Proceedings

of the

Twenty-Sixth Annual Texas Turfgrass Conference

TEXAS A&M UNIVERSITY

and

THE TEXAS TURFGRASS ASSOCIATION

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FOREWORD

We take this opportunity to express our sincere appreciation to all of those who helped in conducting our 26th Annual Texas Turfgrass Conference. Our registered attendance reached an all-time high of 294 which can only be attributed to the promotional efforts of many of the Texas Turfgrass Association members, the excellent speakers who participated on the program, and those interested individuals who attended the Conference.

It is intended that these Proceedings might be used as a reference by professional turf managers in producing high quality turf for both aesthetic and utilization purposes.

Wallace G. Menn
Program Chairman

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Co-Chairman

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TEN WAYS TO BUILD GOLF GREENS

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There's only one way to build a house! No! A well-built house does CERTAIN things - handles excess water promptly (roof doesn't leak), has good insulation, ample storage, and activity areas, etc. Likewise, GOLF GREENS and COMPACTED AREAS when WELL-BUILT must do CERTAIN THINGS - Remove excess water promptly, have ample nutrient and moisture storage and availability, have resiliency for play, texture for firmness, etc. In varying degrees the ways below contribute to the desired uniform result.

Due to FINES present SOIL PREDOMINATES

1. Any SUBSOIL - mud in - shape to grade - and LEAVE the troubles as SOON as paid.

2. TOPSOIL ONTO TOPSOIL - avoid any subsoil - avoid working when wet - carefully conserving what's good can save funds - can do for sandier soils; can be a low budget installation.

3. SUBSOIL UNDER TOPSOIL - sometimes necessary where major fill is required; conserve and replace 4 - 10 inches topsoil.

4. Above plus TILE DRAINAGE - pea gravel backfill within 6" of surface, tiles 20-30' apart, 18-30" deep.

5. Above plus SAND (60%?) and PEAT (20%) mixed into top 2-4, even 10 inches in hopes of better water movement and less compactability.
(Often VERTICAL POROUS trenches, slits, holes and/or grooves are later used as CORRECTIVE in above to better remove EXCESS surface water PROMPTLY).

6. INTIMATE TOPMIX - prepared off-site, based on USGA Green Section research

10"-14" settle topmix over 2" washed sand over 4" pea gravel over field tile drainage	Follow exact specifications for topmix based on samples submitted to laboratory. This system gives low tension at gravel "dump action of excess water"

POROUS TEXTURES PREDOMINATE (no soil)

7. THIN ROOTZONE - on contoured subgrade - into shallow, narrow trenches (10' apart). Place small plastic drains (1.5-2" pipe with frequent narrow slits). Backfill with coarse sand to overflow trench, then place 4-6" washed fine sand over loosened subgrade, then spread 1" PEAT and 1/2" calcined aggregates and fertilizer, then mix well into upper one-half of sand.

8. IMPERMEABLE LAYER - giving ZERO TENSION as it isolates subgrade
Plastic sheet spread over contoured subsoil
Slitted plastic drain pipe laid onto plastic sheet 10-20' apart
Coarse sand over drains, then selected available sand spread 10-20" based on fineness. Add peat, fertilizer, calcined aggregates. Mix into surface 1-3". Compact and plant, mulch and keep moist. Consider tees and football fields as flat areas.

9. PURR-WICK system. Above, plus RESERVOIR POOLS - use WICK ACTION
Form tiers of FLAT, LEVEL POOLS in the subgrade as surface contour and size dictates. Form 3-6" internal ledges for each pool and a surface berm around total area. Place plastic sheet over area and a plastic drain for each tier. Extend drain through exterior plastic wall as sealed, solid pipe, and extend on to drain control pit. Have terminal tee plug and upright to conserve or drain water as desired. Spread sand as above, compact, add peat, etc. Compact, plant and mulch. MRTF leaflet No. 40 available, gives specifics and details.

PURR-WICK provides a rooting matrix which uses the large pores of compacted particles above an impermeable underlay (plastic sheeting). Drainage tubes - placed just above the barrier - have adjustable outlets, which can redistribute, conserve or remove water as needed.

Such a system permits fast infiltration and constant redistribution of water by capillary (wick) action to active roots (absorbing water) and to the rootzone surface (when evaporating water). It, thus, maintains uniform growing and playing conditions (for golf, athletics, etc.).

When excess rain occurs, rapid percolation favors fast removal through sand and drains to controlled exits. When conservation is desired and daily water use is high, reserves can be created by upward adjustments of terminals. Thus, the designer and contractor provide the turf manager maximum storage, plus control of both dry and wet fluctuations.

This prescription for a rootzone attempts to provide designers, contractors, and users with guidelines and explanations. The letters PURR-WICK stand for PLASTIC UNDER sand RESERVOIR ROOTZONE, which utilizes the principle of wick (capillary) action at low soil moisture tensions.

This is ONLY one of TEN possible ways to build a rootzone, BUT it gives control of that necessary, but so variable factor - soil water. Specifications are given as steps in construction; then follows comments, research data and experiments which interpret the idea.

SOME DISADVANTAGES

1. Requires EXACT PLANNING.
2. Requires CAUTIOUS, CAREFUL INSTALLATION.
3. Requires CORRECT MACHINERY - to get sand onto plastic and pipes (drag lines, rubber belt elevators, terratires or light wide track bucket-dozers).
4. Requires early WATER SUPPLY to site during building.
5. RESTRICTS some modifications.
6. LIMITS some uses - or abuses.
7. It is DIFFERENT - compacted, layers, no soil.
8. MISTAKES must be corrected by reconstruction.
9. UNDERSTANDING by operators and inspectors reduces errors.

SOME ADVANTAGES

1. Allows SPECIFIC construction STANDARDS in ample detail and can be inspected.
2. Uses BULK raw material and permits direct delivery.
3. All work DONE ON SITE - as additives.
4. Can be done in RAPID sequence - compact and plant.
5. Can be done ON ANY SUBGRADE material.
6. Gives manager ABSOLUTE water control.
7. Allows LONG PERIODS between irrigation.
8. CONSERVES water to the MAXIMUM.
9. STORES some nutrients as dilute solution, but may need more frequent fertilizer.
10. Plays UNIFORMLY MOIST at all times.

10. Above, plus sub-irrigation by chamber with adjustable FLOAT valve for each tier. Could also add SOIL SENSING PROBES for dryness desired before recharging by float.

PRACTICAL APPLICATIONS OF AERIAL INFRARED PHOTOGRAPHY

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The slides you are about to see are examples of Infra-red photography. These photographic surveys utilize both aerial and ground level photographic techniques and are conducted by ENVIRONMENTAL SURVEYS, INC., with headquarters in Newport Beach, California. Our studies are assembled in our laboratory in Laguna Beach. We also have a branch office in Fresno, and a field research station located in Park City, Utah.

ENVIRONMENTAL SURVEYS does investigations, research, and measurement in several different areas of plant life vitality. One division of ESI conducts plant life inventories in the field, attempts to identify various types of failure of vitality in plant life, whether caused by disease, lack of moisture, heat, cold, or whatever. Another division of the company conducts infra-red photographic type investigations, by air, for the most part, as well as ground level. Utilizing the information gathered by the field staff, it attempts to forecast and understand more completely the various things that are going on in plant life development. We have learned through past experience that infra-red photography is particularly effective in analyzing the health and vitality of trees; that it is also very useful as well in ag, citrus and turf.

Another division of the company uses all this information gathered from the investigations and incorporates them into design concepts. These concepts point toward the natural long lasting solutions and are the most prudent use of the land areas investigated.

Another division of ENVIRONMENTAL SURVEYS, the fourth and last, concentrates its efforts in investigations. It assimilates, analyzes, and organizes data and compiles "Impact Reports". "Environmental Impact Statements" and "Reports" are required by law as well as various governmental agencies in order to substantiate the validity of many types of developments, park creations, rights-of-way for highway building, water courses, etc. As general information relative to the requirements of legally required Impact Reports are made know, ESI's Impact Report team will offer more and more service in this area.

ENVIRONMENTAL SURVEYS, or, as we refer to it, ESI, is very mobile since we do most of our work airborne. We can move about the country quite rapidly, gather our data, cover large areas efficiently, and do analyses and writings that are particularly meaningful to maintenance programs or development programs. Obviously the larger area we can serve in investigative type work, the more efficient and inexpensive the work becomes. However,

at this time infra-red surveys are not inexpensive. They are particularly effective when the advantages and limitations of infra-red or IR type studies are understood. It is possible, of course, to buy infra-red photography on desired sites or targets. The thing we provide in our unique type surveys is not only good photographic recordings of what the plant life is doing on the site, but the understanding and interpretation of the photography. Through our many years of experience of analyzing, comparing and noting the results in irrigation, watering, feeding programs, we have learned the many things that grow out of the IR information. Infra-red is not an X-ray technique, that is it does not see into the ground or into the plants in any way--infra-red photography deals with recording the light reflected by growing plant life involved in the photosynthesis process--the manufacture of chlorophyl and sugars.

The size and the general vitality manifestations of plant life are recorded technically on specific film that renders invisible vibrations of light visible through a false color system. The color used to convey or demonstrate the level of vitality is red. The various shades of red indicate the level of vitality; the brighter the red, the deeper the red, as you will see from the slides, the more vigorous the plant is. Obviously in substantial plant life, such as trees, the vitality recording is much more visible and much more easily detected than in the same type of light reflected from close cropped turf for example. Therefore, if we can, we will begin our discussion of the slides which you will see as follows: (Remember everything red in the picture is really "growing green" to the naked eye--all other colors are natural colors.)

Slide No. 1 is an image of orange groves in the Indio area in California. It shows very distinct color characteristics which help establish our understanding of what the false color system tells us about the plant life. In the center of this picture you will see the very vivid solid uniform shades of red which depict a very healthy orange grove. In the center closer to the top you will notice the groves there have a very faint but distinct departure from the normal red coloration, and you can see a sort of greenish purplish hue that occurs in the center of the grove. These are storm warnings or loss of vitality indications which we mark for investigation in our studies. Uniformity--that is, the even distribution of a particular shade of red in a grove is one of the most useful indications that we get from infra-red. The manifestation of plant life on soil tells us about the soil, about its content as to the minerals, nutrients, alkalinity, lack of moisture, etc. A grove such as in the foreground that's even in color from border to border shows us that the ground or soil composition was very evenly distributed. The white ground as it appears in the photograph is the typical sandy alkaline soil that you find around Indio and the Palm Desert area. The dark patches in the soil in the background are simply plowed fields with no crop growing.

Slide No. 2 shows us a little closer picture of the previous scene. You can detect the failure of the trees' vitality in the center lower section of the Orange grove from the obvious discolorations in the center. Some of that would be visible simply because the failure has proceeded to the point that leaves are absent and is physically different from the plant life around it. When failure

has occurred to this point, infra-red is not as dramatic in its assistance in detecting problems. IR is most dramatic when it can see problems in trees months before visual detection. Notice in the lower left hand corner of this picture the shapes in the soil. The darker area has more moisture, more nutrients, is a more typical soil color; and the whitish color is the alkaline condition in the particular patch of ground. In a picture like this, we can draw lines around the soil types, and we have what we call a soil profile. In testing the soil, we would take soil samples from the two extremes that occur in coloration, and we would know basically the composition of that particular plot of land. The taller trees you see in the center used as windbreaks, are eucalyptus trees; they are healthy; that color is a good reading for eucalyptus at that time of the year. The dark patches in the background are plowed fields. There are some flowers in the varied colored patterns, rectangular patterns, there in the middle right. Incidentally, further up toward the top of the picture in the background is the La Quinta Country Club off in the distance. You will also notice how far through the atmosphere these "reds" will carry. This range of light vibration that infra-red photography utilizes through it is the slower rate of vibrations, that is, lower scale of vibrations; they seem to be more persistent and last longer through the atmosphere.

On Slide No. 3 you notice how even and perfectly distributed the particular shade of red is in the grove in the foreground. As your eyes adjust to the particular manifestation of that red, you will see one or two slightly whitish or lighter trees in that foreground grove. Now let your eyes drift toward the top of the picture...you will notice two rows of that upper grove definitely manifest the little greenish purplish off-colors; those trees we would circle and map for follow-up on a field level survey.

On Slide No. 4 this grove shows a much larger problem, probably 35% of the trees in this grove manifest a degree of problem or loss of vitality.

Slide No. 5 shows a grove with probably 45 to 50% problem with some interesting phenomena occurring which is particularly useful in this type survey. You will notice near the top of the picture that the greens or purplish off-colors have stablished themselves up into three of the residential lots. The problem could have emanated from there and worked down into the grove, or vice versa; what's happening in the grove could be working its way up into the residential area. You notice the two lots right at the very top...the trees in those lots are not yet affected. These are typical indications which we get with infra-red which are valuable in the analysis. This would not be visible, obviously.

On Slide No. 6, there are five distinct levels of vitality being manifested in the orange grove production. The rectangular section in the center which is practically white is a section of trees in shock which perhaps have been hit by herbicides too often or too much, or whatever the reason may be, they are dead and beyond retrieval. As your eye goes clockwise around the picture you will see decreasing levels of vitality in evidence in the orange groves. One section particularly looks very bad and past help. The trees across the bottom of the picture are very healthy date palms with excellent soil types showing beneath the trees.

Slide No. 7 shows a park that we're working on in the Del Mar race track area on the beach. This is a park we are doing and it is an unusually challenging assignment in that we have to re-establish that particular site as it looked and demonstrated plant life before man appeared on the scene. In taking our area shot, you will notice how easily discernable the poisoned areas of the land mass show, probably from old construction sites where construction wastes have been dumped and they still reveal themselves in the soil characteristics. We can plan around those and use the best of what the site presents us. An interesting thing in this picture is the estate adjacent which is a 10 acre site of trees which have been collected from all over the world as individual types for this estate and for the ornamental horticultural display. This particular shot was taken in February and was very indicative of the health and vitality of these trees which fortunately receive daily care and minute inspection quite often to guarantee their healthy condition.

Slide No. 8 is an example of a community tree survey such as the one we've done for the city of Cerritos and others. I'm sure you can see with the naked eye the healthy reds shown by trees on two of the vertical streets in the picture, and the white row of trees that runs horizontally across the picture near the top, indicating a sick or low vitality condition. When we take pictures such as these of a complete community, the Public Works Department can map their tree service and tree treatment program very efficiently compared with the visual inspection method. They can also use the record that infra-red maintains on their trees for future maintenance strategies.

Slide No. 9 shows a row crop farm plowed field ready to receive seed. This particular color in soil we have found to be healthy soil with a proper balance of nutrients and natural composition to grow crops evenly and well. This same even distribution in the soil chemistry occurred in the lettuce crop near the top of the picture. And you can see easily the bright depths of the red that occurs in the crop and also the even coloration of the red across the field. Notice the same soil type on the side that is darker in color that had been watered for enough time to leave moisture in the soil and gives us a good reading on soil when it is wet.

Slide No. 10 gives us a good visual report of the various levels of pollution which occurs in water, and how IR sees it. This is the sewage treatment plant in Indio, California. The holding tank, which is the darker coloration of water is being allowed to fill the treatment tank and the oxygenation of the water in that working tank has been proceeding for about 10 minutes. You can already see the difference in color in the water just from the introduction of oxygen into it.

Slide No. 11 gives the effectiveness of how understanding of water gives us understanding of a particular area that it is affecting. Now the water in this irrigation canal that runs horizontally across the picture is the same color as the water in the holding tank at the sewage treatment pond. It is extremely polluted...the water is so bad that it's contaminating all the plant life on either side of the canal throughout its length; the salts in the water are effervescing out, coming up to the surface on either side of the canal out to 18 or 20 feet, killing all the plant life. You will notice 3 dead eucalyptus trees along the canal that are white and beyond retrieval. The trees that you see there in that orange shade indicates eucalyptus trees in about 35 to 40% life vitality status; they probably cannot be saved at this point. The almond trees that you see in the lower section of the picture are dormant almonds in their winter condition, with weeds popping out from the heat of the sun on the ground. These trees are healthy but they are dormant. There is a distinct difference in reading of dormant trees and trees that are dead, though they both manifest a particular shade of white, or death cast. Another thing interesting in the picture as to water: this shot was taken about 2 hours after a rainfall, and the little bright blue spots that you see near the top horizontally across the picture represent or reflect pure rain water standing in the ditches, and they give that pure water reading which is a bright blue, the same kind of bright blue you see coming up from swimming pools, and other water sources that we know are relatively clean.

Slide No. 12 is a rural scene of a section of land manifesting the typical pattern of an alluvial fan. The corner of the picture behind what appears to be rivulets of color coming down the hill, is approximately 150 feet higher than the opposite lower corner of the picture. There is an even green bluish cast which indicates the even distribution of moisture and soil types throughout the entire area. Those little fingers or tributaries as they appear to be, reveal the movement of moisture beneath the surface from the upper corner. Over a period of years they have established a kind of movement pattern. The plant life on the surface reflects or gives us an understanding of the moisture movement beneath the surface. We're actually reading the plant life on the surface with infra-red photography. As this moisture has very subtly moved downhill to a point where an old wagon or car track crossed the alluvial fan, that has had sufficient effect on the subtle movement of that moisture to a point where it has become very evenly distributed throughout the whole lower section. These are excellent soil types as indicated by the picture, and also give us a very complete and thorough understanding of the moisture working patterns in the area. These things are so subtle and very technically recorded on the film that are not available to the human eye. The eye can see the scars and cuts in the surface of the earth and can see the rock that's showing in the various other visible patterns, but these very small differences in color and reflection exaggerated by IR are particularly useful in planning. This site was being analyzed for the placement of the golf course, and you can

easily see where you would select areas for fairways and greens, etc. Another very valuable point in this picture is the way plant life grows above shallow rock which is in the soil down to maybe as much as 20 inches deep. Plant life which grows above these hard materials puts off a whitish cast. In the picture you can see very definite blotches or circles or areas where that whitish cast occurs and it tells us this would be a poor area to trench or dig or attempt to sustain a sophisticated plant life growth.

Slide 13 shows another area close to the alluvial fan you just looked at. Here, however, we have picked up a grove of California oaks which are just popping out in their spring green finery. Notice how the reds are manifested here; they are getting the heat of the sun. You will notice some of the trees very distinctly are still dormant; they are in their dormant whitish shades. You may be able to detect a couple of trees in this picture, however, have a whitish cast different than the dormancy. And they indicate problems. These trees we would circle for investigation on the field. When we mark plant life for investigation by the field study team, two things should occur here. (1) Field study people should detect disease, moisture, failure, whatever the problem seems to be, that still is on the detection level. The pathologist must be consulted to identify diseases and recommend treatment for diseases. By the same token, soil, water and air analysis must be made by experts in order to complete the information data that is involved in the complete understanding of any particular site. Notice in these types of pictures how the spring weeds are popping out on the hot sides of the hills. This does not mean that other areas of the soil are not good, but by using the understanding of where the weeds occur, we do gain insight as to the healthiest manifestation in a particular scene. You can also see indications of subsurface rock scattered about the swale or low valley.

Slide 14 is a picture of a country club in Palm Desert, California and shows an excellent scene of grass and trees in their very desirable colors. No trees in here exhibit any problem; the grass is very even and the shade of red, of course, demonstrates its health.

Slide 15 is a similar scene, close-up, beautiful grass; notice how the cart paths regulate and direct the cart traffic on the golf course so that compaction problems and other problems don't appear. If you look closely you will see one tree in the exact center of the picture that is white. It is dead; the rest of the trees are excellent.

Slide 16 shows one of the golf courses in Palm Springs...a beautiful scene. Notice the reading on the water in the swimming pool, which is excellent, and the beautiful color of the grass.

Slide 17 shows three lakes with bad water. The strips you see on the fairways are mowing patterns. With certain angles of light reflection we get unusual distortion. These pictures we're showing you are pictures made for presentation more than they are for use in analysis so they aren't exactly indicative of the shots we use for analysis. Most of the technical work is conducted from vertical shots, all taken within the light cone to get the proper light reflected by plants.

Slide 18 shows the effect of poor sprinkler head equipment in that the donut shapes show up very clearly. The co-efficient of water distribution is very poor; there is bad water obviously from the color reflection of the water.

Slide 19 shows a very poor condition; I'm sure you can pick out the problems that are manifested. The water is far enough in the distance to not give us a good reading on it, though some dark blue does show.

Slide 20 shows us some interesting things in soil profile. Notice the strip of land in the center of the picture. The white area, the alkaline type soil, with the soil profile very obviously in the plot which shows us how moisture is retained and how it manifests. There may be some soil chemistry that is demonstrating in a definite pattern. I would suspect this, because you will notice in the front yard of the residence along that same strip I mentioned how the grass manifests in a kind of profile or picture. You notice very closely in the fairways in the lower section of the picture, you will see how the grass manifests in a similar kind of pattern. Also notice the brilliant lawns in the shades of red in the residential area in the upper section.

Slide 21 shows an expensive water display on which much time and money have been spent. This should be reinforced by continual testing of the water to maintain good water quality. This picture shows a poor water condition. The grass in this picture is excellent...it could be just a little bit better if there were good water being used on it.

Slide 22 is a golf course, and I'm sure you can see some correction to the maintenance program should be introduced there. This particular course was very attractive visually. The problems showing on the IR slides just didn't appear visually at all.

Slide 23 is the night-lighted course in Indio, and you can certainly see the effects of constant day and night play with very little time to give this course proper maintenance. It is extremely thin and its grass profile, even its greens, are extremely borderline.

Slide 24 shows a golf course on the way out of business. This is near Merced. The slides will show the poor quality of soil on which this golf course was built. Over a period of 8 or 9 years the bad water, which is evidenced by the alkaline rings around the water reservoir, was dumped on soil with poor sprinkling equipment. You will notice the evidence there of large water droplets hitting and pulverizing the soil. The fines seeping down and forming hard pan underneath the surface then trapped the water or drained it off in an improper manner; consequently, all the combination of mistakes simply made it impossible for the maintenance people to maintain the horticulture display in a manner in which they would like to. The greens here also have a disease color in them. We suspect it is a fungus condition. Notice the white trees that are dead; there are a few that still show the reddish colors, but for the most part the single row irrigation system with poor equipment, the bad water, the bad ground, all together have made survival impossible.

Slide 25 shows the type of soil characteristics on the adjacent farm, which of course shows the type soil from which this golf course was built. It is alkaline with poor nutrient indications.

Slide 26 shows a close-up of a green in which you can see fungus indications, and also the dead trees.

Slide 27 is a high altitude shot of a golf course site in Southern California. This particular type shot was taken to pick out the land areas that showed the most healthy conditions. We were able to locate these from the pinks of the spring weeds showing. Then we could drag down those good soils onto the fairways and greens. Another thing that we were able to do on this assignment, with Slide 28 we took another type shot which helped us measure, once the top soil was being scalped off, how deep to go, how deep not to go, so that the soil remaining would also provide a good base for turf support. In scalping off some of this soil, you will, if you look very closely, see the decomposed granite, or dg, that was uncovered in this scalping and in those areas we knew to terminate the activity and pull the soil from the deeper profile areas. Those dg areas show slightly bluish in 3 or 4 spots.

Slide 29 is the residence hall adjacent to the campus in Pomona. This picture has been particularly useful for us in the analysis of trees and tree colors. The abundance of trees and the variety is here. The familiarity of the students involved in horticultural studies with this particular area, has been extremely helpful. You can certainly pick out the patterns of color in this picture and spot the trees that are suffering, those that have their exuberant deep healthy vital reds are very obvious. Those that have the off colors, brownish, and whites are failing.

Slide 30, with a piacture of the campus in the center, is where their horticultural display occurs. All the various flowers, plant life, shrubs, and trees show extremely beautiful visually, and are also very beautiful in IR. This picture reveals a row of 7 or 8 trees along the street approaching the center that have that orangish brownish off-color cast. These show a definite suffering condition as compared to the other trees in the picture that are vitally red. You can also compare the red lawns which in actuality are the deep green lawn areas, and the weak vitality registered by other lawn areas.

This concludes the slide presentation through which I believe you can quickly and easily understand how IR combines the standard color message with the infrareds of the growing plant life. These two color renditions on one negative manufactured into transparency type slides such as you've seen give us a very effective analytical tool to use in our understanding of the site information provided us by the field study people. Incorporating other indications by pathologists or analysts which are used; all together in a complete survey report, complete with the photography and the composite pictures provides a complete understanding. These are presented verbally, photographically and in written form. This is the objective of ENVIRONMENTAL SURVEYS, INC., a total environmental concept company.

USE OF RYEGRASS FOR OVERSEEDING

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Annual ryegrass was once the standard for overseeding golf greens in the south. It provides fast-foolproof establishment, but has many other unsatisfactory characteristics. Disease problems, coarse nonuniform texture, discoloration in cold weather, and an unpredictable transition all make annual ryegrass difficult to manage. During the 1950's a revolution in overseeding practices occurred. Tests on golf greens utilizing the fine seeded grasses; Poa trivialis, Kentucky bluegrass, the fine-leaved fescues and the bentgrasses, proved mixtures of these grasses can be used to advantage in developing a winter putting surface.

Poa trivialis made the use of these grasses possible. While Poa trivialis produces a soft, damage prone turf, it emerges almost as fast as ryegrass to produce an early playing surface while allowing the slower establishing grasses to develop. Many superintendents began utilizing formulas including two or more of these species. However, they soon found establishment was less certain with a smaller seeded grass than is true with ryegrass. The formulas are more susceptible to wear than ryegrass and transition problems continued.

During the early 60's, Northrup King began a screening program to locate improved fine-textured grasses for overseeding bermudagrass greens. Through the help of experiment stations and cooperating superintendents, we soon found NK100 and Pelo Perennial Ryegrasses to be outstanding. Both carry the attributes of Annual ryegrass, but without its faults. Both produce the color and texture required by superintendents and golfers without the establishment, wear and transition problems common to the fine-seeded grasses. In addition to NK100 and Pelo which are being sold in the formula called Medalist 2 Ryegrass, other new varieties are now becoming available. These include Manhattan, Pennfine and NK200 Perennial Ryegrasses. We can expect additional new varieties in the near future.

Why are the fine-textured ryegrasses valuable for overseeding purposes? My comments shall be based upon our experience with Northrup King's Medalist 2 formulation. We have had experience with these grasses over the past eight years on golf courses and in experiment station trials from Virginia and Florida to the West Coast.

1. The rapid germination and establishment of these grasses is one of the first characteristics seen. Establishing only slightly slower than Annual ryegrass, the fine-textured Perennial ryegrasses are way ahead of Poa trivialis in making a playing surface. Their vigorous root system penetrates thatch. Because there are no bristles (awns), the seeds spread uniformly and can be worked into the bermudagrass sod.

2. Golfers like to play on the fine-textured ryegrasses. Greens seeded to these grasses are fast and putt true. There is no stooling towards spring to cause ball bounce. Because they grow slower than Annual ryegrass, there is less mowing expense.

3. Superintendents regularly comment favorably on their tolerance to traffic. Courses with heavy traffic have found no equal. Not only does the playing surface develop rapidly, it also continues to absorb traffic throughout the season. A green planted to the fine-textured ryegrasses protects the bermudagrass from winter damage.

4. Disease resistance is another plus factor. We have found our Medalist 2 formula to be tolerant of Pythium, leaf spot diseases and Dollar Spot throughout most of the season. However, we do not know of a single grass resistant to Pythium during the establishment period. Disease prevention and control is especially critical during the establishment period no matter which of the grasses are used.

5. We have found our Medalist 2 Formula both reduces and masks Poa annua on many courses. Even when Poa annua is present, fewer seed heads usually seem to develop.

6. Transition from the improved ryegrasses to bermudagrass can be obtained on the superintendent's terms. With proper care, he can hold the winter grass as long as he needs it, or can transition it early in the spring.

All in all, superintendents have found these improved ryegrasses to be reliable. However, like all other grasses, adequate management is necessary to produce the best results.

Because the establishment period is especially critical, it is always wise to follow good agronomic practices at this time. When seeding, be sure the seed is in contact with the soil. Grass seeds held in the air by the bermudagrass blades or lying loosely on top of the thatch are likely to die. Constant moisture will insure rapid establishment.

Control bermudagrass growth. Often, temperatures warm following the seeding of the winter grass. When this occurs, the bermudagrass continues to grow, and if not carefully managed, can crowd out the emerging ryegrass plants.

Disease control is always worthwhile. Be certain you have a fungicide available for controlling Pythium. However, even when Pythium is not expected, other diseases such as Brownpatch, Dollar Spot, Helminthosporium Leaf Spots and perhaps other diseases can cause loss of vigor, discoloration and even loss of stand. A preventative disease control program is always worthwhile.

It has been our experience that superintendents who have been growing Poa trivialis based formulas tend to mow their greens shorter than necessary when converting to the fine-textured ryegrasses. Putting on Poa trivialis is slower than on ryegrasses. In other words, it is not necessary to mow ryegrass as short as Poa trivialis formulas to obtain a playable surface.

During the establishment period, mow a bit higher. Three-eights inch or better will aid improved ryegrasses to establish faster and provide a healthier, tougher turf. After well established, and as the grass thickens, reset your mower at a lower cutting height. We suggest 1/4" once well established. You will find the greens to be fast at this height. If you have a tournament coming and you need extra fast greens, you can drop your mower to 3/16"

Like all grasses, the fine-textured ryegrasses require fertility. Based on experimental evidence, a combination of both organic and chemical fertilizer is suggested. Most studies indicate a pound of nitrogen every two weeks can be used to advantage. The use of rapidly available nitrogen sources when temperatures are around freezing will help to maintain color.

These new ryegrasses will simplify your transition problems. If you want to prolong ryegrass, the following suggestions will help:

1. As temperatures increase, water with increased frequency, but reduce the quantities applied at any one time. Syringing on hot days is warranted.

2. Fertilize only as is required to maintain color.

3. Raise the height of cut until just before tournament time and then gradually drop the mowers.

4. Do not use herbicides.

5. Limit slicing and vertical mowing to the amount needed to reduce compaction.

To speed up transition, consider the following suggestions:

When soil temperatures are favorable for bermudagrass:

1. Water deep and reduce the frequency of irrigation.

2. Limit nitrogen until the bermudagrass begins to grow and then increase the amount of nitrogen applied to favor the bermudagrass.

3. Hold or reduce the mowing height.

4. Frequent slicing and light vertical mowing is much of the answer to a smooth transition from ryegrass to bermudagrass. Start vertical mowing about three weeks before you want to transition back to bermudagrass.

Watering is probably the most critical factor whether you want to prolong or reduce the amount of ryegrass on your greens.

And, don't forget the bermudagrass. Perhaps applications of fungicides during February and March will pay dividends for you. By early application, the chemicals have time to work down into the bermudagrass crowns and root zones to help protect the grass as it comes out of dormancy.

A number of superintendents have experienced success the last several years, using the new ryegrasses. They may well fill the bill on your golf course as well.

SAND TRAP MAINTENANCE

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In past years mechanization on golf courses has reduced the labor content of maintenance tasks and permitted a higher level of grooming. Automatic irrigation systems, the Triplex Greensmower, and the 9-gang fairway mowers are examples of this mechanization. An area on golf courses, which has high labor content and has only recently had work done in mechanizing the tasks, is the sand trap.

The objective of this presentation is to review the various tasks performed maintaining sand traps, how they are being mechanized, and discuss briefly a comparison of labor cost savings when raking is mechanized.

In a review of sand trap maintenance activities on golf courses in several areas of the country, we find that maintenance consists of performing the following tasks:

(1) Raking.

Raking is done to accomplish one or more of the following:

(A) Removing of golfers foot prints.

(B) Break crust caused by sand compaction from irrigation and rains.

(C) Repair and level washouts caused by rain and move sand to higher levels.

(2) Edging.

Edging is done to control growth of grass and provide a sharp line at the edge of the trap.

(3) Cleaning.

Cleaning is required to remove leaves and debris blown into the traps. Cleaning also includes removal of weed growth; however, frequent raking can prevent weed growth.

(4) Adding new sand.

Sand is added to traps as required to fill in washout areas after heavy rains and to replenish sand blown or thrown out.

Now let's take a look at the labor content of these tasks as recorded on various golf courses this past year.

Minneapolis, Minnesota

360 members

86 Traps on 18 Hole Course

Labor Rate - $2.15/Hr.

Edging and Cleaning	- 346 hours	-	$ 744
Raking	- 997 hours	-	2,144
Adding Sand	- 120 hours	-	258
TOTAL	1,463 hours	-	$3,146

St. Paul, Minnesota

160 members

50 Traps on 18 Hole Course

Labor Rate - $2.50/Hr.

Edging	- 158 hours	-	$ 395
Cleaning	- 172 hours	-	430
Raking	- 542 hours	-	1,355
TOTAL	872 hours	-	$2,180

Portland, Oregon

435 members

45 Traps on 18 Hole Course

Labor Rate - $2.50/Hr.

Raking	-	647 hours	- $1,618
Edging	-	105 hours	- 262
Cleaning)			
)		146 hours	- 365
Adding Sand)	-		
TOTAL		898 hours	- $2,245

Plantation, Florida

Public 18 Hole Course

52 Traps

Labor Rate - $2.35/Hr.

Raking	-	2,912 hours	- $6,851
Edging and Cleaning	-	300 hours	- 705
Adding Sand	-	200 hours	- 470
Repairing Washouts	-	150 hours	- 352
TOTAL		3,562 hours	$8,378

Los Angeles, California

600 members

65 Traps on 18 Hole Course

Labor Rate - $2.75/Hr.

Edging	-	728 hours	- $2,003
Raking	-	2,080 hours	- 5,720
Loosening Sand	-	136 hours	- 374
TOTAL		2,944 hours	$8,097

The first two Minnesota courses operate approximately 6 months a year. All other courses shown operate 12 months a year.

Of all the tasks performed in maintaining sand traps, it appears a mechanical rake can easily perform 70% of the total.

To review some equipment built for raking sand traps and equipment on the market today, let's first look at how one innovative superintendent and his mechanic approached the problem. An Allis Chalmers model "G" tractor was equipped with dual wheels to provide flotation and a 9 ft. wide rake mounted at the rear with hydraulic lift. This machine does an excellent job of raking but because of its size is not able to work well in small traps, or complete the raking close to irregular edges of traps.

Two years ago a major farm equipment company entered the market with a 6 ft. rake mounted on a garden tractor. This machine received a lot of interest, and performed well in many conditions. It is limited in its ability to maneuver in small areas and loose sand conditions and, therefore, has only been a partial answer to mechanizing the raking task.

A farm equipment dealer in Florida installed this same rake on their garden tractor with similar results.

Another innovative superintendent in Florida built a rake using golf car axles, a simple frame and 4 wheel drive. This machine performs well and has been the most successful machine marketed to date.

In May of 1972 the Toro Company will begin delivery of its Sand Trap Rake. This machine will be a professional design by the same engineers that designed the Greensmaster 3, Parkmaster 9 and Spartan 7, introduced the past two years.

The outstanding design features on this unit are:

Maneuverable 3-wheel design
Operator conveniences and comfort
A rake for all sand conditions
New trouble-free modern drive systems
Quiet operation

Now that mechanization of sand trap raking is here, let's look at how much time and labor can be saved.

This past summer in a time study with prototype machines, Toro Engineers found that it is easily possible to rake 15 sand traps per hour. Because the operator is comfortable, he can rake all sand traps on a golf course with 50 traps in less than four hours. In hand raking, a man averages 7 to 8 traps per hour. In summary, raking time is cut in half by mechanization.

First, looking at the private club, 6 month operation we see the following 5 year savings:

St. Paul, Minnesota

Cost Comparison

5 Years

Manual		Machine
--	- Cost -	$1,500
$6,775	- Labor -	3,387
____	- Operating Costs -	500
$6,775	TOTAL	$5,387

The other extreme is a public golf course open 12 months. Here the savings are much greater.

Plantation, Florida

Cost Comparison

5 Years

Manual		Machine
--	- Cost -	$ 1,500
$34,255	- Labor -	17,126
--	- Operating Costs -	1,000
$34,255	TOTAL	$19,626

As you can see, mechanization of sand trap raking can save labor costs on all golf course operations and, in some cases, 2 or 3 machines will easily be justified to do the job.

PEOPLE POWER

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"And the Lord God planted a garden eastward in Eden..." Since this time related in the Book of Genesis, we have been evolving to this very day. How effectively the topic I will discuss with you today will change your patterns will depend directly upon your courage as a human being, a man, and a person in your mature efforts to improve your professional surroundings.

If this nucleus of turf professionals gathered here today intends to go back into society and breed success then we must establish some goals as they relate to PEOPLE. We all work for people and people work for us. Additionally, we must endeavor to profess success in our encounters with people in general in daily contacts. This success must not be in how we conquer them but how and what lasting impression we might leave with them. Theodore Roosevelt has been quoted as relating this comment, "Far better it is to dare mighty things, to win glorious triumphs, even though checkered by failure, than to rank with those poor spirits who neither enjoy much nor suffer much, because they live in the grey twilight that knows not victory nor defeat."

In a period of our history which spawns such actions and movements as Black Power, Brown Power, Gay Power, and Women's Lib maybe we need to look closer at our values. Possibly all these groups are seeking is simply PEOPLE POWER! So it is then - People Power - that I shall investigate today! If you will permit, I shall explore two areas which possess great bearing upon the power of people and their significance to the total. One we shall call Continuing Education and the other The Extra Measure.

Continuing Education is a must in my books. Certainly you must concur or you would not be here today. Recently I read an article prompted by an inquiry posing the following questions to the newspaper. "I would like to be a greenskeeper for a golf course. How can I find out about this work? Is it an overcrowded field?" In the response, the scope of knowledge required for such a position was described. To quote, "Responsibility may include grounds maintenance, equipment maintenance and purchasing, structure (building) maintenance, landscaping, hiring-training-direction of personnel, materials purchasing and use, cost and record keeping, budget planning and reports. A qualified man or woman needs a variety of education, experience and skills. He should know how parts of the course relate to golf play, turfgrasses and their maintenance techniques, soils, fertilizers, irrigation, drainage, insects, fungicides, mechanics, accounting, management, public relations, and communications."

This quotation readily emphasizes the importance of a thorough and comprehensive training program in a total endeavor to make the power of the people we have as flexible as possible.

Perhaps it would be interesting to go through the basic areas of a continuing education program as they might relate to your organization. At the very onset of this discussion, let me assure you that having a good, well-rounded program that will properly educate you and your personnel may be the most difficult task you ever encounter. More emphatically, let me say that establishing a continuing education program will surely be the most important and rewarding task you undertake. I might go one step further and state that training is most often the put off job we have on our schedule of things to accomplish. If you presently have an in-service, continuing education program, then expand it....if you do not have one, and fail to start one upon return to your office this week, you are failing yourself, your people, and your profession.

Not only is this an age of the environment to which we must rise to meet the challenge but one in which training is rapidly rising to the forefront.

In recent weeks, I have noticed an increasing number of comments concerning the labor problem and management. With further research, I found that I had marked numerous articles throughout the past few years that related to training. Some of the programs I noticed follow:

1. In-Service Training Illinois Style

   All employees of the 1,200 man Illinois Department of Conservation will receive in-service training on a quarterly basis. Secretaries to executive staff personel will be included.

   New training manuals are being written for each of the major divisions.

   In addition to the quarterly training programs, there will be accelerated attendance at professional seminars, maintenance clinics, and programs offered by other State agencies.

2. Most large organizations and professional associations are establishing elaborate Executive Development Programs. Aims of these programs are to develop the executive staffs of the future through these comprehensive programs.

3. A recent article in "College Management" dug deeply into the need for management training for the administrative heads of colleges and universities. The once required need for a man at the helm with strict academic background is gone. With the new campus problems, scholarship and charismatic personality are not enough for the man in charge. So, as the article was titled, "The President Needs Training in Management".

4. In April of 1970, the University of Texas System Board of Regents established a broad based and comprehensive training program for all employees within the U.T. System. The program is designed to streamline the efficiency of workers at all levels.

My personal past experiences with training have only been rewarding to the highest order. While with the City of Houston, we developed a total program for all people. This action came after a pilot program with the clerical staff within the administrative division. The clerical personnel were not only given training in their given fields but in the area of cross training as well. For example, our program was so successful that many of our clerical staff were able to fill in to handle such items as the total city payroll, as well as ours, and to assist with audits, etc. in the larger city scope. One of the best received programs was when we had the Telephone Company give us a course in the correct use of the telephone and how to maintain good relations and communications when using the instrument.

I have always felt that our program was the most successful when keeping the trainer or instructor at the same level as the person taught, at least as much as the content of the course would permit: A skilled mechanic teaching the fine points of a particular procedure to a less skilled mechanic. We even went as far as to have a plumber train a gardener how to repair commodes and lavatories in his assigned park. In the inevitable emergencies, this type training was a step well taken. Our student was receptive, as he was the one to receive the complaint of the park user if these facilities were not functioning.

In my experience, we always gave the learner something besides a new skill and increased job knowledge. We gave him literature to read and keep as reference. We even presented a certificate to show his participation. By showing the student how he would be able to grow through use of this new knowledge, we always found our espirit de corps to be much improved and the general work output increased for extended periods of time following the course.

Finally, we always tried to send our people to as many educational conferences as possible. Here they hear talks, meet other workers, exchange ideas, find solutions, and, most of all, find out the grass on the other side is not necessarily as green as it looked.

As I mentioned earlier, we need to go through the basic steps of a training program.

1. Breaking-In Period

An employee's initial impression of both his job and supervisor is the most lasting. That's why his first day is so important. I like to call it the "breaking-in period". A good start on a new job means a minimum of lost time, wasted materials, and department friction. Equally important for the employer, it means getting started on the job with minimum physical, mental, and emotional strain and friction.

The employer should develop a new employee check list - a list of items to be discussed on his first day. Such items as exact hours of work, when, where and how to ring time clock, introductions to fellow workers, safety on the job, reporting absence and lateness, why his job is important, department organizations, and getting paid.

During his first day, make sure you give him your personal attention in three areas: (1) Meet him when he comes in. (2) Give him the feeling that the company is interested in him as a person and not just as a new hand. (3) Don't let him wander around by himself. Another critical time is lunch time. Escort him to lunch room or to other workers who might join him during this period.

2. Systemize Your Training Program

You can make sure of the proficiency you want by planning your training program. This helps avoid wrong work habits, spoilage, wasted time. The sooner you plan, the sooner you get more productive hours out of each day - and that much sooner will you reach your own supervisory goal: maximum efficiency, minimum production costs.

The main requirements to be met before a new employee appears for instructions:

a. Prepare time table for yourself showing how much skill you expect your new man to have and by what date.

b. Analyze his job, list all important steps, pick out the key points.

c. Get everything ready: equipment, materials, supplies. Do not make the mistake of using obsolete models or equipment not in perfect working condition.

d. Be sure the work place is properly arranged, just as you'd expect your man to keep it. He's more likely to follow the same pattern if you have everything right.

e. List all details of the job exactly as it's done by the present method. Make sure details include all material, handling, machine work, hard work.

f. Question every detail. Ask yourself: "Why is it necessary? What is its purpose? Where should it be done? When should it be done? How is the best way to do it?"

3. Prepare the Trainee

When the trainee reports to you for training, you can be sure he feels uncomfortable and bewildered, if not worried or embarrassed. Likely, he may feel you are telling him he is a poor employee and you are telling him through this means. He must understand: (1) Scope of training; (2) Purpose of training; and (3) How training will help him.

4. Train the Trainer

When a person is trained by an experienced person, he usually feels more relaxed and receptive.

Develop yourself a "best qualified trainer checklist". Some of the items which could be included in the list follow: Is his work accurate? Is he cost conscious? Puts ideas over effectively? A stickler for accuracy? Expresses himself well?

Then establish his responsibility as a trainer. Provide a stand-in should he be absent. Have class follow-up to determine effectiveness of class. Continue to develop new teaching skills.

5. How to Give Job Instructions

The basic techniques of teaching can be boiled down almost to a formula. This formula consists of four main steps, each step being divided into two segments:

a. Preparation

(1) Analyzing the job
(2) Preparing the trainee

b. Presentation

(1) Explaining
(2) Demonstrating

c. Tryout

(1) Participation
(2) Practice

d. Follow-up

(1) Inspection
(2) Correction

6. Retrain the Older Worker

Studies show that the older worker is generally an efficient and stable, more careful and more reliable in attendance than younger employees. His work is usually of better quzlity than that of younger people. For these reasons, keeping him working is a sound investment. Not only is he less likely to quit for "greener pastures" but, because of his experience and his interest in a career with your organization, his work tends to be consistently superior; and, though oldsters may take a little longer to train on the job, methods developed specifically for them can reduce this training time.

7. Schedule for Training

It is very easy for a supervisor to fall into the error of thinking that once a man is trained, he can forget about him. This is a dangerous attitude. You must follow-up on the initial training and then, as new jobs are brought in, you must make sure that he is trained on each specific job until you are certain that he knows every operation in which he is engaged.

THE EXTRA MEASURE expresses a personal philosophy. Certainly this philosophy can be modified and applied by others to the order of their lives. Hopefully, we all establish a program for our lives at some point early in our maturing years. In my program planning, I have attempted to parallel my program of life with that of a compass; therefore my program of life, as the compass, contains three hundred and sixty points. It is about two of these points I will have talked today - Training and The Extra Measure!

In order for us to all be on common ground, I want to define the words of extra measure. We shall use Webster's Dictionary for clarification. "Extra: Beyond, or greater than, what is due, usual, or necessary; additional; better or larger than ordinary". "Measure: The dimensions, capacity, or quantity of anything, determined by measuring". So when we speak of the extra measure, we speak of going beyond the usual expectations. The success of life in general depends on a person's use of the challenge of "The Extra Measure".

In that we are all professionals in one capacity or another, let us review how this quality of life can enhance our success. First, we must create and pursue a goal for our professional life. Some questions we should ask ourselves in creating this goal follow:

Decide Where

Where do you wish to go professionally? Private industry, governmental, research, own firm or nowhere!

Decide What

What are you seeking in your professional world? Do you wish prestige, money, as little responsibility as possible, or the opportunity to betterment of yourself and mankind!

Decide When

When do you wish to achieve this professional dream? A time table is a must; however, never regard your chances as too late. Time has no boundaries to the desire of success.

Decide How

Set your course of action to reaching this dream. Whatever your total course includes, it must hold "The Extra Measure" as a key ingredient.

My professional goal was set about fourteen years ago. Now that I am near reaching the pattern of the goal, I can begin to work on my lesser goals as related to profession. It has not been a cut and dried road for me. When I completed my tour of duty with the armed forces, I knew I was ready for all things. After all, my society told me I had all that was required for success. That's right. I was married, had completed my military obligations, and had a degree from college; however, times were slow, as today, and following some sixty-two job contacts, I was not so sure. Of the sixty-two, some three had job possibilities. With some good fortune, I landed a job as salesman in a retail nursery. Well, here is where my self-evaluation began. I asked myself the questions I mentioned to you. This was when I determined "The Extra Measure" was going to help me go to the goal I had established. On occasion, a man who is well know in our profession began shopping at the nursery where I worked. I took those extra efforts or measures when assisting him as other customers. One day, he contacted me about a job he knew was open. From that day forward my road to my goal has been straight and unaltered.

When I was interviewed for a new job, the employer was doing research on me. So, following my interview, I did some research also. To reach my goal, I needed to work under a person who was considered tops in his chosen field. If my prospective employer could meet the standards I sought, I was ready to work. From this employer-employee relationship I could record in my mind the techniques he used to make him respected. Likewise, I could observe and note his weak points. My determination was then to combine his fine points with my principles and make certain to never practice his weak traits.

Along with understudying my new superior, I had many facets of responsibility if I planned to be successful in this new job. All of them fell into the category of "The Extra Measure". Some of these were:

1. Take the extra step to do the job. Does the job require more of you than eight hours? Hard to expect to reach mental maturity or professional maturity if you arrive late, take lengthy coffee breaks, and leave early.

2. Go that extra mile to be certain the job you accomplished was correct.

3. Learn every additional job spare time or opportunity will permit. I was determined to be a more valuable employee than when hired. A professor of mine once told me to learn every job I could. Why? Because a person cannot instruct someone to do a job he has not done himself!

4. All good employees are striving to think for their supervisor. Make him look better to those who judge him by the accomplishments of his organization. Make his job easier if at all possible. Acknowledge in your mind his problems and pressures.

5. All good supervisors think for and about their employees. He makes their job easier. Use new techniques that help the worker. Ask them to accomplish a mission; never tell them. Place yourself in their positions.

6. As a production person, we must think big - little plans stir no man's soul.

7. Never be hesitant to admit you made an error or mistake. It takes a far greater man to admit a flaw than to profess a success.

8. Change your old ways to meet the new challenge. Try the new ideas. Then listen to and accept criticism of your decision until you re-evaluate yourself.

9. Carry your attitude banners high above your head. Eliminate from your vocabulary those too often spoken phrases:
   "Not my job!"
   "We have always done it that way!"
   "He should have my job!"
   "Boy, has that guy got a soft job!"
   "That won't work!"

So now you gasp and retort that all of these require extra - that's right, a portion of "The Extra Measure!" My fellow professionals, it would be mental bankruptcy for a mature being to overlook any possibility for self-improvement and advancement.

Remember, you shall pass through this life but once and whatsoever you can do to make it a better life, so let you accomplish. Recognize the other man's faults but do not ride hime to the ground by developing these faults as his only character. As the popular song from the rock opera "Jesus Christ - Superstar" states,".... look at yourself and you can look at others differently". The key secret to all problems large and small is your investment of the extra measure in people. Try investing some with the people you work with, work for, meet, and know. Place yourself below your fellow man and your God! The dividends you will reap will be rewards beyond your wildest dreams.

In summary:

(1) Go home following the conference and begin your training program whether for one man or one hundred!

(2) Invest in The Extra Measure.
John F. Kennedy said, "We have the power to make this the best generation in the history of mankind or to make it the last!" I want to rephrase that some. We have the power to make this turfgrass profession the best in the history of mankind or to make it the last!

CARE AND MAINTENANCE OF TURF EQUIPMENT

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As we all know labor has become the single most important factor in any turf maintenance operation. It's either not available or it is unqualified to perform the required jobs. Often times qualified help is available but because of low wages these laborers turn to other higher paying jobs.

One of the results of this labor situation is that the people in charge of maintaining turf areas have created a demand for improved equipment. Equipment that is capable of doing a job in less time than it previously took several laborers to accomplish. The Triplex riding greensmower is a good example of this.

Manufacturers have responded to this demand with new and improved equipment. But with this comes the additional requirements for maintenance of the equipment. This is what we are going to be talking about today. How to properly maintain this equipment.

Generally speaking there is very little new relative to equipment maintenance, i.e., motors still need lubricating, belts need adjusting, bearings need replacing, etc., but these requirements have become more demanding. Failure to service equipment properly can and often does result in premature destruction of expensive equipment.

In thinking of equipment maintenance one of the most useful tools that can be utilized is that of a schedule of maintenance requirement for all equipment. An inventory of equipment should be kept along with a form for recording performed maintenance on a given piece of equipment. Emphasis should be placed on preventative rather than curative maintenance. What this means is that scheduled maintenance, i.e., lubrications, spark plug changes, tire changes, adjustments, tune-ups, etc. should be performed on the equipment regardless of whether it is still functioning or not. In large operations it may be necessary to computerize maintenance schedules. In most operations, however, satisfactory methods of service scheduling can be accomplished with little difficulty.

In addition to setting up maintenance schedules all persons using equipment should be familiarized with his machine. He should know what parts are likely to wear and what areas need most frequent attention.

What kind of schedule should be set up for a preventative maintenance program? This, of course, will vary with the particular type of equipment in question, but just as an example consider the following schedule. First of all equipment needs to be identified, i.e., mark it in some way to simplify record keeping. Some equipment can be identified by name while others may require such procedures as numbering as in a case where there are several hand rotary mowers. If there are several, simply number them and have a corresponding numbered service record and schedule.

The following is a typical schedule of maintenance for a gasoline powered utility vehicle used several hours each day. Divide the schedule into required periods of time, i.e., daily, weekly, monthly, etc. Next break down each of these categories into service.

A. Daily
   1. Check oil in engine
   2. Lubricate parts where necessary

B. Weekly
   1. Service air cleaner
   2. Change oil at 25 hours service
   3. Check and maintain tire pressure
   4. Check battery

C. Monthly
   1. Check battery with hydrometer
   2. Clean battery and terminals
   3. Replace air filter if necessary
   4. Grease
   5. Check differential and transmission

D. Six Months
   1. Tune up engine
   2. Check wheel bearings
   3. Perform all weekly requirements

E. Yearly
   1. Remove battery and clean; also clean battery hold down
   2. Change differential grease
   3. Repack wheel bearings
   4. Check starter motor brushes
   5. Check brakes

On mowing equipment, emphasis should be placed on both the engine and the equipment itself. Perform all maintenance requirements as specified by the manufacturer.

When it becomes necessary to store a piece of equipment for an extended period of time, there are several points to keep in mind:

1. Drain all fuel from the fuel tank, sediment bowl, and fuel lines. Start the engine and run until all fuel is used up from the carburator float bowl.

2. While the engine is warm, drain out the crankcase oil and replace with the proper weight of oil corresponding to the season when the vehicle will next be used.

3. Remove the spark plugs and squirt a small quantity of oil into the upper cylinder. Turn the engine over a few times to distribute this oil.

4. Remove the battery completely, and store on wooden blocks preferably in a place where it may be connected to a charger from time to time. Do not store the battery on a concrete floor. Check the battery at least every 30 days for discharge and recharge as required to maintain a fully charged condition.

As mentioned briefly, one of the best ways to prolong equipment life is to familiarize the operator with it. If possible, have short training periods with the work crews. Have the mechanics go over equipment with the men, pointing out what areas need most attention.

If these procedures are followed down time can be anticipated and therefore, very little time is actually lost. When a man knows his machine is scheduled for maintenance, he can plan to perform some other job. Not only does this prolong the life of equipment, but it also cuts down on time wasted by supervisory personnel, and time is money.

There is not a foolproof method for keeping equipment running. When machines are used daily for extended periods of time by workers who often would just as soon see it broken, there are going to be breakdowns. The purpose of any maintenance program is to minimize these breakdowns and in many cases, to anticipate them.

In summary, think of terms of <u>preventative</u> rather than <u>curative</u> maintenance. Set up a maintenance schedule for all equipment and adhere to it. Familiarize personnel with the equipment they will be using.

MANAGEMENT OF BENTGRASS IN TEXAS

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The use of bentgrass in Texas extends over a number of years and the one we use most is Agrostris palustris. Most species belonging to this genera are imported forage plants with about 25 species, annual and perennial, in the United States. Research on bent in Texas has been limited which is understandable since most turf research has been done in an area where bermudagrass is the dominant turf, but I am sure more emphasis will be placed on bent in the future. At the present time, there is a choice of seeded or vegetative sources of bent.

A progress report from Wichita Falls presented to the Texas Turf Conference January 20, 1954 showed C-1 (Congressional) and C-52 (Old Orchard) being superior to Seaside bentgrass. Since then, C-7 (Cohansey), Penncross and local selections have become popular. The seeded bents are less costly to establish. There is no reason why bent stolons could not be handled similar to bermudas for faster planting to utilize the vigor of some selections. Oklahoma now has two vegetative selections that show much promise to be tested in Texas. The turf research coordinator at A&M now is in the process of selecting outstanding bents to include in a heat tolerant study.

The main purpose of this paper is to bring out some points of maintenance to be considered and the effect on bentgrass as management of grasses depends on what we expect from these plants. For greens we want a grass to provide a surface for a proper roll of a golf ball therefore we think in terms of persistence and not palatability and digestibility.

Soils

Emphasis on soil media for golf greens began at A&M. For many years, the USGA Green Section has advocated greens with adequate surface, internal, and sub-drainage. The amount of drainage required for bent greens, and in many instances, success or failure of those greens depends very much on permeability of the soil. The Green Section specifications that originated here are being re-evaluated to assure us that this procedure for constructing golf greens is still adequate with minor adjustments. Marginal areas where bent is being grown are more critical and will demand the best soil media to support growth of bent under adverse growing conditions.

Water and Temperature

Watering is frequently carried out on greens and is often incorrect which can cause serious trouble quickly if mismanaged.

Biochemical reactions often involve water as one of the reactants. The main use of water in plants, however, is as a solvent in which enzymes can function as catalysts in putting together or breaking down organic compounds. Water is equally as important in its physical function of maintaining cell shape and arrangement. Photosynthesis is reduced when leaf moisture content is low enough to close stomata, the entry ports for CO_2. We normally think of this as the way in which moisture shortage reduces plant growth. Some evidence suggests, however, that other processes are involved. In germinating seeds where respiration is the dominant process and photosyntehsis is absent, low water content reduces both the germination and respiration rates. Respiration rates of leaves also drop when water content is low.[1]

Soil throughout the root zone should be moist enough to supply plant needs but this moisture should not be so abundant to exclude air from the larger air spaces. Soil that is either too dry or too wet will cause wilting of the turf and in either case, light syringing will save the grass. Action has to be fast when there is a wet wilt condition.

When irrigating bentgrass, it is important to apply water so it penetrates soil without running off and to apply a sufficient amount to replace that lost since the last irrigation. Proper construction of greens minimizes errors in irrigation. Basically, bentgrass greens should be watered deeply but not too often. It would be advisable to go as long as possible before watering. Bentgrass should be syringed immediately when there are stress periods which in many instances will require close supervision of greens observing them often and syringing the greens 4 or 5 times per day may not be too unusual. The most critical times occur from about June 15 to September 15 depending on your location. If greens are constructed properly, frequent syringing will be reduced. If at all possible, foliage of plants should be syringed to reduce temperature and the transpiration rate will be minimized.

The optimum temperature in full sunlight is 60 to 80° F. Since photosynthesis supplies energy and materials for growth, it follows that optimum temperatures for growth are in the same range as those for photosynthesis. Temperature exerts an indirect effect on photosynthesis in addition to its direct effect. If moisture supply is limited, higher temperatures cause moisture loss from leaves to be excessive producing dehydration and closure of stomata.

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[1] Brown, R. H., Associate Professor of Agronomy, University of Georgia, Factors That Influence Grass Growth.

In addition to the direct effects of temperature on photosynthesis, it also affects respiration. Respiration does not respond in the same manner as photosynthesis but increases with temperature until thermal damage of the tissue occurs. The temperature required for maximum photosynthesis is therefore, different from that required for maximum photosynthesis. Low temperature restricts respiration and growth is slowed down. In most cases, photosynthesis proceeds faster at low temperatures than respiration and growth, giving the plant a surplus of energy which is stored for future use.

During stress periods a waterman is a very valuable employee. High spots in the greens will dry out first and low areas will require less water. Proper placement and timing of water is just as important as the water itself.

It is doubtful there is a time when watering greens to soften them to hold the shot is advisable. By watering to hold a shot, oxygen is excluded from soil pores and when this is done, grass roots will slough off except ones near the surface.

When adverse weather prevails, grass will be under more stress with a short root system, and you are apt to lose the bent. Greens should not be kept saturated as the surface will become more compacted which will reduce diffusion of gases into the root system. This will also cause the greens to become firmer from traffic from players. A physical analysis and correct construction of the greens will minimize these problems.

Aeration

When we think of aeration, we normally think of effects of soil moisture and texture on root growth. Aeration of plant tops is just as important, but we do not dwell on this subject simply because it is not easy to do anything about it in the open air. Nurserymen can increase CO_2 content in a sealed greenhouse and increase photosynthesis.

We do need to aerate, that is get oxygen to the roots so that they can oxidize their reserve materials to get energy for nutrient uptake, production of new roots, and other functions.[2]

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[2] Brown, R. H., Associate Professor of Agronomy, University of Georgia, Factors That Influence Grass Growth.

Drainage

Drainage is important when growing grass and good surface drainage is needed but internal and sub-drainage is a concern where bent is grown. A requirement for growing bent in a difficult area is adequate drainage. Greens should be constructed for adverse growing conditions, when stress becomes critical. The three most important factors when growing bent are (1) drainage, (2) drainage, and (3) drainage. What is meant by a statement such as this? Number 1 is surface drainage as we have mentioned; number 2 is internal drainage; and number 3 is sub-drainage. Greens should be built to have better control of water at all times. If too much water is applied to a green which is well constructed with a minimum of 5 inches infiltration per hour, then overwatering is not as much a problem as a green not properly constructed.

Nutrients

Experienced superintendents fertilize bent during the cool period of the year with very light or no fertilization during the hot summer months. In many instances, guidelines for proper fertilization are determined by color, clipping yield, and vigor of the grass. The number of pounds of nitrogen per 1,000 square feet per year will vary but bentgrass is grown best when nutrients are available in approximately a 3-1-2 to a 4-1-2 ratio although there may be some disagreement among fertilizer authorities. Total nitrogen applied per 1,000 square feet per year can vary but 6 to 12 pounds per 1,000 square feet has been used. Usually about 1/2 pound of nitrogen per 1,000 square feet per month or more can be used without harm to the grass. Of course, for best results, all nutrients have to be in balance which can be determined by soil tests.

Some functions of mineral nutrients are apparent. Magnesium is a part of the chlorophyll molecule and therefore its importance in photosynthesis is in the manufacture of chlorophyll. Phosphorus is contained in the high energy intermediate compounds which are used to transfer energy trapped by photosynthesis and released through respiration to do the work of the cells. Many nutrients, such as magnesium, cobalt, molybdenum, copper, and potassium are required as cofactors in reactions mediated by enzymes. In other words, they help the enzyme in a specific manner, to synthesize or breakdown metabolic components.[3]

Diseases

A preventative spray program is advisable but if there is a disease outbreak, the curative rate will have to be used. A broad spectrum fungicide will keep diseases to a minimum. After a complete cycle of 1 year, the turf manager should be able to anticipate diseases expected during prevailing weather. There are many excellent fungicides to control most diseases and disease activity can often be minimized with proper management.

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[3] Brown, R. H., Associate Professor of Agronomy, University of Georgia, Factors That Influence Grass Growth.

Herbicides

Since the middle 60s, bermuda invasion into bentgrass has been reduced by the use of Siduron (2 methylcyclohexyl-3 phenylurea). It has been observed that some bent selections are susceptible to this chemical and it would be advisable to put out spot checks to see if your selection is affected by Siduron. Seaside, Penncross, Highland, Astoria, Nimisila, C-1, C-7, or C-19 are tolerant to this chemical. These grasses will be affected if this chemical is over applied or is used during the hot summer months. In most cases, 9 to 13 ounces per 1,000 square feet have been satisfactory in removing bermudagrass from bent greens in Texas. We do not suggest changing from bermuda to bent unless greens are correctly constructed.

A healthy turf is the best weed control, but if there are weed problems, pre- or post-emergent chemicals can be used as a crutch to minimize weed infestation. It is important to know the sensitivity of your bent selection to the herbicide you are using.

Insects

The most common insects found on greens are sod webworms, cutworms, or armyworms. During 1971, frit fly was a problem in the Dallas area. There is a wide selection of insecticides for control of the worms, but diazinon at 4 ounces per 1,000 square feet is the best control for frit fly. Symptoms of frit fly begin at the edge of greens working inward turning the grass light yellow at first then brown. If frit fly is not controlled, the grass will eventually die.

Nematodes have not been a big problem and a nematocide such as Dazanit, Nemagon, Mocap, or others will reduce activity.

Summary

Bent is being grown in areas where it has never been maintained before and improved techniques of daily maintenance will allow it to be grown so the transition of overseeded bermudagrass greens will be eliminated. It becomes more hazardous to maintain bent in the south and east areas of Texas.

AQUATIC WEED CONTROL

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Numerous complaints concerning excessive growths of noxious vegetation in lakes and ponds are received in our office. The inquiries become so abundant during the warm months that responses to them consume a major portion of our work schedule. Although we do not consider aquatic weeds necessary for good fisheries production, nature seems to have a plan for growing them in all suitable places in defiance of our personal desires. And why shouldn't it be just as natural for aquatic species to invade ponds as it is for terrestrial plants to cover the land areas. Aquatic plants need nutrients and sunlight, among other things, to grow well. Many impoundments in Southeast Texas are both shallow and fertile. Sunlight readily penetrates to the pond bottom in shallow areas and encourages growth of aquatics. When man adds fertilizer to the water he often produces a lush growth of plants, generally unexpected and most surely unwanted.

When confronted with a pond weed problem, the first thing one should do is identify each type of plant in the pond. This is important because there are few, if any, safe herbicides which will control all species of aquatic plants. For example, one plant combination commonly found in many areas is naias and chara growing in the same pond. The pond is treated with a herbicide recommended for the control of naias but chara, which is an algae, is left uncontrolled to multiply rapidly and refill the pond.

Springtime, or mid-April, is an ideal time to treat most aquatic plants. Temperature of the water is warm enough for the herbicide to be fairly effective and the vegetation is tender and growing but not yet abundant. Therefore, the chemical is readily absorbed by the plant tissues but the mass of organic material is not sufficient to cause an oxygen depletion problem as it decays. If the mass of vegetation in the pond looks rather large to you treat only one-half or preferably less, of the pond area at one time. Granular formulations are ideal for partial or spot treatments.

The feasibility of controlling aquatic plants by biological methods has created considerable interest from people troubled with weeds in ponds. Most inquiries are in reference to introduced fish of the Tilapia genera. My experience with Tilapia has been quite limited, but I have noticed that in the Houston area apparently few survive through the winter months. They are either killed outright by a rapid drop in temperature or they become badly infected with fungus as the temperature of the water approaches the low fifties.

One interesting approach to biological control method was the introduction of flea beetles from Argentina for the control of alligatorweed which is notorously difficult to control with herbicides. We have followed the flea beetle releases in Texas rather closely. These flea beetles live and reproduce only on alligatorweed and have spread from the original release site for quite some distance into areas infested with alligatorweed and at times suppressed its growth considerably.

Many pond management bulletins suggest the use of fertilizer to create a plankton bloom which prevents deep penetration of sunlight thus abating the development of vegetation. In theory, I like this approach best of all but in practice the results are sometimes disappointing. Where water is shallow or vegetation growth has a good start this method has seldom been effective for me. Often with the addition of fertilizer in shallow water ponds there will be more growth of vegetation.

There has been considerable interest, but limited research, in the use of dyes to prevent deep penetration of sunlight as well as enhance the beauty of the pond. So far, only a modest amount of favorable results have been achieved. Excessive cost of materials and rapid degradation of the dyes are the two factors adversely affecting progress in this program.

Herbicides bearing a label approving their use in an aquatic environment are generally the safest and most effective means of aquatic weed control. I mention this because of the numerous inquiries we receive concerning the indiscriminate use of some of the substituted ureas, primarily diuron sold under the trade name of Karmex which is not registered in the United States for aquatic use. Several of the substituted ureas show a broad spectrum of control are economical to use, easy to apply, and are interesting to work with in experimental applications. Personally, I believe the greatest value of these materials would be in special situations when applied by applicators who should thoroughly understand the secondary effects of substituted ureas. When misused or used in repeated applications, they can promote extensive growths of noxious branched algae.

Some troublesome aquatic plants have been divided into the following broad groups for discussion of control methods.

Submersed Plants. These are plants which grow mainly beneath the water surface. They normally begin growing in areas of shallow water and progress toward deeper water. Maias, coontail, bladderwort, milfoil, the pondweed group and chara (an advanced form of algae) are among the most frequently encountered plants of this large and troublesome group. Naias is often the first vegetation to invade a newly constructed impoundment. Coontail generally grows in water with high alkalinity values and is often found in impoundments filled from deep wells. It is highly resistant to cold weather. Bladderwort usually grows in water of low alkalinity and is often found in East Texas ponds. Milfoil is the only plant of this group not entirely dependent on complete water coverage as it can grow on wet

marginal land. Plants belonging to the pondweed (Potamogeton) group are widespread and include many species that are highly varied in form. Chara (muskgrass) often grows in water deeper than that tolerated by other submersed plants but vanishes with the arrival of cold weather.

All of the above named plants, with the exception of chara, can be controlled with Aquathol Plus at about two gallons, or Diquat at approximately one gallon, per surface acre. Other brand name herbicides might be equally as effective. Chara should be treated with an algacide.

Floating and Lily-type Plants. First we will discuss the true floaters which include duckweed, water meal, water velvet, water hyacinths, and water lettuce. The duckweed group, including water meal, can rapidly form a greenish-yellow mat on the pond surface, block out sunlight and prevent release of oxygen by photosynthetic processes. Water velvet is similar in habit except it is often colored a beautiful red. These plants are difficult to control by the use of approved herbicides. I generally suggest Karmex at one to two pounds per surface acre as a specific control of the duckweed group if valuable ornamentals are not growing nearby or the water is not used for irrigation. Better control is obtained by injecting the material into the water beneath the mats than by spraying it directly on the plants. Water hyacinths are easily controlled when sprayed with one gallon of 2,4-D amine. In this and all following recommendations, unless otherwise specified, the herbicide should be mixed with 50 gallons of water and a commercial spreader-sticker added. If injury to nearby plants from drift is a problem substitute Dacamine or Diquat for the 2,4-D amine. Water lettuce is an exotic that is often difficult to control. Three quarts of Diquat per surface acre has given good results in tests conducted in Florida. Spatterdock (yellow water lily) is the most difficult of the lily-type plants to control. Spray with one gallon of silvex in water, or one quart of 2,4-D ester in 10 gallons of diesel oil; or apply 200 pounds of Aquathol Plus granules per surface acre. Fragrant (white) water lily and American lotus (nelumbo) are controlled with one to two gallons of 2,4-D amine per surface acre. Water shield is difficult to control, but responds fairly well when sprayed with four to six quarts of silvex per surface acre.

Marginal Plants. Cattail, bulrush, reeds, giant sawgrass, etc. are controlled with Dalapon at 10 to 15 pounds per surface acre. Spray before the plants mature and wet all surfaces well. Repeat as necessary. Dalapon is a specific for grass type plants, so keep it off your turf. Water primrose is a marginal plant that creeps along the surface from the shore toward deeper water. Control it with one to two gallons of 2,4-D amine per surface acre. Arrowhead (duck potato) can be controlled when sprayed with 2 to 3 gallons of 2,4-D amine per surface acre or with 4 to 6 quarts of silvex. Repeat treatment as needed. Aquathol Plus, either liquid or granular, used at rates recommended on the label is often effective.

Algae. For convenience of discussion we will consider all algae as belonging to one of the three following groups: (1) Single cell and colonial algae form part of the plankton in lakes and ponds and are generally beneficial except when they become too abundant. Bluegreen algae a specialized group within this category, are usually undesirable and cause considerable problems in lake management. These algae have the ability to manufacture nitrogen and often become abundant following the first cool days in the fall. They multiply and die off in rapid cycles and may form yellow, blue, or green scum on the surface. Some of the blue-greens are quite oily and may emit putrid odors. Most of the algacides including copper sulfate, Cutrine, substituted ureas and some of the endothalls will control plankton algae. Personally, I have had excellent results in controlling blue-green algae with Amine-D Acetate up to, but not exceeding, one pint per acre foot of water. I use Amine-D Acetate as a specific for the control of blue-green algae.

(2) Filamentous algae has many genera and species. Some of them prefer warm weather, others seem to grow better during the cool season. Most of them can be controlled with the algacides recommended for plankton algae.

(3) Branched algae are actually part of the filamentous group. Some of them, such as Pithorphora and Cladorphora, are so difficult to control that they should be given special consideration. If you have had trouble controlling an alga growth with an algacide which has normally been effective you are probably confronted with Pithophora or some other branched algae. Their response to treatment is highly variable and often disappointing. Branched algae often grow in ponds that have been repeatedly treated with algacides. In the absence of competition from phytoplankton or vascular aquatics the branched algae make use of available nutrients. I do not know of any reliable and consistent method of control. Chara and nitella are two advanced forms of algae that are often mistaken for rooted vascular aquatics. Treat them with the recommended algacides. Nitella is often found in water low in pH and alkalinity and is fairly resistant to copper sulfate.

RECORDS AND BUDGETS - WE CAN'T LIVE WITHOUT THEM

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At a Turfgrass Conference approximately eight years ago in one of the smaller rooms of this Student Center, we had a discussion on "Record Keeping and Budgets". I recall, there were many different reactions. Although a few recognized the need and apparently very interested, some reacted, more or less, to the extent that my responsibility is to make job assignments, go out on the grounds and supervise the work, handle maintenance of the equipment. Some took an approach to the extent of why discuss this subject, my organization has an accounting office where the records are kept and they keep all the reports. As I recall, we concluded, well we better start giving consideration to record keeping and budget preparation.

Today - I think we better discontinue giving consideration. We better start doing it. Regardless of any one person's job assignment, time has come when we no longer can spend all time on the golf course or on the park grounds. The time is now here when we must have pencil, pen, paper, calendar, daily time sheets, injury reports, personnel records, files, file cabinets, desk and chair. And I would like to say to you now, let's approach this, not on the basis that someone forced us into it but on the philosophy that we think is important and is an acceptable, efficient way of operation today. Recently I had a responsibility to design a new golf course superintendent's maintenance facility and one of the things I strongly recommended was for the superintendent to have an office, desk, chair, and file cabinet rather than working off some work bench out in the "bull pen" area.

I am sure each person here keeps some kind of records and I emphasize get credit for it and there might be ways to "dress it up" to the extent that it could be more effectively used.

Labor and Personnel

The cost of labor which traditionally takes up around 70% of total budget, continues to climb and it is necessary today to show where this labor is being spent. Again, at this point, we no longer can say to our superiors that "in my opinion, most of our labor is being spent on this job or that job." You and I well know that if we can make a visible presentation, our superiors will be more receptive. Let me point out two experiences relating to labor and personnel that recently occurred.

TO OUR SUPERIOR (this could be Chairman of the Committee, Board Member, Director, etc.)

On the golf courses we maintain a day to day job assignment showing hours for various responsibilities on the golf course. Many of you are familiar with these assignments which includes maintenance of the greens, fairways, tees, roughs, woodland, nursery, equipment maintenance, maintenance of buildings, etc. This is kept on a per laboring hour basis. At the end of a twelve months period, we discovered that 31% total laboring hours on all golf courses included maintenance of the greens. This is not an opinion, but based on records maintained on a day to day basis. Then, as many of you know, we discovered on the market a riding greensmower and we all realized one of the major advantages of this piece of equipment was to reduce labor and continue to provide the same standard of maintenance. When this equipment was first recommended, the question was asked, how can we justify it and besides we are on a tight budget. Let me digress just a moment and ask the question - How many of you ever recommended an item on a loose budget? But to support this recommendation, we were able to produce actual written records and from these records we were also able to produce in writing how it was economically feasible to purchase the new piece of equipment.

TO YOUR PERSONNEL

A situation presented itself whereby an employee was concerend with his salary and his work load. In lieu of the approach we all often use and that is, that John your attendance record is not too good, you also seem to be injury prone, etc., etc. Written records where John may review with you, will show specific dates John has been away from the job, will show specific dates and how an accident occurred, etc. So, what do you think John's reaction is when he comes in and you have such detailed information for his own personal inspection. Furthermore, we must all realize that the effect this experience will have on John's fellow workers.

Equipment

Records and evaluation should be made on each piece of equipment including performance, reliability, yearly maintenance cost, repairs, etc. Furthermore, other recorded information should include an inventory with equipment number or identification. Replacement of equipment should be on a planned, scheduled basis.

A continued analysis should be made of what lines of new equipment are available. As I have already indicated, improvement in design and use are being made daily and we need to keep abreast of these developments and an open mind. You might ask, where does this come into record keeping? Do you have a file with catalogs and descriptive material of new equipment on the market and is it indexed to where it can be found?

Materials and Supplies

1. Chemicals

   A. We all recognize that a chemical program today is part of a turfgrass program. To many of us this is a comparatively new area and record keeping plus budget preparation in respect to chemicals can get rather complicated. Many times we use chemicals on a trial and error basis for lack of better approach. However, due to these conditions, it is necessary that we maintain some kind of record keeping on the availability, application, cost and inventory. I observed at one time where an individual maintained a card index on all chemicals, brand names, approximate cost, application for quick reference. This seems to be a very progressive approach.

2. Fertilizer

   A. Inasmuch as this is an important item, most budgets devote a separate item in their budget recommendations to fertilizer. As in the case of chemicals, it is always necessary to relate costs to applications and an item by item explanation, especially any changes from the previous budget.

3. Supplies

   A. Contrary to what we normally expect, this item can be rather important particularly at budget preparation time. Included in this item in your record keeping and budget preparation are expenditures which may be the difference where your operation is a good one. For example, we concentrate on a turfgrass program, chemicals and labor and overlook a paint job, ball washers, flag poles, benches, fixtures and repairs. Frankly, many times I have experienced where it is easier to purchase a $5,000.00 item than a $200.00 item. But this proves how detailed budget preparation should be. A systematic program always referring to the past budget is helpful. It is easy to put off the purchase of many supplies which may not "wreck the budget" but cannot be purchased just because they were not listed in the budget.

Preparation of the Budget

Preparation and presentation of a budget is, in my opinion, one of the most important points. Again, I emphasize, regardless of what your job assignment is you need to prepare a budget from records kept. True, it may be integrated into a budget of your division or your department or whatever, but assume some responsibility in this area. For example, do you realize how many labormen today are using a piece of equipment and do not have the slightest idea of what it cost? I recently observed where an individual supervised five labormen and he and the five labormen got together and prepared a budget showing comparative cost, recommendations and why, labor cost, job assignments, indexed it and spent 20¢ on a binder and presented to his superior. What an impact this made on his superiors all the way "up the line".

Basically, a budget is an estimated cost of operations for a certain period of time. This is normally done once every twelve months but results in a specific plan, a program, control, a standard of operation and a challenge. It truly reflects the anticipated sound operation to better serve the people. Consequently, it is imperative to keep a complete set of records containing daily information.

Dos and Don'ts

Don'ts

1. If the budget is cut or adjusted - don't gripe or complain. Make a note and try again the next year.

2. Don't limit yourself to a 12 months plan - be specific for the 12 months period but make it a part of a three to five year plan.

3. Don't say "my budget" - emphasize what you, the Committee or Board can do.

4. Don!t emphasize just dollars - emphasize people and service.

5. Don't put in your budget an ultimatum - you will "hem yourself in".

6. Do not recommend a budget with an excessive cushion although, consideration should be given to adjustments.

Dos

1. Involve your employees particularly key people.

2. Inform yourself of cost of equipment.

3. Emphasize labor - give considerable thought to this - this is where approximately 70% of the budget expenditures go.

4. Put it in writing where it can be easily read. If a budget of your division, consideration should be given to putting it in binder form.

5. Relate to daily records maintained and avoid just opinions.

6. Relate to previous years operations.

7. Have some general information regarding your superiors concern as he will need to possibly integrate your recommendations with an even larger budget.

8. Have a budget regardlesss of size of your particular division or organization.

9. Consideration for an equipment demonstration for your particular organization. For example, what is wrong in the golf course superintendent having open house for the members of the club? Display of all equipment, supplies and personnel.

10. Advisable for the budget to have one major point of improvement - maybe a major landscape program or major program in improvement of equipment. In other words, do not let your budget preparation and presentation become just a routine item but include a recommendation that will "catch their eye".

WEED-FREE TURF TODAY

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Without weeds and competition, and flourish of growth and times of failure, it is much simpler to grow good grasses. Then our concern becomes - WHAT, WHEN, WHERE, HOW and WHY? We well recall when any ground cover was acceptable. Today it must be weed-free for we seek perfection - that is our business in producing quality turf.

All know the blessings of 2,4-D beginning about 1945; then came along 2,4,5-T which better controlled clover and viney weeds. By 1960 Dicamba was available, and around that time MCPP became available in some areas. Today, then, we very often see a blend of 2,4-D, MCPP, and Dicamba. Their ratio tends to be low in Dicamba, and our only question is how little can we use at the best time under the best conditions.

The selectivity of Dicamba on knotweed has made that pest just a nuisance. For example, in athletic fields we can overseed whenever possible, get our seedlings established at least by June 1, then stop the knotweed before runners start to form about June 1. That removes the competition, gives the summer for the grasses to fill in, so the athletic field is ready for use in the fall.

Of course, Dicamba could be used earlier on the seedling knotweed. There is finesse in weed control too. We now strongly recommend fall applications of 2,4-D so that dandelion, buckhorn, etc., are killed with minimum concern for adjacent desired plants, and this gives weed-free turf the following spring. Also, it prevents the least frequency of 2,4-D usage under good turf care.

Pre-emergent Controls

The homeowner has a simple choice as would have many custodians of industrial or school grounds. They may purchase one of five materials, apply it within a five-week period of spring, expect 99% control of crabgrass and be satisfied every time. These are rather routine programs with cost and timing being the major considerations.

The professional turf manager on golf courses or recreational complexes may be keener on controlling Poa annua also. This weed increases the tediousness of a program. At that point priorities must be established. If he is controlling Poa annua, goosegrass, or crabgrass, then to introduce and encourage either bluegrass or bent it can be done. It has been done on many turf areas. A conservative estimate is over 3,000 that are now selectively preventing weeds on more than one turf area, and there are many that have complete weedy grass control on greens, tees and fairways.

The Hardest Question

The hardest question is - "Can you grow good grass?" Is wear, poor drainage, poor varieties, poor management, inadequate water literally stopping the good grass? Conversely, can you make the grass fill in, grow? Maybe you should start out by sodding. Perhaps it is overseeding and plugging. The basic idea is to repeatedly introduce the desired material and gradually take out the unwanted.

The labels are clear cut on Bandane, Balan, Betasan and Dacthal. The tedium of using calcium arsenate is known. Never was the warning - "Read the Label" - more imperative.

An example - In Indianapolis a lawyer purchased 10 bags of material and treated his lawn. He obviously over-treated. He had tall fescue as the undesired weed, which he thought was crabgrass, and he has had a miserable time trying to recover the lawn. Not only did he misjudge the grass, but he over-applied the material. His label reading was less than his legal ability.

Commercial literature of several companies point out their usage. The Po-San program which may restrict the competitive nature of Poa annua is of real benefit.

At Oak Park Country Club in Chicago about August 5, he treated the 17 fairways with Po-San. The next day he sliced in seed with the Rogers Seeder. The seedlings had room to establish. He used some fungicides to protect the seedlings - it looks great as winter approaches in '71.

A similar program at Highland Country Club in Indianapolis illustrates Po-San's ability to slow down the growth, cut the competition, and thus favor the introduced seeding.

There are programs for Balan, Betasan and Dacthal primarily to use before germination of seedlings in the fall, thus new Poa annua is inhibited. Combine this with a touchup treatment in the spring for crabgrass; thus, twice-a-year treatments and established turf that already has a stand may greatly improve.

The Final Question

The final question becomes one of policy. Those who are responsible for decision making should decide - are they willing to do without the weed, its germination, its thickening, its fillin, and secondly what grass do they wish to have. If there is considerable bent already, this appears to be a bottleneck. We do not have selective bentgrass killers within bluegrass as yet. If there is primarily bluegrass present, then upgrading to new varieties offers much promise.

We have a success story to tell. There is success all about us. Today's golf courses are cleaner of weeds, more dependable in stand, more available for use than ever before. That is the result of industry, research and you, turf managers, all working together. It is what our business is so noted for.

COMMUNICATIONS DOWN, UP, ACROSS

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I. Information in any organization must flow down, up, across.

A. The directing function of management is performed by sending information down the lines of authority.

1. Information-giving

a. Communications DOWN

B. The controlling function of management is performed by getting information from those down the lines of authority.

1. Information-getting

a. Communications UP

C. The coordination function of management is performed by both giving and getting information from equals or co-workers.

1. Information getting and giving.

a. Communications ACROSS

II. Let's now discuss each of these three functions of management in so far as communications flow is concerned.

A. DOWN

1. Purpose is to set things in motion.

2. Why communicate down?

a. Give instructions

b. Prepare for changes

(1) Don't let grapevine beat you

c. Discourage misinformation

d. Lessen fear and suspicion

e. So employees will feel the pride of being well-informed

f. Reduce grievances

g. Develop an "espirit de corps"

3. What to tell them?

a. Anything they think you are trying to keep from them

b. All that they will find out sooner or later

(1) If you can't tell them the entire story because of various reasons, you can say this:

(a) Changes are in the offing

(b) We are telling all we can at this time--more will be released as soon as possible

c. Anything which will affect either their status or work

4. How to tell them

a. Use the supervisory line for instructions (don't short-circuit supervisors when orders or assignments are involved.)

b. For general information, use as many direct routes as possible, because you want them to get it unfiltered. Some are: bulletin boards, house organs, general meetings, mailouts with pay checks, etc.

c. Remember that any message that goes through anyone else stands the change of being filtered.

(1) The filter is the person's frame of reference.

(2) Always couch messages, which must be handed down the line, in such a way that there is the minimum room for filtering (interpretation).

B. UP

1. Purpose is to keep things going in the right direction.

2. Why communicate up?

   a. Evaluate how well communications DOWN are taking place.

   b. To secure valid information upon which to make management decisions

3. What kind of information just naturally flows up?

   a. That which the boss will hear anyway from the "wrong person". There is everything to gain by tipping him off.

   b. Things that will make the subordinate look good.

   c. Information which the subordinate thinks will please the boss.

      (1) They soon learn what a boss likes to hear. (This means that the type of information that is really needed does not flow naturally from below)

4. Blocks to Communications UP

   a. The avenues are far more limited than for communications down.

   b. The subordinate is often less articulate on the matter needing discussion than is the boss.

   c. There is a rank difference.

   d. Built-in filters up the line which color the message to fit individual frames of reference. (Meanings are in people--not in words!)

   e. Busy boss doesn't have as much time to listen as the subordinate has time to talk or write.

      (1) Boss has many subordinates. Subordinate has only one boss.

C. ACROSS

1. Purpose is to coordinate management actions with co-workers (equals).

2. Coordination is not the same as cooperation. One can co-operate with another, be most agreeable, yet miss completely the management angle involved. One is a sociological factor (cooperation), the other (coordination) is a management factor.

3. ACROSS communications can be achieved best by:

a. Structuring for it

(1) Build it into procedures

b. Designing layout to make it easy

(1) Physically group those who should work closest together.

c. Having planned staff meetings--well run

d. By delegating decision-making to the lowest possible level in the organization

(1) Keep track of your decisions for one day and see what scope they represent.

III. Some other things a manager/owner can do to cause communications to flow better when they go DOWN, UP, ACROSS

A. Adopt the technique of always asking anyone who brings you a problem, "What do you suggest we do about it?"

B. Develop and install an incentive pay system.

C. Have a suggestion awards program.

D. Install a meaningful employee performance appraisal system.

TURFGRASSES AND ORNAMENTALS IN MAN'S ENVIRONMENT

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This may or may not be the age of Aquarius as the song from the musical, Hair, claims but it most certainly is the Age of Ecology. Everyone who reads a paper, listens to the radio or watches television has to be at least aware of the enormous envirnomental problems facing the world today.

Those of us who have been working in the areas of turf management, ornamental horticulture, park management and similar fields were environmentalist and ecologist long before the terms were ever known to the general public. As a result we are in the forefront of the movement today. However to maintain our leadership it is important that we understand what we are talking about. In this presentation I will discuss a few specific aspects of the role of grasses and ornamentals in our environment with the hope that in doing so a clearer understanding of the subject will result.

Air pollution is undoubtedly the best known environmental problem facing our society today but also one about which much confusion still exists. That it causes great economic loss, severe damage to many plants and endangers our health there can be no doubt. Some ornamentals and trees are being killed in areas of heavy pollution. The Pondorosa Pines of Southern California are notable examples.

The turfgrasses are damaged by smog and turf quality reduced but I know of no instance where turfgrasses have been killed by even very heavy and prolonged attacks. Some species such as Common bermuda and tall fescue show considerable smog tolerance. Great genetic variation exists within the genus Cynodon (bermudagrass) for susceptibility to various air pollutants. C. transvaalensis, African bermuda, is highly sensitive to smog while C. dactylon, common bermuda is moderately resistant. The hybrids between the two species such as Tifgreen, Tifway and Tifdwarf are also sensitive. However, it is possible to select smog tolerant individuals from both species which may be used in breeding smog tolerant hybrids. Santa Anna bermuda is such a hybrid.

It is often claimed that turfgrasses and ornamentals purify the air. While it is true that polluted air passing through dense vegetation will be cleaned to some extent the mass of air above these plants will be unaffected. Smog may extend a thousand or more feet above the ground over most cities so it is easy to see that only a small part of it will ever pass through vegetation.

Similarly, much is said about grasses and other plants giving off oxygen. Again it is true that all plants give off oxygen in the photosynthetic process. However, our problem is not a shortage of oxygen. The oxygen content of the air is little changed from what it was centuries ago. Rather, our problem is to prevent the discharge of toxic gases and other substances into the air we breathe making it unfit for our use.

Ornamental plants particularly grasses, do play an important role in dust control. Grasses have long been appreciated as the best soil stabilizers. Dust and other particulate matter in the atmosphere has increased greatly during this century. It may be the cause of a general cooling of the earth which has been noted in the past 40 years.

Next to air pollution water pollution is certainly our greatest environmental problem today. Water pollutants have many sources but some of the most common are sewage effluent, manure and other agricultural wastes, industrial wastes, fertilizers and pesticides.

At the same time that disposal of waste water is an increasing problem, a shortage of domestic water supplies is also becoming common in many areas. The obvious answer seems to be recycling of water; purifying the waste water and returning it to the sources of supply. But how can this be done economically? Tertiary water treatment which is usually required is very expensive.

One method that has been employed successfully on a very limited scale is to use the waste water, following secondary treatment and chlorination, for irrigation of golf courses and other landscaping. As the water passes through the soil and root system of these plants nitrates, phosphorus and many other substances are removed. Percolation through the soil also destroys dangerous organisms which may be present. Surface water runoff must be avoided because water flowing directly into streams and lakes will not be purified. Therefore it is important that sprinkler application rates be no greater than the infiltration rate of the soil.

On golf courses irrigated as above little or no difficulty in growing grass has been observed. The turfgrasses are quite tolerant of most of the substances found in sewage effluent. Bermudagrasses are especially tolerant and especially efficient in removing nitrates and phosphates.

Unfortunately golf courses and parks can utilize only a minute amount of the total waste water produced in a large metropolitan area. Only those courses situated near sewage treatment plants can economically use the water. Therefore additional new ways to recycle waste water are being sought.

A research project in the San Bernardino Mountains above Los Angeles is studying one possible new method. Thousands of acres of mountainside in Southern California are covered with chaparral vegetation. Following the dry summer period this vegetation becomes highly flammable and wildfires are common throughout the region. At the higher elevations in the pine forests large resort communities have developed causing a heavy drain on the ground water supply and producing huge quantities of waste. Wildfires which may originate in the brushlands below are a constant hazard to these communities.

A project was initiated in 1969 to study the feasibility of using the waste water to irrigate mountain greenbelts across the chaparral covered slopes. These greenbelts, strategically located in respect to the mountain communities, would serve several purposes. First, they would provide fire breaks of lush green vegetation to protect homes. Second, they would serve as disposal areas for the sewage effluent, purifying the water before it is returned to the ground water reservoirs. Third, they would be used as recreation areas for camping, picnicing and similar activities. Turfgrasses will be an important part of the vegetation in these greenbelts. Because of their extensive fibrous root system grasses are highly effective in water purification.

Although the study must continue for several more years before the value of the idea can be determined, at this time it looks very promising.

SOIL CONDITIONS AND TURF GROWTH

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Introduction

Soil, frequently altered in some way from its natural state, is the medium in which most turfgrasses are grown. The grass relies on the soil for physical support, water, essential nutrient elements and aeration. In this presentation, diversity among soils on the landscape, physical behavior of soils in relation to composition and reactivity of nitrogen, phosphorus and potassium in soils will be discussed.

Diversity of Soils on the Landscape

A prime consideration for growing grasses successfully on soils is to recognize that soils differ greatly in characteristics that have a profound influence on their ability to support turf growth. Soils differ in a single lawn or fairway. Differences in a single plot are usually associated with landform changes under natural conditions or with the activities of man, for example, leveling, filling, and addition of topsoil. Differences encountered on a broader scale are caused by climatic, biotic, and parent material variations. Management decisions must be influenced by soil conditions if satisfactory turf growth is to be achieved.

Soil Composition and Physical Behavior

Physically, soils are porous bodies. Porosity in soils accounts for root penetration by grasses; water entry, movement and retention; and exchange of gases bewteen soil pores and atmosphere. Therefore, soil-plant interactions are, in large part, physical in character.

The number, size, and shape of pores and connecting channels in soils, all of which contain water, air, or biotic life such as roots are dependent in large measure on the sizes of the individual mineral particles that compose the bulk of the soil as we see it. Actually 30 to 50% by volume in most soils is considered pore space. In a given volume of soil, pore size and particle size are inversely related. Consequently, sands contain fewer but larger pores than do clays.

A balance between large and small pores is desirable in soils which support growth of grasses. Water, which adheres to the surfaces of soil particles, is retained in small pores, but water drains from large pores. In moist soils movement of gases is through the large pores from which water drains.

In sandy soils, movement of water, penetration of roots, aeration and tillage characteristics are very good, but retention of water is limited; large pores are far more abundant than small pores. In clayey soils, retention of water is high, but movement of water, penetration of roots, and aeration are impaired unless the soil has good structure; small pores are more abundant than large pores. Structure is the grouping of soil particles into a larger body called an aggregate or ped. Small pores occur inside these peds but large pores which permit movement of water and air occur between the peds. Structural development and stability in fine-textured soils is a function of their organic matter content. Soil compaction destroys soil aggregates and decreases both total porosity and volume of large pores.

Soil composition with depth is important to the roots of most plants. The composition and porosity of both surface and subsoil horizons should be considered in evaluating the soil's suitability as a medium for turf growth.

Soil Nitrogen

The bulk of the nitrogen in soils occurs in the soil organic matter. As microorganisms decompose the organic matter the nitrogen may be released into plant available forms. The most abundant plant available form of nitrogen in soils is nitrate (NO_3^-). This form of nitrogen is rather easily leached from soils because it is soluble in water. In poorly aerated soils it may be reduced to gaseous forms and lost by volatilization. From the standpoint of efficiency of utilization by grass roots, nitrogen should be added as or converted to nitrate forms at the same rate it is used by the plant to avoid leaching or volatilization losses. In addition, the level of available nitrogen required to maintain green turfgrass is considerably less than that required for a maximum rate growth.

Soil Phosphorus

Phosphorus in soils occurs in both organic and inorganic forms. The plant available forms of this element have a strong tendency to be strongly adsorbed on the surfaces of soil particles or to interact with other elemental forms in solution to form insoluble compounds. For this reason, keeping phosphorus in a plant available form in soils is a challenge, particularly if the soil pH is outside the 6 to 7 range. High efficiency in the utilization of applied phosphorus by plants is rarely achieved due to fixation of phosphorus in plant unavailable forms. Leaching losses of phosphorus from soils are minimal but erosional losses can be significant.

Soil Potassium

Potassium is associated almost entirely with the mineral fraction in soils. Most fine-textured soils have the ability to supply large amounts of potassium to growing plants. Sandy soils are less sufficient in meeting plant needs for potassium. Available potassium is retained on cation exchange sites of soil colloids until needed by plants and, therefore, is less subject to leaching than is available nitrogen. Absorption of potassium by plants is more a function of the amount available than the amount needed for optimum growth.

Closing Remarks

The brief comments about nitrogen, phosphorus, and potassium have been selected to justify the observation that frequent, light applications of fertilizer to turf are much better than infrequent heavy applications or no applications. Frequent, light applications (3 to 6 times per year?) will lead to a more uniform growth rate; avoid the luxuriant growth following heavy applications, and give more efficient use of the fertilizer applied, and reduce the probability that drainage waters from the turf are unduely polluted with fertilizer ingredients.

With regard to soil-plant-water relations, less frequent, but heavier applications of water than are commonly used on lawns and other turf areas are desirable to avoid salt accumulation and evaporation losses and to encourage development of a deep root system. The entire soil solum should be wetted to field capacity when irrigation is practiced.