Proceedings

of the

22nd Annual Northwest Turfgrass Conference

September 25, 26, 27, 1968
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GEORGE HARRISON

Greetings and a hearty welcome to all those attending our 22nd annual Northwest Turfgrass Association Conference.

Certainly a more beautiful setting for the meeting could not be found in the Northwest. Our hosts, the Johnsons have been most cooperative in making the advance arrangements and we are looking forward to a successful conference.

Dr. Goss, your executive secretary, has spent many hours making arrangements for the speakers who are participating. The screening and selection of subjects and speakers was carefully done by your executive board in order to provide a program that would have appeal to nearly everyone in the various fields of our turf industry. Everyone should be able to note several ideas that will make him more effective on his job. If this is accomplished, the primary objective of our conference will be met.

Special thanks are due to the following conference committee chairmen and their assistants.

Social -- Al Blair
Women's Activities -- Mrs. Doug Weddle
Golf Tournament -- Doug Weddle and Ken Putnam
Entertainment -- Wes Johnson
Registration -- Dick Haskell
Meals -- Elmer Sears
Program -- Dr. Roy Goss

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Construction and Maintenance of Golf Courses in Europe[1]

John R. Escritt[2]

INTRODUCTION

Britain being the birthplace of golf it is not surprising to find it has far more golf clubs than any other European country - about 1700 which is nearly six times all the others put together.

In other European countries we find approximately as follows:

Austria	11
Belgium	11
Denmark	12
France	70
Germany	39
Holland	18
Italy	33
Norway	5
Portugal	6
Spain	17
Sweden	46
Switzerland	24

Czechoslovakia, Finland, Rumania - two each.

Cyprus, Gibraltar, Greece, Yugoslavia, Luxembourg, Malta - one each.

As regards new golf courses up to 15 per year are possibly being constructed in Britain (as against about 50 per year in the 1920's). France has been making 2 or 3 a year for several years but seems to have come to a stop at the

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Director, The Sports Turf Research Institute, Bingley, Yorkshire, ENGLAND.

moment. Austria, Holland, Portugal and Spain are probably making 2 or 3 a year, Germany 5 or 6 and Italy about 10.

In Britain quite a few existing courses are being redesigned and partially re-constructed because of loss of land to roadworks or because the clubs want to modernize.

CONSTRUCTION

General

The normal procedure in Britain is for a golf architect to get out a design and a specification which goes out to tender to firms specializing in construction or sports turf areas. Variations from this procedure do occur e.g. one architect is associated directly with a contractor and offers a package deal "design and construct a golf course". European countries follow the same general lines but skilled contractors are more rare.

There are about 8 golf architects in Europe, most of them British, and recently Robert Trent Jones has come from the U.S.A. to make a few courses including one currently proceeding at Leeds only 15 miles from Bingley. The British architects frequently and the others occasionally use the Institute for technical consultation.

In Britain certainly and in Europe generally there is usually a very tight budget* for new courses so that the architect has to use what the site provides to the utmost; buying in new topsoil for greens or even large quantities of soil improving materials is generally restricted. New sites are often associated with building development and site conditions vary considerably. There are not many of the "natural" golf course situations in sand dune country!

*Typical cost per hole --

Britain	2,500
Spain	2,500
France	3,500

In golf course construction the item which has been most neglected is drainage which in itself is such an expensive item. There are many courses on wet clay and aged anything from one to fifty years in which there is

practically no fairway drainage at all. With new sports grounds, however, it is generally accepted in the British climate that comprehensive drainage is necessary unless proved otherwise. Drainage is normally done with clayware pipes (tiles), laterals being connected to mains through purpose made junctions. Plastic drain pipes are available but in Britain they are not widely used as yet.

Seedbed Preparation

NOrmal procedures for greens include incorporation of sand, peat and complete fertilizer, such as 10: 15: 10 at 4 - 6 cwt./acre. A problem which has not been solved adequately is that of producing a clean seedbed, and it is unfortunately true that because of inadequate preparation new swards on greens often contain many weeds and, more seriously, a lot of annual meadowgrass (*Poa annua*) and other weed grasses. Soil sterilants are never used in practice, possibly because of expense and practical considerations.

Victor Gibeault started up some new work at Bingley on *Poa annua* control and this continues. Gibeault found Bromacil quite useful for seedbed work and further trials have demonstrated that Bromacil at 1/2 lb/acre will give something like 99% control of *Poa annua* but that while Chewings fescue (*Festuca rubra* ssp. *commutata*) can be sown safely 2 - 3 weeks after treatment (subject to weather conditions) browntop bent (*Agrostis tenuis*) is badly affected even after this period. Other universal herbicides used at low rates have shown similar results to those obtained from Bromacil (e.g. Simazin at 1/4 lb/acre, Monuron at 1/2 lb/acre).

Grass Seeds

Mixtures of grass seeds are normally adopted on the following lines:

Greens

8 parts Chewings fescue (*Festuca rubra* ssp. *commutata*) -- 1 oz. per sq. yd.

2 parts browntop bent (*Agrostis tenuis*) -- 1 oz. per sq. yd.

Tees

14 lb. smooth-stalked meadowgrass (Poa pratensis) -- 1 oz. per sq. yd.

42 lb. Chewings fescue (Festuca rubra ssp. commutata) -- 1 oz. per sq. yd.

42 lb. Creeping red fescue (Festuca rubra ssp. rubra) -- 1 oz. per sq. yd.

14 lb. browntop bent (Agrostis tenuis) -- 1 oz. per sq. yd.

Perennial ryegrass may also be used in tee mixtures.

Fairways

42 lb. perennial ryegrass (Lolium perenne) -- 1 1/2 cwt. per acre.

14 lb. smooth-stalked meadwograss (Poa pratensis) -- 1 1/2 cwt. per acre.

21 lb. Chewings fescue (Festuca rubra ssp. commutata) -- 1 1/2 cwt. per acre.

21 lb. Creeping red fescue (Festuca rubra ssp. rubra) -- 1 1/2 cwt. per acre.

14 lb. browntop bent (Agrostis tenuis) -- 1 1/2 cwt. per acre.

These are typical of the mixtures used in Britain and, of course, there is increasing emphasis on the use of good leafy and persistent named varieties. It seems likely that within the next few years grass seed in commerce throughout Europe will by law be restricted to named varieties of proved worth, this applying both in the agricultural and in the amenity fields.

It is probable that most of the browntop bent and Chewings fescue seed used in Europe comes from Oregon, the traditional source of supply, New Zealand, having apparently dried up. The Highland bent performs well and commercial supplies of seed of good or superior competitive varieties are not plentiful. The most highly regarded Chewings fescue is that bred by Van der Have in

Holland known as Highlight. This has a very good color and is fairly disease resistant. At the moment there are several good new varieties of browntop bent and Chewings fescue becoming or about to become commercially available but experience with them is somewhat restricted. They include:

Chewings fescue	Brabantia
	Barenza
browntop bent	Brabantia
	Mommersteegs
	Holfior

Good varieties of Chewings fescue tolerate close cutting better than even the best varieties of Creeping red fescue, but on many sites even these virtually disappear after a few years by which time the Agrostis tenuis is well established. Creeping bent occurs naturally on many golf greens but it has never caught on in Britain for establishment of new greens, probably because of its habit of forming excess surface fibre - mat or thatch.

For fairway and tee mixtures, crested dogstail (Cynosurus cristatus) and rough-stalked meadowgrass (Poa trivialis) have been popular "bottom grasses" in the past but the persistency of commercially available stocks seems to have dropped. Both grasses are therefore in a period of eclipse but breeders are now giving them some attention. As bottom grasses browntop bent and Chewings fescue are always used and Creeping red fescue is also very useful. Creeping red fescue has been used in fine turf mixtures but it does not stand close mowing as well as Chewings. Good varieties of Creeping red fescue available are S.59 (origin Welsh Plant Breeding Station), Dawson fescue (origin Bingley), Golfrood (Van der Have).

Smooth-stalked meadowgrass is a grass on which we have mixed feelings. In trials it does not persist very well at tee height (say 1/4 in.) but in practice many golf tees have a useful proportion of this grass even where there is no record of it having been sown. It does not seem to like the damp British winter but apparently does better in the continental winter. The best regarded available is the Dutch one Prato but there are others available including Arista and it is believed that Merion can also be got.

Perennial ryegrass is highly regarded for use on sports grounds and is commonly used in golf fairway mixtures. There are several good varieties available - S.23 (Aberystwyth), Pelo (V.d.H), Melle (R.V.P) etc. Perennial ryegrass establishes fairly quickly and the good varieties are remarkably persistent at mowing heights of 3/4 in. or more. Below this persistency is variable but, if the grass gradually disappears on golf courses, it has served the useful purpose of acting as a good long lasting nurse crop for other desirable grasses.

This discussion on seeds mixtures refers primarily to Britain and in the past Europe has just followed suit. Generally, the same kinds of grasses and varieties are indeed quite appropriate. In the north winter-hardiness becomes very important and winter kill on golf greens is much more common in Norway, for example, than it is in the British Isles. There is also a shorter growing season. W. Weibull A. B. in Sweden and others are giving special attention to winter-hardiness in their breeding and selection. In some parts of the warmer south of Europe, e.g. Spain, Creeping bent of local origin is sometimes planted vegetatively, particularly on greens, but also including tees and fairways occasionally. On at least one Spanish golf course Bermudagrass (Cynodon dactylon) has been used, apparently with only qualified success because the winters are too cold.

MAINTENANCE

STAFFING

Typical staffing for an 18-hole course is a greenkeeper with 3 or 4 assistants except in Spain and Portugal where there is more labor readily available. A real problem of the times if finding good head greenkeepers. There have been no training schemes and head greenkeepers have had to come up through the ranks. Low wages over the years have restricted intake of young people of the right calibre and we are in the position in Britain that many of the old greenkeepers who have been with their club up to 50 years are retiring and there is a dearth of replacements. Better wages (a head greenkeeper may get 1,000 per annum plus free house, etc.) and a golf greenkeeper's apprenticeship scheme, started only 4 1/2 years ago, are having an effect but skilled staff are not as common as they used to be.

It is, however, remarkable how an untrained man in Britain turns out to have a lot more background knowledge to turf management than on untrained man on the Continent who may never have come into contact with a lawn or a lawn mower! Some Continental golf clubs manage to obtain a head greenkeeper from Britain.

BUDGET

Statistics on a very variable situation are not easy to come by but we estimate that expenditure on materials for an 18-hole course (top-dressing, fertilizer, weed, pest and disease control materials) is of the order of 250 - 500 per annum.

TYPICAL TURF ON EXISTING COURSES

Obviously there is considerable variation among existing golf courses but generally one finds:

greens - mainly Agrostis tenuis but some Agrostis stolonifera and a varying proportion of Poa annua.

tees - Agrostis tenuis, Poa annua and assorted including Lolium perenne.

fairways - Agrostis tenuis and assorted

Fine fescues form a useful proportion of the turf mainly on sandy seaside courses.

TREATMENTS

Fertilizer

Trials at Bingley over the years have shown that simple fertilizers based on sulphate of ammonia, superphosphate and sulphate of potash, though not perfect, do help to produce the turf conditions required. Drawbacks include the flush of growth produced by sulphate of ammonia with insufficient persistency and the fact that the acidifying effect, though useful in the short and medium term, does cause difficulty in the long term.

In the last few years we have been doing work on gradual release nitrogen fertilizers, starting with urea-forms. We

have not been impressed with these and some fertilizer companies who have done their own trials are decidedly cool. Apart from anything else we find that the urea-forms have a similar long term effect on the turf to that produced by natural organics--production of a soft, disease prone Poa annua turf. The Sun oil product (wax coated urea) and magnesium ammonium phosphate have shown fairly attractive growth effects but each has its snags. The urea product, as always, tends to encourage a soft Poa annua turf and the magnesium ammonium phosphate has to be in large particles which are likely to be boxed off with the grass cuttings.

In practice an attempt is made to use fertilizer to the best advantage for producing the right results in respect to playing conditions including a tough hard wearing sward of suitable grasses free from weeds, pests and diseases. Some elasticity is built in to allow for effects of weather, etc.

A. Greens.

A typical approach is a complete fertilizer in spring and/or late summer supplemented by nitrogenous fertilizer dressings as judged necessary (all treatments being bulked with a carrier of compost). The complete fertilizer might be:

3 lbs	sulphate of ammonia	)
1 lb	dried blood	)
1 lb	fine hoof and horn meal	)
5 lbs	powdered superphosphate	) per 100
1 lb	fine bone meal	) sq. yds.
1 lb	sulphate of potash	)
1 lb	calcined sulphate of iron	)
	with	)
28 lbs	screened compost	)

During the growing season there might be three or four dressings on the lines of:

2 lbs	sulphate of ammonia	)
1 lb	dried blood	) per 100
	with	) sq. yds.
28 lbs	screened compost	)

These may or may not have added 1 lb. calcined sulphate

of iron but the last dressing timed for the end of August will usually have the sulphate of iron, mainly as a contribution to reducing the risk of Fusarium patch disease. Autumn fertilizer treatment, particularly as regards nitrogen is restricted because of its tendency to encourage Fusarium patch disease.

Proprietary fertilizer, used by many clubs, are generally based on the suggestions made by the Institute although a variety of constituent materials may be used e.g. casein waste, fish meal, dried poultry manure. Combined fertilizer/weed killer products are used on greens only occasionally.

B. Tees.

Usually these are treated on the same lines as the greens but at reduced rates and frequencies of application.

C. Fairways.

In Britain over the years very little regular fertilizer treatment has been given to fairways at all. In the last ten years or so it has become necessary for most golf clubs to give more attention to their fairways so that lime and fertilizer are now used much more frequently. The reasons for this are no doubt mixed - clubs have been satisfied with the very little growth which they have had from bentgrass growing under very acid, poor conditions but passage of time has accentuated the poverty despite recycling through returning cuttings. At the same time the amount of wear has increased because of more concentrated use and golfers are demanding different standards. Some difficulty is encountered in meeting the requirements which are often stated - namely to keep the original grasses and their best characteristics as regards playing conditions, etc. and at the same time to provide higher levels of fertility to prevent them dying out and give a better color, etc. Typically, acid poor fairways which have received no treatment for many years may receive an autumn dressing of 1 ton carbonate of lime per acre, followed by a spring dressing of an agricultural granular fertilizer containing:

10% nitrogen
15% phosphate
10% potash

at the rate of 3 cwt. per acre - on a non-recurring basis.

Liming acid fairways particularly in wet areas such as Lanacshire frequently leads to attacks of Ophiobolus disease and the fertilizer treatment certainly helps to minimize this. The granular fertilizer is commonly made up from sulphate of ammonia, superphosphate and muriate of potash.

D. Rough.

Very rarely indeed does the rough receive fertilizer treatment although these days the rough is not what it used to be i.e. more mowing and general care is being given than formerly.

Physical Treatments

A. Aeration.

The need for some form of aeration is widely accepted but in golf course management there is a tendency to believe that one passage of some form of spiking machine per annum constitutes adequate aeration whilst on football pitches and the like, regular (e.g. weekly) aeration is practiced. Really good mechanical equipment at a price the customer will pay is not really common and many clubs have a policy of hand hollow tine forking six greens per year in rotation, the other greens being solid or slit tine forked by machine. Tees usually receive one or two passes a year with a solid tine spiking machine and some clubs run a large tractor-drawn spiker over their fairways occasionally. Increasing attention to aeration is now to be found.

B. Scarification.

In many greenkeepers there still persists a reluctance to carry out sufficient scarification of their turf. Nevertheless the last twenty years have seen an

increasing need for this operation and a gradual acceptance of the value of the equipment which has become available. The most common problem on greens met by Bingley's advisory staff is an excess of fibre and inadequate root.

On occasions it is necessary to encourage extra root on golf greens for a year or two by forking before one dares to do much scarification because of the risk of the whole turf rolling up. Tees usually get very little scarification - fairways not much more. The latter sometimes get chain harrowed in the spring.

C. Top-dressing.

A key factor in the management of golf greens (and, to a lesser extent, tees) is the use of bulky top-dressing, preferably compost made up by building heaps with layers of farmyard manure and soil, allowing to stand at least a year before breaking down and mixing with sand to produce a suitable consistency. Quite a good proportion of clubs have satisfactory arrangements for producing compost and there is no doubt that greenkeeping is thereby much facilitated. Those who cannot manage to produce compost buy in materials as available to produce "synthetic" top-dressings of soil, sand and peat, etc. In the period 1945 - 1955, approximately, top-dressing went through a period of unpopularity but it is now firmly re-established as a key operation. Most clubs treat their greens only once a year - in the early autumn - but some top-dress in the spring also and a few even more frequently.

An old recommendation to use pure sand as a top-dressing still causes trouble occasionslly. The root break produced is often the key to our common problem of "too much fibre - too little root".

CONTROL OF PESTS, WEEDS AND DISEASES

A. Pests.

The most common pest is the earthworm. There are still

arguments on the pros and cons of the presence of earthworms but it is admitted that casting species are a nuisance. Discouragement by management is practiced but worm killers do prove necessary. Lead arsenate at 2 oz. per sq. yd. has been the most commonly used, but it is expensive and occasionally fails, so that it is passing out of use. Other materials used have included Mowrah meal and Derris powder but nowadays the most commonly used material is Chlordane. At Bingley first results with this material were variable but in practice results are usually very good and persistency may be several years. We have plots treated in 1961 which are still free of earthworm casts. Dr. Gould has reported Chlordane as being useful against Ophiobolus and we have observed that plots treated with Chlordane for earthworm control have shown reduced Fusarium invasion.

Sometime ago a worm killer containing Toxaphene came on to the market but was withdrawn, apparently because of unreliability. More recently Carbaryl (Sevin) has become commercially available. At 4 lb. per acre it gives quick results but the effect is short-lived even when applied at up to 20 lb. per acre. Dieldrin and Aldrin have proved effective against earthworms in plot trials but their sale is affected by restrictions imposed by the Toxicology Section of our Ministry of Agriculture, Fisheries & Food.

In Britain the only other pest of any real consequence is the leatherjacket, the grub of the crane fly (Tipula spp.). Occasionally seaside golf courses are invaded by this pest which can cause considerable damage by eating grass roots. Treatment is fairly simple with practically any soil insecticide--D.D.T., B.H.C., Aldrin, etc.

Occasional trouble is experienced from fever fly larva (Diplophus and Bibio spp.) and from ants. Cutworms (the larvae of certain species of moths) are only to be seen in ones and twos in British turf but massive attacks are encountered in the southern parts of the Continent, thousands of grubs eating their way through the turf and ruining the playing surface. Ants have proved a considerable nuisance in the south of France, particularly on new sown ground. On the Continent wi boars may do considerable damage grubbing up cockchaf

larvae and in the Ardennes there are three golf courses which had to be completly fenced off to keep out these animals.

B. Weeds.

Our most common weeds are daisy (Bellis perennis), dandelion (Taraxacum officinale), cat's ear (Hypochaeris radicata), mouse-ear chickweed (Cerastium vulgatum), pearlwort (Sagina procumbens), wild white clover (Trifolium repens), creeping buttercup (Ranunculus repens), plantains (Plantago spp.), yarrow (Achillea millefolium) and mosses*. Moss, of course, has to be tackled from the management angle,(it is caused by over-acidity, poverty, bad drainage, unwise mowing?). Lawn sands to burn it out are still used quite frequently but commercial products containing calomel are now highly regarded. For some reason or other, Green committees seem to be more concerned over a few square inches of moss than they are over a 20% invasion by other weeds or even patches of bare ground!

Most ordinary weeds are killed by the most commonly used proprietary weed killers based on 2,4-D and CMPP. Trials for special problems are still proceeding e.g. for the resistant weeds, speedwell (Veronica spp.) and parsley piert (Alchemilla arvensis) and for weeds in young grass. In each case Ioxynil is very promising.

Annual meadowgrass (Poa annua) is widespread and elimination of it would leave a lot of bare ground on golf greens! Crabgrass (Digitaria) is beginning to pose a problem in the warmer climate of Spain and southern France.

C. Diseases.

Over the years the Institute has advanced knowledge of turf diseases and their control considerably. In Britain and over much of Europe Fusarium patch disease (Fusarium nivale) is the most serious fungal disease

*The most common species are Brachythecium rutabulum, Bryum argenteum, Bryum capillare, Ceratodon purpureus, Eurhynchium praelongum, Hypnum cupressiforme and Polytrichum juniperinum.

though Ophiobolus patch (Ophiobolus graminis) is becoming of increasing importance. In Britain dollar spot (Sclerotinia homeocarpa) confines its attention to sea marsh strains of creeping red fescue, but in warmer climates as in Spain it is a serious disease and attacks other grasses, particularly creeping bent.

For control of Fusarium patch disease organic or inorganic mercury products are generally used, the former being cheaper, the latter a little more persistent. Because of public suspicion of toxic materials attempts are being made to find fungicides which are less toxic to man and animals, but our program has been curtailed by staffing troubles. Quintozene (P.C.N.B.) is used occasionally.

Mercury compounds are used for dollar spot control on the odd occasion when it occurs on a British seaside golf course since there is an embargo in cadmium products. In France and Spain, however, cadmium products are readily available.

Corticium disease (Corticium fuciforme) is only rarely serious enough to warrant fungicide treatment and then an inorganic mercury is used. Usually, however, the disease is either disregarded or dealt with by an application of nitrogenous fertilizer if the season is suitable.

Ophiobolus disease is being encountered more and more and, whereas in the main attacks have been in situations characterized by high surface pH and wetness, attacks are now being discovered in situations where these factors are apparently not very conspicuous. It is prevalent on the Continent, particularly in warm areas where frequent irrigation is practiced. It is too early to say that Ophiobolus has ousted Fusarium from its position as most important turf disease but Ophiobolus is certainly causing concern and it is both more damaging and less easy to eliminate than Fusarium. Attention to surface pH and moisture characteristics is an important aspect of control measures and in practice these are aided by applications of organic mercury products applied repeatedly at double the rate used for Fusarium control. On extensive areas of fairways this is very expensive and such areas may be left to natural recovery!

Fairy rings, often the bad ones caused by Marasmius oreades, are not uncommon on old established golf courses but the laborious procedure of digging out or sterilizing with formaldehyde is only occasionally undertaken.

Outdoor Recreation - - Asset or Liability[1]

Gerald W. Pelton[2]

The preparation of this paper has been one of the most challenging and interesting tasks I have undertaken in some time. Finding and listing the assets of outdoor recreation was no great job. Our newspapers editorialize on the subject daily and the library can furnish you reams of materials on the benefits of outdoor recreation, but to find any dissertations which expound on the liabilities of outdoor recreation or parks and open space, is about as easy as finding material opposing motherhood and children.

Before I get too far into my talk I think it wise to define what I mean by outdoor recreation, by assets and by liabilities, so that you might have some idea of the way in which I intend to approach this topic. First for a definition of outdoor recreation, I would like to use one that I first heard from Dr. Sharpe of the School of Forestry, University of Washington.

He defines outdoor recreation as: "The relationship between people and the resources of nature". This definition implies a far broader concept than merely one of activities engaged in out-of-doors. For a definition of assets and of liabilities I went to Mr. Webster for guidance. Assets he says are: "A valuable or desirable thing to have." Liabilities on the other hand are, "something that works to one's disadvantage." For this discussion I have concentrated on two assets which in my opinion are valuable and

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Outdoor Recreation Planner, Planning and Community Affairs Agency, Olympia, Washington.

desirable things to have and without which, outdoor recreation as a field of professional endeavor, could not exist. I will concentrate on three liabilities, primarily of our own making, which work to our disadvantage.

First to discuss our two assets. The first is public opinion. It has only been since World War II that public opinion in terms of being favorable to the development of outdoor recreation opportunities has been significant enough to warrant the attention of the politicians and other decision makers. Within the past six years, Congress has created a Bureau of Outdoor Recreation, they have developed over 85 funding programs that in some way relate to the broad recreation field, they have passed laws on scenic highways and historical sites and considered wild rivers and new national parks. Right now our field, and all that it encompasses, is riding the crest of a public acceptance wave. Last fall King County passed an 118 million dollar park and recreation bond issue as part of the Forward Thrust package. This was the third largest park and recreation bond issue ever passed in the United States and the largest one below the state level. The only two that have been larger were those of New York State and the State of California. Between 1960-1965, eight states passed outdoor recreation bonds for acquisition and development totaling $454.5 million. I do not have the totals for the past three years, but they too are substantial. Our Statewide Outdoor Recreation and Open Space Plan, published in January of this year, identifies 600 million dollars worth of unmet acquisition and development needs in Washington State alone. When Governor Evans announced this figure last January at a press conference, hardly an eyebrow was raised. Fifteen or even ten years ago the headlines would have screamed that he was trying to bankrupt the State by making expenditures on "frills". Today, even the church, who for centuries has preached the doctrine that, "work for work sake is good and that pleasure is idleness and therefore evil", now recognizes the need for recreation opportunities and, in fact, is a leading force in the promotion of many types of recreational activities. You might say the trend is so much in the other direction that it has led to predictions such as that made recently by Hugh Davis, Department of Landscape Architecture, University of Massachu-

setts, when he said that, "within the foreseeable future, work will be a privilege not a requirement". I used to think I was born 50 years too late, with that kind of prediction I'm beginning to believe it was 50 years too soon! And if you still doubt that public opinion is today's primary asset of outdoor recreation, then take a look at the platforms of today's political candidates for office. Platforms are developed to get votes, not lose them.

The second asset of outdoor recreation as I see it, is public participation. The Bureau of Outdoor Recreation Study of 1965 identified 6 billion, 476 million occasions for outdoor recreation experiences in the summer months, for citizens of this nation. This was a 51% increase over the 1960 figures given by the Outdoor Recreation Resources Review Commission. Neither Study considered the child under 12 years of age. Earlier this year, Northwest Certified Surveys completed a year long study of outdoor recreation demand in Washington State. The Study was done for our Agency under the supervision of Thompson Vialle Associates who also analyzed the results for use in our Statewide Outdoor Recreation and Open Space Plan. This Study indicated nearly 350 million occurrences of some form of outdoor recreation activity by the citizens of this state during the 12 months of 1967. We had 22 identified activities such as bicycling, driving for pleasure, huntint, swimming, boating, etc., and 22 area types where these activities occurred. Some of the area types were freshwater shorelands, small urban areas, winter sports areas, golf courses, forest areas, outstanding natural areas, etc. I know that many of you have a primary interest in golf courses so you might be interested to know that in terms of activities on a year-round basis, it ranked 14th out of the 22. I would be happy to discuss some of the details and findings of this Study with any of you either later in the conference or at our offices in Olympia. And for final evidence that participation is a definite asset to the furtherance of the recreation movement in this country, we may review the findings of the President's 1967 Riots Committee as reported by officials of the Department of Housing and Urban Development. Of the 18 metropolitan areas in which riots occurred, the Committee found 12 categories of causes which were consistently repeated. Lack of opportunity for recreation was the 5th most

common of the 12 causes and it rated 1st in one city and 2nd in five others. In the WATTS riots, recreation centers were the only type of structure where no damage occurred during the course of the riots. So we have in the field of outdoor recreation two major assets, public opinion and public participation. Both are powerful assets, both are forces which are almost invincible. Both both carry awesome responsibilities with them.

We have accepted the assets as our rightful heritage in the recreation profession and some of our people consider public opinion at least, as being long overdue. I don't agree with this viewpoint but it is not my purpose to debate it here. What I am concerned about is whether or not we have accepted the responsibilitities that have been thrust upon us. If you will recall at the beginning of my talk, I defined liabilities as: "something that works to one's disadvantage." I further stated that I would concentrate on what I consider three liabilities, primarily of our own making. The first liability as I see it is the general attitude of our people which I consider somewhat narrow and overprotective. We are still trying to sell our services and wares on the basis that they are good for people, and we get mad when some young upstart utters two words, "prove it". Which leads into the second liability; the lack of research and statistical analysis on the part of those people who provide the facilities for the outdoor recreation experiences. "Those people" are you, here, and others in public parks and recreation work and private clubs, camps and resorts. The research has been done by others; by economists, sociologists and, yes, primarily by private enterprise who has a product which will enhance the participants experience at your facilities. Was it the golf course operator or industry that invented the electric golf cart? I have no intention of arguing the point about the enhancement of the golfing experience for the participant who uses a golf cart but it does point up the third liability which is the lack of understanding and, therefore, cooperation between the public sector and the private sector. You will remember Dr. Sharpe's definition of outdoor recreation as the relationship between people and the resources of nature. Private enterprise has certainly had an impact on the type of relationship which can and does occur. If you think not, just remember that the first

camper for use with a pick-up truck was not commercially produced until 1958.

Let us now discuss our first liability, the attitude of the professional. And before we go any further, I wish to identify the professional outdoor recreationist at least as far as this discussion is concerned, as any individual who earns his livelihood through some form of providing recreation opportunities for others. I am not referring to any educational background or any specific discipline. Most professionals see themselves in one of three roles or some combination of them. He is either a disciple spreading the good word of the benefits of recreation participation, an explorer opening new worlds to you by teaching you new skills or a martyr who provides the finest possible facilities in spite of the public conspiracy to either trample them under, tear them down or cover them up. I have yet to meet any professional, including myself, who has seen themselves in the villain's role in the melodrama of life. While I will grant you that we are undoubtedly unwilling and unwitting in this respect, I am sure that we can find many examples. Until we realize that we are not all things to all people and that we do aid and abet air pollution, water pollution, the slaughter on our highways and other social ills, we certainly will take no steps to work with those who have primary responsibilities in these areas. I am sure that we cannot provide the complete answers but until we as a profession, recognize our role in respect to the total problem, we cannot hope to change our attitude from a liability to an asset. The signs are encouraging and many of our people are now concerned about the problems of the total community, not just that element for which they have the authority to make decisions.

Part of our attitude as a profession is our extreme concern with providing for the masses and with providing facilities and services for them free of charge. The one good example of the opposite approach is our attitude towards golf courses. They are expected to pay their own way and in many cases to contribute to the operation of other outdoor recreation areas to which no use fee is attached. This topic also could, and on many occasions has been, the only subject discussed during an entire conference. Much of our attitude has developed from tradition, hence, both charging for golf and the free philosophy of the depression years. I do not wish to advocate here a change in attitude regarding charging or not charging, but

I do wish to stress the point that tax dollars alone cannot acquire, develop, or maintain outdoor recreation facilities at even a minimal level of need and that other sources of funds must be developed by the profession or in spite of them. Let's hope that it is by them. Again, I am speaking generally. Some outstanding examples of budget maintenance through other than tax sources can be seen around the state and nation. Most of Spokane County's park system has been built by volunteer labor working under county supervision. Wheeling, West Virginia's Oglebay Park has a budget of 1.1 million dollars. $30,000 of it is from taxes.

Another weakness in our attitude is that we tend to overestimate our impact on society. We need to take a good look at what our effect on human behavior really is. Have we changed or materially altered the behavior of people or have we merely been affected by the consequences of that behavior? According to Sebastian de Grazia, of Rutgers and author of the excellent book, Of Time, Work and Leisure, only two outdoor recreation activities pursued by the masses, have evolved in the last 200 years. One is swimming, which until the industrial revolution was something done only when necessary to save one's life, and the other is sunbathing. Today 15 million northerners invade the beaches of Italy every winter. For centuries they had remained deserted. Sunbathing has certainly had its effect on our attire, for throughout the world we see examples of a transition from almost complete cover to almost complete nudity. Neither of these activities were motivated by individuals concerned with the leisure put-suits of people. The Red Cross Swimming Program developed after concern was shown for the loss of life not to promote a new form of physical enjoyment.

To promote something, be it a product or an activity, you must know your customer. What motivates him; what does he want; what will be accepted or rejected; where will he go; etc., etc. Answers to these and many many more questions require research and study and here again we have fallen behind.

Therefore, our second liability is lack of research in the area of outdoor recreation. Here again we have some excellent examples of work being done by those having the operational responsibilities. Game Departments have for many years done extensive research pointed towards the

provision of a better hunting or fishing experience for the sportsman. Witness the success of the Coho Salmon transplant to the Great Lakes and male hormone injections in female pheasants. Research methodology is being continually upgraded and becoming more sophisticated through the use of computer programming. Three phases of our current Statewide Outdoor Recreation and Open Space Plan, were accomplished through the use of computers. The Forest Service's Recreation Information Management program, better known as RIM, is a computer oriented system for the management of information about people, places and things over periods of time. One area in which research is wholefully lacking is on motivation factors, on elements that influence choice and on behavior patterns which result once the choice is made. One theory which certainly appears logical, but which will acquire considerable study in order to verify it, proposes five elements that influence the choice of recreation activity. Mr. Francis Christie, Jr. of Resources for the Future, Inc. suggests that choice of activity is influenced by: (1) the ease of participation, (2) a desirable image, (3) opportunity to demonstrate identity with a desirable image, (4) the opportunity to demonstrate skills and (5) the time to enjoy the activity chosen. Mr. Christie states that mass participation, once chosen, will depend upon the ease, not the hardship of accomplishment. Hence, the mass participation in sunbathing; the limited participation in scuba-diving. Skiing did not really become popular until the invention of the ski tow which allows an easy ascent to the top of the hill instead of the laborious climb using a herringbone technique. There are those who claim that the development of ski clothing styles was even a greater influence as this allowed the opportunity to demonstrate identity with a desirable image. I often wonder how many of the ski racks on top of cars are actually used to carry skis to the slopes. We have a lot of assumptions, theories and conclusions drawn from logical analysis but very few backed up by statistics and research.

Another area where we lack statistical backup and adequate research might be called the area of economic impact or demand. If we accept the fact that recreation demand depends on (1) the availability of opportunity, (2) the availability of alternatives, (3) the preference of individuals and (4) when applicable, the income necessary to participate in the preferred activities, then we desperately need information and statistics on alternatives that people

may choose and the implications of these choices. Almost without exception, and our own computerized Study included, Demand Surveys deal with consumption rates, not demand. These surveys are nothing more than use figures, yet we project our supply needs from them because we lack true demand data or an acceptable method to determine it. Consumption will always be greatest where supply is greatest, but demand is probably greatest elsewhere. The percentage of golfers per capita, using public courses, in Spokane will probably exceed that of Seattle for many years to come, solely on the basis that Spokane has 3 municipal courses for 190,000 people while Seattle has 3 municipal courses for 590,000 people. I doubt if any of us would feel that the demand for additional golf courses is greater in Spokane but a traditional Demand Survey showing per capita consumption would suggest that Spokane should be given the priority. Still within this scope of economic impact in outdoor recreation is cost benefit analysis as used today in the decision making process. The type of analysis used in recreation decision making has been likened to single entry bookkeeping. We,society, in general, think only of the jobs that will be created by putting an industry in a marshland instead of a wildlife refuge. We foresee the additional taxes coming in, but we ignore the additional taxes which must go out to support these new employees. New schools, roads, sewers, police, firemen, and all the other services we have come to expect. We do not study what this industry will do to the water table of the area; to the population density surrounding it; to the established traffic patterns, to the air and water pollution potential, etc., etc. If in order to obtain and retain land in a natural or near natural state, we must compete on the open market, then let's start gathering statistics and information that will allow us to do so. How much park land and open space have you watched go under the bulldozer because it is too expensive to put the highway elsewhere. I don't believe that it is that much cheaper to use fast disappearing open space merely because there are no buildings on it. But we have got to be able to prove it.

One final area where lack of research may be a rapidly increasing liability is in the area of time itself. Time available for choice of recreation is rapidly changing and as it changes, the choices people make change also. We constantly hear about increasing leisure time, but I defy you to find me any reliable statistics that will prove it.

In our current work on the State Plan, we consulted the records of the Employment Security Division, the U. S. Bureau of Labor and the Statistical Report. We contacted Labor Unions and large personnel departments. None show any trend towards a decreasing work week and if you refer to leisure time as unobligated time, you can build an excellent case for decreasing leisure based on longer commuting time requirements alone. We are seeing some experiments in block time work where you work 12 hours a day for 3 days and then are off 3 days. Changes are being considered in the school years, and in colleges, such as the University of Michigan; you already have a trimester system. My point here is that it is not recreational forces who are doing the experimenting with time or suggesting the ways in which it can be done. Have we done anything to try and alter the weekend pressures by working with labor to spread time off for employees over the entire week? And, if you still wish to hold the religious doctrine of Sunday as a day of rest, may I remind you of countless examples where even the church holds religious services on Friday nights during the summer so that their members may be free to re-create themselves on the weekend.

My final area of liability deals with the lack of understanding and therefore cooperation between the private sector and the public sector. The area in which we have fallen down the most is probably in the equipment manufacturing phase of private-public relationships. I know of no other profession in which the development of new equipment often increases the work load, the problems, and the cost of job accomplishment rather than being an aid to the field. Highway Engineers work closely with the heavy equipment manufacturers who develop the earth movers to do the job quicker and easier. New equipment is developed in our field and it creates new problems of control, new demands on the available parks and open space, additional construction costs, and the need for new administrative policies, etc. etc. The snow-mobile last year alone required an estimated 75 to 100,000 dollars additional budgeted monies in the Wisconsin State Park Budget for personnel to administer the needs of this rapidly growing sport. The State of Michigan has declared the right-of-way under high-tension lines as official snow-mobile trails. The Honda and other lightweight motorcycles and trail bilkes have required the Forest Service to almost completely rewrite the policies and revamp the trailers and

pick-up campers have forced State Park Planners into a new concept of overnight campgrounds from that generally followed as recently as 10 years ago. The State of Florida has established a State Park beneath the Atlantic Ocean for Scuba divers and many states, including Washington have plans for similar areas. What of the future? How far away is the family helicopter and how will we control them in the high-country, in the forests, and on the deserts of our nation. Will Mountain Rescue Councils, become official government functions rather than volunteer forces? The boating industry has already made yachting financially feasible for a majority of our population, as well as creating problems which always result from mass participation in any activity. What are they planning next? Has the Houston Astrodome started a trend towards moving most of our traditional outdoor sports indoors? I don't know the answers to these questions, but I doubt if industry does either. Recreation is one of the few, if not the only, areas of endeavor where those who produce the goods do not have some rapport with those who are affected by the use of them. It's about time we gottogether to mutually consider the effects on human behavior, the environment and on the economy and to share in the development of actions which will benefit all.

In the past, the public and private sectors have gone their separate ways in the development of facilities. Private resort owners have consistently felt they were in competition with government. But even here the signs are encouraging. Last year the Extension Service at WSU held a series of workshops for the private recreation facility operators. They were well received around the State and had as a by-product, considerable contact between public and private concerns to discuss mutual problems. But recreation professionals in general have not considered or worked with the private sector. The Northwest Turfgrass Association is a notable exception, where for years, people representing country clubs and privately owned golf courses have met with their counter parts from municipal and county departments to discuss solutions to problems of mutual concern.

According to Henry Diamond, Vice President of the American Conservation Foundation, the private sector in outdoor recreation can be likened to the private school which is part of the education system but not the predominant part. He sees the private sector's role in out-

door recreation as being mainly one of supplying the "extras". The Country Club has a very definite place in golf, but the majority of golfers will and should continue to play the public courses. He sees the luxury resort slowly forcing out the small operator in the same manner as the large farm is replacing the small one. Developments, such as here at Alderbrook, which can also classify as a luxury resort, will increase in significance as they provide recreational opportunities for the purchasers of property within the development. He also sees an increasing role for private concessions on public lands such as the concession campground at Benton County's Columbia Park. There will be an increase in supplemental facilities to large federal holdings such as those of the Yellowstone Park Company. Land, water and air are only now being recognized as exhaustible resources. Only now is outdoor recreation recognizing the needs of the urban areas as being equal to or greater than those of the rural areas. Only through mutual understanding and cooperation between the public and the private sectors can the problems created by both be solved by either.

In the past 30 minutes or so I have tried to outline to you two assets and three liabilities of outdoor recreation today. Many more could be added. It we should failt to recognize or cultivate our assets of today they will surely be our liabilities of tomorrow. If we fail to listen to public opinion and ignore it in our plans for the future, there will be no future. If we recognize our liabilities and seek solutions to them, they will be assets tomorrow. May I leave you with one final thought so aptly put by Mr. de Grazia in a speech to outdoor recreation planners just this spring at the University of Michigan. He stated: "Only the city can save the country. For until the city is such that our populations don't wish to flee it, they will continue to ravage the country." Gentlemen, our work has just begun. Thank you.

So You Want to Build a Golf Course![1]

William H. Bengeyfield[2]

Since World War II, we have witnessed phenomenal growth in new golf courses acorss the land. They have arrived in all sizes, shapes and descriptions. Unfortunately, most of them (including those with good design) have also arrived by way of poor construction methods.

It may take only a year to build a new golf course. But, if the work is not properly done, it may take the next eight to ten years to untangle the mistakes and put the course in manageable order. Often initial errors can never be corrected.

Why is it that the here and now of construction invariably captures the attention of golf course developers, while the most important economic consideration of all--the untold years of maintenance that lie ahead--is hardly given a second thought?

The problem of poorly built golf courses usually stems from one of three sources:

1) A number of golf course architects knowledgeable in the field of design have, for one reason or another, generally failed to show a real understanding of fundamental turfgrass requirements. Not once or twice have they failed, but a general pattern of failure is the rule, not the exception.

2) Some totally unqualifed individuals have entered the field of golf course architecture. They are superb in salesmanship but basically lacking in an appreciation of design, golfing values, course construction and maintenance.

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Western Director, USGA Green Section, Garden Grove, California.

3) Key men behind the development of new courses, i.e., those with an investment to protect, frequently hold the fallacious belief that, to do anything well, exorbitant costs are required and can never be recovered. They choose to compromise with the future.

Let's take a look at the problem sources.

Golf course design and construction is not easy work, especially if it is to be done correctly. But a close look at golf courses built during the past 20 years only strengthens the contention that experienced architects have been more concerned with layout and design than with the basic and essential agronomic requirements of their work. The point is easily illustrated.

Not many years ago, two rather renowned and contemporary golf course architects in the United States collaborated on a published article discussing the relationship between golf course design and turfgrass management. They wrote in part, "High quality turf is essential for good play, but it receives only casual player recognition if design is faulty and uninteresting." Good turf, they are telling us, will not compensate for poor design. (Of course, the exact opposite is also true!)

The architects' statement may have validity if applied strictly to championship courses throughout the country. But the architect authors have overlooked the fact that the majority of golf courses in the United States today are not championship courses. Not every club member nor every golfer would want them that way. On the non-chempionship type courses, of which there are so many, good turf has, is and will continue to compensate for questionable design. For proof, look only at the renovation and rebuilding work now going on. In nearly every case, it is being undertaken to correct agronomic deficiencies of earlier architecture, not design deficiencies. The man paying msot of today's golf bill, the average golfer, has time and again demonstrated his keen interest in a green, well-groomed and well-turfed golf course. It is totally unfair to contend that he only "casually recognizes" golfing turf.

This should not be construed to mean that design is unimportant or architects unnecessary. Indeed and beyond question, they are essential in the development of any

golf course. Furthermore, they should be given complete freedom in design when they undertake the project. But the architect is not omnipotent. He is not all-knowing, particularly in agronomic matters. For the good of golf, he must devote greater attention and effort to this phase of his work.

The professions of golf course architecture and construction have had an additional problem in recent years. At a time when golf courses are being built so rapidly, it is inevitable that incompetent and basically unqualified individuals will become active in their field. After all, one is not necessarily a "golf architect" just because he is a scratch golfer, a retired professional, a superintendent or a landscape designer. There are untold examples where so-called "architects" through haste, lack of knowledge, lack of supervision, indifference, and in some cases through greed, have left a new club with insurmountable problems--problems that must be solved another day. Anyone involved in developing a new course should be aware of and alert to this dangerous situation. Two examples will amplify the point.

In a major newspaper in the southwest, a feature story was devoted to a "young and promising golf course architect." During the interview the young man was asked, "How much formal education does it take to become a golf course architect?" He replied, "None, if you know enough bulldozer operators, it just takes practical knowledge."

Now follow a scene shift to one of the great golf courses in America--Merion, built in 1910. In Joseph C. Dey's story on "Merion" (August, 1966 USGA Golf Journal), he tells of the "amateur architects" of Merion of that day. They were a group of businessmen and golfers interested in developing a new golf course. They spent two energetic years in planning and construction. One of their members spent over two months in England and Scotland studying and sketching renowned golf courses there. This group may have started out as "amateurs," but they spent over two years putting together the elements of strategy, construction and design in building this outstanding course. And then, they were fortunate enough to have the assistance of Mr. Joe Valentine, one of the earliest and finest golf course superintendents in the country.

Merion proves that amateurs can do the job. But it takes certain qualities not in the possession of everyone. Qualities such as inherent talent for design, adequate time and financing, and understanding of golf, dedication and self sacrifice. It takes much more than merely knowing several bulldozer operators!

Finally, there is the question of costs. At one time or another, every experienced architect has had a client with 130 acres who wants a chempionship 18-hole course measuring 7000 yards. The client also wants 100 homesites developed on the property, a clubhouse with adequate parking, a driving range, roads, a ten-acre lake and some service buildings as well. And he wants the course built for $200,000, including the automatic irrigation system!

Of course, it can't be done. It's unreasonable of any client to expect an architect to build a cheap palace. Similarly, it's unreasonable of any architect to overdesign and overcharge for good construction. In any undertaking, certain basic costs must prevail, and compromising these costs for expediency or for profit is not the answer.

If it is too costly to build a green correctly, it will prove far more costly to build it incorrectly. In the long run, the cheapest way of doing any job is to do it right the first time.

For help "in doing it right the first time," we would hope this publication of Green Section of the United States Golf Association will prove of value. We are not omnipotent either. But when it comes to agronomic matters and construction considerations, we believe we have something significant to say. We have seen the pitfalls, the abuses, the shortcuts and the excesses of the past.

Anyone contemplating the construction of a new course should find valuable information in the following pages. Progressive architects recognize that sciences and arts other than pure design are involved in planning the golf course. It is when good design principles are blended with golf strategy and accepted agronomic techniques that a product to be proud of is produced.

Golf is played on grass. Grass responds to good management. Good management begins with good construction. It is in this context that this small voice is raised. It is to this cause that this paper is dedicated.

New Equipment and Ideas for Maintaining Turfgrass Areas

Mr. Dick Malpass Panel Discussion Mr. Elmer Sears
Mr. John Zoller Mr. John Beyeht

NEW EQUIPMENT FOR MAINTAINING GOLF COURSES[1]

Dick Malpass[2] and John Zoller[3]

Those of you fortunate enough to attend the Golf Course Superintendents Association of America Convention and Show in February of this year in San Francisco were no doubt impressed by the quantity and diversity of turf maintenance equipment on display.

John Campbell, Links Supervisor at St. Andrews, Fife, Scotland, writing in the January 1968 issue of the "Golf Superintendent" tells of having known and visited with a superintendent of the 1880's whose only equipment was a shovel and a birch broom. A scythe was also used to cut the grass. Surely a far cry from the Superintendent of today with his gas and deisel motors, his powered putting green mowers, triple mowers, hydraulic fairway units, aerifiers, top-dressing machines, slicers, verticutters, power brushes, automatic irrigation systems, and a host of other labor saving equipment. Not to mention a wealth of turf research results at his fingertips to cope with problems of turf diseases, fertilizing needs, weed control, and others.

Turf managers must, of necessity be great innovators. If they can't find a machine to do a particular task for them, then they must make one. It is in this manner that many of the tools we use in our everyday job of turf management have been developed.

Today, we are going to show you a few slides of just such a few machines or perhaps a different way to handle one of our common tasks. No doubt one of you has something in his shop with which you have been working to make a job easier. Perhaps it is the results of your

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Shadow Hills Golf & Country Club, Eugene, Oregon.

3 Eugene Golf & Country Club, Eugene, Oregon.

own or one of your employees ideas which has been made into a practical tool. We know that had we taken the time to contact a number of you prior to preparing this presentation, many more labor saving devices would have come to light.

Major Fred Bove, Superintendent, Brentwood Country Club, Van Nuys, California, in a talk presented at the GCSAA Convention in San Francisco stated as follows: "Golf Course Superintendents have always been confronted with the problem of labor costs. We are constantly on the alert for new machinery, methods and techniques in order to reduce the high rising cost of labor. Maintaining a golf course in an outstanding condition with the least amount of money remains one of the biggest challenges that we face in our profession".

(This presentation followed by slides).

THE WHEEL[1]

Elmer Sears[2]

It has probably been debated and discussed innumerable times down through the ages without ever being settled as to which came first and which benefits mankind more, fire or the wheel. Most would agree that fire was discovered before someone fashioned a wheel and it is probably a stand-off as to the benefits. We must say that our industry makes more use of the principal of the wheel and all its applications than of fire. After the wheel came nuts and bolts and springs and the rest of it which brings us to machinery.

I don't presume to tell you people about machinery. Everyone has made use of some type or another in their operation and in the course of every day life. We are coming to depend on machinery more and more in our modern society, in all sorts of kinds and sizes. Quite a few of

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Forest Lawn Cemetery, Seattle, Washington.

you have a great number in your operation which, of course, makes you an expert or, if you will pardon the expression, a wheel.

I suspect a good place to start is with mowers inasmuch as most of us are involved with the care of lawn. I'm going to avoid trade names. No doubt you all have your favorites. You are aware that there are greens mowers, gang mowers, multiple reel mowers, whirleys, multiple whirleys, sickle bar, flail hammer, and others. There are a multitude of methods of powering the units--self powered, tractor drawn, tractor mounted and others. Each has its particular application to the job to be done, depending upon the type of grass, topography, area size, obstructions and time. Some units have a variety of uses. We have a small riding unit with a whirley mower attachment as well as a tiller. The power unit is used to tow a 5-foot seed and fertilizer spreader, a large sweeper as well as a blower unit.

In the July issue of Grounds Maintenance there is an article on cutter bar mowers or sickle bar. It describes the cutting range from level to 15 1/2 inches above to 10 inches below wheel base level, all horizontal. The obvious advantage is to cut a parking strip from the street level. Also, the bar can be raised on an angle to cut slopes above and lowered to 45° and even 75° to cut banks below road level and avoid obstructions. There is also a boom attachment so that the bar can be operated over a small fence or guard rail and still angle it as well. Cutting bar lengths range from 36 to 54 inches to 5 and 10-foot lengths for industrial uses.

There are some new inovations in the rotary mower field, both in tractor mounted and tractor drawn. The tractor mounted type also has a boom arrangement so that it too can be operated over a guard rail. Another set-up mounts the cutting unit on the side arm so that it can be swung under a barbed wire fence. Another is arranged so that the wheels can be lowered on one side and raised on the other making it possible to go along a steep slope. Still another has the cutting unit mounted on the rear and the dirver faces that way with the tractor traveling in reverse. This enables the operator to have better control and the grass is cut ahead of the wheels.

The principal use made of the tractor in the cemetery

business is, of course, for grave digging. Most operators use the back hoe type although some chain-bucket machines are still in use. I think we were the first to bring this idea to the Northwest. In fact, I think we were the first anywhere. It came about somewhat by accident. While on a trip to Phoenix early in 1949 we noticed a small ditching machine mounted on a farm type tractor. Thinking this could be adapted to grave digging we brought the idea to an engineering firm in Seattle and out of this came the first grave digging machine. Eighteen-inch wide buckets were mounted on chains which ran over sprockets with the dirt carried to either side via a belt on rollers. Two passes had to be made to dig the grave and in normal ground it took about 30 minutes. This first machine cost about $2000 (in addition to the cost of the tractor) and it was contemplated that production models would cost in the neighborhood of $1500. Well, after about a year's operation and innumerable repairs, it was found to be somewhat impractical. Dirt and sand got into the gears and bearings causing considerable wear. Besides, about this time the back-hoe type digger, with which we are all familiar, came out and most operators went for this type machine. Also, about this time a California company put together a large bucket-chain type of digger on a much larger scale. This machine is mounted on six large aircraft type tires using a tractor for power. The buckets are 36 inches wide and a grave is dug in one pass in 14 to 17 minutes. The price tag was $9000.

The back-hoe digger is a very versatile machine. Various sized buckets are available for all sorts of digging jobs. With a front loader bucket it becomes a mainstay in a cemetery or any other operation. One superintendent mounted a platform on the loader to use as a "cherry picker" for tree trimming, spraying etc. Some of the larger machines are diesel powered thus being more economical as well as more powerful. Some have the back-hoe mounted on a double bar arrangement so it can be slid from side to side making it possible to dig next to a building or other obstruction. Some are arranged so that they can be easily removed making the tractor available for other uses. There is one mounted on a two wheeled trailer using a drive shaft from the tractor power take-off for operation.

A recent development in a machine for grave digging employing the bucket chain idea but instead the teeth are mounted on a belt which runs over roller-sprockets. The

mechanism is full grave width and is mounted on a double rectangular frame with three rubber tires. It is self-powered by means of a sprocket drive on the third or steering wheel. The rubber tires are easy on the lawn and is quite maneuverable.

Other equipment used in cemetery operations include side dump trailer trays or buckets of about a half yard capacity. These are generally hooked up 2, 3 or 4 in a row. In this way all the dirt can be taken from the grave site and that required for back filling brought back and side dumped in. There is also a truck on the market that has a dump bed that tilts to either side as well as to the rear. Two cemeteries that I know of use the idea of having a bucket beside the grave for the back fill dirt and by means of a hand winch or power unit it is tipped into the grave thus saving a lot of shoveling. It is mounted on wheels for moving around. We use a unit called a "Load Lugger". This is a bucket arrangement mounted on a 2-ton truck frame. The bucket is raised and lowered by means of chains on hydraulic lifts. It is detachable so that several operations can be going on at the same time. The hydraulic lift has a capacity of from 2 to 13 tons depending on the size of the cylinders. We use this equipment in a number of ways including picking up ready mix for pouring our sectional liners.

The three-wheeled power cart or truck has been used for many years by the police department and postal service and in large plants. They have been adapted for use in parks, golf courses, cemeteries and elsewhere by mounting a small box on the rear and some of these have a hydraulic dump arrangement. This has become one of the most useful pieces of equipment that any operation could have, certainly it has with us. It is handy, quick and can go almost anywhere. There is a piece of spray equipment that fits into the box and operates off the power take-off with a front or rear mounted boom for lawn spraying. There is also a seed and fertilizer spreader that fits on the back and also operates on the power take-off.

Many of us have leaf and grass clipping problems where a power sweeper is useful. Some are self-contained, self-powered and some are tractor drawn but have their own power to operate the pick-up or vacuum mechanism. These are very useful following a thatching or aeration job except, of course, on greens where the turf would be

damaged. This brings to mind the various types of thatchers and aerators.

Another very useful piece of equipment is the sod lifter. It might be supposed that this would be used for grave openings, but it is easier and quicker to remove the sod by hand for this small an area. But for regrading larger areas they are fine. I had always thought that the thicker the sod, the better it would heal when replaced but noticing the extensive fairway regrading at various golf courses, thin sod seems to heal very well. Anyway, some of the sod lifters used in this work are quite elaborate with attachments that cut the strips to length and rolls them up. One tractor mounted machine has a platform to carry along the sod rolls on pallets.

Well, I haven't gotten into compressors or mulching machines, each of which come in a variety of sizes, but I think I have rolled along far enough on my wheel so I'll stop.

Importance of Turf Management in Park Areas[1]

Tom Keel[2]

Turf management for recreation purposes, until recently, was associated mainly with golf courses and athletic fields. The past five years--in our Department and I think throughout the whole west coast--public demand has turned our attention to providing turf in our park areas.

For years, emphasis was on the rustic park setting with picnic tables, play equipment, boat ramps, etc. and people used to accept as routine, park areas that were green during the spring, rough mowed and maintained until it was burned out for the summer. Then they began to notice how the well developed and managed golf courses looked through-

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Director, Douglas County Park Department, County Liaison Officer, Roseburg, Oregon.

out the year and pressure was brought to bear on park planners and administrators to include turfed areas within the park and recreation systems.

In our own department where we have 46 developed park areas, including the famed Salmon Harbor, we find that the developed turfed areas receive three times the usage that the less developed areas receive. This heavy usage is the determining factor behind our development of additional turfed areas and the upgrading of existing sites.

Whenever a new site is obtained one of the first items considered in the development is a turf. To develop a good park turf we use the same procedure as is used in developing a good fairway. We do not have to manicure the areas like you do the greens, aprons or tees as passive recreation does not require such exactness.

To develop and maintain a good park turf it is essential that the area be well-drained and have a good irrigation system. When planning the irrigation system, consideration should be given as to the cost of maintaining the area. Should the system be automatic or semi-automatic? Is the cheapest system really the most economical? In this day or higher labor costs, careful consideration must be given to the daily operation. In heavily used areas--and all our turfed areas are heavily used--fully automatic systems have proven themselves. Controls can be set to irrigate at night when the parks are empty and leave the areas open for use all during the day. Then, too, we all know that night is the best time to irrigate.

We have found that Creeping red fescue and Oregon perennial ryegrass will make a good turf for park areas. Perennial ryegrass, because it is economically priced, fast germinating and holds its color well, is, I feel, very well suited for passive recreation area turfs. We cut out rye turfs twice a week at 2 1/2"--a high height when thinking of golf courses but fine for our parks. By following a regular management schedule of mowing, irrigating, aerifying, verticutting, fertilizing, weed and disease control and with periodic overseeding, we have areas of perennial rye that have been in for five years. Perennial rye will not "repair" itself like the expensive grasses but overseeding and fertilizing for quick growth will take care of this problem.

I've heard said that perennial rye is hard on equipment. It has been my experience that, if the soil is properly prepared for seeding, there is no problem. Any turf that is on rough terrain will be hard on equipment.

Creeping red fescue is another good grass for park areas as this grass does well in the shade. We maintain the areas like perennial rye with a good management schedule. Creeping red fescue looks nice and takes the 1 1/2" mowing height well. It can be cut even lower, if necessary.

Because we have had such satisfactory results with these two grasses, I would recommend their use in park areas with the same climatic conditions as we have in Douglas County. We use some Highland bentgrass but only in small areas.

We are presently watching three plots of new perennial ryegrasses. We have plots of NK 100, Pelo and Manhattan rye. Because this is only the first season we cannot give any conclusion at this time.

During my three years as a city Park Director I was responsible for a nine-hole golf course, so I realize that while turfs in our park areas are not maintained to as high a standard as on the greens and aprons of golf courses, our aim is to make them as nice as the fairways. If for some reason we fall a day behind on the mowing schedule, the public won't be at our door the next morning, but it does take coordinated scheduling of men and equipment to maintain over 2,000 acres of park land which include turf facilities such as camping areas, pavilians, boat ramps, etc. that are spread out over an 80-mile radius.

Proper maintenance of park areas and golf courses is a twenty-four hour, seven-day-a-week job.

How a Grass Plant Grows[1]

Kenneth J. Morrison[2]

Grasses are complex plants that are systematic in germination, growth, and reproduction. The growing plant passes through germination, root growth, tillering or stooling, jointing, stem elongation, heading, pollination and seed set stages. The turf grower is usually interested only in germination through stooling.

Grass plants are different than most other plants in that they grow from the base of the plant rather than at the tip.

Most attention is given to the visible parts of growth but little consideration is given to germination, emergence, and root production. All phases of plant growth should be considered in managing turf.

Rhizomes are stems of grass that are growing underground and they produce new leaves and stems. When these stems grow above ground, they are called stolons. Most of the grasses will grow roots at the stem nodes when conditions are favorable for root production. The sod-forming grasses have stems that break through the leaf sheath. When the stems emerge from the top of the sheath only, they are called bunchgrasses. Bluegrass and bentgrasses are typical of sod-formers while Chewing's fescue is a typical bunchgrass.

Grass Seed

The approximate percentage of the different parts of a grass seed are listed below:

Embryo (germ) - 3 per cent
Starchy endosperm - 86 per cent
Seed coat - 10 to 17 per cent

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Extension Agronomist, Washington State University, Pullman, Washington.

The starch in a -rass seed supplies food from the beginning of germination until the root system can obtain minerals from the soil and the leaves have developed green color and can manufacture food (Figure 3).

Germination of a Grass Seed

When the dry grass seed, with 8 - 10 per cent moisture, is planted, water is absorbed from the soil (Figures 1 & 2). The seed starts to swell and continues to absorb water until the moisture content is about 35 to 40 per cent of the seed weight. The minimum water content of the seed required for sprouting is 30 per cent. Enzymes become active and convert the starches into food for the embryo or young plant.

Most grass seed will germinate at about 35° F. and at a maximum of 95° F. The optimum range is 68 to 77° F.

When a grass seed germinates, the roots start to grow first. At optimum temperatures the primary root breaks through the seed coat (Figure 4). A pair of roots develop next, and a short time later a second pair start to grow, making a total of five primary roots. Occasionally, the sixth primary root will develop, but it is not common. Sometimes one pair of the primary roots will not develop.

As the primary root system develops, the coleoptile enclosing the first leaf starts to grow toward the soil surface (Figure 5). The first leaf emerges from the top of the coleoptile (Figure 6). When moisture and temperature are favorable, the coleoptile and first leaf appear above the ground in about a week to ten days.

Root hairs are small projections on the roots of the wheat plant (Figures 4 and 5). Water and plant nutrients are abosrbed through the root hairs and moved through the roots to the stem and leaves of the plant.

The Root System

The primary root system is usually made up of five roots. The primary root system forms only a small portion of the total root system. The main job of the primary root system is to absorb water and plant nutrients needed for early growth.

The permanent root system grows from the corn near the ground level. The first permanent roots will grow at the tillering or stooling node, just below the ground surface (Figure 7). These roots are always produced about the same distance below the surface of the soil regardless of how deep the seed is planted. The permanent roots do not develop until the first and second leaf buds have appeared above the ground.

Food reserves from photosynthesis are necessary for root production. Root production exceeds top production in most grasses.

The root production is directly correlated with the amount of top growth. Table 1 shows the effect of different clipping heights on root production.

Table 1.: Dry weight of roots in grams per surface foot of soil.

Variety	Red Fescue	Bluegrass	Colonial Bent
Cutting height in inches		Dry weight of roots	
1/4	1.4	1.6	2.4
1-1/2	8.6	7.5	5.0
3	13.7	11.7	7.7

When fescue was cut at 1/4 inch high it produced more tillers, but bluegrass produced fewer rhizomes when cut short. Grass is not killed due to cutting off the buds but is due to reduced carbohydrate or food in the plant.

The Leaves

Soon after the primary roots appear, the coleoptile or leaf sheath starts growing upward and the first foliage leaf emerges from the top of the coleoptile. It is possible to tell the first foliage leaf because it has a rounded blunt end rather than a long, tapered, sharp point like other leaves (Figure 6).

From deeper plantings, the coleoptile may not reach the soil surface. When the coleoptile fails to reach the soil surface, the leaves fold in an accordion-shape and may not

break through the soil surface.

After the first leaf is formed the leaves are arranged on the stem alternately in two opposite rows. The leaves of grasses grow from the base rather than from the tip.

Both the upper and lower surfaces of grass leaves are covered with protective layers of cells called the epidermis. Stomata are small pores in the epidermis that permit the plant to exchange water and gases with the air. Carbon dioxide and other gases enter the plant through these openings. Most of the water that is removed from the soil by the roots passes out of the plant through the stomata (Figure 9).

Veins bring soil water which contains plant nutrients into the leaves, where plant food is synthesized. The plant food is transported to other parts of the plant, particularly to the storage areas such as seed and crowns.

The grass leaf is made up of two parts--the blade and the sheath. The blade is the broad expanded part growing from the stem that produces most of the carbohydrates or plant food used by the grass plant and gives grass its pleasing appearance. The sheath part of the blade is wrapped around the stem and protects the bud at the node. It also produces food.

Grass blades will roll or fold for protection, particularly to prevent water loss. Red fescue leaves roll while bluegrass leaves fold.

Tillering or Stooling

The branching in grasses is called tillering or stooling. The stools develop from the crown of the plant, which is near the soil surface. The depth of crown set in soil is determined by light. The crown is at about the same depth as the seed (Figure 8) in most grasses.

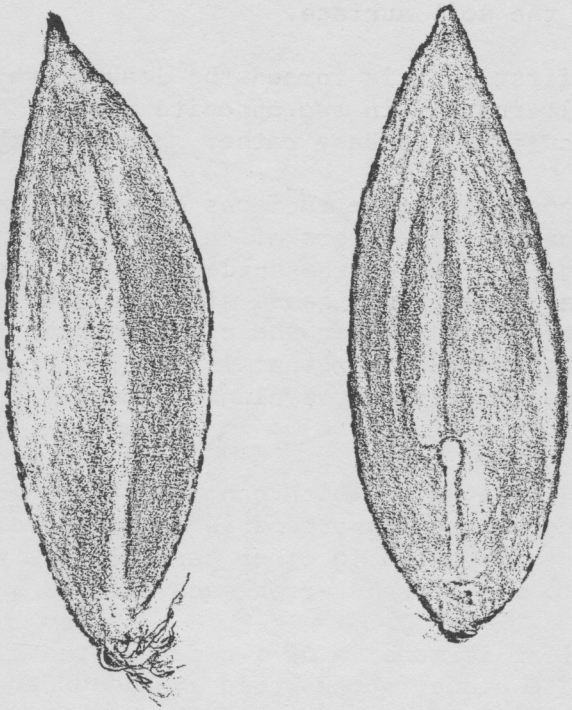


FIGURE 1. GRASS SEED ENCLOSED IN LEMMA AND PALEA.

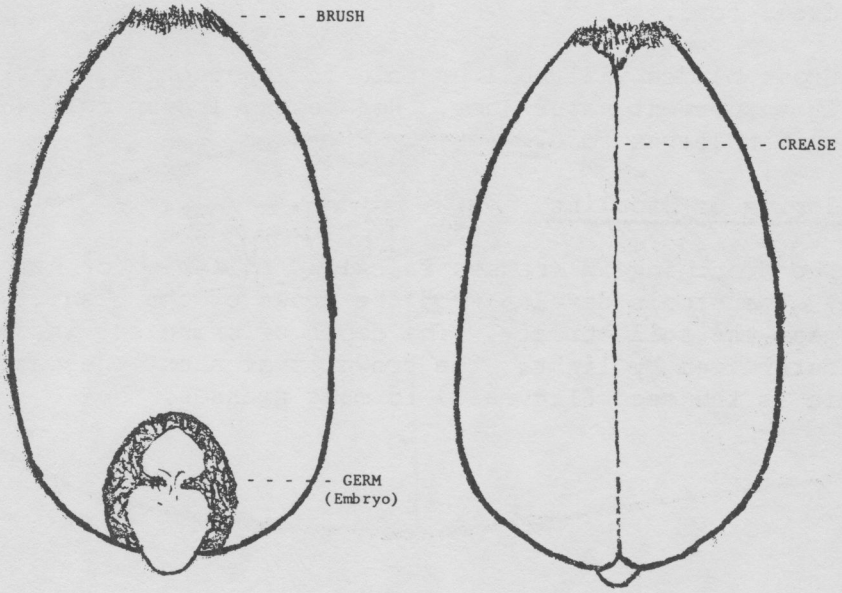


FIGURE 2. GRASS SEEDS WITH LEMMA AND PALEA REMOVED.

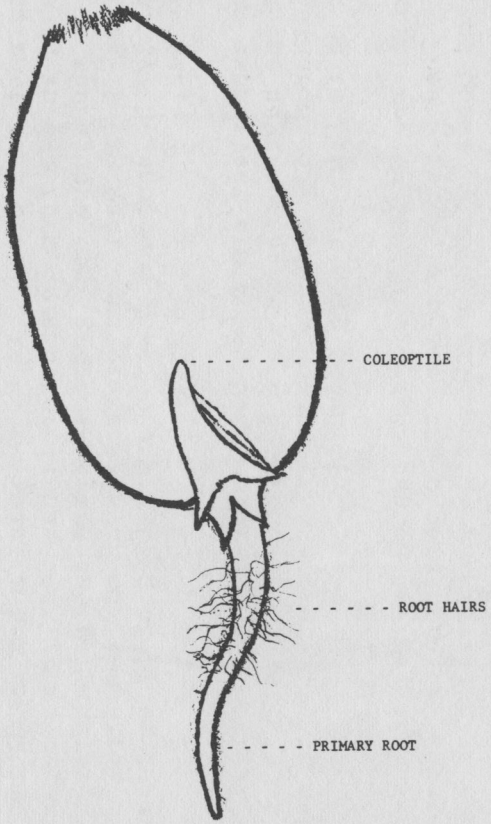


FIGURE 4 GRASS STARTING TO GERMINATE

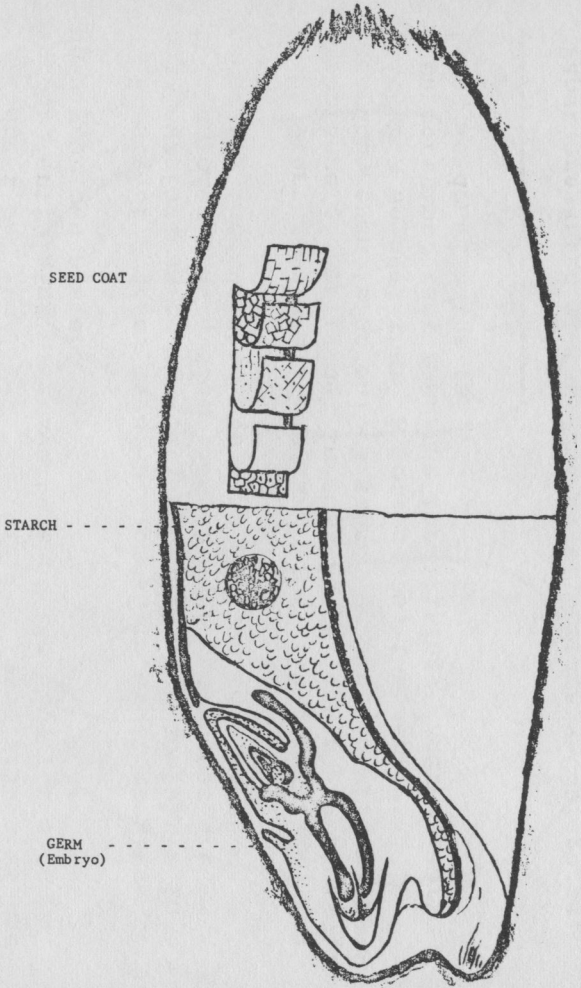


FIGURE 3 CROSS SECTION OF GRASS SEED

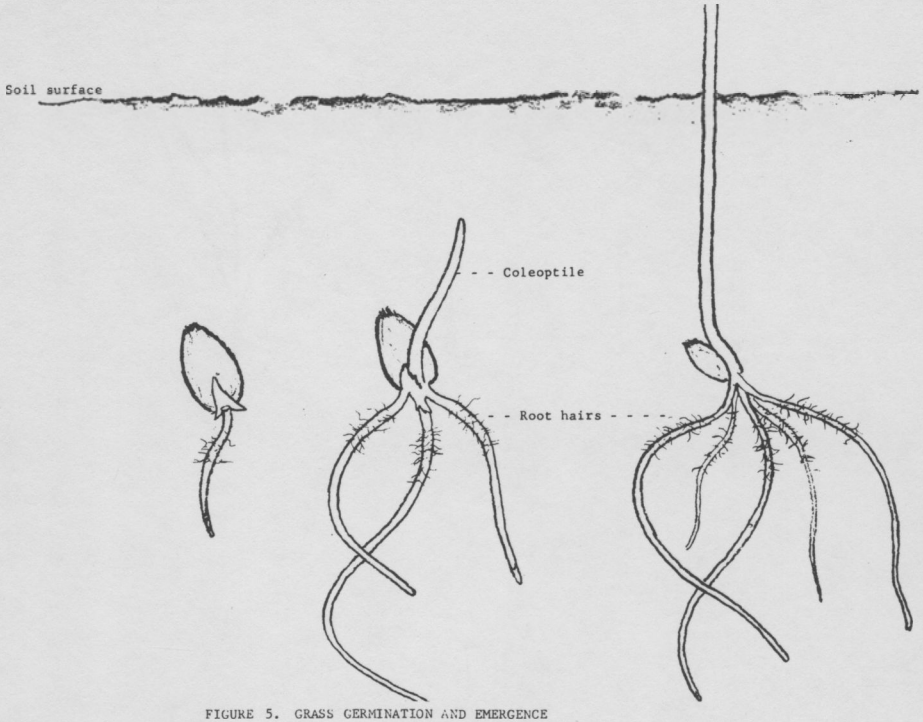


FIGURE 5. GRASS GERMINATION AND EMERGENCE

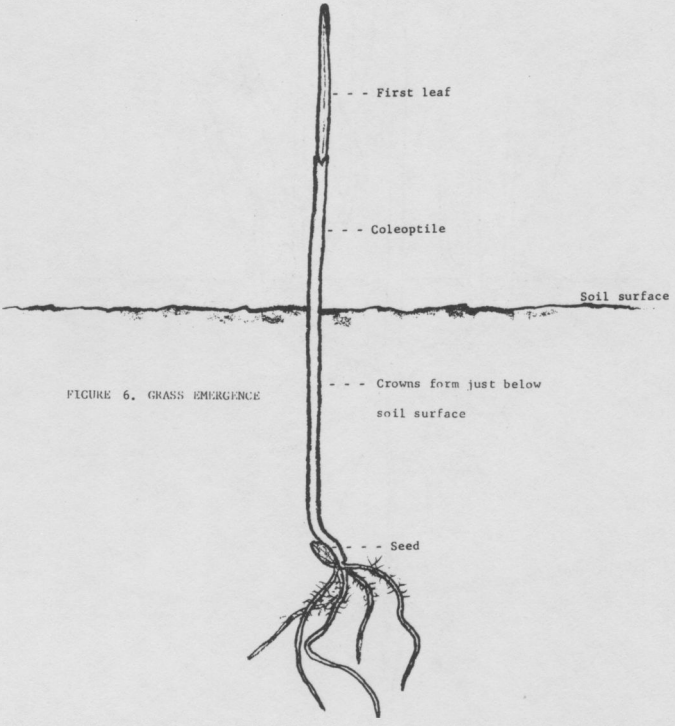


FIGURE 6. GRASS EMERGENCE

FIGURE 7. GRASS SEEDLINGS 1 to 5 WEEKS OLD.

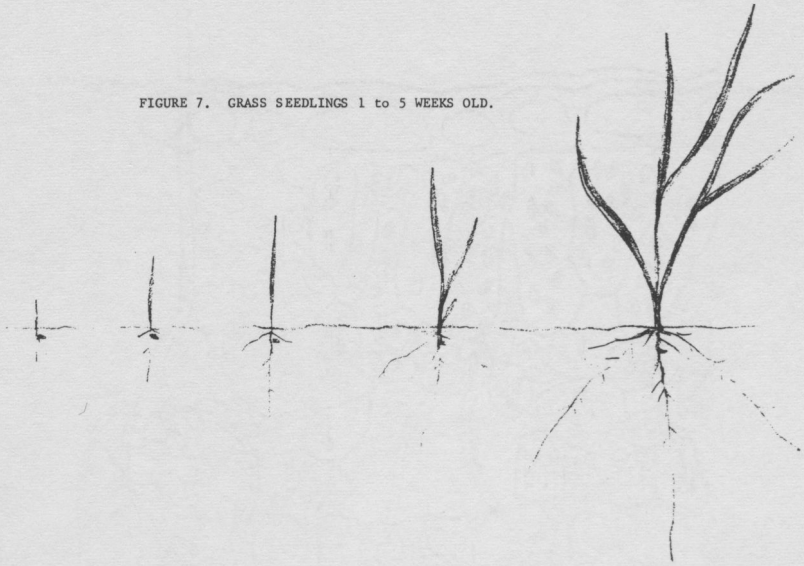
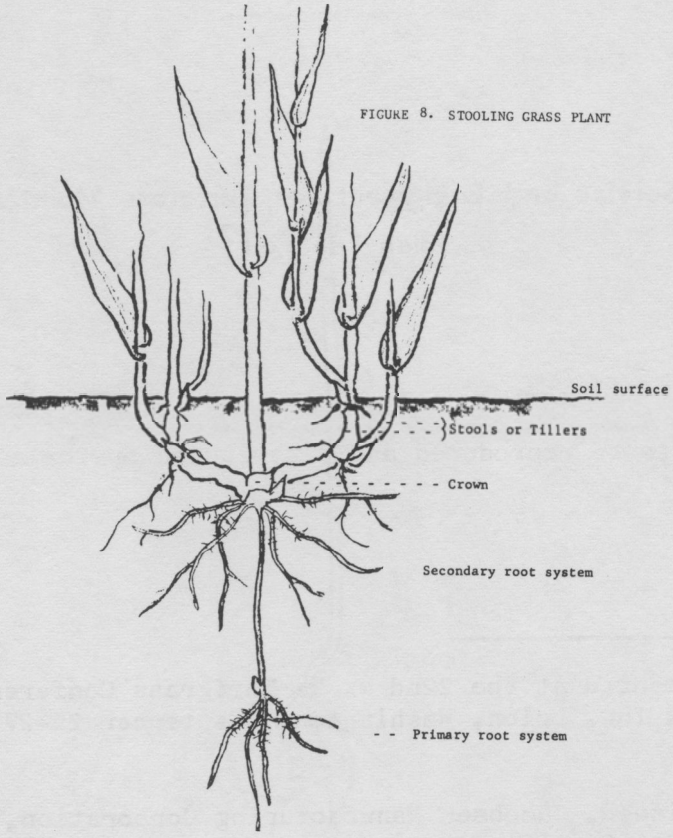


FIGURE 8. STOOLING GRASS PLANT



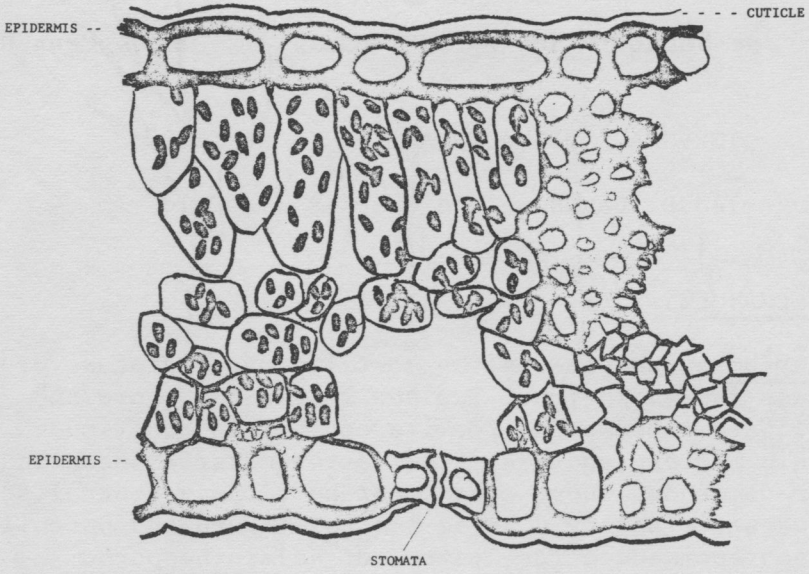


FIGURE 9 CROSS SECTION OF LEAF

Parts, Service and Equipment for Turfgrass Maintenance[1]

Allan Van Pelt[2]

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Sales Engineer, Jacobsen Manufacturing Corporation, Ventura, California.

New Advances in Pesticides and Pesticide Safety

Panel Discussion

Dr. Joe Saunders, Dr. Arlen Davison, Dr. James Pennell

TURFGRASS DISEASES AND THEIR CONTROL[1]

Arlen D. Davison[2] and Charles J. Gould[3]

RECENT CHANGES

Fusarium patch remains the most important disease of turfgrass in Washington. Two new fungicides, Fore and Daconil, are recommended for its control in addition to inorganic mercury and PMA. The latter materials continue to be recommended where costs must be closely controlled. All give satisfactory disease control. Fore and Daconil are also recommended for control of Helminthosporium blights and Rhizoctonia brown patch. In addition, Fore has reportedly given control of algae in turfgrass.

To assist in identification and control of turfgrass diseases a summary follows:

Several of the major diseases of turfgrasses in the State of Washington are often mistakenly attributed to damage from insects, dogs, fertilizers, and other factors. To assist in the accurate identification of these diseases, their symptoms and other pertinent details are described in E.M.'s 2049 and 2050, "Disease Control in Lawn Turf" and "Disease Control in Putting Turf", respectively.

FUSARIUM PATCH is caused by the fungus Fusarium nivale. The fungus may attack either young or old grasses in both eastern and western Washington. On putting green turf

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Extension Plant Pathology Specialist, W.W.R.E.C., Washington State University, Puyallup, Washington.

3 Plant Pathologist, W.W.R.E.C., Washington State University, Puyallup, Washington.

Fusarium patch appears as small round spots varying in color from tan to reddish brown. In lawn-type turf the fungus usually causes indefinite brown and thin areas. It develops most commonly when the weather is cool and moist, which often occurs from August to April. Fusarium patch is the most important disease of turf in Washington.

RED THREAD, caused by the fungus Corticium fuciforme, produces scorched-like areas on both lawn and putting turf. Small, cream or red thread-like growths can be found on the tips of the infected grass at certain times of the year. Cool moist weather favors rapid build-up of this disease. Red Thread is most troublesome in western Washington. It is the most important disease of fescues, but also occurs on bents.

OPHIOBOLUS PATCH, although but recently recognized, probably has been here for some time. The fungus Ophiobolus graminis may be responsible for much of our thin turf in bentgrass lawns. On putting greens it first produces small brown spots that may rapidly enlarge and are accompanied by death of both roots and shoots. Ring-like areas varying in size from six inches to two or more feet are formed. The rings turn gray during winter. This is our third major disease.

FAIRY RING is caused by Marasmius oreades and certain other mushrooms. The symptoms include an outer ring of dark green grass, accompanied at times by rings of yellowed or dead grass. Small tan-colored mushrooms often develop in spring and fall in the rings in western Washington, but mushrooms seldom occur in association with the rings in eastern Washington.

HELMINTHOSPORIUM ROOT ROTS cause thin yellowed areas in turf; Helminthosporium species also cause tan to purple spots on leaves, particularly of bluegrass. The root rot complex is probably common but confusing, and needs a great deal more study.

LEAF RUSTS are common on bluegrasses, particularly in eastern Washington. The most common rust is Puccinia graminis. It produces reddish or blackish powdery pustules. Merion bluegrass is more susceptible than Kentucky bluegrass. Warm, dry weather favors rapid development.

SNOW MOLD is caused by the fungus Typhula incarnata. It produces round or slightly irregular dead spots which vary

in size, and are often covered with a dirty white mold. The symptoms appear about the time the snow melts. This disease is very common in eastern Washington, but rare in western Washington.

DAMPING OFF, characterized by a collapse of young seedlings, is caused by several different fungi. It occurs most often in seedings made too early or too late. Conditions favoring rapid development are: young tender seedlings, cool temperatures, and high relative humidity.

LAWN TURF

Disease	Symptoms	Conditions Favoring Disease	Presence in Washington Western	Eastern	Recommendations for Control Cultural	Fungicidal
FUSARIUM PATCH (Fusarium nivale)	Browning and thinning of turf in large (4-18") rather indefinite spots.	Cool wet	Very common	Common	Promote air and soil drainage. Avoid excessive nitrogen. 1.5 lbs sulfur per 1000 sq ft per year may help.	Fore (8 oz), Daconil (5 oz), inorganic mercury[a] (2 oz), or 10% PMA (3/4 oz) in 10 gal water per 1000 sq ft every 2 weeks. Use twice in spring and twice in fall.
CORTICIUM RED THREAD (C. fuciforme)	Bleached or tan-colored, irregular areas 2 to 24" with red fungus strands 1/8-1/4" long on leaves.	Cool moist	Very common in fescues	Infrequent	Use adequate nitrogen.	Cadmium or mercury compounds once in spring and again in fall. Cadmiums last longer.
OPHIOBOLUS PATCH (Ophiobolus graminis)	Thinning and/or dying of turf in circles 4" to 36" followed by invasion of weeds and annual bluegrass in center.	Non-specific	Common	Occasional	Use ammonium sulfate in balanced NPK nutrition. Avoid high lime and waterlogging.	Chlordane (@ 3 oz active/ 1000 sq ft) has given good control experimentally.
FAIRY RING (Marasmius oreades in West. Wash.)	Rings of dark green grass and sometimes dead zones, with or without tan mushrooms 1 to 2" diameter.	Mushrooms mostly in spring and fall.	Common	Fairly common	Daily soaking of rings with water for 1 month. Keep turf well fertilized.	Suppress with drenches of PMA. Eliminate with methyl bromide. See Wash. State Agr. Stn. Cir.
HELMINTHOSPORIUM BLIGHTS (Helm. spp.)	Root and crown rot resulting in yellowing and thinning of turf or tan to purple spots on leaves.	Moist	Common on bluegrass	Common	Water in morning, pick up clippings, Don't let grass get matted.	Use Fore, Daconil, Panogen Turf Fungicide, PMA, or thiram.
SLIME MOLDS	Usually small dark powdery "pin-heads" on leaves; occasionally large (1-3") grey powdery mounds. Not parasitic.	Mild moist	Occasional spring and fall	Occasional spring and fall	Mow, rake, or wash off with water. Usually disappears after 1-2 weeks.	Common turf fungicides may prevent their reappearance.
RUST (Puccinia graminis)	Reddish or brown-to-black powdery spots. Mostly on Merion bluegrass.	Warm dry	Uncommon	Fairly common	Increase nitrogen. Water during dry periods. Mow frequently.	Usually not necessary. If needed, zineb, Fore, cycloheximide or Daconil may help.
POWDERY MILDEW (Erysiphe graminis)	Grey-white powdery masses on leaves and stems, which may yellow and die.	Mild moist	Uncommon	Common	Fertilize and water to maintain vigor. Promote air drainage.	Usually not necessary. Use Karathane if needed.

[a]Mixtures of mercurous and mercuric chlorides, commonly available as Calo-Clor and Velsicol 2-1.

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PUTTING TURF

Disease	Symptoms	Conditions Favoring Disease	Presence in Washington Western	Presence in Washington Eastern	Recommendations for Control Cultural	Recommendations for Control Fungicidal
FUSARIUM PATCH (Fusarium nivale)	Spots brown to blackish-brown, round, 1 to 2" at first, becoming less distinct, ringlike, grey and 2 to 6" in late fall.	Cool moist	Very common	Common	Promote air and soil drainage. Avoid excessive nitrogen. 1.5 lbs sulfur per 1000 sq ft per year may help.	Inorganic mercury[a] (2 oz), Fore (8 oz), Daconil (5 oz), 10% PMA (3/4 oz) in 10 gal water per 1000 sq ft every 2 weeks.
TYPHULA SNOW MOLD (T. spp.)	Irregular, dead, bleached areas, 2 to 24" with a grey mold, usually under or near melting snow.	Cold wet	Not common	Very common in Northeastern area.	Avoid late fertilizing.	Inorganic mercury before snowfall.
CORTICIUM RED THREAD (C. fuciforme)	Circular scorched spots with short cream to red fungus threads protruding from leaves.	Cool moist	Occasional	Rare	Use adequate nitrogen.	Cadmium or mercury compound once in spring and again in fall. Cadmiums last longer.
OPHIOBOLUS PATCH (Ophiobolus graminis)	Areas reddish-brown at first, later brown to grey, usually circular, 2 to 24" or larger. Weeds invade center of spots.	Most rapid development during first hot dry spell.	Occasional	Occasional	Use ammonium sulfate in balanced NPK nutrition. Avoid high lime and waterlogging.	Chlordane (@ 3 oz active/ 1000 sq ft) has given good control experimentally.
RHIZOCTONIA BROWN PATCH (R. solani)	Thin, brown, brownish-black areas increasing rapidly in size.	Hot humid	Rare	Not common	Avoid high nitrogen and frequent watering.	Fungicides containing PCNB, inorganic mercury, Fore, Daconil, or thiram.
HELMINTHOSPORIUM BLIGHTS (Helm. spp.)	Thin, yellow irregular areas.	Warm	Not known	Not known	Maintain vigorous turf. Avoid thatch.	Use Daconil, Fore, Panogen Turf Fungicide, PMA, or Dyrene.
DAMPING OFF of young seedlings (Various fungi)	Dying of young seedlings, singly or in clumps, during cool weather.	Cool moist	Common	Common	Avoid excessive watering after seeding.	Treat seed and spray young seedlings with thiram.
ALGAE	Greenish-black scum.	Mild moist	Common	Common	Avoid excessive shade, waterlogging and organic nitrogen fertilizer.	Fore

[a]Mixtures of mercurous and mercuric chlorides, commonly available as Calo-Clor and Velsicol 2-1.

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Contract Maintenance of Turfgrass and Ornamentals

Panel Discussion

Mr. Jim Ely, Mr. Alvin Overland, Mr. Bud Johnson

CONTRACT MAINTENANCE FOR TURFGRASS AREAS[1]

By Jim Ely[2]

Large-scale Contract Landscape Maintenance is a new and a challenging profession. It is one that has grown largely from the affluence of our society from what was primarily a hobby into an industry with as many facets as there are horticultural tasks.

Mr. Overland has given us the specifications and qualifications for a maintenance contract. Our job is to bring life to this program by providing manpower, equipment and technical information. As in any industry, there is a division of labor involving channels of authority. This division provides a business with an operating staff in the office, and a labor force in the field. Such an organization allows complications to be met with the leavening agents of background, judgement and experience to provide solutions to the problems that arise.

We all recognize that personnel problems are inevitable in industry. These must be met by careful screening, selection, educational programs, compensatory pay and benefits, and a company policy, the latter of which is essential in order to keep an even flow of communication from field to office and back.

Technical problems are met by using the information provided by our county agents, extension specialists, and material and machinery supplier representatives, as well

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Superintendent of Grounds Maintenance Division, Landscapers Northwest, Tacoma, Washington.

as drawing on the educational background and experience of our own staff. Sources of quick, reliable recommendations are most important to us.

We have instituted two programs that aid greatly in communication within the company and with the client.

1. We will not do any work unless there are written instructions, usually in the form of a contract, outlining what work is to be done, the proper address and time, and a schedule of prices. No additional work will be executed unless there is a written work order or invoice signed by one who can authorize such work. A copy of all transactions stays in the office, a copy goes to the owner, and a third copy is with the foreman on the job. A sample copy of the proposal is provided in the text of this proceeding.

2. We find essential a quality control maintenance check. A form for this is also included in this text. A program of inspection insures proper quality control as well as a training tool for the personnel. It soon pinpoints weak spots in a maintenance program. Here again, three copies are made and given to the key people in the contract.

It is mandatory that a contract maintenance program be operated in a business-like manner, which recognizes the strengths and weaknesses of the business, understands the costs of operation and charges accordingly, and develops a successful program to meet the needs of our society. Contract maintenance does not do away with golf course superintendents, or any other person in the profession. Rather, we see the development of a successful, professional working relationship with all who are in this field. By doing so, the entire industry can prosper.

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DATE: 9/20/68
INSPECTOR: Jim Ely

LEGEND: E - EXCELLENT, G - GOOD, N - NOT ACCEPTABLE

Doug Hacking, Foreman

LAWN MOWING (Improved Areas)

1½	HEIGHT OF GRASS IN IMPROVED AREAS
N	QUALITY OF MOWING
ok	EFFICIENT AND SAFE USE OF EQUIPMENT
poor	MECHANICAL CONDITION OF EQUIPMENT
ok	PERSONNEL OPERATION OF EQUIPMENT
ok	COORDINATION OF MOWING WITH OTHER ACTIVITIES
N	LITTER REMOVAL FROM AREA
N	APPRAISAL OF MOWING IMPROVED AREA

COMMENTS
Too much tall grass, uneven mowing and grass clippings.

TREES, SHRUBS AND MULCHED AREAS

G	WEED CONTROL OF SHRUB AREAS
G	WATERING OF SHRUB AREAS
	MULCHING OF SHRUB AND PLANTING AREAS
N	EDGING OF TURF AREA AROUND SHRUB BEDS
G	FERTILIZING OF SHRUBS AND TREES
	PRUNING OF SHRUBS AND TREES
	INSECT & DISEASE CONTROL ON SHRUBS, TREES AND BEDDING PLANTS
G	GENERAL APPEARANCE

COMMENTS

LAWN WATERING

G	EFFICIENT USE OF WATER
1½	DEPTH OF MOISTURE: ___ SURFACE DRY [XX] SURFACE MOIST
	FREQUENCY OF WATERING
G	EFFICIENT & SAFE USE OF EQUIPMENT
ok	CONDITION OF IRRIGATION EQUIPMENT
ok	PROTECTION OF EQUIPMENT AGAINST THEFT, VANDALS OR ACCIDENTAL DAMAGE
ok	COORDINATION OF WATERING WITH OTHER ACTIVITIES IN AREA
G	APPRAISAL OF WATERING PRACTICES

COMMENTS
You will have to start watering on a schedule now in order to get enough water to keep grass healthy

FERTILIZING

G	SAFE & EFFECTIVE USE OF MATERIAL AND EQUIPMENT
G	EVIDENCE OF PROPER CALIBRATION
G	EVIDENCE OF CORRECT APPLICATION
G	EVIDENCE OF PRESCRIBED AMOUNTS APPLIED
N	PROPER HANDLING AND LOADING OF EQUIPMENT
ok	PROPER DISPOSAL OF EMPTY CONTAINERS
G	COORDINATION WITH OTHER ACTIVITIES
	APPRAISAL OF ABOVE OPERATION

COMMENTS
Get those containers off the site!

LAWN MOWING (Semi-Improved & Unimproved Areas)

2½	HEIGHT OF GRASS
G	QUALITY OF MOWING
G	EFFICIENT AND SAFE USE OF EQUIPMENT
G	MECHANICAL CONDITION OF EQUIPMENT
G	PERSONNEL OPERATION OF EQUIPMENT
G	COORDINATION WITH OTHER ACTIVITIES
G	LITTER REMOVAL FROM AREA
G	CONTROL OF UNDESIREABLE PLANT GROWTH
G	APPRAISAL OF MOWING AREA

COMMENTS

TRIMMING, EDGING AND CLEANUP

N	QUALITY OF EDGING ALONG PAVED SURFACES
G	QUALITY OF TRIMMING AROUND TREES & BUILDINGS
N	QUALITY OF EDGING ALONG PLANTING AREAS
N	APPRAISAL OF ABOVE OPERATION
G	CLEANUP OF DEBRIS AFTER ABOVE OPERATIONS

COMMENTS

COMMENTS FOR LAWN WEED SPRAYING
Some areas were not sprayed. The spray dept. will get this done this month.

LAWN WEED SPRAYING

	PROPER RECORDS BEING MADE AND SUBMITTED ON OPERATIONS
	PERSONNEL FOLLOWING ALL SAFETY PRECAUTIONS
	CONDITION OF EQUIPMENT
	CARE AND CONSIDERATION OF CLIENT'S PROPERTY
	CONSIDERATION GIVEN TO WEATHER CONDITIONS
	SAFE & EFFECTIVE USE OF MATERIAL AND EQUIPMENT
	EVIDENCE OF PROPER CALIBRATION
N	EVIDENCE OF CORRECT APPLICATION
	EVIDENCE OF PRESCRIBED AMOUNTS APPLIED
	PROPER HANDLING AND LOADING OF EQUIPMENT
	PROPER DISPOSAL OF EMPTY CONTAINERS
	COORDINATION WITH OTHER ACTIVITIES
	APPRAISAL OF ABOVE OPERATION

PERSONNEL

G	APPEARANCE
G	RESPECT & CARE FOR PROPERTY
G	SAFE AND EFFICIENT USE OF EQUIPMENT
G	WEARING PROPER SAFETY CLOTHING
G	COURTESY TOWARD OTHER EMPLOYEES, STAFF, PERSONNEL & CUSTOMERS
N	PUNCTUALITY
G	QUALITY OF WORK
G	DILIGENCE IN WORK HABITS
N	EFFECTIVENESS
ok	ORGANIZATIONAL ABILITY

COMMENTS
Glaser is not accomplishing anything. Get him working or off the payroll.

MAINTENANCE QUALITY CONTROL

Proposal

LANDSCAPERS NORTHWEST INC.

Construction and Maintenance
"For The Beauty of The Earth"
7404 Bridgeport Way W. Tacoma, Washington 98467
JUniper 4-3606

PROPOSAL SUBMITTED TO		PHONE	DATE
J. Russell Gleason		968-2127	20 September 1968
STREET		JOB NAME	
Route 6 Box 7214			
CITY, STATE AND ZIP CODE		JOB LOCATION	
Gig Harbor, Wash. 98335		Horsehead Bay	
ARCHITECT	DATE OF PLANS		JOB PHONE
James R. Ely	9/20/68		

We hereby submit specifications and estimates for:

Fertilizing lawn area next to guest house . . . . . $35.00 per application
This should be done at least 4 times per season. The material used will be NuLife's 15-5-10. During the summer months the Nitrogen will be 50% nitroform for slow release and 50% amonic form. This price is contingent on being at your residence for additional work, or mileage and travel time must be added.

Casoron G4 applied to all shrub areas for pre-emergent weed control. $70.00/yr
This is best applied in early March before weed growth begins. It is registered for ornamental applications for weed control for a period of 6 months. We find that we get satisfactory control for the growing season; upon which our price is based. On application of Casoron to the shrub area next to drive at entrance, this can be done at any time that the weeding is completed and during the next rain. Rain is essential to get this material into the ground. This will be done for $35.00

Weeding can be done on a 3 day notice. Your charge on this is $6.00 per hour for the foreman and $4.00 per hour for his helper. They can handle minor pruning, any transplanting, etc.

Pruning will be done during the winter months on a time and materials basis. The hourly rates will be quoted to you before we start to prune.

All price quotations start from the time the men leave our grounds and continue until their return or until they report to another jobsite. In the latter, the travel time and mileage is divided between the jobs.

We Propose hereby to furnish material and labor — complete in accordance with above specifications, for the sum of:

NET dollars ($)

Payment to be made as follows:

Net upon completion of job

All material is guaranteed to be as specified. All work to be completed in a workmanlike manner according to standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over and above the estimate. All agreements contingent upon strikes, accidents or delays beyond our control. Owner to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workmen's Compensation Insurance.

Authorized Signature James R Ely

Note: This proposal may be withdrawn by us if not accepted within 15 days.

Acceptance of Proposal — The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Date of Acceptance: 9/20/68

Signature J. Russell Gleason

Signature Linda Gleason

Contract Care of Turf[1]

Bud Johnson[2]

Contract care of turf is by no means a new industry. In fact, in one form or another it has been going on as long as there have been groundskeepers and gardeners. However, if contract care of turf is an old industry, certainly the approach that we are taking of it is relatively new.

Our experiment stations, Universities, and Chemical Companies have turned it into a science. In fact, most of you here today understand this and are willing to take the time to find out more about it.

I will try to give you a run-down on how we, at Washington Tree Service, approach the problem of Turf Management and possibly some small portion of it will give you an idea that will be of some help.

Ideas, things to think about, discussions, and the passing of these between us have been the primary means of improving our business.

I don't believe I will go into the formulations we use in our fertilizing programs because I'm sure you each have your own preference.

First, of course, as a call comes to us it is given to our Lawn Foreman to look at, evaluate, and consult with the customer, and advise them of what procedures are necessary to give them the type of lawn they want.

We start nearly all our lawn work with aerifying. The importance of aerifying, in most lawns, cannot be stressed too much; even lawns only a season or two old will respond quicker. We feel that in some cases, the aerifying is even more important than the fertilizing. Another aerifying is done in the fall.

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Washington Tree Service, Inc., Seattle, Washington.

Our present fertilizing program is based on 4 applications per year. Starting early in the spring on our regular customers and spacing each application 45 days apart. This completes our program in the early fall but, with the aid of the formaldehyde urea, we are able to carry over pretty well till the spring application. However, I am sure another application, in the winter, would improve the appearance. We stay pretty close to the 3-1-2 ratio, or I should say, that is what we finish with in the fall.

In all fertilizer applications we have been using on an experimental basis, mercelite, which is a 92% mercury. It seems to be doing very well and for several seasons we have had almost no problems with Fusarium, or in fact, any of the fungus diseases. I'm not sure that all the credit goes to the mercelite because we also use sulphur in all applications.

We have, as you may have gathered, gone almost to a completely dry fertilizer. This gives us a greater selection of materials to choose from, and the cost per application is much below that of our former spray on material. We have, however, right on our lawn truck, which is a one-ton van, a small 50-gallon tank and a 4 1/2 gallon per minute pump in case we need it. This is much less expensive than sending one of our tank trucks out to do the work.

In the same truck we carry our fertilizer for the day, the aerifying machine, a self-contained weed rig, cyclone spreaders, and any other tools needed for the day. We find that one man, properly equipped, can do more business in a day than two men can do with a tank truck. They can also do the aerifying and fertilizing at the same time. Incidentally, on my own, and a few other jobs, we have done the aerifying, fertilizing, and weeding at the same time, and they have turned out very well. It is not our practice to do this, but if after more experimenting, we find we can do the job right . . . we will probably continue this way. The weed materials used on these jobs were standard liquid formulations. We do not use any weed and feed combinations because the damage I have seen from weed and feeds would fill another paper.

The more work that can be done at one time, of course, cuts down the cost . . . which improves the profit. Profit is our main reason for being in business . . but long ago

we found that unless the work was done properly, and the customer satisfied, there was just no profit.

More important than the tools we use or the type of fertilizer applied, are the men who do the work. This is probably the one thing that holds this industry down, being able to locate the men who can approach the customer's house, decide what needs to be done, and do it right. Some of the short courses conducted by community colleges are a great help, but for the main part, these men must be hired and trained by you and I. We must continue trying to produce a more attractive industry in order to inspire young people who are looking for a profession to follow. This is the only way we can attract the type of personnel we need.

Every meeting, turf conference, or seminar we attend will help us to do this, and I hope that in some small way I have been able to be of some help to you.

Contract Maintenance of Ground Areas[1]

Alvin Overland[2]

Fort Lewis and its satelite stations increasingly are using the contract method of Grounds Maintenance because in-house forces are insufficient and the area to be maintained has increased.

Resorting to contract has not been as desirable as using in-house forces. Some contractors do the work less proficiently. This comes about from contractors bidding too low and then they tend to "cut corners" to break even on the contract. When this occurs the contractor usually ends up in default. Then there is an intermission of several weeks before another contract can be awarded. During the period between contracts there is very little, if any, maintenance accomplished.

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Post Agronomist, Fort Lewis, Washington.

For the purpose of maintenance there are three categories of grounds to maintain--(1) improved, (2) semi-improved, and (3) unimproved. Improved grounds are given intensive maintenance, semi-improved grounds are maintained only sufficiently to present a neat appearance (usually only mowing and edging), and unimproved grounds are mowed two or three times per year, mainly to reduce the fire hazard.

The Grounds Maintenance contracts cover mowing, edging, watering, fertilizing, cultivating shrub beds, pruning trees and shrubs, weed control and policing (clean-up) of the area under contract.

The contractor must meet certain qualifications before he can be awarded a contract. He must be qualified to perform the work required, financially able to meet payroll and other financial obligations, and must be able to provide proper insurance coverage. Insurance coverage must include a minimum of $100,000 in workmens' compensation and employers liability, and $100,000 - $50,000 - $10,000 in general and automobile liability.

Contracts are awarded for a one-year period only. It would be more desirable for both parties if contracts could be awarded for a longer period. This would allow a contractor a better opportunity to amortize the cost of equipment and thus provide a more favorable bid for the government.

A sample of the technical provisions and specifications for a Grounds Maintenance contract is as follows:

TECHNICAL PROVISIONS

SECTION 1

GROUNDS MAINTENANCE

TS 1-01 SCOPE:

The work covered by these specifications consists of furnishing all plant, labor, equipment and materials, and in performing all operations in connection with grounds maintenance, complete, in strict accordance with the following specifications, and subject to the terms and conditions of the contract.

TS 1-02 JOB INVESTIGATION:

Bidders should carefully examine the specifications, visit the site of the work, and fully inform themselves as to all conditions and matters which can in any way affect the work or the cost thereof. Should a bidder find discrepancies in, or omissions from the specifications, or other documents, or should he be in doubt as to their meaning, he should at once notify the Contracting Officer and obtain clarification prior to submitting any bid. Bidder certifies in submitting a bid hereunder that he has in fact complied with the foregoing.

TS 1-03 DRAWINGS AND SPECIFICATIONS:

The drawings and specifications shall be considered as complimentary, and any work called for on the drawings and not mentioned in the specifications, or vice versa, shall be furnished as though fully set forth in both. In case of difference between drawings and specifications, the specifications shall govern.

TS 1-04 CONDUCT OF OPERATIONS:

a. The contractor shall cooperate with and coordinate his operations with the work of other contractors and/or Government forces who may be engaged in performing other work in the areas involved in these specifications. He shall afford such other parties a reasonable opportunity to perform their work at the time required and shall protect such other work from damage incident to operations being conducted under this contract.

b. The contractor shall conduct his operations in such a manner as to cause a minimum of inconvenience in the use of roads and to occupants of offices or other buildings within the area.

c. Grounds maintenance work shall be performed during regular duty hours for the installation personnel unless other arrangements have been made between the contractor, the officer in charge at the installation and the Contracting Officer.

d. The contractor shall perform each service as often as necessary (unless otherwise stipulated) to keep grounds in a neat and tidy condition.

e. Contractor or one of his employees shall contact the officer in charge or his representative at the installation being serviced during each weekly visit.

TS 1-05 DAMAGED GOVERNMENT PROPERTY:

The grounds maintenance contractor and the officer in charge at the installation or his representative shall, prior to the start of the new contract, make a survey of the grounds and note any damaged property such as sprinkler heads. If damaged property is found, it shall be reported on the Grounds Maintenance Service Record. The contractor will be required to repair or replace any government property which is damaged by grounds maintenance operations during the balance of the year. Repairs made by Government forces when necessary to keep the sprinkler system in operation will be deducted from the next month payment. Another survey will be made near the end of the contract year, and when necessary, payment for services will be withheld until all repairs have been made.

TS 1-06 REMOVAL OF DEBRIS:

The contractor shall remove from the job site all debris and waste material that is produced by his operations and shall leave the grounds and work areas in a clean and orderly condition.

TECHNICAL SPECIFICATIONS

SECTION 2

LAWN MOWING AND EDGING

TS 2-01 CUTTING:

a. All grass within the designated area shall be cut to a height in keeping with the standard practice for the type of grass which predominates in the lawn and in accordance with the height determined by the Contracting Officer. Mowing will start _____ and continue through _____.

b. Sufficient labor and equipment shall be used so that the grass can be cut as required to maintain an acceptable

appearance, usually once per week, during the normal growing season.

c. Mowers shall be kept sharp and adjusted to the specified cutting height at all times. Skips in mowing, streaking of lawns, and dragging over grass without cutting shall be avoided.

d. The terms "lawn" or "grass" used in this contract shall be interpreted as meaning the irrigated ground cover whether weeds, grass, or a mixture of weeds and grass.

TS 2-02 EDGING:

a. Edging is defined as clipping back of grass and/or weeds growing horizontally over edges of walks, driveways, roadside curbs, shrub beds, or other places, where required to present a neat appearance.

b. Grass and/or weeds shall be clipped along all walks to a true and even line aprallel to and not more than 1 inch from edge, of walk, at intervals of time as required, not to exceed twice a month. Grass around each sprinkler head should be kept trimmed to prevent its interfering with water coming from the sprinkler. The contractor shall perform this even though he may not have a watering contract.

c. The ground areas around trees, shrubs, and vines that are bordered in grass will be edged once per month or as directed during the growing season, edging the sod along the same line as exists.

TS 2-03 GRASS CLIPPINGS:

a. Grass clippings shall be left on the lawn except where it is determined by the Contracting Officer or his authorized representative that they are unsightly or damaging the grass, in which case the contractor shall promptly remove the excessive clippings.

b. The contractor and/or operators shall be qualified lawn maintenance personnel.

TS 2-04 SPRINKLING (BY OTHERS):

The Government reserves the right to place or have

placed sprinkling equipment on lawns when it is deemed necessary, but will attempt to regulate sprinkling so as to keep clear of mowing operations. Sprinkling equipment so placed shall be moved by the contractor if interfering with proper mowing of grass and the presence of sprinkling or other equipment on lawns shall not constitute an excuse for improper mowing or trimming of lawns.

TECHNICAL SPECIFICATIONS

SECTION 3

LAWN SPRINKLING

TS 3-01 SPECIFIC AREAS TO SPRINKLE:

a. The contractor shall sprinkle all Calss A lawns, trees, shrubs, and vines lying within the boundaries of areas to be maintained as shown on the drawings and/or specified by the Contracting Officer.

TS 3-02 LIMITS OF SPRINKLING

a. Sprinkling of lawns should be carried out in such a manner as to afford the grass an environment that will be conducive to the development of a deep root system. Deeply rooted grasses have access to a larger feeding area and are better able to withstand adverse conditions. Frequent and light sprinkling of lawns encourage the development of a shallow root system, while thorough and less frequent sprinkling will favor the development of a deeper root system.

b. The contractor shall not allow any of the areas indicated to be sprinkled to dry out to such an extent as to retard growth or damage plant life or cause lawns to turn brown in color.

c. Sufficient water shall be applied to restore the moisture in the soil to a depth of 10 to 12 inches.

d. A sprinkling schedule shall be established based upon actual soil moisture requirements rather than a set period of time.

e. Under normal climatic conditions and on medium textured soils, one thorough watering per week during the warmer part of the year and once every two weeks during the cooler months will be adequate to maintain a healthy turf. The interval between irrigations will need to be shortened on the sandy soils and can be lengthened on the heavy soils.

f. The contractor shall not allow sprinkling equipment to stand in any one spot to such an extent as to cause over-watering.

g. Water will be furnished by the Government.

TS 3-03 CONSERVATION OF WATER:

a. Sprinkling equipment will be placed in such a manner as to water grass and plantings uniformly without wasting water through run-off.

b. The contractor shall maintain existing sprinkler systems in good reapir and operating condition at all times to insure uniform distribution of water over the entire lawn and other areas served by the sprinkler system. This maintenance is limited to repair or replacement of heads and risers. The contractor shall report to the Contracting Officer any malfunction of valves and distribution mains. This paragraph applies whether the contract is for Government watering or contractor watering.

TS 3-04 WATERING OF TREES, SHRUBS, AND VINES:

All trees, shrubs, and vines will be watered in conjunction with lawns and as specified.

TS 3-05 EQUIPMENT:

The contractor shall furnish all equipment of sufficient capacity to properly water all areas as indicated, using such water outlets as are presently available.

TS 3-06 CARE OF GOVERNMENT PROPERTY:

a. Water for sprinkling will be drawn only from available hose bibs or stand pipes.

b. The contractor shall be held responsible for any

damage to plants, lawns, or buildings caused by careless handling of sprinkling equipment.

c. Sprinklers shall not be set in such a position as to throw water into doorways, windows, porches, parked cars, parking areas or to impede vehicular and/or pedestrian traffic.

TS 3-07 COORDINATION WITH LAWN MOWING:

Lawns will be systematically watered in such a manner as to cover the area and move equipment between lawn mowing operations.

TECHNICAL SPECIFICATIONS

SECTION 4

FERTILIZING, MAINTENANCE OF PLANTINGS, AND CLEANUP

TS 4-01 FERTILIZING:

a. Lawns: Commercial fertilizer shall be uniformly applied to all lawn areas during periods specified (months or season). The rate of application shall be 1 1/2 pounds of available nitrogen per 1000 square feet. Apply a fertilizer having an analysis of 15-5-10. Some of the commercial fertilizers are very subject to burning of foliage so care must be exercised to prevent this damage. Fertilizer should be applied when the foliage is dry. The area shall be thoroughly watered immediately after fertilizing in order to prevent burning.

b. Trees, shrubs and other ground cover: Under average conditions it is not necessary to fertilize trees and shrubs. There may exist special cases where trees and shrubs will need a fertilizer application. This should be arranged with the contractor by the contracting officer or his representative.

TS 4-02 MAINTENANCE OF TREES, SHRUBS AND VINES:

a. Weeding: Weeding shall be performed by using a hoe or similar tool and in such a manner as to avoid disturbing the plant roots. Weeding shall be accomplished sufficiently frequent to provide a neat appearance at all times. Even though weeds may not be present in the shrub

beds, the soil should be worked sufficiently to break the crust to allow for better water and air penetration into the soil. Chemicals may be employed in controlling weeds in tree and shrub beds. Only authorized herbicides will be used by properly trained personnel for weed control around trees and shrubs.

b. Debris removal: All grass and weeds will be shaken free of as much soil as practical, and with rocks and other debris removed from the property.

c. Pruning: Pruning of large trees is not a part of this contract. Small trees and shrubs will be pruned sufficiently frequent to prevent them from becoming overgrown and to keep them attractive and natural in appearance. They shall not be permitted to grow up in front of windows, over entrance ways or walks or high enough adjacent to streets to obstruct vision at intersections.

d. Spraying: Spraying to control insects and diseases will be accomplished as needed. Only authorized insecticides and/or fungicides will be used.

e. Watering: Water shall be applied in conjunction with lawns, and as directed on other plantings outside of lawn areas, to maintain them in a healthy growing condition.

TS 4-03 MAINTENANCE OF NATIVE VEGETATION:

a. Mowing: The mowing of native vegetation on non-lawn areas, as shown on the drawing, should be accomplished as frequently as necessary to maintain a neat appearance and to reduce the fire hazard. The minimum number of mowings or weedings shall be once each month during the months specified such as March, June, etc. Cut grass shall be chopped up fine enough to form a mulch or removed from the premises.

b. Edging: Grass and/or weeds shall be clipped along all walks and structures at least once each month during the months specified by the contracting officer.

c. Grass and Weeds in Fence Rows: Weeds growing in the fence row and for a distance of at least one foot on each side of the fence shall be controlled by cutting or by the use of an approved herbicide. Vegetation more than

4 inches tall shall be removed from the fence. Dead and bleached vegetation that presents an untidy appearance shall be removed from the fence row.

TS 4-04 CLEANUP:

a. All of the grounds including walks, lawn, tree and shrub plantings and other areas shown on the drawings will be kept free of vegetal debris whether or not generated in the process of maintenance of grounds.

b. Sweeping: Lawn clippings, pruned material and other refuse generated through grounds maintenance operations shall be swept up or otherwise removed from all surfaces before the contractor leaves the installation.

c. Disposal of debris:

The disposal of all debris which is created under this contract is the responsibility of the contractor. In no case will piles of debris be left on the property.

d. Equipment: All equipment, when not in use, shall be neatly stored in inconspicuous places, and as directed.

TS 4-05 SAFETY:

All operations shall be conducted in a safe manner at all times with particular attention to placement of hose and other equipment across roads and walks.

TECHNICAL SPECIFICATIONS

SECTION 5

LAWN WEED SPRAYING

TS 5-01 SPECIFIC AREAS TO SPRAY:

The contractor shall spray with chemical, as specified, all lawn areas and all grass and weed areas shown on the drawing.

TS 5-02 TIME OF SPRAYING:

a. The contractor shall start and complete lawn weed spraying,as specified, during the period 1 May to 1 July, inclusive.

b. Spraying shall not be done during or within three hours prior to a rain or during windy weather. Do not apply weed control chemicals when temperature exceeds 85° F. Spraying accomplished within three hours prior to a rain shall be repeated, if necessary, in the opinion of the Contracting Officer. Spraying shall not be done under conditions not in keeping with standard practice. In the event weather conditions as determined by the Contracting Officer are such that the work cannot be accomplished, the date of completion may be extended.

TS 5-03 SPRAY DAMAGE:

a. The contractor shall employ operators with sufficient experience to know and observe the precautions necessary for the proper handling and application of weed control chemicals in order that damage to trees, shrubs and flowers may be kept at a minimum. All personnel involved in applying weed control chemicals on this project shall possess a valid license as required by the State of Washington Department of Agriculture.

b. In order to minimize drift of the weed spray material, the sprayer shall be equipped with nozzles having an orifice of sufficient size to produce a coarse spray. The spray pressure used shall not exceed 35 pounds per square inch at the nozzles.

c. The contractor shall be held responsible for permanent damage to plants caused by faulty equipment or careless operation.

d. The use and application of the 2,4-D and 2,4,5-TP spray materials shall conform to the enacted laws regulating the use of these herbicides.

TS 5-04 SPRAY MIXTURE AND COVERAGE:

a. A spray mixture of one (1) quart of 2,4-D amine and three-fourths (3/4) quart of 2,4,5-TP shall be applied in a minimum of 50 gallons of water per acre. The above rates are based on materials that contain an acid equivalent (active ingredient) of four (4) pounds per gallon of the commercial product. A small amount of spreader-sticker agent that is compatible to both the 2,4-D and 2,4,5-TP shall be added to the spray mixture.

b. Spray mixture shall be applied as a coarse spray so as to wet completely the foliage of all weeds in the areas as specified without excessive run-off or wetting the soil.

TS 5-05 OPERATIONS:

The contractor shall provide adequate equipment approved by the Contracting Officer, and adequate labor so as to complete a maximum coverage during favorable weather conditions.

TS 5-06 DRAWING OF WATER:

a. Water for spraying operations will be drawn only from available hose bibs or 2" or 2 1/2" standpipes.

b. Any damage to hydrants or water mains incurred in the process of drawing water will be paid for by the contractor.

Lawns and Sports Turf in Europe[1]

John R. Escritt[2]

INTRODUCTION

As in the United States, lawns (both domestic and public) are very important in Great Britain. In Europe generally lawns round public buildings are important but domestic lawns have not been so highly regarded and even now good lawns (as we understand them) tend to be a status sumbol for the more wealthy types. Commerce is very interested in domestic lawn owners who form a very useful market in Britain particularly but they have received little help from disinterested sources. The Institute at Bingley, which has for so long been the only place in Europe concerned with turf for amenity purposes, has

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Director, The Sports Turf Research Institute, Bingley, Yorkshire, ENGLAND.

relied for its funds on members subscriptions. Sports organizations and golf clubs rather than lawn owners, being mainly responsible for its upkeep, have naturally received most attention. An important characteristic of British lawn owners (and indeed all British turf users) is that once the turf is established they regard it as being there forever and reconstruction or re-establishment with better grasses is not contemplated lightly!

Apart from domestic and public lawns we at Bingley are concerned in Britain with turf for bowling greens (crown and flat), cricket tables and outfields, tennis courts, croquet lawns, golf courses, race courses, public parks, polo grounds, pitches for hockey, soccer and rugby (both Rugby Union and Rugby League). On the Continent we are mainly called in to advise on golf courses but occasionally for playing fields, tennis courts, race courses, etc.

It is very interesting to note that in the U.S.A. and in Europe those responsible for golf courses have been the first to appreciate the need for informed technical advice.

Climate

In Britain the highest annual rainfall of 102 in. occurs in the Lake District and the lowest (20.8 in.) in the east, the Isle of Ely. The average for England and Wales is about 36 in. with a variation from 30-44 in. At Bingley our average rainfall is just over 34 in. Sunshine averages vary from 926 hours in the north of Scotland to 1840 hours in the Isle of Wight. Our coldest months are January and February and our warmest July and August. The lowest monthly average temperature of 35.8° F. was recorded at Dumfries in Scotland in February and the highest of 64.4° F. at Southend in August.

Over the Continent of Europe there is, of course, considerable variation. On the Mediterranean coast there is only 10-20 in. of rainfall, all falling in autumn and winter, while on the western European coast there is often 60 in. per year. On the Mediterranean coast mean temperatures in July are 70-80° F. but in Scandinavia only 50° F. Berlin is one of the coldest places we go to with a mean January temperature of 30° F.

The main practical problems are related to climate - in Britain drainage undoubtedly causes most difficulty, in Southern Europe it is watering and disease and in North

and East Europe winter hardiness figures prominently. Incidentally, in Norway and Sweden most sports played on turf cease for the winter while in Southern Europe very warm summers mean that there may be more play in the winter.

Soil Types

The predominant soil type of Europe appears to be podsolic in character but this includes the brown earths which are differentiated from podsols by a higher base status and brown coloration without stratification; they are formed on more basic rocks under deciduous forests and lower precipitation than podsols. The effect of parent material is most strong in Scandinavia, Great Britain, Iceland and where loess deposits occur. Climatic zoning is most predominant in the classification of Russian soils with which we are not familiar.

In Great Britain one might say that in the south and east brown earths predominate and in the north and west, podsols. Soil profiles undisturbed by man are rather rare in a country with so much history as Great Britain. In practical terms regarding playing field construction one can say that the majority of sports areas have to be constructed on heavy loam or clay soils with only moderate drainage characteristics. Sandy soils are comparatively rare and confined mainly to the coast. Sub-soil drainage can be less of a problem in limestone areas.

In France we meet fairly similar soils - podsolic soils in Brittany, around Paris and in the Vosges; brown earths in Alsace, Lorraine and the Midi; calcareous soils of the Champagne and Burgundy country and in the southwest; Red Mediterranean soils, etc. In Holland we meet Estuarine soils, brown earths and podsols. A full European picture is beyond the compass of this paper.

Standards Required

No one has yet perfected a statistical method of turf assessment for reporting or other purposes. With all sports turf areas the true emphasis is invariably on the quality of the surface and, although basic requirements for long, healthy life are common to all, each sport has special requirements from the turf surface. For tennis an important requirement is a true bounce, for bowls a

true run for the wood, for cricket an unyielding surface giving adequate bounce; golfers seem to require a surface that will hold a pitch shot and then prove fast and true for putting. All sports require smooth surfaces and except for golf and crown bowls, undulating surfaces are not appreciated. The Institute has always concerned itself with the basic requirement to produce suitable playing surfaces.

It is perhaps worth repeating that it is the quality of the surface which is considered important to sport - not the nature or kind of grass. During trials at Bingley with "air houses" for protecting football pitches in winter a soccer representative who saw the trial during severe winter weather described the conditions under the "air house" as perfect for soccer even though (because of shortage of light in the trial area) there was no grass left. The famous tennis courts at Wimbledon contain a large proportion of annual meadowgrass.

Non-Grass Playing Areas

Om Britain we have an increasing population with a greater proportion of leisure time so that more demands are made on existing sports areas at the same time as higher standards of quality are being demanded. Scarcity and high cost of land near population centers is causing increasing interest in non-grass playing surfaces of the water-bound kind e.g. crushed granite with clay as binder on a porous foundation of gravel or clinker ash. Such surfaces will stand very heavy wear but are not suitable for many team games - hockey being a major exception. Non-grass tennis courts of fairly similar construction or of tarmacadam or bitumen have been common for many years, of course, particularly in areas other than the south and southeast of England since, except in those areas, weather commonly reduces use of grass courts considerably. An attractive new type of tennis court is made of a special porous concrete, sufficiently porous for water poured out of a bucket to disappear immediately.

A few years ago practically the only athletic tracks available in Great Britain were those marked out on turf which at other times was in use for sports pitches. There were very few non-grass "cinder" tracks which were highly regarded. A great deal of publicity on the subject resulted in many local authorities producing "cinder"

tracks as status symbols and not all of them were justified. Gradually the emphasis has passed away from plain, ordinary "cinder" tracks to newer types of surfacing and now there is considerable interest in several kinds of costly material which are of a rubbery consistency and which are produced or capable of being produced commercially.

The increasing attention to non-grass surfaces (not forgetting the "carpet" lawn) may mean markedly more use of these and less use of turf in the future.

Reverting to the subject of assessment of the quality of playing provisions I draw attention to the difficulties inherent in comparing results of treatments in various parts of the world. Nearer home, it is difficult to explain to ruling bodies why one area is able to run playing fields cheaper and give them more use than another area since, apart from differing climatic conditions, particularly rainfall (from 20-60 in. per annum in "normal" areas of Britain), we find that the playing conditions satisfying one area may be entirely unacceptable in another. Clearly it is even more difficult to relate findings in different parts of the world to each other.

Construction of New Playing Fields and Sports Grounds

Procedures

There are in Great Britain a considerable number of specialist sports ground contractors - there are less in the European countries but enough apparently to form a European Association of Landscape Contractor, which in 1969 has its annual congress in London. Quite often clients just ask contractors to produce them sports grounds - and the results are often unsatisfactory. Most new playing fields these days are purchased with public money e.g. school playing fields and here the preferred procedure of having properly drawn up specifications for which competitive tenders can be obtained is normally followed. Unfortunately, good specifications and careful supervision are not always forthcoming so that in Britain (as in other parts of the world) a goodly porportion of new pitches are not as good as they might be. The most common fault is over-compaction of topsoil and subsoil in wet condition. The Institute has tried to help

by cooperating with the Department of Education and Science and with the National Playing Fields Association in producing two separate booklets on Specifications. We at Bingley are very frequently employed as technical consultants to architects and engineers in charge of playing field construction and for them we get out draft specifications and drainage plans. There are certain weaknesses in this procedure and, in attempts to raise standards (and improve our own finances), we take over a limited number of projects ourselves, functioning as architects in charge in return for remuneration on a percentage basis.

Types of Site

In Great Britain some very odd sites are pressed into service for sports grounds. We have helped make playing fields in worked out stone or sand quarries, on the shale tips from coal mines and on low lying land which has been filled with household refuse. Even in "natural" areas a typical position is that all the good land is used for building houses and the most difficult area left for a school and its playing field. It is then found that because of the situation of the access or the proximity of services or even because parts of the site are affected by underground workings only one spot is possible for the school building and the playing areas have what is left, no matter how unattractive.

Grading

On most sites there is a need for major grading work to produce levels which are acceptable for modern requirements. This usually means slopes of 1 in 50 to 1 in 100 for football pitches and all general sports areas but rather nearer to level for cricket pitches and tennis courts. Flat bowling greens (42 yards square) are made to standards of + 1/4 in. After topsoil removal major grading is normally done on the cut and fill principle although occasionally special circumstances make grading by importing fill a better proposition.

Drainage

Porous carpets of clinker ash or gravel for drainage are generally restricted to special areas. Bowling greens usually have such a layer, cricket tables and tennis

courts quite frequently, other sports areas only rarely except in Northern Ireland. A belief that such layers make drains unnecessary has died slowly although it is easy to show, as we have at Bingley, that 6 in. layers only take about 1 1/2 in. of rain after which the water rises into the topsoil.

On the majority of normal sites topsoil spreading is followed by intensive subsoil cultivation and pipe drains are introduced afterwards. In the past junctions of laterals and main drains have been found to be unsatisfactory on a great many sites and nowadays purpose made angle junctions are becoming standard. Plastic pipes are now available but have not as yet been extensively used in playing fields in Britain.

Seedbed Preparation

The cost of playing field construction at 1,000 - 1,200 per acre is regarded as very high and so the extra cost of soil amelioration with sand (at about 1/ton) and peat 4. - 8/ton) is not readily accepted except on special areas such as bowling greens, etc. or in particularly difficult situations where occasionally we have been able to get as much as 200 tons sand and 10 tons peat per acre for playing fields. In fact, there seems to be an increasing realization that this kind of expenditure can be justified in terms of successful results. Sand and peat are not used for cricket tables and in fact on the rare sandy sites encountered heavy loam soil is sometimes imported for these. Fertilizer treatment is commonly something straightforward e.g. an agricultural granular fertilizer containing: -

10% nitrogen
15% phosphate
10% potash

at the rate of 4-6 cwt. per acre.

Strangely enough a major obstacle to good playing field production is always that of ensuring adequate topsoil cultivation with, where possible, a fallowing period.

Grass seeds

Mixtures of grass seed are normally used and in choos-

ing them due regard has to be made to the tolerance of the grass chosen to the height of cut the game requires:

bowls	2/16th in. - 3/16th in.
tennis	1/4 in.
cricket table	3/16th in. - 4/16th in.
cricket outfield	1/2 in. - 3/4 in.
hockey	1/2 in. - 1 in.
soccer	1 in.
rugger	2 in.
horse racing	3 in. plus
domestic lawns, variable	No. 1 lawns, 3/16 in. - 4/16 in. No. 2 lawns, 1/2 in. or more

For fine turf mixtures it is usual to use:

8 parts Chewings fescue (Festuca rubra ssp. commutata)) 1 oz./
2 parts browntop bent (Agrostis tenuis))sq. yd.

Creeping bent (Agrostis stolonifera) is practically never used in Great Britain, possibly because of its propensity to run to mat or thatch.

For medium mixtures:

2 parts Chewings fescue (Festuca rubra ssp. commutata)
2 parts Creeping red fescue (Festuca rubra ssp. rubra)
2 parts Crested dogstail (Cynosurus cristatus)
2 parts rough-stalked meadowgrass (Poa trivialis)
2 parts browntop bent (Agrostis tenuis)

Unfortunately, commercial supplies of crested dogstail and rough-stalked meadowgrass seem to have lost their persistency and a good smooth-stalked meadowgrass is substituted to give a mixture such as:

3 parts Chewings fescue (Festuca rubra ssp. commutata)
3 parts Creeping red fescue (Festuca rubra ssp. rubra)
2 parts smooth-stalked meadowgrass (Poa pratensis)
2 parts browntop bent (Agrostis tenuis)

for use at 1 oz. per sq. yd.

Turf for general purposes:

35 lb. Perennial ryegrass (Lolium perenne)

28 lb.	Chewings fescue (Festuca rubra ssp. commutata)
28 lb.	Creeping red fescue (Festuca rubra ssp. rubra)
14 lb.	Smooth-stalked meadowgrass (Poa pratensis)
7 lb.	Browntop bent (Agrostis tenuis)
112 lb.	

for use at 1 1/2 cwt. per acre (1/2 oz. per sq. yd.).

In addition to the grasses mentioned, some use is made of sheeps fescue (Festuca ovina), hard fescue (Festuca longifolia) and fine-leafed sheeps fescue (Festuca capillata (F. tenuifolia)).

At Bingley we have been doing trials with tall fescue (Festuca arundinacea) for race courses but have been a little disappointed. Establishment has been only moderate and at 2 in. height of cut persistency only moderate. At 4 in. height of cut persistency has been better but the stiffness of straw hoped for is not very marked under our conditions.

Good named varieties are being increasingly demanded where available but there is still a considerable trade in very ordinary seed. At the present time grass seed sold in Britain is not subject to the Seeds Act which covers all agricultural seed and which demands inter alia disclosure of the contents of seeds mixtures. Changes in the law are possible and some firms do disclose the contents of their mixtures of which they may list 6 to 12 with different priced mixtures for each of several purposes. In this connection an extensive trial we did at Bingley some time ago is of interest. We designed a trial to answer the question "If there is insufficient money to buy the appropriate rate of a good mixture, is it better to use a lower rate of the good mixture or the full rate of a cheaper mixture?" The answer came out as the lower rate of the good mixture.

Turfing

Until recently we have had no specialist growers of turf in Britain and even now there are very few - perhaps four or five - working in a small way. There are, of course, people who deal in turf - people who acquire existing turf from chalk downs, from near moorland, from old pastures or from sea marshes on certain areas of the coast.

There is a tradition that bowling greens should be laid with sea marsh turf. This is probably due to effective sales promotion in the past coupled with certain attractive characteristics of the material. The turf contains fine grasses (a blend of creeping red fescue and creeping bent) and because of the earth in which it grows (a stone free fine sand or silt) it is easy to cut and lay uniformly so that a newly made bowling green is soon ready for first class use. The area from which the turf is taken is left to natural regeneration, possibly with some help from fertilizer and/or overseeding with hand collected seed from the marshes. The turf laid on the bowling green deteriorates in composition fairly rapidly and usually after about five years it is mainly annual meadowgrass. Nowadays bowling greens are sometimes produced from inaldn turf or by sowing grass seed but the old tradition dies hard. Incidentally, our main trouble with Dollar spot is on the fescue of bowling greens of sea marsh origin.

Cricket tables (typically 30 yards square) are most commonly produced from inaldn turf supplied to an "approved" quality which means that the client accepts the best that turns up locally. He looks for a preponderance of fine grasses growing in heavy soil without weeds or too much fibre, since cricket is played almost directly on earth.

New tennis courts may be turfed but are probably produced from seed more often - if only because of the difference in cost.

After Care of New Turf Areas

It has become increasingly realized in recent years that turf newly established from seed needs generous amounts of nitrogenous fertilizer. On extensive areas this may take the form of 3 or 4 dressings of sulphate of ammonia or high nitrogen granular complete fertilizer in the first year. On finer areas mixtures of sulphate of ammonia with dried blood and hoof and horn meal are generally used. Other practical requirements are of course regular mowing and appropriate top-dressing of bowling greens, tennis courts and cricket tables to produce smooth surfaces - these are not always easy to arrange because owners do not seem to appreciate that they need ground staff before they are using the ground!

Management

Production of Suitable Surfaces

The standard items of turf maintenance have to be considered in relation to the kind of surface required.

Mowing

Heights of cut for different sports have been referred to elsewhere. Particular reference is now made to problem situations. Most bowls clubs seem to want a height of cut of about 1/16th in. and we have to persuade them that regular cutting at 2/16th in. (or even 3/16th in.) is better for them in the long run since no grass performs satisfactorily at 1/16th in. while on the other hand, turf mown frequently at 3/16th in. and kept sufficiently free of surface fibre can be really fast.

Cricket tables are commonly mown at 3/16th in. regularly but individual wickets when prepared for use are mown down to 1/16th in. or less.

Hockey pitches are a special worry. Here we have a vigorous winter game and the players of first class hockey want a surface comparable to a flat bowling green or golf green. Their requirements suggest a fescue/bent mixture cut at no more than 1/2 in. but maintaining a pure sward is not easy. Things are made a lot easier if a longer height of cut of 1 in. can be used thus permitting the use of perennial ryegrass.

Top-Dressing

For bowling greens we need surface conditions similar to those on a good golf green so that the top-dressing used to produce a smooth resilient surface is fairly similar. Unfortunately, few bowling clubs have facilities for producing compost heaps and so they commonly use mixtures such as:

4 parts light loam soil
3 parts gritty lime free sand
1 part granulated peat

at the rate of up to 7 lb./sq. yd. each autumn.

Cricket tables need a surface which will bind well

together when rolled heavily and which will (when the weather allows it to dry) cause the cricket ball to bounce satisfactorily high to a consistent pattern. Top-dressing is carried out at the end of each cricket season with a clay loam soil at 3 - 7 lb. per sq. yd. During the cricket season holes made at wicket ends are filled up with similar soil and rolled out firmly. Very popular in the past for top-dressing cricket tables was pure marl, a calcareous clay. The layering produced difficulties and marl nowadays is used mainly to mix with soils which otherwise have insufficient bind.

The occasional lightly used private tennis court may be top-dressed on the same lines as a bowling green or golf green, but the majority are top-dressed with a heavy loam as for cricket tables.

Winter playing pitches are commonly top-dressed with gritty lime free sand only 'as required' i.e. dressings of sand are applied to low or wet areas during the playing season and, on such areas, surface disturbance carried out by play seems to prevent layering: during renovations at the end of the season 20-50 tons of sand per pitch may be worked into the surface, and sandy soil used for adjusting levels. There are no special specifications for sand - it is a question of using the best available and on winter pitches care has to be taken to avoid large, sharp particles which would damage players knees when they fall to the ground.

Scarification

In Britain surface fibre is generally regarded unfavorably. Whilst some degree of fibre formation and the resiliency it confers is desirable for golf and bowling greens, complaints of slowness etc. soon arise if it is not kept strictly under control. Tennis courts want practically no surface fibre and cricket tables a negative quantity. The different types of rotary scarifier are now widely used but much work is still done laboriously by wire rakes. A wire rake for attachment to the mower is proving useful in reducing formation of excess fibre from procumbent growth, but it is not much use in dealing with an existing problem. Cricket outfields (i.e. those used only for cricket) and lightly used club hockey pitches sometimes become too fibrous, but there is generally little trouble on winter pitches and other extensive areas.

Rolling

Here we have a most argumentative subject. It is widely accepted that rolling soon produced problems with drainage and root development but, if the game requires a rolled surface, then a rolled surface it is.

The most difficult situation arises with cricket tables. Here the requirement is generally believed to be a surface with properties when dry approaching those of concrete. Unfortunately, the British summer climate is not too reliable and a heavily rolled wicket can prove to be a liability. As regards first class cricket there is a feeling abroad that wickets are not what they used to be but it is perhaps significant that in a good summer there are few complaints about wickets. First class cricket (normally played over three days) makes more severe demands than does club cricket played for 1/2 - 1 day, but differences are of degree rather than kind.

Because of the number of variables including the variations in soil moisture when rolling is actually carried out, preparations of cricket wickets has not been put on a scientific basis although the Soil Science Unit of the University College of Wales at Aberystwyth is currently doing research on the subject. At present the conversion of suitable turf into a cricket wicket is entirely a matter of the groundsman's skill and judgement: he commences rolling each year in suitable weather at the beginning of March using a light roller (say 10 cwt.) at intervals to get a general firmness and after a few weeks he rolls the whole table with a heavier roller to get the area more or less ready for use. Then as individual wickets are required he mows right down, scarifies until very little grass is left, remows and then rolls down firmly (using water if necessary).

Tennis courts are not treated anything like so severely, but they do receive a fair amount of rolling.

Bowling greens are normally rolled down once in the spring with a 5 cwt. garden roller or similar to firm up after any winter upheavals and may then receive a further light roll once a month.

Winter pitches create problems. After a game in wet conditions the surface is cut up to varying degrees.

Restoration is necessary to prepare for the next match and to prevent the ground freezing into a rough and dangerous condition. Attempts are made to restore by hand tools or harrows but some rolling does become neccesary and it is generally understood that the roller used should be the lightest which will do what is necessary. Once again hockey proves particularly difficult because of its special requirement for a smooth surface. So we want fine grass, mown short, well rolled, and capable of being used even after heavy rain and, of course, continuing forever to produce a complete unbroken turf!

Aeration

The word "aeration" is generally accepted to describe the various forking and spiking treatments carried out on turf, though very often the real importance lies in aiding elimination of surface wetness.

Hollow tine forking is used to some extent since it offers the best means of reducing compaction and increasing root development. Golf greens and bowling greens may be so treated once every three or four years although the frequency has been increased to once a year on heavily used municipal golf greens. It has been found that hollow tining facilitates invasion by annual meadowgrass and weeds such as pearlwort (Sagina procumbens).

Hollow tining is never (or extremely rarely) used on cricket tables and tennis courts because it tends to encourage surface breakdown. On large areas of winter pitches etc. absence of good tackle and practical difficulties with cores make hollow tining a very rare operation indeed.

Forking with solid tines is very extensively used and there is a wide range of equipment available - hand tools, self-powered equipment and tractor mounted or tractor-drawn machines.

In practice fine turf areas are pierced only about once a year, but there is encouraging recognition that this is insufficient. Winter pitches, on the other hand, are frequently spiked once a week particularly during the playing season.

It will be seen that heavily rolled cricket tables are

quite a problem; at the end of the playing season they are really compacted and sealed up. Hollow tining is not acceptable because of probable surface breakdown in the following season and spiking machines don't penetrate very well. Usually it comes down to hand solid tine forking and this is so laborious that it is an achievement to get it done once a year in the autumn. Spiking machines may be run over the table several times, but the penetration they achieve is of marginal benefit.

Other Treatments

Normal types of turf treatment which have received considerable technical attention over the years have been deliberately left until the end - it is so easy to give them undue prominence.

Fertilizer.--Fertilizer treatments for winter pitches are generally based on granular agricultural fertilizers, formulations being used according to soil tests, user requirements and general judgement of the situation. Fertilizer treatment for fine turf areas is generally on the lines of those described for golf greens but there is a strong and very firmly held belief among practical men in autumn and winter feeds with slow acting organics, particularly for cricket tables. Proprietary products containing bone meal and dried sewage as principle ingredients are therefore widely used.

Weed Control.--Most weed problems can be dealt with by one of the many proprietary weed killers containing 2,4-D and CMPP, provided that suitable weather conditions occur at a time when treatment is not forbidden by user requirements or by the presence of seedling grasses introduced during renovation. An example of the sort of difficulty is that experienced in controlling knotweed (Polygonum aviculare) on professional soccer pitches. Play goes on until May and practice starts in August. With great attention to duty a groundsman can get a possibly 50% bare pitch renovated by the end of May at which time the knotweed is not showing. Young grass does not like selective weed killer so the groundsman must wait until at least the end of July when the weather isn't always reliable. He doesn't want discolored turf when the season starts and, if he doesn't eliminate knotweed, he finds that it disappears early in the winter leaving a very thin open turf.

As on golf greens the presence of even a very little moss is regarded as of great consequence and proprietary mercurised moss killers are soon called upon. Nevertheless, cure is seldom permanent unless the cause is found and dealt with.

Pest Control.--The main pest of sports turf is the earthworm. In Britain there are some 25 species, but only two of them produce surface casts which spoil the surface and interfere with play. There are still many discussions on the place of the earthworm which no doubt does good (e.g. in facilitating drainage) as well as harm but it is generally accepted that sports turf is better without earthworms. Chlordane (12-16 lb./ai per acre) has now superseded lead arsenate as the most commonly used specific, but it is not much used on large areas because of cost and there is therefore considerable reliance on discouraging earthworms by management.

Of the occasional pests reference might be made to the mole (Talpa europaea) which is abundant in England, Scotland, and Wales but absent from Ireland. The burrowing habit of the mole results in the formation of tunnel-like runs and molehills which are decidedly unacceptable. Moles feed largely on earthworms so that they do not figure too frequently as a problem of sports turf but in years when weather favors earthworm breeding moles can be a severe pest. Poisoned bait in the form of strychnine-treated earthworms seems to be the most satisfactory means of attack.

Disease Control.--The most serious disease of turf in Great Britain is Fusarium patch (Fusarium nivale). It occurs quite frequently, chiefly in spring and autumn, and can be most damaging. It affects mainly intensively cultivated areas such as bowling greens, golf greens, tennis courts, cricket tables and fine lawns, especially if annual meadowgrass is present. Treatment of affected turf is usually with organic or inorganic mercury products. Fusarium also occurs on similar turf in most western European countries. On less intensively cultivated areas of larger size Fusarium is less prevalent and damaging and, having regard to costs, is often left untreated.

Corticium disease (Corticium fuciforme) is of quite widespread occurrence (mainly in summer) on most types of turf (especially if containing fescues) but is seldom

serious. Often it is left untreated but sometimes a dressing of nitrogenous fertilizer is used to cause it to disappear. Only rarely is fungicide (inorganic mercury) used.

Ophiobolus disease (Ophiobolus graminis var. avenae) is growing increasingly important. Typically, severe attacks occur on acid bent turf in wet situations when it is limed so that most trouble has been experienced in the northwest of England. The disease is, however, a little more common than this description suggests. Treatment usually involves improving surface dryness, lowering surface pH and possibly treatment repeatedly with organic mercury fungicide at double the rate used for Fusarium - if this is economically feasible.

Dollar spot disease (Sclerotinia homeocarpa) is comparatively rare in Britain, its incidence being restricted to strains of creeping red fescue of sea marsh origin. It has been noted rarely on seaside golf courses but is quite common on sea marshes from which bowling green turf is obtained and on bowling greens made with such turf. Treatment involves use of nitrogenous fertilizer and/or inorganic or organic mercury fungicide. Cadmium fungicides are not available in Great Britain. Dollar spot is an important disease in the south or Europe where it attacks creeping bent seriously. Cadmium fungicides are there readily available and some American fungicides such as Ortho are to be obtained.

Fairy rings of various types cause a good deal of concern and simple but effective treatments would be very welcome.

As with many turf troubles, control treatment for fungal afflictions is often restricted to intensively managed areas because of shortage of money and of man-hours. Even on fine turf areas the necessity to treat with fungicide carries some odor of management failure and groundsmen are not too pleased if they are forced to treat with fungicide even only once or twice a year!

New Fungicides for Control of Fusarium Patch[1]

C. J. Gould[2]

Experiments were continued on the control of Fusarium Patch with new fungicides in cooperation with Dr. Roy L. Goss, Agronomist, and Mr. V. L. Miller, Chemist, at the Western Washington Research and Extension Center. The procedures and results are given below.

Procedure: Highland bent sod raised by Dr. Goss was transplanted to Plant Pathology plots in spring of 1967. The area was surrounded by a high canvas fence to decrease air movement. It also was covered, when necessary, with 50% saran shade cloth to increase the relative humidity at grass level. Urea or ammonium nitrate was applied as needed. Mowing height was 1/4" until 10/17/67, then 3/8". Fungicides were applied seven times at 3-week intervals: 9/19, 10/10, 10/31, 11/21, and 12/12 in 1967 and 1/3 and 1/24 in 1968.

The fungicides and rates tested were: PMAS (1.5 oz. in 5 and 10 gal. water), Calo-Clor (2 oz.), Calo-Gran (64 oz. dry), WSU mercury + cadmium mixture, Merck's TBZ (Mertect 160 @ 500, 1000 and 2000 ppm), Merck S-6 (500 ppm), Chemagro's BAY 33172 (1000 & 2000 ppm), DuPont's 1991 (333 and 1000 ppm), Fore (8 oz.), Daconil 2787 (5 oz.), Chevron CS 2073 (6 oz.), Elanco 331 (3 and 6 oz.), sulfur (32 oz.), plus Fore and Daconil alternating with Calo-Clor, and sulfur alternating with PMAS.

Disease Development: The unusually hot dry summer of 1967 apparently inhibited the Fusarium since its development in the fall was much slower than average. Sufficient disease developed later to demonstrate differences in effectiveness between compounds but the disease did not become

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1 A report to the Research Committee, Northwest Turfgrass Association, at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Plant Pathologist, W.W.R.E.C., Washington State University, Puyallup, Washington.

truly epiphytotic until April, about three months after the last application (1/24/68).

Control of Fusarium: All treatments reduced the incidence of Fusarium Patch and most treatments showed reasonable residual activity. The standard fungicides (phenylmercuric acetate and inorganic mercuries) were usually effective. Both Fore and Daconil produced excellent dense disease-free turf. Since these compounds had also given results in 1966/67, they are now being recommended for trial use. The new group of benzimidazole fungicides (Merck's TBZ, DuPont's 1991 and Chemagro's 33172) appeared to have longer residual action than any other type. They will be retested during 1968/69 and, if again shown to be effective, will be recommended for use in the fall of 1969.

During 1967/68 this research was financed, in part, by the Northwest Turfgrass Association, Diamond Shamrock Company, Rohm & Haas Company, Mallinckrodt Chemical Works, Merck and Company, Chemagro Corporation, Eli Lilly & Company, and Chevron Chemical Company. To all these we express our appreciation, both for the financial assistance and donation of fungicides.

Research Report on Turf in Eastern Washington[1]

Alvin G. Law[2]

Research in eastern Washington on turf has been pointed toward defining the resistance to wear of different varieties of bluegrass. Tables 1 to 4 indicate some of the data collected in the last two seasons on this subject. Table 1 shows the effect of the artificial wear machine on the cover and density of turf of a number of bluegrass varieties. The wear machine developed by Dr. Goss and Professor Roberts was operated over the turf area 30 trips per day 5 days per week for a three-month period, June 1 through August 30. Following this period the percent bare soil was determined by visual estimates as was turf condition and color. It should be noted that the greatest

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1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Professor of Agronomy, Washington State University, Pullman, Washington.

damage occurred on Delta Kentucky bluegrass and the second greatest damage occurred on Newport. Based on the percent bare soil exposed by the wear machine, the least damage occurred on 0217 and on the dwarf types Merion, Cougar, and Nebraska Dwarf.

The following spring data were taken on the same plots on the amount of invasion by Poa annua and the density of the perennial turf and these are reported in Table 2. Examination of the varieties in Table 1 and Table 2 shows that even though considerable wear areas occurred on the components of Cougar, by the following spring the perennial grass had re-established itself in the area and there was a minimum establishment of Poa annua. Generally the dwarf varieties showed the greatest density of perennial grasses even though they had shown considerable wear injury the previous fall.

A summary of the root production of the bluegrass varieties in this same trial outside the wear area for the last three years is shown in Table 3. It should be pointed out that 0217 has maintained the highest level of production of roots throughout this experiment of any of the varieties. Differences between the Cougar components, and Merion are not great, however. The production of roots of Newport and Delta particularly in September after a full season of cutting at either one inch or 1/2 inch are quite low. This is merely another indication of the act of wear resistance of these two grasses compared to the dwarf types in this trial.

Table 4 shows some preliminary data obtained on the effects of Daconil 2787 on control of leaf rust and helminthosporium. These two leaf diseases occur naturally in turf in eastern Washington to a greater or lesser degree. When they began to appear in 1967 on the turf plots at Pullman, these plots were immediately treated with 4 oz. per 1000 sq. ft. active ingredient using the Daconil material. Data taken approximately a month after treatment showed excellent control of leaf rust in Merion. This disease can be extremely serious on Merion and other bluegrass varieties as well and results in production of off color nonvigorous turf. Helminthosporium, which is usually more serious on Cougar than on Merion, also was controlled to a fair extent with the single application of Daconil. These trials will be repeated to attempt to reproduce the results obtained.

Table 1. Effect of artificial wear machine on turf density and quality. 8-30-67.[1]

Variety	One-inch cut					1/2-inch cut				
		Wear		No wear			Wear		No wear	
	% bare soil	Turf cond.[2]	Color[2]	Turf cond.	Color	% bare soil	Turf. Cond.	Color	Turf Cond.	Color
602	15	4	2	1	1	17	3	2	1	1
0217	7	3	3	1	2	17	3	2	2	2
205	17	4	3	1	1	22	4	3	1	1
402	17	4	3	1	1	35	5	4	1	1
Merion	5	2	3	1	2	7	2	2	1	2
Newport	50	6	5	2	3	80	8	5	3	2
Delta	75	8	6	3	4	90	9	7	3	4
Cougar	15	4	3	1	1	30	4	3	1	1
Nebr. Dwarf	10	4	4	3	4	30	4	4	1	2

[1] Treatment started 6/1/67, completed 8/30/67; 30 trips per day 5 days per week.

[2] Rating scale based on 1 best condition, 9 poorest condition.

Table 2. Quality readings on turf varieties following one season of artificial wear. May 15, 1968.[1]

	1"				1/2"			
	Wear		No wear		Wear		No wear	
	Poa annua	Density	Poa annua	Density	Poa annua	Density	Poa annua	Density
602	1.5	2	1.0	1.0	2.5	2.5	1.0	1.0
0217	2.5	2.5	1.5	1.5	1.5	2.0	1.0	1.0
205	2.5	2.5	1.0	1.5	1.5	3.0	1.0	1.5
402	3.5	1.5	2.0	2.0	2.5	3.0	1.5	1.5
Merion	3.5	3.0	2.0	1.5	2.0	2.0	1.5	1.0
Newport	4.0	3.5	2.5	3.0	5.0	4.5	4.0	3.0
Delta	4.0	4.5	3.0	3.0	5.0	5.0	4.0	3.0
Cougar	1.0	2.0	1	1	1	3	1	2
Nebr. Dwarf	3.0	3.0	2	2	5	4	3	3

[1] Visual rating, 1 = best condition, 5 = poorest condition.

Table 3. Average root production in grams of bluegrass varieties cut at two heights and harvested at two dates.

Variety	1967				1966				1965				3 year average			
	1 inch cut		½ inch cut		1 inch cut		½ inch cut		1 inch cut		½ inch cut		1 inch cut		½ inch cut	
	June	Sept.	June	Sept.	June	Sept.	June	Sept.	June	Sept.	June	Sept.	June	Sept.	June	Sept.
0217	10.9	10.2	14.0	9.6	10.5	10.6	8.7	8.4	17.2	19.8	14.9	14.1	12.9	13.5	12.5	10.7
602	10.0	8.7	11.0	10.3	7.9	9.2	8.7	9.3	11.5	14.0	10.1	18.7	9.8	10.6	9.9	12.8
205	10.7	8.6	10.6	8.0	8.9	8.9	8.0	7.4	17.5	20.0	14.4	15.9	12.4	12.5	11.0	10.4
402	9.9	8.7	10.8	9.2	8.5	9.5	7.1	7.9	16.0	24.6	9.7	19.8	11.5	14.3	9.2	12.3
Merion	9.6	8.5	8.7	9.8	9.1	8.8	8.9	8.6	12.2	20.3	10.3	14.4	10.3	12.5	9.3	10.9
Newport	9.8	5.3	6.9	6.4	8.3	7.8	6.1	7.3	10.7	17.4	9.6	16.9	9.6	10.2	7.5	10.2
Delta	9.7	6.6	8.5	5.5	6.5	6.5	5.4	5.0	11.0	12.9	7.1	10.5	9.1	8.7	7.0	7.0
Mean	10.0	8.0	10.0	8.4	8.5	8.7	7.5	7.7	13.7	18.4	10.9	15.8	10.8	11.8	9.5	10.6
Cougar	10.2	8.3	7.5	7.7	8.5	8.8	8.1	9.3	14.9	20.6	5.8	9.2	11.2	12.6	7.1	8.7
Nebr. Blend	13.7	13.6	11.8	14.6	5.6	9.7	4.9	6.8	4.2	19.7	7.4	9.6	7.8	14.3	8.0	10.3

Yield in grams per plug (4" dia. x 6" deep).

Table 4. Effect of Daconil 2787 on diseases of bluegrass. Pullman, Washington. 1967.

Variety	Leaf Rust		Helminthosporium	
	Treated[1]	Control	Treated	Control
Cougar	1.0[2]	2.0	2.0	4.5
Merion	1.2	4.7	2.0	3.8

1 4 oz. per 1000 sq. ft.

2 1 = free of disease, 5 = severe disease.

Agronomy Research Report[1]

Dr. Roy L. Goss[2]

Essentially this paper will present only a brief summary of a few of the selected activities in the agronomic research program at the Western Washington Research and Extension Center and outlying research areas. Some of the projects included in the agronomy program are those that have been recommended by the research committee of the Northwest Turfgrass Association. Portions of several of the projects are being supported with financial assistance by way of grant-in-aid from the Northwest Turfgrass Association. Partial assistance in some projects is being given by certain commercial companies. The remainder of the research program and staff is supported by Washington State University.

1 Paper presented at the 22nd N. W. Turfgrass Conference, Alderbrook Inn, Union, Washington. September 25-27, 1968.

2 Associate Agronomist, W.W.R.E.C., Washington State University, Puyallup, Washington.

SOME FACTORS AFFECTING SOIL CALCIUM LEVELS

Soil calcium levels have shown a steady decline in putting green turf plots for the past several years. The decline was particularly noticeable in plots receiving the highest levels of nutrition, particularly nitrogen. In all plots receiving 20 pounds of available nitrogen per 1000 sq. ft. per year, the calcium levels averaged 500 to 1000 pounds per acre less than those receiving 12 pounds or 6 pounds of nitrogen per 1000 sq. ft. per year, respectively. This, of course, backs up the theory of the effect of acid-forming fertilizers, such as urea, on soil calcium.

Since we did not know what was happening to this soil calcium, a second sampling of the area was made, but at deeper zones. The initial sampling was from 0 to 6 inches and the second sampling was from 6 to 14 inches. An entirely different picture was obtained on the lower depths. There was virtually no difference between the calcium levels between the 12 and 6-pound rate of nitrogen applied and only a slightly reduced calcium level where the highest level of nitrogen was applied. Some of the plots had calcium levels as low as 100 to 150 pounds per acre in the 0 to 6-inch layer where high rates of nitrogen had been applied. In no case did the calcium level drop below 2000 pounds per acre in the 6 to 14-inch layer when used as a comparison.

The results of these tests at this time indicate that turfgrass managers should be descrete in the amount of irrigation water applied to prevent excessive leaching of calcium and should retest their soils frequently enough to keep a close check on calcium levels. When calcium levels become too low, there is usually a decrease in the pH level which can affect the uptake of other nutrients. If the calcium level is low, and you are using acid-reacting fertilizers, then light applications of lime on an annual basis on golf putting greens or high quality lawns would be in order.

SULPHUR INVESTIGATIONS

Sulphur continues to produce both interesting and significant effects on putting green turf. Some of these effects can be summarized as follows:

1. Color.--The grass color is significantly better in

plots receiving sulphur than those without. Deeper green is noted particularly on plots receiving 20 pounds of nitrogen per 1000 sq. ft. per season and becomes less noticeable on those receiving lesser amounts. Plots receiving 12 pounds of nitrogen still show significant response in color to added sulphur, whereas those receiving 6 pounds of nitrogen per 1000 sq. ft. per season show only a light response to sulphur. The check plot is inversely affected by sulphur. The check plot is greener in the strip not receiving sulphur. Perhaps the discussion of the effect of sulphur on algae may help clarify this in further discussion.

Plots previously exhibiting lighter green color where no phosphorus had been applied respond significantly to applications of sulphur. This would tend to indicate that trace amounts of sulphur are being obtained from phosphorus applications or that sulphur in some way can partially replace a need for phosphorus. These investigations are continuing to grow. Plots receiving sulphur produce over 33% as much clippings as those not receiving it. This should be registered as an undesirable factor rather than a desirable one; however, it is an index of the vigor of the plant. Both the vigor and density of the turf is greater where sulphur has been applied.

2. Scalping.--Due to the faster growth rate and greater vigor, some of the sulphur plots resulted in greater puffing and scalping when temperatures were higher. The usual factors of excessive moisture, excessive nitrogen, and heat that tend to help increase puffing, were accentuated in plots receiving sulphur. If puffing and scalping is to be avoided, it is suggested that the nitrogen level be reduced along with irrigation to the lowest acceptable levels during the period of the greatest heat stress.

3. The effects of sulphur on Poa annua.--A higher percentage of Poa annua has been reported in plots not receiving sulphur. It should not be construed that sulphur is acting as a herbicide on Poa annua, but perhaps that it increases the vigor and growth of bentgrasses, making it more difficult for Poa annua to become established. This is a noteworthy observation and merits additional investigations.

4. The effect of sulphur on black algae.--Sulphur rates have been applied on plots at the Research Center at the rate of 50, 100, and 150 pounds of elemental sulphur per

1000 sq. ft. per acre per season. All levels of sulphur have significantly reduced the occurrence of black algae (actually a bluegreen algae). The portions of the check plots not receiving sulphur are greener than the areas where sulphur was applied. Likewise, the no-sulphur area contains a vigorous population of black algae. Sulphur, in this case, may be acting as an algacide and the algae, in turn, may be releasing nitrogen for plant growth, thereby causing a darker green color. All of these factors are being pursued at this time.

A SUMMARY OF SPEEDWELL RESEARCH

Experiments for further testing of chemicals for the postemergence control of speedwell (Veronica filiformis) were initiated in early September and no plot report is available at this time. In addition to Dacthal, Balan and other preemergence herbicides are being investigated. Balan has shown some promise as preemergence control of speedwell in other areas and will be investigated for both preemergence and postemergence control here. Phytotoxicity studies of Balan at this time indicate that the highest rates recommended by the manufacturer (3 lbs A.I. per acre) have shown absolutely no burning when applied during the hottest part of the summer on Highland bentgrass turf. Additional information regarding its effects on speedwell will be available at a later date.

Dacthal continues to exhibit good postemergence control of speedwell when applied at the rate of 12 lbs A.I. per acre. Investigations are under way at this time to determine the mode of action of Dacthal in the control of speedwell. That is, whether it is root or foliar absorbed. This work will be conducted by the use of radioactive tracer technique in the greenhouse at the research station.

When using any of the preemergence herbicides, turfgrass managers should be careful to avoid mixtures with other phenoxy-type herbicides as well as other pesticides. At least a week or 10 days should be allowed after application of preemergence herbicides before other treatments are made.

NEW RESEARCH PROJECTS

In addition to the projects that are being carried on at this time, two additional projects will be initiated--

one is a varietal observation study. We have never maintained a series of new varieties that are being produced by leaders and seedsmen around the world at this location. This becomes a very cumbersome, time-consuming, and expensive program of maintenance. Due to the vast numbers of plant materials available today, it is felt that many of the new types should at least be observed in plots under management so that better advice can be given to turf managers in this area.

Seed quantities have been obtained from Sweden, Holland, Germany, and areas in the United States. These plots were planted in early September and will be observed for their response to climate, mowing, fertility management, and disease resistance.

The second research project will be concerned with cultural practices affecting Poa pratensis (Kentucky bluegrass varieties) in western Washington. Washington State University has never recommended bluegrasses as a single genus or species planting in western Washington. We have always maintained that, due to the widespread occurrence of bentgrasses and the vigor of the genus Agrostis, that bluegrasses were eventually taken over and crowded out. Perhaps other factors of wetness, low pH, low light intensities during the winter, and other factors may also affect the bluegrasses. These studies, however, are aimed at (1) the use of variable rates of lime so accurate information can be gathered on the effect of lime on bluegrass longevity in western Washington, (2) the use of preemergence herbicides to control the germination of bentgrass to increase the longevity of bluegrass, (3) investigate the effects of mowing heights on bluegrass longevity and (4) determine to what extent diseases are affecting longevity.

If all of these approaches fail to produce good bluegrass over an extended period of time and, if the bentgrasses begin crowding out the bluegrasses, then the emphasis on the project will be shifted to postemergence control of bentgrass in bluegrass. This is a national problem and is very serious in eastern Washington and other parts of the Pacific Northwest as well.

Other research and progress includes cooperative research with Dr. C. J. Gould on the interrelationships of agronomic and pathologic factors affecting disease control.

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