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of the

Texas Turfgrass Conference

TEXAS A&M UNIVERSITY

and

THE TEXAS TURFGRASS ASSOCIATION

COLLEGE STATION, TEXAS

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F O R E W O R D

The 1970 Texas Turfgrass Conference marked the 25th Anniversary of this event and we take this opportunity to express our sincere appreciation to all of those who helped to make it a success. The growth of this Conference and of the Texas Turfgrass Association during the past two decades is indicative of the dedicated support of the Association's members and its officers.

Our special thanks to the chairmen of each session and to the speakers whose talks have made this publication possible. It is intended that these proceedings act to preserve some of the history and heritage of Turf Management here in Texas, and in addition, that they might be used as an educational tool in the furtherance of this profession.

Wallace G. Menn
Program Chairman

Dr. Ethan C. Holt
Co-Chairman

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HISTORY OF THE TEXAS TURFGRASS ASSOCIATION AND CONFERENCE

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Today I am highly honored to have the opportunity of giving you a bit of history concerning the Texas Turfgrass Association. Having seen this association born and watched it develop and grow, I may be a little nostalgic in my remarks. If I were only speaking to those who were in attendance at the first conference and have continued to be active for these twenty-three years perhaps we could visit the rest of the afternoon recalling incidents of interest to us. Many of you, however, are not interested in the history of this conference per se; you are concerned with the immediate problems and answers along with what lies ahead.

I don't need to remind any of our audience that we live in an affluent society, but I would like to illustrate what I mean by such a society. Recently I was told of a chairman of a greens committee who lives in Sherman, Texas. This man lived out on the edge of town and had a fine home worth some $75,000 to $80,000 and was a happy man. One day he came home from work and he was met at the door by his wife who was very angry. In fact, she was so angry that she could hardly speak. She wouldn't let her husband in the house. However, he got in but she was still very angry. In a few minutes she quieted down enough so that he could ask her what was the matter. His wife asked, "Who was that blonde I saw you walking out of the downtown hotel with right after lunch?" The man said, "She's my mistress." Again, that just infuriated his wife. After a few minutes of patience he said, "Now let me talk a little bit. Who supplies you with that Lincoln Continental out on the drive?" Who provides you with this $75,000 home to live in and who pays your charge account at Neiman-Marcus? You think about these things a little bit and in about a week or ten days, let's get together again and discuss this situation when you can look at it more objectively." In a few days, they were riding together downtown and passed the Sherman Hotel and his wife looked out on the street and she recognized a neighbor who was coming out of the hotel with a nice looking redhead. She said to her husband, "Isn't that John over there and who's that with him?" Her husband said, "Yes, that's John and his mistress". His wife turned to him with a smile and said, "Our little blonde is a lot cuter, isn't she?"

In the summer of 1946, Howard and Frank Goldthwaite along with O. J. Noer, Fred Grau, and Marvin Ferguson made a tour of some of the golf courses in Texas. After visiting with greens chairman, golf pros and other interested individuals maintaining golf courses and grounds, they realized that there was a need for up-to-date information among the greenskeepers, superintendents and other people interested in turf. No organized way existed for the dissemination of information concerning improved grasses, fertilizer, good management practices, and many other new things necessary to maintain a sound turf program. At the completion of this tour Howard and Frank Goldthwaite contacted Mr. G. C. Warner who was then doing research on pasture grasses at the Experiment Station and myself. Fred Grau had told the Goldthwaites about his experience in other states in the development of conferences and turf organization. It was decided that one of the first things to do in Texas would be to have a conference in which people could discuss their mutual problems.

Therefore, it was decided that it would be well for Texas A&M University to sponsor a conference on turf. It fell my lot to organize this conference and with the help of Frank and Howard Goldthwaite it was possible to obtain the services of some outside experts in the field of turf. It was further decided that this conference should be broad based and that invitations be sent to individuals throughout Texas, New Mexico, and Louisiana who had an interest in turf. These invitations went to individuals interested in golf courses, cemeteries, highways, airports, schools, parks, the corps of engineers, along with those industry people servicing the profession.

I would like to quote a paragraph taken from the program of the first annual conference:

> "Purpose - The purpose of the first conference on turf is to give interested persons an opportunity to discuss their problems with each other, to present fundamental information that is basic to all turf work, to give all workers in the field a broader appreciation of the many problems concerned with turf. The conference will include discussions on the soils of the Southwest; adapted turfgrasses; turf diseases; grass breeding and turf management; turf for airports; roadside development; turf weeds and their control; trees and shrubs in parks; and rodent control."

And I quote again from general information given in the printed program:

> "Good turf for public and private use is assuming great importance in the Southwest. Modern industrial developments are being built with generous areas of turf as a part of their plan. Native and introduced grasses are being used to prevent wind and water erosion on roadsides, airfields, and military establishments. More extended use of turf for beauty and pleasure is a desirable part of the plan for a more enjoyable post-war period."

With this as a background, the first conference was held on January 20, 21, and 22, 1947.

On January 21, 1947, a banquet was held in Sbisa Hall. At the end of the banquet, Master of Ceremonies, Graham Ross of Dallas, called a business meeting of all those present. The object of the meeting was to discuss the organization of a turf association. It was stated that it was both logical and practical for members of this first conference to establish a turf association and that through a united effort important developments could be made in the area of turf improvement. After considerable discussion the assembly voted unanimously in favor of an organization. The following officers were elected: Gordon Jones, President; Jimmy Gamewell of Hobbs, New Mexico, First Vice-President; Dr. Howard B. Sprague, Second Vice-President; George Aulback, Secretary-Treasurer.

The assembly discussed a name for the association and by unanimous vote the name "Texas Turf Association" was chosen. A special committee was appointed by President Jones to draw up a constitution and by-laws. The newly formed organization decided that the annual dues and fees should be $5 and it should be organized by regions. Membership dues were accepted at the close of the organizational meeting and seventy-one individuals paid their dues and jointed at 10:30 p.m. on January 21, 1947. Thus was born the Texas Turf Association.

The first business meeting of the new association was called at 11:00 a.m. on January 22 at the close of the conference. Two resolutions were passed. I quote in part from these resolutions because I feel that they have been so important throughout the years of the organization:

> "Be it resolved that the Texas Turf Association recognized the great need for detailed research in all phases of turf management in Texas and go on record as being exceedingly desirous of obtaining from the USGA Greens Section a Research-Fellowship Grant and that this grant be made to the Texas A&M College to assist in its turf program, thereby making possible the training of future leaders in the field of turf and providing basic data on problems of turf management."

And I quote from a part of the second resolution:

> "That Texas A&M College be urged to include within the limits of resources suitable provisions for developing research on all phases of turf management and breeding grasses. Also, an extension program to carry the results of the research to all the people of Texas, and a teaching program to develop well-trained leaders and operators in the field of turf-culture."

These resolutions were submitted and approved, thus ending the first conference which had a total attendance of 126 individuals. In 1965, a State charter for the Texas Turf Association was obtained.

Certainly, time does not allow me to go into detail concerning the next 23 conferences, so I propose to just give you in my opinion some of the things that have been important through the years in connection with this fine organization.

There has been considerable discussion as to how we could get 25 conferences in a period of some 23 years, and in order to set the record straight, at this time I would like to list the conferences and their dates.

1947-1948	Texas A&M in January
1949	Two conferences jointly with Oklahoma; January - Dallas; November - Tulsa
1951	Two conferences at Texas A&M; February and December
1952	One conference at Texas A&M in December
1954	Two conferences at Texas A&M; January and December
1955 to Date	Annual conferences at Texas A&M in December

Attendance dropped to a low of 37 Texas members in 1948 and 49 members when held in Tulsa. It was then decided to hold the annual meeting on Texas A&M's campus. In 1952, the attendance was 99. It had reached almost 200 by 1960. For the past ten years there has been more than 200 in attendance each year.

The Turf-Newsletter began in 1947 and I was editor until 1952. James Watson came along and edited the Newsletter for a year and a half. Ed Daniels of Wichita Falls was elected to edit the Newsletter and he and Earl D. Staten were editors during 1953 and 1954. From 1955 to date, Albert Crain has been editor along with a silent partner, his lovely and devoted wife, Barbara.

The past presidents of the Association have been:

1947 - Gordon H. Jones	1959 - Charles Campbell
1948 - Gordon H. Jones	1960 - L. W. DuBose, Jr.
1949 - Howard B. Sprague	1961 - Ken Krenek
1950 - Frank Goldthwaite	1962 - Carroll Kiser
1951 - L. B. Houston	1963 - Dan Lynch
1952 - Dick King	1964 - Tom Leonard
1953 - Elo Urbanovsky	1965 - Bill Scheibe
1954 - Spencer Ellis	1966 - Quinton Johnson
1955 - Hughy Johnson	1967 - Carlton Gipson; Jim Holub-7/67
1956 - Wylie Moore	1968 - Jim Holub
1957 - Bob Frazer	1969 - Phil Huey
1958 - Grover Keeton	1970 - W. Wayne Allen

The proceedings of the meeting of the Turfgrass Association constitute an encyclopedia of turfgrass management and production. The information reported in the proceedings of the conference covers every facet of turf management. The first speaker at the first conference was Mr. L. B. Houston, and he pointed out the need for an overall research and educational turf program in the Southwest. Dr. Fred Grau and Dr. R. D. Lewis (then Director of the Texas Agricultural Experiment Station) expanded on the requirements and opportunities of the turf research program of the Southwest. Progress of the research done by the Texas Agricultural Experiment Station was first reported in the 1950 conference and each year thereafter.

At the first conference in 1947, Dr. Luther Jones attributed poor greens in the Southwest to poor soil physical conditions. "Drainage is essential," he said. His prescription for putting greens was to construct them using tile drains with proper mixtures of fine gravel, coarse sand, organic matter, good soil, and have over-head sprinklers. These ingredients are as relevant today as they were in 1947. The need for soil aeration, presently a common practice, was first discussed by Tom Mascaro at the conference in 1948. Top-dressing mixtures have been a subject for discussion since the first conference. The importance of using a top-dressing material that would not cause layering was emphasized by O. J. Noer. He also recognized the importance of proper soil-plant-water relations.

During the period of these conferences turfgrasses and particularly the bermudagrasses have been changed so much that they are hardly recognizable as the same species. You might be surprised at the people who do not know that the tifgrasses are bermudagrasses. In 1947, only common bermudagrass was available. With your support, Texas A&M University has evaluated hundreds of bermudagrasses and has released several improved strains.

Landscape design, with emphasis on ornamental trees and shrubs has been a part of the program since 1947. These conferences have helped to point out that turfgrass managers have a greater responsibility than just growing grass. Ornamentals, ground cover, shade trees, and aquatic plants have been discussed. Likewise, personnel management, public relations, salesmanship, record keeping and safety have found their place in discussions at this conference.

At the first conference, Howard Sprague discussed management in relation to drought tolerance in turfgrasses. Today water efficiency is of even more urgent concern in turfgrass management. One advantage of the automatic irrigation systems available today is water efficiency. Considerable time at these conferences has been devoted to irrigation systems and water requirements of turfgrasses.

At the first conference, disease and insect control was discussed and it has been on the agenda of every conference held in Texas. Fred Grau, at the conference in 1948, discussed control measures for both disease and insects, but emphasized that resistant varieties would be the ultimate control and he encouraged breeding and selection of turfgrasses for resistance to disease and insects. Many varieties have been found that are resistant to certain insects and disease, but it remains a primary objective of the breeding programs today.

At the 1947 conference, Marvin Ferguson discussed weed control and in his discussion he stated, "Grow grasses first, then control weeds." At that time hand labor was the only means of weed control. The list of herbicides available today is quite a contrast to those mentioned at the first conference. Herbicidal selectivity and activity have become so refined that weeds are not the problem today that they were in 1947. With so much emphasis on environment pollution today do you suppose that we will get back to hand weed control in the near future?

The values of organic and inorganic nitrogen sources have been discussed pro and con throughout all the conferences. Synthetic organic nitrogen sources have been developed and are still being improved. In addition to nitrogen, the requirements for phosphorus, potassium, the minor and trace elements have been discussed at many conferences.

Cool season grasses for overseeding bermuda putting greens have long been a topic of discussion at the conference. Bentgrasses are still the most popular grasses for putting greens. Requirements for maintenance of bentgrasses through the hot, humid months in Texas have been discussed frequently since the first meeting. A survey in 1964 supported by the Texas Turfgrass Association reported that conservatively $211,000,000 was spent annually in Texas for turfgrass maintenance. On and on we could go and mention many, many things that have been discussed, but time will not permit.

The Texas Turfgrass Association has supported the research program of the Texas Agricultural Experiment Station in many ways. Visible support has been that the Association has contributed some $16,000 to turf research at Texas A&M University. Of this, annual contributions have amounted to approximately $7,000; $5,000 was contributed to A&M in 1963 to enable the Experiment Station to conduct a turfgrass survey concerning the importance of turf in Texas; $4,000 was contributed in order to permit the initiation of a full-time turfgrass research program. These monies have been invaluable in the overall research and educational program, but the encouragement of the Association and its individual members has been the spark that lit the fuse for the research that has been done by the Texas Agricultural Experiment Station. These research programs have also been stimulated by the attendance at the summer field day.

In the early days of the research program, Goldthwaite's of Texas contributed mowers, fertilizers, fungicides, and herbicides to assist the research program as requested in a resolution at the first conference. USGA has provided scholarships for graduate study in the field of turf.

At present time, we have at Texas A&M two full-time professional staff and field technician, a lab technician, two graduate students, and eight undergraduates in turfgrass management. So from this you can see that there has been definite progress made from an humble beginning of the Texas Turfgrass Association.

The first undergraduate scholarship given by the Texas Turfgrass Association was approved on December 12, 1961 for the spring semester of 1962, and this was for $100. Since that time there has been some sixteen recipients of the Texas Turfgrass Scholarship. As of December 1, 1969, the dollars expended for scholarships have been $4,800.

I would like to discuss briefly the part that Texas A&M University has played in the development of human resources as they apply to the broad field of turf. At present time, more than fifty graduates of Texas A&M are involved in turf work or closely allied areas. I have a list of most of these graduates and what they are doing today, but time will not permit me to name all of them and give you a history about each. I will mention only a few, first is Marvin Ferguson who graduated in 1940. He then went to Beltsville, Maryland, and worked under Dr. Montieth, one of the great turf men in the world, and Dr. Ferguson was employed for many years by the U.S. Golf Association. Another is Dr. Jim Watson. At the time of the first conference, Jim Watson was a senior student in agronomy at Texas A&M. I knew that Jim had an interest in turf, so I asked him to operate the tape recorder for the first conference. Of course, Jim was happy to do this. At the beginning of the spring semester of 1947, Jim was awarded a scholarship at Penn State to work on an advanced degree under the "Dean of Turf", Professor Burt Musser. Upon completion of his advanced degree at Penn State he returned to Texas A&M as a member of the faculty assigned to the area of pasture and turfgrasses. Jim did not stay at A&M very long, but was lured away from A&M by Toro Manufacturing Company, and he moved to Minneapolis, Minnesota. At the present time, Jim is director of distributor relations for Toro Manufacturing Corporation.

The first recipient of an undergraduate turf scholarship at A&M was Quinton Johnson and this scholarship was provided by Goldthwaite's of Texas and was awarded in February, 1950, in the amount of $30.00 per month. Quinton has been President of Texas Turfgrass Association and is a Greens Superintendent.

A recent graduate is Dr. Richard Duble. Dr. Duble was one of the finest golfers as a student that A&M has produced. He recently finished his advanced degree and today he is back on our campus as leader of the research and teaching program in turf.

Others I would mention briefly are Bob Frazier, Director of Parks at San Antonio; Al Lagasse, Executive Director, American Association of Landscape Architects; Ken Krenek, Parks Superintendent, Corpus Christi; Charles Campbell, Director of Parks and Recreation, City of Fort Worth; Jim Latham, Agronomist, Milwaukee Sewage Commission; James Moncrief, USGA; Ed Daniels, Executive Director North Texas Regional Planning Commission; Holman Griffin, USGA; Phil Huey, Superintendent of Parks, City of Dallas; and so goes the list.

People are the most important part of any organization, and this is true of the Texas Turfgrass Association. Some of the individuals who participated in and attended the first conference are still involved in turf in some way. In checking the names of those who were charter members of the Association and who held a membership in 1969-70, I find the names of Reggie Bowman, W. R. Bush, Albert Crain, Paul Drummet, Sonny DuBose, Charlie Gregory, Oliver Himes, Jim Jennings, Scott Russell, and Howard Goldthwaite. If I have missed anyone, we will be happy to correct the records. Many of the individuals who were on this first turf program are still active today, such as Fred Grau, Marvin Ferguson, L. B. Houston, L. G. Jones, Gordon Jones, R. D. Lewis, Ralph Plummer, Howard Sprague, and George Warner.

As I look back through the years at the leadership given this conference by its past presidents along with many other individuals I am indeed grateful that I have had the opportunity, particularly in the early conferences to work closely with such men as Frank and Howard Goldthwaite, L. B. Houston, Howard Sprague, Sonny DuBose, Al Crain, Gordon Jones, O. J. Noer, and Tom Mascaro. It is not generally known, but Tom Mascaro of West Point Products Company, now Hahn and West Point, recorded and published several of the proceedings of the conference at no cost to the Association.

Professionally, the man that made as great a contribution as any one individual to the programs of the conference was Dr. O. J. Noer. In 1958, a few of O.J.'s friends met without his knowledge to formulate plans whereby he would be honored beyond his lifetime. The result was the O. J. Noer Research Foundation, Incorporated. I have a copy of a letter dated November 16, 1970 to the Director of the Texas Agricultural Experiment Station which states:

> "I am enclosing a check payable to the Director of the Texas Agricultural Experiment Station in the amount of $4,000."

This check comes from D. E. Champion, President of the O. J. Noer Research Foundation. It is my understanding that we will hear more about this at the banquet on Tuesday evening.

It has been my observation that members of the Texas Turfgrass Association as individuals has been a most unselfish group. Each individual member has shared both successes and failures at the annual conferences. There have been no professional secrets withheld by anyone. There has developed among the membership a sense of pride in the annual conference. The membership, since the beginning of the Association, has supported in every way possible Texas A&M's College of Agriculture and its turf program. You have been an inspiration to all of us involved in the program at A&M. It has truly been a symbiotic relationship between the Texas Turfgrass Association and your Land-Grant University. It is my hope and prayer that the efforts of both organizations will continue to be mutually beneficial and will grow geometrically in the years ahead.

INDUSTRY IS AT THE CROSSROADS OF PESTICIDE DEVELOPMENT

David L. Watson
Velsicol Chemical Corporation
Chicago, Illinois

I would like to take a moment to extend my appreciation for the opportunity to participate on the program of the Texas Turfgrass Association Education Conference.

I remember back to the early days when I first entered the "agrichemical" business, of the many happy days I spent in Texas, relative to the development of insecticides and fungicides to combat the many problems which existed in those days and which must still be controlled. Much of that time was spent in the State of Texas and working with the competent staff personnel of the Entomology and Plant Pathology departments here at Texas A&M.

An address on the subject "Industry is at the Crossroads of Pesticide Development" is most timely. You are all well aware of the many "non-factual" accustions relative to DDT which led to the wrong decision to ban it, with few exclusions, in this county. The words and terminology cannot be coined more suitably than they were by Dr. Francis A. Gunther of the University of California in his article in the January issue of FARM CHEMICALS entitled "Too Soon on DDT?" -- DDT was "killed" in a witch-hunt; its defense was culpably inefficient or blatantly ignored. Truly, it never had a chance; the action was premature here as it has been in other countries.

I refer you to the specific occurrence where DDT was banned in Sweden by a government ruling and later taken off the banned list when no insecticide was available as a suitable replacement for mosquito control. The officials, although late, finally recognized the need and took action so that the Swedish populace would not be subjected to disease reoccurrence, which is inevitable if the mosquito vector is not controlled. They openly admitted the shortcomings of their decision. On their part this was admirable. Unfortunately, the political pressures and instability in our own society will not allow for such reconsiderations.

The world, in general, is and will continue to pay copiously in the form of sickness, hunger and starvation for the hasty decisions regarding this insecticide. Yet a Nobel Prize was granted to Dr. Paul Mueller in 1948 for his work on DDT. Our country as well as other well-developed countries will have to bear the cross because our influence essentially will make DDT and other important insecticides unavailable in countries where the need is desperate. Never in the history of insecticides has there been a compound for which so much time, money and effort has been expended to determine its effects on the world's ecosystems, including man himself. The tools and the facts were and still are at hand, and if properly analyzed and judicially administered, would determine the uses which have minimal adverse effects on the environment. Unfortunately, the facts have been "blatently ignored." It is also unfortunate that we now recognize the fact that it is time for reason and not emotion.

Based on research of recent years, it is evident that the value of the biologically active materials such as Thuricide, Juvenile Hormones, Ecdysones, Chemosterilants, Pheremones, etc., as satisfactory substitutes for pesticides either in part or in total is not completely understood. The fact remains, however, that they are all chemicals, and as such require all of the necessary research and development in accordance with USDA and FDA guidelines for pesticide registration. It becomes evident, therefore, that we can expect no relief relative to cost or increased performance from this type of compound. The possibility, however, of combinations of these materials with pesticides is being and should be investigated further. The integrated control programs where beneficial insects are used in conjunction with pesticides is showing promise, especially in deciduous fruit in the northwestern, mid-western, and eastern states. The use of milky disease powder in combination with insecticides relative to the Japanese beetle control is classical. The test of time, however, has shown that the organic pesticides are required and that biological control agents alone do not produce the desired and lasting protection.

I am sure that you are all wondering how all of this relates to the Texas Turfgrass Association. Well, whether you like it or not, you are directly involved. It directly involves you because regardless of what phase of the turfgrass industry you are in, the increased cost of pesticides will change the economics relative to your industry. If more of the reliable pesticides are banned or severely restricted, new ones must take their place, and they will be more expensive. The estimated average costs of producing a commercial pesticide, based on a 1969 survey of industry, is approximately $1 million per year. If it takes 10 years to develop a pesticide to the point of sales, the average cost is $10 million. The costs have increased almost astronomically over the past 10 to 15 years. For instance, development costs increased 245 percent from 1956 to 1964 and 340 percent from 1956 to 1969. In 1956, one out of 1,800; in 1964, one out of 3,600; and in 1969, one out of 5,040 compounds became commercial pesticides.

All areas of the agricultural and related fields, including the turfgrass industry, will be influenced by the recent legislation and regulatory requirements relative to registration of an insecticide, or for that matter, any pesticide to be sold for interstate commerce. Requirements are more stringent than for a drug for human consumption, and it is a matter of record that the cost of developing an insecticide is four times more expensive than that of a drug for human medication. The legislative control of pesticides has been paramount, as dictated by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) of 1947 and the 1959 Amendment and the 1954 Miller Amendment to the Federal Food, Drug and Cosmetic Act of 1938.

The individual states also have their own rules and regulations as indicated by the stand recently taken by New York, Michigan, Maryland, California and others. The most recent regulating agency is the Environmental Protection agency (E.P.A) to be headed up by Mr. William Ruckelshaus, former Assistant Attorney General and Chief of the Civil Division of the Department of Justice.

The number of pesticide advisory committee and public hearings pending under the Food and Drug Act and FIFRA is mounting geometrically. There are almost 200 petitions pending at the F.D.A today. Formal procedures are clogging the administrative channels, and it is difficult to have an application for label registration considered in the normal course of events. The new agency will be responsible for the USDA and FDA functions relative to pesticides, which cannot help but slow down petition and label action in the immediate future. Will EPA regulate without excessive regard for public opinion? Such a possibility seems remote, and most likely will only come about when it is decided to balance the benefit-risk equation relative to pesticide use. Such will occur only when undue hardship and suffering occurs to those most responsible for regulating action at the government level. Regulations can ruin a product as it did in 1959 during the cranberry incident, which many of you remember.

This industry must and is taking a long, cold hard look at the added expense these new agencies will incur to get a new pesticide registered. We are looking at the profitability aspect of pesticides versus other areas of opportunity that will yield a more rapid return on investment at equal or higher profits. Many companies, including Velsicol, have cut back basic research designed for synthesizing new and better pesticides. The result of such action is quite obvious -- increased prices for pesticides in agriculture, as well as in the turfgrass industry. The lack of competition in pesticide research will yield inferior and more expensive products. If industry and our allies at the State and Federal levels cannot head off what appears to be an outright attempt on the part of certain legislators to abolish pesticides, we will be forced out of an essential business.

Yes, industry truly has arrived at the crossroads of pesticide development. A frequent question in the board rooms of many prominent companies basic in the manufacture and sale of pesticides is whether or not to continue in the business. If we do not contine, the writing is on the wall. It will lead to government participation and subsidies which have never been successful in the past and will not be in the future in our free enterprise system. The door will be left wide open for international companies to basically control the pesticide industry in the U. S. A.

We will always have pesticides because we cannot exist without them. Our concern is quality, cost and availability. Without pesticides, food production would fall about 25 to 30 percent, and current acreage for agricultural production would have to be increased by at least half. Food costs would rise about 50 to 100 percent. While food now costs about 16.5 percent of our income, it would cost, without pesticides, about 30 percent of our income. Few estimates have been made relative to what the health situation would be without pesticides in our country. One should stop and seriously consider if we want to again be subjected to the scourge of malaria, encephalitis and yellow fever, to only mention a few. If essential pesticides are restricted or banned only in part, then replacements must be found in groups of compounds that do not have the problems for which DDT was banned, i.e., persistence, resistance, effect on the environment (soil, water, plants, fish, birds, plankton, algae, crustacea, mollusks, animal wildlife, etc.). This, of course, is a monumental task and again, one must consider the cost factor, since we may be worse off than we were with the original materials.

Therefore, it is mandatory that each pesticide be evaluated on its own merits or demerits and not according to classes of compounds. As previously mentioned, we know a great deal about DDT, as we do about many other compounds in the group commonly called chlorinated hydrocarbons. If replacements are to be found outside of this group, then they must be selected from the carbamates or phosphates. Although each class of compounds has a basic similarity, each product is accepted in the field because of its individual merits. Therefore, each product should be evaluated on the merits of the individual product and its usage, not simply on a class basis. Industry looks for an easing of restrictions of its products with the formation of the new super agency, E.P.A. It now appears we have learned to use the legal tools within FIFRA to effectively fight the banning of our products. Industry has learned the lesson of DDT well.

DDT "ban-advocates" have dismissed worldwide health and agricultural needs by supposing and saying that "money-hungry industry will always produce more pesticides than can be used, so it is all right to ban many of those we now have." The plain fact is that the pesticide well is running dry. This fact is easily ascertained, as I am sure you have noted, by the reduction in number of new insecticides that are available for trial at university experiment stations.

The same old pollution controversy continues even though we know factually that pesticides are a very small segment of the larger problem of pollution from all sources. We must encourage the "ban-advocates" to look at the pollution problem in proper perspective. Pollution and its correction involve many factors -- basic technology, economic considerations and adjustments in social behavior. Many segments of the environment are better today than they were 40 years ago; for example, the anadromous fishery is returning to the Thomas River in England, and on our own coast, the striped bass are returning to the Chesapeake Bay in record numbers to spawn. The great Lakes are yielding more fish today than heretofore in history. Much of this can be directly attributed to the proper and judicial use of chemicals such as TFM (3-trifluoromethyl 4-nitrophenol), which has successfully brought the killer lamprey under control. If this had not been done, the trout and white fish populations of our Great Lakes would have been reduced to the point of extinction. The oceans are virtually uncontaminated in the practical sense, even though it has been mis-stated that DDT through effects on marine plankton would deplete the human oxygen supply. Data is available which indicates that 1 ppb has no effect on four different species of marine phytoplankton. Levels of DDT and its metabolites are reported to be only 1 ppt or less in the oceans and are not expected to rise above this figure even if regulated uses continue. Thus, the alarm has been sounded about a residue one thousand times less than the no-effect level.

The same rationale can be used relative to the 2,4,5-T controversy. It has centered around the possibility of causing miscarriages and malformation of the fetus in pregnant women. If we relate this back to the test results on mice, a 130-pound pregnant woman would have to eat almost 147,000 pounds of contaminated rice per day to receive a dose equivalent to that administered to the test mice. Relating this to animals, a 1,200-pound cow would have to eat 4,500 pounds of grass per day containing 30 ppm of 2,4,5-T to receive the equivalent mouse dosage.

It is difficult for people to appreciate the magnitude of residue levels we are talking about when we say 1 ppm, 1 ppb or 1 ppt. Let us relate this to something practical -- 1 ounce of vermouth in an 8,000-gallon tank car of gin is 1 ppm and a mighty dry martini. If added to 1,000 railroad tank cars of gin, the 1 ounce of vermouth becomes 1 ppb. So look at it in a different perspective -- a part per billion is like 1 cornstalk in 50,000 acres of corn.

Much has been said about contamination of soil, but the fact remains that it is producing more now than before; and regardless of what has been said about pesticides and wildlife, it is a fact that there is more game today than there was 300 years ago. Chemical producers are not for a minute advocating that everything relative to pesticides is right or that there are no problems, but we are saying the problems that do exist can be solved.

Because of emotion, precipitated mainly by political endeavors through distortion of the facts, the development of new pesticides has truly arrived at the crossroads. The picture will not be clear until the pesticide controversy is put in proper perspective and we, as citizens, live up to our basic responsibilities of dealing with facts, not emotion. Let us help others come to the realization that pesticides are essential for our well-being and that we cannot exist without them. The free enterprise process must continue to exist and prosper in the pesticide industry. An industry subsidized by the government is not the answer. Let's work together in the preservation of this important industry to see that pesticides are judicially recommended, properly utilized, and that they continue to play their necessary role in our society.

HERBICIDES -- PAST, PRESENT AND FUTURE

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The early history of chemical weed control is obscure, but inorganic compounds such as ashes and common salt were probably first used in early biblical times. Lime and sodium chloride were recommended for weed control in Germany in 1840. H. L. Bolley at the North Dakota Experiment Station in 1896 aided in the development of selective weed control in crops by using copper sulfate, ion sulfate, sodium chloride, sodium arsenite and corrosive sublimates. Among inorganic compounds used for weed control since 1900 are ammonium sulfamate, inorganic borate, sulfuric acid, sodium chlorate, and others.

Although oils have been used for many years for weed control, the use of 3,5-dinitro-o-cresol in 1932 was really the beginning of the development of organic herbicides. However, the synthesis and field testing of (2,4-dichlorophenoxy) acetic acid (2,4-D) in the early 1940's, as a systemic plant growth substance, had the greatest impact on weed control. It served as a stimulus to private, governmental and industrial agencies for the production and development of the phenoxy herbicides and other herbicides.

Most herbicides in use today have been developed in the last 15 to 20 years. Thousands of organic compounds tested have resulted in the acceptance of approximately 150 herbicides. On the basis of sales in the United States at the manufacturing level, these are the herbicides most commonly used: atrazine, trifluralin, amiben and related products, 2,4-D, 2,4,5-T, nitralin, propachlor, CDAA and related products, picloram, paraquat and dicamba.

Briefly, the development of a new herbicide consists of determining the market potential; selection of promising phytotoxic materials from several hundred compounds; determination of toxicity and deformative effects to plants and animals; as well as formulation studies, patent applications, field testing, and residue sampling. If a particular compound is very promising, advanced field testing and toxicity studies are undertaken in order to obtain more information for registration with the USDA (now Environmental Protection Agency/EPA/). Its effectiveness and safety features are determined. If the chemical is registered, a petition for FDA residue tolerances is submitted. The manufacturer then decides on manufacturing, packaging, labeling, price setting, and marketing procedures based on information obtained.

Each step in the development and registration of new herbicides has become more difficult because of the voluminous data required for proof of safe use in the ecosystem. Developlent costs have increased. In 1960, development costs of each herbicide was about $1 million; today costs may range from $3 million to $5 million or mor per chemical.

We must be concerned more than ever not only to the effectiveness of the herbicide, but also to its total effect on the environment, including soil micro-organisms, fish, birds, livestock, plant life and humans. We must be aware of possible metabolites or interactions with other applied or natural chemicals or an herbicide that might result in toxic by-products to desirable plants and animals. To my knowledge, no such toxic by-products occur with presently used herbicides.

Early weed control specialists who used arsenites, chlorates, borates, and oils were interested in materials that sometimes had long residual properties to give effective weed control for long periods of time.

DDT is a good example of a compound with long residual life that affords effective control of insects for extended periods. However, it was soon realized that DDT may persist in foodstuffs to which it was applied and remain as a residue to be consumed in small amounts by livestock and man. Other insecticides were converted in soil, animal and plant tissue to metabolic products more toxic to mammals than the parent compound. This development in the early 1950's resulted in the necessity of residue analysis of the parent compound and metabolic products that occurred in the natural environment after application.

Due to the rapid disappearance in plants and soils and low toxicity of most herbicides to mammals, herbicide residues are usually not a problem in foods and feeds. However, soil residues of certain herbicides can occur if not used properly to injure sensitive crops grown the year following application.

The persistence of 2,4-D (the most commonly used herbicide) is relatively short in soils, vegetation and water sources. Much decomposition of 2,4-D in soil is affected by micro-organisms. Under warm, moist conditions, breakdown in the soil is rapid (1 to 4 weeks after 1/2 to 3 pounds per acre). Accumulation of 2,4-D in the soil from one year to the next is unlikely.

The phenoxy herbicides (2,4-D) are useful because of their selectivity, phytotoxicity to a wide range of weeds, their ability to be translocated within plants, relatively low mammalian toxicity and short residual life. Disadvantages of 2,4-D and related compounds is that many broadleaf weeds pecies are resistant, many broadleaf crops are susceptible (cotton), and degradation may be too rapid for effective control of some perennial species.

One reason 4-amino-3,5,6-trichloropicolinic acid (picloram) may be more effective on some perennial weeds and brush than 2,4-D and 2,4,5-T is the longer residual characteristics of picloram.

Present research deals with the development of new herbicides to improve weed control potential and minimize crop injury. Research is also conducted to make presently used herbicides more effective. Improved formulations, carriers, surfactants and herbicide mixtures are studied. Proper timing of application with the appropriate rate per acre has to be determined.

Improved application techniques and equipment to produce uniform sized spray droplets resistant to evaporation and drift are under investigation.

Herbicides were developed to control noxious weeds to make agricultural production easier, more productive, less expensive and possible in many areas of the world. Mechanical and chemical methods may be combined for best results. However, mechanical cultivation may not be possible on steep, rocky terrain or large acreages where speed of application is essential. Herbicides make possible reduction of hand labor and cultivation practices and enables each grower to more effectively care for large acreages.

It has been estimated that prohibiting the use of all phenoxy herbicides (mainly 2,4-D and 2,4,5-T) presently used on 62 million acres of cropland, would cause immediate additional costs of maintaining production of $290 million to U. S. Farmers. Costs include: (a) extra labor needs; (b) substitute herbicides; (c) added cultural practices and (d) loss of crop quality. In addition, farmers would contribute an additional 20 million hours of labor without reimbursement.

Annual loss to U. S. agriculture from weeds and cost to control them is over $5 billion. The use of herbicides is an established tool on industrial sites, military bases, road and powerline rights-of-way, farms, and ranches. There is no evidence to indicate herbicides are harmful to the public, if used as recommended.

The discovery of new herbicides will and must continue. However, the herbicide technology of the future should be more broadly based to emphasize mode of action, selectivity, fate, improved formulations, and application equipment.

More emphasis is needed on biological processes and effects on organisms in the treated areas as affected by initial application and resulting residues. More research is needed on the nature and resistance of plants to herbicides and detoxification mechanisms involved.

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GENERAL SESSION

ROLE OF ORGANIC MATTER IN

SOIL, AIR AND MOISTURE RELATIONSHIPS

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A discussion of organic matter is really a discussion of soil because of the integral role of organic matter. Soil properties influence the kind and quality of turfgrass in a number of ways. First, there are certain basic requirements which the soil must provide for satisfactory turfgrass growth. Among these are: support, water, air (especially oxygen), temperature and nutrients. Secondly, on playing fields and other heavily trafficked areas the soil must provide "footing". It must support the play action to which the turf facility is subjected and; further, it must provide the resilience needed to "hold" a golf short, to cushion the legs and bodies of players against jarring when running at full speed, or when falling as a result of bodily contact. The ability of a given soil or of a given turfgrass facility to meet these requirements is a function of the physical, chemical, and biological properties of the soil.

Any soil or soil mixture, whether it is a true natural soil or whether it is a man-made mix functioning as a medium for plant growth possess chemical, physical and biological properties. And, although it is possible to separate the independent and direct effects of each of these major groups of soil properties there are; nevertheless, marked inter-relationships between the three groups. The physical phenomenon have important effects on the chemical and biological properties and processes which, in turn, influence plant growth. Likewise, biological properties play a vital role in promoting favorable environment through their affect on the physical and chemical conditions or factors. And, the chemical properties influence (and, in turn are influenced by) both the physical and biological properties and processes. Thus, it is apparent that modification of any physical, chemical, or biological soil property will affect directly or indirectly all other soil properties which, in turn, will influence plant growth.

These basic considerations must be kept in mind as we discuss, "THE ROLE OF ORGANIC MATTER IN SOIL, AIR, AND MOISTURE RELATIONSHIPS". For, although organic matter in its most restricted definition (raw, undecomposed state) has direct influence only upon the biological properties, as it passes through various phases of decomposition, it has direct impact on physical soil properties, and the end product of its decay - humus - has important bearing on the soil chemical properties.

Organic Matter

The original source of soil organic matter is plant and animal tissue. By far the largest contribution comes from plants with the contribution from animal tissue being so small as to be almost insignificant. Under turfgrass conditions, two very distinct situations must be recognized. These are:

1. Organic matter that develops (grows) in place - consists of the residue of the leaves, stems, and roots of the grass plants -- and it occurs in various stages of decomposition.

2. Organic matter (again in various stages of decomposition) added as a soil conditioner or amendment to sites under construction or to established turfgrass areas as a component of topdressing.

Irrespective of the source, the effect of the organic matter component on the soil is essentially the same--once it becomes incorporated into the soil; or, as in the case of the late stages of decomposition, an integral part of the soil. It is this situation that will be discussed rather than a "thatch condition" -- the situation resulting from accumulations at or near the surface of established turfgrass areas. Likewise, no distinction will be made with regard to kind of organic matter--other than to enumerate some of the more common sources.

Benefits

Benefits or desirable improvements resulting from the use of peat (a static and readily available source of organic matter) have been listed by Lucas, et al as:

1. Increases the moisture-holding capacity of sandy soils.

2. Increases the rate of water infiltration of fine-textured soils.

3. Makes soil more friable and better aerated.

4. Decreases soil volume weight and thereby eases root penetration.

5. Increases the buffering effect of the soil which makes acidity and soluble salt levels more difficult to change.

6. Increases microbial activity in the soil which may help produce desirable plant growth regulators and antibiotic substances.

7. Serves as a source of slow-releasing form of nitrogen fertilizer.

8. Makes certain elements, such as iron and phosphorus, more available to plants.

Examples of organic materials useful as a source of organic matter for turfgrass areas are: peat, sawdust, cocoa hulls, gin trash, bagasse, ricehulls, sewerage slude, manures and compost. Leaves, grass clippings, straw and other similar materials may be used in the compost; as, of course, may any other material mentioned. Local availability is frequently the determining factor in the choice of an organic amendment. However, choice should always be based on an understanding of the characteristics and behavior of the material.

Organic additives may be classified on the basis of rate of decomposition as dynamic and static forms. Static types, like peat and sawdust require a much longer time to decompose than the dynamic types like manure, spent mushroom soil and compost.

Sawdust and peat are two of the more widely used organic additives for turfgrass soils. Both are satisfactory materials when used in accordance with their known properties. For example, unique properties one should remember about:

Sawdust. Among others, Burton and Associates at Tifton, Georgia, and Waddington and Associates at Massachusetts have shown the value limitations of sawdust. The desirability of using material that has undergone partial decomposition is generally recognized. Sawdust from hardwoods decomposes more rapidly than that of softwoods, thus nitrogen tie-up; and, therefore, need for supplemental nitrogen to reduce the carbon-nitrogen ratio is greater with hardwood sawdust.

Waddington reported germination and seedling growth were suppressed by some fresh sawdust materials. Ash and red oak sawdust produced the more severe toxic effects. Abnormal seedlings and stunted roots occurred when extracts from these were used. Nitrogen added to the mix did not overcome these deleterious affects. Merion bluegrass was more susceptible than Pennlawn fescue, Highland and Seaside bentgrasses. These adverse effects were not apparent in sawdust weathered for two (2) to seven (7) months. When fresh sawdust must be used, Waddington suggests mixing with soil, potting, seeding and comparing germination with seed planted alone.

Peat. Peat is probably the most widely available of all organic materials. It is an easily obtainable, usually uniform source of stable organic matter. Frequently there is confusion with regard to peat terminology and classification. Problems associated with peat use may be avoided if the characteristics of the various kinds of peat are known.

Peat is the plant remains that have accumulated and undergone partial or incomplete decomposition in water or excessively wet areas such as swamps and bogs.

Among the more important differences in physical and chemical properties are botanical composition, water-holding capacity, stage of decomposition, organic matter content, nitrogen content and chemical reaction (pH). Peat is brown, reddish-brown or black, depending on its state of decomposition and moisture. It may be fibrous or non-fibrous, depending on its botanical composition and its state of decomposition. Criteria for purchasing peat are generally available and should be taken into account when they are purchased. See table.

RANGE IN ANALYSES OF COMMON HORTICULTURAL PEATS

Type of Peat	pH	Water absorbing capacity* percent	Volume weights lb/cu. ft.	Nitrogen* percent
Sphagnum Moss	3.0-4.0	1500-3000	4.5- 7.0	0.6-1.4
Hypnum Moss	5.0-7.0	1200-1800	5.0-10.0	2.0-3.5
Reed-Sedge (Low Lime)	4.0-5.0	500-1200	10.0-15.0	1.5-3.5
Reed-Sedge (High Lime)	5.1-7.5	400-1200	10.0-18.0	2.0-3.5
Peat Humus (Decomposed)	5.0-7.5	150- 500	20.0-40.0	2.0-3.5

(After Lucas et al)

* Oven-dry basis

Again, any source of organic matter may be used to advantage providing its properties and state of decomposition are known. In general, materials with 10-20 to 1 carbon-nitrogen ratio will perform satisfactorily either as amendments or for inclusion in top-dressing. Materials with wide carbon-nitrogen ratios should be composted prior to use; or, if their use is necessary, add extra quantities of nitrogen to speed the rate of decomposition.

Organic matter comprises only a small percentage of the total volume of most natural soils, but it plays a significant and vital role. The amount of organic matter in a natural soil is controlled by the prevailing temperature and moisture relationships. These factors, along with nutrient supply, control biological activity; hence, the amount of organic matter. Organic matter in soil serves as a constant source of plant food, especially nitrogen and sulphur; it serves as food (energy) for micro-organisms and it improves soil structure; thereby, promoting desirable air moisture relationships.

Excessive amounts of organic matter may create rather serious problems, especially on intensively managed areas such as golf greens. Most recommendations today call for only seven to ten percent by volume of peat or equivalent organic matter when soil is being modified for construction.

The most significant role of soil organic matter is that related to improvement and maintenance of stable soil structure. And, for this reason, it has important impact on the air-moisture relationships. The capacity of the soil to hold water and air, the proportion of each and the movement of water into and through a soil are primarily functions of soil structure. Structure is a soil term which refers to the arrangement or grouping of the individual particles into units. A structural unit may be defined as a group or groups of particles bound together in such a manner that they exhibit different physical properties from a corresponding mass of the individual particles. Such a structural unit is called an aggregate. Terms used to describe various types of structure are granular, crumb, platy, and blocky. In general, the granular and crumb structure is most desirable from the standpoint of plant growth. Platy structure is generally associated with slowly permeable soils derived from shales. Soils in which structure has been destroyed--partially or completely--are said to be dense and compacted. They have reduced air space.

The structural aggregation of soil is greatly influenced by the amount of colloidal organic matter present. The end product of decay of organic matter--humus--is an integral part of soil aggregates and is sometimes referred to as the cementing or binding agent in aggregates. Stability of aggregates is directly dependent upon the amount of organic matter and the degree of biological activity obtaining stability; also, a function of traffic, especially when soil is wet and poor turf cover exists. The structural aggregation of soil determines, to a large extent, the porosity, permeability and water capacity of soils.

Porosity can 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 particles 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 small pores which are responsible for a low water-holding capacity and rapid drainage.

Another term associated with porosity (and other soil physical properties) is texture--the size of individual soil particles. Sand, silt and clay are the basic textural terms. Texture is a most important characteristic of soil because it describes, in part, the physical qualities of soils with respect to porosity, coarseness or fineness of soil, soil aeration, speed of water movement in the soil, moisture storage capacity and, in general, the inherent fertility of the soil. For example, sandy soils are often loose, porous, draughty, and low in fertility but well aerated. Clays, on the other hand, may be hard when dry or plastic when wet, poorly aerated, but possibly high in fertility.

Thus, the addition of organic matter to either the sand or the clay has beneficial effects on the air-moisture relationships. In the case of the clay primarily because of its impact on structural porosity. However, in the case of sandy soil or of sand used as the primary ingredient in a mix for specialized turfgrass areas, the addition of organic matter is necessary. And, although it will not necessarily become an integral part of the "soil" for quite some time, it will nevertheless, serve to improve water-holding capacity and to help counteract the effect of compaction; thus, help to maintain satisfactory air relationships.

SOURCES AND USES OF SOIL MODIFIERS IN TURF

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The popular term for a soil modifier is a soil amendment and I feel either term is adequately descriptive. An amendment is something which is added to anything to modify it. A soil is any substance or medium in which something can take root and grow. Since few natural soils are suitable for good turf growth when subjected to compaction, we use amendments to make them more acceptable.

The sources of soil modifiers are limited only by the imagination and may be either natural or manufactured. Some of the basic catagories of soil modifiers are, other soils, organic materials, plastics, ion exchange resins, and rubber. The types of organic modifiers alone would fill a small book and hydroponic farms are evidence of the fact that plants can be grown with a minimum of soil solids.

Turf managers have long sought methods of evaluating soil materials for use in growing turf under special conditions. Either a practically priced "mail order" mix or a formula for making suitable soils from the materials available to them would be acceptable. Modern technology has offered some of both. Individuals may have their component materials analyzed by special laboratories and mix their own or they may purchase mixed soils which have been properly analyzed from several relatively new companies.

Soils may be modified for a number of reasons with some of the most basic being to provide the right kind and amount of pore space for the retention and movement of air and water, to reduce compaction tendencies, to give resiliency and to improve the capacity for storing and exchanging nutrients. A good soil amendment may do all these things or a specific amendment may be selected for a single purpose.

A few years ago, many turf managers were concerned about the trend toward too much sand in greens. As a result of experimentation at Purdue University, pure sand of a selected particle size has been shown satisfactory for good turf production and when modified in the top few inches, will produce a satisfactory golf green, tee, football field, bowling green or other sports turf area. Of course this isn't quite as simple as I have made it sound and you should know all the details before you attempt to use this method.

Pure sand with a particle size range of 0.2 mm to 1.0 mm resists compaction and will provide adequate pore space for water and air movement. Pore size is considered to be one-third of the diameter of the solid particles in a uniform mix, therefore a uniform material with the particle size just described would have many pores ranging from .06 mm up to .3 mm.

Most authorities seem to agree that a soil which contains a minimum of 12 to 18 percent non-capillary or air-filled pore space will support good turf growth. The previously described mixture meets those requirements but needs some means of moisture retention to be managed easily. Moisture retention in the proper amount as well as nutrient storage and exchange capacity can be added with soil amendments.

A clay soil or a silty soil on the other hand will never have enough pore space of the right size to work well in a golf green but has a terrific capacity for moisture retention and nutrient storage. A heavy clay soil is penetrated by air and water only with great difficulty and once admitted, these elements along with the transported nutrients may be held so tenaciously as to be unavailable to the turf.

The ideal solution to our problems would seem to be to mix the two materials just described but clay, silt and fine sand only tend to clog up the pore space in a good mix and they are unnecessary.

In this age of modern technology, we have to leave behind the old wives' tale about a black soil being the most productive. This is especially true of heavily trafficked turf areas. My thinking is that no silt, clay, or fine sand, commonly referred to as "soil" is needed in a turf bed at all. It is added simply because heretofore we have thought it necessary and because we had no other amendment as readily available or as cheap.

The best time to incorporate soil modifiers into a soil is during construction when all materials may be mixed uniformly; however, soil modifiers may be introduced into a turf bed at any time with good results. On a golf green, these materials are placed in holes made by aeration machines or other hole-punching tools such as a soil probe. Soil modification to the working depth of most aerifiers, which is some 3 or 4 inches, can certainly help but the modification is more effective if it is accomplished to a depth of 12 to 16 inches or at least deep enough to penetrate into the drainage system if one exists.

Although some soil amendments alone may support turf growth we should keep in mind the fact that most amendments are just that and not complete soils in themselves. For this reason, only soils modified with amendments and not straight amendments should be incorporated into holes made in an established turf bed.

If the material introduced into holes in a green is not capable of supporting good turf growth by itself then we are simply filling holes with a different material which may be almost as undesirable as the original. Although some immediate improvement may occur in the turf when aeration holes are filled with pure amendment, continued modification will cause a different set of problems and the immediate benefits will be short lived.

We all know the problems associated with soil layering, and vertical layering is exactly what we are doing when we introduce pure soil amendments into aerifier holes. Layering also occurs when a modified soil is introduced but to a lesser extent. Also, with repeated hole-punching-hole filling operations using properly modified soils rather than pure amendments, the long range picture gives us more assurance of lasting success.

Taking into consideration the maintenance level to be employed and an accurate estimate of use, a turf bed can be constructed by using modern laboratory analysis as a basis for mixing materials. This bed should never have to be rebuilt because of soil failure and will require a minimum of subsequent mechanical aeration. Essentially, these are stabilized soils which can only be compacted so far and no further under normal use and maintenance.

For conservative turf managers who are more interested in facts and sound investments than they are in risking their employer's money and their own reputation just so they can claim to be soil experts in their own right, the days of "by guess and by golly" are almost over. I say "almost over" because there is still a tremendous amount of misinformationand a gapping lack of any information at all on <u>what</u> is wanted in a soil mix as well as <u>where</u> and <u>how</u> the necessary analysis should be made.

We now have a considerable amount of information on soil physical analysis and a good technician can measure the physical properties of soil materials and positively determine the proportions needed for an acceptable putting green soil. This is a monumental achievement which was not accomplished overnight and will be of lasting value but it is only a good point from which to start further investigations into the nature and properties of soils for turf.

S O D   C E R T I F I C A T I O N

A N D   P R O D U C T I O N

P A N E L   D I S C U S S I O N S

SOD CERTIFICATION PROGRAM

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The purpose of sod certification is to maintain and make available to the public, sources of high-quality propagating materials of superior varieties so grown and distributed as to insure genetic identity. Only those varieties that contain superior germ plasm are eligible for certification in Texas. Certified propagating material should be high in varietal purity and of good sodding value.

Before a variety is considered to be eligible for certification, it must first be approved by the State Seed and Plant Board. The purposes of this Board are to approve varieties for certification, set up standards for the kind or variety of propagating material and/or seed, and approve the Texas Department of Agriculture certification inspectors. The Board consists of Grady C. Clark, Jr., Chairman, Eastern Seed Company; Heino (Bill) Staffel, Jr., Secretary, Texas Department of Agriculture; Dr. Harold E. Dregne, Department of Agronomy, Texas Tech University; Dr. Morris E. Bloodworth, Head of Soil & Crop Sciences, Texas A&M University; Douglas Conlee, Conlee Seed Company, Incorporated, Waco, Texas; and Wilmer Smith, Route 1, Box 46, Wilson, Texas.

The Commissioner of Agriculture is charged with the duties of prescribing rules and regulations relative to the enforcement of seed and turf certification, the appointment of inspectors, collection of fees, issuance of tags, and actual enforcement of the law and regulations promulgated by the Plant Board.

Sod certification is a voluntary program in Texas whereby the applicant applies to the Texas Department of Agriculture for inspection of his production.

Under the Sod Certification Program in Texas, we recognize two classes of stocks, foundation and certified.

A. Foundation stock must be produced by or under the direct supervision of the Texas Agricultural Experiment Station, or be from stock approved by the State Seed and Plant Board tracing back to acceptable sources. Foundation stock shall be the initial transplants from breeder vegetative propagating material.

B. Certified stock must be the initial transplant from foundation stock. A grower of the certified class of stock may increase his acreage from his own production, provided he has complete control of the stock at all times, and it is planted on his own farm.

Fields established from foundation production may continue to produce certified stock after the first year, providing that application for certification is made each year, and the stock is produced in conformity with the certification standards.

A field to be eligible for the production of foundation stock must have been inspected by a representative of the Texas Department of Agriculture for two consecutive years preceeding the year it is to be planted, and it must have been found free of all other perennial grasses and objectionable weeds.

A field to be eligible for production of the certified class of stock must be inspected by a representative of the Texas Department of Agriculture during the growing season. At least two inspections approximately six weeks apart must be made. The field must be found free of all other perennial grasses and objectionable weeds. The second inspection must be made within fifteen days of planting. During the interval between the two inspections, the soil must not be mechanically disturbed or chemically treated.

A field to be eligible for production of foundation or certified class stock may be thoroughly treated with a recommended soil fumigant and left undisturbed for four weeks, at which time an official inspection must be made to determine if the land is free of perennial grasses and objectionable weeds. After fumigation, soil conditions must be favorable for seed germination and active plant growth in order to determine whether or not the soil fumigation is effective and qualifies the land for acceptance.

In addition to the annual $10 application fee, which is required only once each year, the preplanting inspection and turf inspection fees for both classes are required to be paid.

Pre-planting inspection:

$12 for any acreage up to and including the first 3 acres
$2 for each acre in excess of 3 acres

Field inspection of turf:

During production--$12 for any acreage up to and including the first 3 acres
$2 per acre in excess of 3 acres

All applications for pre-planting inspections and turf inspections must be filed with the Director of the Seed Division, Texas Department of Agriculture, P. O. Box BB, Capitol Station, Austin, Texas 78711, prior to June 1.

At least four official inspections must be made during the growing season at a time when it is possible to identify any other perennial grasses and/or objectionable weeds.

The objectionable weeds shall include, but not be limited to: Cyperus spp., Dichondra spp., and Cenchrus spp.

A field to be eligible for production of foundation or certified class stock must be isolated from any other perennial grass by a strip at least 25 feet wide. In addition to the required 25 feet of isolation, when the contaminant is Cynodon spp. producing viable seed, the production field must be isolated by a terrace or a similar barrier approved by the inspector so as to prevent washing of the seed into the production blocks. This barrier will be included in the 25-foot isolation distance.

Planting stock packed for shipment in bags or other containers must be sealed to insure viability of stolons upon delivery. Planting stock shipped bulk or sod block must be protected in a manner to prevent drying out in order to insure viability of grass upon delivery. The consumer must be given a certification tag for each load. The amount of sod or stolons must be shown on each tag for each load.

Certification tags will be available on which space will be provided for the certified producer to write the date of sod or sprig harvest, and the bushels or square area in the container or load it represents. Report forms will be available to the certified producer on which he must record the tag number, the date of harvest, and the bushels or square area the tag represents. This report must be sent to the Director of Seed Division, Texas Department of Agriculture, at least once a month.

Constant care and grower supervision must be maintained throughout harvesting, handling and packing of stock eligible under the provisions of the program so as to maintain the genetic identity and purity of it. All stock must be measured in bushels or square area when distributed, if it is to retain certification status. The standard measure of a bushel is considered to be 1 square yard, or 1-1/4 cubic feet.

In conclusion, the Sod Certification Program, like all other certification programs, cannot possibly be any better than the integrity of the producer. The Texas Department of Agriculture will work with you in any way it can to improve the quality of Texas turf.

SOD CERTIFICATION AND PRODUCTION
A SOD GROWER'S VIEWPOINT

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I have been asked to discuss my views on the new turf grass certification standards, and how they will effect the turfgrass producer.

As is usually the case, there are two ways to look at this. I feel personally that on the whole they will be a tremendous help to the Texas grass producers, but I will try to cover both sides.

First, let's talk briefly about the certification standards. They say that physically the nursery must be laid out and graded so as to prevent any flooding and carrying of objectionable seeds onto the certified plots of grass. This is covered under section two of field standards which states:

> "A field, to be eligible for the production of foundation or certified stock must be isolated from any other perennial grass by a strip at least 25 feet wide. In addition to the required 25 feet of isolation, when the contaminant is to the Cynodon species, producing viable seed, the production field must be isolated by a terrace or similar barrier, approved by the inspector, to prevent washing of the seed into the production blocks. This barrier will be included in the 25 foot isolation distance."

To install 12 acres of certified grass on my farm, I must sacrifice 172,000 square feet of land as isolation barriers. This is almost 4 acres of land which must remain unproductive. The cost of the land plus the lost production is discouraging. I think this distance could safely be reduced without effecting quality, particularly between the certified plots of grass.

The second area covers the land preparation and states:

> "A field to be eligible for the production of foundation or certified class of stock must be inspected by a representative of the Texas Department of Agriculture during the growing season. At least two inspections, approximately six weeks apart must be made. The field must be found free of all other perennial grasses and objectionable weeds. The inspection must be made within 15 days of planting. During the interval between the two inspections the soil must not be disturbed or chemically treated.

In lieu of the preceding requirements, a field to be eligible for production of certified or foundation class stock may be thoroughly treated with a recommended soil fumigant and left undisturbed for four weeks, at which time an official inspection must be made to determine if the land is free of perennial grasses and objectionable weeds. After fumigation, soil conditions must be favorable for seed germination and active plant growth in order to determine if the soil fumigation was effective and will qualify the land for acceptance."

Now that we have covered the land requirements, let's talk about planting the grass. We will discuss the certified grass only.

"Certified stock must be the initial transplants from foundation stock. A grower of the certified class of stock may increase his acreage from his own production, provided he has complete control of the stock at all times and it is planted on his own farm.

After the grass is planted and growing, at least four official inspections must be made during the growing season, at a time when it is possible to identify any other perennial grasses, and/or strains or objectionable weeds. There shall be no more than one clump, 6" in diameter, per 450 square feet."

I don't think there should be an allowable for other perennial grasses. If you start with clean land and plant foundation stock, there should be no foreign perennials and/or strains in the nursery. If foreign strains develop or other perennial grasses come in, these can be eliminated with varsol, dow-pon, or some other non-selective herbicide. Six square inches in 450 square feet does not sound like much, in fact it works out to about 5/100 of one percent. To the sod buyer it probably would not be objectionable. But this 6 square inches of foreign grass shredded and mixed into 20 or 30 bushels of sprigs can make a great deal of difference on a golf green.

We have looked rather briefly at these standards, now let's discuss the effects they will have on the turfgrass industry.

First, the initial cost of planting certified grass is going to be much higher. To prepare the land by cultivation requires several years and considerable expenditure in labor and machinery.

To prepare the soil by fumigation is quicker, but I feel it is a little less sure because of the many factors involved. Also, it requires a larger initial capital outlay. Then there is the inspection fees, and the cost of the planting stock.

After the grass is planted and in the nurseries, the higher cost is not going to end. There will be annual inspection fees and the maintenance of clean grass. There will be four field inspections made each year. These things will mean higher prices for the consumer.

To sum up the negative effects of the certification program, I would say - higher cost to the consumer and producer, as well as more work for the producer.

Okay, we have covered the bad side, now let's look at some of the good things the program will bring. I think the number one and most important result will be higher quality.

In the past if a person wanted some grass, he more or less had to trust his luck when ordering it. I have seen Tifgrass sprigs with 50% or more foreign grass. This has put a burden on the good producer, who has good grass in his nursery. In the past, if there was any foreign grass that might come up in an area which had been planted, it was almost automatically assumed that this culprit had come from the nursery. The only thing the producer could do, if indeed it had not come from his nursery, was to invite the customer to inspect his nursery, or to make a trip and dig up the foreign grass and show the customer that the grass was in the soil before planting.

In the future, when grass is shipped and accompanied by a "certified" tag, these questions will be eliminated.

I think that the certification standards will go a long way in restoring the confidence of our customers in Texas. There has been more and more grass bought from out-of-state the last few years. If a club or golf architect wanted to be absolutely sure of getting good clean grass, the only way was to order "certified" grass from out-of-state, or to make a personal visit to a nursery for inspection. I know of three golf course fairway planting jobs in the last year in which the Texas growers have lost at least $50,000.00 in revenue.

While the prices of certified grass will necessarily be higher for the consumer, I think, that their confidence in the product will make it worth the higher cost.

As all the grass producers gradually acquire the certified grass, a customer will know that he may buy from any grower in Texas with confidence.

I think as these standards are put into effect a few minor changes will be made, but on the whole, I think they will be a tremendous help both to the producer and consumer.

In my opinion, to be able to insure the customer of the highest quality grass at a competitive price should be the first consideration of very grass producer.

THREE VIEWPOINTS ON GOLF COURSE DESIGN

PANEL DISCUSSIONS

THREE VIEWPOINTS ON GOLF COURSE DESIGN
THE ARCHITECT

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A. What is a golf course?

If I asked the question "what is a golf course?" and graded the answers, I'll bet 90% of the golfers wouldn't score 70. Perhaps those in this room would score considerably better. Those of you who answered, "It's one big headache" would score 110. But it can be a "pleasant" headache if you are a player or member on a well-groomed course. But for those of us who are in the business, it's usually an "Excedrin headache"; but we must like it, because there are certainly easier ways to earn a living.

An 18-hole golf course consists of that area "thru the green" as defined by the USGA (plus the hazards?). This is the definition on which most people score 70. But this is the player's definition. To those us in the business, a golf course is that area "thru the green", and the hazards; but it also includes the clubhouse, the parking area, the swimming pool, the tennis courts, the maintenance building, the water well, the booster pumps, the water system, the service roads, the power supply, the rock outcrops, the unused area, the fences, the cart barn, the cart paths, the low spots, the ridges that scalp, the slopes too steep to mow, the flat areas too flat to drain, the woods whose trees are too close to mow with power equipment, the hard greens, the mushy tees, the bare spots under trees, and all other nightmares created by nature, unqualified golf course architects, unscrupulous contractors, and/or lazy golf course superintendents.

Why the golf course superintendent? Surely he had nothing to do with the design or construction of the new course? Why blame him? Theoretically, this is a logical approach. And if everything went "by the book" (that is, the <u>superintendent's</u> book), the inclusion of the superintendent for a share of blame would be an error. But those cases where everything goes "by the book" involve less than 1% of the courses built. In the other 99%, the superintendent shares some of the blame, although it is a much smaller share, at first. More on this later.

I'm not going to dwell on the subject of "What does a golf course architect look for in designing a new course?". Dr. Ferguson in his pamphlet "<u>Building Golf Holes for Good Turf Management</u>", published by the USGA, does a beautiful job in dealing with ideal sites, soils, etc. Rather than taking up your time rehashing this excellent monograph, I urge you to read it. And the magazines are full of articles by touring pros and ex-touring pros, telling you how to design championship courses, although most of them don't know a planimeter from a thumb tack. But if

I had to answer the question of what I would look for in designing a new course, I'd have to answer frankly, "plenty of money"! Given enough money and a place to dump the water, a good architect can create anything the client wants.

Notice the three elements:

1. Enough money

2. A place to dump water

3. A good architect

Sometimes, all three are lacking. Let's dispose of item 2 first. That really means "Let's solve the problems of drainage". I mean overall drainage, not sub-drainage alone. In hilly areas, this is usually no problem <u>if</u> the architect knows how to handle excess water and trickle water--the stuff that persists for a day or two after a rain. But that situation isn't nearly as tough as building golf courses in areas of 45 to 70 inches of rainfall and ground slopes averaging 2 feet per mile! I regard the problems of drainage as one of the most important, and most neglected phases of golf course construction. Some of you might ask "if it's so important to you, why do some of your courses have some pot holes or spots which won't drain properly?" Good question--because it ties back to the problems of money and people, which are to be discussed here.

As mentioned earlier, I'm not going to talk about making championship golf courses. I imagine that Henry Ransom will have a few things to say about championship courses and membership courses in a few minutes. I would rather discuss with you the problems and solutions of the <u>business end</u> of building golf courses, as well as some new developments in the field. Then I would like to say a word about the role of the superintendent in a golf course construction program.

Golf course construction has been experiencing the same sort of inflationary price increase as all other phases of our economy today. About 10 years ago, maybe more, the National Golf Foundation indicated that the average golf course cost about $10,000 per hole, or about $180,000 for an 18-hole course. Today, that same golf course will probably cost between $280,000 and $300,000. And this is for an <u>average</u> course. The extra special courses can run any place from $350,000 in our part of the country to as much as $1,000,000 in other parts of the country where not only are labor costs higher, but there is considerable rock and stone to be dealt with as well as clearing of heavy timber and anti-pollution laws against burning the timber. Please remember these prices are for the construction of the course only. They do not include land costs. And land costs aren't getting any cheaper either. Therefore, with the exception of the most unusual club, there is a distinct shortage of money on nearly every course being built today. In fact, there is a strong tendency for golf courses to be built only in connection with real estate developments, since this is about the only way that many courses can be justified.

Whenever golf courses are built in connection with real estate developments, the cost of the course is usually financed by a loan commitment from a bank or from a mortgage company. Usually the mortgage companies, or any lending agency, wants to know exactly what it's lending the money for. The reason is obvious: If they have to take over the facility on which they are lending money, they want to know what the quality of the facility is as it might relate to either operating the facility or selling it. This means more and more lending agencies are demanding complete plans and specifications for the golf course as well as for the entire sub-division. The day is rapidly passing when a golf course architect can build a course "out of his hip pocket". This business of putting on a show for the future owners of the course by gazing out in the woods with your chin in your hand, and then waving your arms and stating you are going to build a "championship course" for them, is just about over. The golf course architect's business is getting down to the same hard facts of life as any other competitive business.

Actually this is a good sign. It means that there is a demand for more qualified golf course architects with agronomy and engineering backgrounds. The ability to hit a long tee shot on the course, or handle an even longer shot at the bar, is playing an increasingly smaller part in the selection of golf course architects. The slide rule, the planimeter, the transit, and the soil test reports are becoming a far better judge of the qualifications of the architect than the score he turns in. This does not mean that a degree in agronomy and a good background in mathematics will automatically qualify a man as a golf course architect. Obviously, if the man doesn't shoot an excellent game of golf himself, he doesn't have the "feel" for the type of golf hole which creates real challenge for the better golfers. There's simply no way you can read and learn about this phase of the game. You have to know it because you have played it. But simply because you have played consistently in the low 70's does not mean that you have the same delicate touch with the slide rule and planimeter as you do on the greens. So it's becoming a more exacting business all the time, and the client will be the one who benefits.

On the other hand, the very nature of these advances is also causing the costs of the course to go up. In years gone by, the architect would give the client a golf course routing plan (which the client usually thought was the entire set of plans for the course) and would tell him the course was going to cost about "X" dollars. The client would approve this expenditure, and the golf course architect would hire some bulldozer operators, or use his own, go out and build a golf course to that sum of money. Sometimes the golf course was excellent, sometimes the quality had to be cut down enormously to get within the budget. But there were no real plans and specifications and the Architect-Builder could get by with anything. Today, the lending companies insist on plans and specifications for bids or to negotiate a price with a contractor. Furthermore, golfers are becoming more and more demanding in their requirements for quality, and the superintendent is demanding courses which are maintained with less expense. Therefore, it is necessary to build-in far greater quality in the courses today than was necessary some 25 years ago.

Today, it is not uncommon for my office to put out 20 to 25 sheets of drawings and 60 pages of specifications to cover an 18-hole golf course. This is great for the client. It shows him exactly what he's going to get. It defines the quality; it assures an orderly progress of construction; it lets the lending institution know what they're putting their money up for; and it usually assures competitive bids. But any time you pin down the quality, the quantities, and the methods of construction, you are bound to put a certain amount of fear in the contractor's mind; and this automatically results in a higher price. Therefore, it is easy to see that there is a chain of events:

1. Higher prices for land and services

2. The necessity for borrowing large sums of money for golf courses.

3. The demands of the lenders for adequate plans and specifications.

4. The demands of golfers and superintendents, and therefore,

5. The higher prices being bid on the golf courses.

So far, we have not seen a decrease in cost of construction. The opposite has been true. It is not uncommon for bids to come in from 10 to 15 percent higher than anticipated, partially because of a time lag between the first discussions of the golf course and the time the bids are received. These higher-than-anticipated bid prices usually result in a scurry to cut quality, or to cut services rendered, to get the golf course down within a budget. This is unfortunate, but it's a fact of life.

One of the first places that a new club or an existing club wants to cut is in the maintenance of the course between the time it is planted and the time the club plays on it. This is usually called the maturation period. The club feels that it can maintain the course cheaper than the contractor can, and the club is usually correct. The contractor is not anxious to stay on the job for this purpose. Therefore, the club insists on whacking off a good-sized chunk of the contract price and insists that its own staff take over the maintenance. Usually this doesn't cut the bid price far enough. The owner or club is looking for additional ways to reduce the initial cost of the golf course. The additional cuts in costs are usually made up of a number of smaller but important items. This might be a reduction in the depth of the seedbed, a reduction in the thickness of the gravel blanket, a reduction in the number of subdrains, an increase in the size of permissible stone left in the fairways, decrease in the amount of fairway preparation and fitting, change in the type of grass being used, decrease in the number of drain pipes under fairways or in ditches, etc., etc. The architect can easily provide all the necessary plans and specifications to develop a dream course from the maintenance superintendent's standpoint; that is, if the golf course architect is really an architect and not simply a good salesman. But it's the owner who puts up the money; and when the owner insists on cutting down on costs, usually it is those features which make life easier for the maintenance superintendent which must go first. I've never seen an owner agree to a 16-hole high quality golf course so that his maintenance superintendent can have all of the easy work features that he wants.

When the final specifications and contract with the golf course builder are drawn up, in 90% of the cases, we've sacrificed a number of points which we would much prefer to retain so that the course will look better from our standpoint and maintained easier from the superintendent's standpoint. But, if you can't afford a Cadillac, you'll have to buy an Oldsmobile. And if you can't afford an Oldsmobile, you'll have to use a Chevy. And occasionally you ride a bicycle.

So that's the reason some of my courses occasionally have pot holes or spots which won't drain properly. And that's the reason also that <u>many</u> architects have the same problems with their golf courses. The owners insist on reducing the quality of the finish grading to save money, and pot holes, trees which are too close together, tees which are too small, sand traps which do not have adequate sub-drains, and a multitude of other sins come into being.

Another way they frequently choose to cut costs, much to the disgust of both the architect and the superintendent, is to postpone the completion of the course by leaving much of the clean-up work and finishing work to the golf course superintendent and his crew. This doesn't actually cut costs. In fact, it usually results in higher costs than if it were done by the contractor. But it looks good on paper as far as the other members of the club are concerned because the total money spent for construction seems lower. The fact that it has to be absorbed by increased maintenance costs over the first 5 years of operation doesn't seem to faze the average member at all.

So, before anyone comes up with the remark, "That's the way the architect left it", perhaps they should examine all of the facts and see if it really isn't the way the club construction committee left it.

This doesn't mean that architects are not guilty of sloppy jobs. I've heard of some architects who have quoted prices to clubs for construction of a golf course; but when the construction was over, the clubs found that the cost did not include thinning or clearing of the roughs. Sometimes an architect just does not have the funds available from the club to put on the nice beautiful finish that he would like to present to the superintendent.

So now we come to the second phase of this discussion. What can be done to cut the cost of golf course construction without cutting quality? A lot can be done. The trouble is, nobody either wants to do it, or there are other compelling reasons which make it necessary that construction costs be increased rather than decreased. Before we can examine costs objectively, we have to know what the elements of cost are. Approximately 1/3 of the cost of a golf course is accounted for by the greens. One-third is in the watering system, and the remaining 1/3 covers earth moving, fairways, tees, roughs, and clearing.

The water system is the easiest to discuss, so let's eliminate that first. In the days when labor was less than 75¢ an hour, no one bothered too much about an automatic watering system. Now that labor costs are probably going to reach $2.50 an hour minimum according to law by 1972, everyone is looking toward ways of cutting out maintenance labor by automation. Automation usually has a 7 to 10 year payout, meaning that it earns 10% to 14% on the investment. Although this is attractive, it's not stupendous. But the real problem lies in the fact that it's difficult to get people who will water at night at all; and it's even more difficult to get people who will water conscientiously. Therefore the problems of quality control in the watering of a golf course, plus the increasing necessity to conserve water, make automation even more attractive than the percent return on the investment. But it does mean a higher investment in the beginning. Therefore, we have gone from the $55,000 to $60,000 manual system to the $120,000 completely automated system.

It is doubtful whether P.V.C. or asbestos cement pipe will become significantly cheaper; but it's quite certain that the automation of the watering systems will become more sophisticated, tending to push prices up further. Since it is only human nature for a superintendent to visualize himself at a console in a plush office, (possibly with a fireplace!) pushing buttons which will automatically water the golf course, mow the greens, rake the traps, and fertilize the fairways, (and when this becomes possible, I'm going to apply for the job myself even though I'm not qualified), there's going to be a consistent trend toward sophistication from a convenience standpoint. So don't look to the watering systems as a means of cutting costs unless we are forced to reverse the trend of high quality courses and accept a centerline watering system with minimum coverage or have no golf course at all.

It is very doubtful whether clearing and grading costs will be reduced, since labor costs are constantly going up, equipment costs are constantly going up, and rules and regulations covering the burning of trees are getting stricter.

The other factors of construction costs in this category involve the fitting of fairways and the planting of grasses. Here I think there might be some savings to be had. For example, we recently developed a new stone picker which we tried out on Long Island on a course this year which has greatly reduced the cost of picking stone down to 1/2-inch size or under, out of the top 3 inches. It does a substantially better job than anything I've seen on the market. I'll be glad to tell anyone interested where they can obtain such a machine at the end of this discussion.

On the other hand, the use of hybrid grasses, both northern and southern and the demand for increasingly smoother fairways and roughs which can be power mowed, are increasing costs of construction rather than decreasing them. And the necessity for getting back on the golf course after heavy rains means that more subdrainage of low spots in fairways, and increased pipe drainage across fairways must be installed.

Perhaps the greens offer the greatest possibility of saving money. At present greens cost from $1 to $1.50 per square foot of putting surface, including the earthwork, the contouring, subdrainage, gravel blanket, seedbed preparation, sand trap cutting, etc., etc. In some areas, the costs might be significantly higher, but these are local conditions. The cost of greens shot up tremendously when the USGA came out with its recommendation and then its specifications, covering construction of greens. This is not a criticism. In fact it's back-handed praise. For the first time there was a significant contribution to taking the construction of golf greens out of the classification of being "witchcraft" and putting it into the classification of a science. The specification has worked out beautifully in my work, and I'm sure it's worked out just as well where it has been followed properly in all greens construction. I heartily recommend it, with minor exceptions.

On the other hand, in looking into the specifications, one can read between the lines and see that there's a certain amount of academic recommendation which is not entirely practical or economical in large scale production, and a certain amount of necessity in using available products which are possibly obsolete today.

The entire problem with sub-drainage needs to be studied from the standpoint of reducing costs. It takes plenty of money to dig trenches, grub them out, install pipe and its connections, fill them with gravel, etc. Although this work might already have been performed, it would seem to me that a review of the calculations of the amount of water being received by the putting surface, flowing through the gravel blanket, and being carried off by the drain tiles should be reviewed with the idea of cutting down this expense. In a rainfall of about

2 inches per hour, it is doubtful whether more than 1 inch of the rain will go into the seedbed, with the rest of it running off the surface slopes. For a 6,000 square foot green, this represents only 500 cubic feet per hour, or 10 cubic feet per minute. This is approximately 75 gpm. If there are two major drains under the green each green would have to drain approximately 35 gpm. Realizing that each drain is probably 60 feet long when measured perpendicular to the line of flow, each foot of pipe must take in less than 1/2 gallon per minute, which is small. With any sort of pitch at all to the pipe, it should be possible to cut the pipe size down substantially. And with the gravel blanket reduced to 3 inches, the movement of water should still be more than ample to permit greater spacing between pipes and yet remove all the water that falls during very severe rainstorms. Substantial cost reductions might be made in this manner.

I think there can be substantial savings in a seedbed mixture itself. Anyone who has ever built a golf course realizes that the use of natural soil poses tremendous problems. The soil is seldom what we want for greens. Either it contains too much silt, too much clay, is too wet, too dry, or is not uniform. The necessity of trying to work large quantities of soil under exact weather conditions, followed by grinding and mixing, has undoubtedly raised the cost of greens. Some years ago I became interested in the use of calcined clay and sand plus the addition of peat for seedbed mixtures. I had always maintained, as was later proven by the manufacturers, that one of the main functions of the calcined clay was <u>adsorption</u> and not absorption. It was also obvious that there must be some smaller particles made during the manufacturing process which might be available at a much lower price. Since this material was probably dry and easily handled, the idea occurred to me that it might make an ideal substitute for topsoil to be mixed with sand, which is also easily handled.

Accordingly, a couple of years ago I obtained permission from River Oaks Country Club and Jim Holub to put in half of a practice putting green using only calcined clay fines and sand, adding peat, fertilizer, and trace elements as necessary. This mixture appeared to be entirely too sandy and drouthy when first installed; but the way the grass started growing, the softness of the green, and the way it held water was a pleasant surprise to all of us. Dr. Ferguson has examined this green and I think that he too believes it has considerable merit. In fact, I believe Dr. Ferguson has done some experimenting of his own with this type of mixture. The permeability and infiltration tests run by Agri-Systems here have indicated several advantages for this type of mixture. The biggest advantage comes in the field, where we are working with 2 and 3 cubic yard bucket loads and not in spoonsful and cupsful. There is no need to grind the material since it's already ground.

There's no need to dry it up since it's already dry. And it doesn't get sticky when wet. The material flows freely and can be used in hoppers with automatic metering devices and loaded onto conveyor belts. So can sand. Therefore, the use of these materials can result in blending which is far easier than any method used today which produces a satisfactory mixture; and the grinding operation can be completely eliminated. Portable mixing and conveying equipment can be developed which will not only mix the materials at each green site, but can probably convey the material right onto the gravel blanket in one operation, rather than having to mix it at one site, store it, load it onto trucks, carry it to the jobsite, dump it, and spread it.

I do suggest that pre-mixes be made in one location and shipped all over the United States. Generally speaking, the amount of calcined clay fines required is less than 35% of the total mix. It would seem foolish to ship the other 65%, consisting of sand, to distant points. It would be far better to ship the 20-35% portion to each jobsite, and obtain local sands which are much cheaper on a delivered basis, providing they meet reasonable specifications.

Although the cost of calcined clay fines is several times the cost of native topsoil, the advantages to be obtained in labor-saving devices, mixing, and quality should balance or outweigh the higher cost. And I have a hunch that over 90% of the calcined clay fine particles will contribute to the holding of fertility and moisture; whereas, in native soil mixtures, there is often a lot of inactive silt which does nothing put plug up the pores and lead to trouble down the road.

This brings me to the third part of this talk which is not particularly pleasant but needs to be brought out in the open. This phase of the talk deals with the relationship of the superintendent and the new golf course, and the relationship between the superintendent and the golf course architect. Before I go any further in this talk I would like to make one thing very clear and I don't want anyone in this room to forget it. All of the work of the golf course architect can go for naught if the superintendent does not bring the course into good condition and keep it that way. If the golf course architect, and the contractor, have done an excellent job of design, engineering, and agronomy, a good superintendent can make the course a real pleasure for everyone. The superintendent who really doesn't know his stuff can ruin the best work of the best architect and contractor in one year's time. A good superintendent, on the other hand, can gradually correct the mistakes of a stupid architect or bad workmanship of a contractor; but the chances are it will take about 5 years. So the ultimate fate of a golf course really depends upon the superintendent. It's awfully nice if the architect gives the superintendent a chance by following the best practices of design and agronomy. In other words, the architect and the superintendent should have the same goals in mind.

Unfortunately, the architect often finds himself fighting the superintendent, and vice-versa. There's one very well-known man in golf course construction, who asked me a couple of years ago, "Why is it that every golf course superintendent tries to make a jackass out of the golf course architect, and usually succeeds?". Golf course architects all over the country have given me the same story of the same problem. It isn't true in 100% of the cases; but it seems to be true in more than 50% of the cases. I would like to bring this problem out in the open, in the interest of better relations and in obtaining better golf courses at a lower price, and see what can be done about it. I believe there is some relationship between the self-confidence of the superintendent, or perhaps his background and training, and his attitude toward the golf course architect on the job. Perhaps this attitude might even extend to anyone who has a knowledge of turf or agronomy and who enters upon that particular superintendent's domain. Those superintendents who are well-trained in modern methods, techniques, and construction practices, seem to get along very well with most of us. Those superintendents who are afraid of their jobs, or who have some sort of inferiority complex, usually either ignore the architect or take on the old attitude that "the best defense is a good offense", and they come out fighting. This leads to a very unhappy situation for everyone, particularly the architect.

I find that whenever the superintendent understands the problems and knows his own job thoroughly, we get superb job results. It's been a real pleasure to work with men like Robert Wilson, Jim Holub, Carlton Gipson, and a few others here; and I think that my particular work on their courses has turned out better than average. On the other hand, there are some superintendents around the country who have taken the attitude that the golf course architect is "out to get his job"; and they fight us, either actively or passively.

A few years ago, I finished rebuilding some greens at one of the clubs in the State, but the superintendent didn't like the seedbed mixture. We planted both hybrid bermuda on the greens as well as cool season grasses for immediate cover. The superintendent claimed that the mixture was so drouthy that grass wouldn't grow; and sure enough, it wouldn't. The fact of the matter was the superintendent would not put enough water on the greens, as evidenced by taking a knife and cutting out a core and finding it practically bone dry. After my work had been completed and summertime was nearly upon us, the superintendent decided it was time to show up the architect, and he started watering the greens so thoroughly that the sand traps were soaking wet. The "tipoff" came when not only the Tifdwarf grew, but the wintergrass, which should have germinated two months before, started germinating around the first of June. This same superintendent started topdressing the greens with a 2-1-1 mixture, in spite of the fact that Agri-Systems' tests had shown that the proper mixture was 5-1-1. His reason was that this mixture had been successful on his previous course. The results of changing the topdressing mixture are beginning to show up adversely on this particular course.

I have no idea why this particular superintendent wanted to take this attitude. It certainly was detrimental to completing the course; and it is going to be detrimental in maintenance later on. Although this is a single example, there are many others that I can cite, and I've heard dozens of others from other architects.

It's high time that superintendents realize that the architect has the same goals in mind as the superintendents, and the architect is not trying to take credit away from the superintendent. There is nothing we would love better than to go back to the club a year later and tell the green chairman and the president of the club that the superintendent had done a tremendous job of bringing the course into the beautiful shape it's now in, in spite of adverse conditions. But for some reason or another, whenever an architect sets foot on club property, many superintendents feel that he's out to "show up" the superintendent or create problems for him. Nothing could be further from the truth.

The superintendents should also realize one thing: Whenever there's construction work and an architect is on the job, there can only be one boss. The architect is hired to do a good job based on his knowledge of golf course maintenance. Whereas there's plenty of room for differences of opinion, and plenty of room for discussion, there's no room for dissention. Every architect is willing to listen to a superintendent who is willing to cooperate. We are very glad to have the superintendent's ideas on every single point involving the golf course or the grounds. But there will be cases where the superintendent's ideas and the architect's ideas are not the same. If, after weighing the superintendent's ideas, the architect decides on a different course of action, then the superintendent should still cooperate with the architect to the fullest, realizing that in most cases the decision of the architect is based on his best judgment for the good of the golf course, and there's no pride of authorship involved. After all, the architect is sticking his neck out in making these decisions and is responsible to the club or the owners in the event these decisions are not right. But all too often, the superintendent sets about through practices or intrigue or whispering to the owners to try to prove that the superintendent is right and the architect is wrong. This is a childish procedure which leads to no good, and it only confuses the membership. It often boomerangs on the superintendent. It also creates inaccurate stories about the architect.

The purpose in my bringing these matters to light in this discussion is to plead with the superintendents to be big enough men to realize that their job is to take over after the architect's work and develop and maintain a course to the best of their ability. Their job is <u>not</u> to design or construct the golf course, or to try to show that they are golf course architects themselves, or to try to prove that they know how to grow grass and the architect doesn't. This is a ridiculous attitude. And as I said at the beginning of this discussion, those superintendents who really know their stuff and are helpful to architects usually end up with excellent golf courses; and those superintendents who try to fight the architects either end up with <u>a bad course</u>, <u>a bad job</u>, or <u>no job</u>.

THREE VIEWPOINTS ON GOLF COURSE DESIGN
THE GOLF PROFESSIONAL

Henry B. Ransom
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The first hole to be on easy side, either four or five. Not too difficult -- to get the player off to a good start. The way the majority of people play the first hole has a lot to do with how much they enjoy themselves.

The eighteenth holt to be the same type, to keep him coming back. The Pro Shop to be near the number one tee and near the men's locker room. It is very desirable to have it so the members have to come through the Pro Shop on the way to the number one tee or the practice area.

The practice tee to be located near the number one tee and the Pro Shop and have teaching conveniences, also practice putting green near the number one tee.

Tees should be long enough to accommodate three sets of markers -- four is more desirable so as to give the member a variety of golf shots.

Place traps so as not to hurt high handicapped players. You have so many more of them. Do everything to encourage him. The low handicapped player will play regardless.

Greens should be constructed so you do not have severe slopes. There is a well-known architect today that constructs greens with so many severe slopes and large areas that it is without benefit. You do well to find three cup sets without making the members unhappy. This particular man did some work on Oakland Hills Country Club in Bermangham, Michigan the last time the national open was held there. The members were standing in line to resign and many did. They had to change the golf course back the way it was previously.

The trend today in many instances is to build the golf course extremely long so the members cannot enjoy playing and if he does play the club suffers from lack of revenue. The chairman of the Green's Committee in one instance I know, changed one bunker on a par five hole that prevented you from cutting a corner, enabling you to get on and to. This particular bunker was taken in and put back four different times as different chairmen were in power. One would be able to get it across the bunker and the other one could not and this was an unnecessary expense to the club.

I have also known of instances where one would be a hooker and would try to eliminate things that would be harmful to a hooker and the same applies to a slicer.

THREE VIEWPOINTS ON GOLF COURSE DESIGN
THE SUPERINTENDENT

Robert R. Wilson, Superintendent
Oak Hills Country Club
San Antonio, Texas

Before we get to the designing of a golf course, let me make a very personal observation. Only a qualified Golf Course Architect should design golf courses. I do not know any qualified architects who are practicing the art of greenkeeping. I do know one or two greenkeepers who are practicing architecture, but not very well. My point is, these are closely related professions, but about as different as dentists and surgeons. Both are doctors, but in different areas of endeavor.

In my opinion, architects could insure the quality of their finished product, the golf course, if they would insist that the owners hire a qualified superintendent before construction actually began, or just as soon thereafter as possible.

If a superintendent can see what is under the grass, he will be better prepared to maintain it when the architect and contractor turn the course over to the owners. By working with the architect and contractors, he will better understand the workings of the irrigation system, the overall course drainage system, and I'm sure he will feel more inclined to give credit where credit is due.

After he is hired, he could also start planning the layout of the maintenance facility. Too many times this project is left until the last minute and when it is, the quality of the facility usually shows it. If the owners are going to spend thousands of dollars on equipment to maintain their course, doesn't it make sense to see that it is properly housed. And later on as the superintendent is hiring his crew, a good looking place to work out of can be a very important selling point. Also, if constructed soon enough, it will provide a well-secured storage depot for the contractor's supplies and equipment.

We just mentioned hiring of the people to maintain this golf course. Why not let the superintendent hire his key personnel during construction and integrate them into the contractor's work force so that they too can become acquainted with the baby before it starts growing up. Knowing that they have contributed to the making of their course, they are going to do a better job of maintaining it when it is turned over to them.

Now let us get to the golf course and seed bed material for the greens. The architect has carefully used laboratory analysis, sieve and screen sizes, and all the other wonderful, modern measuring and testing devices now available to help determine exactly what goes into our seedbed; and this is great, because the superintendent is on the job and he can watch the mixing of these specified materials and get the feel of the materials so that later he knows exactly what went in the mix. Let me emphasize feel, because five or six years from now, when the run of original soil has been exhausted, the lab specs won't change, but the color and feel of the new soil supply will be different. Because he was there when it was originally put together, the superintendent has a much better chance of exactly duplicating the top dressing with the original seed bed.

No golf course is any better than its service road system. I have never been on a really good golf course that didn't have at least an all-weather surfaced system that looped around or through the course. The system may have come later, but why wait. If it can save you time and money later, it has just got to save as much or more time and money during construction. Show me a course that got to the planting stage without at least one dose of bad weather and I'll show you a miracle. Design a service road system into your final plan, Mr. Architect, and see how much quicker the course gets polished into shape. No mud, no dust, no ruts across the fairways, no equipment worn out before its time, and quick access to where the work is going on. All this and more during and after construction with a good service road system.

Let us go one step further to fully utilize this investment. Let us integrate this service road system into our master cart path plan and save more time and money. By using our service roads for carts or scooters between greens and tees whereever possible, we have shortened the time of allowing these money-makers on the course. And, they do make money. In fact, they can pay for their own paths by including a cart path surcharge in the rental fee. Here at Oak Hills, we set aside fifty cents per eighteen hole round per cart to be used only for the construction or reconstruction of cart paths; and this is the only thing for which this money can be used.

No two things cost an owner more than maintaining sand bunkers and trimming or thinning established trees on the course.

The architect designs traps or bunkers for play. The owner has played courses where there are traps that are simply beautiful. He wants the best and the more intricate, the better. Here is where the architect and superintendent should get together and explain to the owner just how much this intricate beauty is going to cost, not so much in construction, but in later maintenance. High facings and long fingers into the traps mean hand work and hand work is the cancer of budgets. This same hand work goes into tree trimming and thinning. During construction, heavy equipment is available to go in and do the job quickly and on raw land, as opposed to the maintenance crew having to later rent equipment or use undersized equipment of its own, and then having to reestablish turf damaged by this equipment. The savings can be tremendous.

A turf nursery is important to the golf course the same as any of the playing greens. Build and establish the nursery at the same time the greens are being built. Use the same seedbed material and when disaster strikes, you don't have to worry about the difference in the quality of the turf you use for repairs.

Clubhouse landscaping and the maintenance of this area is of vital concern to the superintendent. If the architect and/or contractor is responsible for planting and establishing the clubhouse grounds, now is the time for a general understanding by all parties as to who will maintain this area and at what point it is the responsibility to be passed on. If no provisions have been made, then the superintendent and owner can decide what is needed and set a timetable for accomplishing this task. This route offers the option of the superintendent and his crew doing the job or letting a contractor.

And now we come to what is probably the most critical point in the success or failure of this whole project. The architect and contractor have designed and constructed and planted and nurtured a piece of raw land into a living golf course. They have fulfilled their contractural obligations. Now the owner accepts their work and the superintendent assumes the responsibility of maintaining this brand new facility. At this moment, every person involved must know they have been completely honest with themselves and each other about what the first twelve to eighteen months of maintenance is going to cost. Because if adequate money is not available to insure the required maintenance needs of this bright, spanking new golf course, everyone will suffer. The architect's finished product must be polished by the superintendent so that the golfer can enjoy what he has paid for.

ACTIVE INGREDIENTS

AND CHEMICAL COMPATIBILITY

PANEL DISCUSSIONS

ACTIVE INGREDIENTS IN FERTILIZER

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Fertilizers are applied to soils to furnish plant nutrients. Therefore the active ingredients are the nutrients. Although there are 13 mineral nutrients required for turfgrasses to make normal growth, as many as 8 may be needed in a regular liming and fertilization program. These, along with common sources as lime or fertilizer materials are listed in Table 1. These salts when mixed together do not generally result in adverse reactions which reduce nutrient availability.

The nutrient composition of fertilizer is expressed as % N, % P_2O_5, and % K_2O as shown on the label. Other nutrients are usually shown as percent of the element. The same applies to solids and liquids. Before fertilizers are sold in Texas the label must be registered with the Fertilizer Control Service. The product is subject to sampling by inspectors. These samples, collected by prescribed techinques and tools, are analyzed and checked with the registered label. If differences are greater than acceptable, penalties are assessed.

In applying fertilizer for turf and other plants it is desirable to determine the nutrient content. For example, an application of 80 lbs of 16-6-12 would be 12.8 lbs of N, 4.8 lbs of P_2O_5 and 9.6 lbs of K_2O.

Most recommendations are as lbs of nutrient. For example, if we wish to apply 2 lbs of nitrogen per 1000 sq. ft. from ammonium sulfate, the following calculation is made:

$$\frac{\text{2 lbs of N}}{\text{.21 (21\%)}} = \text{9.5 lbs of ammonium sulfate}$$

To obtain the same amount of N, 12.5 lbs of 16-6-12 would be required.

$$\frac{\text{2 lbs N}}{\text{.16 (16\%)}} = \text{12.5 lbs of 16-6-12}$$

The formula used for any such conversion is:

$$\frac{\text{lbs of nutrient desired}}{\text{decimal fraction for \% composition}} = \text{lbs of fertilizer}$$

The amounts of P_2O_5 and K_2O supplied by 12.5 lbs of 16-6-12 are calculated as follows:

12.5 lbs x .06 (6%) = .75 lbs of P_2O_5

12.5 lbs x .12 (12%) = 1.5 lbs of K_2O

The following example illustrates the procedure for calculating the amount of active ingredient to use in preparing a solution for a foliar application of iron sulfate.

<u>QUESTION</u>: How much iron sulfate (coppreas) is needed to prepare 100 gallons of a 2% solution?

100 gal	800 lbs
8 lbs/gal	.2 (2%)
800 lbs	16.00 lbs of iron sulfate

Fertilizers can be injected into irrigation systems. Regular or concentrates solutions prepared from dry fertilizers can be used.

<u>QUESTION</u>: Wish to apply 1 lb of N per 1000 sq. ft. per inch of water. How much 32% nitrogen solution would be needed?

1. One inch of water per 1000 sq. ft. equals 144,000 cubic inches or 624 gallons.

2. One lb of N from a 32% material:

   $$\frac{1}{.32\ (32\%)} = 3 \text{ lbs of solution}$$

3. Therefore 3 lbs or about 1 quart of 32% solution needs to be injected into the irrigation system at a ratio of 1 part solution to 1664 parts water.

Several methods of applying fertilizer on turf are satisfactory.

These are:

1. Broadcast dry fertilizer
2. Spray liquids or solutions
3. Inject into the irrigation system.

Which to use depends on available equipment, fertilizer materials, frequency of application and many others. Each manager must develop the system that fits his operation and supplies plant nutrients needed in amounts and frequencies to maintain his turf.

Table 1. Plant nutrients commonly applied in lime and fertilizer materials.

Nutrient	Material
Nitrogen	Ammonium nitrate, ammonium sulfate, urea, ammonium phosphates, sewage sludge, urea formaldehydes, organics
Phosphorus	Superphosphates, ammonium phosphates, ammonium polyphosphates, bone meal
Potassium	Muriate of potash, sulfate of potash, sulfate of potash - magnesia
Calcium	Ordinary superphosphate, gypsum, calcitic limestone, hydrated lime, calclined clay
Magnesium	Magnesium sulfate, sulfate of potash magnesia
Sulfur	Gypsum, ordinary superphosphate, ammonium sulfate, other sulfates, elemental sulfur
Iron	Ferrous sulfate, chelated iron compounds, polyflavinoids, other sources
Zinc	Zinc sulfate, zinc oxide, chelated zinc compounds, polyflavinoids, other sources

ACTIVE INGREDIENTS AND CHEMICAL COMPATABILITY - PESTICIDES

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The term ACTIVE INGREDIENT refers to the chemical constituent responsible for the effectiveness of a pesticide. For a weed killer, it IS the herbicide. For example, Weed-B-Gon is a Tradename for a weed killer, the sodium salt of 2,4-dichlorophenoxy-acetic acid is the ACTIVE INGREDIENT. Carbaryl (1 - napthyl methylcarbonate) is the ACTIVE INGREDIENT in the insecticide, Sevin. Pentachloronitrobenzene (PCNB) is the ACTIVE INGREDIENT in Terraclor, a fungicide.

The ACTIVE INGREDIENT used or recommended determines to a great extent the succeses or failures experienced with pesticides. We should learn to associate tradenames, or products, with ACTIVE INGREDIENTS. It is required, by law, that manufacturers identify ACTIVE INGREDIENTS in pesticides. ACTIVE INGREDIENTS must appear on that part of the label displayed under customary conditions of purchase. It must be sufficiently prominent and in type size which can be easily read by a person with normal vision. ACTIVE INGREDIENTS can be classified, or grouped, according to their mode of action, their structure, their toxicity or their residue hazards. For example, we can classify herbicides as SYSTEMIC (translocated) such as 2,4-D, CONTACT such as paraquat or pre-emerge such as Balan. Insecticides can easily be grouped as CHLORINATED HYDROCARBONS (chlordane, toxaphene, aldrin, heptachlor, DDT), ORGANOPHOSPHATES (malathion, parathion, diazinon) or CARBAMATES (sevin). Fungicides might be classified on a similar basis. If we are aware of the characteristics of these various groups of ACTIVE INGREDIENTS, we can predict to some extent the ACTIVITY and HAZARDS associated with the pesticide, and increase our cofidence in the decision to use a particular pesticide.

The method of application of pesticides depends on the activity and the chemistry of the ACTIVE INGREDIENTS. Thus with certain ACTIVITY INGREDIENTS such as the substituted areas (diuron, monuron) and triazines (simazine, atrazine) soil application is most effective, because these materials are poorly absorbed by the foliage of plants, but are readily absorbed by roots. Others such as organic arsenicals and paraquat must be applied to the foliage as they are inactivated by the soil.

The type of insect we want to control determines the ACTIVE INGREDIENT we should use. The insect pests of turf can be roughly divided into three groups - those that feed below the surface of the soil, those that chew the leaves and stems, and those that suck plant juices. In general, the chlorinated hydrocarbons are used to control soil inhabiting insects (grubs) and chewing insects (worms, grasshoppers) because of their relatively long residual activity. The systemic insecticides, organophosphates and carbamates are used to control sucking insects such as chinch bugs, leafhoppers, and mites.

The concern over pesticide residues is evidence in itself of the concern of the American people with contamination of our environment. The pesticides available today represent a wide diversity of chemicals varying in chemical, physical, toxicological, persistence and other properties. More than 400 chemicals involving some 40,000 products are registered by the U.S.D.A. However, it is estimated that as few as 25 basic chemicals constitute 90 percent of the total pesticide usage in the U.S. We need to develop a thorough understanding of the effects of these compounds on our environment. There is a fundamental difference between the organic pesticides of today and the inorganic ones used extensively 20 years ago. The ACTIVE INGREDIENTS contained in those pesticides were inorganic materials such as mercury, selenium, arsenic and lead. The fundamental difference between those materials and organics is that the inorganics are PERMANENT. Once applied to the soil, they are there to stay unless leached away with water.

When organic pesticides are introduced into our environment, they are immediately subject to decomposition to CO_2 and water. OXIDATION, the reaction of the ACTIVE INGREDIENT with sunlight and air (oxygen) is one means of decomposition. Hydrolysis, the reaction of the ACTIVE INGREDIENT with water is another. The absorption of the ACTIVE INGREDIENTS to clay particles and organic matter, likewise, inactivates the pesticide. Finally, decomposition takes place by microbial action.

The chlorinated hydrocarbons are among the most resistant organic pesticides to decomposition. It is because of this residual characteristic that they are so effective against insects that inhabit the soil and those that chew the leaves and stems. DDT, perhaps the most widely used pesticide, undergoes most decomposition reactions, yet under certain conditions it is very stable. Solid DDT exposed to sunlight and air is resistant to oxidation, and in darkness is almost completely stable. DDT is nearly insoluble in water, thus, it is not subject to hydrolysis. DDT is slowly decomposed by soil microbes.

On the other hand, the organophosphates and the carbamates are readily subject to decomposition. Sevin is readily subject to hydrolysis. In addition, its decomposition is catalyzed by iron salts. It is not surprising, then, to find that malathion is not a persistent insecticide. Malathion itself is not very toxic to mammals, so we can understand why this compound is widely used.

The compound, Dexon, is a highly effective soil fungicide, but is readily decomposed by sunlight. It is not effective as a foliage spray. On the other hand, zineb and maneb, two important commercial fungicides, must be oxidized because their decomposition products form the plant protectants, or ACTIVE INGREDIENTS.

We have already lost our privilege to use DDT and are in danger of losing all CHLORINATED HYDROCARBONS. Without this group of insecticides, there are a number of insects for which we have no chemical control. This, also, is the safest group of insecticides that we have from the standpoint of mammalian toxicity. Our handling techniques have become rather careless because of the relative safety to which we have become accustomed. The ingredients presently available to replace the chlorinated hydrocarbons are the ORGANOPHOSPHATES and the CARBAMATES. These insecticides are much more hazardous than the chlorinated hydrocarbons. We must encourage handlers of these materials to develop safe handling techniques and convince them that CARELESSNESS could lead to serious illness. SKIN CONTACT OR BREATHING THE DUST OR VAPOR IS EXTREMELY HAZARDOUS!

Percent Active Ingredients

The percentage of active ingredients and inert ingredients appears on the manufacturer's label of all pesticides. The percentage of active ingredients in the material must be considered when calculating application rates. Most application rate recommendations are expressed in terms of weight of active ingredients per 1,000 square feet or per acre. When calculating a recommended amount of a commercial pesticide to treat a specific area, both the SIZE of the area and the PERCENT ACTIVE INGREDIENTS in the pesticide must be considered. Proper equipment calibration is also essential for successful use of pesticides.

Formulations - Physical and Chemical

Pesticides are manufactured in various physical formulations - dusts, granules, wettable powders and emulsifiable concentrates. Some ACTIVE INGREDIENTS are more effective in one formulation than in others.

Phenoxy herbicides such as 2,4-D are available in several chemical formulations - acids, salts and esters. The acid is generally a finely-ground powder which can be applied as such or in a liquid carrier. The esters are liquids formulated in organic solvents which can be emulsified. The plant leaves absorb the ester formulations more readily than the salts. In most cases, a rain-free priod of 6-12 hours is required for effective weed control for salts, whereas, the esters resist washing from plants. The salts of phenoxy herbicides leach readily in sandy soils, and may yield enough chemical residue in the soil to give some preemergence effects. Ester formulations, however, are extremely volatile and should not be used near desirable trees and shrubs.

There are numerous facts to accumulate about ACTIVE INGREDIENTS. We cannot keep all these facts in mind, but we can keep them in hand. A reference file with facts concerning the pesticides you might use can be of considerable value when faced with a specific problem. Reference information on pesticides should include: recommended use, rates of application, toxicity (LD_{50}), residual properties, precautions and comptability with other chemicals. Farm Chemical Handbook which is published annually by Meister Publishing Company, Willoughby, Ohio, can be used to cross-index from one trade name to another, from trade names to ACTIVE INGREDIENTS and vise versa. It also includes a brief description of each pesticide, intended uses and toxicity. Another item which contains much useful information is the product label which is often overlooked.

Everyone is aware that toxicity to mammals is a very important consideration when making pesticide recommendations. Some pesticides are highly toxic, others are relatively safe. The index by which pesticides are rated as to toxicity is the LD_{50}. The LD_{50} is defined as the milligrams of ACTIVE INGREDIENTS per kilogram of body weight that will kill 50% of the test animals. For example, parathion and diazinon are both organic phosphates, however, parathion has an LD_{50} of 6 mg/kg, whereas, diazinon has an LD_{50} of 134 mg/kg. When you make a decision to use a pesticide, be specific and provide details to those responsible for applying the material. There should be no question as to how much material is required, what volume is required, and where it is to be applied. They should also be made aware of the hazards involved with the pesticide to be used. It is up to you to see that pesticides are used safely and in so doing, improve the image of pesticides.

B U D G E T I N G   A N D   M A N P O W E R

P A N E L   D I S C U S S I O N S

BUDGET FOR NEW EQUIPMENT

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To budget properly for new maintenance equipment, the turfgrass manager must have knowledge of the prevailing economic and labor environment, awareness of the equipment available for purchase, information regarding any expansion or redesign plans for the facility and clear, concise operating records. For a budget is a plan -- a plan that allocates and commits funds to support current or future actions. And, the budget must be based upon accurate records if it is to become the effective management tool for which it is prepared.

Budgets may be developed for any purpose. Those concerned with equipment purchase should be designated as "capital"; whereas those concerned with equipment repair and maintenance should be designated as "operating."

Capital budgets are concerned with planning for expenditures that will return a benefit beyond a one-year period. Expenditures that will be used within a one-year period are classed as operating expenses and so budgeted. Designation as capital, rather than as operating expense for items with an over one-year life, agrees with generally accepted accounting principles; and further, is a requirement of the Internal Revenue Service for taxing purposes.

Most of the equipment purchased for maintenance of turfgrass has a useful life of several years -- certainly, in most cases, beyond a one-year period. For this reason, to budget for equipment or to prepare the capital budget becomes one of the key elements in strategic financial management. The committment of current and future assets for a period of 5 to 7 years for certain pieces of mowing equipment and for 20 to 25 years, or even longer, in the case of an underground irrigation system, places a high degree of responsibility on the turf manager. The funds committed for these purchases are tied up and become unavailable except as they are returned through the depreciation allowance and the savings or benefits they generate. Without adequate plans and records, a sound judgment for the committment of funds cannot be made. For those turf facilities with limited funds, proper utilization of capital could mean the difference between success and failure.

Plans for the capital budget must, of necessity, be based on adequate equipment and an efficient operation. And, since adequate equipment is essential for efficient operation of a turf facility, its selection, procurement and use must be based upon a planned and organized approach with proper supervision. Only through such an approach will it be possible to meet the ever-increasing demands for improved maintenance standards on our turfgrass facilities. This problem is particularly pertinent in view of the rising labor costs. Operations must be keyed to the use of equipment which will produce a greater number of work units per man-hour of operation. Great strides have been made in this direction during the past two decades, but still greater strides must be made if user (player) and spectator demands are to be met.

RESPONSIBILITY FOR PLANNING

To illustrate an approach to planning and developing capital budgets, let us take a look at a park system, or a school district.

The community -- represented by the board -- is responsible for the overall programming of operational standards. They must decide the kind and level of maintenance for their particular needs -- little league playing fields, picnic areas. These expressions are made through their appointed representatives -- the Park Board or School Board, (although the reverse situation is frequently the case). Based on the authorized expenditures (existing budgets) the department, in cooperation with the turf manager, prepares and submits a long-range and an immediate plan of operation. If approved, the turf manager executes the program under the general supervision of the park director or school superintendent.

Planning for adequate equipment, then, is the direct responsibility of the turf manager acting within the confines of an operational program, planned and developed in cooperation withthe committee and approved by the Board of Directors.

Participation in local, regional and national educational conferences, particularly the National Show and Conference, is invaluable from the standpoint of keeping abreast of developments in turfgrass operations and the availability of new equipment.

When planning for new equipment, the manager should carefully examine the capacity, the maneuverability, the sturdiness and durability of equipment -- and in the case of certain mowing units, their trimability. Also, a study of the maintenance records on each piece of similar equipment currently owned and operated to determine annual service and repair costs will provide a basis for projecting life expectancy. The reliable manufacturer and his authorized representative will be of great assistance in this respect. Certainly, the planned acquisition of replacement equipment must include detailed data to support the need. Records of performance, cost of repairs, down time and efficiency of operation provide invaluable documentation of the needs.

Many golf courses and some parks and school grounds were designed and constructed during the era when labor costs were negligible and mechanization of little importance, thereby creating many time-consuming operations requiring the use of low-capacity and often costly equipment. Landscaping may not have been planned, but grew haphazardly over the years with little thought to the maintenance demands being created (often in accordance with the whims and fancies of some particular member).

Shrubs and trees requiring specialized care in the way of spraying, trimming, and pruning, and often located in such a manner as to interfere with large capacity mowing equipment--thus requiring additional time-consuming operations to maintain surrounding turf-grass--do not contribute to efficient operation. The turf manager has a responsibility to point out these deficiencies and to develop a long-range program of re-design in keeping with modern trends. This should include landscaping to eliminate problem trees and shrubs, substitution of more hardy species requiring minimum maintenance and located to accommodate equipment with greater capacity. In the case of a golf course, the construction of greens and tees employing the latest materials and techniques developed through research will unquestionably contribute to efficiency. Such a program may require several years for completion, but with compe-0 tent direction, supervision and adequate equipment, may be accomplished through careful budgeting for new replacement equipment.

It must be recognized that adequate equipment for one turf facility may be inadequate for another and excessive for a third; therefore, equipment must be selected on the basis of the individual requirements for the particular facility. Consideration of the local economic climate, the available labor pool and standards established for the level of operation, will dictate the various kinds, sizes and types of equipment required for efficient operation.

Other considerations when developing the budget for new equipment, would include: 1) consultation with the manufacturer or his representative regarding the type of equipment needed. Information on new equipment and improved features, as well as the suitability of their equipment for the job at hand, is readily available from the reliable manufacturer. 2) The availability of parts and service facilities. This is of prime importance when selecting a machine or other equipment. If repair parts are not available when needed and a machine is inoperable for extended periods, it is of questionable value and certainly will contribute little to efficient operation. 3) Develop or estimate a reasonable or probable life, and based on current replacement costs, allow for the proper amount of depreciation per year. Then, request or provide a yearly sinking fund for the orderly replacement of the equipment when it becomes economically feasible or when new and improved equipment becomes available. 4) Prepare supporting statements for capital budgets. List each piece of equipment separately and state concisely why it is needed and the benefits to be derived from its use. 5) When possible, invite those responsible for approving your selection of equipment to join you at local turf equipment field days or national shows.

LEASING

Capital budgeting has significant long-range implications and may have a major impact on the economic well-being of a turfgrass facility. When dependable estimates and reliable projections indicate the desirability of the investment and funds are not available or, if the large commitment would jeopardize the financial structure of the organization; then, a leasing program should be considered. Most major manufacturers offer practical leasing arrangements or programs to qualified organizations. The major advantage of the lease-buy program is to reduce or eliminate the requirement for an immediate capital expenditure. Instead, the equipment purchase is programmed in the operating budget and handled on an annual basis. Also, there may be a tax advantage. Such a program is particularly suitable for new turf and recreational facilities and for those desiring to expand their current operation, or for that matter, any organization concerned with new equipment purchases.

G E N E R A L   S E S S I O N

A CLOSER LOOK AT ARTIFICIAL TURF

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What impact will the widespread use of artificial turf have on our training of new turf managers? Will we be teaching them to operate vacuum cleaners rather than mowing equipment? Will we be teaching them to repair damaged areas with glue and scissors or with a sod-cutter?

Will we be out of jobs because the synthetic turf has cut maintenance costs to nil? Don't you believe it. Inexpensive maintenance is one of the big selling points of artificial turf; however, when we look a little closer and get down to the dollars and cents, we find that in some cases maintenance costs actually increase after installation of synthetic grass. The area does not have to be mowed, but it does require vacuuming. The area does not have to be irrigated; however, it does require a fairly elaborate drainage system and must be washed periodically. Repairs are difficult and quite expensive when the surface is damaged; it won't grow back. All of these things add up to a sizeable budget for maintenance. So, if I were you, I would not rush down and trade in my mowing equipment on a vacuum rig.

Let's digress for a moment and take a look at how and why this artificial grass "fad" got started. With the development of synthetic turf the various manufacturers began an enormous sales campaign in which their advertisements compared artificial grass with areas of natural turf. Did they compare the synthetic surface with a well-maintained area of natural turf? I believe not. They probably picked some of the worst athletic fields in the nation for this comparison. I feel that the majority of the athletic fields in this country are not being managed by qualified personnel. When I speak of qualified personnel, I am referring to individuals with some training in Turfgrass Management. Many of the individuals charged with caring for our athletic fields have no reasonable concept of the complexity of plant growth nor the technical skills required in growing turf that will withstand the heavy traffic of our various sports' activities. In most cases, whether it be high school, college, or university, practically all other budgetary items are given attention before any thought is given to the expense of turfgrass maintenance. For these people, who don't want to pay the relatively cheap price for high quality natural turf, maybe a synthetic surface is the answer to their grass problems. <u>But they are going to have to pay for it!</u>

Let's look at a few figures. In checking the maintenance costs of the football field at Texas A&M (Kyle Field), I found that less than $5,000 was spent annually in growing grass in this stadium. Yet they recently spent in excess of $500,000.00 in putting a synthetic surface on Kyle Field plus a practice field. They could have doubled their maintenance budget ($10,000) and grown grass for 25 years before justifying the investment for synthetic turf on Kyle Field.

In the December, 1969 issue of Northwest Turfgrass Topics, an article by Dr. Roy L. Goss stated that several grass football fields in Western Washington had been recently rebuilt at a cost of under $50,000. This included subsurface drainage, automatic irrigation, proper soils, and either sodding or seeding. If you would deduct this from the approximate cost of a synthetic surface, say $250,000.00, and then allow $10,000 annually for maintenance costs on a grass field, you could still grow grass for 20 years for what you would pay for artificial turf.

You automatically say, "If this is all true, why go to artificial turf?" The answer is that in many cases, synthetic turf definitely has a place on the playing fields of our nation. Many fields receive excessively heavy traffic where it is a near impossibility to grow grass. There are playgrounds and other areas that receive unusual amounts of traffic that would challenge the wearability of any grass. These are areas where synthetic turf may be economically feasible. But let's not tie ourselves down with economics, for other factors certainly come into play. Prestige is undoubtedly a major factor in choosing artificial turf. "Other leading Southwest Conference Universities have synthetic turf on their football fields; why don't we?" Also, artificial turf is surely a drawing card used in recruiting top quality high school athletes into our colleges and universities.

Safety is one of the big selling points of synthetic turf and I do not doubt that the artificial surfaces may be safer than many of our natural turf areas. However, much of the natural turf is not being maintained adequately so as to provide a safe playing surface. I feel that the safety factor diminishes greatly when comparing synthetic turf with a well managed natural grass cover. Along this safety angle, I'm sure you have all heard the claims that knee and ankle injuries have been reduced drastically when switching to synthetic surfaces on football fields. But have you heard the latest? According to a recent publication put out by the Merion Bluegrass Association, knee and ankle injuries may be reduced; however, serious head injuries and more impact injuries are caused by the hard synthetic surface than by natural grass. Cuts and burns are also on the increase. So, it may boil down to "What would you rather have, a twisted ankle or a shoulder separation?"

Looking at golf course use of synthetic turf, I would like to refer to an article in the April, 1969, issue of Turf-Grass Times by Dr. Gene Nutter, editor of that publication. His experiences with artificial turf on golf courses indicate the use of synthetics on non-playing areas only. Synthetics would be adaptable to such areas as driving ranges, locker rooms, pro-shops, and even walkways, but not to such critical areas as golf greens. Dr. Nutter cites one example of a golf course near Knoxville, Tennessee, which was probably the first regulation course to fully use synthetics on greens and tees. This course closed before the end of its first year in play. Rumor has it that the golfers of the area did not care for the effect that artificial turf had on their game and thus did not support the venture. Golf World Magazine (October 1968 issue) reporting on the same golf course, indicated that the players would not accept the artificial turf due to failure of the greens to hold an approach shot. In checking an advertisement which suggestively indicated the use of synthetics on greens and tees of one particular course, Dr. Nutter found that in reality, the artificial surface was only being used on a bridge crossing at that course. Let's look again at cost. The previously mentioned publication put out by the Merion Bluegrass Association states and I quote, "It is claimed that new golf courses can save more than $17,000.00 in maintenance equipment. But artificial turf (as I have already mentioned) requires a different form of maintenance. One tee in artificial turf (15 x 20 feet) costs $750.00 plus installation; a 4,000 sq. ft. green is estimated at $8,450.00 plus installation. The $2.50 a square foot estimate given turns out to be more, nearly $3.50 a square foot when asphalt, gravel, tile and engineering are included." (Unquote). So you can readily see that the initial cost of artificial turf is going to be considerably higher than natural grass. Synthetics have their place on and around golf courses; however, I would be skeptical of their use on putting greens.

Let's look just briefly at the possible use of synthetic grass on home lawns for, as we all know, home lawns constitute the large majority of turfgrass grown in this country. The synthetic surfaces have proven to be ideal for patios, around swimming pools, small putting green areas in large apartment complexes, and in other areas where growing grass is quite difficult. Of course, price is still the big drawback in home lawn installation. For instance, a 1,000 square foot area of artificial turf at $2.50 per square foot installed would cost $2,500. Now compare this with the cost of sodding a similar size area with natural grass; it runs around $100 to $200 depending on the particular variety.

Even though price is a big obstacle, I feel that there are other factors that may prevent synthetic turf's widespread use on home lawns. One of these factors is heat absorption and/or reflectance. If the heat being reflected from or absorbed by these synthetic materials on a home lawn, even remotely approaches that of an artificial grass football field, then I personally don't want any part of it. This past summer during late August, Sim Reeves and I went over to Kyle Field at about 3 or 4:00 in the afternoon and laid a thermometer at midfield. The thermometer registered 165° Fahrenheit. I'm sure that most of us have enough trouble trying to keep our homes cool during the summer without adding to our problem.

Even if we get past the price and the heat, I feel that there is nothing to compare with a beautiful, well kept, natural turf lawn or the sweet smell of freshly mowed grass. I am surprised that the environmentalists of our nation have not challenged the widespread use of synthetic grass. No doubt, its use will change the environment and in this respect, it might possibly be considered a pollutant. Certainly, the artificial turf cannot boast of the production of life-giving oxygen as can natural grass. In the latest issue of The Golf Superintendent, Mr. Norman Kramer, President of GCSAA, made the statement that the 750,000 acres of golf turf existing in the United States today could, theoretically, provide the total oxygen requirements for over 50 million people each day.

In closing, I will only say that synthetics undoubtedly have a place in filling the needs of certain turf areas, but that they are not the answer to all turf problems.

STATUS AND FUTURE OF HYBRID BERMUDAS IN THE SOUTH

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There has been considerable concern for the future of hybrid bermudas throughout the South, especially in the upper South, after a severe winter such as we had in January 1970. In many instances, in the Atlanta area, 70% of the greens were lost and had to be replanted at the cost of $150 or more per green. This amounted to about $3,000 per course and often, all bermudagrass greens were affected to some degree.

A quick review will show that early introduction of bermudagrass, Cynodon dactylon, was along the Georgia and South Carolina coastline. Research by Paul Tabor, retired Plant Materials Specialist, USDA, SCS, shows that there is evidence that the common name, bermudagrass, originated in the vicinity of Sunbury, Georgia about 1800. At that time, the accessible nearby Colonel Islands were known as Bermuda thus the grass could have been called bermuda since the immigrants to Sunbury were from the Bermuda Islands. Many of these immigrants died during an epidemic and most of the survivors returned to their homeland. A severe hurricane in about 1804, partially destroyed fences and buildings at Sunbury and bermudagrass began to spread over the townsite. There are many versions of the origination of the name bermudagrass but this seems to be as logical as any. Mr. Paul Tabor has found several varieties or strains of bermudagrass on the Islands near Darien, Georgia where ship ballast was dumped during the lumber trade era of this port. At one time, there was a golf course at Darien, Georgia where, of course, the greens were sand greens and it was supposed to be one of the oldest courses in the United States; however, very little is known about it.

The hybrids are far superior to the old common bermudagrass for putting quality but there is no doubt that cost of maintenance is more with hybrids than with common bermudagrass. Major selections were made of bermudas after World War II. At first the naturally occuring selections were in some cases, as good as those in the synthetic cross which were made by individuals. The breeding program at the Georgia Coastal Experiment Station has probably turned out some of the best hybrid bermudagrasses for greens which are definitely used more widely than any other bermudagrass selections. These hybrids have been promoted and sold by progressive turf or sod nurseries.

At the present time, there are only two full-time turfgrass breeders at universities in the United States and they are,

Dr. Reed Funk of Rutgers University in New Jersey and
Dr. Al Dudeck with the University of Florida located at the Ft. Lauderdale Field Laboratory.

Needless to say, Dr. Funk is working with cool season grasses, bluegrasses mainly; whereas Dr. Dudeck is working with warm season grasses. Dr. Dudeck started his program in 1970 and he has much research ahead of him.

Some grasses being used presently for greens for Texturf 1F originally known as T-35, Bayshore #1 or sometimes called Gene Tift, Tifgreen or 328, Everglades 1 which is not being used very much now and the latest one, Tifdwarf which has gained much popularity in the last couple of years after a slow acceptance.

Tifgreen has been used more widely than any other grass on putting greens closely followed by Tifdwarf. Unfortunately, Tifdwarf was released as a very inexpensive grass to grow and many turf managers are finding that this is not true.

There has been much discussion during 1970 concerning winter hardiness of Tifgreen and Tifdwarf and unfortunately, Mother Nature did not make a choice between either Tifgreen or Tifdwarf as both were lost; however, research has shown that where nutrients are in proper proportion, Tifdwarf was slightly more cold hardy. Tifgreen was more cold hardy when potash was at a lower level and in many instances this past spring, loss of bermudagrass occurred under low potash levels. In one known instance the potash level was as low as 30 pounds per acre. Tifway and Ormond are used for fairways and tees and Tifway is being used more than Ormond.

One of the limitations of hybrid bermudagrasses is lack of cold tolerance and they definitely have northern limits of distribution, but this past severe winter, three bermudas survived in Illinois and Wisconsin. These were not fine strains of hybrid bermudas but medium to coarse types. In the past, coarse types have survived the severe winters in the higher elevations of the Appalachian Mountains.

The Plant Industry Station at Beltsville has made comparative tests to evaluate bermudagrasses for winter survival and turf quality.

All bermudagrass are perennials and are considered a warm season grass. They start growing in the spring and cease to grow with frost or below freezing temperatures. Leaves will be killed when the temperature is below freezing unless special management practices are put in effect.

Bermudagrasses probably have one of the widest range of adaptation of any grass we have. It will grow in calcarous soils as well as acid soils and from sandy to heavy clays but it does have to have water to survive.

Bermudagrasses as a whole are not shade tolerant grasses, and in many instances will die when growing in the shade. The selection FB 137 commonly known as No-Mow, has shown much promise as a shade tolerant grass. If the chinch bug and the virus eliminate St. Augustinegrasses, we will need to find more shade tolerant bermudagrasses than we have now.

Classification of bermudagrasses are separated on the number of spikes and arrangement on the central axis, but in turf, we are not too concerned with this but the taxonomist is for classification purposes. We are more interested in bermudas for turf use. We want to know if the grass will withstand or support game or recreation it is required to. Football fields require one type of bermuda and golf courses use a different type as requirements are different.

On the golf course, we think of the greens first and we will list bermudas used on greens and their requirements.

One of the first hybrids selected was Tiffine also known as Tifton 127, selected at the Georgia Coastal Plain Experiment Station at Tifton, Georgia and released in 1953. It represents an F_1 hybrid between Cynodon dactylon and Cynodon transvaalensis from East Lake Golf Course in Atlanta, Georgia. Tiffine is light green with a fine texture and has been phased out by use of Tifgreen and now Tifdwarf.

Tifton 328 was released in 1956 by the Georgia Coastal Plain Experiment Station and it was the best of several F_1 hybrids between a fine-textured common bermudagrass and Cynodon transvaalensis from #4 green of the Charlotte Country Club, Charlotte, North Carolina. It was selected in 1951 and released in 1956. It has probably been planted on more golf course greens throughout the world than any other bermudagrass released so far.

In 1960, some of the original greens planted to Tifgreen began to show evidence of mutations. Most of these greens were in areas where Tifgreen was in stress or under pressure and at certain times would show much discoloration. Such a green existed at #12 at the Florence Country Club, Florence, South Carolina. At least 4 variations of grasses have been selected from this particular green. One of these was Tifdwarf which was increased and researched in comparison with Tifgreen for 3 years before it was released as Tifdwarf. Since its release, it has gained much momentum; however, it was originally released as a very low maintenance grass which it has not proven to be.

Those turf managers who are putting more effort into Tifdwarf are more pleased with it than they were originally. Where golf courses are growing Tifgreen, doing a good job, and are happy with it, it is suggested that they do not change to Tifdwarf, but if the members are not happy with Tifgreen, in many instances greens are being converted to Tifdwarf. Tifdwarf has some problems such as a purplish appearance during cool weather and it seems to attract all the sod webworm moths in the vicinity.

Selections were made in Florida, several years ago, such as Everglades 1. It was selected at the Bayshore Golf Club in Miami Beach, Florida. It is dark green, fine-textured, close growing, vigorous putting green type grass; however, it has a very grainy appearance if it is not constantly groomed and kept with a minimum of thatch. It is considered to be a hybrid between Cynodon dactylon and Cynodon transvaalensis. It is well adapted throughout Florida; however, it is giving away to other selected grasses. Everglades seems to have frost tolerance; however, it is not cold tolerant.

Another selection that is being eliminated quite rapidly is Gene Tift or Bayshore. It is a light green, fine-textured grass resistant to leaf spot diseases, but it can be a very grainy type grass unless it is combed and groomed constantly, and will create a grainy texture which is not desirable for putting.

Texturf 1F is a naturally occurring hybrid originally selected as a T-35 A at Texas Agricultural Experiment Station, College Station, Texas. It was released in 1957 as Texturf 1F. It is fine-textured with a light green appearance and recovers quite rapidly in the spring. It produces very few seed heads but is susceptible to leaf diseases. Due to this disease susceptibility, it is not used in the Gulf Coast area and seems to be better adapted in the Dallas area.

This includes all of the bermudagrasses that are being used on greens; however, there are several new hybrid bermudas being used on fairways and tees. In this phase of golf course turf, there is more need for fairway and tee grasses than for grasses for putting surfaces. In many instances, Tifway is not desirable for play; but maintenance practices can influence this tremendously. This grass has been observed under many, many types of maintenance. Tifway was found in a seedlot of Cynodon transvaalensis from Mr. Meredith of Johannesburg, South Africa in 1954. It was released from the Georgia Coastal Experiment Station in 1960 as a fairway and tee grass. It is being used throughout the bermudagrass adapted area on fairways and tees in preference to common bermudagrass, but if it is not maintained properly, a well kept common bermudagrass fairway is preferred by many golfers. It is being used in preference to other bermudas that have been used in the past as fairway and tee grasses. Tifway has been promoted and sold by turf sod nurseries who have done an excellent job in selling their product and as a result, Tifway has gained in preference to other selected bermudagrasses.

At the present time, there is a selection of grass in Tifway that is superior in spring deadspot areas and is being increased at this time to observe it for possible expansion where spring deadspot is a problem. Tifway has definitely lost some prestige in the upper South where spring deadspot and winter kill have caused a tremendous amount of loss. When a golf course loses as much as 30 or 40 acres of its Tifway fairways, then there is a problem to replant if there is a loss the following year.

During the winter of 1970, much Tifway was lost in the upper South and in some cases as far south as the Atlantic and Gulf Coast areas. Where Tifway was lost it was often replaced by seeding with common bermudagrass; however, before the summer was over, much of the Tifway began to make a regrowth from the underground parts. When you are playing golf, you cannot wait all summer for the grass to recover. If the spring deadspot problem is not solved in the near future, there is no doubt that Tifway will be replaced with a more hardy grass. The same applies to Tifgreen and Tifdwarf. This past severe winter showed no partiality to Tifgreen or Tifdwarf.

Researchers are now looking at many selections and comparing them with bermudas being used today. Oklahoma probably has one of the largest selections of bermudagrasses in the world and for many years to come, new selections will be made from this large collection of grasses made by Dr. Wayne Huffine.

The bermudagrasses that withstood the severe winters in Illinois and Wisconsin will be excellent breeding material for future crossings for winter hardy bermudas to be used on greens as well as selections for fairway use.

During 1970, much interest has been created by use of radiation on Tifgreen and Tifdwarf and mutations that have been created from this exposure. In all probability, very few of these mutations will amount to much; but, if only one out of Tifgreen and Tifdwarf turns out to be a very desirable grass, then it will be well worth the effort. There is no doubt that other selections of bermudas will be exposed to radiation in the future to see what mutations will be produced. At this time, I would say that the future of the bermudagrasses looks brighter now than it has in the past.

THE TEXAS COMMUNITY PESTICIDE STUDY LAB AND YOU

Dick Steeno
Environmental Health Specialist
Texas State Health Department
Community Pesticide Study Laboratory
San Benito, Texas

Speakers specializing in topics concerning the environment, pollution, pesticides or ecology are currently in popular demand.

Your president, Wayne Allen, recently heard one of my presentations to his service club in Weslaco, Texas, and recognized that what he had heard was a discussion of some very significant pesticide research that is being done in Texas in which you also should be vitally interested and that is the reason for my presence here.

The contours of change sponsored by the consideration that our planet is virtually a spaceship, which your organization and all citizens must recognize soon, are already silhouetted on the horizon. As it has throughout the history of mankind, reaction based on a foundation of reason built with sound scientific facts, can result in the continued progress of man; but unscientific reaction without reason or foundation can sponsor a regression that could substantially detour the path of progress for future generations. This consideration is of prime importance when we consider the agricultural capacity of our nation and the potential food supplies that will be required by growing populations of the world.

Pollution is not a new problem. Consider that some of the primary pollutants in our atmosphere are naturally occurring substances such as dust, pollen, viruses and bacteria. After nature, then man's daily living places the next greatest burden on our planet's environment.

It is frustrating to see our nation, currently in a state of malaise on the subject of environmental pollution, seemingly unable to separate fact from fiction so that effective coordinated programs of action could be launched toward practical solutions of pollutional problems.

The "Paul Reveres" of our day are relentlessly sounding the alarm of "over-reaction", invariably advocating "lynching without trial of jury" -- using all publicity media daily to proclaim that "pesticides are a primary pollution source and thereby significantly contribute to the accelerated demise of all living organisms".

The only reaction of American agriculture to date has been one of disbelief and that "these events aren't really happening". It does appear that their major concern now is that they are a factor of relatively minority influence politically and that capitulation to the forces of numbers is inevitable.

To further complicate an already confused situation, we must also consider that the agricultural and biological men of science cannot essentially agree on a basic preliminary pesticide pollution report primarily because gross variations in methodology apparently exist and thereby constitute a major obstacle to such a scientific expression of solidarity.

The divergent views of the "Paul Reveres" and the men of science must be resolved within a reasonable time so that the communities of our nation, particularly those located within rural America, can determine whether a real pesticide pollutant threat exists and if one does exist, does it significantly affect human health and the viability of associated organisms living within this sphere of ecological influence.

With these preliminary comments in view, let's consider these major points supplemented by (35mm) slides during the balance of this presentation.

1. What is the Texas Community Pesticide Study Lab?
2. What have we learned to date?
3. How you can be a professional environmentalist.

I. The Texas Pesticide Research Lab (slides)

A. Organization

1. One of 16 such units in U.S.
2. Texas unit established in San Benito in 1965.
3. Non-regulatory Texas State Department of Health Lab.
4. Staffed by state employees and funded by federal funds on annual contract re-negotiation.
5. Conducts specified research on possible pesticide effects on humans, wildlife, and samplings of air, water and soil.

B. Work Scope

1. Long-term Study - periodical blood and urine sampling of human volunteer group (highly occupationally exposed participants vs. control subjects) supplemented by annual physical examinations, X-rays, and EKG.
2. Pesticide Poisonings - detailing these as they occur annually.
3. Aerial Applicator Crashes - investigations to determine possible pesticide effect on incident.
4. Profile Date - development of background data on population trends, pesticide usage, agricultural cultural practices and other important data associated with sampling.
5. Wildlife and Marine Samplings - primarily coordination with other agencies.

II. What Have We Learned To Date

A. Highlights

1. Advanced Pesticide Methodology
Gas Chromotography techniques to determine pesticide content of samplings have significantly updated the results of samples tested even a few years ago. Continued refinement of these techniques and their practical application to samplings is the usual at our Texas facility.

The sample preparation, the type and maintenance condition of the equipment plus the abilities of "interested technicians regulate the quality of results obtainable through the use of this equipment.

It is highly probable that other factors such as the Polychlorinated Biphenyls (PCB's), misinterpretations of pesticide chartings on the graphs, utilization of improper containers such as plastic containers to ship the earlier samplings might have significantly contributed to the pesticide content results currently being used as the basis for so-called "scientific expression".

2. Water Samplings

Over 600 water samplings from all available sources in the South Texas study area have been tested for hydrocarbon pesticide content. These samplings included run-off from acreages historically treated with very high amounts of hydrocarbon pesticide applications to crops, yielded no significant content when tested.

Essentially this study indicated that only one out of every ten samples of water tested had any hydrocarbon pesticide content and usually in the amount of 1 to 2 parts per trillion considered to be a very insignificant healthwise.

B. Health Effects

1. Long-term Study

The health status of volunteer participants in this study such as aerial applicator pilots (average 18 years of occupational service) and manufacturing formulator personnel (average 16 years of occupational employment) provide the contrast with a control group of non-occupationally involved personnel. To date, all indicators trend toward no statistically important health effects between these categories.

When the past historical agricultural chemical usage of the hydrocarbon insecticides and the current utilization of the organophosphate and carbamate pesticides within the study area is considered, this is an extremely important preliminary trend.

2. Pesticide Poisonings

Poisonings do occur essentially caused by abuse of chemicals when these products are mishandled occupationally.

No fatalities have occurred within the study area due to pesticide causes during the most recent three years of detailed surveillance. These incidents have been reduced to a reasonable number annually primarily due to an educational program to industry and coordination with the medical community personnel.

III. How You Can Be A Professional Environmentalist

As an organization and as individuals you are in an enviable position to do something constructive about improvement of environment. Based on the premise that "something will happen when you make that something happen", you can be a professional environmentalist by consideration of these three areas.

A. Encourage Environment

Living plants - trees, shrubs and grass, not only provide an improved landscape but as a result of their life function they utilize carbon dioxide and release oxygen into the atmosphere precisely a basic requirement for environment improvement.

These plants will also provide shelter and possibly food for wildlife such as desirable bird species. Waterways with waterfall or fountain effects can perform an equivalent function for marine life. Thus, you see that one improvement can be compounded into additional benefits.

B. Handling Pesticides Professionally

Consider these points carefully before using a pesticide:

1. Proper diagnosis of problem
2. Is treatment essential to protection?
3. Selection of safest proper control
4. Know pesticide facts - Read label

5. Handle pesticide professionally

   (a) Protective clothing - rubber gloves, respirator, clothing
   (b) Emergency treatment (Symptoms)
   (c) Medical attention - Poison Control Centers

6. Securely restorage unused product
7. Proper empty container disposal

C. Public Relations Participation

1. Local Organization - join and become an "active" member within your community.
2. Speaking Opportunities - accept the challenge to speak whenever possible toward objectives of environment improvement to adult and youth groups. Remember that you are a "specialist" in your profession. Be in a position to discuss pesticides with some basic scientific understanding for those interested community citizens who lack this knowledge.

SUMMARY

The Texas Community Pesticide Laboratory located in San Benito, Texas, has been and continues to actively monitor the possible long-term effect of pesticides upon the health of man whether occupationally or non-occupationally exposed to these substances.

To date, preliminary findings do not indicate that insecticides are prime pollutants environmentally, nor does the trend of the study indicate that the human health is being adversely affected when in the proximity of the application of these materials for the protection of agricultural crops. The only exception to this generalization would abuse of chemical occupationally which would necessitate medical attention before the recovery phase.

There is much that you can do within your local community to aggressively initiate improvements inherent to the application of your professional knowledge and thereby reduce pollutant factors that currently exist there.

The important conclusion of this presentation is that "regulation" is not the real answer to solving pollutional problems but "communication" based on reason will most likely provide the long-range solutions toward a better environment.