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THE GRASS PLANT AND ITS ENVIRONMENT

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I want to discuss with you some of the results of our research at Manhattan in connection with management problems that we have run into in nine years of research. I think perhaps we can reverse the procedure that we used yesterday morning and show the pictures first. You can gather what we are talking about after you have seen some of the things that we are studying.

Pictures

One phase of research has been studying combinations of warm and cool season grasses. We started out by attempting to introduce Bermudagrass into cool season grasses. Today we recommend getting Bermuda established and introducing the cool season grass into the sod.

We have to grow grass in the shade and it's quite a challenge at times. We planted these 3-foot strips of grass right into the roots of elm trees near the trunks where we had good competition and good shade. Unfortunately elm diseases killed part of the trees that we had for shade and had to abandon these plots. But we did obtain some good information.

We tested some 40 or 50 bluegrass hybrids produced on the West Coast. Most of these are probably good forage grasses. As far as we are concerned, we got one out of the group that was worth further test. It is a relatively disease-free, low-growing bluegrass coming from Pullman, Washington under No, 602. This selection looks good to us.

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Before we started working with grasses, there was very little interest in grass research at the Kansas branch stations. Then without our supporting the program at the branch stations, they jumped into a very extensive testing program of grass varieties. They have small plots compared to ours, but they separate those plots with a row of tall fescue. It makes a nice division between plots. The soils at Hays Branch Station are highly alkalin, well drained, quite sandy, and many of the bentgrasses and bluegrasses become chlorotic under these conditions. These sad looking patches here, I'd like to mention, are a native bluegrass - may extend out to this area - called Poa arida. We thought perhaps native bluegrass, Poa arida, might be well adapted to growing in this region but we find it extremely chlorotic, susceptible to many diseases and not satisfactory at all. Tall fescue on the other hand is tolerant of these conditions and is always green.

We decided after doing this management work for about 4 years we had pretty well milked the cow dry unless we wanted to go into some intensive root studies. We decided what we really needed, after surveying most of the available grasses was just plain better grasses on which to build a good turf program. We started in with Zoysia because it was available and because it would produce seed in the greenhouse.

Let's look at some of our Zoysias. This is our seedling space planting and we have a great deal of variation in vigor. Some were not winter-hardy. There is a great variation in disease that doesn't show up at this time. There are differences in color and in growth habit. In the next three to five years we'll have a Zoysia strain that can be propagated by seed.

Among the various types are very fine textured, slow growing dwarf types. We couldn't imagine them having any use but then we let our imagination loose and thought

such a type might have a place in patio work, growing in between the stones. We are going to call it patiograss. We are increasing a strain at the present time that we call patiograss. It grows about 1/2 to 3/4 inches high when it's full grown. You wouldn't have to trim the grass between the stones. We are going to give that a real good look before we turn it loose.

I was interested in your discussions here that sometimes you lose Bermudagrass from seed even down here in this region. I have always thought that Bermudagrass from seed was satisfactory south of Wichita, but up in our region the only way we can hold it over in winter is to bury it under about 3 inches of prairie hay or straw mulch of some kind to protect it. Ordinarily, we use our own winter-hardy vegetative strains. The seeded material isn't satisfactory.

Bermudagrass breeding work has consisted of hybridizing common Bermuda with Uganda and other types and observing the progeny. Progeny are observed to vary in growth rate, texture, density, color and color retention. About 300 plants have been selected for further study. One of the progeny showed remarkable color on November 22 after several frosts. Similarly, an introduction from Africa, P.I. 224, 143 showed good color at the same time. These two plants should be of interest further south where winter temperatures seldom go below 25°F even if they are not winter-hardy at Manhattan.

So much for the Bermudas. We have been interested in bents also. This slide shows some old seeded bent greens in Wichita that are quite mottled in appearance; brown, yellow, and occasionally green plants. This is a plug that had been taken from a green plant to fill a cup and it shows the contrast in types. We took a plug sample from the better areas in these old greens established back in about 1928 to 1935, and we have named those our wintergreen selections.

We cloned the material out in the greenhouse, selected those that were uniform and planted them into 10-foot straight rows. This was taken in early June and shows the terrific amount of variation that we had in bent material from one single collecting trip.

From the best bentgrass types we selected 3 plants for establishment in an isolated area. We have about 3 or 4 ounces of polycross seed harvested from these plants for trial plantings.

Chlorosis is one of our main problems and one for which we have not had a satisfactory solution. We had an opportunity to test some iron materials on the Dean of the School of Agriculture's lawn. The soil consisted of about 3 inches of block material overlying a limestone base. The pH was 7.8. Iron sulfate and a number of chelate compounds were tested. Good response was obtained from 2 ounces of iron sulfate in 5 gallons of water per 1000 square feet, also from a number of chelate materials. Eight pounds of iron sulfate in dry form per 1000 square feet also showed good response. At least one chelate produced some burn, the grass being off color for about a week.

We have done some work also with dyes or paints that might be of some interest to you. These materials have been recommended for use on dormant or off color grass. Here was one that was highly recommended from back East in the Washington area. It is not too much different from that of the cool season grasses in the winter immediately after application. The next slide made two weeks later will show that what is sunfast in Washington is not necessarily sunfast in Kansas and Texas and Oklahoma because we have sunshine in the wintertime and the color bleaches right out.

The next slide will show how we went in for rather extensive trails with different dye materials. These down here were put on at Thanksgiving time and this shows the fresh application of new material at Christmas time. Notice that the Thanksgiving applications has faded appreciably compared with the Christmas applications except with certain treatments when there was good color retention. One of these was the Dow M-819 formulation that is being sold now by Sherwin Williams and Luminal Paints, if not some other companies.

Last year we ran the same type of experiment, and we are quite satisfied with all of the materials we tried. While the colors vary on the new formulations, all of them that we tried held their color all winter very well. Dying or coloring is satisfactory as far as we are concerned.

I just want to summarize briefly now the results of our number of years of work with 25 kinds of grasses. I didn't take time to give you that information while we were going through the pictures.

As a result of these years of testing, we have come to these conclusions for our region, and I think they will mean something to you too. Of the warm-season grasses that we tested, U-3 Bermudagrass is of borderline hardiness the first year. After you get a good layer of thatch with the stolons down underneath the ground, U-3 probably is the best warm-season grass that we have. K-151 Bermuda is probably a better grass from the standpoint of hardiness and rate of growth, and I'd probably recommend it over the U-3 for football fields and athletic turf.

Meyer Zoysia is the best of the Zoysias that are commercially available. Emerald Zoysia is of questionable value. Is it so thatchy that is gives alot of trouble. It is perfectly hardy, disease-free, and nice in other respects but it looks like a cocoa door mat all winter.

Tifgreen Bermudagrass, is best for anyone who wants to try Bermuda greens up in our area. It isn't too practical from a color standpoint, but from a wear standpoint Tifgreen is a pretty good grass. You can still putt on it even though it's white.

Ugandagrass has considerable disease, but it is perfectly hardy; it might have a place in the greens program with sufficient nitrogen and good management. We have quite a bit of disease on the African Bermuda also.

Of the cool-season grasses, Kentucky bluegrass is still probably the best. When we first tried Merion, we didn't think much of it - it developed rust and it didn't have too much over common bluegrass. However, as Merion bluegrass plantings age, the more rugged seedlings tend to crowd out the tender and disease susceptible material, and it actually improves with age. The one big threat that we have for Merion in our region is not rust but curvularia.

Kentucky 31 fescue is probably the outstanding grass from a number of standpoints, if you are considering wear and traffic.

Perennial ryegrass is our best temporary grass. It's really a perennial up where we live and even with moderate management, you can keep it two or three years if it's irrigated in the summertime. We have a lot of people who consider ryegrass and crabgrass as the perfect year-round rotation. They grow crabgrass all summer-ryegrass all winter. They are very happy with it, it doesn't cost much and it's pretty good rotation for them.

Of the bentgrasses, and I know this is of interest to those of you who are growing bent, Cohansey or C-7, is the outstanding grass as far as the budget is concerned. It is practically disease free in the summertime. Arlington is running

a close second, with Penncross next. Then one of our own grasses that was sent up from Penncross next. Then one of our own grasses that was sent up from Springfield by John Arrowood is a very good grass. The only disease that bothers it is dollar spot. Of course, we use a lot of Highland bentgrass for collars and that sort of thing. It is easily replaceable and we still like it for that reason.

But what we really need is better grasses than these that we have, and in our breeding program we are attempting to develop these.

On the matter of height of mowing we have found that we invariably get the fastest spread on Bermudagrass and Zoysia where we cut 1/2 inch high three times a week. We also found, and I think this is common knowledge to you, the shorter you mow- the more often you have to mow. It's part of the mowing managment relationship and if you are going to mow short you are going to have to mow often. We found that without fail the short grass had short roots under the best management. You can have a lot longer roots than a lot of people have on short grass. By that, I mean short grass, 1/2 inch or less, will seldom have more than 12 to 16 or maybe 18 inches of roots with us. Alot of people are getting along with 3 or 4 inches of roots, but that isn't enough. But if you mowed a little higher then you'd definitely have longer roots that reach farther down into the soil.

The final observation on our management program was that whether irrigated or not, Bermudagrass was dominant over all other grasses with two exceptions. If Merion bluegrass is mowed 3 inches high, Bermudagrass can't crowd it out. If Meyer Zoysia is mowed to less than 1 1/2 inches high, Bermudagrass can't crowd it out. So these are some clues in management in our region where Meyer Zoysia is dominant over Bermuda at a 1 1/2 inches or less, and Merion bluegrass is dominant at 3 inches.

SOME BASIC SOIL CONSIDERATIONS

J. R. Watson, Jr.[1/]

There are certain basic requirements which soil must provide for satisfactory turfgrass growth. These are: support, water, air (oxygen), temperature and nutrients. The ability of a soil to meet these requirements is dependent upon its physical, chemical and biological properties. When any soil property limits satisfactory growth of a grass adapted to the prevailing climatic and use conditions it must be corrected, adjusted or modified. This correction, adjustment or modification of a soil property or properties that limit satisfactory turfgrass growth may be defined as "soil management".

Soil management of turfgrass areas involves maintenance of an adequate fertility level, providing drainage -- both surface and internal, supplying moisture, correcting adverse chemical conditions such as salinity or alkalinity, alleviating compaction and, on specialized use areas such as golf greens -- the use of amendments and conditioners to provide resilience and shot holding ability. The degree of manipulation of soil physical, chemical and biological properties needed or required for the most satisfactory growth of turfgrass will depend primarily on the use to which the turf will be subjected and the funds available for materials and equipment needed for modification of the soil. Intensively used areas such as golf greens will demand a higher degree of modification than will large scale areas used less intensively.

Physical Soil Properties. The texture, structure and porosity of a soil governs the infiltration (movement of water into a soil), retention (water holding ability) and movement of moisture through (percolation) and out of (drainage) the soil. These

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physical properties likewise control the air-water relationships and, because of their inter-relationship with the chemical and biological properties, exert a major influence on the productivity of a soil.

Infiltration, or the ability of water to move into a soil, is often a limiting factor in turfgrass growth. Heavy equipment used in modern construction, although efficient and economical, may severly compact soil surfaces. Normal maintenance equipment, especially if used under wet conditions, as well as player traffic contributes to soil compaction of established turfgrass areas. Compacted surfaces materially reduce infiltration rates.

Compaction resulting from construction should be corrected before turfgrass is established. This is accomplished by properly preparing seedbed areas once the rough grades have been established. Plowing, rotovating and disking are techniques employed on both large and small scale areas.

Another approved technique for small scale intensively used areas (golf greens) which aids in reducing compaction is the incorporation of amendments such as peat and sand in the seedbed mixture. "Offsite" mixing of these materials is recommended in order to avoid "layering"which will interupt movement of water through the soil. If these materials are mixed "on site" caution must be exercised to avoid internal layering, as well as surface layering. The excessive use of "beater" type tillers will cause the deterioration of soil structure and a subsequent surface layer of "fines" -- clay and silt. These surface layers become quite hard, interfere with establishment and growth of the grass, as well as prevent proper water infiltration and air movement.

On established turfgrass areas, the major amount of soil compaction occurs in t upper one-half to one inch layer of soil, hence, correction or alleviation of the problems associated with compaction is relatively easily accomplished by the use of modern aerating equipment. The process of aeration (cultivation) will do much to

encourage better root growth under compacted soil conditions. Aeration aids water penetration and reduces surface runoff, thereby conserving water. Too, aeration temporarily improves the air-water relationships of such soils, thus resulting in conditions that favor nutrient availability. Because of these factors, deeper root development generally occurs and, if maintained, results in permanent improvement of the soil physical condition. This equipment is used on both large and small scale areas. In general, such equipment should be used when the turfgrass is growing most actively. Spide disks may be used to advantage during periods of reduced growth. This equipment improves water infiltration and, like aerating equipment, will also assist the drying out of overly wet areas.

Percolation, or the movement of water through a soil, is a function of texture (size of soil particle -- sand, silt or clay) and structure (arrangement of soil particles). These same factors influence the water holding capacity of a soil. Sandy soils are known as "droughty" soils. Their water holding capacity is low, and water moves through them quite freely. The reverse is true of clay soils.

On small scale areas, either type of soil may be modified or improved by adding quantities of the opposite textural class. Such a procedure must be approached with caution in order to avoid serious difficulties. It is best to make up small samples using varying quantities of the proposed mix (including peat), subject these samples to varying moisture and compaction tests, and use the information gained as a basis for the ultimate mix.

On large scale areas the addition of amendments is impractical and it becomes necessary to work with the existing soil. Proper fertilization, judicious watering and installation of adequate drainage facilities provide the most satisfactory means and methods of managing these areas.

Drainage is of two types--surface and sub-surface. Surface drainage is of pri improtance on all turfgrass areas. Adequate surface drainage will tend to alleviat sub-surface or internal drainage problems. Adequate surface drainage, along with the installation of tile drains, often will aid in correcting adverse chemical conditions such as salinity. Intercepting tiles along the base of hillsides adjacent to turfgrass areas are often necessary if "springs" occur in the hillsides.

Internal drainage of "heavy" soils is quite slow. Also, these soils hold more water than will soils of lighter texture which drain more freely; therefore, watering practices must be adjusted to conform with the prevailing soil type to avoid improper drainage which would materially interupt good air-water relationships.

Porosity may be defined as that percentage of the soil volume not occupied by solid particles. In a soil containing no moisture, the pore space will be filled with air. In a moist soil, the pores are filled with both air and water. The relative amounts of water and air present will depend largely upon the size of the pores. Two types of pores are recognized -- the capillary and the non-capillary. For convenience, these may be designated as the small (capillary), and the large (non-capillary) pores. The small pores hold water by capillarity and are responsible for the water-holding capacity of soils. The sum of the volumes of the small pores is called "capillary porosity." The large pores will not hold water tightly by capillarity. They are normally filled with air and are responsible for aeration and drainage. The sum of the volumes of the large pores is called "non-capillary porosity".

The total porosity of a soil is not as important as the relative distribution of the pore sizes. Total porosity is inversely related to the size of the particle and increases with their irregularity of form. Porosity also varies directly with

the amount of organic matter present in the soil. Clays, for example, have a higher total porosity than sands. Clays have a large number of small pores which contribute to a high water-holding capacity and slow drainage. Sands, on the other hand, have a small number of large pores which are responsible for a low water-holding capacity and rapid drainage. In years past the ideal soil for plant growth was considered to have about 50 percent total porosity equally divided between small and large pores, or in other words, contain 25 percent water space and 25 percent air space. Percent information indicates that the total pore space should be somewhat lower.

It must be recognized that the above proportions of solids, air and water space seldom exist in the soil medium. These proportions are merely a goal or standard to strive for. Modification of the physical properties of soils for certain turfgrass areas may be desirable, but for most, modification is not practical and one must work with the existing soil. The golf green is one area that should almost always be modified.

Physical Properties in Relation to Root Development. Roots must have water and air, as well as nutrients, to grow and develop; hence; the growing tip of the root -- zone of root hair development where these materials are absorbed -- follows or grows through voids where these materials are found.

We have mentioned earlier that water moves into soils through the large pores and that as the excess water is drained away, these pores are filled with air. It is within the large or non-capillary pores that the capillary water absorbs oxygen so that the moisture which the roots take in and the plants use contains a sufficient amount of this essential element. We might also assume that this water, charged with oxygen, contains a sufficient amount of this essential element as well as the necessary nutrients required by the plant for root development and growth. As a

result, we will find plant roots growing around and within the large pores and utilizing the capillary water charged with oxygen and nutrients within a restricted area. Until quite recently, it was thought that capillary movement or film adjustment would cause available water in adjacent areas to move into the root absorption (root hair) zone and replenish the supply. Thus, it was felt that the plant roots could more or less remain within a given area and extract practically all of the available water. It has now been established, however, that such is not the case and that, although capillary or film adjustment does occur, that it is not rapid enough to provide plants with the required amount of water and nutrients.

It is now recognized that most of the water and nutrients which plant roots are able to take up are made available to those plant roots by the growth or extension of the roots into parts of the soil which have a sufficient amount of available moisture and a ready supply of nutrient elements. In other words, the plant root must seek out new supplies of moisture and nutrients, instead of these materials seeking the root; otherwise, it would soon utilize all the nutrients and water in a given area. This is one very good reason for developing and maintaining as desirable physical soil condition as possible under turf. It also point out the importance of an extensive well developed root system.

Soil Air. The interchange of soil and atmospheric air is referred to as aerat Aeration of soil is essential for the development of the long, light colored roots abundantly supplied with root hairs. Inadequate soil aeration, or in line with the terminology we have been using -- insufficient large pores, decreases in intake of water by plants directly through its effect on absorption and indirectly by reducin root growth. In water-logged soils, or where sufficient anaerobic biological activ occurs, the accumulation of such products as methane, carbon monoxide and hydrogen sulfide may result. Also reduced forms, such as nitrites, ammonia, ferrous compoun

and manganous compounds will build up in soils. These products are quite toxic to plant roots and if the situation is prolonged, death of the plants occurs.

In addition to the more or less direct influence of soil aeration on root growth and development, soil aeration exerts an important indirect effect as a factor in the occurence and severity of certain plant diseases. Such effects are of two kinds: (1) the lack of oxygen and/or excess of carbon dioxide on the growth and longevity of the pathogen, and (2) the increased susceptibility of the host plant when grown in poorly aerated soils. Pathogens that attack plant roots are the ones that are most influenced by soil conditions. The importance of temperature, pH and moisture content are widely recognized as factors affecting root attacking organisms. It is assumed by some that the principal effect of high moisture content arises from the attendant poor aeration.

Chemical Soil Properties. Management of this group of soil properties involves primarily the adjustment of soil reaction and inherent fertility to meet the nutritional requirements of turfgrass. This is accomplished by fertilization, a subject which will be discussed in detail in other papers.

Biological Soil Properties. This group of soil properties include the micro and macro plant and animal populations of the soil. The populations of these plants and animals may be beneficial or harmful. Management of both physical and chemical soil properties materially influences the biological soil properties.

Of particular significance from the standpoint of soil management and its influence on biological soil properties is the relationship of microbial activity to thatch and mat accumulation. Certain groups of micro-organisms utilize raw organic matter as a source of energy or food. Products resulting from their conversion of the raw organic matter are subject to utilization by grass and other higher plants.

Just as with turfgrasses, the activity of the micro-organisms is influenced by temperature, moisture and available nutrients. When nutrients are limiting, the needs of the micro-organisms are satisfied first. When excessive amounts of organic matter are present grasses may suffer from nutritional deficiencies until sufficient decomposition has occurred to release plant food.

Practices such as aeration (cultivation), fertilization, watering and -- on golf course greens the use of topdressing -- which are conductive to the growth of turfgrass also promote microbial activity; hence, these factors will tend to control the accumulation of thatch and mat.

SAFETY IN YOUR PROGRAM

John W. Hill[1/]

Safety is of increasing importance in this age of technical developments. I just came from an hour session of the A&M System Radiological Health and Safety Committee. We have ten sources of radiation on this campus that are plenty hot. So, the more chemicals, the more devices and the more technology we have, the more actual possibilities we have of injury. In thinking about what I might talk to you fellows about this afternoon I worried and studied for some time. Having been in accident prevention and insurance with state agencies for 22 years, I find myself coming back to one point: People. Individual people; management, foreman, supervisors, skilled technicians, tractor operators and laborers. These make up the personnel that you work with day by day. These are the people that are going to have the accidents, that are going to cost your firm, your agency, your organization; or it is these people that are going to make your job easy, safe and profitable.

As we think about safety, or I had rather use the term accident prevention, we must think about people. Individual employees. I have some very firm convictions with regards to accident prevention. First of all accidents do not happen; they are caused. I have been investigating accidents 22 years and until this day I have not found a single man that can not tell me why his accident occured. Something in the activity of that day caused him to let down, to not practice the things he already knows. Some basic cause is behind every accident. I am not suggesting that all accidents are caused by the man who has the injury. We have an A&M College System employee who has just spent over two weeks in the hospital because an irresponsible driver pulled out in front of him. This man had violations of all kinds and he had

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his license taken away from him because of DWR. He caused an outstanding research man to be confined to the hospital for two or three weeks. I am telling you this to show you that the injured is not always the cause of the accident. But the accident didn't just happen, it was caused, in this case by the other man. The accidents that occur to your employees, to your supervisors and to you as a person in any agency or any organization or any program are caused by somebody.

Now I have some philosophies as to what we may do about accidents. Bear in mind that some of the things I am talking about will help you have a better operating job and a better operating program. With more of your men being on the job more days and not in hospitals losing salary. Life is a pretty rough struggle, isn't it? And to me this thing of accident prevention is a pretty serious sort of thing. It is serious for the one who pays the man's doctor bills, hospital bills and compensation. It is serious for the organization who has to do without the skilled operator or even laborer. The whole program is upset because somebody had an accident.

I am convinced that one of the best methods of beginning accident prevention is with the selection of individual personnel we employ. There are two criteria for selection. First, a man must be physically fit to perform the duties to which he is to be assigned. Let me take one of our own organizations as a typical example the Texas Forest Service. They have people who climb look-out towers and fight fires all the time in the piney woods of East Texas. We would be foolish beyond any doubt to hire a man who had multiple sclerosis of the lower limbs to climb a look-out tower, wouldn't we, or a man who was sixty years old and could hardly walk a mile? The man must be physically fit to perform the assigned duty even if it is digging ditches with a shovel.

Each individual has to have some training for the job that he is assigned to do and the individual must be able to comprehend or understand the instructions. Otherwise, you may have an employee like the one the foreman took out one morning and instructed to dig a ditch 2 ft. deep, 4 ft. wide and 10 ft. long. He dug all day and didn't question it at all. When someone asked what he was going to do with the hole, he said he was not paid for that. That is the foreman's job. I don't want that kind of man on my job, do you? You may have to put up with a few of them, but let's do our best to select these people from the physical as well as the mental side.

Now that want to do the job completely. Let me tell you another story about physical ability. In a canning plant in the state of Texas, a foreman hired two people one day. He didn't think very far before assigning them jobs. As the cans came off the machine which made them and put them in a box, the boxes had to be put on a conveyer. From the conveyer the boxes were stacked in the warehouse six cases high. He hired two people, one of them was just barely over 5 ft. and the other was 6 feet 2. Where do you think he put them? He put the tall guy at the machine and the short guy in the ware house. They were both physically fit so far as their physical ability was concerned but they didn't fit the job. Apparently far fetched but frankly fellows, these types of assignments frequently result in more quitting jobs and others having accidents. So, even if we have physically fit and mentally fit fellows we have to do some training and make proper assignments.

We need to train our people in job know-how, even if it is to run a mower, on a green or fairway, push a wheel barrow or a shovel, or if it is to sling a weed cutter. If the foreman knows anything about the job, he can judge well enough if a man has the know-how. A man may need training in special skills especially with technical equipment and chemicals. Don't give a man a sprayer with insecticide

or herbicide in it without informing him of the nature of the material and the hazards involved. Otherwise he may come up with a dertmatitis that will send him to the hospital and result in lost time. As a supervisor, you should know the nature of materials used in your program and keep your men informed if you wish to keep high calliber men in your organization.

It has been interesting to me to note that we have been carrying on an escape program on the campus in regard to radioisotope materials. We find that the people do a better job and get more done if we can spend some time in helping them know what the particular hazards are with these materials. I am convinced that if a man knows the chemical he is using has some danger, he will use it more carefully. Some of the phosphorus compounds are pretty serious and I am sure some of you are using phosphorus compounds. We had a serious accident on this campus that almost resulted in the death of an employee from absorption of a phosphorus compound through the surface of the skin. Special techniques and skills can prevent this type of accident.

There are two other points as far as training is concerned that you may not quite agree with. One of them is prepare a man to fill the job that is ahead of him. You are giving him credit for things that he can do and at the same time you are building in his mind the second item of attitude. Now I find it pretty hard at times to talk to groups like this or even talk to our own crews, because they are thinking what you are talking about doesn't apply to me. Well, that is attitude and is the thing we are talking about. Many accidents are a result of attitude, because attitude determines a person's behavior. Now statistically, about 5% of accidents are the result of mechanical failures which were brought about by the man himself or by some of his fellow employees. But the other 95% of the accidents are a result of personal behavior; individual acts which are a result of attitudes. If a man enjoys his job and likes his fellow employees he is much

less accident prone. If a man has an interest in his organization and feels that his supervisor is concerned with his welfare, he will have a much better attitude. And because of that he will have less accidents.

Now I come to another key individual in this accident prevention program, the supervisor. There is not a laborer or skilled machine operator in the country that will continue to do the job the same way day after day, without supervision. A major telephone company had a safety program for years and years. They reached the point where they felt everyone was safety conscious, from top level all the way down to the lowest ditch digger or hole digger. Thus they did away with the safety department because of its expense. What do you suppose happened to their accident frequency? It started up the very minute they eliminated the safety program. It took them 18 months to decide to put back their safety program. So I am simply saying that we need supervision. We need supervision to the point that top management expresses to the worker, to the supervisor, the skilled technician that their interest in the program itself. This supervision of the safety program must be carried to the point that if a man is caught breaking a basic safety rule and is fired for it, the supervisor will be backed up by everyone concerned, including the men themselves. Supervision must be able to tell a man that there are certain policies and procedures that must be followed in order to carry out the job in an efficient, safe manner.

Sometimes you may need to train your supervisor to properly supervise. That may sound foolish but too frequently a foreman has just grown up in the job with no particular training or emphasis of the responsibilities concerned.

Now, there are some supplementary activities that I would like to mention to you, in addition to <u>selection</u> and <u>training</u> and <u>supervision</u> that are important. I like to see regular safety meetings in which all personnel are brought together

as an organization. Now, holding a safety meeting and then going out and getting in your car and violating a safety rule as a supervisor or a superintendent or as a manager of some particular golf course or city park or school system or what ever it might be is not going to help the program. You must practice what you preach yourself. In the safety meeting call attention to the accidents that have occurred in your organization. New practices, procedures, materials and the hazards involved should be brought out at these meetings. All safety meetings do not have to be formally called meetings. The Southwestern Bell System has what they call tailboard conferences. The foreman has been instructed by management, when he undertakes a hazardous job, to call his gang together at the back end of hi truck and lay out the exact procedure to be followed in that particular job. This has merits. Each individual then knows what he is going to do. That reminds me of a bridge job I was on one time. We were moving a 12 x 12 x 20 ft. timber, with wood tongs. One fellow called the signal and got the timber in the air. Then, somebody said where are we going, hell, I don't know. Somebody took something for granted didn't they? That's the way accidents occur and just don't kid yourself. So, you should have safety meetings whether they be formal affairs in which you have some outstanding speaker to come in or whether they be just between two greens mower operators and the foreman. You may have to tell them a half a dozen times but tell them over and over until they know what the score is.

What is the difference in a safety meeting and an operational meeting? None what so ever. That is one thing that has bothered me all of these years that the foreman and the supervisor wanted to tack safety on the side as if it were a burden and unneccessary. If you are going to mow a green; if you are going to resod a gre if you are going to dig a ditch; if you are going to drive an automobide, safety must be an intregal part of every step. It can't be something tacked on the side.

Now in addition to safety meetings, safety posters are available from all sorts of industrial firms for free. These deal with all types of general and specific problems.

For those of you who are dealing with chemicals and various types of things which are toxic to the human body, we in safety say first that if it can be eliminated let's eliminate it. Well, you can't eliminate some types of insecticides to kill bugs, can you. So, let's protect our workmen from it. Personal protective equipment, clothing, goggles, hard hats, etc, are important in the safety program. If you had one or two mower operators laid up in the hospital from being hit by golf balls, I believe that you would find hard hats pretty cheap if they would eliminate this. Personal protective equipment is important and it is a supplementary item. But, don't just hand the man a set of goggles or a respirator and tell him to go do a job. He must be instructed in how to use the equipment if it is to be worthwhile.

Another supplementary item is inspections. Run through your plant or equipment shed and see what you can find that is unsafe. Take a look at your equipment once in a while; trucks, pickups, mowing machines and all those types of equipment that you use and be sure that they are safe. Don't be adverse to our state safety car inspection.

When you have an accident, if you are the superintendent or the manager or the foreman, talk to the man who has had the accident. You might learn something that would help prevent the accident happening again. We make a practice of trying to investigate every accident that has any consequence here. We don't get around to all of them because they are a little to numerous to get to all of them.

Then another factor which is a supplementary activity is a simple first-aid program. During the war we selected 100 construction employees for study, all of them of the same caliber; carpenters, electricians, plumbers, tractor operators, truck drivers and of all skills. We gave 50 of these standard American Red Cross 18-hour first-aid course. We studied accident occurrence with the 100 men for 3 years. Those who had the red-cross course had 50% less accidents than the others Why, I don't know, except that in taking a first aid course they see themselves in a light of a broken bone, a cut arm, a punctured eye ball or what ever it might be they were safety conscious, they had a change of attitude about the things they were doing.

Another supplementary item is the selection of proper equipment for the particular job. Let me give you another example. One of our men was sent to the Brazos River Lab. to build a door for an equipment storage shed. He was a jack-leg mechanic, carpenter, and tractor operator. You may have some of those type people in your organization. But the foreman gave him a square, a saw, a hammer and a hatchet, to build a two by four frame and put sheet iron on it. He was to dove tail the joints. He sawed the width of his 2 x 4 and started to split it with his hatchet. When he failed to hit the mark, he set the hatchet along the mark and hit it on the face with the claw hammer. A piece of steel flaked off of the claw hammer and went all the way through his right eye and embeded in the socket. The man is blind today. But I am saying he lost his eye purely because the foreman sent him out improperly equiped. He should have given him a wood chisel for the job.

We could continue with many points and examples. I think we might summarize at this point and then ask for questions. If accident prevention is to be successful, safety consciousness must be ingrained into every individual from the top

level down and safety precautions must be an intregral part of every phase of the program. Some of the ways by which this may be brought about have been discussed. Accident prevention begins and ends with people and their attitudes. Proper attitudes are built through selection of employees physically able to do the job, mentally capable of being trained and then given the proper training to do the job. Safety meetings should be held, safety posters used, as well as furnishing proper tools, protective equipment and clothing and training in the use of hazardous chemicals.

SOME SCHOOL GROUND PLANNING AND MAINTENANCE PROBLEMS

J. W. MacQueen[1/]

In considering some of the school ground planning and maintenance problems I want to talk about three main factors. These are people, proper cultural practices and planning of school and class room buildings. If planning is not done properly it intensifies the other problems.

Now concerning people, as in parks, the school ground areas must be organized to accomodate people, or the student body. The student body, of course is the reason for the existance of the buildings and maintenance program. Areas around school grounds and class rooms, dormitories, hospital grounds, etc., must be organized according to use. All of these areas are classified as areas of intensive use, and they are subject to extreme wear. Recreation and game areas should be properly located with respect to buildings and properly developed to minimize the problem of wear and tear in landscape areas. Landscaped areas should be developed separately and apart from recreational areas. Both of these of course must be developed with relationship to the building, and usually we consider that the landscape area is developed in the line of vision where the public can see it.

Another factor in intensive use areas is that of a planned layout of adequate walks. I was very happy to hear Mr. Jim Watson mention that yesterday. A planned layout of adequate walks is very essential because there is always a heavy flow of traffic from building to building, area to area. These

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1/ Ground Maintenance Department, A & M College of Texas

walks must provide adequate communication from one area to another, from building to building or from the street to a building, etc. These walks must be of adequate width. I don't think that any walk less than 6 feet wide should be considered, preferrable 8 feet, in order to accomodate the flow of traffic during the hours of class room change. The walks, of course, must lead in a straight or direct or they will not serve the purpose. I will talk about that a little more when we have a few pictures.

We have another catagory of people to consider and that is service personnel. Water, gas, telephone, power, stem; all of these involve people. If a gas line or water line needs to be repaired or relocated people are involved. These individuals have only one object in mind when they come to a job and that is to preform the job for which they are hired. If a water line is to be installed or to be repaired where there is a specimen shrub or a specimen tree, that particular plant doesn't mean much to the contractor or to the plumber. It is just something that is in his way and if it wasn't there he would be alot happier. Now, it is possible to eliminate that problem, particularly in case of new buildings. When new buildings are planned, the installation of utility lines should be made at a central point, preferably in a tunnel or a conduit. In the case of old buildings, however, it is not quite that simple. The only thing to do is to organize the landscape plantings in accordance with the existing lines. One way to eliminate some of the difficulties is to use turf or ground covers instead of shrubs where it is known that utility lines exist underground.

Another factor with people is that of litter. Litter is a national problem not only in school grounds but on highways, cities, etc. There is no answer to it except, perhaps, education. As far as school grounds are con-

cerned, providing adequate sturdy containers in strategic areas should be of help in this respect.

I am not going to say much about cultural methods because they are touched upon in other portions of the conference, but as far as turf is concerned you have heard many times that fertilization is essential. Soil tests are a necessary part of the fertilization program. I believe that the application of fertilizers has been simplified somewhat by the use of pelletized materials, at least it has for us. The use of cyclone-type seeders in the application of pelletized materials to small areas has meant labor saving. It is needless to say aerification is a must for any of these areas that are intensively used. Irrigation is not a luxury but a necessity for any turf area around a school ground.

Fertilization and watering are equally as important for shrubs and trees as for turf. Mulching also is a necessity for trees in dry localities. It must be kept in mind that when heavy mulches of organic matter such as decomposed sawdust, woodchips, rice hulls or peat moss are used, supplemental feedings must be practiced; otherwise the plants themselves will suffer from lack of nutrients while these materials are being broken down by the soil bacteria. I know of an instance where washed pea gravel is used as mulch for shrubs. This is excellent material in areas that are exposed to very heavy strong winds. Also, it is giving reasonable control of nutgrass. Along with other cultural practices is pruning which is a complete subject unto itself. There are many good bulletins on insect and disease control from Agricultural Experiment Stations, USDA Farmers Bulletins and pamphlets and miscellaneous publications.

Planning: The object of landscaping a school or class room building, dormitory or hospital should be to provide the maximum of desired ornamental effect with the minimum of maintenance. The planting of a building or an area of that

nature is only one phase of the overall planning with maximum utility in mind. It is necessary to keep in mind the selection of the proper species. We must keep in mind the climatic tolerance of a specific shrub. We must know whether the specific shrub or group of shrubs will tolerate conditions of exposure such as sun, shade, or the disicating winds of the summer. We should know the growth habit of those shrubs; their evential height and spread. We must provide adequate space for plant development, don't try to plant a shrub that has a six-foot spread in an area that is only 4 feet wide.

We build attractive buildings and frequently hide them with plant materials. I feel that around a public area it is better to under plant than to over plant. We must consider the location of windows, entrances and, as mentioned before, the location of utility lines. Windows that are to be used for light and ventilation should not be blocked. I have seen some areas where a mixture of shrubs had been used and very little consideration given the habit, height or rapidity of growth and even to items such as branch habit and leaf texture. It is not very wise to plant a single tow of various shrubs. Shrubs should be planted in groups of one species or type to obtain the proper effect.

Trees of course or required for shade and to provide proper scale to the building. The over planting of trees, of course, can be equally as detrimental as the over planting of shrubs.

Ground covers have their place, but without complete soil preparation, the maintenance of ground covers may become too expensive and also fail to give the proper effect. If ground covers are to be used, I feel that a pre-planting preparation of soil sterilization to eliminate weeds, Bermudagrass, nutgrass and even soil born diseases and insects is necessary. One of the best means of sterilizing ground cover beds is the use of Methyl bromide at the rate of 2 lbs. per 1000 sq. ft. This has given excellent control of nutgrass.

Ground covers, of course, can not be planted and just left alone. They, as well as turf, must have proper watering and feeding. And again, a ground cover bed is not very practical for use in an area where it is known that telephone lines, gas lines and water lines are entering a building.

Turf: Because of the disease problems that we are facing with St. Augustine today, it is not a very practical grass for turf around public buildings. The grounds around this building are an excellent example. Until some means has been found to help us combat diseases of St. Augustine, I certainly wouldn't want to be involved with any more St. Augustine. Zoyzias, due to their slow rate of growth during establishment, are not satisfactory as yet around school rooms and buildings. We need more information on Zoyzias. It is possible to obtain a cover of Zoyzia in one season if it is planted early enough in the spring and given a good fertilizer program all during the summer. It is not possible to have an acceptable cover before the first of September. So that leaves us with Bermudagrass as being the most satisfactory grass for use under general school ground conditions. A number of color slides will be used to demonstrate some of these points.

TREES AND SHRUBBERY AS THEY INFLUENCE TURF MANAGEMENT

A. E. Rabbitt[1/]

First of all, I want to express my thanks for the opportunity of appearing on your program. I think it is one of the best conferences I ever attended.

As Mr. Campbell stated, I am agronomist for the National Capitol Parks, which is under the Department of Interior, and we are responsible for the maintenance of approximately 35,000 acres of land of which 7,000 acres is maintained in turf.

As you realize, trees and shrubs are used to soften hard building lines; to provide shade; to screen out undesirable sights; and to beautify cities, parks, homes, highways and recreation areas. When selecting trees for a park or golf course, one should choose those types of trees that are to be used by the shape of its canopy, its habit of growth, whether it grows tall and slender, or small and spreading; its bloom or fall color; size and shape of its leaves; and the type of root system and its evergreen or deciduous nature. You should also consider how trees and shrubs will affect the cost of maintenance. Like the type of tree and shrub, the maintenance will differ in the various sections of the country. Dr. Keen on Monday showed how the climate and exposures on one side of a building are entirely different from the other side. Mr. MacQueen showed some excellent examples of local plantings of the wrong type of shrub, and others that were growing under adverse growing conditions.

1/ Agronomist, National Capitol Parks, Washington, D. C.

The basic fundamental principles of growing turf and trees are similar since they require good soil with proper aeration.

Another problem created from growing turf under trees and shrubs is supplying the plant with sufficient water during hot and dry seasons. Trees and shrubs, like turf, require fertilization when growing under artificial conditions. Many of our turf problems are due to planting trees undesirable for the intended use of the area and planting them too close together. Over-planting seems to be a general practice rather than spacing trees and shrubs sufficiently apart to allow their maximum growth. In the East, one of our major turf problems is establishment of grass under trees since the best time to plant fescue grass, which we use the most for shade purposes, is in the fall. About the time the seed germinates, we have our first killing frost and it is only a matter of weeks before the young seedlings are covered with leaves and unless they are removed by hand raking or mechanical means, much of the grass is smothered and killed.

The type of trees will not only vary from one section of the country to another but will also vary from one section of a state. For example, in the East it is difficult to grow turf under red and silver maples because of their heavy surface roots. Trees with a shrub-thick dense top and foliage such as the Chinese elm, always create a very difficult problem of establishing and maintaining grass. This is due to the density of foliage which prevents sufficient sunlight for the grass to carry on the process of photosynthesis. Again, under certain conditions the root competition from the trees, and the hard, compacted soil, contribute to the failure to grow the desired stand of grass under trees.

Most trees are grown under artificial and adverse conditions. Some of the adverse conditions are: smoke, physical injuries, disrupted water tables, hard packed soils, inadequate root space, reflected heat from pavements and buildings. Another disadvantage under which most of our trees live is the lack of humus build-up provided by decay of fallen leaves. The humus or duff formed by decayed leaves found in forests is nature's way of feeding the tree and also is nature's method of protecting the young feeding roots from the sun.

Trees grown in the city and on the golf course are subject to in ry from lawn mowers, from installation of sewer and utility lines. Precaution should be taken to prevent the destruction of tree roots when installing such lines.

In selecting trees and shrubs for golf courses one should consider the type of root system because the competition of roots and shade makes it difficult to establish and maintain turf. Trees should also be so placed that they add to the beauty and playability of a golf hole and not to be planted in areas near greens where frequent pruning of the roots is necessary for preventing the tree from robbing the mositure under a green. The size of the species of tree should be considered when planting areas between fairways and they should be spaced at sufficient intervals to allow the tree to grow to its maximum size and shape and allow enough room so the area can be maintained with power mowing equipment.

Many golf courses today have maintenance problems because the proper species of trees and shrubs were not planted and they were so spaced that it is necessary to trim around the trees by hand. The club is paying maintenance money that could be used to advantage in maintaining and improving the golf course. It

is very important to choose species of trees that are clean, and the branches are not broken off during wind storms. The black gum and sycamore are trees which fall in this category. In the East probably more dogwoods and white pine are used to divide fairways, screen tees, and to add color to golf courses. The crepe myrtle is also used for supplying color during the summer months. Dogwoods furnish beauty during the spring blossom period and in late fall when the leaves turn; whereas the white pine supplies color during the winter months.

Slides: Showing excellent fescue turf growing under large elm trees at Lafayette Park. Two slides were shown with a 150 ft. radius of large elm trees - one which had excellent turf and growing under conditions which supplied sufficient sunlight for growing excellent turf. The second picture showed the area to be denuded of turf. This was due to the heavy compacted soil and the heavy shade produced from the tall buildings across the street practically the entire day.

Slides showing the large magnolia trees on the South lawn of the White House. It was pointed out that it was impossible to maintain grass or even ground cover under such heavy foliage.

The picture of Ike's famous putting green was illustrated as to the disadvantage of having a tree within 10 feet of a green. It was necessary to remove the roots which appeared near the surface of the grass and the area was filled with old golf driving mats to a thickness of approximately 6 inches and a depth of 4 feet. The green has not showed any evidence of drying out from the tree roots since the mats had been installed.

A picture of the famous cherry blossoms was used to illustrate a mass planting for color effect. However, with such conditions it is very difficult to maintain grass under trees of this type.

A picture of a Chinese Elm was shown showing the large surface roots growing above the ground and scars of the roots caused by mowing equipment. The injury received by the mowers allowed a diseased condition to be started and the result the tree was lost.

A picture of flowering dogwood with the Capitol in the background was shown. While the dogwood is a beautiful tree, it is the type of tree under which it is very difficult to establish and maintain turf.

Two pictures were used showing the mass planting of elms in the late '30's and the excellent turf under them. The second picture was taken in 1958 showing the trees in a crowded condition and as they now exist create the turf maintenance problem. If the original planting of trees had been spaced further apart we would not have the turf maintenance problem which now exists.

A picture showing the use of LoBlo leaf blower cleaning leaves under the trees adjacent to the reflecting pool, indicated that the machine is capable of doing the work of eight men and the initial cost of the machine to the government was $275. This machine can pay for itself in three days operation. It is strongly recommended that golf course and park areas having leaf problems consider this method of leaf removal. It is also an excellent

piece of equipment for removing leaves from newly seeded areas and for cleaning debris off golf greens.

The elm tree killed by the use of sodium arsenite for Bermudagrass eradication on sidewalks near the Jefferson Memorial verified the precautions Mr. Hill outlined in the use of chemicals for herbicides and fungicides in his safety talk.

The program of feeding large elm trees in the downtown park area with 10-6-4 fertilizer was outlined. An air compressor was used to drill holes to a depth of 24" in circles starting from 3 feet of the trunk. Considerable amount of money was saved by this operation and it is estimated that one man with air compressor could do the equivalent work of 12 men. The question was raised as to the damage done to the tree roots by drilling with the air compressor. It was pointed out this method had been in use by the National Capitol Parks for a number of years and to date no damage has been observed or any injury received by the drilling method.

TURF MANAGEMENT PROBLEMS - USA

Charles G. Wilson[1/]

In Mr. Wilson's introductory remarks he told of pleasure at being at the Turf Conference, commented on its growth, and congratulated the program chairman on the fine program arranged for the conference (excluding myself, of course, he said).

Mr. Wilson stated he would take the group on a turf tour of the United States by way of pictures showing what is happening in some of our own region, or in regions that apply to our own climatic conditions.

Slides: Mr. Wilson stated he is often amazed at the ingenuity of golf course superintendents. This picture showed what one superintendent had done to solve the litter problem. He had tied a metal waste basket to a tree in which the caddies could throw candybar wrappers and such litter. The tree had been struck by lightning and damage was shown in the picture. Though the superintendent had said he should have used a plastic wastepaper basket, as it seemed this metal one had acted as a conductor for the lightning.

Picture showing damage in hot summer months in New York after a cold, delayed wet spring. In July the temperature rose to 90 degrees, with the humidity the same, with rains all that time. The temperature then dropped to 70 degrees and the humidity to 50, with drying winds.

1/ Agronomist, Milwaukee Sewerage Commission, Milwaukee, Wisconsin

A putting green which had too much water in the soil, not proper control of fungicides, with tied up trace elements. Lincoln Country Club. Wet season troubles, not any surface drainage, every known type of fungicide and nematodes, too. Result shown after applying 2 ounces of iron sulphate in 5 gallons of water on bent greens.

Picture showed same area one hour after treatment and the green chairman claimed the greens had been dyed. Mr. Wilson says grass gets tired blood, too.

Showed water-soil problem at Denver Country Club and surface drainage layout, with beautiful swale to divert surface water.

Taken on Florida Keys - where golf course was being constructed. Ocean bottom brought up to construct the golf course on. Rains insufficient to leach out salt, salinity shown in picture, with poor seed germination.

Houston - an illustration of too much rain and trouble in changing cups. On this course, the superintendent had used a heavy duty meat baster to take the water out of the cups.

Next picture - same course - showed workman taking water from the cups. A good method when cups are filled with water.

Picture of the world's largest golf green at the new Supranant course just outside of Boston. This green measures 27,000 square feet in size.

Picture of power spiker used by Wes Updegraff, developed in Oklahoma.

Taffic problems - this showed picture of parking lot on tee for caddy carts at the Denver Country Club. Good answer to the cart problem.

Sometimes difficult to grow turf. Cincinnati - Harry Meslah made path with cold mixed asphalt.

Houston - Bermudagrass putting green of Gene Tift, overseeded with redtop and bent, and what happens to seeding as a result of compaction. Mowing fringe of green, poor stand of grass.

St. Augustine lawn taken over by Bermuda, showing Bermudagrass growing in foot path. Bermuda is more wear-resistant than St. Augustine.

Picture of ditch, tile, at Sunset Country Club in Florida. Poor turf on fairway.

Next picture showed mass of tree roots in water line of Austrian pines. Roots extending much beyond perimeter of tree limbs.

Jim Haines' tree root pruner. Next picture showed size of tree roots. This piece of equipment can root-prune an 18 hole course in one day.

Flander's course (Brae Burn in Houston) - illustration of use of DSMA on Dallisgrass.

Detroit - pictures of Clarence Walfrom using arsenicals - sodium arsenite in putting green sod. Treat with 6 lbs. of actual sodium arsenite per 1000 sq. ft.

Picture shows sodium arsenite being used for temporary seedbed sterilant. Superintendent makes 12 passes over 1000 sq. ft., worked in well, stolonized with Toronto bent.

Many arsenicals being marketed - one of which is PAX, which is doing a good job as a pre-emergence treatment. Picture at Pine Valley treated the previous year.

U-3 Bermudagrass fairway, showing delayed reaction from arsenical the following June.

July picture - thought bent had chlorosis, but bare spots were where Poa annua had died and the bent OK.

Point Clear - edging walks using ATLAS A-2 ounces in a bucket of water. Next picture showed edge of walk after liquid material had been applied. Next picture - sweeping or brushing up the grass. Next picture - finished operation.

Charlie Danner of Richland Country Club at Nashville. No problem with Bermuda encroachment. Next picture of Ryan edger used there. A series of pictures of what the edger does to bent and Bermuda. The secret is frequent edging - once a week; also a good stand of bent, so Bermuda can't encroach.

Showing turf on collars of greens in Miami. Spray collars the same as fairways. Thinks fertility the answer to good collars.

Care in using chemicals - picture showed foot prints on greens made by workman who had been applying heavy concentration of sodium arsenite off the green and had tracked the chemical onto the green.

Gibberellic acid pictures. First on Eli Lilly turf plots which showed growth had increased, but bent had also been fertilized with 10-10-10. The growth was rather soft and succulent, showing need of more research on gibberellic acid.

Next picture showing application to hydrangeas another story. Picture showed size of treated plant compared to size of untreated hydrangea.

Oscar Bowman at Old Warson using tractor and rake to remove thatch, followed by mowing with rake and brush attached to mowed, then top-dressed.

Composting topdressing - showing compost piles made by Emilio Strazza in New York. Compost was prepared 3 years in advance so that it would not separate after being applied.

The last was a picture at Riviera Country Club showing Republican Vice President Nixon and Democratic Senator Smathers out for golf - Mr. Wilson said when you can get such men together for a game of golf it is a tribute to the superintendent who maintain the course.

THE USE OF SYNTHETIC NITROGEN ON TURF

E. C. Holt and J. A. Long[1/]

Turf fertilization research has been conducted at the Texas Agricultural Experiment Station almost continuously since 1951. We do not intend to review this earlier research this morning since this might take several hours and since you are not particularly interested in the details of such studies. We will attempt to draw some conclusions based on the several years experience at this location.

There is considerable tendency on the part of an individual, once he has found a fertilizer practice that he can use successfully, to continue using that practice. The results of fertilizer research should serve as an indication to that individual, the advisability of trying other practices. Fertilizer studies are of necessity conducted under non-use conditions which places some limitations on their value. However, the results of such studies should serve as a guide with the details of the management practice being worked out by the individual.

As we have mentioned many times previously, the results of fertilizer studies with turf are not easy to evaluate. You are interested mainly in quality of turf produced. Yet, what determines that quality? Fertilizer should be used at a level to maintain good growth but not excessive growth. How do we determine the desired level of growth since maximum growth is not desired? Color is important but it is hard to categorize and is not a linear function of level of nitrogen. In other words color may change very little about certain levels of nitrogen. Thus, while the desired results may be expressed

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1/ Agronomy Department, College Station, Texas.

very simply as good turf quality, determination of treatments adequate to produce this but not in excess of actual needs may be difficult.

We would like to review with you some of the types of evaluation we have made of fertility treatments and end up with some conclusions regarding our findings especially with Urea-formaldehyde nitrogen carrying materials. The material we have used is Uramite, 38% nitrogen, produced by DuPont and the research has been supported in part by a grant from DuPont. The results presumably would apply in a general way at least to other similar products.

Our main interest in recent studies has been in level of nitrogen and frequency of application necessary to maintain good quality turf. The studies have been conducted on Texturf 1F Bermuda mowed 3 times weekly at putting green height. The grass was grown on Lufkin soil and not on a putting green.

One of the measurements to evaluate response to treatments has been yield of clippings. The first chart shows weekly yields averaged for bi-weekly periods with 8 different treatments and the check plot. It is apparent that we did not obtain uniform growth with any treatment. A number of other detailed conclusions also may be drawn from this chart. We will not go into all of these since it would take some time in studying the chart to see all of them. It is apparent that spring growth was better where the initial nitrogen application was heavier. Fall growth was better where the nitrogen had been split into a number of applications. These results indicate that 12 pounds of nitrogen may not have been adequate since good growth in both spring and fall was not obtained with any single treatment. This had not been true the two previous years when for various reasons the treatments were not started until June 1. The treatments were started two months earlier in 1958, April 1, and this could account for the difference in response.

It may be noted that the check plot produced less than 10 grams per week average with some fluctuation from one period to another. The single 12-pound application averaged 28 grams with a low during any one week of 17 grams. These results indicate nitrogen release over an extended period with this material.

Color is probably more important than actual yield of clippings and was rated weekly throughout the growing season. Two charts will be used showing some of the color responses averaged for bi-weekly periods. A single application of 12 pounds of nitrogen with Uramite produced good initial color with a gradual decrease during the summer. The later ratings were satisfactory but the color was not as sharp as with other treatments. When the nitrogen was split into two equal applications, resulting ratings were more uniform but never as high as with a single application. With 4 applications, the early ratings were low with the fall ratings being good. With the delayed release of nitrogen from Uramite, this is the type of pattern that would be expected. Note the similarity to the Milorganite patterns with either 3 pound or 1½-pound applications.

Density observations and acutal plant counts have also been made in evaluating treatments. These data will not be shown because of the shortage of time.

The above methods give good relative measurements of treatments, that is, the comparison of one treatment with another, but they do not tell us whether the levels of nitrogen have been sufficient, excessive or inadequate for optimum performance. Measurements of available nitrates in the soil and fixed nitrogen in the plant tissue have been studies with selected treatments.

If nitrates are being released by the fertilizer more rapidly than they

are picked up by actively growing turf, this would indicate fertilization in excess of actual needs of the plant. The fact that no nitrates were detected with the test would not necessarily indicate inadequate fertilization. In fact the optimum situation would be one in which the nitrogen was released only as rapidly as needed by the plant. Nitrogen in the tissue or clippings indicate to some extent also the adequacy of fertilization. The results of these analyses are presented in the following chart.

Soil nitrates were never in excess of 6 PPM. On the basis of other studies this would not seem to be excessive. In 1957 soil nitrates in excess of 15 PPM were encountered for 3-4 weeks after applying 12 pounds of N from Uramite. The 1957 application was in June. Soil nitrates were in excess of actual needs with ammonium nitrate applications in 1957. The longer season in 1958 and the earlier application of the materials, apparently resulting in slower initial release due to cool soil conditions, resulted in no excessive nitrates in 1958.

Nitrogen in the clippings was quite high initially even though the color ratings with some of the treatments was not too good. It may be noted that tissue nitrogen was also high in the check plot and that there was not a great deal of difference between the check plot and other treatments. Nitrogen was high with all treatments probably because we were removing only the leaf tips where nitrates are accumulated. The high level in the check plot probably results from the very small growth that was taking place. Thus, while tissue nitrogen was fairly high, total nitrogen removal was low.

We believe these results warrant drawing the following conclusions:

1. 12 pounds of nitrogen was not adequate for the 8-month growing season.

2. A single application of 12 pounds of N from Uramite gave good spring and early summer response but did not last the entire season.
3. An application of 6 pounds or less of Uramite nitrogen in the early spring does not give satisfactory growth and color.
4. Heavy applications of Uramite in late spring and summer are likely to result in excessive nitrogen release.
5. Preferred treatments would appear to be 8-10 pounds of nitrogen in early spring followed by one or more supplementary applications during the growing season of either a U. F. material or a readily available form. Many factors influence the breakdown of these materials and it may be necessary to use supplemental readily available materials at times. Many of the details of use will have to be worked out.

A RESEARCH PROGRESS REPORT ON THE CONTROL OF BROWN PATCH ON ST. AUGUSTINEGRASS

J. A. Long, E. C. Holt & W. W. Allen[1/]

Brown patch disease is no doubt one of the more destructive diseases occurring on St. Augustinegrass. The characteristic dying or chlorotic patches occurring in St. Augustine lawns interrupts the continuity of the lawn areas where it occurs resulting in an overall unsightly appearance. Where the disease activity is high and when allowed to go unchecked, the chlorotic patches will remain somewhat conspicuous throughout the summer growing period even though the disease is generally active from September to May.

Rainy weather with night temperatures of from 65 to 75 degrees seems to be an ideal environment for brown patch disease. No definite relationship seems to exist between fertility levels of the soil and soil pH with the occurrance of the disease or degree of activity of the disease. Observations of the disease in a number of locations has shown that activity is about as severe on St. Augustine lawn areas of high, optimum and low nutrient levels. Observations also have indicated that the disease occurs both in well-drained areas and low poorly drained areas and not predominately in one site.

During the informal session on Monday evening, Mr. A. M. Hillis presented a review of the research work conducted at L.S.U. on brown patch disease control. He indicated that from results of isolation and artificial innoculation, the causal organism was identified as Rhizoctonia solani. This isolate induced the

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typical symptoms which we associate with that of brown patch on St. Augustinegrass. This information was further substantiated by the results of preliminary studies conducted at Texas A & M College. During the spring of 1958, one experiment was conducted on diseased St. Augustine turf around the Memorial Student Center. Although we did not obtain much information relative to selecting a chemical for positive control of the disease we did obtain some information on the nature of the organism. Isolates of both Rhizoctonia solani and curvularia luna were identified in samples taken from diseased turf.

In October of 1958 additional experiments were initiated on decreased St. Augustinegrass in nearly all lawn areas of the Campus. These tests were conducted in cooperation with Mr. J. W. MacQueen of the Grounds Maintenance Dept. The fungicides evaluated in these tests included Terraclor, Kromad, Dithane Z-78, Parzate, Terasan 75, Cerasan 200 liquid, Semasan and Captan. In one replicated test Kromad, Dithane, Terraclor emulsifiable concentrate and Terraclor granular at the respective rates of 3 and 5 oz; 5 and 10 oz; 1½ and 2 qts; and 7 and 9 pounds per 1000 sq. ft. were tested. The results of this experiment showed both Terraclor formulation to be effective in controlling or arresting brown patch disease. Considerable discoloration of St. Augustinegrass occurred from the emulsifiable concentrate and granular applications of Terraclor. The application of the wettable powder form of Terraclor at 1#/1000 sq. ft. in 25 gallons of water in another location showed it to be quite effective in checking the spread of brown patch disease. Slight discoloration was observed, but the turf soon recovered.

One repeat application of Terraclor wettable powder at the rate of 3/4 pound in 25 gallons of water per 1000 sq. ft. made to the same area treated 1 month before with 1# of the above formulation appeared to be an effective treatment.

We have several slides to show how some of the treatments appeared 6 weeks after the initial application.

In closing we would suggest that if any of you anticipate using Terraclor for treating brown patch disease on St. Augustinegrass, that you consider the following: (1) Use the wettable powder form of Terraclor; (2) make an initial application of 1 pound in 25 gallons of water or more per 1000 sq. ft.; (3) water the treated area lightly, particularly where heavy turf is present; (4) make a second application of 3/4 pounds of the wettable powder Terraclor in 14 to 30 days if rainfall occurs after the initial application and night temperatures range around 70°F; (5) make the fungicide application before or at the time disease symptoms are first observed, which will be in September or early October for most areas of Texas where St. Augustine is adapted. Treating diseased areas in late October or November, no doubt would provide satisfactory control of the disease but recovery of turf would be slow because of temperatures at this time.

The information and suggestions reported here are preliminary and apply only to St. Augustinegrass.

Disease Control Panel (Summary of opening remarks)

Dr. Don C. Norton[1/]

There is not a golf course or golf green in this state that does not have plant parasitic nematodes unless it has just been fumigated. The fact that a golf green or golf course has nematodes is not so important. The thing that matters is the kind of nematode and the population. We have to have lots of nematodes in order to have damage. We sometimes have to have even more with grass due to the extensive root system of some of the grasses in contrast to shrubs and flowers. We have to have more than we do on some of the plants which have been damaged with fewer nematodes. Actually we have, since 1954, surveyed all sorts of crops in this state for nematodes. It is a new field and we have more questions than we do answers. During the survey we have sampled some golf greens and have had samples sent to us from various golf courses. There are about six or seven nematodes that we know exist in this state in golf greens and various golf courses. But there again it is hard to tell from a sample just how much damage is being done.

If you send a sample as you may, if you wish, I will be happy to examine it. It will be difficult for me to tell you sometimes how much damage is being done. The only thing we can go by is associations. If the grass is doing poorly, and can not be corrected by adequate fertilization or other practices, and there is a high population of nematodes I would suspect them as causing the damage. The thing I would do then would be to go back and run some trial fumigation tests or trial

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1/ Department of Plant Physiology and Pathology, College Station, Texas.

control tests. To send a sample in for analyses for nematodes, put a pint of soil in a water proof bag, refrigerator bags are commonly used. If it is a golf green, you may wish to take several samples from the green, put all the soil in a large paper bag, shake it up and from that take out about one pint of soil and send it in. The main requirement is that the soil not be dry at the time the sample is taken. If you want a disease analyses also send it to Dr. Harlan Smith with the grass roots and some of the tops too. We will process the soil for nematodes and disease organisms and send you a statement of the findings.

The most effective way of clearing a green of nematodes is soil sterilization. But this destroys the grass too. Methyl bromide is one of the most effective compounds for this purpose. There are some chemicals available which will reduce the population of nematodes without destroying the grass but the nematodes will come back in a few weeks or months.

Disease Prevention

Mr. Charles G. Wilson[1/]

How many here carry on a disease prevention program? Not many individuals indicated that they were carrying on such a program thus, suggesting that disease prevention is not too satisfactory. More people become concerned when they see the visual symptoms of the disease. As I understand it, when we see the disease today or tomorrow it may have actually started its work as much as three or four months before it makes its appearance. In other words it is increasing and building up the population for a considerable period of time prior to the actual develop-

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1/ Milwaukee Sewage Commission, Milwaukee, Wisconsin

ment of symptoms. So you can see that a disease prevention program to be effective would have to start early.

Some of the things that should be considered when a disease prevention program is not working satisfactorily is whether we have chosen the right fungicide. Invariably as we travel around and we hear of failure of disease control programs, we find that the failure is not on an entire course but with only two or three greens. Many factors influence the action of the fungicide, thus it may be necessary to change fungicides under some conditions. Another thing to consider is to check the label on the material you are using to find out for sure that the manufacturer claims the control of the disease that you wish to check. Also, you should check as to whether you are using the gallonage of water per 1000 sq. ft. that the manufacturer suggests. Probably many of us have spray tanks that we have set for delivering a certain amount of water and we use that regardless of the fungicide being applied. These and many other factors are important in determining the effectiveness of the disease prevention and control program.

Insect Control Panel (Summary of remarks)

Mr. George Davis[1/]

The control of insects must be based upon the characteristic of the insect, particularly the type of mouth part. For instance, chewing insects can be controlled by stomach poison where as sucking insects are controlled by contact poisons or by fumigation. Thus, many of our insecticides that would be effective against chewing insects would not be effective against insects with sucking mouth parts.

Here we have an example of a chewing type mouth part insect. This is the eastern tent web worm whose favorite hose is the pecan tree. You may also find this insect on about any type of tree. For this type of insect you can use DDT, lead arsonate, toxaphene, chlordane, are nearly any of the stomach or contact poisons. Also, you can obtain fairly effective control by cutting out the portions of the limbs that are infected and destroying them.

Chewing Insects

Here we have the larval stage of the wire worm. The adult stage is a beetle. The insect does most of its damage in the larval stage feeding on root systems in the ground. It stays in the larval stage for two or three years before it emerges as an adult and during this time it can do alot of damage. You may find as many as 15 to 20 larval per sq. ft. of soil area. Here we have the adult and larval stages of the May beetle or June bug. The larval stage is commonly known as the white grub, and this is the stage in which the insect does the most damage. The

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1/ Stauffer Chemical Company, College Station, Texas.

adult will feed on leaves of trees, especially pecan trees, at night. The adult lays eggs in the latter part of June or July. The larval or grub enters the soil and starts feeding on plant roots immediately after hatching. There is relatively little damage the first year because the grubs are small and require little food. During the winter they go down deeper into the soil to avoid freezing and the next spring come back closer to the surface, usually within one to three inches of the top, and feed on root systems. This continues for two or three years before the larval stage matures to an adult and during this stage they can do extensive damage to grass root systems. Soil insecticide such as chlordane and aldrin do a good job of controlling the larval stages of both the wire worm and June bug. The recommended rates of 3 lbs. of actual material per acre should be used. The materia must be washed down into the soil either by sprinkling or rain before it becomes effective.

The fall Army worm has caused considerable trouble in past years. It starts feeding in a small area and spreads as it grows similar to the way in which an army marches. Stomach or contact poisons such as toxaphane, DDT or chlordane will do a good job in controlling this insect. The sod web worm also does considerable damage to turf. We had an outbreak of this insect on St. Augustine in this area last fall. It can be controlled with such insecticides as heptachlor and chlordane.

Here we have another chewing insect that is more or less specific as to host plants. This is the bag worm that feeds primarily on arborvitae. There are a few species that will attack elm and other trees of that kind. The insect is easy to kill if you start at the right time but if you wait until the 10th to 15th of june, it is too late. Malathion is effective in controlling the insect if used through May. Lead arsonate is about the next best and toxaphane will do a fair job but DDT is not effective at all.

Here we have the long horned beetle which is the adult of the round-headed borer. This is a chewing insect that is very difficult to control after it gets inside the stem or branch of the tree or shrub. The adults do little damage in the way of feeding on leaves of various plants. Here we have a picture of the larval stage. You will notice the brown part of the head is very small while the other portion of the body is large in comparison to it. This is the way you can tell it from the flat-headed borer. The round-headed borer is the one that goes into the heart of the limb. The only way to control the round-headed borer after it has entered the limb or twig is through mechanical injury with a wire or some other such instrument or fumigation of the tunnels with materials such as carbon bisulfide. Actually the best control is through prevention of infestation by spraying every 3 to 4 weeks during the egg laying period which is roughly from June through August. Most any of the materials such as DDT, chlordane, dieldrin or any of the long residual insecticides are effective in preventing infestations by the insects.

Sucking Insects

Aphids: This is an aphid on a rose bud and aphids can be very distructive to roses or to all plants for that matter. Aphids multiple very rapidly and can build up extremely large populations in a short period of time. Malathion and chlordane are effective in controlling these insects.

Lace bugs or Lacewing bugs: These insects do a lot of damage to ornamental plants such as azalea, firethorn and rhododendron. Both the adults and nymphs suck the juices from the under sides of foliage leaves. The under surface becomes spotted with flattened specks and blackish, shiny excrement. Malathion and nicotine sulfate, are effective control measures.

Euonumus scale: They may be found on any part of the plant. The young are referred to as crawlers and are active for only a short time before attaching themselves to the plant for the rest of their lives. As a result of feeding and exudation they give the foliage a blackened appearance. The use of miscible oil or oil-emulsion sprays in the early spring or several applications of malathion in the crawler stage are effective means of control.

Leaf minor: They make irregular tunnels inside leaves. They are difficult to control because of being inside the leaf. Phosphorus insecticides will do a fair job but usually no control is necessary. Leaf minors have a lot of natural predators which will normally control the population. An insecticide program may kill off the natural enemies of the leaf minor and unless the program is continued, the problem might even become more severe than without treatment.

Ants: Ant hills or beds can be controlled by applying a ring of granular clordane, aldrin or dieldrin around the nests. The ants will track it into the nests and it will do a good job of killing out the colony. Two applications may be necessary at times. The use of a water mixture poured into red ant hills also does a good job. Ants can be controlled in buildings with slab-type foundations by spraying around the outside base of the building with clordane, dieldrin or aldrin. In the case of buildings on piers, it will be necessary to treat around each pier.

Puss caterpillar or asp: This insect does relatively little damage to plants but produces a very painful sting. Clordane and malathion have been used effectively in controlling the insect.

SUMMARY

TEXAS TURFGRASS CONFERENCE

Marvin H. Ferguson[1/]

Dr. Trogdon opened the conference on Monday at noon by commenting upon the progress of the Association. He said this was a conference in which we were not likely to hear of revolutionary discoveries but he said that we will learn from one another's experiences. He said that part of the value of a conference such as this was in getting to know one another better and that this is a value that cannot be measured in dollars and cents. According to Dr. Trogdon turf is a contributing factor in the economy of our state and he indicated that he was impressed by the fact that this was a conference in which the turf plant was to be considered in its environment. He welcomed the group to the College officially and extended his wishes for a successful and enjoyable conference.

Dr. Ray Keen, of Kansas State College, spoke on the subject "The Grass Plant and Its Environment". Pointing to a map of Texas showing the climatic and soil groups, he posed the question "where do you live in relation to climate"? It was pointed out that climate is dominant and that it determines the kind of grass we grow. Dr. Keen hastened on to say that climate is not necessarily weather climate which is measured from definite standard situations. He said that this type of information is useful but that it is not necessarily a reflection of the climatic environment of a grass plant. This is because the plant grows at the surface of the soil where temperatures, humidity and wind movement may be much different than at a standard height of about six feet. Dr. Keen also said that averages of temperature are not very useful in studies of plant environment; on the contrary, extremes

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1/ Mid-Continent Director, National Research Coordinator, U. S. Green Section, A & M College of Texas.

of climate are very important. He illustrated this point by saying that the climate of Kansas on the average is about the same as that of Hawaii, yet Hawaii grows vegetation of a semi-tropical nature; whereas, the extreme cold winters and the extremely hot summers of Kansas preclude the use of this type of plant.

Dr. Keen said the effects of water table level are very important. He pointed out that this is a function of soils. Soils, in turn, result from the type of climate and vegetation and, therefore, these factors interact with each other - soils, climate, and vegetation. Texas has numerous soils regions and a great deal of climatic variation; therefore, our vegetation must vary a great deal. He spoke of microclimate as being the climate immediately surrounding any particular patch of turf. Dr. Keen said that we cannot do much about climate control but that we can do a great deal about controlling the climate immediately surrounding a small area of turf, such as a putting green. And he said that this kind of climate control is a part of the job of turf growers. It was pointed out that localized dry spots in greens may have a different climate because of increased temperature resulting from a lack of evaporation and transpiration. A south slope or a north slope 10 feet apart may be the quivalent of several hundred miles geographically, because of the angle at which the sun strikes the soil. He concluded by saying that one should think of the climate of a grass plant or the environment of a grass plant as being that area immediately surrounding the plant itself and not in terms of the climate that exists around your head.

Dr. Watson followed Dr. Keen on the program and discussed "Basic Soil Considerations in Growing Turf". Dr. Watson reiterated one of Dr. Keen's statements about the interaction of climate, grass and soil. He pointed out that variations in grass were limited because of the fact that relatively few species are used fo

growing turf. We have a limited choice in this respect. He said that climate can be modified little except on very small areas, and that soil offers perhaps the greatest opportunity for modification. He said that the basic plant requirements that a soil provides are those of support, water, air, nutrients, and that it has some influence upon the temperature. Good soil management implies adequate fertility level, adequate drainage, the maintenance of an adequate moisture level and the maintenance of proper pH conditions for nutrient availability. The use of the turf area and the funds available determine the extent of modification that can be undertaken. Dr. Watson said that in practical turf grass growing we sometimes lose sight of soil effects. He said that building of greens is done rapidly and sometimes compaction occurs during construction. The correction of compaction on established turf areas depends upon cultivation but this alleviation of compaction is likely to be temporary. Dr. Watson stressed the importance of drainage - both surface drainage and subsurface drainage. He indicated that the roots of plants often gives a clue with respect to the aeration characteristics of the soil in which the roots were grown. Dr. Watson closed by reiterating that there is more opportunity for modification in soils than in any of the major factors effecting turf growth.

After a recess Leon Howard presented some of the research that he has done in connection with his thesis problem. Leon has done a great deal of work over the past two and a half years. He constructed a putting green by the use of shovel and wheel barrow and he did all the work himself. He devised and constructed much of the laboratory equipment used in his experiments because it was not available commercially. There is a rather involved procedure for carrying out the kind of study that Leon has done. It will not be necessary to go into the details of

these procedures but the gist of his talk is that through a great deal of effort he has arrived at the point where he has confidence in his ability to analyze materials to be used in a synthetic mixture, to make trial synthetic mixtures and to predict whether or not these synthesized soils will behave properly on a putting green which is subjected to compaction, overwatering, and the usual severe treatments that are given to putting greens. Such a contribution is of tremendous value to golf.

Mr. John W. Hill was the last speaker on the afternoon's program and he spoke on the subject of "Safety in Your Program". Mr. Hill said that as our technology advances there are more chances for accidents. People, both skilled and unskilled, are the factors that make a business easy, safe and profitable or difficult, unsafe, and unprofitable. He said he should like to consider the assigned topic from the standpoint of "Accident Prevention" because he said "accidents don't happen - they are caused". There is a basic cause of every accident and this is a serious matter because accidents involve loss of time, loss of pay, and sometimes loss of limbs or perhaps even life itself. Under the heading of what we may do, Mr. Hill listed several things:

A. A man must be physically fit for the job he has to do.

B. He must have a mental ability to do the job required of him.

C. You must put the man on a job he fits.

D. You must do some training.

E. Point out the particular and peculiar hazards in any chemicals or any machinery that a man must use.

F. Prepare a man to do the job that is ahead of him. Many accidents are the result of attitudes and of personal behavior.

Mr. Hill stressed the value of regular safety meetings and said that "tailboard conferences" held among workmen immediately before carrying out some particular operation are extremely helpful. Other ways to promote accident prevention are by the use of posters, by the use of personal protective equipment, such as goggles, hard hats, and things of this sort. Men should be instructed in the use of respirators and other safety equipment and any operation should be subject to regular safety inspection. Mr. Hill said that a first aid course often makes a person much more safety conscious. He concluded by saying that safety is an attitude or a point of view.

On Monday night there was an unofficial session in which many interesting pictures were shown. This is a session that is becoming increasingly popular at our annual conference because it gives an opportunity for anyone to say anything that is on his mind whether or not it is scheduled on the program. This session was moderated by J. B. Moncrief and he did an excellent job of it.

On Tuesday morning the group was divided into two separate groups, one concerned with parks and the other with golf courses. In the park maintenance session Mr. A. E. Rabbitt spoke of park maintenance in the National Capital Parks. He reviewed some experiments that had been done in the past that indicated that when seed mixtures are used relatively little nurse grass should be included in the mixture. He also showed the results of experiments which indicated that small amounts of seed can be used with adequate fertilizer more profitably than large amounts of seed with inadequate fertilizer. Mr. Rabbitt stated that there are 35,000 acres in parks in the National Capital and that 7,000 acres of this area is in turf. Many pictures of Nation Capital park areas were shown and the type of of use to which they are subjected was discussed. Water management is one of the

most important factors in the management of turf in the Washington area, according to Mr. Rabbitt's statement. We might add that water management is one of the most important factors in the management of turf anywhere.

Mr. MacQueen, of the Grounds Department at A & M College, spoke about school ground planting and maintenance problems. He said that people, cultural practices, and the planting of school and classroom buildings were the three major headings which he would discuss. Because plantings are organized to accomodate the people, adequate walks are extremely important. He said that the arrangements for utilities which must be accessible to contractors, craftsmen, etc., should be taken into consideration. Plantings often interfere with access to these facilities and are often destroyed by workmen concerned with utilities maintenance. Mr. Mac Queen said that litter is one of our increasing problems. Adequate sturdy containers are helpful but education is needed in this matter. Under the heading of cultural practices, one of the important points that Mr. MacQueen made was that fertilizers which are pelletized can be used to very good advantage with cyclone seeders. This type of distribution equipment allows the distribution of fertilizer under trees and shrubs where wheel-drawn equipment cannot be used. He pointed out the importance of the cultural practices of aerification, irrigation, pruning and mulching, as well as insect and disease control. Mr. MacQueen said that planting should achieve the maximum ornamental effect with the minimum maintenance. The selection of proper species is important but it is better to underplant than to overplant a public area. Furthermore, group plantings give a better effect than specimen plantings. He said that ground covers are limited because of the large amount of maintenance necessary. In speaking about the turfgrasses used, he said that St. Augustine is one of the good ones but the difficulty encountered with disease has caused a hesitancy to use this species; that Zoysia is a good one, but very slow; and that bermuda still looks

like the best material for general turf use.

In the other section, Dr. Keen was talking about turfgrass problems and experimental work in the Central Plains area. He said that their research work originally consisted of a cutting height test, a shade test and some variety testing. Incidentally, this variety testing is now a very important part of the work at Kansas State College. There is a considerable collection of bluegrass types, there is a collection of bents that are called "winter green" types because they were taken from the Wichita area during the wintertime and these selections stayed green throughout the winter. A great deal of work has been done with Bermudagrasses in a hybridizing program that has made use of the polycross technique. I have seen these Bermudas and there are some very interesting ones along them. Dr. Keen has numerous Zoysia selections and he finds a great deal of variation in color, in vigor, in height, in seed production, etc. He has also done a considerable amount of work with dyes or paints for dormant turf. It has been found that many of the dyes which are successful in the eastern part of the United States will not withstand the intense sunlight of the Central Plains area and they fade out rapidly. In summary, Dr. Keen said that of the warm-season grasses U-3 Bermuda appeared to be the best one. A selection called K1-51 at the Kansas State College shows a good potential. He said that Meyer is the best of the Zoysias available commercially; that Tifgreen was perhaps the best choice for anyone who wanted to use Bermudagrass for greens in that area; that Kentucky bluegrass is the most reliable of the cool-season grasses available.

Following Dr. Keen's talk, the group divided into various sections and panel discussions were conducted during the remainder of the day. The first panel dealt with disease problems and was composed of Dr. Don Norton, Mr. A. M. Hillis, Mr. Joe Smith and Mr. Charlie Wilson. Dr. Norton discussed the effects

of nematodes present is important. He said that the lasting effects of sterilization were quite variable. Joe Smith made the point that diseases are caused by a situation in which the host plant, the causal organism, and the temperature and environment are proper for disease activity. He said that disease is not possible if any one of these factors is removed. Charlie Wilson said that cultural practices need to be considered in disease control. He said that proper composting of the soils to give soil some structure and stability was probably more important than we had considered it in the past. Mr. A. M. Hillis discussed some of the work that has been done with brownpatch in the Louisiana experiments and he gave instructions for sending in samples of diseased turf. He said that polyethylene bag containers act as incubators and he suggested that aluminum foil might be used more effectively. It was also brought out in this panel that insidious diseases at either end of the Bermudagrass season are quite important. These seldom cause any serious or spectacular damage but they do weaken the Bermudagrass during its dormant period and cause the transition period in the spring to be much more prolonged.

The panel on insect problems was composed of Mr. George Davis, Mr. A. W. Crain and Mr. Mark Gosdin. Mr. Davis pointed out in this panel that the combination of malathion and chlordane will control most of the pests that attack turf areas. He said that malathion is a good insecticide for the control of the sucking insects and that chlordane will control most of the chewing insects. A question about chinch bugs brough the reply that toxaphene or chlordane will control these. It was also mentioned that diazinone has been used to some extent in the control of chinch bugs and that this is one of the materials now being recommended for household insects, particularly roaches. However, this material

is a phosphorus type insecticide and is quite poisonous. There was considerable discussion upon safety measures which involved the wearing of protective clothing, rubber gloves, and respirators. It was also mentioned that Poison Information Centers have been set up to handle questions pertaining insecticidal poisoning and that these lists of these Centers are available from most county agents and from the USDA Green Section office. Mark Gosdin made the point that rhodesgrass scale should be treated when the insects are young and he said that this is a principle that applies to many other insects such as grubs, because if insects are allowed to grow to mature size they will do a great deal of damage before they reach that stage.

The third panel had to do with management problems. This panel was composed of Dr. J. R. Watson, Mr. Eugene Bockholt, Mr. A. E. Rabbitt and Mr. L W. DuBose. This panel was one used as more or less a "catch-all" and the panel members discussed any problems which came up. The discussion in this panel ranged through such topics as labor unions, soils, amounts of budgets, the value of retirement plans, and the kind and size of spraying machines that were suitable for use on the golf course.

Panel discussions are extremely difficult to record because of the variety of questions and the many persons involved in the discussion. However, these sessions are valuable to our conference because they give each person an opportunity to ask questions about the things that are bothering him. May I offer apologies for the inability to provide a better summary of this discussion?

The banquet was held on Tuesday night and Mr. Herb Graffis was the principal speaker. Mr. Graffis mentioned the peculiar economics of golf and pointed out

that we need more golf facilities, that many people who play golf cannot afford the country club facilities because so much of the money at a country club is spent for things other than golf. Mr. Graffis is always an entertaining speaker but if we but look beyond his humor we find that there is a serious note to his talk and that his remarks are certainly applicable to situations in which we find ourselves.

Following the banquet, there was a business meeting in which the newly elected officers and directors participated. I should like to take this opportunity to commend the Association upon the officers that it has selected and to commend the officers who have been elected upon their apparent dedication to the task that is ahead of them. It is my privilege during the course of each year to attend numerous turfgrass conferences and to follow the operations of several turfgrass associations I think that it is fair to say that this Association is one of the most soundly operated organizations of its kind.

This brings us to the Wednesday morning session. Dr. Holt and Mr. Long have provided some information with relation to research being done at the College; Charlie Wilson has given us an excellent tour of turfgrass problems throughout the country with his slides and discussion; Mr. Rabbitt has given us a very fast tour of the National Capital Parks through the use of his pictures and his discussion of the use of trees and shrubs as they are related to turfgrass maintenance. In his talk, Mr. Rabbitt has brought out many of the things that turf growers need to be concerned with; that is, the spacing of trees and shrubs to facilitate easy turf maintenance; the conflict which exists between trees and turf in heavily shaded areas or in areas of heavy traffic, and the problems concerned with fallen leaves, competition of tree roots, and things of that sort.

This has been one of the best conferences in the history of the Texas Turfgrass Association. I am surprised and pleased to note that we have 110 people in the audience this morning at the last minute. This certainly is a different story than we have had in the past when there have been only a few faithful ones to stay for the last day's program. Perhaps this is an indication that Dr. Holt and Mr. Long made a wise decision in scheduling such people as Charlie Wilson and Ike Rabbitt for the last morning's program. I commend all of you upon your interest and steadfastness, and I should like to compliment the speakers for their excellent presentations during this conference. We will now turn the program over the Mr. Campbell, our new president. Thank You.