleum products as individual treatments.

4. A study of the compatability of nurse grasses with pure and mixed seedings of the basic turf grasses under heights of cut of 3/4 and 1½ inches. The addition of a nurse grass did not aid in the establishment of a dense, vigorous turf. The addition of a nurse grass did not reduce the weed population or improve the general appearance of the turf with regard to turf quality factors or drought resistance. The addition of ryegrass did not hasten the initial stand or improve the quality of the turf. Heights of cut and density influenced the persistence of the nurse grass. In a turf mowed at 1½ inches perennial ryegrass was in greater abundance than when it was at 3/4 inch cut. Turf mowed at 3/4 inch height of cut was superior in quality factors and drought resistance and appearance and more satisfactory than turf mowed at 1½ inches. The closer cut turf had less disease, less smothering out and less winter injury. Throughout the six year test, which is concluded this year, a mixture of Kentucky bluegrass, a good strain of red fescue and a good strain of Colonial bent produced the highest quality turf.

5. Rhode Island bentgrass selection. From 352 plots selected previously from over 5000 selections, eight improved strains were found, selected, planted in rows for seed production. The plots from which these selections were made have been maintained at a height of one inch receiving only minimum maintenance with no irrigation, weed or disease control. A similar crop of seed sufficient for increase was harvested this year.

6. Fungicide trials. I have a report that was prepared by Dr. Howard in that respect. It is as follows. Severe dollarspot injury on Toronto creeping bent provided the only significant comparison of fungicidal chemicals tried. Although the degree of injury varied for the treatments on the dates when notes were taken, the data of September 18 are typical. The five dupli-

cate areas where no fungicide was applied averaged about 30% kill. Where the new fungicides--Orthacide SR406-- was applied, the plots received 60% kill. That was not due to chemical injury but entirely caused by the fungus. This increase in disease where an otherwise good fungicide was applied is a cause for speculation. Tersan 75 applied according to the manufacturers directions permitted about 10% of the grass to be killed by dollarspot. The top form materials were Crag 531, Actidione, Cadminate and Calo-clor. The Cadminate and Crag 531 provided a most unblemished turf. This was also true of the Actidione until the last application was made during cool weather in late September.

The experiment to determine the relation of nitrogen application and lushness of growth to the damage of brownpatch failed to yield the hoped for results. Brownpatch did not develop on the Colonial bent plots. Observations of the plots indicate that about five pounds of nitrogen in the form of Milorganite per thousand square feet per season was about optimum. The plots receiving no nitrogen had the highest percentage of crabgrass.

Helminthosporium blights are not recognized as our most serious turf disease. Some may cause spotting of turf similar to that of dollarspot while others cause a general melting out or leaf yellowing over large areas. Observations to date indicate that mercurials either as phenyl mercury or mercury chloride are the only chemicals that will prevent or control them. To affirm the observations of others, while the application of fungicide as sprays is more effective, dry applications with sand causes less injury to the turf. Thus during hot weather when showers are more frequent and some disease spots appear, these can perhaps best be touched up with a little dry fungicide. That is the end of Dr. Howard's report on the fungicide trials.

7. Other projects with regard to chickweed and annual bluegrass control have given varying results with various chemicals.

8. Pure seedings and mixtures of warm and cool-season turf mixtures are under study on a turf roadway maintained at two heights of cut.

9. Improved selections of putting green grasses are under study in a practical putting green test.

10. A series of individual grasses and mixtures is under study with respect to shade tolerance.

11. A study of a comparison of Astoria, Rhode Island and Highland Colonial bent fertilized with different levels of nitrogen was started in 1951.

12. A 10 foot strip through the center of all the putting green plots was treated for disease prevention and control. Five treatments at 3/4 to 1½ ounces of PMAS in five gallons of water per thousand square feet at 10 to 20 day intervals gave excellent control of disease and perfect control of crabgrass.

13. Fairway and lawn plots planted with various individual grasses and mixtures indicated B-27 Merion bluegrass to be superior to other bluegrasses. Astoria and Rhode Island Colonial bents were superior to Highland Colonial.

14. Zoysia Z-52 continued to be hardy, was mowed at a height of one inch, appears to be definitely a hot weather grass, goes off color in early October and greens up again the following June. U-3 bermuda did not prove hardy. However, further testing will be conducted.

15. The highly advertised midget grass which is supposed to end lawn turf problems appears to be nothing more than the little weed pearl-wort often observed in putting green turf.

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Report from H. B. Musser

There are a few highlights that I might mention briefly. The one is the results again this year with our strains of fescue. The strains that were outstanding during the previous years were again outstanding this year under very extreme drought conditions. The fact is with the exception of Merion bluegrass and these better strains of fescue, we didn't have anything in our plots this year that was satisfactory under extreme drought. I might qualify that by saying that Alta and Kentucky 31 and the selection from Alta, 144, also survived our drought conditions very beautifully this year. Of course, they are not of as much interest to golf course people as they are to some of our other phases of special purpose turf.

The results with the polycross bent again have shown that there are very definite possibilities in that method of producing creeping bent. At the present

time we have three parents which are pretty good performers from the standpoint of the quality of turf they produce, without having too much vigor. I think we are justified in selecting those strains as parents for production of polycross seed.

The other outstanding thing, that agrees very nicely with what Jess DeFrance just reported on, is the tremendous difference that we observed and recorded in the disease incidence on the more starved grass areas in our fertility tests. We are just beginning to get some documentation on it and actually show that there is a very definite tie-up between good fertilization and disease incidence, particularly dollarspot.

We have one thing that we are quite proud of and that is our lay-out to test the effect of aerification on runoff under various methods of management, which has been financed by West Point Lawn Products. Ed Merkel, our graduate student, has spent a lot of time on it during the last two seasons and we are beginning to get some excellent results on it.

Our nitrogen-potash studies are continuing and Professor Holben, who is doing that work, is beginning to get the soil to the point where deficiencies of potash and, therefore the application of potash, are beginning to show.

We are continuing our studies on the effect of water and compaction in connection with aerification under the United States Golf Association Green Section fellowship. We have split those plots up now and are studying the effect of aerification in bringing that turf back and trying to determine what the differences are in fertilizer penetration and so forth.

I want Ed Merkel to come up here and give you a brief report on his runoff and compaction studies. I might say that this work is being done on a fellowship grant from the West Point Lawn Products Company and we are more than grateful for the interest they have taken in subsidizing the work.

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Report from Ed Merkel

We have six tiers which are divided up into 12 plots each. Three of these tiers are compacted and three are uncompacted. On each of the six tiers half of

those plots are thatched and three unthatched. Six of the plots on each tier are aerated-- three of the thatched and three unthatched.

When you start applying the water, you can really see the results because it just runs off the compacted ones that have not been aerified. On the difference in the amount of water running off, I get about 80% running off the compacted plots that haven't been aerified and that was reduced down anywhere from 30% to 50%. On the non-compacted plots I only get about 20% runoff from the unaerified ones. That goes from zero to only 1% or 2% on the aerified.

Most of my data is just picked out stuff. I haven't analyzed anything as yet.

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Report from Jack Harper

As Professor Musser indicated, most of you are familiar with the set-up that I have up there at the present time sponsored by the U. S. Golf Association Green Section. The project started in 1947 and Jim Watson had it about three years and I took over in 1949.

For those of you who don't know the set-up, we have four moisture levels and five compaction levels. The moisture levels are what we call saturation, field capacity, "as needed" and the last one is dry or natural rainfall.

The first of the compaction levels is no compaction. Then we have two levels at which we use a roller which applies about 15 pounds pressure to the square inch. One of these treatments is rolled once a week and another is rolled twice a week. Then for heavier compaction we are using rollers which deliver about 60 pounds pressure to the square inch and again one series twice a week.

The newest addition to it has been aerification which was carried out this spring. In doing this we took all the plots that we had and divided them in half, aerifying one half and continuing the regular treatments on the other half. The moisture and compaction treatments run at right angles to each other so that there is every possible combination.

After aerifying in the spring I applied Super-phosphate to give about four pounds of P_2O_5 to the thousand and about a month later I took soil samples at one inch intervals and went down to six inches. I ran the Truog determination on phosphorus on the samples. Although I don't have that data analyzed yet, there showed a definite trend toward more phosphorus down at 4, 5 or 6 inches in the aerified plots than there is in the no aerification plots.

Some of the other data that I have taken this year and haven't had time to analyze yet includes clover counts, point quadrat counts for population, crabgrass counts, the phosphorus samples mentioned before and penetrometer studies to determine the relative degree of compaction. We weren't satisfied that the penetrometer readings would be enough on compaction so I have also been taking volume weights which we will try to correlate with the penetrometer and at the present time I am working on X-ray spectrometer samples.

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Report from H. B. Musser

I should mention one more phase of our turf work and that is studies of the various carriers of nitrogen. Our particular interest is to determine whether the new Urea-form material will compare advantageously with our natural organics as far as growth rates are concerned. By now I think we are very definitely safe in saying that the Urea-form materials at least in the range of availability that we have been studying, do compare very favorably and can be used very nicely to supplement our natural organics. My only gripe has been that we haven't been able to get them produced commercially.

We have a series of crabgrass tests in cooperation with the other tests that are being done at various states and we have limited ourselves to studies of only the materials that are recognized as having definite value for crabgrass control; that is, the mercurials, potassium cyanate and sodium arsenite.

We have a pretty nice looking area of solid Poa annua. We have the idea just as Jess has that there should be some way of either making the darn stuff grow and keeping it growing or being sure that it won't grow. That came largely as a result of the pressure that is being brought to bear on most experiment stations that

are interested in this special purpose turf work to see if some better documented information could be secured on this whole Poa annua picture.

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Report from Dudley Meredith

I haven't got very much to say tonight except that I have enjoyed traveling around this country and meeting people who are interested in turf research, seeing what magnificent results you get with your bentgrasses and the work that has been done with Merion bluegrass, Zoysia and other promising grasses.

In South Africa we make tremendous use of the various types and strains of bermudagrass. We have one or two other Paspalums which we use in various areas. We have tried temperate region grasses such as bluegrasses. They do very well in our winters but they find that our summers are very hard to bear.

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Report from Gunnar Torstensson

Your problems are much like ours. One thing seems to be very important: people who are working on the line of breeding grasses try to get as good a green as possible and people who try to bring out the seed try to have as much seed as possible. That seems to be two quite different things. In Sweden we are trying now to breed pure seed and then make some tricks so that the plant will bring seed just at the moment you want it. To some extent, it is going quite well. It is not the scientific man who has showed us the way; it is from the practical farmers.

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Report from J. H. Boyce

Over 90% of all turf research currently being carried on in Canada is being conducted by the Division of Forage Plants at the Central Experimental Farm in Ottawa. Turf research was started by this Division in 1924 with the setting up of a project entitled "turf

grass experiments" the objects of which were to determine the relative value of species and strains of grasses and mixtures of these for the production of turf on putting and bowling greens, lawns, fairways, parks, cemeteries, playgrounds, athletic fields, airports, roadsides and other turfed areas; to determine the best cultural practices such as soil preparation, rate, date and methods of planting, fertilizing, liming, top dressing, rolling, watering and other operations necessary for the production of satisfactory turf for the above mentioned purposes; and to determine the best methods of controlling weeds, diseases, insects and other pests and disorders in turf.

All research work at Ottawa is set up on a project basis. Main projects and sub-projects directly bearing on turf research are as follows:

I. Under Project Title, "Plant Introduction and Testing New Species".

(a) Preliminary testing of new introductions of turf species.

(b) The collection and preliminary testing of vegetatively propogated turf species.

II. Under "Turf Grass Experiments".

(a) Active sub-projects.

(1) Turf nursery

(2) Comparative tests of species and strains of bentgrasses for the production of turf on putting and bowling greens and high quality lawns.

(3) Comparative tests of species and strains of grasses for the production of turf on lawns, fairways, parks, cemeteries, playgrounds, athletic fields, airports, roadsides and similar turfed areas.

(4) Studies on the control of turf weeds.

(5) Studies on the control of snowmold.

(b) Contemplated sub-projects upon which some preliminary work has been done.

(1) Studies on the influence of different nitrogenous fertilizers on the growth and quality of turf.

(2) Studies on the effect of bituminous materials on soil stabilization and on the establishment of turf grasses.

(3) Studies on the influence of fungicides on the germination and establishment of turf grasses.

(4) Studies on the influence of aeration and related maintenance operations on the quality and usefulness of turf.

III. Under Grass Breeding Projects.
The primary purpose of the grass breeding projects conducted by the Division of Forage Plants is the development of superior strains for agricultural purposes. Nevertheless, the breeding material of turf forming species (Poa, Festuca and Agrostis) is screened for lines which might be useful in the production of turf. As a result of this work with creeping red fescue, a progeny test of what appeared to be superior lines was laid out last year.

IV. Future Developments.
Future plans include the continuance of active projects now being carried and the further development of the sub-projects mentioned in II: (b); 1 to 4, insofar as limitations of land, labor and finances will permit. Because of the high maintenance costs associated with turf research work, it is planned that as much research as possible will be conducted on local golf clubs and other turfed areas. It is also hoped that it will be possible to promote turf research work in other regions of Canada. Recent attempts along this line have resulted in increased interest at a number of stations in the Experimental Farms Service. Turf research projects are now being set up at some of these stations.

This turf research is an extremely expensive business particularly from the standpoint of maintenance costs. What we are trying to do now is to get more of our work out on the golf courses, athletic fields, cemeteries, roadsides or anywhere where we can get the work done.

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Report from B. P. Robinson

Products of agricultural research are subject to the ever changing vagrancies of environment. Results are often appraised according to the procedure and length of time involved in reaching a conclusion. For this reason, some of the Turf Research being conducted at Tifton cannot be reported or closed as the end of a chapter but must, if turf research products are to have any meaning, be continued for several seasons. This continuation not only adds to the value of research products but always uncovers new avenues of approach for the advancement of all types of research.

I-- Breeding and Selection of Grasses for Special Purpose Turf.

The turf research center is continuing to test selections of bermudagrass from golf courses and the best selections from the breeding program at Tifton. This, of course, involves management of the strains and periodic observations throughout the growing season. Since the release of improved strains or varieties often involves new systems of management, the research center has initiated programs of management involving the newly released Tifton 57 bermudagrass. A study of the transition problem from bermuda to rye and rye to bermuda has been the object of one of these management studies. This test established in 1950-51 has involved various rates of seeding rye grass, rates and time of applying nitrogen and levels of phosphorus and potash.

Another management study has been the introduction of improved strains of grasses into existing turf. Where it is desired to remove all of the existing sod on putting greens, methyl bromide continues to be the best chemical for such a job. Tifton 57, however, has been introduced directly into undisturbed turf by sprigging into Acrifier holes, strip sodding and by putting cup cutter plugs into undisturbed turf. The transition study which was established in 1950-51 will be continued and will be supplemental with a test to determine the fertility requirements of all improved strains of bermudagrass. Several clubs which now have Tifton 57 on putting greens have complained because Tifton 57 appears to produce somewhat of a mat under normal management practices. A study is being initiated in 1951 to learn how to manage Tifton 57 in order to produce an excellent putting surface.

It is realized that Tifton 57 and most of the outstanding selections from golf courses are not ideal

for putting green purposes. With this in mind, hybridization of Tifton 57 with a fine leafed strain of bermudagrass (South African bermuda) has been under way since 1949. Several of these hybrids are not being established in our turf plots and appear to be far superior to the South African bermuda. Crosses made during 1951 have involved the fine leafed bermuda with hybrids of 57, Tifton #12, Gene Tift and Everglade strains of bermudagrass. It will not be possible to determine whether or not any of these crosses are worthwhile until a chance has been had to observe them in our turf garden.

Two strains of centipede grass now exist which have value as turf grasses in the Southeastern United States. Red centipede is very aggressive and produces a fine turf but turns a reddish brown in early fall. Yellow centipede is not as aggressive as red centipede but will hold its color until frost. Crossing the two types of centipede has resulted in hybrids all of which act like the red parent. Since the red character is apparently dominent, improvement of either strain may be limited to individual plant selection within each strain. The crosses were made in 1949, thereby giving only one field observation on the hybrids.

Improved selections of Zoysia matrella and Zoysia japonica from various individuals and localities in the Southeastern United States are being established in the turf plots to determine their possible value for turf in the Southeast. Selections made by the United States Golf Association Green Section and the U.S.D.A. at Beltsville, Maryland, will be included in this test. It is the objective of the research center to establish an extensive selection and breeding program with the Zoysias comparable to the bermudagrass improvement studies.

Bentgrass selections are now being secured in order to initiate a program of selecting and testing of this genera in the fall. Some of the best bent strains now being produced in the United States will be included in the test.

Since the use of cool season grasses is a must with the turf producer who desires to maintain a year round green turf, the program of management and adaptation of cool season grasses will be continued in 1951-52. This will include such grasses as ryegrass, Kentucky bluegrass, Merion bluegrass (a selection of Kentucky bluegrass), Alta fescue, Kentucky 31 fescue, Chewing's fescue, red fescue, Astoria, Seaside and Highland bent and so forth.

II-- Management and Fertilization of Turf Grasses

A test to determine the rate of seeding, height of cut and fertilization of common bermuda, Tifton #3 bermuda, lawn Bahia, centipede, St. Augustine, carpet and Zoysia matrella has been in progress since 1947. After establishment, the test has consisted mainly of two heights of cut-- 3/4 of an inch and 1½ inch-- and fertilization. This test, of course, will continue in 1951-52.

Attention has been given the use of various nitrogen sources on bermudagrass and centipede for the production of fine turf. This has included both organic and inorganic sources and will be continued for the coming year.

The lime and fertilizer requirements of Southern turf grasses--common bermuda, Tifton #3 bermuda, centipede, carpet, St. Augustine, lawn Bahia and Zoysia matrella-- for the production of good turf has been in progress since 1947. New developments in the test required the establishment of another plot in 1949 involving carpet and St. Augustine grass. In order to obtain still more data, pots of these two grasses were established in the greenhouse during the winter of 1950-51. Results of this test will be available in the form of a thesis published by the Turf Specialist.

A research grant of $250 by the Southern Seedsmen Association and a like amount from the U.S. Golf Association Green Section will support a study involving seed mixtures for the establishment of turf areas. Mixtures of cool season grasses for quick germination and growth with the usual Southern permanent turf grasses will be used. Two fertility levels and management practices are proposed.

III-- The Production and Use of Top Dressing Materials

In 1946-47 top dressing mixtures were produced involving sawdust-sewerage sludge compost and sandy loam soil. Such mixtures appeared to be satisfactory for turf purposes, but the composted sawdust-sewerage sludge needed to be tested against a proven organic material used for making top dressing mixtures. Thus, in 1951, composted sawdust-sewerage sludge, fresh sawdust and peat moss were included in a greenhouse test to determine the effect of these materials on growth of Tifton 57 bermuda when mixed with sandy loam soil and grown under two systems of fertilization and water management. Water was applied so as to maintain a moisture content of 60% saturation and to leach the

pots about every 5 to 7 days. All the leachate has been saved for chemical analysis and periodic yields of bermudagrass has been taken. Results of this test should be available in early 1952.

IV-- Crabgrass and Weed Control

Weed control tests in turf have been conducted annually at the research center. The American Cyanamid Company has given $300 for crabgrass control research in 1951. This company also gave a similar amount in 1950. Plots for the control of crabgrass involve such chemicals as potassium cyanate, (liquid and powder forms), sodium arsenite, PMAS and experimental herbicide #2-- Carbide and Carbon chemicals.

V-- Insect Control

Since the establishment of the Turf Research project, various insecticides have been used for the control of insects in turf areas. Mole cricket control tests have been continued up to 1951. A new insect commonly called "ground pearl" has been discovered in centipede lawns in various sections of southern Georgia and northern Florida. Recently it was found that this same insect was attacking lawns in Tifton and the areas devoted to centipede on the Station lawn. Tests have been established in order to find some method to control this pest. It is expected that the trials will continue until 1952 or 1953.

A new program to be started not involving turf research but which will lead to the improvement of Southern turf is that of a Turf Management course to be offered cooperatively by the research center and the Abraham Baldwin Agricultural College, Tifton, Georgia. A short course is to be offered once each year if the demand is great enough and the two-year management course is now underway. It is hoped that golf courses in the Southeast which are in need of better trained personnel will support the two-year course. Young men interested in turf management could gain valuable experience on the research plots while attending the college on a turf fellowship.

Turf Consultation Services

During the 1950 annual Southeastern Turf Conference, the advisory committee of the Southeastern Turf Research Center made available the services of the turf specialist to golf clubs and other organizations interested in turf production. The turf specialist was to be available on call provided consultation services

did not interfere with the turf research being conducted at Tifton, Georgia. Organizations visited were to pay $25 per day for consultation plus traveling expenses. Where more than one club was visited in a given area, such clubs could share in the basic charge per day and traveling expenses. To date over 20 clubs have been visited in the States of South Carolina, Tennessee, Alabama, Louisiana, Florida and Georgia.

TURF RESEARCH

Fred V. Grau.

Research in turf management is essential to continued progress so that recommendations can be made upon a basis of facts, not opinions. The ultimate goal in research never is reached. When one problem or a phase of a problem is solved, another problem is there to engage the scientist. What we need is a continuous flow of fundamental information into a central reservoir of knowledge. We believe that state agricultural colleges are in the best position to develop information on turf management. The work is done in the climate where the problems exist and where educational features and extension service facilities can be developed to carry the results to the practical man in the field.

The Green Section can fulfil a valuable function by acting as coordinator for the national turf program, doing pilot work at Beltsville and at neighboring courses, visiting cooperative stations and turf areas occasionally and by stimulating extension service and teaching where they are needed. Publications of our annual Review will serve to keep everyone up to date.

Research takes two forms. We have the basic or fundamental research. A good example of fundamental research is the study of the life history of an insect which is attacking turf.

The applied research is that which we are doing a great deal of now. The applied problems directly help you to do a better job of maintaining turf.

Tax funds to supply applied research still are painfully inadequate for the size of the turf industry. Industrial interests more and more are devoting a share of their advertising dollar to the support of sponsored research.

One of the achievements that we can cite is the recognition of turf management by the American Society of Agronomy. It means that the most eminent body of agricultural scientists has recognized turf management as a legitimate part of agriculture. It makes it much easier to go to the administration of a college and talk to him about turf management on a par with the dairy industry, with pomology, entomology and all the other phases of agriculture.

I probably shouldn't even mention this but when I got home, I found my more recent copy of Scientific Monthly, on the hall stairs. I leafed through it and found an article, "Better Grasses for Better Turf", an article they asked me to write for the Scientific Monthly, which means just another step forward. It is bringing turf management and the development of better grasses for better turf to a whole host of people who were not acquainted with what was going on in this field before.

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RESIDENT TEACHING OF TURF MANAGEMENT

H. B. Musser

There is so little documented evidence on many phases of the turf management subject that one who is attempting to guide the man who is just starting in the game sometimes has to scratch his head pretty hard to determine exactly what should not be taught, rather than what should be taught.

Unfortunately, most of our reference material is somebody's personal opinion. That is why I, as a teacher, am so tremendously interested in development of our different research programs because it is only by careful observations, by critical experiments that we can settle a lot of this difference of opinion that there is on so many phases of the whole turf program.

Let me give you an illustration. There has been a lot of store set by fertilizer experiments. There have been a lot of recommendations based on fertilizer experiments that were conducted on field crops. In general they point the way, but there the essential differences between what we have to face as far as fertilizing turf is concerned and what is the common practice from the standpoint of the ordinary field crop. We grow that field crop for a certain length of time. We harvest it and then there is a period when the soil is resting. Where turf is concerned, we expect it to start to grow at the earliest possible time in the spring and we expect it to keep green and to do a good job for us until the ground actually freezes up in the fall. The nutrition problem for special purpose turf is entirely different and yet in a large number of cases, we have had to depend on experiments that were designed for an entirely different purpose.

There are three and perhaps more pretty distinct phases of teaching work. The first is resident teaching where we attempt to present in a more or less formalized way the science and theory, the background, basic facts on which all plant development is dependent. That can only be partially successful because unless you can tie up very definitely that theory with the art, you have done very much less than a perfect job. It is only if you are able to apply that theory to practice, that you can teach successfully.

We have a second phase of teaching which to me is tremendously important. That is, if we are engaged in the practical application of a subject, there are certain technical phases of it that we come into contact with only occasionally that we are apt to get rusty on, so I think that a particularly important part of any teaching program is the adult educational side of the picture-- the extension teaching-- which is nothing more than keeping us up to date on the latest developments and keeping our minds active, not getting stagnant on our jobs.

A third phase of this teaching program is the concentrated, high-power short course. I will not attempt to discuss that because I still have a very open mind as to the possibilities of it. There is a tremendous amount of information available, but I doubt whether you can give that in a concentrated dose so that a man who is starting from scratch could get anything but a start within that length of time.

There are two ways of getting an education. The one is the concentrated four-year college course to learn the theory, plus a reasonable time for getting practical experience. Then there is the long, hard way that a lot of us have come through in order to get what we have-- 20 or 25 years experience tied up with a lot of reading and a lot of attention to developments. If the demand is there for the concentrated training, I think there are a number of educational institutions at the present time that are in shape to produce this training. In other words, if you ask for it, we are in a position to offer it.

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EXTENSION SERVICE

C. K. Hallowell

I want to talk about what extension is and what the factors are in extension and who uses extension. More than 40 years ago agricultural experiment stations had a lot of facts that were really going up on the shelf after they were worked out. It was quite a concern of many people in the country as to how to get those facts out to where they could be used. I think when you are thinking about extension and perhaps wondering about whether the college is going to render you a service in extension, perhaps sometime it would be worthwhile to go back to those days when we were concerned about the facts not being used. That is the reason that Congress passed the Smith-Lieber bill in 1910 creating agricultural extension. The law would be administered by the land grant colleges and they would get money provided state and county money was used to match it. It is one of the activities created directly under the United States Department of Agriculture. The actual policies developed on the local level, not the national level.

Here in Pennsylvania we have always interpreted the meaning of agricultural extension as being that it is just as important to carry practical experience as the scientific developments of the college, also the services and assistance available from governmental agencies and private organizations and institutions that are not in a position to render assistance with particular types of problems.

The people who helped to put the Smith-Lieber Law through perhaps had something beside what Congress had in mind. I think the reason they thought agricultural extension should be effective was that it would help people accomplish what they would like to do with greater satisfaction, not necessarily to grow more corn and have more money at the end of the year, but perhaps to have more knowledge to fulfil their purpose in life better. I think in turf people want to know about growing grass because they want to feel they have accomplished something better.

In addition to those in the employ of the United States Department of Agriculture and those of us who are working for a land grant college, many commercial agencies have very active men carrying on an extension program. I think the same principal of carrying the facts to the public holds true whether you are in

college work or with a commercial firm.

It is important that the man on the county level meet with the people to find out their needs and designs or what they want. It is what the people want that makes a successful program. Any county extension man who tried to superimpose a program of some type of work that he thinks is needed and doesn't consider what the people want is doomed to failure. Such has always been my experience. It hasn't taken me any trouble to find our what the people want. They have declared what information they wanted me to get for them and we have tried to do that.

What is the responsibility of the people? They determine the program but they must have some unity, must work together, must have some common purpose. They should unite to see what type of program they would like to have carried on. In that way they can set up what is needed in their county or on the local level.

As for what our committee thinks or find out they are doing, I will start first with Charlie Wilson of the Green Section. I wrote to him and asked him for a specific instance of extension work or demonstration work. I think you would be interested in knowing what he has done with the Mid-Atlantic Association this year. The president of the Mid-Atlantic Association appointed a committee to work with Charlie Wilson in preparing a report. That committee is quite active and prepares a report of the findings that they observed on the golf course where they played golf and met at their last meeting. That information is released by the committee and mailed to all members of the organization. The report is fair, not critical, and is constructive. That is Charlie's contribution to demonstration work being done in this area.

William Daniel, member of the committee from Purdue, reports that chemical treatments with Dowfume kills weed seed before establishing new turf. The way they demonstrated it at Purdue was to treat an area early in the spring and have the turf well established by the time they had their summer meeting. Then on the day of their summer meeting they treated another area as they had treated the first one, showing exactly how to put the material on. So they had what we might call a report demonstration. They had a good turf free of weeds to show the people as a result of treating with methyl bromide two or three months previous, and then they treated an area to show how to do it which would be a method demonstration. They have done considerable work in a demonstration way to show how iron sulfate

effects putting green soil.

We pass on to Texas A & M College where J. R. Watson works. He is Professor of Agronomy who devotes 3/4 of his time to teaching and 1/4 to research. The only way he finds time for extension is in vacation time or in extra-curricular activities. The college and the Texas Turf Association have a close working relationship. They sponsor the annual turf conference which has a wide-spread variety of turf interests besides golf.

Texas is divided into regions-- North, South, Gulf Coast, East, West and Panhandle. Each region has two or more regional directors who are responsible for regional meetings, turf membership and so forth. The turf association defrays expenses of technical personnel to meet in those regions. Consultation and advisory meetings are made upon request. Individuals or organizations requesting assistance must defray the expenses for this type of visit.

It is also sponsoring a turf tour. Jim Watson made a tour of the North, East, Gulf Coast regions covering 2400 miles in 2½ weeks. The next week he took a tour of the North and Panhandle regions covering 1100 miles in just one week. On these tours regional meetings were held and all types of turf areas visited. Jim Watson says that possibly 400 or 500 letters, requesting assistance, are handled from March to November. This includes letters from home owners as well as other types of turf. You can see there is a big job to be done down there.

Then we pass to California and John Gallagher writes that one of the things they have demonstrated is the importance of fertilizing prior to seeding. They had some idea that it wasn't practical to put fertilizer on until the grass had become well established. He said that fertilizing prior to seeding gave striking results in some demonstrations and these plots were shown to the superintendent of Forest Lawn Memorial Park and the director of the landscape department of the Los Angeles school system. Both adopted the practice and now always use it. He said that 35,000 plugs of U-3 bermuda were planted in the Rosebowl football field.

Then the athletic field superintendents were encouraged to meet, organize and discuss their mutual problems. O. J. Noer was there last May at their conference. There were about 80 or 100 of those men who are meeting four times a year with the college men and they want to be informed and kept up with the develop-

ments of turf. John assisted the men in charge of turf at the UCLA football field to improve it. Aerification, mowing the grass shorter, improving the management practices were contributing factors.

Then he sent along clippings from one of the sports editors who interviewed Coach Sanders on the first day of practice. Coach Sanders looked at the turf on the field and remarked that bermudagrass helped cut down injuries and he couldn't see how a boy could be hurt on a field like that. That is one of the things that we are trying to get over. When I talk to women's clubs, I always tell them to think about their homes. Do their boys and girls have good turf to play on? Then we try to discuss that and see if they can't do something about seeing that people grow the right turf at home.

The outstanding examples that I believe has happened in the last two years in developing an extension program that I have observed is in Westchester County, New York. William Bengeyfield, the assistant county agent, was put in there to carry on a turf program and I believe he did it well. They put on a large turf conference last fall primarily for other interests than golf. It was well attended.

Georgia sent us along a little information from Dr. Robinson on what they are doing. They are finding out that many people are growing bermuda in the shade. They point out that you must either remove the trees that are producing the shade or try to grow some other grass in that area. They are demonstrating the importance of sun in growing bermudagrass. They are also using chemicals on weed control and in demonstration work. Dr. Burton developed the different strains such as Tifton 57 and they are demonstrating the use of that as they go around over the states. Of course, the southeastern turf conference is one of their projects. This is the 5th year. They are putting out a publication. I think it is so very important for anybody doing turf work to have some release of information to create interest in what is going on and, as Fred said, keeping people informed continuously of activities pertaining to turf. Much work is being done with other than golf courses by the people at Tifton. Many of the requests for information come from lawn owners.

For anybody who is going to be a turf extension specialist, I have tried to point out that I can't see how they can make it go unless they are willing to keep the people who are interested informed. That means keeping themselves informed about the factors

they might bring from the college and might get from other conferences to the people who are carrying on the work. Then keeping themselves informed on the problems in the field. There is no question that the extension man should serve urban people just as rural people. I think we have come a long way in that respect, mainly because the people have wanted a program.

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INDUSTRIAL SERVICE COMMITTEE REPORT

Warren Lafkin

Because of a commitment made last winter to meet with the Western Michigan Golf Course Superintendents Association, Dr. O. J. Noer, Chairman of this Committee, was unable to be here today. Dr. Noer did correlate the ideas expressed by the individual members of the Committee while in my office last Thursday and his notes are the basis of my remarks.

At one time, in fact within the memory of O. J., T. L. Gustin, G. A. Davis, myself and other members of the Committee, the motives of commercial men were often questioned and we were not considered a part of the turf improvement program. Industry was looked upon as having only one selfish objective, the pursuit of profit. However, through the years that picture has changed. We now enjoy the privilege of taking part in meetings such as this one. We realize the responsibility that goes with our privilege. Since a few years after World War I, the trend has been for teamwork between commercial firms and the governmental research workers and extension men. This is as it should be because one complements the other. Industry puts proven research to practical application.

Industry has made many contributions toward the better management of turf. It is the job of industry to develop the new products which come out of research--their own as well as that done by public service agencies. Industry must keep abreast of all the advances in turf science. This means keeping in touch with all the "Grass People" - the men engaged in turf maintenance and the agricultural colleges and other agencies engaged in turf research. Industry must see the need and then develop and market the new products that are needed.

Higher wages and labor shortages made apparent the need for greater mechanization, to eliminate or reduce hand labor to a minimum. Equipment manufacturers have made mechanical tools available. There has been a constant effort to improve these tools, to make them ever more efficient and satisfactory to use. Grass cutting machinery is vastly better now than a few years ago. Service and repair parts services have constantly improved. New equipment creates a need to educate the users to best methods for using and maintaining the new tools. Industry provides trained men to give this education service to the consumer.

Industry not only gives advice, but seeks it, too. Engineering departments are seeking the advice of the men who use the equipment they design. The development of aerifying equipment is a good example of how industry produces new equipment to fill a specific urgent need. Many other examples could be cited.

In recent years chemical firms have cooperated with research workers and practical turf management men in the development of better fungicides, pesticides, herbicides, soil sterilizing materials and fertilizers. An example is the National Coordinated Chemical Crabgrass control program, in which many manufacturers are cooperating with leading agricultural experiment stations in a program coordinated by the USGA Green Section.

Many industry-sponsored and financed research projects have been established at various experiment stations. Many needed developments have resulted from the close cooperation between industry and public research and development facilities. Let me mention a few: Tersan, 531,Cadminate, Phenyl Mercuric Acetate, Potassium Cyanate, DDT, Chlordane, Aldrin, Methoxychlor, Parathion, 2,4-D, Lindane and Dowfume MC2. Many others could be named.

Cooperation among the manufacturers also results in progress. The chemicals and equipment used in turf maintenance cannot always be treated individually. They must all fit together into the management program. Manufacturers can and do get together to test their products in combination with those made by other concerns.

Cooperation is the keynote to turf progress. This progress can best be accomplished by a joint effort of those in commercial development, private research and those in public service. Industry supplies equipment and materials for testing to recognized research agen-

cies and to private users. Information which comes out of these tests is used by the industrial concern in the improvement and development of the product. The coordinated and cooperative approach is a sound program and highly desirable.

The development of better grasses is a big achievement. The Fellowship established at Penn State, by the late Howard F. Wagner, is an example of an industry sponsored project to test turf grasses in the area where they are to be used rather than just growing grasses which produce the best yields of seed or the best pasture in the Pacific Northwest, irrespective of their performance in use areas. The first poly-cross bentgrass is a result of this research and Professor Musser is well on his way toward superior strains of the creeping red fescues. Merion bluegrass is an example of a superior strain of grass, selected not because it provides the best livestock grazing but rather for its turf forming ability. We are indebted to the keen observation of Joe Valentine for this indigenous variety and to the energy and vision of Dr. Grau in getting it into commercial production. Other and better grasses are sure to come. Their development depends in a great measure upon teamwork between research, extension, turf management interests and the seed growing industry.

Most men in industry today, serving the turf management field, take their responsibilities seriously. Almost without exception they are dedicated to a high code of ethics. They can be depended upon to keep mistakes to a minimum, never make the same one twice and never urge anyone to do anything he would not do himself were their positions reversed.

Although I am not a manufacturer, as a dealer in turf equipment and supplies, I have an obligation to disseminate accurate, up-to-date information to the general public, serving their interests as well as my own. I have been tremendously impressed this season with television and its vast potential for public service in the turf development and management field. Unfortunately, television must temper genuine public service with commercialism. TV programs cost a lot of money and someone has to pay the bill. Industry has the opportunity to render a genuine service in the public interest, through the medium of television. Literally millions of home owners, especially those with new homes, are eager for help. It is my frank opinion that in the short space of a few months, TV, through programs such as Phil Alampi's Home Gardener on New York's WJZ-TV have disseminated more worthwhile

information than either research, extension and industry have been able to do in person and by the printed work over a period of years. Most of us enjoy black and white TV now, just imagine the possibilities of color television, especially in the horticultural field. There are virtually no limits to the possibilities of television in visual, practical education and industry in cooperation with research and extension can and will do the job.

In conclusion we should like to express our gratitude to Dr. Grau and his co-workers in the Green Section and in Federal and State Experiment Stations for their accomplishments. It is the ground work for progress which is irresistible.

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THE SHAPE OF THINGS TO COME FOR GOLF

Richard Tufts

The shape of things to come. I presume this means that I am to suggest to you what conditions and what problems are likely to arise in the future in connection with the development of the game of golf. Your guess is better than mind. However, there is no harm in thinking out loud about the possibilities.

The best way of determining where an object is going to, is by observing the direction in which it is moving. Thus, perhaps the best way to forecast the future is to watch the trends of the present. Today in golf the following are perhaps a few of the trends which are of particular significance. Costs, as we all know, are increasing; wages, taxes, supplies, equipment. The large incomes are being cut and fewer people are able to afford the luxury of a membership in our exclusive clubs. On the other hand, there are more people with comfortable incomes and with more leisure time to spend in relaxation. We do not find many new clubs in the big metropolitan areas but we do see that the game is growing rapidly in the smaller towns all over the country. The game is healthy and more people are playing it than ever before.

If these be straws that indicate the direction of the wind, what do they foretell? Simply one thing. We must be prepared to serve more people at less cost. If golf as a healthy, character building relaxation is going to continue to grow, we must retain our present

standards of maintenance and yet so reduce the cost of doing everything necessary to retain these standards that we can satisfy the increasing demand for golf at a lower cost than ever before.

This, then, is our problem for the future. How is it to be solved? Again there can be only one answer. By greater knowledge, by improved equipment, by new materials and by adjustment of our ways of doing things. By this I mean to suggest that we need to know still more about how to grow grass, we need new fertilizers, insecticides, sprays and chemicals that will do a better job for less money. We need new and better grasses that will be more disease and drought resistant and better adapted to our particular requirements, and the many different local climatic and soil conditions. We need equipment that will do the job better and more cheaply and that can be used to replace hand labor. We need to modify our courses and our practices so that this new knowledge, new materials and new equipment can be used to full advantage. I would like to go on record here as favoring the substitution of mounds and roughs for bunkers and traps. They can be just as effective and they should greatly reduce the hand labor required for maintenance.

Finally, how are all these changes to be brought about? It can only be done by those who are interested working together as a team. The scientist, the extension worker, the industrialist and the superintendent, each one has his part to play. The task is too big and too complex for any one of the four to undertake without the aid of the other three. Let us each accept the future as a challenge and work together to provide golf for more people at less cost.

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THE SHAPE OF THINGS TO COME FROM THE GOLF COURSE SUPERINTENDENTS VIEWPOINT

Agar M. Brown
Presented by Bill Glover

The golf course superintendent is a man in an envious position. In varying degrees, he controls the success of a golf course by providing conditions which affect the attitude of its members, be it a private club or a municipal course.

To achieve the desired result, a superintendent must call upon his fullest resources to cope with Mother Nature, the player, the attitude of employees under him and the equipment available to him.

Turf research can help in many ways but he is, because of necessity, interested in results that can be effected now. Some theoretical research work may be necessary to form a background for a practical job. The steps taken to achieve an end result often do not have favorable reception. Coping with today's conditions today to the best of his ability and to provide turf under current conditions is his prime concern. He values research and recognizes its importance but often finds he is stabbing in the dark because an answer is not available to him.

Today's superintendent recognizes the need for having properly trained men under him, both as a valuable asset to his forces as well as insurance to his employer. Providing a capable assistant is not as easy as it appears. First, many courses do not have a budget which would permit the hiring of an assistant by setting a wage scale that would attract such a man. Second, many practical men desiring to advance do not have the academic background which will permit them to take further studies in turf management in schools and colleges presenting such courses. The advancement of many a capable man is handicapped because he cannot meet the entrance requirements demanded by a school. He may have a practical background which in many cases would qualify him for a job but until he gets that additional knowledge which the superintendent has accumulated during his years with the club and is only now available through various schools, he cannot establish himself as a top notch man. In order to protect the profession of fine turf management, it is hoped that certain entrance requirements for schools and colleges will be so set up that such men may be allowed entrance.

Extension service in turf management is a field that many superintendents are not aware of because they have never been contacted by such an individual. A capable man holding such a job would truly have a "labor of love" because by the time he was qualified, industry would snap him up. It can be hoped that there will be developed such contacts in the future. Perhaps the biggest job in any plan of extension service could be made by offering courses pertaining to turf management and which would be available without stringent entrance requirements for those wanting to improve their knowledge. Many courses are being offered by

various schools throughout the country through their extension service but unfortunately not on turf management.

Since the turn of the century manufacturers and distributors of equipment, supplies and services have often been the best contact for a golf course superintendent. Their representatives have provided information which he can adopt to his turf needs at once. Many superintendents do not have the opportunity to join and meet with men in their profession. The superintendent, in turn, has advanced suggestions for improvements in many products which have been of benefit not only to its manufacturer but to all turf men. We feel that this relationship will continue.

The Golf Course Superintendents Association of America during its quarter century of existence has felt it has helped immeasurably in providing for improving turf conditions throughout this country. It looks forward to being of greater and continued service in "The Shape of Things to Come in Turf Management".

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ATHLETIC FIELD TURF

Marshall Farnham

As I have listened to the talks this evening and the four big fields that we have heard discussed, it strikes me from my rather limited experience that probably the people concerned with athletic field turf are very much in the position that most of us in the golf course turf maintenance business were as long ago as 30 years. It seems quite striking that while all of these fields have a definite contribution which can be made to the production of better turf on the athletic fields and while turf research and the services which Mr. Lafkin pointed out are available from industry, they are all extremely important. It seems rather outstanding that probably there is more need at the present moment for the extension type of activity in the improvement of athletic field turf than any of the other fields.

Before we can get to that work, there is a need for the athletic field people to get together as they have started to do in California and come to some ideas of their own as to what they do want. I think there is an outstanding lack of uniformity of interest in that

angle. Perhaps as a goal which might be striven for, the best definition of the need for athletic field turf that I have heard is that something is wanted which is firm, smooth and green. That is a rather simple definition but when it comes down to the actual production of that end, their interests are primarily with the third angle-- the green part-- because in many cases we can't go into the ground work as we would like to. It is a big problem. A few of us were fortunate this past summer in making a tour of some of the fields from Philadelphia up as far as West Point and I think the striking thing there was the complete absence of knowledge of those specifically involved with maintenance of these various fields as to what his neighbor was doing and that neighbor might have been as close as ½ a mile away. That is why I say those activities are in the stage that many of us were 30 years ago in the golf course maintenance business.

The only difficulty in the development of this extension service angle in reference to athletic field turf is that it must come on request and until these groups get together and get some common thinking and begin to make requests, the extension services aren't going to be called on. Maybe we must go to some kind of educational work basically extension without waiting for the request.

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THE SHAPE OF THINGS TO COME FOR LAWNS

Colonel W. K. Bonnell

Officially my interest in lawns is extremely limited to those areas where traffic is heavy, play is rough and the population has a comparatively high density and children average two or more to the family--specifically the public, low-rent housing development. Here we need the toughest, most wear-resistant turf that can be developed. From a professional and personal standpoint, however, the home lawn is my field.

As far as turf research is concerned, it seems to me that this has far outrun our ability to assimilate or disseminate the data that has been developed. However, it must continue. Our principal need then is to get the news of the latest developments to the people who are responsible for developing and caring for the greatest and most wide-spread areas of lawn-- when you lump them all together-- that is, the average house-

holder and the grounds keeper of any institution where a good lawn can contribute so much to the attractiveness or livability of the place. To do this, we need the benefit of each of the services discussed in the other three subjects this evening.

Only by resident teaching in the schools where the research has been carried on and the trials over the years have shown the value of the improved strains and methods and timing can the gospel be spread. Should inculcate enough of what is new so that at the time the student is ready to perform, new things will be common knowledge to him and he will be able to perform. It is evidence that the spread is all too slow when we recall a popular but misleading article published recently in our Sunday newspaper by a professor of one of our leading technical colleges that insists a high percentage of red-top in the home lawn seed mixture is necessary to the production of a fine lawn. It would seem to me that a greater need is a technique or method of reaching the schools-- and alerting their faculty agronomists-- where the results of latest research have not been accepted and are probably not even known to exist. Getting the USGA Journal with its excellent articles on Turf Management from the United States Golf Association Green Section and Professor Musser's book, TURF MANAGEMENT, in the school libraries and on professional reading tables would seem to be an excellent start.

Extension services of the many county agents of state schools can do much. Some popular booklets have been published that demonstrate the latest developments of turf research. Some contain obsolete and misleading information. To bring up-to-date these teaching courses or publications that have not kept pace but stick to the older lawn grass mixtures and methods of turf development and management is a major problem of those who have found out what newer methods and equipment can accomplish. So, there is a big field for the extension service in passing out the latest information to the people who need it. Popular magazine and newspaper articles that fail to give the latest information should be monitored and corrected by those who know.

Probably the medium that has the greatest public appeal and reaches most directly the person who is going to work on a lawn himself or have his lawn worked on is the service furnished by the industries related to lawn making and maintenance. The house organs such as Scott's "Lawn Care", West Point's "West Pointers", and Warren Lafkin's lawn bulletins have a popular appeal

and reach out to the average person more directly and far quicker than is possible to the schools or extension services. Then, there is the broad field of industrial advertising that brings up-to-date the thinking of all that see and read. I look with a dim eye at the one that tries to appeal for the use of Zoysia as a lawn grass by calling it "Flawn", but perhaps that is better than claiming to sell a "Green Lawn Mixture" made up of high percentage of ryegrass, Timothy and red-top-- of course, it's green and in a very few days, but what comes after?- Crabgrass and dandelions. However, it appears that the industries are ever alert to catch up with the latest results of research. It takes time, though, to produce commercial quantities of the improved strains of grasses and to develop and manufacture improved equipment so that the eventual consumer must wait a few years to make use of the new things.

Because of this lag, the newest products must be built up gradually. As long as common Kentucky bluegrass is all that is economically available, lawn-mower manufacturers, for instance, should make lawn mowers that are capable of cutting the lawns 1½ to 2 inches in height, instead of making and selling a machine that is set on delivery to cut to 3/4 of an inch. We must continue to manufacture and sell 2,4-D, PMAS, Potassium Cyanate, Scutl, Weedone and the like, as long as the weeds are more aggressive than the grasses planted. We must have fungicides until we can plant and maintain lawns of the disease resistant strains. Insecticides we need because the insect pests are always with us. Of course, the industrial publications are colored by the particular product they purvey, whether it's a fertilizer, improved grass mixture, piece of equipment, or what have you, still there is plenty of good data that can be obtained from the advertising services of industrial or commercial enterprises.

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NEW GRASSES FOR CEMETERIES

C. R. Runyan

During the past two years it has been my good fortune to use Merion bluegrass on a fairly large scale and Z-52 on a large enough one to evaluate these two fine grasses for our use. When one can seed Merion at the rate of 7 pounds per acre on subsoil without any top soil or organic matter other than some straw to pre-

vent washing and secure a good stand, I feel that here is a grass that we have been seeking for many years. True, it takes time to secure these results and plenty of fertilizer and this rate of seeding was born of necessity, not choice. However, if these results can be secured under unfavorable conditions, it would seem that with good seedbeds and not too much slope, ten pounds per acre should be sufficient unless time was too much of a factor.

With the appearance of Merion bluegrass on the market, some "tall tales" have appeared. To lead the home owner to believe that Merion bluegrass is a cure-all for every ill of turf and that all one has to do is secure a sufficient quantity of this fine bluegrass and all his or her lawn troubles will be over, smacks too much of some types of patent medicine advertising.

Because of its vigor and disease resistance, Merion has a distinct advantage over ordinary bluegrass, but sound soil management and turf practices will still be necessary for good turf.

It was about 15 years ago that Mr. Joseph Valentine, Superintendent of the Merion Country Club of Philadelphia, first noticed a small patch of bluegrass on the golf course which not only persisted but continued to enlarge. Mr. Valentine called it to the attention of Dr. John Montieth, Jr., then the Director of the U. S. Golf Association Green Section, who placed some of it in the test then located at Arlington, Virginia. Its performance there led to further tests. To the Green Section must go the credit for the introduction, testing and propagation of this fine bluegrass. It was also the Green Section under the direction of Dr. Fred V. Grau, its present director, that provided the stimulus that led to commercial seed production.

The Green Section recommends that Merion bluegrass should not be used in mixtures and that one pound per 1000 square feet is the most that should be used. With good soil and with a well-prepared seedbed half of this amount or even less is sufficient to produce a good turf, given care and sufficient time.

Fine as Merion bluegrass is, Z-52 makes a worthy companion or rival. So spectacular has been the performance of this grass since we have learned how to handle it that we are planning to convert at least those areas where we do not have ivy on the graves. The behavior of Z-52 has been almost unbelievable. If I had not seen it with my own eyes, I doubt if I would have believed it. From two-inch plugs planted in late Oc-

tober, 1950, (some of the places where they were planted had 75% cinders), they have spread rapidly and remained green during the severe drought of the past season. One plug has made a spread of 38 inches with a center solid area 18 inches across. A patch of older turf about 150 square feet also remained green without water.

I am not concerned about the off-color during the winter or that it will be necessary to grow cool-season grasses in combination with Zoysia. Alone it is not likely to require more than one cutting before Memorial Day and that is a valuable factor. In the fall cutting would probably be ceased by late September although the Zoysia would remain green much longer. A companion cool-season grass, while desirable from the standpoint of winter appearance, might upset this economy factor of Zoysia turf. In my opinion Z-52 is one of the truly fine grasses so far developed.

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HIGHWAYS

Wesley Hottenstein
Presented by H. B. Musser

I am not trying to speak for the highway departments of the 48 states and try to picture to you the shape of things to come in highway departments. All I can say is within the last two weeks we had a group representing the highway-roadside committee of the National Highway Research Board at Penn State to look over the cooperative experiments that the experiment station and the Pennsylvania Department of Highways are conducting. My impression was that they were primarily interested in better species of herbaceous materials for slope control. In the past they have been using a great deal of woody material.

Incidentally, I had a letter from one of our greatest states from the standpoint of population saying that their costs in highway improvement ran anywhere from $7000 to $32,000 per acre. I was amazed at that because we in Pennsylvania talk of our figures in the low 100's. Apparently there is that tremendous problem as far as slope control is concerned. If I were to attempt to put my finger on one thing that the highway departments are looking forward to from the standpoint of turf and grasses and herbaceous material, it is to find the best possible species that can be maintained

at the lowest possible cost.

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THE SHAPE OF THINGS TO COME FOR THE ARMED FORCES

R. H. Morrish

As a representative of the Department of Defense, it seems that I should indicate to all of you, as those who spoke before me have indicated, that I have a committee, too. It is composed of Mr. Alton E. Rabbitt, Department of Navy, Bureau of Aeronautics whom most of you know, and Mr. Burton Kiltz, the Agronomist in the Department of the Army. I wish to assure you that in spite of what you may read in the newspapers or hear elsewhere, at the working level of the agronomists in the Department of Defense, we truly do have unification.

Those responsible for the construction and maintenance of grounds at Army, Navy and Air Force installations are appreciative of the technical assistance that has been and is being provided by the U.S. Golf Association Green Section.

We are not engaged in agronomic research as such. The Department of Defense is a research agency in the development of new aircraft, ordnance equipment, rifles, jet fuel and other things used in combat, but to date we have been unsuccessful in selling the idea that they should finance agronomic research.

The testing that we are able to do consists largely of the evaluation of practices under actual field conditions from the standpoint of their adaptation to use on military installations on a world-wide basis. Such field observational tests can hardly be signified by the term "research". In order to perform our work in an efficient and economical manner, we will continue to depend upon established research agencies such as the U.S. Golf Association Green Section, the U.S. Department of Agriculture and the state agricultural experiment stations to provide us with technical information, which is applicable in the establishment, maintenance and management of grasses for the specialized uses that are required by the armed forces.

The agronomists employed in the Department of Defense are primarily concerned with the technical supervision of the construction of grounds at new installations

and the maintenance of grounds at existing facilities. The work is broad in scope in that it involves the specialized uses of grasses and other vegetative materials on all types of grounds including lawns, athletic fields, golf courses, airfields, cemeteries, small arms ranges, parade grounds, ordnance storage areas, bombing ranges, maneuver areas, forests and recreational areas. The acreage of land now under the command jurisdiction of the Department of Defense is large and the annual expenditure for the maintenance of these grounds is in the millions of dollars. These funds are not being spent for beautification but rather for utilitarian projects on dust and erosion control and for protecting the investments in land and the vegetative cover thereon including grasses, trees, and shrubs. To maintain and manage these grounds in accordance with the requirements of the military missions to be performed upon them is a sizeable job. It is a big job in acreage alone. We have the command responsibility of maintaining on a world-wide basis over 10 million acres of land. That is a pretty good slice of the land area on the globe. And all such management must be in consonance with the accepted national policy for the conservation of national resources.

We have many important problems but perhaps the one that is of greatest importance and has the greatest challenge to us and to you is the fact that as yet we haven't found a grass or a combination of grasses that will take the beating that vegetation should be able to take as a result of the operation of jet-propelled aircraft. If any of you as plant breeders, grounds maintenance supervisors or turf specialists have any ideas along that line or have anything new coming along-- and it must be good to stand that kind of treatment-- we certainly would like to have it. I think Ike Rabbitt and Burton Kiltz and I would in some manner get to mighty good commissions in either the Army, Navy, Air Corps or Marines, if you will come out with it.

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THE SHAPE OF THINGS TO COME FOR CANADA

C. E. Robinson

I had the pleasure of working with the Armed Forces during the second World War in Alaska and saw the construction of the Alaska highway. Ordinarily building highways is no great problem to any nation with present day equipment but when you have to get organized over 1700 miles of barren, uninhabited country, it is a problem. It was a great surprise to all who had the opportunity to see the road develop to see the original road base hacked out in about three months time. It wasn't very long after that that the road was surfaced and traffic was rolling merrily along.

I was impressed particularly with the know-how that you people possessed but more so with the ingenuity and organization. That is what you must have in your work. It is not sufficient to have know-how these days; you must have organizing ability and you must be able to produce these things at reasonable costs.

I am not going to dwell on the turf problems because I think it has been well covered. Growing turf in Canada isn't a great problem to those who have the know-how. A great many haven't because the problem is so simple. I can recall back in the early 30's talking to Sandy Somerville who had just won the American Amateur Championship-- one of the few Canadians who had the good fortune to win this championship. Sandy told me that the turf on the courses over here excelled anything we had in Canada, England or Europe. I was a bit curious about that and took the opportunity of visiting the clubs he mentioned and found that they were all on reasonably light, open, well-drained soil. It has always been obvious to me since observing these good clubs that they are types of soil that are generally associated with the finest turf.

Since that time we have had the development of the Aerifier and we think it is the finest piece of equipment that has come about during the last decade. It is probably more important in our country where we have greater frost and possibly more moisture in the soil than you have. During our spring season when the frost is going out of the ground, our soils are very soft down for three or four feet. We don't want to get compaction on the surface but with the continual movement of equipment on the surface, the subsoils are vibrated and often become compacted to a great extent.

In England for years they have been thinking about this problem and they have come up so far as to plow land with a stationary tractor pulling the plow back and forth across the field with a series of winches and cables. That points up to subsoil compaction. Perhaps we don't pay enough attention to this problem. Perhaps that is the reason we have a shortage of water in America today with all these fast moving tractors that seem to me to be getting heavier all the time. We get them out on the soil early in the year when the surface may appear in good condition but I do think they are compacting subsoils and causing a lot of unnecessary runoff and the eventual shortage of water which is common in a great many areas today. I believe this is a problem that might be studied further.

I would like to again refer to the Aerifier. I think I will repeat that it is the greatest piece of equipment we have found. It will undoubtedly be improved on and perhaps we can reduce the amount of aerification necessary if we pay more attention to the type of top dressing material we use. There seems to be a great deal of confusion in our country as to what type of material you should use. I think Dr. Grau has made it quite clear when he has been up there, also Professor Musser, Professor Dickinson, Dr. Noer and other authorities on the subject that we are greatly indebted to but still we have a certain amount of confusion. A lot of our people don't understand that the local soils contain considerable sand. Some of them are inclined to over-do the sand and some do not put in enough because they don't understand the basic principles of soil science.

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THE SHAPE OF THINGS TO COME FOR SOUTH AFRICA

Dudley Meredith

You might be wondering how it is that a commercial company-- African Explosive and Chemical Company-- is interested in turf research in South Africa. We have a big company out there which has an agricultural advisory section. It has made a lot of money not only selling fertilizers to the farmers but also selling explosives to the mines. They started making fertilizers in an incidental way. I believe they are now making money out of fertilizers and they decided that since they had such a big stake in the country, they would put up an agricultural advisory section. We

started putting down cooperative experiments and we put down cooperative experiments with the Professor of Botany of the University Farm belonging to the University situated in Johannesburg. We started experimenting there and we have been carrying on mainly with fertilizer experiments and doing some genetic work and trying to sort out varieties for nearly 20 years. The company had the money and the University had the land but no money, so we have put down and are still carrying on these cooperative experiments.

I first met Fred Grau at the International Grassland Congress in 1937. We have been corresponding ever since then. Two or three years ago I had to organize lectures on crop production and pasture management to a new course in soil conservation out in South Africa and Fred, in addition to all his other duties, helped me tremendously. He sent me books, literature and even paid for the books out of his own pocket which I think is a wonderful proof of great friendship. I would like to thank him personally tonight for all the help he has given us. I would also like to thank the U.S. Golf Association because through Fred they have helped me to keep turf research working in South Africa. There was a time when my chief thought that my company might withdraw from this work and I really think that turf research would have come to a stop in South Africa if they would have done that. I again thank the U.S. Golf Association and Fred Grau in particular for the help they have given me to keep going out there with turf research.

This cooperation between us and your association is very valuable because all sorts of strange things come out of Africa. I have been particularly interested in going around the United States this year to find Lehman's lovegrass, weeping lovegrass and now Willman lovegrass all growing in the southwest in many places now becoming climatized and spreading on its own. All those came from South Africa and we have done something in that way to sponsor the good relationships and help soil conservation in this country. I think if we devote some attention now to turf grasses, we will probably get results equally spectacular.

For instance, we think nothing of this Willman lovegrass in South Africa because it grows very widely all over the country. It is a miserable little grass in South Africa with a lot of seed heads and very little leaf for grazing. But you see it growing under irrigation in Arizona and it is the most amazing looking grass. We have 170 genera of grasses in South Africa and another 600 species. It has been estimated that

at least 2000 strains of bermudagrass are there so that we only have to explore them and try them out in this country and we will probably find something that will be of great value to you.

I won't say very much about the problems of turf grasses in South Africa. They might be summarized as seed, feed, weed and insects. We have to develop grasses that will grow from seed. We have a big weed problem in South Africa. You may be interested to know that although we have crabgrass, goosegrass is a much worse pest to us. We have to find out the best way of feeding our grasses with fertilizers and I think we have many more insects than you have.

Finally, I would like to say that as a visitor, I hope you will allow me to say one or two words. I think you have a tremendous lot of work to do in this country. I have been to a number of institutions, many of them with huge departments of Agronomy, and I have seen some of the worst lawns that I have seen anywhere. In fact, I have seen some wonderful stands of crabgrass on some of the best universities in the country. I have seen some terribly poor home lawns in this country. I think that we in South Africa in general have very much better home lawns than you have here. You have home lawn problems, you have public park and cemetery and university problems.

I would just like to say that I appreciate the work that is being done and the lead that has been given by the U.S. Golf Association, but I would urge you to try to include everybody, as we try in South Africa. Don't keep your organization as the U.S. Golf Association or if you want to do it that way, try to bring in all the other phases. I think you will get along very much better if you can get everybody interested in turf into the organization but we must admit that the U.S. Golf Association has taken the lead. I would urge all of you who work on golf courses to talk about research all the time. I feel that is one way of getting people to know that there is a turf research organization being run by the U.S. Golf Association and that it needs support. Fred Grau and those working with him at the turf research stations do what they can but they can't go around all the time asking for money. Those of you who work on the golf courses and get help from the United States Golf Association, I feel should be the leaders in your community and stress the needs of the United States Golf Association for funds so that everybody can benefit.

In conclusion I would like to say that I have appreci-

ated being here today. I can't tell you how much I have learned and what a stimulus this has been to me. I am sure it will have good effects on turf research in South Africa and the improvement of turf services out there and ultimately be of greater benefit to you.

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