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THE EXPANDING FIELD OF SPECIAL PURPOSE TURF

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Office of the Chief of Engineers, Washington 25, D.C.

It is a real pleasure to meet old friends in Texas and the Southwest. Texas and I have not been strangers. Over the years I have managed somehow to travel into every county of Texas, Oklahoma and New Mexico. Simon Wolff, Bud Smith and I have hunted the seed and plants of grasses, trees, and shrubs over these states. They were not fine turf grasses for the most part, but I understand the Texas Turfgrass Association is not concerned solely with fine turf. And this is as it should be. Turf has many forms and many uses. Golf courses are but one of them.

Some of you men have been guests of the Army and you know what our Army problems are. Some of you have likely spent many hours planting stones in long continuous rows around our lawn areas, and painting those stones white. You have built low picket fences around other lawn areas, and some may have pushed our lawn mowers off the back of trucks on the pavement so they wouldn't cut grass. You have trimmed our shrubs into fantastic shapes and planted trees and shrubs all over Army property into jungles of unrelated materials. If you have done these horrible things, please have the good conscience to either deny them to your sons who will in turn be Army guests, or tell them you were forced to do them at gun point or from threat of court martial; and ease the sadness of my declining years.

It must have been 30 years ago while giving advice to the residents of your neighboring State of Oklahoma on turf problems that the complications of turf grasses became apparent to me. We made some fertilizer tests on bermuda grass lawns at Oklahoma State University. In one experiment we used all rates so low we could not tell where we put them. In another we tried to kill bermuda grass with fertilizer and this too failed. It grew so fast we couldn't keep up with it. Today we have access to extensive fertilizer experiments, many of them published, and we know what to expect from different rates and kinds. At Oklahoma State University we were concerned with pastures and forage crops. Today both Texas and Oklahoma have turf projects, and extensive work in this field is being performed in a thorough and professional manner.

Before I leave the subject of fertilizers I wish to explain briefly our policy at Army installations which is, I believe, also the policy of the Navy and the Air Force. The average military installation has approximately 1200 acres of improved grounds (lawns, cemeteries, parade grounds, ball fields, and the like.) The commanding officer of the installation cannot afford to fertilize these 1200 acres. He does well to fertilize one tenth of the area, and this not heavily. Most fertilizer is concentrated on ball fields, parade grounds, golf courses, and other traffic areas. Most of our fertilizers are inorganic materials. 10-6-4, 16-20-0, ammonium nitrate and ammonium sulfate. Although we use considerable activated sewage sludge and some urea-formaldehyde on golf courses, these materials are seldom used on lawns. We believe that the inorganic materials are satisfactory for our purposes on lawns.

Now in regard to turf species. We in the military departments are enthusiastic supporters of the Texas A & M philosophy that the grass selected should fit the site. We use the improved bermuda hybrids on specialized sites where they serve a specific purpose but do not advocate them elsewhere. Some of these improved species are hard to mow, must be fertilized heavily, irrigated frequently, and they develop thatch. Our commanding officers do not know what to do with thatch, not on 1200 acres, and neither do I. I feel that some of our turf men fail to recognize the advantages of the older species: common bermuda, carpet, centipede, King Ranch bluestem, buffalo, and blue grama grasses; each in its place. Some states, it seems, devote more attention to the new strains and neglect the old ones. I have not noted this deficiency in Texas. We sometimes tend to overlook the thousands of acres of roadsides, open areas adjacent to lawns, drainage channels, embankments, and parks, where the hardier deep rooted grasses are superior.

I have some opinions about drainage. During the War we built literally thousands of houses and barracks with excavated depressions underneath. These depressions collected water and became sources of mosquito infestation and were a general nuisance. In more recent times permanant structures have been built and the depressions were eliminated. Drainage toward, rather than away from buildings, has continued. There is evidence that improved planning and design for lawns have not kept pace with the building itself. Part of this problem arises from the tendency to defer planting and landscape design until the construction

of the buildings, walks, and drives have been completed; and by that time drainage inlets and outlets, walks and drives, and other elevations related to storm drainage have been fixed. This problem has been a continuing annoyance, and local correction has resulted in unnecessary expense. Drawings for use by contractors should, for example, show the finished turf below rather than above pavement to eliminate expensive maintenance of elevated borders.

Important technical strides have been made in mulching seedbed in recent years. It is my conviction that nearly all seedbeds should be mulched with some vegetative material at the time the seed is planted. The expense involved is low cost insurance for obtaining a uniform turf. During the War years many thousands of acres were mulched with straw or prairie hay in Texas to develop airfield and lawn turf on military installations. At that time the problem of mulching steep slopes had not been solved. Since then, machinery and procedures have been improved to permit the stabilization of slopes. Even on level areas the use of a new cut-away disk harrow is providing an improved method for anchoring mulch. Cheaper mulching materials may be available eventually. We should know more about our soils. In my opinion this has been our most misunderstood problem in turf management. We are still in the "topsoil age" in turf. I earnestly hope that we may graduate from this age soon. We tend to sanctify topsoil because it has organic matter in it, but a poor topsoil is a poor turf foundation no matter what color it is. We have wasted time singing hymns to topsoil when we should have been analyzing it.

We all recognize, I suppose, that the standard soil tests have their

limitations in central and western Texas. There are many things we need to know about a soil when we use it for turf. Dr. Ferguson's research work on soil permeability points this problem up. We need to know how much coarse sand, fine sand, silt, and clay are in a soil; how much toxic salts; how deep grass roots penetrate into it. If a druggist paid as little attention to the materials he uses in his prescriptions as we do in preparing a soil for a seedbed, he would be run out of town. We don't even know what materials we should use, the subject is so complicated. Road builders know more about soils for construction purposes than we know about them for turf plantings. Most of our turf failures may be traced to a poor selection of soils. A soil should be custom tailored to a specific turf use. Clay loams are generally better suited to a lawn and a sandy loam to an irrigated ball field or golf green.

I could speak for a long while on irrigation. This is a subject that has caused me considerable anguish. Our irrigation engineers have done much to improve watering systems for turf. The systems I have inspected on our Army installations are not efficient. It is an unusual irrigation system that does not deliver the rainfall equivalent of Beaumont in one part of the ball field and of Pyote in another. It is an unusual new pop-up irrigation system that does not require about as much maintenance to keep it operating as it did to drag the hose around and couple up the old bayonet-type system. We are not quite ready to abandon the older types until we learn how to use the new; and the new type is so easy to turn on that we apparently are wasting just about as much water as we did before. A check of about a dozen systems during the

last year convinced me that the operators did not know how much water the grass needed, how much was being applied, how deep the water penetrated, or how deep it should penetrate. The irrigation engineer has a responsibility to install an efficient system but the operator has an equally important responsibility to learn the facts of turf life.

I wish to complement the commercial firms who have contributed so well to technical progress in turf management. They have employed some real talent in furnishing turf specialists with the fertilizers, seed, and equipment that are essential to a turf program. It has been estimated that about 100 million dollars are spent annually on fertilizers for turf in the United States. One company sold about 30 million dollars worth of seed, fertilizers, and other materials for turf last year. Another company sold approximately 20 million dollars worth of turf equipment last year. Compared to sales of face creams and beer, these amounts must be small indeed, but turf management is becoming big business, and growing rapidly. We have many important corporations to thank for the quality of their merchandise and the advice that has been furnished to assure its efficient use.

I have been asked to give you a brief summary of the extent of our military operations. I will not bore you with many statistics. The three military services, Air Force, Navy, and Army maintain in some manner about 31.5 million acres of land, an area somewhat larger than the state of Louisiana. There are approximately 665,000 acres of turf represented by lawns, ball fields, recreational areas, cemeteries and the like. There are 85 National cemeteries, 40 post cemeteries, and

perhaps 600 private cemeteries maintained. There are approximately 170 golf courses, and 300,000 acres maintained as airfields. Over one million acres of land are leased to farmers and ranchers for pasture (this too is turf). The grazing of turf has been one of our most effective weapons against vegetative fires, a problem that is of greater importance than for most public agencies.

In closing I wish to express appreciation for your interest in the work of the military departments, and for the opportunity to discuss our problems with you.

CADDIES, CARS AND CATASTROPHE?[1/]

Gene C. Nutter, Executive Director
U.S. Golf Course Superintendents Association
Jacksonville Beach, Florida

Look on with me please through my crystal ball to the year 1990. The event: THE ANNUAL TERRESTRIAL OPEN GOLF TOURNAMENT ON THE PLANT MARS. The contest is in the closing heat of this semi-final round! Thousands of spectators are following along as the favorite team completes the forty-ninth hole-a par 50.

Each team of contestants is mounted on a six man mechanical speed, driven by a chauffeur-pilot. No caddies are seen (a thing of the past.) Instead, on the back of each of the aero-golf cars is specially equipped Univac transmitters into which the contestant feeds such data as wind direction and vilosity estimates - course rating information - width of fairway - distance to hole - and hazard locations (some wealthier contestants have cars equipped with meteorological instruments, soil tensiometers and penitrometers, turf density meters, sextants and range finders). You see, caliber of the tournament golfer has changed. Our 1990 contestant is a spectacled, paunchy, egghead type with a PhD in mathamatical statistics and an advance degree in military tactics. Some of the better financed contestant teams provide statistical technicians to operate the Univac.

Univac analyzes the above data and transmits to the contestant on a written card which of his fifty bag of clubs to use for "firing" his next shot. He then punches the proper button on the back of the automatic club selector attachment, and the club is delivered into his hands. -- Oddly enough he must still soil his hands and swing his own club. Unfortunately, for this reason golf is being threatened in popularity and is becoming thought of more and more as a contest for the "uncouth". But, already the genius of planetary industry is solving this problem by the development of a ball launching missile attachment for the aero-golf car.

After the ball is "fired" the contestant team mounts their aero golf car, signals the driver-pilot, and the car proceeds to the point where it awaits while the next competitor plays through. Then , the radar operator on the aero car locates his contestants ball by special frequency control and the automatic pilot guides the car to the proper ball, where the team dismounts and prepares for the next "firing".

1/ Copy of speech given at 15th Annual Texas Turf Grass Conference, December 12-14, 1960.

Contestants in this tourney are not individuals but teams, sponsored and financially supported by manufacturers of electronic brain computers, atomic powered aero golf cars, interplanatory business cartels and government sponsored teams from political states in the universal family.

The Gallery:

Now let's look at the characteristics of the 1990 gallery. The real sportsman drives his own dual-seated atomic powered aero-ground convertible. He travels along on pre-determined traffic lanes called golf tracks - and may turn on the radio controlled automatic pilot while he chats with his companion or views the contest.

Overhead along the golf track, a portable mounted monorail with full vision, tear-drop 100 passenger cars, carries the tourist specials.

Although caddies are gone from the game and foot travel eliminated, atomic power has maintained the aspect of silence in the game - even in the mechanical age. All traffic in the area stops as each shot is "fired". Traffic control is maintained by special electronic traffic control systems. The radio operator in each contestant's aero golf car signals his team's "firing" to special periodically spaced traffic control centers along the golf track. This information is relayed by electronic signal to the respective section of the golf track and automatically haults all traffic along the section of the track where the ball is "fired".

Special rest stops are installed along the 500 mile golf track where spectators may refresh themselves, snack, view inter-planatory news, or check the stock markets by ticker flashes.

Meanwhile - our own semi-final round draws to a close and both contestants and spectators wind their way to over-night quarters to rest and party. In preparation for tomorrow's final round, engineers check the traffic control systems and the GOLF PLANET DIRECTOR (formerly called greenskeeper - then golf course superintendent) - reviews with his staff conditions of the 500 mile golf plant along the golf track and make plans for the night crew to check settings of the electric mowers prior to dawn operations - activate the automatic radio tensiometer, irrigation controls - while the biochemical labs analyze fresh turf quality samples to determine composition of the next aero application of chemio-theropeutic foliar sprays containing radium treated fungus preventatives and radio active insect repellents.

---ODDLY ENOUGH - GOLF IS STILL PLAYED ON GRASS.

Thus, gentlemen you have been privileged to look in on the evolution, scope and status of your profession in tomorrow's world of golf.

FANTASTIC, ABSURD!!! Possibly - but gentlemen let me hasten to point out to you that we are already in a golfing REVOLUTION which is both

sociological and technological and which is seeing:

1. The extinction of the caddy - once a vital force in golf.
2. The advent of mechanical pools of golfer-carrying cars - now for joint occupancy - but soon to be single-seated, smaller and more mobile units.
3. The decline of the philosophy that exercise is a therapeutic necessity to body health (i.e. bodies as we know them today).
4. Development of grassless traffic paths and traffic paths and traffic funnel areas throughout the golf courses where once mechanical monsters were forbidden.
5. A spiriling increase in golf interest, both as spectator and participant sport (TV influence) - producing greater demands on existing golf facilities which already average 708 golfers per club facility.
6. A threat to the early idea that golf is a leisurely game of skill for gentlemen with time on their hands and money in their pockets.

Review these facts - and you will find it difficult to deny that the topic of my talk - "Caddies, Cars and Catastrophe???" is compelling and apropos! Technology is catching up with us as demonstrated in the story of the junior executive, who had been complaining of aches and pains to his wife. Neither one could account for his trouble - nor could his physician throw light on the problem. Arriving home from work one night he informed her, "I finally discovered why I have been feeling so miserable. We just purchased some new ultra-modern office furniture two weeks ago and I learned only today that I have been sitting for two weeks on the waste basket."

Gentlemen, changes ahead are coming fast and furiously!

PRESENT TRENDS

Caddies and Cars:

First let's review the caddy situation - Recently, the western golf association awarded the 1,000th Evans Scholarship to a boy named Dave Williams, who had been a caddy at the Butterfield Country Club, Hinsdale, Illinois for the past five years. This outstanding caddy scholarship program was initiated in 1930 by the fabulous and immortal champion of golf, Charles "Chick" Evans. It was designed as a means of caddy solicitation and development. This last year (1959) alone, the Evans Foundation spent $304,500.00 in caddy scholarships.

Yet, the caddy is rapidly disappearing from the American golfing scene. WHY:

1. The advent of pool carts.
2. The advent of power driven golf cars.
3. The socialogical problems of the age.
   Boy's no longer need to work long hours shouldering golf bags that

provided needed income for schooling or other activities. For a long time the Evans Scholarship Fund was a major influence in recruiting new caddies. However, today even the promise of a college scholarship is not a strong factor in inducing the modern boy to become a caddy.

4. The advent of College golfers as a source of golf professionals and touring competitors, rather than their evolution strictly through caddy ranks.

The day that the first hand-cart was drawn out from the first tee, the roll of the caddy became threatened. Many clubs, officials and caddy-masters overlooked this early threat by saying "Oh - that's for public courses only". Then, about seven years ago the first powered golf car arrived on the scene. This was really something new. A fad. Some said "It won't last". Gentlemen, statistics disprove this story. View with me Table 1:

Golf Car Growth in New York City (Metropolitan Golf Association) and Chicago District Golf Association) areas.

Metropolitan Golf Association		Chicago District Golf Association	
Average No. of Cars per Club	Percentage of Clubs having cars	Average No. of Cars per Club	Percentage of Clubs having cars
1960-11.8	65%	21.5	100%
1959- --	--	12.6	--
1958- 8.0	40%	10.1	--

Above figures compiled from:

1. "Electric Golf Cart Survey" March 1956, Metropolitan Golf Association.
2. National Golf Foundation Golfdom.

Gentlemen, tell me if the above facts indicate that golf cars are a "Passing Fancy". Later, as golf cars begin to show up on more courses throughout the Country, Czars of golf rationalized this development by saying"...Car growth won't effect the caddy situation - we will require caddies with each golf car and collect extra revenue--". I am sure these thinkers had their eyes opened when last year the final round in the down-fall of the caddy became evident when the famous Tamo-O-Shanter Club in Chicago eliminated caddy service. Oh you could have a caddy - if you located one and made your own arrangements. The above action was branded as radical and look upon in defiance and disfavor by many groups and by many golfers. Quite possibly this reaction was justified - but gentlemen - regardless of how you view this fact - THIS IS A TREND.

Gentlemen, please do not misunderstand me. I am not advocating the extinction of the caddy or necessarily the rise in golf car utilization. Rather, I am reviewing facts and predicting trends that will effect you as a golf course superintendent and GCSAA as the official "voice of the golf

course superintendent".

Neither do I think that caddies will be eliminated immediately. Some clubs do require that caddies accompany golf cars. However, the number is decreasing rapidly. Last year the Metropolitan Golf Association survey indicated that 50% of the clubs responding required caddies to accompany cars, while a similar survey by the Chicago District Association indicated that only 36% of the responding clubs required caddies with cars.

The startling facts indicating these trends however, are the two statistics that last year in the Chicago District Association the use of golf cars increased over 100% over 1959. And, the second startling news, that the Tam-O-Shanter Club had set the pace with ALL CARS - NO CADDIES.

So, gentlemen, you can see the pace being established in the social-ogical and technicalogical revolution on the golf course - and speaking of caddies - I am reminded of the story of the two wealthy playboy's who had just taken up golf. They were out to play the full course for their first time. They were full of hope and promise and approached the pro with great enthusiasm and bluster. They were informed by the pro that they could not play today "no caddies". Whereas the more anxious and affluent one quickly replied, "Oh, that's OK we'll settle for buicks today."

In this trend ahead, those who strongly support the caddy program hasten to point out that the game will be damaged and setback by the extinction of the caddy because:

1. The roll of the caddy is steeped in traditions of the game.
2. The caddy played an essential and personal role of service to the golfer, not to be replaced by cars including - Advice to the players, personal service to the golfer and care of the course (replacement of divots, raking of traps, etc.).
3. Damage to turf by the cars.
4. Lack of exercise by the golfing public.
5. The loss of power of concentration on the game while galloping in a golf car.

Proponents of golf cars point out:

1. Year around clubs suffered from loss of caddies service when school resumed in the Fall.
2. Golf cars will speed up the game and permit more play per golf facility.
3. Cars will permit the revival of interest and play by older golfers no longer able to walk the course.

Which school will win? You notice the question (?) after the title of my speech - not an exclamation. There are facts on both sides and time alone will tell - but I am thoroughly convinced that:

A. Golf cars are here to stay and that technology will constantly their style and function.

B. More and more clubs will adapt golf cars in increasing numbers.
C. Increasing car fleets will cause increasing turf damage, operational problems and higher turf-grass maintenance cost.

And so - out of all of this I am concerned not so much for the sociological aspects of the game because I am sure that it will endure - but in the role that the superintendent must take in shifting his operations to meet this golfing revolution.

We were wrong in 1955 when our Annual G.C.S.A.A. Conference went on record, according to Golf World, and stated"...cars are here to stay, and wisely used, would be of no appreciable damage to the courses."

Facts in 1955 might have merited these comments, but they were unimaginative and very unwise predictions. We can hide behind an unforeseen speed of advance in technology and can be excused for having made one major mistake. However, we cannot continue to make mistakes and maintain or develop strong leadership in the industry. Let's look to the future with a sharper focus and a more open and provocative imagination and estimation.

In looking toward and planning for - this future Golfing Revolution, I would like to suggest for you - the superintendents of America - a ten point program. To meet this revolution ahead the superintendent, both collectively and as an association must:

1. Convince golf architects of the incrasing problem of golf car operation so that future design will be practical and in preparation for the car revolution.
2. Convey to Members the need of necessary facilities to properly house and maintain the growing fleets of golf cars.
3. Must convince members of the potential damage to the turf and the serious need for higher maintenance budgets to offset the damage of larger car fleets.
4. Persuade members of the need for traffic control regulations on the course, and a club traffic authority or committee to enforce needed regulations.
5. Establish himself (the superintendent) as the final authority on the use of cars during periods of adverse weather or course conditions.
6. Demand and accept responsibility of car operations as part of the ground maintenance program.
   In order to have control of these operations and the car income to offset the predicted damage, the superintendent must accept this responsibility and turn the added problems into advantages to his maintenance budget.

   Some superintendents shun the car operations and state that they do not want the added responsiblity. This philosophy must change. Superintendents must realize that they will grow and improve, individually and professionally only in proportion to the new challenges and opportunities. If they desire better recognition, salaries and

working conditions, they must prove their management ability by reaching out and accepting new responsibilities and exerting new leadership.

We have many men operating golf courses who are drawing "darn good" greenskeeper or foreman salaries, the only way they are going to advance out of this category is to prove their leadership and management abilities. As greenskeepers, they can expect little improvement in the future.

Remember, it is worth "going out on the limb", because that's where you find the fruit.

7. In order to improve efficiency of operations and to meet increasing financial obligations connected with car operations, business management must be improved.
   - -Better prepared and presented budgets.
   - -More objective purchasing and purchasing procedures.
   - -More accurate job and cost analysis.
   - -Greater manpower efficiency.

8. Improved public relations so necessary in selling your programs and profession to club officials, and so necessary in dealing with the golfing public in the more complicated era ahead. In the era ahead to accomplish this public relations improvement the superintendent must take on the polished look for the manager, and develop the glib tongue of the professional added to the authoritative stature of the plant scientist - this will be the new image of tomorrow's professional superintendent.

9. Reach out for new educational opportunities.
   Rapid technological changes ahead will quickly pass by the superintendent who does not keep up, and advance with the growing technology.
   Tomorrow there will be no displaced "farmers" to fall back on. We must teach and train new help.
   Our Association (G.C.S.A.A.) must take the responsiblity and leadership in training tomorrow's superintendents.
   As individuals, the superintendent must realize that his future in tomorrow's rapidly growing world will depend upon his outlook towards learning. He must grow or grope.. There will be no place tomorrow for the status quo. You will either go up or down and you individually will determine your own direction of travel.

10. Expand his leadership in golf. More and more it becomes evident that the determining factor in successful golf club operation lies with the grounds operation - WHY?

    Because most of the variables in other departments of golf are controllable - while inplant sciences we are dealing with variables less under our control (diseases - insects - weather, etc.). So our knowledge (superintendents) and ability to predict and cope with natures problems becomes the focal point of the golf club's success. Thus if our superintendents will - he can become the real leader focal point in golf.

But he must recognize the opportunity ahead and rapidly shift to gain respect, stature and leadership ability so that he can reach out to grasp this responsibility. He must husband this new responsibility wisely and prove to the golfing public the real role of the professional superintendent in tomorrow's game of golf.

This 10 point program, Gentlemen, offers an insight on the potential problems and the challenges and the real opportunities in tomorrow's era of golf.

Thank you.

PRESENT STATUS AND PROBLEMS IN TURF DEVELOPMENT AND MANAGEMENT FOR PUBLIC SCHOOLS

Frank Hyde
Director of School Properties
Andrews Independent Schools
Andrews, Texas

It would be a difficult task to trace with any degree of accuracy the manner in which turfgrass began to play its role in our public schools. I find it even more difficult to review the present status of turfgrass in our public schools without first reviewing the past. So, if you do not mind, let us pretend that we are artists. Our assignment is to paint a scene from memory. Most of us can remember our elementary and high school days and the beloved old school sites. So, let's each do a landscape study of the school sites where we attended public school.

If it were possible for everyone here to put on display his "painting" at this very moment, I am sure we would see many interesting scenes. I am afraid that my painting would reflect a rather desolate scene. We would see an old wood framed two story building with a fire escape crawling up one side of it. Over the site or school yard, as it was called, there would be a multitude of misplaced trees with a couple of basketball courts wedged in where space permitted. We would see large patches of weeds growing here and there over the site. Most of the grounds would look like a rodeo arena. And to complete the scene, I would have to add a few boys with mud encrusted feet chasing a few hogs that just happened to show up while sack lunches were being enjoyed by all. I couldn't resist the temptation to include a few of the big boys, standing just beyond the barbed wire fence that surrounded the old school yard, rolling Bull Durham cigarettes and apparently cursing the new fangled P. E. program.

I hope your memories of your beloved old school sites served up a better picture than the one just described. I feel, however, that my "picture" helps to remind us just how far we have advanced in school plant design, planning and construction during the past thirty years. As I look back over the years trying to determine the present status of turfgrass in our public schools, I find it is hard indeed to keep from drawing upon my own personal experiences.

What I am about to relate is probably far removed from the normal development and use of turfgrass areas in our public schools. It may serve, however, as a kind of unfounded history that we may follow and believe, up to a point.

The development and use of turfgrass in many public schools has evolved in the following manner. Not too many years ago when a new school was built there would be some native grass that would survive the construction period. It would begin to grow in patches over the site and with the opening of school each year, it was either ignored completely or scraped off with hoes. A little later, the persistent grass established a "beach head" next to the building, in many cases; and to everyones surprise, it recovered year after year from every possible assault. Finally, the school janitor or an energetic P.T.A. worker brought out a lawn mower and gave the old grass a good "haircut". After a few mowings, it began to look so good that it was decided to let it spread over the whole site. Making the history short, many schools found themselves in the business of turf establishment and maintenance.

It would be foolish to say that this is the way public schools have incorporated the use of turfgrass into the physical plant. We are all aware of the many factors that have influenced the wider use and acceptance of turf by public schools. There is the matter of curriculum change going back tothe introduction of physical education programs, more emphasis upon competitive sports such as high school football and organized, supervised playground activities. The impact of a changing economy has affected an upgrading of school facilities in many areas of our state. We can think of numerous things that have influenced a wider use of turfgrass by our public schools and I am sure the factors of influence will vary from one school system to another.

As most of you know, the public schools of Texas have just completed a five year program of self-evaluation. The purposes of the program have been directed toward the improvement of each and every public school in the state. The primary purpose of the program was to help each school improve its educational program so that it would comply with the standards and principles of accreditation. I believe that during the past five years more attention has been focused upon the public schools of our state than ever before. Attention to every component of the public school has pointed up the fact that classroom space alone does not make up the learning environment. This is spelled out in the supplement to Bulletin #560 of the Texas Education Agency, entitled; "Principles and Standards for Accrediting Elementary and Secondary Schools." Principle XI begins with this statement: "The school plant is suitable in design and size to meet the needs of the instructional program of the community...

There are sixteen standards under Principle XI dealing with the school plant. Of particular interest to us are the following standards.

1. "The school site is easily and safely accessible for pupils

walking or being transported to school and is provided with playground facilities designed for safe use. The grounds are landscaped, clean and attractive, and free from safety hazards."

7. "School plant facilities are designed to promote use by the community."

10. "Maintenance service is available, as needed, to all units of the system to maintain adequately the facilities..."

The principle and standards cited point up the fact that our public school facilities are undergoing a major change. It would be interesting to consider the many changes we have seen in recent years in school plant planning , design and construction. Time will not permit such a review, but I am sure we can readily see that the use of turfgrass is being expanded in our public schools. We now recognize the importance of the role turfgrass plays in the public school facility. And because of its important role, many schools are finding that a grounds program requires more than the voluntary services of the school janitor or energetic P.T.A. member. Therefore, it seems that we may draw the conclusion that the present status of turfgrass in our public schools shows much promise. We recognize its many tangible and intangible values. It is considered an asset tothe school plant. Because of its present role and value to the public school it is natural, therefore, that it creates some problems and responsibilities.

One of the first problems we are faced with is the establishment of turfgrass areas in the landscape of the new school site. I refer to a new school site primarily because it lends the greatest opportunity for planning a step by step program of turf establishment.

In the Andrews schools we have experienced a variety of problems in establishing turfgrass areas. During the past five years we have added a little over one hundred acres of grounds to our schools. We now have one hundred and forty-seven acres of grounds. With the growth we have experienced, we have had our share of problems in developing new sites. The problems we have experienced may be peculiar to our area, but there are certain things that would apply elsewhere. Some of the things we have experienced are:

1. The Need for Early Planning

We have found that as soon as possible after the architects have been hired to plan a new building with us, it is profitable to discuss our site development plans with them. By doing this, a number of problems can be avoided and planning the establishment of turfgrass areas can be made easier.

These things may at first seem far removed from the actual procedure of establishing turf on the new site. From experience we have found it good practice to have the following things clarified and written into specifications if necessary.

2. Clearing of the site and disposal of debris.

If this is clarified at the beginning, the possibility of burial pits being dug on the site can be ruled out. The exact responsibility of the contractors can be spelled out so that you are not left with a major job of cleaning up the site.

3. Sub-grading, breaking the hard pan and finish grades.

These things can usually be added to the dirt contractors job at a cost below what the school would have to pay at some later date or if school employees and equipment were used.

4. Stock piling top-soil.

In some cases it pays to make this a part of the contract. By doing so it helps avoid the possibility of having the site stripped of the top soil and used as fill for the building areas.

5. Copies of or access to topographic surveys of the site and test-hole information.

This can be helpful in planning the turfgrass areas. In some cases you may find there are outcroppings of caliche or some drastic change in the soil formation over the site. Such things will demand some planning to overcome immediate and future problems related to establishment and maintenance of turf.

6. A master landscape plant to be furnished well in advance of the date the school is to begin landscaping the site.

It is always profitable to review the landscape plans with staff members of the school and particularly with the principal who is to be in charge. He may have some specific short or long-term plans for the use of certain areas on the site that could call for a change in the final location of turfgrass areas.

The greatest advantage, however, in having master landscape plan to study before site development begins is that a costly maintenance program can be sharply curtailed or avoided.

7. Provision for ample water mains and outlets for site irrigation.

Architects seem to have a habit of overlooking the fact that a good water supply will be needed for the new site. Usually a few hose bibbs around the building are provided but little thought is given to the water needs of the site unless you insist on it.

8. Site delivery to the school.

In many schools it is common practice for the local board of trustees not to accept the school site until the building or buildings on it have been completed. Again in many cases, the completion date of buildings by the contractor coincides with the beginning of school in September. This means that it is next to impossible to establish turfgrass areas until the following year. If plans are made and agreements worked out in advance it is possible to have a great portion of the site well established to turf before the buildings are completed.

9. Planning the budget.

Everything mentioned thus far is reflected in one way or

another in a budget. When a budget for developing a new site is made, it should be the end result of a lot of careful planning. The acreage to be established to turfgrass must be determined and a step by step analysis of expected costs made. This would include seed, fertilizer, insecticides, equipment and every anticipated cost related to establishment and maintenance of the turfgrass areas.

It should be mentioned here that those of us who are charged with the responsibility of developing and maintaining a grounds program for public schools must constantly keep in mind our responsibility related to the budget. Every cent spent for grounds development and maintenance is reflected in the per capita cost of education. It behoves us therefore, to make every dollar we spend count toward a better school facility without unnecessarily increasing the per capita cost of education.

To sum up briefly at this point, it would seem that the most important thing in planning the establishment of turfgrass in the public school site is to plan early, plan thoroughly and have time for study of the plans and for revision of them if necessary. To state it another way, early planning is the basic need in the program of turfgrass development and management for public schools.

We have grown into some specific management practices related to our turfgrass in the Andrews schools. I would not say the practices are all good or bad. For us they seem to be worthwhile. I should mention that we use common bermudagrass throughout the system with the exception of relatively small areas in academic malls and patios where we have St. Augustinegrass and Tifgreen.

Some of our management practices with common bermudagrass are:

1. To use seed instead of sprigs when developing a new area. By doing so we avoid the problem of "hilling" or minature sand dunes building up around each sprig of grass. Normally we use two hundred pounds of extra fancy select hulled bermudagrass per acre. This gives us complete coverage when it comes up. Because of our wind erosion problems, it is of primary importance that we strive for complete and rapid coverage of the area.
2. We have found that it pays to roll the seedbed and firm up the soil immediately after seeding.
3. Take it easy, so to speak, when seeding large areas. It is a big temptation to seed a twelve acre site for example all at once. We prepare no more seedbed and seed no more than we can safely handle.
4. After seeding an area, we appoint a "nursemaid crew" to look after it until the grass is established. This may sound strange, but in our area if the seedbed dries out and the wind hits we are likely to lose not only the seed but the seedbed as well.

5. After the new turfgrass area has been established and is ready for mowing, we set the reel type mowers as low as we can get them. Attention is given to the condition of the mowing equipment. A dull mower can play havoc with young bermudagrass by bruising it or even pulling it up. Close mowing continues until the turf is fully established. The frequency of mowing is governed by the rate of growth. We try to avoid removing no more than one-half inch of leaf surface at any mowing and especially when the grass is very young.

6. A preventive program of treating all turfgrass areas with dieldrin to check possible grub worm or other subterranean insect damage is in effect at all times. Fifty per-cent wettable dieldrin powder is applied at the rate of nine pounds per acre per year.

7. A record of fertilizer applications is maintained. We have found that it is not a good idea to trust ones memory when you have numerous sites to maintain.

8. A systematic maintenance check of all equipment related to the turfgrass program pays dividends. Equipment operators must be trained and guided to develop some personal concern about the equipment they use.

9. Evaluate every piece of equipment and be sure that it is doing the job it was designed to do.

10. The grounds crew participates in an informal in-service training program. An attempt is made to inform each employee of his responsibilities in such a way that he develops an interest in his work and takes personal pride in doing each job well.

In closing, I would like to sum up the present status and problems; future outlook, programs and needs in turf development and management for public schools as viewed by one, who like many others in public schools, finds himself involved in the turf business.

Our public school facilities are expanding and growing as never before. Turfgrass plays an important role in the school plant. Educators will continue to evaluate the many tangible and intangible benefits derived from turfgrass in the public school facility. Public schools, generally speaking, are awakening tothe need for planning and putting into effect programs designed to meet their needs in turf development and management.

It would seem, therefore, that those of us charged with the responsibility of developing and maintaining public school sites will be facing some very definite challenges in the future. A well-planned turfgrass program can alleviate the task of site development and maintenance. The turfgrass in our schools will continue to represent a considerable investment. The dividends to be received are many but dependent largely upon planning and management practices.

PROBLEMS AND TRENDS OF COLLEGE CAMPUS MAINTENANCE

D. R. Thornton, Superintendent
Grounds Maintenance Department, College Station
Texas

The college campus in the United States has made great strides in development and redevelopment within the last ten to fifteen years.

Many weed patches have been transformed into green lawn areas, and many narrow gravel walkways have been replaced by wide, modern, concrete walks.

This trend of redevelopment and modernization of old landscaped areas continues at the present time and involves mainly the following four items:

(1) Rerouting and widening of walks.
(2) Redevelopment of lawn areas.
(3) Replanting of shrubs and base plantings.
(4) Year-around flower displays.

In the following discussion, I would like to consider briefly each of these four trends.

Rerouting and Widening of Walks:

The rather large problem of rerouting and widening walks on the college campus has been in progress for the last several years. This redevelopment has been necessary due to the large explosion of college students during the last ten years.

In developing new walks the study of student traffic is the first step. Many times the paths made across lawn areas indicate the best walk locations. Where possible walks should be routed reasonably close to these traffic areas. If this is used as guide, walks are more likely to be used. If walks are planned for the sake of pattern alone however, it is necessary many times to force traffic to the walks through the use of landscape plantings.

In the construction of new walks six feet has been set as the minimum width while eight and ten foot walks are standard in heavy traffic areas. Where possible new walks running parallel with streets are being constructed against the curb to eliminate unnecessary edging and the problem of mowing and maintaining curb panel strips.

The grounds department of a college in North Texas has greatly cut the cost of walk construction on that campus by eliminating reinforcement in all but a few twelve foot crossmarked sections that serve

as equipment crossings. They have also set a minimum width of ten feet on main entrance walks to buildings. This allows vehicle deliveries to buildings without damage to lawns.

In the future other ideas like these will be needed to ease the maintenance load.

Lawn Redevelopment:

At Texas A & M the major problem of campus redevelopment is the reworking of lawn areas.

This task in many cases involves complete excavation to a depth of eight to twelve inches or more. This is due to the large amount of brick, cinders and other construction materials buried a few inches under the surface.

This excavation is of course very expensive. However, it is necessary if the end result is to be a beautiful, green lawn.

In backfilling these areas a good topsoil with five pounds of 12-12-12 or similar complete fertilizer added per cubic yard of soil is used. This gives the new grass a good start and greatly speeds coverage.

Another costly item in lawn redevelopment is the installation of underground sprinkler systems.

Since 1950, $31,000.00 has been spent by Texas A & M on sprinkler systems. All but a small portion of this system is of the pop-up type. P.V.C. plastic pipe and fittings have been used in all of these systems with the exception of one. The average cost per sprinkler head on our pop-up system is $13.00. Our quick-coupling systems cost $72.00 per head installed.

In the future rotary pop-up systems controlled by time clocks are being planned. The labor savings onthis type system will greatly aid our overall maintenance in the future and more than justify the higher cost of installation.

The selection of a turfgrass for general use on the A & M campus was an easy task. Common Bermuda grass was the easy choice due to the availability of seed and the low cost of establishing a lawn.

T-47 Bermuda (Texturf 10) is also slated for general campus use as soon as sod is available from our new turfgrass nursery.

Tifgreen Bermuda grass which is now used around the College Chapel as a special purpose grass will be used only in special show places due

to the extra maintenance and special mowers necessary to keep it in good condition.

St. Augustinegrass at the present time is not scheduled for general use due to disease, mowing, and thatch build-up problems. If in the future a satisfactory control for brown patch is developed, St. Augustine will again be considered for general campus use.

In the last few years Meyer Zoysia has been tried on the campus with hopes that it would be the answer to a great many turf problems. However, it has proven to be agreat disappointment. We find it very slow and difficult to establish, intollerant of shade, and very sensitive to cold weather and frost. This fall it became dormant three weeks ahead of Bermudagrass lawns.

The grass does have several good points however, even though it is not what we had hoped it would be. The grass has an excellent glossy green color in summer and requires less mowing to keep it in top condition. It also has a somewhat slower lateral growth rate when compared with Bermuda grass and therefore requires less edging around shrub beds and walks.

The bad points of the grass however, in our opinion, far outweigh the good points and it is no longer considered for campus use.

Replanting of Shrubs and Base Plantings:

Another major job in campus redevelopment is the replacement of over grown shrubs and base plantings. In accomplishing this task the first consideration is the development of a good design. In the development of this design the selection of plant materials is very important to future maintenance. Care should be taken to select plants that require a minimum of maintenance.

A list of the better low maintenance plants for the A & M College-South Texas Area is as follows:

GROUND COVERS

Low Types:

Trachelospermum Asiaticum--Japanese Star Jasmine
Trachelospermum Jasmoides--Chinese Star Jasmine
Vinca Species--Periwinkle
Liriope Species--Liriope
Juniperus Horizontalis--Horizontal Juniper
Juniperus Chinensis Sargent--Sargent Juniper
Gelsemium Sempervirens--Carolina Jessamine
Lonicera Species--Honeysuckle

High Types:
Juniperus Sabina Tamarix--Tamarix Juniper
Juniperus Chinensis Compact Pfitzer--Dwarf Chinese Pfitzer
Ilex Vomitoria Dwarf--Dwarf Yaupon
Plumbago Capensis--Plumbago
Lantana Sellowiana--Trailing Lantana

SHRUBS

Dwarf Shrubs: (1 to 3 feet high)
Ilex Vomitoria Dwarf--Dwarf Yaupon
Punica Granatum Dwarf--Dwarf Pomegranate
Juniperus Chinensis Compact Pfitzer--Chinese Pfitzer
Juniperus Sabina Tamarix--Tamarix Juniper
Buxus Harlandi--Box
Hypericum Species--Hypericum
Lantana Camara--Lantana

Medium Shrubs: (3 to10 feet high)
Abelia Grandiflora--Glossy Abelia
Ilex Vomitoria--Yaupon
Raphiolepis Indica--Raphiolepis
Viburnum Suspensum--Sandankwa Viburnum
Feijoa Sellowiana--Feijoa
Ilex Cornuta Burford--Burford Holly
Callistemon Lanceolatus--Bottle-Brush
Juniperus Chinensis Pfitzer--Chinese Pfitzers
Legustrum Japonicum--Wax Leaf
Nandina Domestica--Nandina
Pittosporum Tobira--Pittosporum

Large Shrubs: (10 to 25 feet high)
Ilex Vomitoria--Yaupon
Lagerstroemia Indica--Crapemyrtle
Nerium Oleander--Oleander
Photinia Serrulata--Photinia
Punica Granatum--Pomegranate
Feijoa Sellowiana--Feijoa
Eleagnus Pungens--Eleagnus
Pyracantha Coccinea--Firethorn
Eriobotrya Japonica--Loquat

TREES

Small trees:
Eriobotrya Japonica--Loquat
Ilex Vomitoria--Yaupon
Juniperus Chinensis Twisted--Twisted Juniper

Koelreuteria Apiculata--Goldenraintree
Lagerstroemia Indica--Crapemyrtle
Malus Purpuria Eley--Eley Purple Crabapple
Parkinsonia Aculeata--Retama
Prunus Persica Scleropersica--Double Flowering Peach

Large Trees:
Albizzia Julibrissin--Mimosa
Cedrus Atlantica--Atlas Cedar
Cedrus Deodara--Deodar Cedar
Cedrus Libani--Cedar-of-Lebanon
Eucalyptus Pulverlenta--Dollarleaf Eucalyptus
Gleditsia Triocanthos Thornless Moraine--Moraine Locust
Liquidambar Styraciflua--American Sweetgum
Pinus Taeda--Loblolly Pine
Pistacia Chinensis--Chinese Pistache
Plantanus Occidentalis--American Planetree
Quercus Lyrata--Overcup Oak
Quercus Macrocarpa--Bur Oak
Quercus Nigra--Water Oak
Quercus Phellos--Willow Oak
Quercus Shumardi--Shumard Oak
Quercus Virginiana--Live Oak
Sapium Sebiferum--Chinese Tallowtree
Taxodium Distichum--Common Baldcypress
Ulmus Crassifolia--Cedar Elm
Ulmus Parvifolia--Chinese Elm

This list of plants is not intended as a complete list for this area but rather as a selection of the better plants, maintenance wise, that are now in use on the A & M Campus.

After the development of a good design proper planting is then of importance. In the planting of shrubs and trees special care should be used in the preparation of planting pits. A pit two feet wider and one foot deeper than the plant ball being planted should be used. Refill soil should be mixed with five pounds of a complete fertilizer to each cubic yard of soil to give the plant a good start.

Ground cover beds should be prepared by tilling to a depth of ten to twelve inches. A complete fertilizer and one part peat moss to three parts soil should then be thoroughly mixed in.

After the bed is completely mixed a complete sterilization with Dowfume MC-2 is recommended. This kills all insects, weed seeds, and soil diseases and gives the new plants a chance to become well established before weed competition can develop.

With a good landscape design, good healthy plants, and well prepared planting pits a new landscape planting will develop and make a good showing in a fairly short period of time.

Year-Around Flower Displays

Another trend on college campuses in the last few years has been the use of year-around flower displays. These displays require a great deal of time and maintenance but are more than worth the effort required to produce them.

The planting schedule for the A & M campus begins in early February with the planting of tulip bulbs. These bulbs remain in the ground and bloom for three or four weeks beginning about mid-March. Some good varieties include "City of Haarlem" and Red Emperor"--two good red varieties; "Mrs. J. T. Scheepers"--a good pure yellow variety; "Glacier"--an excellent white variety; and "Princess Elizabeth"--a very pretty pink variety.

Following the tulips a large summer planting is undertaken. This planting for the coming year includes five varieties of caladiums for use in shady locations, Pink Satin and Commanche petunias, fountain grass, red salvia, pansies, perriwinkle to name only a few.

These plantings give color until late September when chrysanthemums are planted for late fall color. Red, yellow and pink Delaware chrysanthemums are very good bedding mums for the A & M area.

The mum planting is then followed by a planting of pansies and stock which give color through the winter months.

This flower schedule provides year-around color on the A & M Campus and draws more public comment than all other maintenance operation combined. We think it is well worth the effort we put into it.

Summary

College campuses in the past fifteen years have been involved in a program of redevelopment and modernization to meet the requirement of a fast growing population. The redevelopment in so far as campus maintenance is concerned is directed mainly to the widening and rerouting of walks, the redevelopment of lawn areas, the replanting of shrubs and base plantings and the planting and maintenance of year-around flower displays.

CEMETERY TURF

Ed Daniel, Director
Parks and Recreation Department
Odessa, Texas

It is wonderful to once again attend a Texas Turfgrass Conference. This Association has certainly grown since its beginning. I was a student here at Texas A & M when the Texas Turf Association, as it was then known, was founded. This Association and its members has done a lot for me. I always pick up a lot of information at these conferences and certainly enjoy them. However, many of my professors who taught me while I was a student here are urged to comment as the old Methodist preacher did about one of his members. This preacher was good in his profession and also very witty upon occassions. He was holding a revival and had just completed delivering a very inspiring sermon when up the isle came this member who had been regularly converted during each revival for the past several years. He says, "Lord, here I am, Save me! Fill me full!" The preacher could be heard to comment, "Don't do it, Lord! He leaks!" Yes, I will admit, I do leak. I need this association and conference to put back that which has leaked out and to add a little bit more.

I intended to bring my turf foreman with me, but two or three things came up which prevented my doing so; namely, pennies, nickels, and dollars. His name is Stevenson, and we call him Steve for short. Steve is responsible for all fertilizing, mowing, and weed spraying of our turf areas. He does a good job at it, too, when we will let him alone. Steve works five days one week and six the next. You can probably guess what he does on practically every Saturday he is off; he does the same thing at home on his home lawn that he has done all week at the Park Department, and like most turfgrass people, his home lawn gets under his skin sometimes.

About four or five Saturdays ago, Steve was doing as usual, following the bosses orders, mowing, trimming, and edging his own lawn. It was a hot day too. Steve was just about to call it a day and go have a cool, shower that is, when a lady in a big Cadillac drove up and hollered at him. She ask him if he did lawn work, Steve thought a minute glancing back over his beautiful lawn before answering, "Yes, Mam." The woman then ask him what he charged. He was taken back a little, but quickly recovered and replied, "This woman here lets me sleep with her." The Cadillac left in a cloud of smoke.

Have you ever wondered how a cemetery got started? I am sure you watch T.V. Ever see Matt Dillon wandering through the markers on Boot Hill, or have you seen the late Seth Adam's Wagon Train when a member of the train, who is killed by Indians or dies a natural death, is left in that lonely grave beside the trail. Many of our cemeteries began just like that. It is from this that possibly the phrase was coined "desolate

as a cemetery." No trees, flowers, or grass; nothing but weathered headstones tilted at various angles. It was true that the cemetery was desolate.

Then came the community project. About once a year, the community would have a cemetery cleanup day. Everyone in the community turned out to chop weeds, rake trash, and remound the graves. They would work all day with each bringing their picnic lunches. At the end of the day, they would walk off and leave the cemetery for another year; to grow up with weeds, to become littered with trash, and for the graves to sink in again.

Eventually, some civic-minded soul approached the city or county governing body and requested that a man be employed to take care of the cemetery. He could plant flowers, grass, and trees, plus digging the graves. Every lot owner and every green thumb in the community was this man's boss; fifty different people a day, with fifty different sets of orders on how to plant, water, and mow grass. This type of operation was followed up until not too many years ago. Within the last twenty years, the memorial or perpetual care type cemeteries came into existence. These are privately-owned cemeteries, designed and laid out with ease of maintenance their main objective. We find this type of cemetery in more and more demand.

Some of the inherited obstacles we find in most cemeteries, which are hardest to overcome are graves too close together with individual markers and arborvitaes planted on each corner which have grown together almost wholly covering the lot. We find practically every variety of grass known, with orders from one lot owner not to let the Jones's Bermuda crowd out my St. Augustine; do not let the Rye grass get on my lot; do not run that 32" mower over my lot, use a hand mower; be sure to water my lot every morning. These are just a few of these inherited obstacles. Please keep in mind though, that we are talking about plots ten by ten or twenty by twenty lying side by side.

How do you overcome these things? It isn't easy. Much time has to be spent with lot owners, garden clubs, plus your cemetery or park board trying to show them the advantages of a well-rounded maintenance program of watering, mowing, fertilizing, spraying, etc. You should make an attempt to get the same people to attend such conferences as these. Slowly you make progress, and eventually will get to follow most of your suggested ways. You have weeds; you have flowers; and you have grass burrs. The problem is how do you spray for weeds without damaging, or at least, being accused of damaging the petunias. You have to be careful, and in many cases use hand labor to prevent damaging the trees and shrubs with spray materials.

The future of cemetery turf looks much brighter. Equipment manufacturers are now making equipment that is more adaptable to cemetery maintenance. Mowers with which you can mow closer to markers without

damaging them, and with which a man can cover more area in a day are now on the market. Trimmers and edgers, with which a man can trim a round markers and curbs much easier and quicker can be had today. Less and less hand work is being done, or rather is necessary to be done in cemeteries today. Mechanical diggers are replacing the air compressors, just as air compressors once reduced the amount of pick and shovel work necessary for opening and closing graves. Modern irrigation equipment is being more and more utilized in cemeteries. We have come from the hose and sprinkler to the aluminum pipe, to the quick coupling systems, and now to the semi-automatic and automatic systems. We are using more and more fertilizer because we have found in so doing, not only do we produce better turf, but in most cases, we are using less water. This is important, more especially in our semi-arid areas. Water is costly and sometimes very, very limited; even with your own wells. Wise and judicial use of water pays off from both the budget side of the ledger and from the growing of better and healthier turf. Makers of cemetery markers are beginning to design their markers to make maintenance around them easier.

There are more hardier and better varieties of grass available for cemetery use, grasses which are easier to establish and easier to maintain. These same grasses are creating better public relations for cemeteries. Not necessarily the turf by itself, but by allowing more time for maintenance personnel to care for and plant more flowers and shrubs in properly designed and prepared beds.

PRESENT STATUS AND PROBLEMS IN TURF DEVELOPMENT AND MANAGEMENT FOR PARKS

Spencer P. Ellis, Director
Parks and Recreation Department
Wichita Falls, Texas

Yesterday afternoon, four of my distinguished colleagues discussed these same topics as they related to other facilities. Dr. Nutter discussed golf courses; Mr. Hyde discussed public schools; Mr. Thornton discussed colleges; and my former partner in crime, Ed Daniel, discussed cemeteries. This morning I would like to talk with you about some of the problems facing the park end of turfgrass management. Basically, everything that was said yesterday applies to parks as well, although the specific instance may be somewhat different. The general practices and problems of turf management are the same whether they be on a golf putting green or on a softball field.

Good turfgrass in park areas is extremely important and has many functional purposes in addition to its asthetic values. Of course there are many problems facing us today and a great deal of research is being conducted in order to solve these problems. We are continually striving to arrive at the perfect solution. Geneticists are developing new and improved varieties of grasses. Biologists and entomologists are attempting to provide better controls for diseases and insects. Chemists and agronomists are striving to concoct the perfect chemical compound for weed control and fertilization; while the equipment manufacturers are doing their utmost to provide us with perfect maintenance tools. Regardless of all this high-powered assistance, we are still responsible for applying the products of their labor by proper management. In effect, you and I are still responsible for solving our own problems.

What are some of the problems we are faced with in turf management today? Let's look at a few slides and see if we can come up with some solutions.

1. As I said previously, park turf has a functional as well as asthetic value. (Montreal Botanical Garden)
2. The fine turf completes the picture, provides a ground cover and a restful green carpet. (Capitol Grounds, Denver)
3. Again you can see the value of good turf. (City Park, Denver)
4. This, gentlemen, is what we are all striving for. This lawn of 328 Bermuda is properly maintained and managed. (Breckenridge Park, San Antonio)
5. Unfortunately, most park turf areas look like this. This is very poor turf. The soil is low in fertility (especially nitrogen), has never been cultivated, and receives little if any irrigation. Consequently...sad grass. (Hamilton Park, Wichita Falls)

6. This is common bermuda and illustrates a rather unusual problem. You will notice the dead spot in the center of the slide and the luxurient growth around this dead spot. This is not mechanical damage and no diseases are present. Have you diagnosed the problem and figured out a solution? This problem is caused by a leak in a natural gas line. (Weeks Park, Wichita Falls)
7. This is a new area that has just been planted. It is irrigated and will eventually become fine turf, however, since the grass is not well established, some cool season weeds are present. Frost will stop some of them and the clover can be removed with chemicals. (Breckenridge Park, San Antonio)
8. This slide represents two problems in management -- compaction due to foot traffic and low fertility. (Breckenridge Park, San Antonio)
9. Here is a problem that is always with us when a curb is used to separate turf areas from other surfaces. Good maintenance requires that this area be edged regularly. (Breckenridge Park, San Antonio)
10. Another constant problem. Sidewalks must be edged for appearance sake and the grass should be removed from the cracks by chemical or mechanical means. (Breckenridge Park, San Antonio)
11. Notice the area immediately behind the swing set where the grass is worn out. Regardless of how hard we try it is sometimes impossible to grow turf. This is a good example of one of those "sometimes". The solution to this problem would be to extend the asphalt surface to include the area that receives intensive wear. (Breckenridge Park, San Antonio)
12. We all have softball fields to maintain and if more than one game per day is played on a softball field it is usually impossible to maintain a turf infield. Therefore, the solution is to skin the area completely. This facilitates easier maintenance in that the infield can be dragged with equipment and speeds up the preparation of the field for play. This grass could also stand a good fertilization program. (Breckenridge Park, San Antonio)
13. St. Augustine is our best turf for shaded areas, however, it will not stand traffic. This slide illustrates three problems. A sprinkler system was recently installed and you can pick out the ditches by the darker grass. This indicates that a cultivation of the entire area would be helpful. The grass needs fertilizing and some of the grass shows evidence of chlorosis. (Breckenridge Park Zoo, San Antonio)
14. This slide illustrates another phase of management and maintenance. The grass needs cutting for one thing but pay particular attention to the row of posts inthe right foreground. The grass must be removed around each post in order to have a well-groomed appearance. This can be done mechanically or with some of our new contact killers. It may also be possible to sterilize the soil with a chemical such as CMU. (jefferson Park, Wichita Falls)

15. Not too much imagination is required to pick out the problem here. First and foremost this grass needs cutting. Secondly, the turf could be improved by fertilization and irrigation. (Caswell Park, Austin)
16. This slide illustrates the improper use of turf. Again it is impossible to grow grass under heavy traffic. The solution to this problem is the installation of a sidewalk. (Riverside Cemetery, Wichita Falls)
17. Here is a serious problem -- nut grass. As far as I know there is no simple and easy way to get rid of this pest except to move off and leave it. (Breckenridge Park, San Antonio)
18. But I can say this much -- if it is not controlled, it soon looks like this. (Riverside Cemetery, Wichita Falls)
19. This St. Augustinegrass needs cutting. (Riverside Cemetery, Wichita Falls)
20. This poor turf is the result of poor management. The area does not receive any irrigation and is seldom fertilized, consequently just weeds and nut grass -- no turf. (Riverside Cemetery, Wichita Falls)
21. What is the problem on this common bermuda? It is not water because the area has been properly watered. It is not nutrients because it has been properly fertilized. It is not compaction because it has been aerified every 6 weeks. There are two things wrong with this area. First, the salt content of the soil is high and second there have been two frosts on the area and the grass is about to go dormant. (Park Office, Wichita Falls)
22. This slide illustrates two problems in maintenance. First, the curb must be edged and secondly the gravel parking area should be sterilized to kill the grass. (Park Office, Wichita Falls)
23. This problem occurs around every tree in all parks. How do we get rid of this grass around the base of the tree? There are three basic ways. (1) Trim the grass with a mechanical piece of equipment such as a Dilly or Trimo. (2) Remove the grass physically with a hoe or clippers. (3) Remove or retard the growth of the grass chemically. The latter method is cheaper in the long run, however, extreme caution should be used in the selection of the chemical agent because some chemicals will also kill the tree. (Park Office, Wichita Falls)
24. The proper grass must be selected. As you know, it is next to impossible to grow bermuda in heavy shade. Therefore, St. Augustine is used in this area. (Caswell Park, Austin)
25. This slide illustrates chlorosis in St. Augustine and is caused by the inability of the plant to extract the iron molecule from the soil. This can be remedied by addition of iron sulfate. (Caswell Park, Austin)
26. St. Augustine and bermuda ordinarily do not mix. Generally, St. Augustine will crowd bermuda out if sufficient nutrients and water are available. In this slide, again, a cutting is in order. (Caswell Park, Austin)

27. This Bermuda lawn was very healthy until the week before the picture was taken. Good watering and fertilizing practices were followed and no diseases or insects are present. I might point out that this situation occurs every fall without fail in the Wichita Falls area. This, gentlemen, is the result of light frost that has killed the tender growth...
28. and left the older grass still green. (Home lawn, Wichita Falls)
29. There are three problems shown on this slide. The Dallas grass in the foreground and the purple headed crab grass in the center can be controlled chemically but the nut grass continues to thrive. (Auditorium Lawn, Wichita Falls)
30. You people from South Texas should be familiar with this disease. Do you recognize this fungus on St. Augustine? (Louisiana Parkway, Corpus Christi)
31. If not, look at this close-up. (Louisiana Parkway, Corpus Christi)
32. You should have diagnosed this problem as large brown patch. It is often fatal but can be controlled by spraying with tersan and related compounds. The cost of controlling this fungus in a large park system, however, is usually so great that it cannot be done economically. (Louisiana Parkway, Corpus Chrisit)
33. Do you recognize this problem? It is not a disease nor lack of water or fertilizer. If you look closely you can detect that the tips of the leaves were torn off instead of being cut. The solution -- use a sharp, well-adjusted mower. (Lindale Park, Corpus Christi)
34. What's the problem here? Poor management, since a turf is almost non-existant. This area should be renovated, grass planted and good watering and fertilizing practices instigated. (Travis Park, San Antonio)
35. This new 328 Bermuda is beginning to deplete the nitrogen initially available in the soil and needs fertilizing. (Breckenridge Park, San Antonio)
36. This slide is a close-up of the previous picture. (Breckenridge Park, San Antonio)
37. Equipment must be properly adjusted. This bermuda was scalped because the mower was set too low. (Breckenridge Park, San Antonio)
38. Gentlemen, so far we have hardly mentioned water, and no one can deny that water is important. But...(Great Falls, Potomac River)
39. Regardless of how much water you have, it must be properly applied... (Buchanan Fountain, Chicago)
40. and in the right places. In this aerial view of a golf course you can easily pick out the fairways that have been watered. (Wichita Falls Country Club)
41. Because if you do not water properly, your parks look like this. (Ranch near Stephenville)

42. or like this. (Signal Peak near El Paso)
43. When good management practices are followed and you solve all your problems, your parks will look like this. (White House, Washington, D.C.)

PROBLEMS AND TRENDS OF HIGHWAY TURF ESTABLISHMENT

Roy Rodman, Superintendent
Landscape Architect, Texas Highway Department
Austin

It is strange to the casual observer's thinking that the Highway Department is probably the largest grower of Turf in the State. This same observer, however, expects the right-of-way to have a pleasing appearance and to be in harmony with adjoining property. The aesthetic value received from the use of Turf does not measure up to the economic results that it gives in preventing erosion and stablilizing the road-bed. In maintaining the necessary Turf, we have additional economic benefits that result in a safer highway for the motoring public by providing flatter slopes, better vision, more pleasing appearance and a feeling of greater safety.

Having a system of State Maintained Highways totalling more than 61,000 miles you can see that our land holdings are large. It is not possible to definitely acertain the exact acreage, but it is estimated that we have approximately 500,000 acres of turf areas on our highway system. The expressway or freeway really does require acreage as the width of the right-of-way varies from 300 feet upward depending upon the terrain. Where two expressways cross the area required for this interchange, ranges from 100 to 150 acres and generally speaking approximately one half of this area will be in turf.

The turf that is used on a Farm-to-Market Road and the maintenance of it is not the same as that for a State or US Highway or an Express-way. Neither is the turf on anyone of these highways the same through-

out the state. The degree of maintenance that is given to the turf generally varies according to the volume of traffic that is using the highway. This variation also is the result of the rainfall and climatical conditions that occur over the State.

Along the coast in the Southeast part of the state, you will find quite a bit of Centipede and St. Augustinegrass on our expressways. The rest of the state where we have a normal rainfall above 30 inches you will generally find Bermuda. For that area having rainfall under 30 inches, you will find that we use the native grasses except in the urban areas. Where the city will provide the water, we install a sprinkler system and use Bermuda generally. We attempt to maintain a turf area in the Urban Areas in a neatly trimmed condition as obtained with reel type mowers and trimming of grass along curbs. This effort is made so as to provide a highway facility that will not be a blight to the adjoining property.

In mentioning the various grasses on our right-of-way in various areas of the state, we do not have a pure stand of this particular grass as it is impossible without a heavy expenditure and it would not be justified. Motor vehicles traveling the highway along with the wind and runoff water are constantly bringing in various weeds and grasses. Another feature of our work that has received public acclaim is our native wild flowers that we preserve and encourage their growth on the right-of-way particularly during the early spring, all of which gives a mixture of plants for a vegetative cover to prevent erosion.

Through experience we have found that if you will not work against

nature that she will do a creditable job of providing a vegetative cover under certain conditions. In the hill country of Texas when a new road is constructed, the slopes are generally protected with a covering of small rocks which stablize the soil from wind or water erosion. Within a year or two, the wind will bring in sufficient native grass seeds to give us a very good cover. Even in the area of the state where we have serious erosion, if our maintenance operations are properly timed and handled we can get nature to give us a big assist.

In establishing turf on newly constructed areas our standard specifications call for it to be either byvegetative planting or by seeding. Under vegetative planting, we have Spot Sodding--St. Augustinegrass or Bermudagrass--Block Sodding, Broadcast Sprigging, and Mulch Sodding. Our seeding methods are Broadcast Seeding, Disked Seeding, Straw Mulch Seeding, and Asphalt Mulch Seeding. Time does not permit a detailed study of our various specifications, but generally, all our sodding methods involve the use of rhizomes and soil being brought in in various ways. With the sodding we use 300 pounds of 16-8-8 or 16-20-0 fertilizer per acre, depending upon the area of the state. Under each of the four methods of seeding, we have seven types or mixtures of seed that we use. At the time of seeding, we use 400 pounds of either 16-8-8 or 16-20-0 fertilizer per acre. Heavy use of fertilizer has proved to be a very effective way to secure a good quick vegetative cover. In recent years, we have done a few experimental jobs in which we have used agricultural lime in the eastern part of the state and we have found it to be beneficial.

On express ways carrying heavy columes of traffic, it is imperative that we have a method of sodding or seeding of steep slopes that will keep the dirt off the travelway if we have a rain before the vegetative cover is provided in order to protect the motorist. Some of the ways that we eliminate this is by the use of straw mulch, asphalt mulch, or use a quick germinating seed for a temporary or nurse crop with watering to further speed growth. There are numerous other mannerisms that we are forced to use to provide a safe facility for the traveling public while we are establishing a turf, but time will not permit their enumberation.

In establishing a turf on the right of way throughout the state, we do not have any one or two methods of one or two grasses that can be used to the exclusion of all others for a particular job. It is necessary that each job be designed according to its needs at an economical cost. An effort has been made to give you an overall viewpoint of our problems and our solution to them that we have evolved in the past thirty years. A few comments regarding the following slides will probably give you a much better understanding.

DEVELOPMENT, LABELING AND DISTRIBUTION OF TURFGRASS PESTICIDE CHEMICALS

Dr. J. Everett Bussart, Chief Entomologist
Velsicol Chemical Corporation
Chicago, Illinois

My topic is "Development, Labeling and Distribution of Turfgrass Pesticide Chemicals". I wonder what thoughts this title brings to each of you here today. To business executives it probably creates visions of new uses for chemical products and the economic implications involved. To salesmen it may raise expectations for new lines of persuasion to complement those that may have lost their freshness. To technologists it could recall memories of endless laboratory and field testing. To theoretical scientists it may give hopes of a new "break-through" in the scientific field. To the consumer, it may give a feeling of satisfaction to know a new potent chemical is available. Or, it also may bring confusion as to availability and proper use for this material. At any rate, it is a subject that is much broader than the simple title may imply.

When invited to present this topic, I thought of the extremely broad subject and could hardly visualize discussing this topic in 30 minutes. Then I considered the part Velsicol Chemical Corporation has had in the turfgrass chemical control program. As you know, chlordane and heptachlor have wide acceptance of usage in the various insect control programs. Also, chlordane has gained acceptance as a pre-emergence application for crabgrass control. Just at this time we are evaluating other chemicals for use in the Turfgrass Pasticide Chemical Control Programs such as a fungicide for the control of various diseases of turf and also some selective herbicides. Hence, with products now being used as well as others being evaluated in the Turfgrass Control Programs, I believe you can realize we have faced this topic various times and I speak from experiences in the various steps necessary in placing a new product on the market.

First, let us look at the subject in relation to the broader aspects of the producing and consuming public with which a pesticide is ultimately concerned. Turfgrass pesticides must be used under a variety of soils and climate and management practices that are constantly changing. As a result, the circumstances under which a turfgrass pesticide is used are never the same from State to State or even from one town to another and even within a given area. The control of the pests has to be attempted under these diverse conditions.

Furthermore, living things have great powers to adapt to environmental change and the agricultural environment is changing both naturally and through the efforts of man. Thus, when a new pesticide is applied, it is introduced into a situation that is living and changing and may even be changed as result of the application.

Let us now consider the responsibilities of the various agencies concerned with the development and use of a new turfgrass pesticide. Various Federal Experiment Stations, State Experiments Stations, and other institutions which may or may not be privately owned, contribute to the knowledge of a pesticide through both testing and research. However, I propose to refer mainly to the responsibilities of the chemical industry and of Federal or State Government Offices that are vitally concerned.

Industry's essential objectives are to develop new pesticides and to get them legally on the market with as little delay as possible. Since industry develops new pesticides for sale, it has the primary interest in securing the information required by law for registering such products for sale. This would entail responsibility for securing physical and chemical properties of the pesticide, procuring reliable data on the toxicity to various pests, plants, warm-blooded animals, including the applicator, fish or wildlife as well as to provide the essential information for pharmacological purposes. To carry out these responsibilites, industry must undertake the synthesis of new chemical compounds and the study of their evaluation in tests to determine the performance under field conditions similar to those for which their use will be recommended. Individual companies may vary in whole or in part in discharging these responsibilities but usually they supply samples of the candidate pesticide to Federal or State Experiment Stations for evaluation.

Possibly the easiest way to show the progress or development of a new pesticide is to follow the outline to show the steps in development and marketing of a chemical. Each stage of development, such as biology, chemistry or toxicology are being evaluated simultaneously, however, for the ease of following the stages of development we will follow each individually up to marketing.

BIOLOGY - From various evaluation studies it is necessary to compile data to determine the pests against which the chemical is effective. Also to establish the correct dosage to apply as well as the proper timing of applications. It is necessary to determine the effects of temperature, light, rain, soil type and fertility on the effectiveness of the candidate material. As indicated in the outline, initial screening tests will give an indication of the possible pests that may be controlled. This is followed by laboratory or small plot tests to establish the dosage needed to give effective control. Finally, large scale or field tests are used to secure information on the control obtained under similar application methods as will be used by the ultimate consumer when the chemical is marketed. The last step before placing a material on the market is to secure label registration from the U.S. Department of Agriculture as well as individual States that have Pesticide Laws. Naturally, all information obtained from the entire outline are necessary in securing the label registration. All the claims we make on a lable must be carefully worded since they must be the truth in the language the consumer understands.

CHEMISTRY - The outline for chemistry has been divided into three studies in the development of a turfgrass pesticide until marketed. Possibly these divisions could be called Production, Formulations and Analytical.

A. Formulation - A proper formulation is necessary since this often determines the success or failure of a pesticide. Various types of formulations are emulsifiable concentrate, wettable powder, dust or granular. The formulation must be easy to use, designed to get the chemical to the site of action in the most efficient form, and must be economical.

The chemical must be stable in storage for periods of a year or longer and must not be affected by extremes in temperature from below 0°F. to above 100°F. The formulation must not separate nor block during this storage period since many formulations have separated or hardened such as a chunk of concrete 6 months later.

Containers and container weights must be determined in this development program. This would include the size and type of container, whether glass, stainless steel, plain iron, or resin-lined. Those of you that have not had the experience of being uable to get 2 pounds of material in a 5 pound container have not adequately investigated bulk density of the new product.

The chemical properties of the new product must be developed and placed in the technical literature at the time the product is introduced to the market.

B. Production - The first laboratory prepared sample is very small such as 1 or 2 grams or less. If this sample shows promise in the preliminary screening evaluation tests, then slightly larger samples must be prepared until the product is ready to be moved into the pilot plant. Process development is necessary to find how the product can be made most economically - first in the pilot plant and finally in the large scale plant. This process development should begin as soon as a new pesticide shows promise in order to supply quantities of the product for development purposes and operating data for the design of large scale plant.

Engineering is necessary for the design, erection and initial operation of the most economical plant. The Chemical Engineering Department prepares a report at this stage which furnishes rough estimates of costs and return on investment at estimated sales prices and volumes.

Concurrent with the later stages of research and the engineering and erecting of suitable production facilities, a market development must be considered. This market study would determine the possible markets as well as the potential for each market. All of this survey is necessary to provide the Chemical Engineers with enough information as to the possible size of the production plant to produce the necessary quantity of the new pesticide.

C. Analytical - If a pesticide is to be used on food crops it is

necessary to develop a chemical analysis method to establish the possible residues on the raw agricultural crop harvested. These residues are not as important when the pesticide is applied to turfgrass, however, a chemical cannot be developed for a specific use but must be included in various control programs to provide sufficient production to insure economical use. If no residues are found, then the product may be registered on a "no-residue" basis under the Federal Insecticide, Fungicide and Rodenticide Act.

When residues are found to occur on food crops, a tolerance must be established by a petition to the U.S. Department of Agriculture and the Food and Drug Administration. The USDA decides if the product is useful and renders an opinion as to the correctness of the residue data. The Food and Drug Administration then examines the amount of residues found and if not considered harmful at the levels found will publish the tolerance. The USDA will then register an appropriate label for the pesticide.

C. TOXICOLOGY - The first preliminary acute tests are made on rats or other laboratory animals to determine the range of toxicity to warm-blooded animals. If the pesticide shows promise then long term animal feeding studies are run concurrently with the large scale biology field studies. The compound is added in various dosage levels to the diets of rats and perhaps other animals. The effects on the animals are carefully noted and compared at various dietary levels.

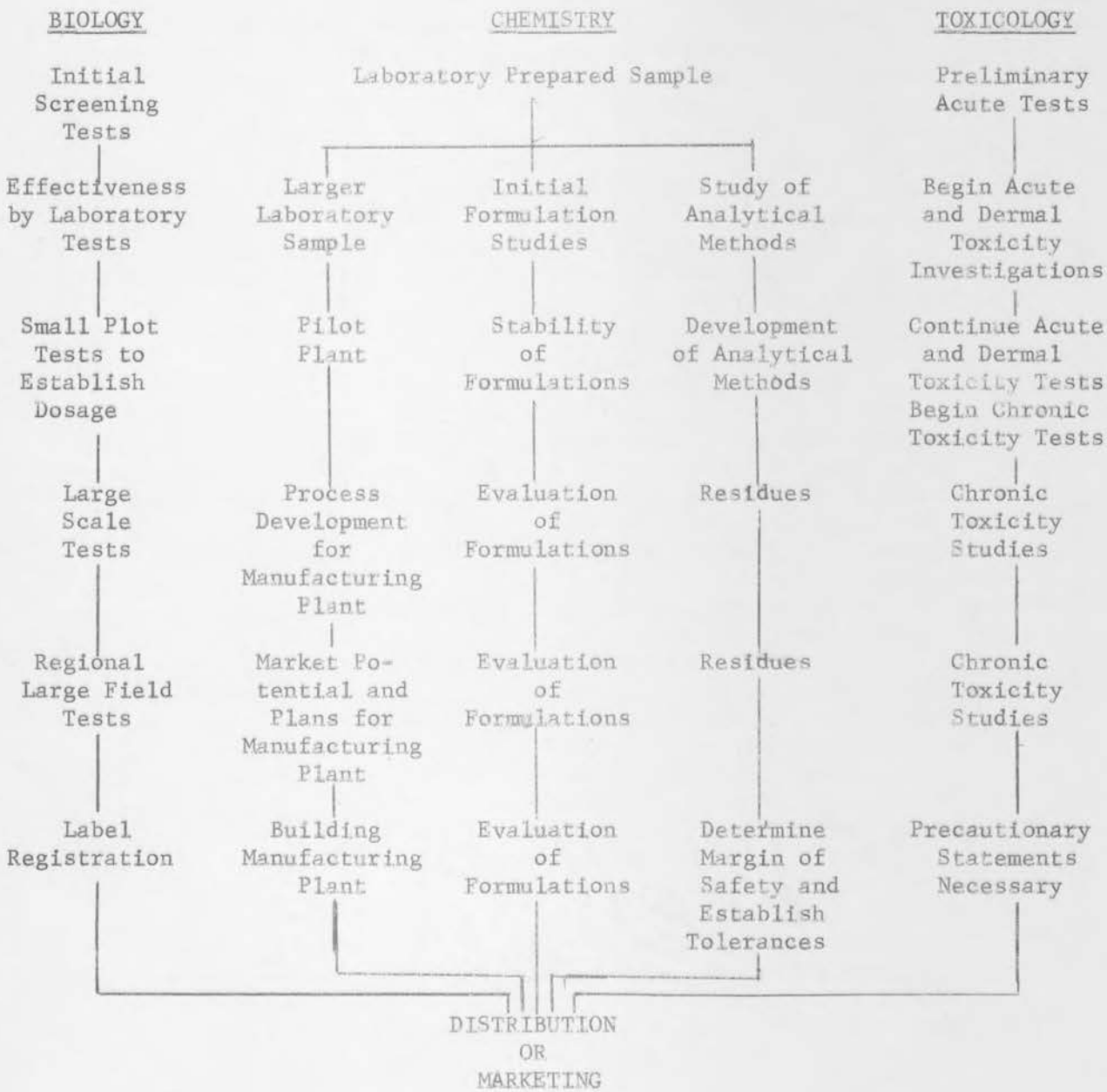
During the course of the experiments, periodic examinations are made of the blood and general condition of the animals along with organ function tests. Periodically during the feeding tests, small groups of the animals are sacrificed and detailed examinations of their tissues are made. At the termination of the experiments the remainder are sacrificed and carefully examined.

By applying appropriate safety factors to these long-term studies, it is possible to estimate the amount of the residue which will be safe in human food.

After the toxicity studies are completed and the results fully evaluated the necessary precautionary statements that may be necessary on labels for safe use of the pesticide are established.

Finally you may be interested in the possible cost in developing a pesticide through all of these research programs which involves three or more years. The outline gives an estimated cost for the development of a new pesticide. It is difficult to give an accurate estimate of the total costs for development but it is commonly agreed that it will vary from $775,000 to over $3,000,000.

DEVELOPMENT, LABELING AND DISTRIBUTION OF TURFGRASS PESTICIDE CHEMICALS



ESTIMATED COSTS FOR DEVELOPMENT OF A NEW PESTICIDE CHEMICAL

	Estimated Cost in Thousands of Dollars
1 - Synthesis 100 - 1500 Compounds	$ 50 - $ 150
2 - Preliminary Screening	
3 - Market Analysis	
4 - Select about 10 Most Promising Compounds	50 - 150
5 - Prepare 50 - 500 Grams Each	
6 - Secondary Screening	
7 - Acute Toxicology	
8 - Phytotoxicity Testing	
9 - Patent Applications	
10 - Select 1-3 Compounds, prepare 25 - 100 Pounds	75 - 300
11 - Analytical Methods Development	
12 - Biological Performance Field Tests	
13 - Start Chronic Toxicity Studies	
14 - Flavor and Quality Studies	
15 - Residue Analysis	
16 - Formulation Studies	
17 - Experimental Label Registration	
18 - Pilot Plant Production - 1 Compound	100 - 500
19 - Advanced Field Testing and Comparisons	
20 - Residue Analysis	
21 - Conclude Toxicology Studies	
22 - Process Studies and Plant Design	
23 - Petitions for Tolerances	
24 - Label Registration	
25 - Build Full Scale Manufacturing Facilities	500 - 2,000
26 - Packaging Chemical	
27 - Labeling Chemical	
28 - Sales Literature	
29 - Recommendations	
30 - Market Expansion	
Total Costs.....	$775,000 - $3,100,000

TURFGRASS SURVEY

W. Wayne Allen, Regional Agronomist
U. S. Golf Association Green Section, College Station
Texas

Your organization, The Texas Turfgrass Association, recently made a grant to the Texas Agricultural Experiment Station for the purpose of conducting a survey of the turfgrass in Texas. Actual work on the survey has begun and this presentation will summarize the present status of the work.

For the sake of clarity the following is taken from the Project Outline (Proj. No. S-1258)

"Reasons for Undertaking the Work:

Turf production is an agricultural enterprise which until recent years had received relatively little attention from the standpoint of research. Yet, when the many and varied uses of turf are considered, it is probably the most important agricultural enterprise in the United States. Some of these uses include home lawns, school grounds, athletic fields, city parks, golf courses, cemeteries, industrial sites, highway rights-of-way, and air fields. A recent estimate showed nearly 14 million acres of all kinds of turf in the United States. Only a few accurate figures are available on the size and maintenance costs of the turf enterprise but it is estimated that the annual maintenance costs is close to 3 billion dollars. Turfgrass production requires various degrees of management depending on the types and degrees of usage. The growing of grass on a golf green is one of the most intensive and intricate production problems encountered in agriculture while the growing of turf on air fields may require relatively little attention. The growing of turf requires various degrees of fertilization, watering, mowing and disease and insect control depending on the area of the state concerned, type of grass and use being made of the turf.

This survey should provide useful information on types of grasses and extent of usages and maintenance costs for fertilization, mowing, watering, insect control, disease control and other types of maintenance expenditures for each of several types of turf. This information will be useful in determining the importance of turf and turf research needs. The information will aid in evaluation and reorientation of the existing turf research program and in developing realistic budget needs and requirements. Finally, a better knowledge of the scope of turfgrass production and management and the problems involved should make it possible to better serve the public in the development of better grasses and improved maintenance practices.

Previous Work and Present Outlook:

An estimate of the number of home lawns and the types of grasses being used was obtained through the cooperation of county agricultural agents in 1951. At that time there were an estimated 1,225,000 home lawns in Texas. The important grass species were Bermuda (61%) and St. Augustine (34%). Other grasses were of minor importance. No information was obtained on maintenance practices or the costs involved.

A survey of the type suggested here was conducted in Los Angeles county, California in 1954. The results of this survey were summarized and published in a brochure sponsored and printed by the Southern California Golf Association. The Los Angeles county survey included the cost of establishment as well as the annual maintenance cost. The annual maintenance cost for all types of turf was estimated at more than 90 million dollars for Los Angeles county.

The Texas Turfgrass Association has expressed an interest in a turfgrass survey for the State of Texas and is making a grant of funds for the purpose of supporting such a survey. Because of the impracticability of determining the total number of home lawns or the total acres of the various types of turf in the state, the survey will attempt to develop the information on a per capita basis for cities or counties with various population or in some cases on a per unit area basis."

Several types of turf will be surveyed. Progress on the work which has begun will be summarized.

City Parks

City population was the criterion upon which our random sampling was based. Three categories were used and they are as follows:

Category	I	Population of 10.0 to 24.9 thousand
"	II	" " 25.0 to 74.9 "
"	III	" " 75.0 and above

Cities to which questionnaires have been sent are as follows:

Category I	Borger, Mineral Wells, Henderson, Bay City, San Marcos, Pecos, Mercedes.
Category II	Garland, Longview, Pasadena, Temple, Big Spring, McAllen.
Category III	Lubbock, Wichita Falls, Houston, Austin, Odessa, Corpus Christi.

Each has been returned except Mineral Wells, Bay City, Pasadena, San Marcos, Pecos, Mercedes and McAllen.

Even though no tabulation has started, some interesting observations can be made. Labor expenditures: consistently the greatest figure reported with the single exception being that of total investment in underground irrigation systems. This could be expected because the investment in irrigation systems accumulates. Problems such as invasion of cool-season weeds, invasion of warm-season weeds, general management, water management and excessive foot traffic have been listed as big turf problems. Reports of cost of commercial fertilizer used ranged from zero to several thousand dollars. Expenditures for insecticides, fungicides and herbicides have ranged from zero to about $3,000. These figures illustrate one definite point and that is the value of random selections and large samples. (In this case many cities). The size of our sample is larger than required statistically so we feel that we are well within the limits.

Home Lawns

The work on this phase of the survey thus far has been that of selecting the sample. Each individual to be questioned will receive a card 10 - 14 days prior to his interview. The cards will contain information about the survey, a copy of the information requested and mainly a plea for their cooperation. At present the cards are being printed. This phase of the survey will be pushed forward soon after January 1. According to present plans, the services of professional telephone interviewers will be used. Each of the 3,000 residences in Texas to be contacted will be contacted by telephone to obtain the data for the home lawn phase of the survey.

School Lawns

Based upon estimated populations each county was placed in one of five categories:

Category	Population (thousands)
1	less than 10.0
2	10.0 - 24.9
3	25.0 - 74.9
4	75.0 - 99.9
5	100.0 - above

One county from each category was randomly selected to be sampled. Every school superintendent in these counties was sent a questionnaire which resulted in 170 questionnaires. The overall

percentage of returned questionnaires is presently 73%. The percentage return by regions is as follows:

Panhandle 89%; North Texas 73%; Gulf Coast 74%; East Texas 78%; Central Texas 71%; West Texas 65%; South Texas 53%. After the first questionnaire was sent and a reasonable time was allowed for replies, a second was sent which resulted in several more replies.

Detailed tabulation will be postponed until we feel that we have received all the questionnaires that will be sent. An interesting point is that approximately half of all the questionnaires returned up to now were returned within the first week. The mail left the campus on a Monday and on Thursday and Friday many had been completed and returned.

While no tabulation has been started there are some observations that can be made. For example, it is evident that the records kept vary considerably from school to school and the various budget items certainly vary (as would be expected!) The problems which seem to be most critical are those of excessive foot traffic in congested areas, water management, weed invasions (both cool-and warm-season weeds) and a few have limited proper fertilization program.

The wide range of degree of maintenance is very evident. The relative degree of maintenance would certainly be hard to determine. However, one cooperative superintendent wrote this: "We have no football field - very little grass, a lot of weeds, one small mower." His report was just as welcome as any other.

PUBLIC AND PRIVATE SUPPORT FOR TURFGRASS RESEARCH

R. D. Lewis, Director
Texas Agricultural Experiment Station
College Station, Texas

It has been stated that grass is the best common denominator between town and country. Yet the public in general takes grass and turf for granted. The public must be made to appreciate the value and importance of grass and turf in order to get increased public support for turf research. Even in publications dealing with grass, such as the 1948 Yearbook of Agriculture entitled "Grass", there is relatively little mention of grass for turf. The expanding field of Agriculture, sometimes referred to as "Agribusiness" includes not only the production of crops and livestock but those industries which supply Agriculture with pesticide chemicals, fertilizer, gas, oil, etc. Included in this great business also is the processing, transportation and marketing of agricultural products. The public needs to be made aware of the fact that these and many other phases not mentioned are a part of the field of Agriculture. Even though only about 10 percent of the population lives on farms, a far greater percentage is involved in Agriculture. This same vertical relationship applies in the special field of turf when we consider not only the production of turf but also the industry which supplies seed, fertilizer, pesticide chemicals and equipment and finally the utilization of turf.

In the Texas Agricultural Experiment Station there are some 45 research locations. The work at these many locations is divided into 25 research programs and carried on under some 430 research projects. Only a few of these projects specifically mention turf, but many of them have to do with water, insects, diseases and grasses all of which have a direct bearing on turf. A project devoted to the introduction and preliminary evaluation of new plants has resulted in the release of more than one improved turf grass variety. Some of the sources of funds for research are the general revenue or state appropriated funds, federally appropriated or Hatch funds, funds from the operation of the state chemist and feed control services, funds from the sale of agricultural products. Funds from the above sources are used both directly and indirectly in conducting turf research.

Another important source of funds is grants from organizations and industry interested in turf research. Your own organization has contributed significantly to the furtherance of turf research. The turfgrass usage survey now being sponsored should have a significant influence in the future. The United States Golf Association Green

Section has made a grant of $2000 annually for more than 5 years. Other grantors include duPont, Mathieson, California Spray-Chemical Corp., Stauffer, Upjohn, and Cleary.

In addition to these monetary grants, significant contributions of supplies, services and equipment have been made by Goldthwaites Texas Toro Company, Watson Distributing Company and Jacobsen Manufacturing Co.

You as an interested turt grower have an opportunity and a responsibility to inform others including your legislators of the value and importance of turf and the need for turf research.

TURF PROBLEMS AND MAINTENANCE PRACTICES - PAST, PRESENT AND FUTURE

James M. Latham, Jr., Agronomist
Milwaukee Sewerage Commission
Milwaukee, Wisconsin

"In recent years, practices in golf courses maintenance have changed considerably. The putting green mowers formerly did not cut the grasses as close as they do today. We used to cut the putting greens every other day; now, we are compelled to cut them every day. With few exceptions most putting greens were a mixture of creeping bent, fescue, Poa trivialis, Poa annua, and clover. Yesterday, chemicals on a golf course were in very limited use; today, with the big array of chemicals being advertised as fertilizers, fungicides, insecticides, or what not, the greenkeeper must have some technical information, or a source from which he can obtain such information, unless he is to become a victim of the salesman with the best line of talk. While we all realize that the best education he may get is from practical experience, yet I am of the opinion that knowledge along theoretical lines is helpful." 1/

In the 31 year period since this was published, attitudes have changed very little. The same things are being said today, but consider what we have to work with in comparison to 1929.

In those days the "acid-era" of turf management was at its peak. The use of lead arsenate was still being studied by experiment stations. Although it had been advocated 8 years earlier in Illinois, the usefulness of sodium arsenite would not be proven until Fred Grau's work in

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1/ John Morley in The Bulletin of the USGA Green Section, Feb., 1929.

1932 and 1933. The fungicidal properties of mercurial compounds had been recognized for only a few years. Commercial fertilizers were just becoming accepted. Gasoline powered equipment was coming into widespread usage. Green committee chairmen were boasting about maintaining a 9 hole golf course with only 5 men.

Aren't we saying the same thing today? These comments are almost as timely today as 30 years ago. They mean much more to us, because of the broadening of turf research facilities all over the country. Problems still exist, however. Even though few in number, their solution will mean a great deal to the turfgrass grower.

There are 4 all-time problems that continually face the turf worker: Nature, People, Labor and Money.

The blessings of nature - flood, drought, heat and cold can be accepted.

The ravages of people, however, are a never ending puzzle. Vandalism and carelessness are inexcusable but common. Besides just damage, one golf course has reported the theft of a green. A cemetery publication regularly has a page devoted to the latest methods of vandalism.

Adequate amounts and quality of labor are problems becoming more and more acute. Even at today's comparably low wage scale to turf workers, 60% to 70% of a golf course budget is devoted to labor.

Money is everyone's problem. Golf course budgets are bigger than ever, but insufficient to fulfill the desires of some golfers.

Schools in most areas cost so much that there are no funds left

for adequate grounds maintenance. Old cemeteries are feeling the pinch because lot sales in the not-so-distant past did not adequately project maintenance cost rises.

Present turf management problems are few, but are formidable. Compaction due to heavy use of turf should probably head the list. Almost all turf areas are being used now more than ever before. Equipment is available to partially counteract this, but more traffic can be expected.

Golf greens will be better because of the leadership of the USGA Green Section work on soil mixtures. Specifications for construction have been drawn up for building greens. Research here at A & M has provided the first concrete ideas for scientifically combining top-soil constituents into a compaction resistant mixture.

The Pennsylvania Turfgrass Foundation has recently published specifications for the construction of athletic fields. The July, 1960 issue of The Golf Course Reporter reprinted this and added sections on maintenance and renovation. Both publications should be of interest to those working in this field.

Golf course architecture is improving so that machine maintenance is more feasible and most architects are making attempts to provide the maximum usable putting surface for play rather than artistry. While on this subject, mention should be made of the larger number of golf courses being poorly built today, in spite of the great amount of information available for use. Too many courses are being forced to rebuild greens only 2 or 3 years after original construction.

New grasses being developed today are excellent in their potential turf quality. Most of them, however, require close management to keep them at their high potential. Penncross bent and Tifgreen bermudagrass are examples of this.

If a turfgrass supervisor bought all the equipment he could use on a given area, his shed size would be doubled. Selective buying of quality equipment allows him to make maximum use of the labor available. Mechanization is the basis of modern turfgrass work.

The chemical industry has made great strides in the turfgrass field. Consider the problems today:

Diseases: Pythium aphanidermatum (cottony blight) is about the only one that cannot be prevented. New diseases are showing up, however, such as Ophiobolis spot in the Northwest. Striped smut of Merion bluegrass in the Northeast. Spring dead spot of bermuda in the crabgrass belt.

Weeds: Poa annua and nutgrass are about all that are not easily controlled. 2,4-D and related compounds, DSMA and its relatives of other arsenicals, have pretty well taken care of things. Newer and even more efficient materials are being developed.

Insects: No major problems exist if damage is recognized in time.

Management of turf areas is being improved all the time. The circle of events is being completed in one instance where the swing is again going toward the use of compost for topdressing greens. Since

good topsoil is becoming increasingly hard to get, it must be made.

Machines are being built for rapid soil sterilization. Screening has improved, but the preparation of soil is still the most laborious single operation facing golf course superintendents.

In recent years the laurel wreath for progress should go to three groups: the military, cemetery, and highway maintenance workers. These people have recognized the value of turfgrass and are making the most of it at very low costs. They have utilized the low maintenance grasses to the utmost, but have amply supplied the grasses needs. In the Southeast, Bahia, carpet and centipede grasses are being exploited to provide low cost turf for erosion control and good appearance.

Future problems that face the turfgrass business are of great magnitude. Of prime importance is supervising personnel. The long hours and relatively low pay are not too conducive to the modern American boy. The necessary period of apprenticeship, although highly important, is especially trying to one with a college background.

Golf courses, parks, and other turfed areas of the future will probably be located in marginal areas. The trend is already evident in Florida. One golf course there required one million cubic yards of earth to fill in a swamp on which it was built.

We can look forward to ever increasing use of outdoor facilities for recreation. A 20 or 30 hour work week has already been proposed. Night work has been necessary in some areas to mow, topdress and cultivate the turf. Football fields will host 30 to 50 games each season

and more can be expected.

On the brighter side, though we can expect increasingly effective pest control. Longer residual, more active material will be developed. A satisfactory pre-emergence wee control is a certainty.

Grass variety work going on today will be increased. Can you imagine a bermudagrass that needs mowing only once a week or less? Heat and drought tolerant bent grasses?

The mechanical revolution is continuing so we can expect more efficient, trouble-free equipment to be developed.

The superintendents, in cooperation with experiment stations will develop better management programs to provide the type turf desired. With the tremendous nationwide interest in turfgrass management today, tomorrow will bring the efficient management required for heavily used, high quality turfgrasses.

SHADE TREE FERTILIZATION

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Fertilization is one of the very important phases of shade tree care. By periodic application of supplemental plant foods, it will strengthen the root system, give richer color and encourage stronger and greater branch and twig growth. Vigorously growing trees are usually less susceptible to the many diseases that endanger weak trees. When the soil is high or in good balance, with required plant food elements, trees will have less dead branches and twigs, buds and leaves will be large and colorful, and new growth will be greater and stronger. Trees lacking required plant foods are ready targets for borers, bark beetles and pathological diseases. It is quite common knowledge that borer and beetle larvae cannot develop under the bark of healthy growing trees. It should be remembered however, that not all tree ailments can be cured or prevented by keeping trees well fertilized. Symptoms that may indicate plant food needs could very well be some other problem. Impressions made in this paper are how fertilization, or lack of it, will affect trees. The terms "fertilizing", "plant food" or "feeding" actually may not be correctly used in that plants really manufacture their own food by their process of growing and living. What we really do is put the necessary elements into the soil so the plants can make use of them.

Diagnosis

While it is not always advisable for one not experienced in shade tree care to diagnose his own problems, there are some things he can look for that might help determine fertilizer needs. One of the first would be soil analysis which can be done by the Agronomy Department at colleges, or accomplished thru the local county agent. These tests will show fertility levels and requirements needed to bring soil to proper growing standards. To obtain soil samples one should take a small earth auger or post hole digger and drill holes at about the ends of the branches under the tree. This is generally the area where the feeding roots are found and where the plant food would be applied. The holes should be about 18 to 24 inches deep and possibly 2 or 3 holes under 1 tree. About a cupfull from each hole is enough to be sent to be tested, and can be sent in most any tight container.

Leaves can also tell us about fertilizer needs. If they are abnormally small by comparison to a tree of the same species, pale in color, or if leaf area on the tree is thin, it could very well indicate plant food needs.

Condition of the branches in general can often be a barometer of

soil conditions. Many small dead twigs and branches, as well as larger branches, can point to a need for fertilizer.

Another helpful method to determine soil deficencies is the length of new growth each year at the ends of branches. New growth begins each growing season from a terminal bud at the tip of a branch, and continues to grow until the end of the season when it forms another new bud. This growth is quite obvious and easy to determine by a ring or callous which forms where the terminal bud was, and the new growth begins. The new growth then would be the distance from the callous, or ring, to the last tip or terminal bud. If this growth is shorter than that on trees of the same species, or gets shorter on the branches each year, it could indicate a need for fertilizer. This growth is usually more evident on the periphery of the tree and less conspicious inside the crown. Moisture can also effect this growth, but in this discussion we are thinking of normal moisture conditions and speaking of fertilizer needs. These symptoms could very well warrant fertilizer applications, but there is another important situation that should not be overlooked. It is probably a condition that is the greatest offender, which is simply where trees are growing too close together. It causes the symptoms mentioned above because there is not enough soil area to supply the demands of an expanding root zone. Most arboriculturists agree that the feeding roots extend to and well beyond the ends of the branches. Therefore a normal growing, properly spaced tree with a 50 foot diameter branch spread would require all the space within that 50 feet diameter for healthy growing habits and plant food needs. It is unnecessary to elaborate on the abuses of improper spacing in tree planting but it does add to tree care problems, plant food deficency being one of them. When trees are young and small, growing on a fixed and unexpandable soil area, their needs may be well satisfied. As they grow larger their needs become greater with root and branch expansion, but the soil area does not. As a result there is likely to be a shortage of necessary plant food, light and space. Careful study and judicial removal along with applications of plant food will greatly improve over crowded growing conditions.

The thoughts presented here on diagnosing fertilizer needs were used as a guide and may not apply in some cases. The conditions mentioned are things to watch for however, in the event there is no professional diagnostician available. Diagnosing tree troubles is almost a study in itself.

Fertilizing Methods

Having made a decision to fertilize, there are a number of ways it can be accomplished and different kinds of materials may be used.

Dry Fertilizer Applied in to the Soil

Perhaps one of the oldest and most commonly used methods to fertilize trees is by using finely ground materials applied into the root zone. This can be done by drilling holes in the soil in an area under the outer tips of the branches. Usually about 3 or 4 rings of holes around the entire tree will give adequate distribution of the material. The holes should be about 18 inches apart and 18 to 24 inches deep. Two inch diameter holes are large enough, and are less conspicious on good turf. The dry material is then filled into the holes to within a few inches of the top to prevent burning of the grass. The amount used in each hole of course will depend on how much fertilizer is being used for the tree. Even distribution into the soil is important; therefore the large number of holes all around the tree. The object to place the holes at ends of the branches is that close to the tree trunk are the larger roots which serve as buttress and anchor roots. Fertilizer and water application close tothe trunk are much less effective. If there is room enough in the holes after fertilizer application they can be filled to grade with sand, peat moss, or the soil from drilling operations can be raked back into the holes. On fine turf the excessive soil can be cleaned up, otherwise can be spread over the area. Because dry fertilizer does not become available to the plant until it is dissolved the fertilized area should be well soaked after application. If the turf area permits, the holes can be left open for nature to fill. In so doing organic matter and water will become easily available to the root zone through the partially open holes. Open holes could be objectionable, however, on fine turf and especially where ladies might walk wearing high heels, because of the injury element.

Some Methods of Making Holes

To make the holes one can use a heavy duty electric drill preferably 5/8 or 3/4 inch size with an earth auger made especially for that purpose inserted into the chuck. The electric drill method leaves a clean hole with no compaction along the edges of the holes, and is quicker and easier. The punch bar method has been used in years past, but was hard work, slow, and the opinions of some was that it left the side of the hole compacted. Another very good method to make holes for dry application is with an air compressor. The compressor is used in place of the electric drill to auger the holes. A special device is attached to the air line which by releasing a valve will blow both air and dry fertilizer into the root zone. The force of the air will loosen the soil and at the same time blow the material into the soil. The attachment for the compressor is available but the entire operation could be costly because of heavy equipment necessary. Some may think the electric drill or air method may be damaging to the roots, but it is felt in the profession that the damage is small compared to the benefits obtained. In the area where the holes are drilled the roots are very small so little damage can be done

by breaking or tearing the roots. This gives two methods with which to use dry fertilizer to be applied.to the root zone, the compressed air machine and electric drill. The electric drill is most commonly used.

Liquied Fertilizing

This method has come into use and is becoming quite popular. The material used is different from that used in dry applications in that it is applied into the root zone in solution. High nitrogen liquid concentrate fertilizer is mixed with water in the sprayer tank and kept agitated during the operation. Some liquid fertilizers come in dry crystal powder and some are concentrated liquids or pastes. These fertilizers dissolve completely in water without any residue, so they may be pumped through a regular hydraulic sprayer. Equipment should be hydraulic sprayer capable of working pressure of between 200 and 300 p.s.i. with about a 250 to 400 gallon tank. A water lance device is attached to the end of the sprayer hose and used to apply the liquid into the root zone. This system is much easier than the dry application, and requires less inserts into the soil than bythe drill method. The lance insertions can be 3 to 5 feet apart and about 24 to 36 inches deep. There is the opinion that it will help loosen the soil because of the high pressure and water volume. The cost of equipment to do liquid fertilizing could be a problem if it were purchased only to do a small job or is not used very often. Most golf courses, park, and commercial arborists have hydraulic sprayers so about the only extra equipment would be the water lance. A water lance can be made with a plumbers "T", a hand valve, a length of pipe about 24 to 26 inches long with a sharp point on one end with four 1/4 inch holes in four directions near the point. The idea of the device is to insert it into the soil and be able to control pressure and flow of liquid with the hand valve. One-half inch I.D. fittings are usually adequate to make a water lance.

Liquid fertilizing probably has advantages over dry fertilizers in that the tree will receive the food faster, since it is already in liquid form. It still must go through a bacterial process to be absorbed by the roots, for a tree which needs feeding and watering in the shortest time possible, liquid feeding seems to be the answer. There is some question as to whether liquid feeding lasts as long in the soil as dry feeding. Urea in liquid fertilizer is known to adhere to soil particles and not leach away as readily as previously thought. Liquid feeding under pressure may distribute the fertilizer faster and better in the soil so that more good is derived from it.

Dry Fertilizer Mixtures

Nitrogen is one of the most important elements in shade tree fertilizer. The generally accepted rate of actual nitrogen per tree is 1/2

pound of actual nitrogen per 1 inch diameter of tree trunk. To determine the amount of fertilizer to use for a certain tree on the basis of 1/2 pound of actual nitrogen per diameter inch, this method can be used. Devide the nitrogen number of the fertilizer into 100, the answer will be the number of pounds of fertilizer it takes to make one actual pound of nitrogen.

Examples

A 20-10-10 analysis fertilizer, 100 ÷ 20 = 5, or 5# of fertilizer to get 1 pound of actual nitrogen.

(a) The amount of 5-6-4 fertilizer to feed a 10 inch tree: 5-6-4; 100 ÷ 5 = 20, 20 x (10x1/2) = 20 x 5 = 100 or 100# fertilizer for a 10 inch tree.
(b) The amount of 10-8-6 fertilizer to feed a 30 inch tree: 10-8-6; 100 ÷ 10 = 10, 10 x (30x1/2) = 10 x 15 = 150 or 150# fertilizer to feed a 30 inch tree.
(c) The amount of 33 1/3 -0-0 fertilizer to feed an 18 inch tree: 33 1/3-0-0; 100 ÷ 33 1/3 = 3, 3 x (18x1/2) = 3 x 9 = 27 or 27# of fertilizer for an 18 inch tree.

For shade tree fertilizing we usually like to use a 10-10-10 or a 12-12-12 analysis, or something with a high nitrogen content.

If soil analyses show no need for anything but nitrogen then amonium nitrate or some other type of high nitrogen fertilizer can be used. The point to remember is 1/2 pound actual nitrogen per diameter inch of tree trunk. Sometimes overfeeding, especially with high nitrogen fertilizer, may cause abnormal growth. Plenty of watering after dry fertilizer applications is important in that the material doesn't become available until it is dissolved.

Dry fertilizer applied into the soil seems to last quite a long time. In March 1955, in Kansas, several trees were fertilized with a 12-12-12 analysis, with the electric drill and auger method. Two years later while digging to install a sprinkler system some of the fertilizer was found in the soil. Laboratory tests showed it still contained about two percent nitrogen. This was in rather heavy soil.

Trees should be fed only enough to keep them healthy. Every year or two should suffice until it grows normal again, and then every 3 to 5 years, if it needs it, to keep it a healthy green color. Some trees may need constant treatment, depending on the conditions in which they are growing. Over crowded growing conditions could be one of them. Iron chlorosis (lack of iron) is a situation which needs frequent attention. It will be mentioned later in this paper.

A formula for making liquid fertilizer from dry materials: use 100 pounds of ammo phos (mono-ammonium phosphate) 13-39-0, and 100 pounds urea (45-0-0). This makes a mixture of 200 pounds of approximate 30-20-0. If potash is needed, add muriate of potash (0-0-60). Twenty pounds of 0-0-60 to 100 pounds of mixture will add 12 pounds of actual potash making a mixture of approximately a 30-20-12.

Using only the nitrogen figure of the mixtures (30-20-0), 3 1/3 pounds of fertilizer must be used to get one pound of actual nitrogen (100 ÷ 30 = 3 1/3). Since five pounds of actual nitrogen are needed for a ten inch tree (one-half pound per diameter inch), a tree of this size will require 16 2/3 (5 x 3 1/3) pounds of the mixture. This 16 2/3 pounds of dry mixture is ready to apply to the soil when mixed with about 100 gallons of water. With high pressure (200 to 300 p.s.i.) and high volume (g.p.m.) equipment this operation is rather time saving over the drill and auger method. Two men can apply 3,000 to 4,000 gallons of this mixture to trees in an eight hour day. This would have to be a very effecient operation however, and various elements could be concerned, such as soil type, water availability, etc.

Amo-phos is about 98 to 99% soluable, so the "clean out" screen in the sprayer must be checked about twice a day to remove that 1 or 2% residue which collects there. Do not use a coarser screen or operate the sprayer without a screen, because small particles of phosphate may become lodged under the valves of the sprayer pump. Two othermixtures that can be used and work well are:

1. 200# ammonium nitrate, and 100# ammo-phos, making a mixture of 26-13-0. This mixture requires 2 pounds to an inch of diameter of tree.
2. 300# ammonium sulphate, and 100# ammo-phos, making a mixture of 19-10-0. This mixture requires about 2 1/2# to an inch of diameter of tree.

Time to Fertilize Trees

Spring is about the best time, but they can be fertilized any time when the fertilizer can be applied into the soil. Springtime is preferred by most arboriculturists because the tree is going into it's peak growing season. Nitrogen is released only when proper soil temperature, moisture and bacterial activity is present to release it. Usually there is more rain in early seasons to help dissolve dry fertilizers and going into the warm weather is another factor. Trees fertilized in spring should produce or show results during that growing season. Because fertilizer, especially dry, works slowly one should not expect real quick results. Late fall, or winter feeding is acceptable, and nitrogen will not leach out very much during cold weather. Usually results will not be seen much sooner than spring feeding. In 1956 trees were fed in mid-February in Kansas with about 1 pound actual nitrogen per diameter inch. Amounts were experimental. About 1000 gallons water was applied around the trees after the operation to help dissolve the material. By mid-May

the results were very evident and adjoining unfed trees could be easily distinguished. There was no apparent damage from over fertilizing. The effects could be noticed for at least 3 years. Late fall and winter fertilizing may have an advantage in that it can be done during what might be a slack time laborwise.

Liquid fertilizing can be done during the growing season and quicker results may be obtained. The fact that it goes into the ground in solution and becomes more readily available has advantages over dry applications. Liquid fertilizers can be added to insecticides and fungicides also, which makes it more economical and can help a tree recover faster from heavy chewing or fungus damage. Fall or winter fertilizing with liquids would be practical also because the tree is dormant then, and the nitrogen would remain in the soil ready for use in the spring growing season.

It is generally accepted that little fertilizing be done after July or August. Some governing factors would be temperature and moisture conditions, but usually the tree is growing least at that time of year and is going into a dormant period. Late winter or spring applications would be much more effective.

Chlorosis of Shade Trees

Chlorosis first appears as a yellowing of the leaves between the veins, gradually includes the entire leaf and finally causes a curling and dying of the margins. In advanced stages it can cause deformed and a die back condition of the branches. Within a few years it can kill a tree. Chlorosis is more often found on pin oaks than other shade trees. It has also been found on broadleaf evergreens, sweet gum, some maples, azaleas and rhododendrons.

The cause is generally considered to be lack of iron, or the inability of the plant to use the iron in the soil. Iron may be in the soil but unavailable to the plant because of unfavorable soil conditions. For iron to remain available the soil should be quite acid.

In central Kansas where pin oaks, or instance, are growing without artificial watering we have found little trouble with chlorosis. High alkali water used for watering pin oaks has resulted in frequent need for treatment of yellowing pin oak trees.

One of the various methods found to be satisfactory for treating chlorotic pin oak trees is the soil treatment. The trees are fertilized in the same manner, with dry fertilizer, as are other shade trees. The material is different however. Material to apply: A mixture of equal parts of iron sulfate (ferrous sulfate), finely ground sulfur, aluminum sulfate, amonium sulfate. Rate of application: Trees - 2 1/2 to 3 pounds

per inch diameter of tree trunk. Use the heavier application for trees over 6 inches diameter and on high alkaline soils. In treating trees for this problem it would be very wise to determine the soil ph first. Shrubs: Applications based on pH of the soil. Apply 1 to 1 1/2 pounds of the mixture for each half pH above pH 6.0 per 100 square feet of the area. The heavier applications can be used on silty or clay soils. Time of application- early in spring or as soon as the symptoms appear in late spring or summer. In the central Kansas area the above treatments for trees has been found to be satisfactory, but less desirable results have been noticed on trees after late July.

Repeat again the following spring if chlorotic symptoms appear on foliage. An ample supply of moisture will aid in the stimulation of growth and give quicker response to the treatment. Another very fast method to get iron into the tree is by injecting iron sulfate into the trunk of the tree. This is done by drilling about 1/2 inch dia. holes into the sapwood area near the outer bark. The holes are drilled in a downward direction near the outside of the tree and not straight into the trunk. The rate of iron sulfate to use is about 1 gram per circumference inch. The material can be obtained in 5 gram capsules and about 1 gram is used in each hole. The holes should be sealed with bees wax or nursery wax. It would also be well to disenfect the holes with mercury bichloride and wood alcohol to help prevent disease fungus. The trunk treatment can be used in connection with the soil treatment for quicker results, but unless it's very necessary, it would be well not to use it. Arborists frown on creating any more bark injuries to tree than absolutely necessary.

There is still a great deal of work being done on chlorosis in trees and shrubs and many materials are being tried. The above methods have given very good results in Kansas and are still widely used in other areas.

Golf Greens Near Trees

This situation may create more problems than just fertilization. From the fertilization standpoint it would seem the liquid method would be about the best, in that the turf would be less disturbed with a water lance. Deep feeding, or application, of the material would be important so the roots would go down for the fertilizer, rather than come up for it, as might be the case with surface applications on the green. In some cases where tree roots have grown into, or near, the surface of the green, a trench has been dug at the edge of the green and a barrier installed. Roots had to be cut of course and then the barrier installed to prevent further growth from going into the green area. A reasonable amount, perhaps 1/3, of the root zone could be cut without too much damage to the tree. The remaining root area should be kept well fertilized.

Fertilizing Lawns to Help Trees

The question is often asked if feeding turf will help trees. Good turf requires a certain amount of nitrogen per year, about 4 pounds actual per 1000 square feet. Some of the elements will naturally leach down into the root zone of the trees. If enough were broadcast on the turf area to satisfy the tree needs, no doubt the turf would be badly burned or even destroyed. Continuity of turf feeding will help trees to be sure, but to give them all that is required they should have deeper applications. It is the opinion of many arborists that surface feeding and watering of turf encourages the roots of trees to grow towards the surface also. This helps create problems in growing good turf because of competition from the tree roots. While surface applications of fertilizer to turf helps trees it is not considered adaquate.

SOUND PROBLEM SOLVING

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From the time we are born, our entire life if affected by sounds. Psychologists tell us that one of the innate or inborn basic fears at birth is a loud noise. From birth we build in our own mind associations with both pleasant and unpleasant sounds and those you hear today have to do with the unpleasantries of mechanical difficulties. Some of the sounds are merely warning signals.

Please do not concern yourself with the technical nature of this presentation because, we are merely going to attempt to make each of you aware of the importance of sounds if properly applied to turf maintenance equipment. Thousands of dollars can be saved with the proper applications of sounds when they are treated as Warning Signals.

The first signal (train whistle) has nothing to do with turf equipment yet all of us readily recognize this sounds as a danger signal. It's true; we do see the sign, Stop, Look and Listen, yet strangely enough we depend a great deal on the sound to tell us whether or not the train is coming and on occasion slide through the crossing.

Another warning signal of a different nature (baby crying) that we are all aware of is that of a child crying. I imagine that anyone who was late in attending this conference is wondering whether or not they are in the right room. I assure you, you are and from here on in sounds will apply to mechanical equipment.

We are introducing today just a <u>few</u> of the many sounds that can effect the operation of equipment and we will show some of the results of operator negligence in not heeding the warning signals given by the equipment.

First, we will view a few of the slides and have a short discussion on each regarding the unnecessary costs that occur in some everday maintenance procedures.

1. The first slide shows a carboned up engine. In itself, no real damage has been done, but the result is excessive fouling of plugs and a loss of power, causing unnecessary delay of time and, of course, time is money to all of us. The sound is a simple one in that the engine runs very quietly because the exhaust gasses cannot escape from the cylinder. A carboned up muffler would emit the same basic sound.

2. Sometimes a "pinging" sound accompanies a condition such as you see on this slide. The condition causes excessive spark plug fouling and again the problem causes unnecessary delay and time-consuming "fixes" instead of remedies. Surely, if the operator's automobile made a strange sound, he would bring it immediately to a garage to determine the malfunction. May I say right here and now, noises in engines do not eliminate themselves. Something or someone causes them to be eliminated. In other words, remedies eliminate problems, not time.
3. The third slide shows dirty air cleaners. While one of the air cleaners on the screen appear to be clean, both of them are plugged sufficiently in order to starve out the engine or cause a choking sound. In the case of a 2-cycle engine, the plugged air cleaner acts very much like a choke and this can be heard easily. Engines will not burn dirt and dirt is the most important source of excessive engine wear. Its presence can cut the life of an engine in half or even considerably more than that. Poor maintenance practices grow to become a costly item in the budget.
4. The next slide displays a piston that has not received sufficient lubrication. Actually the engine has a language of its own. It is necessary for operator, mechanic or foreman to be able to understand this language. The engine from which this piston was removed must have seized at least two or three times prior to its final failure. During this period of seizure a very definite high squealing sound must have been obvious to the operator. Since nothing was done about it, over $60 was spent on the repair of the engine. Suppose this had been a tractor or some other vehicle in the park department equipment pool. This could have resulted in a $300 or $400 repair bill all because the operator failed to listen for the connecting rods knocking or the pistons squealing.
5. This next slide shows a condition of improper oil being used in an engine and excessive heat. The warning signal for the operator should have been a very resounding connecting rod knock for over a period of nearly five hours. Cost of repair to this one-cylinder engine amounted to $56.

One of the very common and yet extremely destructive forms of sabotage to air cooled engines is overspeed. Small engines fortunately have governors which control the top operating speed. Most lawn equipment engines and industrial engines are designed for and rated at speeds up to 3600 R.P.M. Above this rated speed, the life expectancy of the engine is decreased at least 25% for each 400 R.P.M. Unfortunately on small engines, the governor is readily accessible and some operators make unauthorized adjustments to run the machines faster. This, of course, results in very costly maintenance and undue wear to the entire unit. Excessive speeds when pulling gang mowers cause excessive wear. When in transport, Park Department trucks, etc. operated

at road speeds that are not recommended have definitely been the cause of expenses not normally occurred with good operational practices. Many of the park systems have put governors on trucks and tractors to avoid these excessive speeds.

6. Long before the bearing, which you see in this picture, becomes worn to the extent this one is the engine would have a noticeable growl. When the bearing begins to wear, a low-tone howl is readily audible. To replace the bearing in the early stages of its danger "signallying" would probably cost in the neighborhood of $5 yet not replaced in time might, on a small one-cylinder engine, run as high as $40 to $50. This again points out the importance of listening carefully.
7. Here is an example of a shaft on which a pulley rattle, clanked, etc. for over 50 hours. The operator did not call it to the attention of the foreman in time and this resulted in excessive damage being done to not only the pulley and shaft but to the rest of the machine as well. The example does show how completely indifferent some operators are to the sound of turf equipment.
8. We are not displaying these various cases of failure other than to show the importance of sounds when dealing in mechanical equipment. This slide shows what can happen in a gear case on which the worm wheel and worm gear were run without oil for nearly 50 hours. The operator surely must have been aware of the whining sound it made, but did not bring it to the attention of anyone, which resulted in very costly repairs of more than just the gears. Had he just brought it to someone's attention, I am sure this $70 repair bill could have been save. Sound is important, isn't it?

ACTUAL PROBLEM SOUNDS

1. The taping of engine sounds is a difficult one. The engine sound on tape is somewhat different than the actual engine running, however, if one listens carefully to the first engine sound, consider this to be a perfect running unit. (Sound of perfect running engine).
2. The intermittency of firing which you hear as the next sound should surely call something to the attention of the operator. The problem may not be clear but obviously there is something wrong with the ignition system and the problem could be located either in the spark plug, magneto points, condenser or timing. In any event an engine continuing to run in such an intermittent fashion would certainly cause a flooding action such that the engine would not give its full power. The main idea to learn from this sound is that generally on one-cylinder engines this type of intermittent sparking usually indicates ignition problems.
3. Listen carefully to the next sound and compare it to that of

the perfect running engine. (Sound of surging engine). Ostensibly, the engine is not running smoothly and service should be given to the unit. While gross damage would not be done to the engine from this surging, once again overloading of the cylinder could cause flooding and loss of time in correcting the problem. Very often this sound indicates a lean carburetor setting and a half turn on the carburetor could solve the problem. Surging could also cause excessive carboning and spark plug fouling.

4. (Sound of quiet engine). In our first slide today we showed an engine that was completely carboned up. We indicated at that time that the sound would be a muffled sound, therefore, the lack of a sharp report such as is customary with engines. This could indicate a plugged muffler or exhaust ports. Once again we mention these technical items just to show the importance of listening by the operators and foremen in the shop.

5. The next sound you hear is one that was taken just outside of an equipment shed. Fortunately, the foreman recognized the sound. Let's just listen. (Sound of a loose cutter bar on rotary mower). I'd say "fortunately" the foreman recognized the sound and made the man shut off the machine. He then called the mechanic to repair it. The sound you heard was a loose cutter bar on a rotary mower. Actually the damage to the mower itself would be of little consequence but when one thinks of the damage of such a bar sliding off into space, as the engine starts, one realizes the costly law suit or possible permanent maiming of a person near the machine, the sound becomes extremely important.

6. Let's listen to the next sound just for the purpose of orientation of a reel type mower improperly adjusted. I have called on many park department service shops and had the opportunity to observe in the last 15 years some of the practices of operators. The short-sighted view instead of sharpening is to tighten up the reel so that is surely cuts grass. On a recent call when the operator was asked why the reel was so tight he indicated that he was told that it was a self-sharpening unit. Let me say, gentlemen, that to my knowledge there are no self-sharpening or self-correcting mowers in today's market. Theoretically reel-type mowers sharpen themselves but nearly all big users own their own grinding equipment.

7. On the previous slides you had the opportunity to observe a piston that had inadequate lubrication. Listen to this sound. (Engine seizing sound). The squealing sound you have just heard probably took place four or five times before a final seizure stopped the engine permanently. Each time the engine in its own language was attempting to warn the operator of impending failure, the operator failed to heed, or completely disregarded, the warning signal. This negligence caused a very expensive repair bill involving the piston, connecting rod, cylinder, bearings, crankshaft, or in other words practically a new engine.

These are just a few of the many sounds that accompany the operation of equipment. In no way are we attempting to orient specific sounds with specific problems, but just use these as examples. We are building a course around sound problem solving that can be given by our service representatives in various parts of the country. Our talk today was merely to bring out the importance of sound problem solving and naturally sounds can be applied to equipment other than that involved with turf maintenance.

The last slide I would like to show merely to key up the importance of in-service training of mechanics, foremen, and operators in the various park departments. Surely the type of negligence shown on this slide would eventually lead to unnecessary repairs. Preventative maintenance is of utmost importance from both the time and money standpoint. Let's listen to just a few words from a representative of the Ethyl Corporation (taped in voice).

I think the words of the representative further points out the job ahead for all of us. Ours, of course, to provide service training sessions and yours, to make arrangements to train operators and mechanics. Let's do everything we can to key the personnel responsible, to heed the sounds or warning signals of equipment and save the painful sound of money spent on needless repairs.

ARE YOU GETTING YOUR MONEY'S WORTH

Verne Fish
Toro Manufacturing Corporation
Minneapolis 6, Minnesota

Are you getting your money's worth from your grass cutting equipment? You say, yes...no. How do you know?

If one were to stop to think a few minutes, it might be surprising to learn that maybe you don't know the answer to this vital question. Machines that wear out prematurely through improper care and maintenance result in increased parts replacement, excessive labor for repair and unproductive "down-time". In addition, the improper machine for a particular mowing job, as well as abuse of the equipment, result in premature replacement.

Offered here, is a simple formula which may help to determine whether or not you may be GETTING YOUR MONEY'S WORTH from your mowing equipment.

$$\text{Machinery operating costs} = \frac{\text{Original cost + Repair costs}}{\text{Time}}$$

Let's take this formula apart and look at it, a piece-at-a-time. First, Original Cost. Why does a tractor cost so much money? Golf course tractors or turf tractors for instance, are practically hand-made, not as a production line tractor such as a farm tractor. The turf tractor is engineered to eliminate as much damage to turf as possible and still perform with more power and better durability than other types of tractors. Actually, they cost around $2600.00 which is about the same as you pay for a low priced car, less accessories. On the average, you turn that car in at 30,000 to 36,000 miles. Let's see what happens to your tractor during its life-span.

Tractors will run about 7-hours a day and 5 1/2-days a week. Allowing six full months for idleness in a year, the tractor totals up about 924-hours per year. When pulling gang mowers, the tractor travels at say, 5 m.p.h. which equals 4620-miles per year. However, tractors pull mowers in second and third gear.

Tractor time in third gear (70%) or 647 hours/year @ 810 r.p.m.

Tractor time in second gear (30%) or 277 hours/year @ 1480 r.p.m.

If you combine the engine speed, plus the hours run in each r.p.m. category, apply the result to an average (high gear) of an automobile, the net result will be equivalent to 22,057 miles per year. Tractors are used on a golf course a minimum of five years or an equivalent of 110,285 miles. This $2600.00 tractor now appears to be doing its share

for the budget.

You say maybe the above is true, but $430.00 for a greensmower sounds darn high. And besides, it's necessary to purchase some replacement parts and keep the units clean and properly adjusted. Why?

Greensmower statistics are of little value unless applied in such a manner that they compare against some other piece of equipment. Greensmowers actually run substantially more than you may think.

a. Five cuttings per week @3 hrs. per cutting, equals 15 hrs. per week.
b. 26 weeks per year of cutting equals 360 rolling, operative hours, per year.
c. At an average mowing speed of 3 m.p.h. each machine travels a total of 1170-miles per year.

These rolling 1170-miles mean actual operating wear. If we adjust downward 10% for transporting purposes-green to green, the following figures begin to come to light.

a. 1170 miles means the reel bearings must deliver accurate to within .002" some 7,949,800 revolutions per year.
b. The bed knife thus receives 55,598,400 cuts per year and a lot of that cutting is being done under wet, and sandy, hot and dry conditions, not to mention loose spikes dropped from some member's golf shoe.
c. The rollers, which are constantly being exposed to sand and grit, along with the corrosive effect of chemicals, must deliver to within 1/64" accuracy some 2,205,492 revolutions.

Assuming that your club has six greensmowers, we multiply the above unit statistics by six and an obvious pattern is disclosed. Six Greensmowers cost approximately $2580.00. This is nearly the same cost as that $2600.00 tractor. However, these six travel a total yearly mileage of 7,020 or nearly 2400 more miles than the tractor (actual rolling miles) or about 35% more mileage than the tractor.

As you probably know, a club which uses six greensmowers, enjoys a long life-span from its equipment and experiences lower maintenance costs than if it were to use three greensmowers for the same amount of work. The reason for this is that, when all the greens are being cut with only a small number of machines, each machine has to be run faster and longer. These excessive speeds not only increase wear, but the operator does not have time to notice harmful objects such as sticks, stones, spikes from golf shoes and coins. It is Toro's feeling that enough machines should be used to prevent abuse or overuse of the equipment.

These figures are quite realistic and certainly give us an idea as to the type of performance that is expected of your equipment. Actually, it is possible to operate on fewer dollars by spending just a little more for equipment initially.

You now ask yourself, "AM I GETTING MY MONEY'S WORTH?" We don't know until we look at Repair Costs.

During the last war it was discovered that automobiles would perform for several thousand miles more than was previously thought. Pre-war cars were junked at 30,000 to 35,000 miles. These same cars were run 100,000 and more miles when it became necessary. This, of course, was made possible through proper care and maintenance. The same is true with grass cutting machinery. Naturally, there are certain moving parts that are going to wear out through normal use, but suggestions can be offered to help prolong their life.

These suggestions are for the most part, outlined in the Owner's and Operator's Manual, which comes with each new machine.

A. Daily Checks
   1. loose bolts and nuts
   2. belts and chains
   3. cleaning mowers--(compressed air, if possible)

B. Lubrication
   1. Oil level and air cleaners
   2. Zerk fittings
   3. Check gear case levels.

C. Adjustments
   1. Follow factory recommended procedures
   2. Use correct tools
   3. Regular daily routine

D. Training the operator
   1. Proper selection and over-seeing of operators.
   2. Correct and complete instruction
   3. Induce personal pride

One common reason for a shortened life-span and high maintenance costs is the use of a machine in the wrong job. In choosing your equipment, here's a few things which might be considered:

1. Consider the area to be cut. Is it wooded, rough cutting, hilly or more formal areas? Then decide if a reel type or rotary type or sickle type machine is to be purchased.

2. Consider the amount of usage. Perhaps the machine will be used in large extensive areas. Figures are available as to the capacity. If the machine is to be used for trimming purposes and the usage is not too extensive, a small, light-

duty machine can be used, but high maintenance costs on this type of equipment should be expected.

3. Simplicity of design is very important. A complicated machine has many moving parts and may have a high maintenance cost. Also, it may be difficult to adjust and a trained expert may have to be used for repair.

4. Construction and durability. The machine should be substantially built, well-braced with good bearing. The side-frames, handles or drawbars should be heavy enough to do the job. The bed bars, reels, blades should be rigidly constructed.

Even though proper and high-quality equipment has been purchased, we have to set-up systems for handling maintenance and repair. Now we ask again, "ARE YOU GETTING YOUR MONEY'S WORTH?" You still don't know--no records. Adequate records are the "key" to the TIME element of our formula.

It is wise for every user of heavy equipment to keep a record of operation and maintenance. Over a period of years it <u>will</u> pay dividends. This record should show the following:

1. Name of machines
2. Serial number
3. Date purchased, dealer and price
4. All lubrication points
5. Accumulative running hours
6. Parts replaced due to wear or breakage and cost
7. Total labor for installing parts
8. Total hours of down-time.

At the end of the cutting season, this record will show the number of hours the equipment has run, plus the cost of maintenance. This record is invaluable for determining the proper type of unit to use in a given area, the most economical brand of equipment, who are your proper as well as your undesirable equipment operators, methods for improving maintenance practices. Also the record is almost a necessity to properly determine the most economical time to trade in your old equipment. It is your best tool for <u>selling</u> your board of directors on your new equipment needs.

Actually there is no pre-determined life-span for any machine because of the many operating intangibles. The questions of "cost per-machine-per-year and useful life-span" can only be answered by you. Variations in terrain on which the macine is used, the type of lubrication it receives, the correctness of repair, the treatment by the operator, storage, accuracy of records, all have influence, and in fact, determine the answers to these questions. Comparison of your own maintenance figures over a period

of years will enable you to see when machines should be replaced due to high maintenance costs. Also, it will show the life expectancy of any piece of equipment at the time of purchase.

In short--by QUALITY equipment, buy the RIGHT machine for the right job, OPERATE and MAINTAIN it properly, keep adequate RECORDS--then and only then, will you truly be GETTING YOUR MONEY'S WORTH!

SUMMARY OF TEXAS TURFGRASS CONFERENCE

Marvin H. Ferguson, Mid-Continent Director
National Research Coordinator
U. S. Golf Association Green Section, College Station
Texas

Theme: The Expanding Field of Special Purpose Turf

The conference began with Dr. G. M. Watkins, Director of Instruction, welcoming the group to the campus.

Mr. Burton F. Kiltz, Chief Agronomist for the Corps of Engineers, U. S. Army, was the keynote speaker. Mr. Kiltz began by pointing out that many problems that the Army presently faces in grounds maintenance were the result of wartime expediency and improper planning.

Problems of military installations were enumerated as fertilizer use, grass species choice (matching species to site), drainage, the use of mulches in establishment, mechanical and physical considerations in handling soils, whether or not to save topsoil, and irrigation. Mr. Kiltz gave examples of problems which exist in most of these categories. He indicated the Department of the Army now maintains some 165,000 acres intensively.

Dr. Gene C. Nutter, Executive Director of the G.C.S.A., spoke of the future of turf for golf courses. He cited predictions of a population growth to 220 million people by 1970 and a growth in gross national product to 750 billion. This is an increase of 75% in GNP contrasted to a growth of 25% in population. Dr. Nutter predicted that these growth phenomena would bring about an increase in leisure time, an increase in golf and in turn increased problems and opportunities in golf course maintenance. He pointed out that superintendents of the better golf courses occupied some of the most interesting and remunerative jobs in agriculture. Dr. Nutter told a fantastic tale of a golf tournament in 1990 to illustrate some of the problems that must be faced in connection with the golf car problem. He predicted more cars, more damage to turf and thus increased costs and he said that the golf course superintendent must be flexible enough to deal with the problems that will arise.

Mr. Frank Hyde, of the Andrews School District, told of the place turf occupies in the development and maintenance of a school plant. He pointed out that schools will continue to grow and that there will be increased emphasis upon site selection and development. He said educators are becoming more conscious of the fact that classrooms alone do not make up the learning environment. Academic malls between classroom wings are being used very effectively.

In new school site development, Mr. Hyde said that early planning with the architect was important in order to make decisions about clearing, disposal of debris, subgrading, drainage and topsoil stockpiling. He said that a master landscape plan should be prepared in advance of building completion and that early site delivery was important. Mr. Hyde stated that approximately 37% could be added to the cost of building maintenance where grounds were devoid of turf cover.

Mr. D. R. Thornton, of Texas A. & M. College, spoke of redevelopment needs in the landscaping of college campuses. He said that 4 major considerations are involved. They are (1) the rerouting and widening of walks, (2) lawn redevelopment (including the installation of sprinkler systems), (3) replanting of shrubs inconjunction with the development of good design, and (4) the use of year round flower displays.

Ed Daniel, of the Odessa Parks Department, discussed the problems and outlook for cemetery maintenance. He traced the evolution of cemeteries inthis country from "boot hill" days when the phrase "desolate as a cemetery" had real meaning to the present time when many perpetual care establishments are being used. Mr. Daniel said that progress had been made in making maintenance easier through the use of better grasses, more modern grave markers and properly designed shrub and flower beds.

Mr. Spencer Ellis, of the Wichita Falls Park Department, spoke of the fact that turf has a functional as well as an æsthetic value in parks. He used slides to illustrate problems and solutions in park maintenance.

Mr. Roy Rodman, of the Texas Highway Department, estimated that 500,000 acres of turf exist along the highways of Texas. He said that the philosophy of the department is to work with nature in the establishment of vegetation on road shoulders. An attempt is made to maintain the natural flora of the area. Mr. Rodman used slides to point out the importance of matters such as slope design and to illustrate some of the types of roadside planting that had been done.

Dr. J. E. Bussart, of the Velsicol Corporation, traced the development of new pesticide materials through the stages of development from the earliest discovery of pesticidal value to the time when the material is ready for market. The processes are both time-consuming and expensive. A knowledge of these procedures should give comfort to those who fear that pesticides may not be adequately tested before marketing.

Wayne Allen, USGA Green Section Agronomist, reported on the progress of the study of the extent of the turfgrass industry in Texas. This is the study being financed by a Texas Turfgrass Association grant. Mr. Allen outlined sampling procedures but indicated that results were not yet sufficiently complete to permit the projection of figures.

Dr. R. D. Lewis, Director of the Texas Agricultural Experiment Station, discussed public and private support for research. Dr. Lewis reviewed some of the significant early publications of the Texas Turf Association. He said that turf was the most nearly common denominator between urban and rural areas. Dr. Lewis issued a challenge to the group to "get more understanding on the part of the public". He said that making people aware of the part grass plays in their lives is a prerequisite of public support for research.

Dr. Lewis spoke of "agribusiness", that segment of our economy engaged in business related to agriculture. About twice as many people are engaged in supplying the farmer and in processing farm products as are engaged in farming. Dr. Lewis said this is true of turf as well as the remainder of agriculture.

The Tuesday afternoon sessions of the conference were devoted to panel discussions. This question and answer, "give and take" part of the conference, is very important in that it permits the discussion of pertinant problems that may not come up in the scheduled talks. However, since these discussions are a potpourri of many subjects it is not possible to summarize them.

On Tuesday evening the banquet program was devoted to the honoring of past presidents. These past presidents of the Association were presented with lapel pins and scrolls expressing the gratitude and appreciation of the membership for the services rendered by these men. Dr. R. C. Potts made the presentations. Mr. Gordon Jones and Mr. Elo Urbanovsky represented the past presidents in responding to the honor.

The banquet program and business meeting was concluded by the passing of the presidential gavel from Pres. L. W. DuBose to incoming president Kenneth Krenek.

On Wednesday morning, James M. Latham, of the Milwaukee Sewerage Commission, discussed "Turf Problems and Maintenance Practices" through the use of slides. Mr. Latham showed many ingenious methods used by golf course superintendents in the solutions of problems.

Mr. Fred Wagner, of the Wagner Tree Surgery Company of McPherson, Kansas, spoke on tree fertilization. Mr. Wagner illustrated several methods of placing fertilizers inthe soil in the root zone area of shade trees. His talk was illustrated by slides which showed some nutrient deficiency symptoms in trees and their response to fertilization.

Roger Thomas, of Jacobsen Manufacturing Company, and Verne Fish, of the Toro Manufacturing Company, shared the topic "Equipment and Equipment Maintenance." This is a subject that requires constant attention on the part of all who operate equipment. An unusual feature

of the discussion was the use by Mr. Thomas of a sound track which reproduced the noises made by an engine when running normally and with various defects.

After a summary of the conference, President Kenneth Krenek adjourned the conference. The 1961 conference will be held on December 11, 12, and 13.

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