Proceedings

of the

Fourteenth Annual

Texas Turfgrass Conference

TEXAS A & M COLLEGE SYSTEM

AND

THE TEXAS TURFGRASS ASSOCIATION

COLLEGE STATION, TEXAS

DECEMBER 7-9, 1959

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Design and Construction for Efficient Maintenance

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With the continuing rise in prices for materials and labor essential for the maintenance of golf courses and other turfed areas, we should all realize the importance of exploring every possible means of reducing the cost of turf maintenance. There are a number of approaches which we can make to the problem of maintenance costs. The efficient management of personnel and equipment are of course, primary considerations, but I'm sure you all have seen and are familiar with courses which were designed and constructed in such a manner that even the most efficient management could not produce the desired results on a reasonable budget. Most of you, as superintendents, will seldom have occasion to be associated with a golf course during the design and construction stages, but for those of you who are with clubs or courses which plan new construction or who are contemplating a rebuilding program, there are certain principles which if carried out will make your job of maintenance easier to fulfill. Perhaps also there are trouble spots or maintenance bottle-necks on your course which you can eliminate and thus make your maintenance operation more efficient.

There are many ways in which the design of the golf course may affect the cost of maintenance. The cost of labor is the largest item in the operating budget, normally taking from 75 to 85 percent of the budget. Any streamlining we can accomplish to eliminate tedious, time consuming tasks will serve to cut operating costs.

To take the golf course features in order, we may start with the tees. Tees should be long (generally more than 100 ft.) to allow frequent changing of the tee markers and also to permit flexibility in the length of the hole. They should be made to blend into the surrounding terrain, and should be elevated only enough to

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provide level footing for the golfer and to assure good surface drainage. Normally if we are teeing off downhill the tee should slope from back to front and if teeing off uphill should slope from front to back. An inch fall in each ten feet of length is sufficient to provide good surface drainage. Where it is necessary to elevate the tee, it should be made to blend into the surrounding terrain by means of long gentle slopes. Corners and sharp breaks in contour should be avoided. These considerations affect the ease of maintenance and permit the use of large units of power equipment without danger of scalping.

At this point we might consider another factor which requires attention here as well as on other portions of the course. The use of electric and gasoline powered golf carts is increasing daily and as the number of these vehicles increases so do the maintenance problems created by them. One of the basic considerations in designing a golf course, along with the strategy of each hole should be the routing of both foot and cart traffic. In the area adjacent to the tee and around the green this traffic must necessarily be concentrated, to some degree, and provisions should be made to handle the concentrated wear and tear resulting in these areas. On the fairway where traffic is spread out there are no particular problems created, but adjacent to each tee and green the traffic patterns should be considered and cart paths and parking spaces should be provided.

The two items we have discussed so far, tees and the routing of cart traffic are areas in which each of you as superintendents can accomplish much toward an easier maintenance program. It is not too difficult or costly in most instances to make those changes in a tee which will make it easier to maintain. Also with cart traffic, if your preliminary study of the situation is thorough and careful, the installation of cart paths and parking areas can eliminate some of the trouble spots which increase maintenance costs.

Fairway bunkers are the next item in our progress around the course. I'm sure that a study of almost any course would reveal some fairway bunkers that are so placed that they have no effect upon how the course is played. These bunkers which do not affect the strategy of play and those which penalize the high handicap golfer should be eliminated. Fairway bunkers should be built so that the sand is visible, so that they will be well drained and so that all slopes are gentle enough to be maintained with large equipment without danger of scalping. In shaping the bunkers it should be remembered also that scalloped edges may be attractive but that they add to the cost of maintenance. It is easier to maintain the areas surrounding bunkers if the edges are smooth rather than scalloped.

Pockets or low areas which collect and hold water in the fairways should be corrected either by properly graded open swales or by the installation of tile drains.

With reference to putting greens there are several important factors which we should consider. The first of these is the size of the green. Cup locations need to be changed frequently when player traffic is heavy. In order to have enough space to change the cups frequently, it is necessary to have large greens with several cup setting areas. On a well designed green these areas can be so placed with reference to mounds and bunkers that the difficulty of the approach shot to the green can be varied with the cup setting. The size should vary from about 4500 square feet to perhaps 9500 square feet with the size of a particular green depending upon the strategy of the hole and the type of approach shot which will normally be played to the green. A green of 9500 square feet is large enough to provide sufficient cup setting area, and if we increase the size much beyond this point we are adding to the cost of maintenance without adding to the interest or playability of the hole.

Where possible, bunkers around putting greens should be far enough away from the putting surface to allow the passage of large mowing units between the bunker and the green. The green can be shaped and mounds can be placed so that the bunker will be near enough to the green to be effective and still allow room for mowing between the green and the bunker. Blind traps should never be built. From the golfers point of view there is nothing more disconcerting than to play a shot which he expects to find in a good lie near the green and then find himself in a trap which was invisible from the fairway. Here, as with fairway bunkers, it is extremely important that bunkers be set up so that the sand is visible to the golfer as he approaches the green. Where bunkers are set into a mound, maintenance is made easier if a slight roll or lip is placed around the upper edge of the trap to divert surface water and pervent the washing down of sand flashed against these edges of the trap. If you have blind traps they should be removed or raised.

Drainage, both surface and internal, is extremely important if we expect to maintain a good putting turf under conditions of heavy play.

Surface drainage should be channeled from the green in 3 or more directions, and none of these should be directly into the approach to the green. With a well designed green, surface water can be removed at the sides and even to the back of the green. Where the surrounding terrain and the strategy of the hole dictate that water must come off at the front of the green, it should be designed to spread the water over as wide an area as possible to avoid concentrating it into an area which would remain wet and all too often become a maintenance trouble spot.

On the green there should not be any low areas or pockets which will catch and hold water as these are potential trouble spots. Sharp contours on the green should be avoided for here even more than in other areas scalping can be critical.

Surface slopes on the green should not exceed 4%. Internal drainage in the green is very important whether you are in an arid region or a high rainfall area.

Subsurface drainage is affected both by the soil mixture used on the green and by the underlying material. There are certain functions which we expect of a good putting green soil mixture. These are:

1. Drain quickly and yet does not become hard and compact as it dries.
2. Provide ample airspace porosity as well as sufficient water holding capacity.
3. Resilient enough to hold a well placed shot and at the same time not require excessive amounts of water to keep it "soft".
4. And of course most important that it will support a good turf year after year.

To accomplish these principles which we have outlined, the procedure for building a green should follow these steps

1 The subgrade should be contoured just as the finished surface will be shaped but about 16 inches below finish grade.
2. Tile should be laid in a suitable pattern on the subgrade in trenches deep enough to accommodate them. Water should not have to move more than 10 feet laterally to reach a tile.
3. The tile trenches should be back filled with a clean washed gravel and in addition a layer of gravel about 4 inches deep should be placed over the entire subgrade of the area to be covered by the putting surface. If gravel is larger than 1/4-3/8 a layer of coarse sand 1-2" deep should be placed over the gravel.
4. A pre-analyzed mixture of sand-soil-peat should be mixed off the green site and then placed to a depth of 12 to 14 inches over the gravel. After smoothing and sterilizing, the new green should be ready for

planting and with proper care for many years of trouble free service.

Plant materials, trees and flowering shrubs can be used to distinct advantage on the golf course if judicious planning is used in their placement. A variety of flowering shrubs correctly placed will do much to beautify the golf course. The selection of planting materials and their placement should be studied carefully

The last area of discussion which I will take up is the design and operation of the watering system. Some of the points which should be considered in designing a system are the rate at which water will infiltrate into the soil, the amount of water available and the pressure at which it is to be available. With consideration given to these points a system can be designed to apply water at a rate which will give maximum utilization and a minimum of water loss. In planning the system consideration should be given to the automatic systems for although they are more expensive to install, the savings in labor effected will set this additional initial investment usually within a 5-year period.

In general, we can sum up those practices which should be followed by stating that everything on a modern golf course should be streamlined. There shouldn't be any sharp slopes or angles because you can't operate on such areas with big machinery. Greens should be large and well drained, and bunkers should be 6 feet or more from the putting surface where ever possible. Sand traps should be placed properly and shaped so that they will be visible and well drained. All slopes should be such that they can be maintained with fairway units. Tees should be large and should be suitable for mowing with fairway mowers. Bunkers should not be placed to penalize the beginner or poor player. Make the course a real test for the low-handicap player but a pleasant place for the beginner.

A good plan to follow in eliminating trouble spots on the course is for the superintendent to make a list of his problems, the professional to make a list of his suggestions, and the chairman and members of his committee should walk the course-not while playing - and make up their own list. Then decide on a program to follow and go through with it.

Modern Equipment and Maintenance Requirements

J. R. Watson[1/]

Today a rapidly increasing population - some say exploding - coupled with more leisure time than at any period in history is placing heavy demands on all types of recreational facilities and services. Increasing economic and production efficiencies will, unquestionably, result in even more leisure time in the future. This, from the standpoint of usage, will exert still more pressure on existing turfgrass areas as well as necessitate the construction of new facilities. In the face of rising labor costs - over five (5) percent last year - and with user demands for higher quality playing conditions, it seems mandatory that the organization (whether it's a golf course, park, school, highway, airport or cemetery) charged with maintaining turfgrass must either increase budgets or increase efficiency in their operations. Growing resistance to higher budgets would seem to indicate that rising labor costs must be offset by more efficient operations. Efficiency, in this case, implying the development and maintenance of the highest possible degree of turfgrass quality and user acceptance commensurate with a given expenditure of time, energy and money.

Adequate, modern equipment contributes to efficient operation and maintenance of turfgrass areas. Since labor is the biggest expense item in a yearly budget (65 to 75 percent last year), this means, primarily, that hand operations must be keyed to the use of not only more mechanized equipment, but also to equipment which will produce a greater number of work units per man hour. Great strides have been made in this respect during the past two decades, but still greater strides must be made if our turfgrass recreational facilities and services are going to maintain even their current level of acceptance.

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Machinery and equipment requirements for modern turfgrass culture and management depend on the available labor force, the level of maintenance, the size, landscaping, kind of grass and use for which the area is designed. These considerations are basic when determining the size, number and types of equipment needed for efficient and economical operation of turfgrass areas. The selection, procurement, use and maintenance of equipment should be approached on the same basis as the overall operation of the organization; i.e., a planned and organized approach with proper supervision.

Planning for Adequate Equipment

The direction for increased efficiency through adequate equipment does not necessarily lie in the development of new equipment, non-existant today. Rather, increased efficiency may (and probably does) lie in the development and execution of programs built around equipment presently available, or in the later stages of development. Certainly the greatest immediate potential for increasing efficiency calls for such an approach in our thinking. This means planning.

Planning is a management function and will be discussed by our next speaker (D. M. Lilly); nevertheless, I should like to touch briefly on the importance of planning in respect to equipment requirements.

Planning for adequate equipment begins with a detailed study of the layout of the turfgrass area or areas. Ideally, a scaled layout of the golf course, park, school grounds, etc. should be prepared. If more than one park, campus or cemetery is involved, all should be mapped individually and then brought together (on a reduced scale) on a master layout. Such a layout should show the various landscape and terrain features; roadways and bridges; and the location, size and shape of special features such as ball fields, greens, or for that matter the entire course, may prove advantageous. From the layout, coupled with a knowledge of the necessary maintenance practices and capabilities of the machines to be used, plans for increasing efficiency through adequate equipment may be developed These should be developed along two lines - an "immediate or current program" and a "long range" program.

Immediate Program

The objective of this program should be to determine if the area or areas concerned, in their present condition, are being maintained as efficiently as is possible with equipment on hand or available for purchase. This involves, among other things, an examination of the capacity, mobility, maneuverability, sturdiness, durability - and in the case of certain mowing units, trimmability - as well as a study of the maintenance records on each piece of equipment to determine annual service and repair costs. When contemplating the purchase of new or replacement equipment, satisfy yourself that you are making a wise choice. Record the actual time involved in cutting and in transporting between cutting areas. Compare the performance of the old versus the new. Determine, for example, how many independent 30-inch cutting units can be replaced by one tractor with integrally mounted hydraulically operated 30-inch cutting units. For that matter, compare the savings in time and labor between one such 7-unit mower with two conventional pull type 5-unit setups. Don't forget to consider the difference in the number of operators and the fact that, in the latter example, you tie up only one tractor instead of two. Replacement of inadequate and costly (from the standpoint of operation) equipment with units which will produce more work per man hour of operation will contribute materially to efficiency; however, since equipment purchases are essentially capital expenditures, and certain types may last from five to fifteen years, no equipment should be purchased except within the framework of a long range program.

Long Range Program

This approach is basically a modernization program. Many of our turfgrass areas were designed and constructed during an area when labor costs were negligible and mechanization of little importance, thereby creating many time consuming

operations requiring the use of low capacity, and often costly equipment. Landscaping may not have been planned; rather, it may have grown haphazardly over the years with little thought to the maintenance demands being created (often in accordance with the whims and fancies of some particular individual). Shrubs and trees requiring specialized care in the way of spraying, trimming etc., and often located in such a manner as to interfere with large capacity mowing equipment - thus requiring additional time consuming operations to maintain surrounding turfgrass - do not contribute to efficient operation. Such areas should be due for a face lifting.

A long range program of redesign in keeping with modern trends, landscaping calling for elimination of problem trees and shrubs, substitution of more hardy species requiring minimum maintenance and located to accommodate equipment with greater capacity; replacement of obsolete irrigation systems with modern automatic or semi-automatic systems; and, perhaps most important, the construction of specialized, intensively used areas such as golf greens and athletic fields by employing the latest materials and techniques developed through research will, unquestionably, contribute to efficiency. Such a program may require several years for completion, but with competent direction, supervision and adequate equipment, may be accomplished with only a reasonable increase in operating budgets. Continuity of direction, attainable through a longer tenure of office for managers and supervisors, is basic to the success of an efficient operation. (You are all familiar with golf courses that have expensive equipment stored in the shed, or piled against the side of a hill, and which was purchased at the direction of a one year chairman and obsoleted by the next years' chairman.)

Equipment Requirements

To properly maintain grass areas, certain basic units are required. These include mowers, fertilizer spreaders, seeders or drills, aerators, sprayers,

irrigation equipment and certain specialized items such as edger-trimmers, renovators, sweepers and rollers. For large scale areas, additional items like tractors, trucks, mist blowers, dusters, wood chippers and curb dressers may be required for the most efficient operation

Mowers. Grass cutting is likely the major time consuming phase of the grass maintenance program. Likewise, good mowing practices are perhaps the most important single factor contributing to the well-groomed appearance of turfgrass. In addition, proper mowing encourages more rapid coverage of turfgrass, promotes density and vigor and serves to check the growth of weeds. For these reasons, the selection and care of the mower are particularly significant.

Mowers are available in varying widths and with numerous features. Requirements of a good mower are mobility, maneuverability, easy adjustment, durability, sturdiness and adequate horsepower for the size and usage expected. A mower, as with any equipment, is only as good as the service organization behind it, from the owner-operator through the local distributor to the manufacturer. Therefore, in addition to the inherent design features, the ready availability of parts and service is a most important consideration when selecting a mower.

Most manufacturers build two lines of equipment - "consumer" and "institutional". Consumer equipment is designed and constructed for cutting home lawns. They operate satisfactorily when used for a few hours a day or a few days a week. Institutional equipment, on the other hand, is built to stand up under eight hour a day, five day a week usage for extended periods. Institutional equipment is of rugged construction, functional design and is capable of performing under continuous use if cared for properly. Obviously, there is a considerable cost differential between the two lines, but as with most items, cost is a function of value received.

On well landscaped plots, irrespective of the area involved, mobility, maneuverability, size and design of mowers is of utmost importance from the standpoint of efficiency of operation. Unless the plantings - trees, shrubs and flower beds - are laid out to accommodate wide mowers, it may be much more efficient to choose two or even three small size units than to attempt to cut with one wide mower or tractor drawn units. Delays encountered in maneuvering larger equipment around mowing obstacles, hence tying up more expensive equipment and possibly higher paid workers, plus the time required to "clean up" inaccessible areas, often may consume more man hours than would be required to operate the smaller equipment. On such areas mowers which will trim along borders, around trees, and especially cut under low hanging branches without damage will save additional clean up and trimming time. Combinations of large and small units working in teams are generally the most efficient method of handling areas landscaped in such a manner. As stated earlier, the long range approach to efficient maintenance of such areas may be to re-model the landscape to permit the use of greater capacity mowers.

Four basic types of mowers are available - reel, rotary, sickle and vertical. Choice of a given type will be governed by the particular duties expected from the mower. Each type has certain advantages and certain limitations which need to be carefully considered before the selection is made. Consultation with the manufacturer or his representative is always helpful in this respect. The reliable manufacturer always backs up his equipment.

Spreaders - Seeders. Most fertilizer spreaders may also be used as a seeder. A spreader is almost essential for uniform and even distribution of fertilizer and seed. As with mowers, spreaders vary in width, ease of operation, accuracy, durability and construction. When selecting a spreader, consideration should be given to the hopper capacity, ease of disassembly for cleaning, even distribution pattern, wheel and tires of sufficient size and width to prevent undesirable marking of

turf, and positive on-off controls. Tractor drawn units should be provided with positive on-off controls easily operated from the tractor seat. Spreader-seeders, other than cyclone types, should be equipped with a baffle board to aid distribution and avoid banding or streaking of the fertilizer or seed.

Grain or grass drills are desirable for seeding grass in areas where moisture may be limiting. The drill permits deep placement of the seed. Drills are not generally satisfactory for fertilizing established grass areas because they lay the material down in bands rather than a uniform broadcast.

Aerators. Aerators may be classified on the basis of the tine configuration. If the purpose in using the aerator is to improve water infiltration and percolation, then any type is apparently satisfactory. Aerators are available in various sizes and with varying number of tines. Selection should be based on the requirements of a particular type of turf, on the speed of operation and durability of the equipment.

Sprayers. Most herbicides and fungicides used on turf require only sufficient volume of spray material to give uniform coverage. An adequate gallonage range even for those materials that have to be washed into the soil is available by choosing the correct nozzle. Low volume - low pressure sprayers require smaller pumps and less labor and time in refilling. They are less expensive since they do not need to be constructed with high pressure lines and valves, but may not always be the best choice.

Small trailer types of sprayers are best adapted for use on specialized areas, whereas tractor mounted units operating with their own power plant are more desirable for large areas. Power take off types may be less expensive but, again, not always the wisest choice.

Dusters - Mist Blowers and Wood Chippers. These lines, indirectly concerned with grass maintenance, do - on certain types of areas - contribute to efficiency and economy of operation.

Dusters Generally will not be required if a satisfactory spray rig is

available. On large scale areas dusting by airplane may be the only practical way of controlling heavy infestations of insects or disease.

Mist blowers provide a very satisfactory method of applying insecticides, fungicides and often liquid fertilizer on shrub plantings and trees along boulevards, driveways and the like.

Wood chippers provide an economical means of disposing of fallen trees and branches which have been pruned.

Maintenance of Equipment

Lasting and satisfactory operation of all equipment may be obtained by following a routine program of care. When a large expenditure for maintenance on a relatively new piece of equipment occurs, it is the duty of the supervisor to find out why. In some instances the trouble may be inherent in the machine and cannot be prevented, but too many times accelerated wear is caused by lack of ordinary care and maintenance.

The maintenance of equipment, like the selection of equipment, embodies more than just the actual mechanics of doing the job. Maintenance and the facilities for doing same must be planned and programed. The plans should include regularly scheduled programs for training operators to properly use the equipment and perhaps, most important, to acquaint them with the overall objectives and policies of the organization. Maintenance plans also include programs for securing adequare storage and painting facilities; and procurement of the correct tools.

Record keeping on each and every piece of equipment is another important phase of maintenance. A record showing, among other things, the accumulated running hours, parts and labor for repairs will be helpful in determining the efficiency of your maintenance program and may serve to justify either new equipment, or in conjuction with studies on efficiency, indicate replacement with larger capacity equipment.

In the final analysis, mowers, as with most other equipment, are wheeled vehicles; they have the same maintenance requirements and should receive the same type of care given commercial trucks, cars and tractors.

Summary

There is little question that the organizations charged with managing turfgrass areas must seek ways to improve the efficiency of their operations. Many organizations have been working diligently in this direction for quite some time, all others must follow suit in the near future if the present quality of their turfgrass areas is to be maintained or improved.

A carefully planned and organized evaluation of equipment and its maintenance is a major step toward improving efficiency of operation. Adequate equipment for one golf course, one cemetery, one park system, or one school system may be inadequate for another and excessive for a third; therefore, equipment must be selected on the basis of the individual requirements for a particular organization. Features and considerations as developed earlier will dictate the various kinds, sizes and types of equipment required for efficient operation.

Other factors to consider when determining modern equipment and maintenance requirements are: (1) Equipment purchases for the most part are capital expenditures and should be treated as such - amortized and depreciated; (2) The manufacturer or his representative should be consulted on the type of equipment needed. Information on new equipment and improved features, as well as the suitability of their equipment for the job at hand, is readily available from the reliable manufacturer. (3) The availability of parts and service facilities is of prime importance when selecting equipment. If repair parts are not available when needed and a machine is inoperable for extended periods, it is of questionable value and certainly will contribute little to efficient operation.

Personnel Management and Relationships

D. M. Lilly, J. M. MacKenzie and J. R. Watson[1/]

In recent years many very fine talks on human relationships and supervision have been presented at the Golf Course Superintendents Association National Conference and Show. Several of these have been published in the Golf Course Reporter, Golfdom and the U. S. G. A. Journal. In addition, there are excellent textbooks, many published in the last few years, that treat the subject "Personnel Management and Relationships" very adequately. The ideas and practices recommended in all these sources are sound. They apply in any field where people are brought together to perform useful work. A review of the basic ideas and techniques as they apply to professional turfgrass superintendents in the discharge of their responsibilities is to be the subject of this discussion.

First, however, I would like to mention some personal conclusions that have resulted from observations made over the past few years. I am convinced that the central problems facing golf courses today are ever increasing costs on the one hand and more intensive usage on the other. The latter compounds the former. Figures just released show that, on the average, 70% of the total golf course maintenance budget is spent on salaries and wages. This represents, incidentally, a 5.1% increase over the figures of last year. I am also convinced that the technical competence of the golf course superintendent, particularly in the agronomical field has risen substantially during recent years. There have been many reasons for this - just to mention a few - individual and collective desire for acquiring knowledge on the part of the superintendent; a marked increase in the technology of turfgrass culture resulting from research by colleges, universities and industry.

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This information has been rapidly disseminated by various agencies such as the extension service, U. S. G. A. Green Section and, again, by industry; educational conferences - state, regional and national have likewise contributed much to the advanced technical competence of the superintendent.

All this has been essential and the good that has been done is reflected in the quality of the turfgrass grown on our golf courses, parks, school grounds, athletic fields, cemeteries, airports and highways. But, at this point I come back to the centeral problems facing us today and ask the question - Does the superintendent spend enough time and effort training himself in the area of labor management? I am afraid not in all cases; yet, I think you will agree with me that it will be only through improving efficiency in this area that our golf courses, parks and school grounds will be able to maintain their quality of service without substantial increases in their budgets. It's easy to say - we'll increase our revenue and raise our budgets - but where does the money come from? - It comes from taxes, either in the form of increased dues from members, or increased levies on the citizenry. Increasing taxation is not the answer in my opinion. The fact that many states as well as cities have reached the limit in public acceptance of tax increases has been painfully demonstrated during the past two years in too many states to attempt to list them all.

Management as a Profession

Management is the art of getting things done through people. The professional manager, like the physician, combines science and intuitive judgment in the practice of his profession. The use of science in management as we know it today need not, and must not, be confined to the management of industrial plants. "It won't work here!" and "We're different!" is an admission of failure to keep progressive and to admit that yours are any other organization is not being run

in the most efficient manner. Certainly, individual cases are unique, and solutions, of course, vary from organization to organization, but sound management principles are not unique, and their application should not be limited to the factory! Any group activity regardless of the nature of the group or its goal, benefits from the application of professional management. Churches, schools and government agencies, in realization of the benefits to be derived from effective management, are now among those sending representatives to national management conferences for the express purpose of gaining more insight into management activities and principles.

Historically, the profession of management is very old. The science supporting the profession, however, date back only to the last decades of the nineteenth century. While considerable misunderstanding will always exist concerning the place of science in management, we can readily understand how ineffectual the medical profession would be without the benefits of a scientific approach to their problems.

In its simplest terms, a scientific method may be any method that applies a logic of effective thinking, based on applicable science, to the solution of a particular set of problems. Such a method is applicable in an "exact" science, as in the case of the physical sciences, or in an "inexact" science as in the social sciences. Professional management merely combines the logic of effective thinking with the facts gathered by the scientific approach in solving business problems. It differs from traditional management in the manner in which decisions are made; i.e., decisions made under professional management are based on facts developed by a studied approach as contrasted to predicating primarily on opinions, prejudices and unsound rules of thumb.

Management as a function in an organization plans, coordinates, motivates and controls the efforts of others so that the entire organization moves toward

specific objectives. It follows then, in the case of a golf course or park department that management is a function of executive leadership in golf course or park operations. The managerial functions (of the superintendent) involve planning, coordinating and controlling the activities of others in accomplishing the organization's objectives within the framework of the policies set up by the club, park system or school district.

Objectives, Policies, and Plans

The same words stimulate different ideas based on each person's experience. To assure that we will be discussing similar ideas when we hear the words objective, policy and plan, a few sentences of explanation seem in order. The word objective, as we will use it may be explained simply by answering the questions, "Where are we going?" and "What are we trying to do?" In other words, our goals. To describe an organization's objectives or goals may require several paragraphs or pages or they may be expressed in a few lines. The objective of a corporation or private business is basically to produce profits for the stockholders. A private organization such as a golf course may have as its objective the design, building, and maintenance of the best possible golf course from the membership point of view. A public institution, board or authority may have as their objective providing areas for beautification of the city or for public recreation of various kinds.

All objectives must be achieved, of course, within certain moral, financial and legal limitations. In addition, it may be that the owners in a private enterprise, or the governing bodies in a public enterprise, have designated some special way in which the objective is to be achieved. These limitations and designation of means are specific in the policies of the organization. In a private enterprise, the statement of a very basic policy would simply say that the company shall earn a profit for the owners by producing superior products

for a certain market at a competitive prices with due regard for the moral, ethical and legal restrictions that apply.

The details of what is to be done to achieve the objective and the who, what, where, when, why and how of doing it are spelled out in the organization's plans. The act of preparing these plans, or planning is a very vital part of professional management.

Planning and Organizing

As we have intimated in our previous remarks, the orderly and efficient attainment of a goal is rarely achieved without considerable planning as to how the desired end can be achieved best. Planning begins with a statement of objectives by the controlling organization. This should be a statement covering not only the objectives, but also the policies and long range plans that are to govern the means of achievement of the objectives. The superintendent acting within the confines of this overall program and, in the case of the golf course, in consultation with the Green Chairman lays out the objectives for a given period. Given the objectives, a much clearer understanding of how they will be accomplished can be obtained if we can answer the following questions about the work to be done.

1. What is to be done?
2. When is it to be done?
3. Where is it to be done?
4. How long does it take to do the job?
5. How is it to be done?
6. Why is it to be done?
7. Who can do it best?

What is to be done? - To help in answering this question, we use budgets, programs, charts and diagrams as aids in correlating all the factors that go into achieving our objectives. An annual program of all the work carried out under the supervision of the manager or superintendent laid out on a quarterly basis may be the first step in taking a new look at your plan of work. For example:

	Jan.,Feb.,Mar.	April,May,June	July,Aug.,Sept.	Oct., Nov.
Golf Courses:	Mow Water Fertilize Repair Greens Repair Equipment, Building repairs	Prepare for Transition Mow,water,fertilize, Aerate, Clean up Grounds, Plant Flowers	Begin Preparation for overseeding of Winter grass Mow,Water,Fertilize, Aerate Insecticide Program, Rebuild Greens	Complete overseeding, mow, water Fertilize Set out Shrubs Fungicide program Repair Equipment
Athletic Fields:	Repair Equipment,Lay in fertilizer, supplies,Chemicals, repair damage to Field	Fertilize,Aerate Water, Mow Sprig or Sod bare areas	Fertilize,Water Mow, Aerate Insecticide Program. Bring turf to playing conditions (Desired hgt. of cut, etc.)	Spike-Seed Rye (for colorduring late season or post season games) Fertilize - to aid in holding late color. Water, Mow, Pick up torn out stolons (bag or sweep) Repair Damage

Obviously, these are not all of the jobs that must be done, nor will all be required on any one area.

Before we can look at the details of each project, however, there are several limiting factors to be considered. For example: How much can be spent? How little can be spent and still do a satisfactory job? What must be sacrificed, if anything, to meet the budget objective? What is the calendar of events? - Any tournaments, post season games, conventions, etc.?

A detailed budget by months or quarters with allowances for each and every job will help in determining what you can do and how you can do it. It will also help you in selling your program to those in higher authority. To makeup a budget by projects, however, you must know your costs for each type of job. Do you know these costs? If not, you will want to start studies and records that will help you in future years.

When is the job to be done? - From the budget we can proceed to make detailed plans for the timing of each job. Each project can be planned by breaking it

down into steps listing materials, man power, money and other requirements on a monthly, weekly, or daily basis. If this is done for all activities, then weekly or daily totals can be made showing the number of men required each day or week as well as material deliveries, and money flow. To prepare such an analysis, however, we must know the time required to perform each job or group of jobs. How long does it take a man to mow a green, an athletic field, an acre of highway or airport turfgrass? How long should it take? An annual, monthly, weekly and daily schedule will give you and your men a guide to follow when the playing season rush is on as well as insurance that all the necessary work is done before the season starts.

In a business with a seasonal pattern such as yours, planning of this type during slack periods of usage will result in substantial cost reductions when maximum use periods occur. The first year many questions will be raised that may have to be answered by direct observation and more careful record keeping during the coming year. But, once the job areas are outlined and people assigned, the pattern of instruction can be broken down into the basic information that must be given in advance of the daily or detailed supervision. Daily work patterns can be provided in the schedules mentioned above so that the entire day is fully and effectively occupied and so that teams of men are brought together and coordinated as needed. Do not forget to plan for adverse weather, keep a list of jobs that can be done under cover on rainy days.

Where is the job to be done ? - This question may also stimulate constructive thinking about the jobs to be done. Obviously, a green has to be cut on the green, but the question is "which green?", "which fairway?", and "which park?". If the job is cup setting, "which holes are to be reset?". This decision then determines where the employee goes to do the work. The sequence of greens cut or holes reset may be chosen to require the least travel time between holes. In this respect, an accurate scaled map showing all major work areas, irrigation lines and accurate green sizes is

mandatory. Maintenance work may be done on equipment in the field, in a shed, or in a well-equipped shop. The most economical answer may not be the most obvious. Don't be fooled into thinking that because a certain route or certain practice has always been done in this manner, that the job can't be accomplished in a more efficient way if it's carefully analyzed and studied.

How long does it take to do the job? and How is it to be done? - As you work on your plans and study your employees' activities, two questions are going to keep coming up --

1. How much time should it take to do the job?
2. How much time does it actually take to do the job?

The second question can be answered by keeping records on how many man hours are required to cut a certain area or to perform any of the other projects and jobs. Such records, however, do not usually tell how well the job was done or by what method it was done or how much idle time occurred while the job was being done. In industry, the work of Frederic W. Taylor at the beginning of this century showed there was a vast difference between how long it takes to do a job and how long it should take to do the job. Taylor discovered when equipment was properly used and the unnecessary work removed from the job that the actual effective working time was frequently from 50 to 80% of the time actually spent in the past. We also know from repeated studies of industrial operations that anywhere from 10 to 50% of the man's day may be spent in idleness or non-productive work. An interesting fact about this idle or non-productive time is that roughly 2/3 of the idleness is the result of inadequate supervision or management and on the average only 1/3 is chargeable to the man himself. To properly answer the question of how long the job should take, break the job down into elements or steps and determine how long each step takes by the best available method. Then put together the necessary steps to arrive at the total time the job should take if there are no delays or wasted time. If you were to hire a

trained time study man to make your methods and time studies, he would probably use a stop watch. You, however, can do some studying and observing of your own with your wrist watch or the clock on the wall.

The problem in the past has been that the application of motion and time study has tended to irritate and aggravate the employee rather than to convince him of the desirability of doing what seems obvious to management. In fact, this irritation was sufficient to obtain a ban on all time study by Federal Government Agencies from 1913 to 1949. Within the past 10 to 15 years, the emphasis has been on getting the employee to study his own job and to participate with management in seeking improvements that will eliminate unnecessary work and reduce the amount of idle time. Formal programs called Work Simplification Programs have been pioneered under the leadership of Allen H. Morgenson.

These programs have found widespread acceptability by both Unions and Management throughout industry. In an organization with less than 100 employees such formal programs may not be practical and are actually not necessary if the supervisor will first of all train himself to look for better methods of doing work and ways of eliminating idle time, and secondly will try to encourage his men to find ways of making their own job easier. Most men, and by that I mean 95 to 98% of all employees, will take pride in their work if given the proper encouragement and opportunity. Many of them derive satisfaction far beyond any pay in thinking up and applying good ideas on their job. Such ideas, of course, need to be reviewed for safety, effect on the quality of the work, and potential damage to equipment before they can be properly used.

Why is the job to be done? - Obviously to produce a useful result, but how many jobs actually produce the results we want? One method of studying jobs to reduce the time and effort required is to sort out the elements or steps of the job into productive and non-productive work. This forces us to question the

necessity of every element and many times a sizeable amount of the work can be eliminated by challenging the entire job or its parts. For example, is it necessary to trim or rake as often as specified? Can we eliminate sand trap raking entirely? Some courses have the player do the raking and so eliminate much of the raking by the employees. Where a job or a part of it passes the test or productivity and necessity, then a reason must be given for doing it. We may decide that now that we know why we do a particular job that it can be done some other way much more effectively.

Who can do the job best? - Can you do your job best or are there parts of your job that can be done better by others? Perhaps you can do any job better than the best of your employees, but obviously time does not permit you to do all jobs. It is true that you are the one finally responsible for all results and this cannot be escaped. Since a major portion of your success hangs on planning, seeing that the plans are carried out, and then replanning to correct the discrepancies between plan and action or between plan and needs, you must delegate some of your authority and responsibility to your individual employees or to designated assistants. If you have more than ten employees reporting directly to you, less and less time will be available for planning. If you have twenty or more employees reporting to you directly, you will probably not be able to plan at all during the periods when this many men are on your payroll. You owe it to yourself and your club, park system or school system to appoint, train, and use an assistant to relieve you of the pressure of making hourly decisions. This enables you to do your planning and, equally as important, provides for continued operation of the organization in your absence for vacations, illness or other personal reasons.

Many of the projects listed in your annual plan or provided for in your budget can be carried out by one team of employees. Some jobs may occur at irregular intervals and may require special skills and abilities that are not needed in day to

day work. Tree trimming, building construction, plumbing, etc. are some, and in these cases, contracting may be a better answer.

Again, each man on your team of employees either can do or is selected and trained to do a certain group of jobs. Some thought of these assignments and the qualifications and training necessary will lead to superior results for both you and the employee.

Assuming that you have planned your work and organized your team to carry out the plan, we are ready to discuss supervision.

Supervising and Controlling

So much has been said about the psychology of handling people that it is worthwhile to recall the basic reasons for supervising people at work. Basically, we supervise because some useful objective must be reached by two or more people working together. If these people can achieve an objective requiring the efforts of a number of people, each individual must be instructed on his contribution toward achievement of the objective. To do this in the most efficient manner will require a supervisor or manager. Further, it will be necessary that the manager completely and thoroughly understand the total objective to be able to explain and direct the individual activity required for successful and efficient accomplishment.

Supervision is justified only insofar as it helps the man who is doing the work. If we remove our own personal feelings of position and pride from the picture, we realize that we must make it possible for the man we supervise to work so much better that his increase in output more than covers the added cost of our salary. A good supervisor must know what he wants his men to do, tell them what he wants done, and help them to do it in the best possible way. In doing this, your men will be properly instructed in what they are doing and why they are doing it. You must obtain adequate equipment for them. You must let them know what is expected of them insofar as quality and quantity of work is concerned.

Evaluation of results - The effectiveness of your management can be measured in some areas and comparatively judged in others. A most important activity is your periodic evaluation of your efforts as well as the efforts of those working for you. You can measure yourself and your performance financially against your budget, your quality of effort by the total annual compliments or complaints, your safety record by the lost time accidents in your work force, and in any other area where you have set definite objectives subject to measurement by qualitative data. Those who work for you can be measured both by the amount of work performed in a given period of time compared either to time studied standards or to past history. The evaluation of the quality of their work may require closer personal examination on your part, but the calculation can be made more accurate and satisfying if you have definite specifications of quality for key jobs. Twice a year or more often, if necessary, you should give your employees an evaluation of their performance. This applies to the satisfactory employee particularly so that he may be encouraged and developed. The correction of the unsatisfactory employee falls under the heading of job instruction and, if necessary, discipline.

Human Relations

Management is a function of assistance rather than dominance. Give recognition to an employee's ability and performance when they meet your requirements. Take a firm constructive stand when they don't. A man-hour of labor can be utilized only through the courtesy of a sensitive human being. Each employee has feelings - of love and hate, happiness and sorrow, pride and shame, security and uncertainty. D. C. Faith, George Washington University, consultant on personnel, sums up a basic tenet for management in these words, "Most insulting, dangerous thing you can do to another person is to disregard him as if he didn't exist . . . If you haven't time to smile and say good morning to the janitor

who went to work only yesterday, then you are taking money out of your own pocket." Call your employees by name and make an effort to learn something about their family. Discuss their problems with them if the opportunity arises.

When these things are done, your employees will help you to carry out your plans more perfectly than you ever dared expect. If you do not manage properly, charm, tact, and leadership must be more effective in order to maintain a minimum of cooperation.

Decision Making

If one were to summarize, inas few words as possible, the nature of the management function perhaps the best reply would be "decision making". Decision making itself is simply the selection of one alternative from a group of two or more alternatives. Among this group can be found the alternative of maintaining "status quo". This possibility should not be underrated, for this, in some cases, may be the best solution. The number of alternatives available, of course, is limited only by the imagination and resourcefulness of the analyst - the manager.

Bibliography

Aulbach, George. Pro's Most Important Sale - Himself. Golfdom. April, 1959.

Barnes, R. M. Motion and Time Study. John Wiley & Sons. 1949.

Bengeyfield, William H. Are You a Good Boss? The Golf Course Reporter. Vol. 26, No. 1, Jan. - Feb. 1959.

Border, Elmer. Labor Management. The Golf Course Reporter. Vol. 24, Special, 1958 Conference Issue.

Boyd, Taylor. The Superintendent Budgets for Better Golf. The Golf Course Reporter. Vol. 26, Special, 1958 Conference Issue.

Clock, John. Employee, Employer Contracts. The Golf Course Reporter. Vol. 24, Special, 1956 Conference Issue.

Davis, Ralph C. The Fundamentals of Top Management. Harper & Bros., New York, 1959.

Dunlap, Frank. Developing Recognition for the Superintendent. The Golf Course Reporter. Vol. 22, Special, 1954 Conference Issue.

Ferguson, Marvin H. Trends in Golf Course Management. USGA Journal. July 1956.

French, C. E. Work Simplification in Turf Operations. 1958 Purdue Turf Conference.

Harris, Robert Bruce. Architectural Matters Affect Maintenance Costs. USGA Journal. April, 1959.

Henenman, H. C., Jr. and Turnbull, J. F. Personnel Administration and Labor Relations. Prentice-Hall, Inc., N. Y. 1952.

Lundy, James. Effective Industrial Management. MacMillan Co., N. Y. 1957.

Niebel, B. W. Motion and Time Study. R. D. Irwin, Inc., Homewood, Ill. 1955.

Pion, Argel. Problem Solving in Turf Management. 1958 Purdue Turf Conference.

_____ What's Your Basis for Cost Estimation. 1958 Purdue Turf Conference.

Planting for Quality and Maintenance

J. W. MacQueen[1/]

Landscape development around public and semi-public buildings must be so planned that only the minimum of maintenance is necessary. This is essential because of frequent limitations in funds, personnel and time.

Quality and efficient maintenance of a landscape planting can be obtained through a careful study and planning of the building area. Since public buildings, schools, playgrounds, golf courses and surroundings of a clubhouse are usually designed by specialists, why become concerned with landscape planting? This becomes a problem because often-times it becomes necessary to re-design and re-plant for the following reasons:

1. New construction such as additions to the clubhouse and other buildings, construction of swimming pools, tennis courts, expansion of parking facilities, etc.
2. Re-location of drives, walks, tees, greens, service areas, parking facilities, etc.
3. Failure of plants due to environmental conditions such as improper light and exposure to winds.
4. Soil problems, namely, poor drainage, soil reaction, structure, improper soil preparation.
5. Obsolescence of the original planting due to maturity, overcrowding, etc.
6. Failure due to insects and disease.
7. Under-estimation of site problems and plants selected by original designers.

A planting design is intended to enhance the architecture of a building and not to hide or compete with it. The planting must have a definite relationship to a building and provide dignity and richness. Plants bear the same relationship to a site that good building materials do to a building. Thus, it is

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essential to study the building lines when designing a landscape planting. Trees can frame a building and soften its lines. Shrubs and groundcovers can create a base for it and organize the space around a building. Low shrubs and ground-covers can draw attention away from or soften lines of prominent walks, driveways, etc. Shrubs can screen service and parking areas which are often unattractive.

When designing a planting it is necessary to consider the proper scale and the relationship of the surrounding area to the building, walk and drive widths, etc. In addition, a study must be given to the location of entrances, windows, service areas, and utility lines, both overhead and underground. A planting design must provide for circulation and not interfere with proper access to entrances, not block windows if light, ventilation and vision or view are involved. It is hardly practical to locate shrubs or a groundcover or other plant beds over gas, water, heat or power lines which might have to be uncovered for servicing. In this regard all underground utility lines should be located in close proximity to each other if such service lines should enter from a street to a building. When overhead lines service a building tall shrubs and trees should not be planted beneath them.

A landscape planting will provide decoration and interest through color, texture and form of the plants used. The element of color is obtained from foliage, flowers, fruit, stems, branches, twigs and buds. When introducing color it is necessary to consider its quantity and relationship to the building and other elements around it.

The variations in the texture of plant materials are fascinating and almost endless and are frequently overlooked. Foliage sizes range from the scale-like leaves of junipers, needles of pines, spruces, firs and other conifers to palm fronds of several square feet in size. There is also the variation in leaf shapes, margins, divisions, thicknesses and surfaces such as shiny, dull, smooth, fuzzy, crinkled, veined, etc. These texture variations enrich a landscape composition by way of contrast.

Plants are available in many shapes--upright, pyamidal, vasiform, weeping, oval, round, spreading, creeping. Some plants take one form when they are growing, another as they mature and a third as they become old. This is especially true of trees. Shrubs also change character with maturity, especially erect growing species, which have a tendency to open up and develop woody flower and fruit structures of character and interest. This type of structure should be exploited if it can be incorporated in a design rather than to hack and cut the plants in an attempt to conceal stems and branches. Any time a plant must be severely pruned to perform a task for which it is not suited the wrong plant has been selected.

The relationships between the plants, ground surface and structural elements involved in a landscape plan depends almost entirely on the concept of the designer. Plants can be spaced so that they never touch. They can be crowded so as to form continuous mats on the ground such as groundcovers; above ground such as shrub masses and screens; or, as canopies overhead with trees. Plants can be spaced regularly or irregularly in masses or individually in any variation or combination between these extremes. The planting of meaningless, isolated specimens of shrubs over a lawn or along a fairway must be avoided. Groups of plants and naturalistic masses are necessary to give structural character to the design and each group or mass should consist of many specimens but of a few kinds rather than one or two specimens of several kinds. A planting arrangement is successful if it is appealing to people who see it, if it will grow well and if the maintenance required is consistant with the landscape program and the nature of the plants.

Design features which aid in curtailing maintenance include the use of paved areas instead of turf or groundcover around service areas, pools, etc.; the use of simple bed lines and patterns for flowers, groundcovers and shrubs; the use of durable and permanent edging materials for flower and groundcover

beds and turf areas, such as brick curbing, rigid steel edging, etc. The construction of retaining walls of dry stone or masonry to eliminate steep slopes and terraces will help to solve a difficult maintenance problem. On the other hand raised "planters" under roofs are seldom satisfactory for growing plants because there is usually an insufficient soil area or improper drainage for root development. In addition there is usually a lack of sunlight and continuous moisture for good plant growth.

Efficiency in landscape maintenance is obtained not only through good design but also the proper selection of species. Plants must be carefully chosen according to their climatic requirements and their cold and heat tolerance. They must also be chosen for soil type preferences such as sand, clay, loam, organic soils and all related variations. Exposure requirements such as sun, shade and wind must be considered. Moisture requirements of plants vary, some require considerable moisture, others prefer a somewhat dry location and almost all plants require drainage. There is a wide variation in the rate of growth and eventual height of plant species. Some grow more in one year than others do in twenty. Plants can become too large for many locations--plants having a six foot spread should not of course be planted in a location having only four feet of space. The susceptibility of plants to insects and diseases has a direct effect on maintenance. Plants which are susceptible to nematodes and those requiring frequent spraying to combat disease and insect infestations should be avoided in landscape planting. Pruning requirements must also be considered in the selection of plant materials, slow growing plants are generally preferred over those having rapid growth. Avoid plants requiring special pruning.

It is highly recommended that soil of groundcover beds and beds to be planted with low shrubs, whenever practical, be sterilized. The use of a soil sterilant or fumigant will help insure the success of a planting by eliminating

soil-borne disease and insects and serious weed pests such as nut grass. Once a groundcover planting becomes established in a well-prepared and sterilized bed there is less possibility of competition from serious weed pests.

When given proper growing conditions and when the proper species are selected woody plants will remain attractive for a number of years. There are of course exceptions in that individual plants may become poorly shaped, or do not grow well for some inherent or special reason.

What are the plant types used in landscape design? The general classification can begin with groundcovers and proceed through to shade trees. Groundcover planting is the organic surfacing of an area with low-growing plants which usually cover over the surface with creeping stems on the surface or by some form of underground growth structure. Groundcovers can provide a pleasant change and contrast in ground patterns as well as textural interest and foliage color. Shrubs can be grouped into dwarf types reaching only one to three feet and suitable for "high" groundcovers and low masses. Medium shrubs are those growing from three to ten feet and large shrubs from ten to twenty-five feet or more in height. Trees can be grouped into small and flowering trees and larger shade trees.

Some of the recommended species for this area are:

Groundcovers

(1) Low types - Trachelospermum asiaticum, Vinca species, Liriope species, Mondo species, Juniperus horizontalis, Juniperus horizontalis plumosa, Juniperus chinensis Sargent, Trachelospermum Jasminoides, Gelsemium sempervirens, Lonicera species.

(2) High types - Juniperus sabina Tamarix, Juniperus chinensis Compact Pfitzer, Ilex vomitoria Dwarf, Ilex cornuta rotunda, Punica granatum Dwarf, Rosmarinus species, Plumbago capensis, Lantana sellowiana.

Shrubs

(1) Dwarf shrubs - 1 to 3 feet

Ilex vomitoria Dwarf, Ilex cornuta rotunda, Punica granatum Dwarf, Juniperus chinensis compact Pfitzer, Juniperus sabina Tamarix, Buxus harlandi, Hypericum species, Lantana camara, Salvia greggi, Santolina species, Malpighia species, Rosmarinus species.

(2) Medium shrubs - 3 to 10 feet

Buxus microphyll japonica, Abelia grandiflora, Ilex vomitoria, Jasminum mesnyi, Jasminum humile, Raphiolepis indica, Viburnum suspensum, Feijoa sellowiana, Ilex cornuta Burford, Callistemon lanceolatus, Juniperus chinensis Pfitzer, Leucophyllum frutescens, Ligustrum japonicum, Ligustrum quihoui, Nandina domestica, Pittosporum tobira, Severinia buxifolia, Tamarix hispida.

(3) Large shrubs - 10 to 25 feet

Acacia berlandieri, Eriobotrya japonica, Feijoa sellowiana, decidua, Ilex vomitoria, Lagerstroemia indica, Ligustrum lucidum, Nerium oleander, Photinia serrulata, Punica granatum, Sophora secundiflora, Viburnum japonicum, Vitex agnuscastus, Xylosma senticosa.

In conclusion it can be stated that a well planned landscape design together with the proper selection of plants will provide:

1. More beauty
2. Greater efficiency in the use of space
3. Greater economy in construction and planting
4. Efficient maintenance

Basic Considerations for Maintaining Ornamental Plantings

A. F. DeWerth[1/]

Most ornamental plants are grown and used for one major reason--which is an attractive appearance at all times.

This basic purpose makes the requirements for growing these plants fairly simple in principle--the plants must be selected to suit the environment and purpose of the location in which they are placed--or the environment and purpose of the location where the plants are to be used must be determined and then changed to suit the needs of the plants which have been selected to be used there.

Usually the best approach to any landscape problem of this sort is a compromise between these two extreme considerations.

To successfully select and use plants and to maintain them so that they present an optimum attractive appearance at all times requires a thorough knowledge of the effects of environment on the growth of the plants and the response of these plants to these environmental factors.

I. Moisture

Everyone concerned with plant growth knows that moisture is all important to good plant growth. In most areas of Texas a deficient supply of natural moisture exists at some time of the year so that supplemental supplies of moisture must be provided for optimum results.

Unfortunately irrigation is a method of supplying water that is not always amenable to rules and regulations and most situations require judgement and skillfull handling.

There are two critical periods in the life of ornamental plants when an adequate supply of water is especially important.

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The first of these is when plants have just been newly planted or transplanted the quantity of water used by the plants at this time is not large but since the root system is usually limited an ample but not excessive amount of water in the soil is very important.

The other time when these plants have a maximum requirement for water is when the plants have become large, are growing fast and have an enormous rate of evaporation, or in flowering plants when the flowers begin to develop.

While most of these plants must have an adequate supply of water for normal growth, too much water is equally bad or even worse.

Overwatering usually causes stunted growth, yellowed foliage or failure to bloom or set fruit. In severe cases the entire root system is lost and the plants may die. For this reason beds or areas prepared for planting these plants should have excellent drainage. If this drainage is not ppesent it must be provided by artificial means of some sort.

II. Soil

The soil is of fundamental importance for good results and minimum maintenance of ornamentals. While the subject of plant nutrition today is widely known and usually concientiously maintained--perhaps at times overdone--the importance of soil structure is not so widely known and more often is misunderstood. Very often the terms "soil structure" and "soil texture" are used interchangeably and this is far from correct.

Soil texture refers to the "size" of the particles that make up any soil composition, while soil structure refers to the "arrangement" of these particles.

For maximum plant growth and ease of maintenance the structure of the soil is of even greater importance than soil fertility.

Research over the years has shown that when the air holding and water holding capacity of a soil are nearly equally an ideal structural condition is approached.

Recent research on the preparation of soils for growing ornamental plants has shown that for most areas of Texas a near ideal structural condition can be developed by the addition of equal parts of peat and perlite to the existing soil.

This should be added in suitable amounts so that the composition in the top twelve to fifteen inches of soil is prepared so that each of these materials make up about 1/3 of the total volume.

This adequate soil preparation will be a great aid in reducing maintenance of areas devoted to ornamental plantings for the following reasons.

1. The danger of overwatering is considerably lessened because of the increased drainage and increased oxygen supply in the soil.
2. All ornamentals tried so far will endure considerably longer periods of moisture stress without injury to the plants, than they will in poorly prepared soil.
3. Greater and more extensive root systems are produced.
4. Feeding programs are more effective and the dangers of over fertilization and underfertilization are lessened.

III. Pruning Practices

The pruning of ornamental plants is another cultural practice that is often misunderstood and is also usually over emphasized.

The proper maintenance of ornamental plants by pruning requires some special training but in general it is most often overdone. Care should be taken to prune only when it is required. When the proper plant is selected for the proper place and the proper purpose very little if any pruning is required.

Ornamental plants should never be pruned unless there is a specific reason for so doing. The most important reasons for pruning ornamental plants are the following.

1. To provide better shade.
2. To provide better landscape effects. (Natural form of the plant should always be retained unless for specific purposes such as hedges).
3. To provide better flowers or fruit.
4. To improve vigor of the plant such as root pruning before transplanting.
5. To train the plant for some specific landscape use.

IV. Mulching

Mulching plantings of ornamental plants is an important cultural and maintenance practice that is often overlooked.

In colder areas where the soil freezes during the winter mulches are especially important to prevent alternate freezing and thawing during the winter months.

On evergreens this prevents evergreen plant losses due to lack of sufficient moisture in the soil and also prevents losses of roots on all plants during unseasonable warm spells that often occur in almost all Texas areas.

The use of mulches the year around on ornamental plants is an inexpensive way of reducing maintenance costs of these areas because the following results can be expected from their use.

1. Weed control is reduced or eliminated.
2. Soil temperatures are equalized.
3. Moisture is conserved and the needs for supplemental waterings are reduced.
4. Soil structure is improved as the mulches decompose.
5. Beneficial soil organism populations are increased.

V. Proper Plant Selection

When new ornamental plantings are made, the need for many maintenance and cultural practices can be reduced or in some cases can be entirely eliminated. The proper selection of plants for the major landscape purpose of surfacing, enclosure, shelter and enrichment can best be accomplished by following what is often referred to as the basic triangle of ornamental plant selection, with the three corners of the triangle designated as follows: Arrangement, selection and maintenance.

When these requirements are met the ultimate in plant selection is achieved--which very simply is the right plant for the right purpose planted in the right locations.

A Selected List of Exotic Plants And Their Adaptability to Building Interiors

A. F. DeWerth[1/]

Key to Maintenance Requirements

Light Requirements:

High - Bright Light or Full Sun:

Preference: 5000 to 8000 foot candles for average length of day.
Tolerance: 1000 to 2000 foot candles with 12 hour illumination.

Medium - Diffused or Filtered Light:

Preference: 1000 to 5000 foot candles for average length of day.
Tolerance: 500 to 1000 foot candles with 12 hour illumination.
Simple test: When hand is passed over plants between them and light source, shadow cast by hand should be barely visible.

Low - No Direct Light:

Preference: 100 to 500 foot candles for average length of day.
Tolerance: 50 to 100 foot candles with 12 hour illumination.

Soil Moisture Requirements:

Dry: Soil should be dry for best growth; only occasional light waterings should be given to moisten soil thoroughly at 3 or 4 week intervals. Dry, sandy, well drained soil should be used. Examples: Cacti and other succulents, perperomias and sansevierias.

Moist: Soil should be kept uniformly moist but never wet. Allow soil to become moderately dry before watering and then water thoroughly. Plants have delicate fine roots which will rot when soil is wet.

Wet: Soil should never be allowed to become dry. Excellent drainage should be provided in containers so that air is available in soil. Water should never stand on soil surface when water is applied or should never be allowed to stand in saucers under containers.

Plant Use Requirements:

Tub Plants: Plants which develop into large specimens suitable for lobby decorations in public buildings or to be placed on floor in homes for interior decoration.

Vines: Plants that require support such as trellises or totem poles or that can be used for ground covers in interior planter boxes or as trailing plants on ledges or over the edges of interior planter boxes.

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Small Planters: Plants suitable for small novelty container, dish gardens, small pots or for edges or borders of interior planting boxes or beds. Care should be taken in using these plants in combination so that all plants used have identical light and moisture requirements.

NO.	NAME OF PLANT	MAINTENANCE REQUIREMENTS								
		Light			Soil Moisture			Uses		
		High	Med.	Low	Dry	Moist	Wet	Tub	Vine	Small Planters
1	Acanthus montanus		X			X		X		
2	Aglaonema commutatum			X		X		X		X
3	Aglaonema modestum			X		X				X
4	Aglaonema robellini			X		X		X		X
5	Aloe variegata	X			X					X
6	Asplenium nidis			X			X	X		X
7	Beaucarnia recurvata	X			X			X		
8	Begonia rex		X			X				X
9	Caladium, Fancy leaved		X			X		X		X
10	Caladium, Lance leaved		X			X				X
11	Chlophytum elatum		X			X		X	X	X
12	Cissus antarctica		X			X			X	
13	Cissus erosa		X			X			X	
14	Cissus quadrangularis	X			X				X	X
15	Cissus rhombifolia		X			X			X	
16	Codiaeum craigi supreme	X				X		X		
17	Codiaeum elegantissima	X				X		X		
18	Costus speciosa		X			X		X		
19	Crassula arborescens tricolor	X			X					X
20	Dieffenbachia amoena		X			X		X		
21	Dieffenbachia picta		X			X		X		
22	Dracaena deremensis warnecki		X			X		X		
23	Dracaena draco		X			X		X		
24	Dracaena godseffiana		X			X				X
25	Dracaena marginata		X			X		X		X
26	Dracaena sanderiana		X			X				X
27	Euphorbia lophogona	X			X			X		X
28	Euphorbia mili	X			X			X		X
29	Fatshedera lizei	X				X		X		X
30	Ficus benghalensis		X			X		X		
31	Ficus benjamini exotica		X			X		X		
32	Ficus eburnea		X			X		X		
33	Ficus elastica		X			X		X		
34	Ficus elastica decora		X	X		X		X		
35	Ficus elastica variegated		X			X		X		
36	Ficus macrophylla		X	X		X		X		
37	Ficus nitida (retusa)		X			X		X		X
38	Ficus pandurata		X			X		X		
39	Ficus religiosa		X			X		X		
40	Ficus rubiginosa variegated (australis)		X			X		X		X

	Maintenance Requirements (Con'd.)								
	High	Med.	Low	Dry	Moist	Wet	Tub	Vine	Small Planters
41 Gynura aurantiaca	X				X		X		X
42 Hedera canariensis variegated	X				X			X	
43 Hedera helix Gold Dust	X				X			X	X
44 Hedera helix Green Ripples	X				X			X	X
45 Hedera helix Hahn's variegated	X				X			X	X
46 Hedera helix Hahn's Self Branching	X				X			X	X
47 Hibiscus rosa-sinensis cooperi	X				X		X		X
48 Homocladium platycladum	X				X		X		X
49 Hoya australis	X			X			X	X	
50 Hoya carnosa	X			X			X	X	X
51 Hoya carnosa variegated	X			X			X	X	X
52 Kalanchoe tomentosa	X			X					X
53 Ligularia kaempferi aureo-maculata		X			X		X		X
54 Pandanus baptisti		X		X			X		
55 Pandanus sandersi		X		X			X		
56 Pandanus utilis		X		X			X		
57 Pedilanthus tithymaloides	X			X			X		X
58 Peperomia acuminata		X		X			X		X
59 Peperomia astrid		X		X					X
60 Peperomia clusaeifolia variegated		X		X					X
61 Peperomia glabella variegated		X		X					X
62 Peperomia hederifolia		X		X					X
63 Peperomia incana		X		X					X
64 Peperomia minima		X		X					X
65 Peperomia obtusifolia		X		X					X
66 Peperomia obtusifolia variegated		X		X					X
67 Peperomia pereskifolia		X		X					X
68 Peperomia polybotrya		X		X					X
69 Peperomia sandersi		X		X					X
70 Philodendron cordatum		X			X		X	X	X
71 Philodendron dubia		X			X		X	X	
72 Philodendron erubescens		X			X		X	X	
73 Philodendron friederichstahli		X			X		X	X	
74 Philodendron guttiferum		X			X		X	X	X
75 Philodendron hastatum		X			X		X	X	
76 Philodendron karstenianum		X			X		X	X	
77 Philodendron lacerum		X			X		X	X	
78 Philodendron melinoni		X			X		X		
79 Philodendron panduriforme		X			X		X	X	
80 Philodendron patteri		X			X		X	X	
81 Philodendron radiata		X			X		X	X	
82 Philodendron soideroi		X			X		X	X	X
83 Philodendron squamiferum		X			X		X	X	X
84 Piper ornatum		X			X		X	X	X
85 Polyscias balfouri		X			X		X		X
86 Polyscias paniculata		X			X		X		
87 Rhoeo discolor	X			X			X		X
88 Ruellia makayoana		X			X				Baskets

Maintenance Requirements (cont'd.)

	High	Med.	Low	Dry	Moist	Wet	Tub	Vine	Small Planters
89 Sanchezia nobilis variegated		X			X		X		
90 Sansevieria Bantel's Sensation	X			X			X		X
91 Sansevieria cylindricus	X			X			X		X
92 Sansevieria ehrenbergi	X			X			X		X
93 Sansevieria trifaciata hahni	X			X					X
94 Sansevieria liberica	X			X			X		X
95 Sansevieria parva	X			X			X		X
96 Sansevieria subspicata	X			X			X		X
97 Sansevieria suffruiticosa	X			X			X		X
98 Sansevieria trifaciata laurenti	X			X			X		X
99 Scheffler actinophylla		X		X			X		X
100 Scindapsus aureus		X		X			X	X	X
101 Scindapsus aureus wilcox		X		X			X	X	X
102 Synadenium granti	X			X			X		X
103 Syngonium albo-lineata		X			X		X	X	X
104 Syngonium auritum		X			X		X	X	
105 Syngonium Green Gold		X			X		X	X	X
106 Syngonium hoffmani		X			X		X	X	
107 Syngonium liqulatum		X			X		X	X	
108 Syngonium podophyllum		X			X		X	X	X
109 Syngonium wendlandi		X			X		X	X	X
110 Syngonium White Gold		X			X			X	X

Use Requirements of Foliage Plants

1. Plants should be watered lightly and infrequently.
2. Should not be placed in direct sunlight.
3. Kept in temperatures of 60 degrees or above.
4. Fertilize lightly only once every 6 months.
5. Air conditioning isn't detrimental to foliage plants (when properly hardened off before they are sold).

Diagnosing Troubles:

Listed below are some of the symptoms of common foliage plant troubles which may arise under interior conditions, and some of the conditions which usually cause these symptoms.

1. Lower leaves turn yellow and drop off at the slightest touch--usually overwatering.

2. Burned margins or brown tips on leaves--allowed to become too dry for short period--too much fertilizer--low temperatures.

3. Yellowing and dropping of leaves at various levels on plant -- gas fumes, chilling, overwatering, poor drainage and aeration.

4. Small leaves -- poorly drained soil, tight soil mixture -- soil too dry over long periods.

5. Weak growth, light green or yellow foliage -- too much light, root rot, poor root system.

6. Yellow, wilted -- soft growth -- too high temperature -- root injury.

7. Small leaves, long internodes -- lack of sufficient light -- high temperatures.

8. Parathion injury to susceptible plants. Dieffenbachias, philodendron selloum and wendlandi injured by parathion aerosols. Chinese evergreen, scindapsus, crassula and syngoniums injured by parathion sprays.

Turf Disease - Fungi

Jim Holmes[1/]

No doubt the fungus plant is the least understood of all plants with which a turfman deals. Fungi are classified as plants and differ from the higher plants which we can easily see by only one exacting regard. That is they do not contain chlorophyll, thus do not have the ability to synthesize food and must obtain their food from material which has already been made. The fungi of importance to turf men are those which obtain their life sustenance from grass plants. Practically all the fungi of importance to turfmen can obtain succor from both dead and live grass.

Fungi which obtain their sustenance from living material are known as parasites and are considered pathogenic on a given plant if disease symptoms are visible. Fungi which obtain life giving materials from dead plants are known as saprophytes. If the particular fungus can obtain food from both living and dead material they are known as facultative fungi.

To beter determine if the various fungi which are known to be parasitic on bentgrass were present on visibly healthy, vigorous turf the following experiment was conducted:

1. A plug from the healthy area described above which was 4½" in diameter with about 5" of soil including mat and thatch was obtained.
2. The plug was thoroughly moistened with tap water, then placed in an airtight glass container.
3. The vessel containing the plug was kept at room conditions for a period of one week.

The first slide shown is mute evidence of the condition of the turf on the plug at the end of the incubation period. The following slides are photomicrographs

1/ Regional Agronomist, U.S.G.A. Green Section, Chicago

of the various fungi which were present. Rhizoctonia sp., Fusarium sp., Helminthosparium sp., Pythium sp., Curvularia sp., and Colletotrichum sp. could be microscopically identified. As you well know this constitutes a group of fungi which are considered among the most damaging to turf grass.

All these organisms appeared and were visible from fungi which were contained on the plug when it was incubated as no innoculum was added. It would appear from this experiment that these disease causing organisms were present in the mat and thatch either subsisting saprophytically or were in their seed or resting stage. Therefore, we can just about conclude that we are never without an active disease or the presence of disease causing organisms.

Fungi are more easily identified through observation of their resting or seed stage. Fungi seeds are known as spores. Most fungi which are troublesome on turf reproduce and are spread by spores. The various differences in these spores can be readily observed in the photomicrographs. Of course, there are variations in fungi and not all of them produce easily recognizable spores. Such is the case for Rhizoctonia in which the growing body or mycellium of the fungus produces a firm resistant unit called a sclerotium. Therefore, the sclerotium is the seed or resting body of Rhizoctonia. If fungi could be observed with the naked eye it would be as easy to determine their various differences, as it is to differentiate between higher plants which we can see.

Proper identification of the fungus or fungi actually causing the disease condition is a problem I have frequently encountered. Not only are visible disease conditions often misleading but more than one disease causing fungi is frequently present in the diseased area.

Because of the constant presence of disease causing fungi, it is quite important that a preventative fungicide program be followed. It is beginning to appear that early spring is one of the most active periods for disease causing

organisms. I suggest that a preventative fungicide program be followed in spring similar to one followed during periods of extreme heat and humidity. It would also be advisable to be sure that some form of mercury is used in spring as the fungi usually active at this time are quite susceptible to this chemical.

Similar to most phases of turf management, disease control is primarly based on common sense. However, the superintendent should familarize himself as much as possible with the fungus plant which is certainly one of his most deadly enemies. He also should become thoroughly familiar with the various chemicals which offer excellent control of the various diseases causing organisms with which he must deal.

Methods of Application and Factors Effecting Selectivity of Weed Control Chemicals Applied to Turf

John A. Long[1/]

The theme of the fourteenth annual turf conference was designated as modernization in maintenance methods in turf areas. In holding with the idea of modernization in maintenance methods, the previous speakers emphasized the need for personnel to adapt and modify their present practices where necessary to meet the demand for the production of better turf. From this standpoint it would seem quite desirable for personnel managing turf areas to have a better understanding of weed killers, methods of applying these materials and some general idea as to how they function to produce the results desired.

Weed control chemicals when they are used in turf areas at present may be classified into three categories based on how they are applied. These methods of application are; preplanting, post-emergence, and pre-emergence. The application of chemicals to plantbeds before planting turf or ornamentals for weed control is classified as the pre-planting method. Post emergence method of application means that the chemical spray is applied when weeds are established and growing in turf. Pre-emergence method of application is indicated when chemical sprays are applied to turf areas before weeds emerge from the soil.

Chemicals used as pre-emergence applications in general show a low toxicity to established and growing turf but are quite toxic to germinating weed seed or young weed seedlings. Two pre-emergence chemicals being used to a limited extent at present on golf greens are phenyl mercurie acetate and chloradane. These have a relatively low toxicity to bent and Bermudagrass

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and are quite toxic if they contact very small weed seedlings or seed that has just germinated. Some new chemicals designated for use as pre-emergence chemicals are zytron, Fenac, DAC 895, Alanap 1 F, PAX AR 76, sesone, urea derivative, triazine derivatives and calcium arsonate. These materials are generally not recommended for use on putting greens until further experimental work has been carried out. A number may be suitable for use on fairways, parks, cemeteries, home lawns, roadsides and other similar areas. Some of the newer pre-emergence herbicides such as zytron, DAC 895 and Fenac have excellent residual properties from the standpoint that they remain active against germinating weed seed over a long period of time. These chemicals show relatively high activity on both broadleaf and grass type weeds as they germinate. Materials such as phenyl mercuric acetate and chlorodane have a short residual period, thus frequent applications are required to obtain desirable results. Length of residual toxicity of pre-emergence chemicals in the soil vary considerably in relation to soil and climatic factors. Recommendations for the use of these materials should be based on comprehensive experimentation before they are employed extensively in turf areas. Follow directions on container labels closely or consult qualified specialists for the safe use of pre-emergence chemicals.

DMA, AMA, sodium arsenite, 2,4-D, silvex and endothal represent some chemicals which are most effective when applied as post-emergence sprays. They are not very effective as pre-emergence treatments. The post-emergence method with post-emergence type chemicals represents the most widely used approach to weed control in turf areas. In most situations the turf manager will not consider the use of weed killers until he can see the weeds and further will not consider control measures until weeds affect the quality of the turf cover. Since the post-emergence method is used most widely, some factors which operate to cause the chemical to kill weeds and not affect turf will be presented. An

understanding of how selectivity works in the use of weed killers is desirable because such information will aid personnel in obtaining better and more uniform results. It also may help to explain why turf damage occurs with certain chemical treatments when such damage is not expected.

A number of factors function to provide a basis for the selective action of chemicals on weeds. These are:

1. Differential wetting
2. Arrangement and angle of leaves
3. Location of growing points
4. Difference in plant tolerance to toxic chemicals
5. Placement of chemicals
6. Dormancy of plants

Selectivity of chemicals based on differential wetting can be influenced by the plant leaf structure. The leaves of most turf grasses have waxy leaf surfaces that are corrugated or formed of small ridges. Most of the spray droplets hitting the leaves bounce off, thus very little residue of the chemical is left in contact with the leaf. In contrast leaves of many broadleaf weeds have smooth surfaces. Spray droplets contacting the smooth leaf surface adhere more uniformly, the result more chemical residue is in contact with the leaf and thus more activity occurs against such plants.

The arrangement and angle of leaves also influences differential wetting and thus selectivity to some degree. In dense turf leaves tend to orientate vertically in response to sunlight. Spray droplets tend to run off or bounce off such surfaces. Crabgrass plants, dallisgrass plants and many other weed plants have leaves arranged and extended more nearly parallel with the ground surface. More chemical will adhere to leaves in this position. Wetting agents which improve the wetting properties of sprays also cause more of the spray to be held on the upright leaves of the turf grass resulting in increased discoloration. Numerous complaints of damage to St. Augustine grass with 2,4-D

may be partly due to the arrangement and position of its leaves. The broad leaves in a parallel position probably hold many more spray droplets than Bermudagrass.

The location of growing points in plants represents an important factor in determining the selective killing property. The use of strong solution of fertilizer salts such as ammonium nitrate and ammonium sulphate provide a very good example. When the solution is applied to control clover in Bermudagrass turf, the Bermudagrass is severely discolored but recovers rapidly, clover usually does not recover. The growing points in clover are in the axils of leaf branches and at the top of the plant. The spray contacts these areas very easily but in Bermudagrass the growing points are well protected by leaf sheaths or are located below the soil. The toxic spray solution does not contact these areas unless high water volumes are used to apply the spray. Endothal's selective action on clover and other boradleaf weeds operates in this way.

The difference in plant tolerance to toxic chemicals based on biochemical mechanisms within the plant provides the most desirable and striking type of selectivity. Examples of this which we are all familiar with are (1) 2,4-D applied to both grasses and broadleaved weeds, the broadleaved weeds are killed and grasses are not effected; (2) DMA applied to dallisgrass in Bermudagrass, the dallisgrass is killed, Bermudagrass is not killed; and (3) DMA and AMA applied to crabgrass and sandburgrass in Bermudagrass, crabgrass and sandburgrass are killed, Bermudagrass is not effected. Selectivity based on plant tolerance represents the safest and most dependable type available to turf maintenance people.

Selectivity based on dormancy and selectivity based on placement represent other types which can be very useful in the production of turf and ornamentals.

Some chemical sprays used during the winter months when turf grasses are dormant function very effectively; the use of the same materials when turf grasses are actively growing may be hazardous. Selectivity based on placement probably would be more useful in ornamental applications. Certain granular materials may be used in and around shrubs and trees with little or no harmful effects. In contrast if the same chemicals are used in a spray form, they may be quite harmful.

It is important that turf maintenance people know the range of selectivity of the material they use on both turf and weeds to be treated.

Survey of Turfgrass Research at Texas A & M

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

The turfgrass research program at Texas A & M was started in 1949 and has now completed its 11th year. This is not going to be an attempt to summarize those 11 years of research. Rather it is aimed at acquainting you with what is now going on in the research program so that you may feel more a part of it.

The Texas Turfgrass Association has maintained an interest in the research program throughout its history. An annual grant of funds has been made for research, usually small but of definite significance in the overall program. We would like for you as individuals to feel that it is your program and while we can't work on everyone's problems, we would like to think that solutions to the problems we are studying, would be of benefit to you.

As indicated this is going to be a survey of research, to better acquaint you with the program, and not a detailed report of results. For those of you who attended the field day in July, this will be somewhat of a repetition or review. For those who did not attend the field day, you can get some idea of what you might see at a future field day at this location.

Slides

St. Augustine Breeding

Most of you probably have heard by now that St. Augustinegrass produces viable seed, but you may wonder what this means to you. Does it mean that you can establish St. Augustine from seed? We don't think so yet. It does mean that more disease resistant and shorter growing types probably can be selected for vegetative reproduction. When enough is known about the chromosome number and behavior, mode of pollination, method of reproduction and breeding behavior, seeded varieties can be developed.

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St. Augustine Disease Control

In the meantime we have the severe brownpatch problem with St. Augustine. When the disease occurs in the late fall, winter and early spring months, it creates a more critical problem because the grass is inactive and does not recover from the disease. This makes an unsightly appearance and frequently results in weed invasion. Control of the disease has been obtained with Terraclor emulsifiable concentrate, 1-2 quarts per 1000 square feet, wettable powder, 1-1½ pounds per 1000 square feet, or granular 5-6 pounds per 1000 square feet.

St. Augustine-Bermuda Management

St. Augustine is frequently mowed at 2-3 inches height with the idea that this is necessary in order to maintain a dense stand. A height of clipping study has been underway for 3 years in which St. Augustine is doing well at 1¼, 1-3/4 and 2¼-inch heights, Common Bermuda types at 1¼ and 1-3/4 heights and Sunturf at 1¼ inch height. None of these grasses have done well at 3/4 inches clipped weekly.

Fertilization

Fertility studies have been conducted almost continuously since the program started. Recent studies with both lawn and putting green management have involved the use of urea-formaldehyde nitrogen sources in comparison with milorganite and ammonium nitrate. Good results are obtained with fairly long residuals when U-F materials are applied at heavy rates, 6 to 12 pounds of N per 1000 square feet, but the slow nitrogen release results in inadequate nutrition when light rates are used. This has led to the introduction of combinations of these nitrogen sources with readily available types and this is being studied in the research program.

Soil mixtures

Special soil mixtures have been studied for several years. The type of soil or clay and sand partical size as well as organic matter influence the mixture. Bentgrass has been maintained at College Station on mixtures containing 80 to 85% sand. Good rooting depth and water relations are also observed. A special putting green has been developed for use in evaluating fertility practices and new grass strains.

Dallisgrass control methods have been studied and developed. The use of DMA (disodium methyl arsonate) has given near 100% control at times but a repeat spot treatment probably will be necessary. Two applications of AMA (amine methyl arsonate at either 7.5 or 15 ounces per 100 square feet gave good control in 1959. Repeat applications probably should be delayed until active regrowth occurs.

Sandbur or grassbur control is possible with DMA at the same rates as for Dallisgrass.

Nutgrass control is being studied. AMA shows possibilities for selective control in Bermudagrass turf, using repeat application of 8 to 16 ounces commercial AMA per 1000 square feet, but this is still in the experimental stage.

Observations of Renovation of Greens*

Jim Watson, Jr., Leon Howard, W. L. Clark, Jim Holmes, and A.W.Crain[1/]

To renovate means to restore to life, vigor or activity; to renew, make over or repair. Renovation is the technique or procedure involved in the restoration or renewal process. Renovation of greens is generally undertaken when some basic factor or condition -- which cannot be corrected by proper management -- causes poor turf quality which results in unsatisfactory playing conditions. The degree of renovation required to produce satisfactory playing conditions can be determined only if the basic cause of poor turf can be ascertained. For purposes of clarity, and in keeping with the general concept of renovation techniques, it seems in order to group the practices into two separate categories -- renovation and rebuilding. Such a grouping and the terms used to describe each category is necessarily an arbitrary one, and overlapping of techniques is recognized.

Renovation. A term used to classify those practices which lie beyond the scope of routine maintenance and which, if performed, will (1) produce a satisfactory response from the current management program, or (2) reduce an abnormal expenditure of management effort (time, materials, equipment and supervision) required to maintain satisfactory playability. Such is the more generally accepted connotation of the word, "renovation". The introduction of a new strain or species of grass, elimination of excessive thatch and mat accumulations, correction of faulty surface drainage, replacement of tile to restore proper subsoil drainage, incorporation of amendments or severe cultivation to alleviate soil compaction, and the elimination of tree roots infesting greens are among the practices that fall in this category.

1/ Toro Mfg. Corp., Leon Howard & Assoc., Catto & Putty, U. S. G. A. Green Section, and Goldthwaite's, respectively.

* This material was taken from a paper prepared by Dr. Watson for the 1958 National Golf Course Superintendents Association Show and Conference. Since similar topics were discussed here, this is being used as a summary.

Rebuilding. A term which refers to those practices involving complete changes in the total green. In some sections, changes in the total green are referred to as "complete renovation" and, in a sense, such usage is correct; however, the more generally preferred term is "rebuild". Included in this grouping are complete changes in soil mixture, corrective sub-grade contouring with or without installation of drain tiles, reshaping and relocation of greens.

Management. Basic management practices such as fertilizing, watering, aerating, mowing -- including vertical to control thatch -- and the control or elimination of diseases and insects are normally performed in a routine maintenance program. Improper or inadequate performance of management practices often gives rise to conditions which may be interpreted as a need for renovation since, to correct the malpractice, might restore the green to acceptable playing condition. To focus attention on the importance of adequate materials and equipment for a sound program, these practices should not be confused with renovation.

Observations of Greens Renovation*

Probably the advent of improved strains of fine leaved bermudagrass has been responsible for more greens renovation than any other single factor during the past few years. Throughout the Southeast, South and Southwest, greens are being converted from common to fine leaved bermudagrass. Conversion, in some cases, is accomplished in connection with a rebuilding program; in others it is strictly a renovation process as defined earlier.

Conversion to improved strains of bermuda in the Southern areas, and to improved strains of bentgrass in the Northern areas is a clear indication of progress. Acceptance on the part of the Golf Course Superintendent and public is no doubt due in large part to the various state, regional and national educational turfgrass conferences.

* Recognition and thanks are given to A. W. Crain, Bud Elmer, Jim Hamner, Jim Jennings, Chat Mendenhall & Carl Anderson for their helpful contributions in preparing this paper.

Renovation

A. W. Crain, Agronomist for Goldthwaite's Texas Toro, reports during 1957, several Texas Clubs, including Fort Sam Houston Golf Club and Oak Hills Country Club in San Antonio, Corpus Christi Country Club and Oso Municipal Golf Course in the Corpus Christi area, and Bryan Country Club in Bryan converted all or some of their greens to an improved strain of bermudagrass. Strains used were Tifgreen, Gene Tift and Sunturf. The basic reason for renovation was, in all cases, to replace the existing bermudagrass with an improved strain. No soil or design changes were made.

Techniques employed in the renovation program were as follows: The greens were severely verticut, thoroughly aerated and sterilized -- a temporary soil sterilant, Vapam, was used. After the proper waiting period, the greens were stolonized -- sprigs spread over the surface -- topdressed and fertilized (heavy application of a 10-5-5 organic base fertilizer).

Results -- within six weeks (including the two week waiting period) most of the greens were back in play.

Previous work on these and other courses in the area indicated that the procedure outlined was the most desirable method of converting to an improved variety of bermudagrass. Sprigging into aerator holes, and the use of four inch plugs on twelve inch centers had proven to be unsatisfactory under their conditions. Experience had also shown the necessity of adequate fertilization at the time of renovation.

Crain also reported that during the past four years, courses at Weimar, Eagle Lake, Navasota and Yoakum, all located in South Texas, converted from sand to grass greens. Sub-grades were established, stone and pea gravel spread, seedbed prepared, and Gene Tift bermuda established, The conversion of these courses to grass greens is a milestone of progress worthy of note.-- there are no courses left with sand greens in the South Texas area.

Rebuilding

Jim Jennings, Superintendent of River Oaks Country Club in Houston, Texas, rebuilt three greens in 1956. Rebuilding was undertaken because (1) the greens had poor sub-drainage, (2) native or common bermuda was no longer acceptable to the membership as a putting surface, and (3) the architectural design needed modernization. The value and success of the program is clearly demonstrated by the fact that in 1957, rebuilding of the remaining 15 greens was undertaken. The size, redesign and contouring of these greens were the responsibility of the Architect, Ralph Plummer.

Techniques employed (for all greens) were as follows: Sub-grades were established, four inch Orangeburg tile installed in twelve inch ditches and surrounded with 1½ inch gravel, than three to four inches of 1½ inch gravel spread over the entire sub-grade. A twelve inch seedbed (consisting of four parts coarse sand and one part of the existing soil mixed off-site) was put down over the gravel blanket. A one inch layer of hypnum peat and 75 pounds per 1000 square feet of a 10-5-5 organic base fertilizer was applied to the surface and rotovated to a depth of four to six inches. Following final grading, the greens were sterilized with Vapam. After the Vapam waiting period, the greens were stolonized to Tifgreen bermuda and topdressed.

The 1957 program was started on July 5, planting began on August 15, and completed on September 18. Good coverage was obtained in 60 days. Abnormal rainfall (three inches on September 3, with two inches coming in a 30 minute period followed by 20 inches in the next 3½ months) created some very serious problems. Some of the banks and approaches were rebuilt as many as five times; topdressing became too wet to spread over than with shovels, and thus heavy toppings were required for leveling.

Jim reports if he were undertaking the 1957 project again he would start earlier, have plenty of dry topdressing material mixed and stored for covering purposes and, above all, hope for better cooperation from the weather man.

Summary

Renovation of greens should be considered when (1) proper management practices fail to produce satisfactory response or, (2) more than a reasonable expenditure of management effort (time, materials, equipment and supervision) is required to maintain satisfactory playability. The degree of renovation required will be determined by the nature of the basic cause responsible for unsatisfactory performance.

The techniques and practices employed to renovate greens vary widely and, for purposes of clarity, may be grouped into two major categories -- renovation and rebuilding.

When renovation or rebuilding of greens is undertaken, the program should be based on the latest information (research and field) regarding materials and techniques. Only a limited number of greens should be renovated or rebuilt initially. Such an approach will serve to verify the validity of the program, to prove out the materials and techniques and, perhaps most important, demonstrate to the membership the value and benefits resulting from renovation or rebuilding.

Long Range Planning on Golf Courses

Grover Keeton[1/]

Today popularity in golf courses is increasing and most of us in this room this morning should feel very fortunate that such a condition exists. There are people playing golf today who have never played before. I cannot see why such a rush to the golf courses should stop within the near future as every survey made indicates the need for more open spaces and more leisure time facilities. A golf course meets this need as well or better than most any other facility. Such a trend has resulted in more golf courses open for play, more golf courses under construction, and a record number of golf courses in the planning stage. Granting of this meeting we are primarily concerned with courses already in operation, but you and I as employees of a golf course should be aware of all surrounding conditions in our profession.

Let's ask ourselves these questions:

1. Should we be concerned with other golf courses? We could have the attitude "they don't bother me, I am only interested in my own golf course." I agree our own golf course and employer should be our major concern but on the other hand we should be familiar with the trend of our product. Can you imagine a salesman representing a company selling a product and not aware that his product is gradually becoming out-of-date? To an extent, we are all salesmen.
2. Another question - are we guilty of saying "what was good twenty years ago is good enough today", or "I have done it that way for twenty years". No person could be more wrong, particularly in golf course turfgrass work, by attempting to follow such thinking. The changes, even during the past few years, have been too numerous to mention, however, later on I do want to mention some of the major items which I think should be included in a golf course superintendent's long range plan.

1/ Superintendent of Golf Courses, City of Dallas Park Department

3. Another question and we have heard it said many times "isn't a long range plan too expensive to follow?" or "we do not have the money". First, it is expensive not to follow a long range plan. Such a program is merely establishing a major goal and accomplishing it on a year to year basis. Long range work on fairways, tees, greens, clubhouse, etc., normally can be performed by golf course personnel along with routine course maintenance. In fact, one way of identifying a long range program is by saying "it is a sneaky way to secure major improvements." A similar situation is when a small child learns to walk by taking a step each day.

4. Another question is "don't you think long range planning is the responsibility of the Greens Committee or the Board?" Such thinking on a day to day basis places a course superintendent in the classification (and salary scale) of a short term laborer instead of a long term professional.

The major items which should be considered in a long range program are:

1. Water
2. Ground maintenance
3. Turf
4. Machinery
5. Storage facilities
6. Budget

WATER

We all know water is an essential item as Dr. Marvin Ferguson said "it has many functions in a plant." We must plan for extreme conditions. Recently the Northeastern part of the country suffered one of its worst droughts in their history and in the Southwestern region seven years of rain fell within a few weeks. Our long range plans must be made accordingly. We are also going to have to compete with industry for use of water as it is reported that by 1975 a 100% increase in water will be necessary for industry. In addition, by 1980 a person will need 200 gallons per day where today he is using 140 gallons per day. In view of these conditions it is now reported only 28% of the total United States rainfall is available for use. The remaining 72% returns to the atmosphere by evaporation. It is also estimated that only 12% to 13% of this 28% is used.

Because of these developments one can readily see why we must think of the following conditions when we think of long range water usages on a golf course:

1. The need for large reservoirs, irrigation ditches and use of every available stream. 80% of water from U. S. comes from surface sources.
2. Attention must also be directed to those grasses which can use water efficently and drought resistent.
3. The necessity for maintaining a high fertility level and in order to utilize the water available more efficiently. As Dr. Fred Grau mentioned in his article in the October, 1957 issue of Golfdom Magazine, "in many cases fertilizer has been a good substitute for water."
4. Finally, emphasis on proper handling and scheduling of daily watering. It is possible to add underground watering systems by course personnel but by following a long range master plan with proper designing as to location of valves, adequate pressure, sufficient pump volume, etc.

GROUND MAINTENANCE

As you know, on many occasions the golf course can take on a worn look prematurely as contrasted with many courses which have been built within the past few years. Such conditions exist due to the lack of handling the little things in ground maintenance which improve the general appearance. Courses constructed twenty years ago are out-of-date today unless provisions have been made for constant remodeling through a planned program. Original features of the course may be incorporated in a long range plan, but we all agree the golf course with the round, flat green is out-of-date. The modern course has its greens setting in the midst of elevated contours, large enough to provide plenty of space for setting of cups and designed to minimize the problem created by carts and golf buggies. Large tees, 100' in length, constructed to blend in to surrounding terrain by means of long gentle slopes. These factors offer many advantages in maintenance today because of

the use of power equipment as well as aid in frequent rotation of tee markers. I must confess when we want to reduce expenditures in long range planning it normally comes from the fairways, however, I sometimes am not sure this is the proper approach. We all agree that the golf course is normally judged by the condition of the greens but a good fairway program can be a good economical move. Most of our long range fairway maintenance can be centered around areas of erosion, continued spot seeding and sprigging where necessary, elimination of weeds and cleanliness of underbrush between fairways, and on public courses will speed up play which is very important on weekends.

The ground maintenance program should not stop with fairways, greens and tees. We should think of the area around the clubhouse. Let's never think that our responsibility as golf course superintendents stop with the greens, tees, fairways and the maintenance shed. To make our long range program complete, we must think of shrubbery around the clubhouse, walks, trash disposal and the fence row and a general beautification of the entire grounds. This may be a change in our thinking but we must expand our thinking if we successfully expand our maintenance program. I know many of you recall Mr. Bob Williams', Past President of the Golf Course Superintendent's Association, talk here a few years ago when he said his country club included the swimming pool as part of his responsibility and he at first wanted no part of it but it advanced his position (and salary) in many ways.

TURF

This includes many maintenance procedures under varying conditions, however, we must today plan and provide supplies and equipment to apply various fungicides, insecticides and herbicides. This may not be included in your budget in the first year as you would like for it to be but as it becomes increasingly important in golf course work we can gradually increase its supply.

There are economical ways and means to follow long range planning particularly in turf. A good example would be what every golf course should do today - establish its own nursery with one of the improved strains of grass. A simple program would include sprigging a small nursery with the grass best suited for your conditions and then sprig the greens from the nursery. On the other hand, if at the beginning we propose to our Board of Committee to spend few hundreds of dollars for purchase of enough grass to sprig twenty greens most of us would be refused before we got started.

FERTILIZER

Turf grass requirements vary from species to species and from region to region reflecting a diversity of soil and climate. Considerable progress has been made in making and developing better fertilizer. Extensive efforts have also been made today and for the future to develop chemical materials. Posphate and potash have not been subjected to as many changes as nitrogen sources.

Our long range program should be alert and flexible to the extent of possible usage of liquid fertilizer in the future. The Golf Course Reporter, September - October, 1959 issue in an article by William E. Pritchett, University of Florida Agricultural Experiment Station, informs us there are now two general types of liquid fertilizer, namely, nitrogen solution and liquid mixed fertilizer.

EQUIPMENT

Commercial people have assisted us many times in economical means of turf maintenance particularly in use of equipment and our primary concern today and in the future is to know how to take advantage of larger and more power equipment. For example, we are expected today through means of modern machinery to actually provide the grass with adequate air, gas and plant food when years ago most of us were only concerned with the top of the soil. Progress has been made in the

development of machinery to the extent that superintendents must plan for their proper usage to fit their particular course as well as proper care and safety methods. Today if you discover as many as three or four men on the same green doing routine maintenance work, we can be assured that man power is being wasted -- with proper equipment and instructions it is not necessary for labormen group themselves using forks, hoes, etc. to make necessary corrections. The long range equipment program dictates that all new construction should be done with the thought of eliminating manual power as far as possible and replacing it with power operated equipment. If we are to get maintenance work performed with least amount of interference with the increase in play, power operated equipment will be needed and again in most cases this can be done by making purchases on a year to year basis through proper planning and budgeting.

STORAGE

As automotive equipment and machinery is added additional housing and storage facilities will be required and should be part of a long range planning program. In this day of machine age no ordinary shed or barn will suffice. Planning of adequate storage facilities should include an enclosed maintenance yard with work shops, properly heated and lighted for the repairing and overhauling of machinery and equipment, bins for repair parts, equipment for sharpening mowers and tools, dry, safe storage for painting supplies and a hard-surfaced area would even add to the overall appearance of the shed. In addition, storage and bin space should be made available for chemicals, herbicides, fungicides, insecticides, employee room facilities, with first aid supplies, rest room facilities and outside area large enough for employee parking. To provide maximum efficiency, we should keep in mind to plan our storage facilities so the shed would be flexible, stacking be done in a regular and uniform manner, and inventory can be done without difficulty. A storage plan for any period of time should remember that good housekeeping is the best practice to follow or a place for everything and everything in its place.

BUDGET

I know to many of you such a word frightens you somewhat because basically most superintendents are not the type to look into this matter as it necessitates paper work. However, in our own way we must make repeated efforts to record expenditures and be concerned about the maintenance budget. Know what actually goes into the budget is a more thorough way of being familiar with the expenditures. A golf course maintenance budget requires that about 75% of expenditures be for salary and wages. Other costs includes materials, supplies and repairs for the equipment, course, buildings, etc. This can be done by keeping daily records, having some idea what a particular job costs, number of man hours needed and showing comparative costs. This will indicate our desire to live within the budget when following a long range plan.

In conclusion, a long range program prepared by the golf course superintendent should complement the work he does in directing the maintenance of course, grounds and clubhouse. In order to command the salaries we think we are worth we must be interested in long range planning and keep abreast of the everchanging conditions in golf course turfgrass work. Our interest and thinking must also be a long range basis if we are to successfully prepare and follow a golf course long range program.

Budget Preparation and Record Keeping

Marvin H. Ferguson[1/]

Records are extremely important for purposes of accounting and for future budget preparation. They are important because costs continue to rise and it is necessary to know where the maintenance dollars are spent. Sometimes the elimination of some unimportant golf course feature can provide an important saving in money.

Frequently golf clubs desire to compare maintenance costs with other clubs. This is almost impossible because differing accounting techniques and differing physical characteristics of golf courses render most such comparisons invalid.

Because of this consideration, together with a need for better cost accounting methods, a USGA Green Section subcommittee under the chairmanship of Mr. Allan Brown was established for the purpose of studying "Uniform Terminology and Accounting." The committee first undertook to define the various areas of a golf course with respect to their maintenance requirements. A list of these definitions follows:

GOLF COURSE

The whole area on which the game of golf is played, including practice area and all club property, except the grounds immediately around the club house and that used for private residences or for other recreational purposes.

TEE

The tee is the starting place for the hole, consisting of a flat area maintained at short height of cut. It may be elevated or level with the ground. The exact position of the teeing area should be indicated by two markers. These should be movable so as to vary the position of the front of

1/ Mid-Continent Director, National Research Coordinator, USGA Green Section.

the teeing area. The following color code is recommended for the tee markers:

TEES	COLOR
Back	Blue Course
Middle	White Course
Front	Red Course
Women's	Yellow Course

TEE SLOPES

If the tee is elevated, the banks around the tee shall be known as the tee slopes and shall be considered a separate part of the course.

FAIRWAY

The fairway is that part of a golf hole between the tee and green on which the turf is groomed to provide an improved lie; other than the rough, hazards, roads, paths, etc.

ROUGH

The rough is that part of a golf hole between the tee and green other than fairway, hazards, roads, paths, etc., not including woodland or swampland, practice area, nursery area, and all other areas not regularly maintained within the boundaries of the course. The rough is generally maintained by cutting or mowing at heights in excess of the height of the fairway.

WOODLAND

Any area occupied by trees, saplings, bushes, etc., which requires hand labor and cannot be maintained by gang mowers.

SWAMPLAND OR BOG

Any low area containing an excessive amount of water, which cannot be maintained by the customary golf course equipment.

NURSERY AREA

Any area which has been set aside specifically for nursery purposes such as the cultivation of sod, trees, flowers, bushes, etc.

PUTTING GREEN

The putting green is all the ground of the golf hole which is especially prepared for putting or otherwise defined, not including collars or aprons.

COLLAR

The area immediately adjacent to the putting surface that is maintained at an intermediate height of cut between the putting green and the fairway.

APRON

The approach or area immediately in front of the putting surface, between the collar and the fairway, which is usually maintained at an intermediate height of cut between the collar and the fairway.

HAZARDS

Water-A water hazard is any lake, pond, river, ditch, surface drainage ditch or other open water course (regardless of whether or not it contains water), and anything of a similar nature. All ground or water within the margin of a water hazard, whether or not it be covered with any growing substance, is part of the water hazard.

Bunker (Sand) - A Bunker is an area of bare ground, often a depression which is covered with sand, but not including the banks or slopes immediately surrounding the Bunker. These should be considered part of thefairway.

Bunker (Grass) - Same as sand Bunker, except the area is covered with grass instead of sand.

In order for maintenance costs to be meaningful, they must be based upon some standard unit of measurement. Only by determination of "unit costs" may we evaluate efficiency and economy in maintenance.

The following units of measurement are recommended:

1. MAN HOURS

To provide a common denominator, it is suggested that "man hours" of labor be used to determine the amount of work on any part of the course.

This can then be related to dollars according to the hourly rate prevailing in any given area, or on any course.

2. ONE ACRE

It is suggested that this unit be used for measuring the amount of labor for maintaining fairways and rough. This multiple provides a convenient unit by which to measure the amount of labor, and the cost of maintaining any fairway or rough area, regardless of size.

Once having determined the amount of man-hours necessary to maintain an acre of fairway, this multiple can then be related to the total area of the fairway.

3. 1000 SQUARE FEET

It is suggested that this unit be used for measuring the amount of labor necessary to maintain putting greens, collars, and aprons.

It would seem that the only valid comparison which could be made between clubs must be based on man hours required per unit of maintenance. The following example illustrates the method whereby we could determine unit costs:

> Course "X" has 115 thousand square foot units of putting surface. It is mowed 208 times during 1959. A total of 2496 hours is spent mowing greens. To find the cost of mowing a unit of putting green in terms of man hours, the following formula may be used:
>
> $$\frac{\text{Total Hrs.}}{\text{No. of units x No. of times mowed}} = \text{Hours per unit}$$
>
> Substituting, $\frac{2496}{115 \times 208} = \frac{2496}{23920} = .104$ hours per unit

Because it is reasonable to assume that any given operation will require varying amounts of time from day to day, our figures for the average time required to perform a given unit of work throughout the season would be more nearly accurate than if figures were obtained for only a few days.

The next logical step appeared to be that of devising a series of forms upon which data pertaining to maintenance costs could be recorded, and to test the adequacy of these record forms by conducting a pilot study. A great many sources of accounting practice have been drawn upon in devising the record forms and no claim of originality is made. No doubt you are presently using some forms very similar to these.

A brief explanation of the suggested record forms follows:

Form 1 - a daily time sheet for the individual workman. Each workman should check the items on which he has worked during the day and record the hours in the appropriate column. Where the work does not fit any of the categories listed, the workman should check "other" and make an explanatory note somewhere on the sheet. This form should be turned in daily to the superintendent.

Form 2 - a summary sheet for the transfer of the information given on daily time tickets. The superintendent should use this summary sheet to make a daily record of the total hours spent on each phase of maintenance. At the end of each month, the daily entries may be totaled to provide a monthly summary of the time consumed by every operation.

Form 2a- a weekly payroll form. On this form each workman's time for each working day is recorded (this also is transferred from the daily time sheet Form 1). Form 2a provides a record of the total hours of labor for each man, his rate of pay, his total earnings, net pay and the totals of these items for the entire crew.

Form 3 - a basic data sheet which will serve as a description of the course with respect to the areas subject to various categories of maintenance. Units of maintenance will be derived from this information. We have found that aerial photos made to sacle (obtainable from nearly all

local Soil Conservation Service Offices) are extremely useful for determining areas. A planimeter can be used to obtain fast and accurate measurements of area from these photos.

Form 4 - a summary sheet showing supplies purchased. This information should be drawn from invoices or purchase orders. These data, together with year end inventories, will provide figures on supplies used and their value.

Form 5 - a summary sheet of equipment and maintenance costs. If the club maintains a "repair parts" inventory, this must be considered in determining the cost of repair parts used.

Form 6 - an inventory of equipment. This should show each item of equipment owned by the club, an identifying number, its estimated value, its estimated useful remaining life, and the annual rate of depreciation.

Small items, such as hand tools, should be placed on a separate inventory. A budget item usually takes care of replacement needs of such "expendable" items.

Form 7 - an equipment operation record. This should show the item of equipment, an identifying number, and a record of its operation. This record usually is the responsibility of the superintendent, though he may pass the responsibility to the operator of the equipment. This record will have no value from the standpoint of maintenance costs, but it will be helpful in establishing "expected useful life" of equipment.

It is not necessary that your records follow these procedures. These are merely suggestions. However, your job will be easier and your value to your employer will be greater if you can provide him with accurate and adequate records.

Weed Control

Gene Nutter, Gene Bockholt, John Long, Wayne Allen, and Charles Wilson[1/]

Herbecides are classified as pre-emergence and post emergence, acting on newly germinated seed and on established plants, respectively.

Selectivity of a herbicide is dependent upon the (1) surface characteristics of the leaf, (2) the arrangement and angle of the leaves, (3) the location of the growing points (above ground exposed, or low and protected).

Biological selectivity is divided into tops and root system killing areas. Herbecides should be applied according to enzymatic makeup of the plant and application during dormancy of desirable grasses.

Control of clover (endothal) and nut grass (AMA) were discussed. Also, Dallis grass (DSMA), Grass burrs (5 oz./1000 sq. ft. DSMA)

Questions asked by the audience.

1) control of clover 2) winter control of nut grass* 3) control of nut grass in rose plantings 4) control of nutgrass in annual and perennial plant beds** 5) nut grass seed 6) goathead control 7) sand burr control

* There was much discussion on the winter control of nut grass. This came about because many of us are experiencing difficulty in controlling nut grass during off-season, i.e., the dormancy period of annuals, perennials and woody plants. It was brought out that Vapam and MC-2 will do a good job, but only when the temperature is just right. Possible solution for the control of nut grass would best be accomplished with long range planning by the user. Plants infested with nut grass could be removed, forfeiting the planting for the following year and applying chemicals during the warm season.

** The problem here appeared to be the ability to destroy nut grass in a cultivated plant bed adjacent to buildings or lawn areas. It was pointed out by

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1/ U. S. G. C. S. A., Watson Distributing Co., Agronomy, Agronomy, and Milwaukee Sewerage Commission, respectively.

Mr. Wayne Allen that nut grass will creep and even though a straight down-kill is possible, the nuts some 12"-15" out on the lawn area could easily grow toward the cultivated bed. Metal or wood dividers between the lawn area and cultivated bed would be prohibitive costwise in that these retainers would have to go so deep in the soil to separate the nuts from the plant bed. Possible solution to this problem might be to sterilize the lawn area out from the plant bed a distance of 2' - 3' for perfect control.

All of the panel members felt everyone should be extremely careful in the application of chemicals. In fact, only responsible persons should handle chemicals. They went further to say that in analyzing chemical uses, one should look up as well as down. Trees can be killed as we all know.

Building or Renovating Turf Areas

J. R. Watson, A. W. Crain, Leon Howard, Jim Holmes and W.L. Clark[1/]

The renovation of an area is a practice where the soil and turf is changed beyond normal maintenance standards and which change is commonly regarded as an improvement for maintenance and aesthetic purposes.

Rebuilding is a complete changing of soil, structure, grade, and turfgrass to attain the highest degree of aesthetics and function.

Bermuda grass sod can be successfully planted during the winter months providing enough water can be applied to keep the soil and roots of the grass moist, even though the grass will not be growing. This will also economically utilize usually slack winter labor.

Bermuda grass seeding should not be attempted closer than 4-6 weeks before the first killing frost, or before the last killing frost, usually during April or May.

Fertilization practices concerning rates and results desired, along with application procedures as related to aerification, were also discussed.

Questions presented to the panel by the audience.

1) strip sodding in the wintertime 2) median or boulevard slope design of turfed areas* 3) time of year to sod 4) mulching for protection of winter seeding or sodding 5) control of build-up of turf in the West Texas area 6) correct program for fertilization of newly seeded or sodded areas 7) poor-boying fertilizer application**

* The problem here appeared to be "should a boulevard or median grass strip be concave or convex". It was pointed out that a concave boulevard would naturally hold water and would probably need catch basins or inlets to drains it. The convex design of boulevards or median strips have a tendency to build up along the side of curbs due to splash over of mud, etc., from motor vehicles. It was pointed out that in some cases sod would build up to a height of 6"

1/ Respectively, Toto Mfg. Corp., Goldthwaite's, Leon Howard & Assoc., U. S. G. A., and Catto & Putty.

adjacent to curbed boulevards and had to be removed by maintainers and large loaders every five years. The panel appeared to be in accord with this, in that the final grading of a median strip should be held a little below the top of the curb to offset build-up and costly removal of sod as a frequent operation.

** The problem here was "should those people who use fertilizer scrimp on its first application, then the following year apply the second". There was quite an argument by the panel on this question. In fact the vote was three to one. I believe I am correct in saying three panel members felt when fertilizing only a correct application should be applied, but one member suggested doing the best possible job with the amount of money one had, slowly working toward a better fertilization program. Some of those in the audience were of the opinion a fixed budget limited large scale fertilization programs and I agree. Some felt that a half-way fertilization program wouldn't do the job at all, however, some felt that if half of the fertilizer was put on one year, perhaps the next year's fertilization would bring the turf up to what it should be. It was the consensus of many that fertilization of turfed areas in parks, schools, cemeteries, etc. be applied at those areas first noticed by the public. A good program then would have an impact on the public and would make it easier for managers to receive a higher budget for fertilization programs.

Long Range Planning Needs

Dee Hampton[1/]

I. Introduction
Long range planning should include a complete study of the following:
- A. Labor plans and procedures
- B. Design and construction for efficient maintenance
- C. Equipment needs-present and future
- D. Education
  1. Your own-turfgrass conference, literature, etc.
  2. Your superiors-possibly encouraging them to come with you
  3. Personnel and public
- E. Budget and records

II. Education
1. Your self-Turfgrass conference, literature, etc.
2. Your superiors-possibly by encouraging them to come to conference with you.
3. Personnel-safety, efficiency, interest in job
4. Public-workers for taxpayers; may include PTA and Dad's Clubs, etc.

III. Labor plans and procedures
- A. Are they trained for their jobs
  1. Safety
  2. Efficiency
  3. Interest-more than just a common laborer
- B. Will need replacements for future
- C. Distribution of work over:
  1. Days
  2. Months
  3. Seasons
  4. Years-starting on program, it cannot be done over night

IV. Equipment Needs
- A. Safety-especially school grounds and parks
- B. Ability of equipment to complete job-size
- C. Amount of equipment needed to efficiently utilize labor and time
- D. Cost of upkeep and replacement-possibly with cooperation of other organizations of type
- E. Sprinklers or water system can often pay for self in cost of filling cracks and washes in heavy soils and in control of goatheads by good turf.

V. Design and Construction
- A. Clearance for equipment
  1. Between shrubs and trees
  2. Fences and right size gates possibly to use larger equipment as system grows
  3. Backstops and playground equipment
- B. Grades
  1. For good drainage-necessary for good turf
  2. Not too steep-never over 1 on 3

1/ Goldthwaites Texas Toro Company, Dallas, Texas

(A) Hard on Equipment
(B) Hazardous
(C) Washes
(D) Costly to maintain

C. Landscape around building
1. Heavy traffic
2. Cost of maintenance over years as it grows
3. Elimination of narrow, hard-to-maintain strips

C. Design mainly for benefit of users

VI. Budget and Records
A. Records will improve efficiency of a budget
B. Records may show where accidents occur
C. Records may point out costly operations
D. Records show expense of equipment maintenance
E. Records and time-motion studies will help to justify your expenses and your requests for future spending

Budget Preparation

Bob Frazer[1/]

Budgeting, in all of its aspects, is one of the most important functions of any operation.

A budget is work plan, complete with cost data, that is followed closely throughout the fiscal year.

Budgeting is a year round activity. From the very beginning of the fiscal year, plans should begin for the following year.

Budgeting should be, but not always is, an exacting procedure. Costs vary, therefore some allowance should be made for increased costs and, when possible, some contingencies.

Planning for the acquisition and maintenance of equipment is a very important budgetary function.

An analysis of personnel costs is also a significant phase of budgetary activities.

The yearly budget should be a segment of a long range budget (5 years, at least).

1/ Director Park & Recreation Department, San Antonio, Texas

Labor Plans and Procedures

Charles B. Campbell[1/]

Planning defined - A scheme of action or procedure. A plan of operations.

Why Plan:

Efficiency of labor operations increases or decreases in a direct ration with good planning. As labor will run from 60 to 85% of any total park or school budget, and with labor costs constantly increasing, we have to get maximum efficiency from our labor to survive.

Our own labor, percentagewise, runs as follows: Golf Course Division 64%; Recreation Division 80%; General Parks Division 62%; Percentage of total park system budget allocated to personal services is 67%.

An Outline of Planning Procedures and Techniques

I. Objectives
   - A. Long Range
   - B. Immediate

II. Planning Considerations
   - A. Long Range
     1. Master Plan
     2. Annual Work Program
   - B. Immediate
     1. Monthly
     2. Weekly
     3. Daily

III. Evaluation and Appraisal of assets and liabilities
   - A. Assets (In view of objectives)
     1. Equipment (physical)
        - a. General condition and state of maintenance
        - b. Adaptability of equipment to the specific job
          - (1) Do we have the right equipment?
          - (2) If not, is it better to:
            - (a) Buy it?
            - (b) Rent it?
            - (c) Contract the work?

1/ Director, Department of Parks and Recreation, Midland, Texas.

2. Personnel
   a. Supervisory
      (1) Foremen
      (2) Subforemen or leadsmen
   b. Labor
      (1) Skilled
      (2) Semi-skilled
      (3) Common
   c. Maximum efficiency from personnel
      (1) The individual
         (a) Each man/woman is an individual
         (b) Individual skills, abilities, and interests
         (c) The right man for the right job
         (d) In-service training
            1. Care and maintenance of equipment
            2. Operation of equipment
            3. Job "know-how"
            4. Safety
            5. Work methods and techniques (the "easy" way and the "hard" way to do a job)
            6. Importance of the individual
         (e) Working conditions
         (f) Morale

B. Liabilities
   1. Lack of funds
      a. Low wage scales for labor
      b. Competition for labor with private enterprise
      c. Limitations on equipment purchases and availability
   2. Extraneous considerations
      a. Weather
      b. Emergencies
      c. Importance of alternate plans

Outline for Immediate Labor Plans
(Section II-B of Master Outline)

I. Immediate Labor Plans
   A. Monthly plans
      1. Monthly objectives outlined by supervisors
      2. Foreman detail and present labor plans to supervisor for approval
      3. Importance of deligation of authority
      4. Monthly plans outlined by foremen to entire labor force.
         a. Importance of men being "in the know"
   B. Weekly Plans
      1. Objectives based on monthly plan and work progress
      2. Clarification of objectives to each group and individual
   C. Daily Plans
      1. Clear objectives on part of each individual as to work to be performed
      2. Need for having all tools and all materials loaded on trucks for the job at hand
      3. Planned truck routing to avoid unnecessary "backtracking" and excessive "riding" time

D. Alternative Plans
   1. Inside work for extreme weather
   2. Secondary work objectives in event type of weather makes primary assignment impractical
   3. Secondary work objectives if unavoidable work stoppage occurs
   4. Standing orders for all employers when work stoppage occurs
      a. Above all do something
         (1) Police area for trash, debris, broken glass etc.
         (2) Close observation of immediate area and other areas passed enroute to assigned task
            (a) Water running or leaks
            (b) Vandalism
            (c) Broken tree limbs
            (d) Trash and debris
         (3) Immediate remedial action if practicable
         (4) Importance of reporting items to supervisors when remedial action not practical

Record Keeping

Ken Krenek[1/]

Accurate records, properly kept, will tell a fairly complete story of any operation. Records in themselves need not be complicated, but should provide enough information to enable one to answer any of a number of questions which arise from time to time concerning a certain operation.

Webster defines "record" in a number of ways, but the one most suitable for our purposes is "that which is written to perpetuate a knowledge of events". Basically, records embrace a very small number of variables. When you include the subject, date, time, quantity, and cost details, you have just about all you need. These, however, have a breakdown which expands the list. Different organizations keep a different number of records, however, sufficient records should be kept to answer all reasonable questions that may arise concerning the organization. For instance, the following questions may arise concerning certain phases of your work. How much grass was used? How long did it take to plant it? How much of the work was done with power equipment? How much by hand? How much time was spent watering? Can the job be done better next time? Can it be done cheaper? Items as basic as watering are worthy of a few records. Do you know how much time it took to water each of your areas? Do you know how much water it took? Can you pre-rate the cost of watering equipment to determine all of the cost?

Why do we keep records? What do records do for us? Can we afford to keep records? Are records a bunch of nonsense? Have you ever asked yourself a question about an old job, an old purchase, or the like? Maybe you wanted to know . . . when was it done? How much did it cost? How much material did it take? What was the cost per foot? Per square foot? What was the labor cost? How long did it take? What were the results? Who worked on the job? The

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answers to these questions can be yours if you keep good records. By good records I mean accurate records properly filed. Your records must satisfy the entire requirement. If they are inaccurate, they are useless. If you have prepared good records but cannot find them, they are equally as useless.

The keeping of records should be a function of every one who is not under constant supervision. This includes personnel both in the office and in the field. All records, however, should find their way into the office periodically and positively, because in order for records to be effective, they must be properly filed. This can best be done in the office.

Do not commit your work to memory. Few of us are capable of retaining all the information necessary for the required length of time. Even so, if it is not written, it is difficult to "prove" should the occasion arise.

Records which originate in the office are generally a more routine function and are kept more accurately. Such records generally deal with finances, equipment costs, and general statistics.

Field records are the ones which could probably stand the most improvement. Records keeping is a job by job, hour by hour, day in and day out, continuous process. The human element is the key to the problem. If you can successfully and permanently impress upon your personnel the importance of good records, they need only the proper tools, then, to initiate the records process.

What forms are necessary for keeping records? This, of course, varies with the operation, however, no matter how simple the operation, information should be recorded on a standard data sheet and not on a piece of dual-purpose material such as a book of matches, scratch paper, wooden stake, or the like. Those responsible for record keeping should be provided with a form or set of forms prepared in such a manner as to be readily adaptable to any type of work that a given group of workers may perform. The forms should be prepared in such a way as to require a minimum amount of writing on the part of the person keeping the

records. If necessary data can be recorded easily and quickly, it will most likely be more accurate and more complete.

How long should records be kept? This, of course, varies with the type. Some will be of a temporary nature while others will be permanent. When temporary records have served their purpose and no longer contain significant or useful information, they can and should be discarded. For instance, it would appear to be of little significance that a flower bed was cultivated, or a cup was changed in a green two years ago; yet for a period of time, this information is useful. On the other hand, legal records are kept permanently.

What should be recorded? If a job is important enough to be done, it is important enough to be properly recorded.

Records are not a bother - they are a help. They can help us in many ways. Records help us in one of our most important functions - that of planning ahead. Records serve their greatest purpose when they enable us to do our job better. We plan our budget and our work with heavy reliance on past records. We can order materials and plan jobs with the help of records. Also, never overlook the value of records for public relations and publicity purposes. When someone from your organization makes a talk to a garden club or civic group, the office records file is usually the first stop. Occasionally, your local newspaper will be interested in doing a feature article on some phase of your operation. You can do much toward making it a more interesting article if you have kept good records and can interpret them properly for the press.

These are only a few ways that records can help us. There are many others. Never belittle the importance of records, no matter how basic they may seem. Information, later found to be insignificant, can easily be discarded; important information, not recorded, is most likely lost forever.

Keep accurate records properly filed and they will repay you manyfold for your efforts.