Washington
1963

Proceedings

of the

17th Annual Northwest Turfgrass Conference

September 25, 26, 27, 1963
Portland, Oregon

NORTHWEST TURFGRASS MEMBERSHIP DUES

	Annual dues
Golf Courses—	
Less than 18 holes	$20
18 holes or more	40
Nursery, landscaping and ground spraying firms	20
Architects and engineering firms	20
Equipment and material supply firms	20
Participating membership	10
Associate membership	5
All others	20
Cemeteries—	
Less than 400 interments per annum	20
400 to 600 interments per annum	25
600 to 800 interments per annum	30
More than 800 interments per annum	40
Park Departments—	
Less than 150 acres total area	20
150 acres or more	40

1. Annual Dues payable on or before May 15th each year. Dues are based on annual due date nonprorated.
2. Membership includes registration fee for one person at Annual Turf Conference. Other persons from member organization registration fee $5.00.
3. NO INITIATION FEES ARE CHARGED.
4. Nonmembers may attend the annual Conference by paying $10.00 registraion fee. For further information on dues, contact Northwest Turf Treasurer.

It has been an honor and privilege to serve as your President of the Northwest Turfgrass Association during 1962-63. I've been deeply interested in this organization for the past 14 years. I served as treasurer for several years and in these years I have seen this organization grow.

We have a great deal more interest from our good neighbors, the Canadians. Whoever attended the conference in Portland, Oregon, in September could see by the standing Oregon groups that they have a growing interest in our organization also.

It has been said each year that this has been our biggest and best conference but I can sincerely say that the one held in Portland this year was the biggest ever.

I also express my deep appreciation to the board of directors and my committees who performed their duties so faithfully this past year and made it our biggest.

I want to extend my best wishes to Milt Bauman, your new President, who I know will be very sincere and active as he has always been for your organization.

Henry W. Land, Sr.
Superintendent, Tacoma Golf & Country Club

Northwest Turfgrass Association

OFFICERS

1963		1964
Henry W. Land, Sr.	President	Milt Bauman
Milt Bauman	Vice President	Ken Putnam
Dick Haskell	Treasurer	Dick Haskell
Roy L. Goss	Executive Secretary	Roy L. Goss

BOARD OF DIRECTORS

Milt Bauman	Overlake Golf & Country Club P.O. Box 97, Medina, Washington
Manny Gueho	Vancouver Golf Club New Westminster, British Columbia
John Harrison	Hayden Lake Golf and Country Club Hayden Lake, Idaho
Dick Haskell	Seattle Park Department 4101 Beacon Ave., Seattle 88, Washington
Henry W. Land, Sr.	Tacoma Country and Golf Club 320 So. 129, Tacoma, Washington
Harvey Junor	Portland Golf Club Portland, Oregon
Carl Kuhn	H. D. Fowler Company 901 Lane Street, Seattle, Washington
Glen Proctor	Rainier Golf & Country Club 2222 So. 111th, Seattle, Washington
Ken Putnam	Seattle Golf and Country Club Seattle, Washington
John Zoller	Eugene Golf and Country Club Eugene, Oregon
A. Vernon Macan, Honorary	Victoria Golf and Country Club Victoria, British Columbia

TABLE OF CONTENTS

THE INFORMATION IS THERE, READ IT

by E. E. Hardin
Seed Technologist, Oregon State University

Guarantees are popular these days. A person doesn't think of buying such things as cars, batteries, tires, watches, household appliances, without first checking on the guarantee. You also have guarantees of a kind as turf people buying seed. In fact, you can buy seed with two types of guarantees. First of all, you can buy certified seed which guarantees the genetic purity of the seed. This assures you of the exact variety which you feel you would like to plant. The second type of guarantee available to you is the analysis tag. Both state and federal laws insist that this information be provided for your protection.

Each state has a law of its own which regulates the sale of seed within its boundary, and these requirements may vary from state to state, but in general they all demand the same thing. In addition to the laws enacted by each state, there is a Federal Seed Act which demands that certain information be placed on all containers of seed which are shipped from one state to another. The Federal Seed Act states that the seed being shipped must conform to the laws of the state into which it is being shipped. Both the state and federal laws are enforced by law enforcement officials. The job of these people is to see that all seed is truthfully labeled. They, in essence, are your guarantee.

This guarantee, like any other, is good only if you read the information available to you. You may have faced the same frustration as I have — feeling elated to think that I had a guarantee on a blown-out tire, only to find that the appraiser figured I had used 90% of the rubber and consequently was entitled to only a 10% reduction on a new one.

With seeds it is a little different. If you read the label, it could prevent a catastrophe. Let's examine a typical purity analysis tag and see exactly what it does tell us. Most states require the following information:

Labeler's name
Labeler's address
Kind of seed
Lot number

% Pure seed	% Germination
% Inert	% Hard seed
% Weed seed	Date of germination
% Crop seed	Noxious weeds per lb.

It is the responsibility of the person whose name appears on the label to insure the validity of the information and the contents of the container. Most states do not limit what seed can be sold; only that the quality be stated on the analysis tag. One exception is the noxious weeds, which are usually limited.

The lot number identifies a *specific* lot of seed, and it is the symbol which traces it back through marketing channels to its origin.

The analysis of the seed is a quality determination. Once seed has been harvested and cleaned, a sample is drawn from the lot. This sample should be representative of the entire lot and not a sample from any one bag. The analysis performed on this sample is only as good as the sample itself. Anyone can submit a sample. If the seed is certified, in most states it must be sampled by a certification representative. There is also an official sample which is usually drawn by a State Department of Agriculture representative. By far, the majority of samples are drawn by an

individual connected with a company involved in the cleaning, wholesale, or retail aspect of seed movement. The official sample is the most reliable from the standpoint of being unbiased and having been sampled by a prescribed method.

Once the sample is drawn, it is submitted to one of three types of seed laboratories: federal, state, or commercial. Regional laboratories are operated by the Federal Seed Act Division of USDA. These laboratories are concerned with enforcing only the Federal Seed Act and do not accept commercial samples. The Official or State Seed Laboratory is associated with a University or State Department of Agriculture. These laboratories test both law enforcement and commercial samples. The third type of laboratory is the commercial, which may be either of two types: those who are employed by a seed company, or those who operate laboratories as a private enterprise. Regardless of which one tests the seed, it is done under a set standard so that all seed is tested by the same method. These are the people who furnish the information that is used on an analysis tag.

In the purity analysis of a sample, all contaminants are removed from the pure seed. These are then separated into three categories: inert matter, weeds, and other crops. The pure seed and the three types of contaminants are weighed separately and reported in percentages.

The percent of pure seed, of course, is the kind of seed named on the tag. The percent of inert matter consists of material which is not seed, such as chaff, dirt, stones, stems, and broken seeds one-half or less than the original size. The weed seeds are those undesirable seeds, including noxious weeds, which are listed separately on the tag. Other crop seeds are agricultural seeds, other than the kind under consideration, which by themselves would be desirable.

One more determination is made when doing a purity analysis. A large portion of seed is checked for noxious weeds. These are seeds which are considered serious pests when accompanying a particular kind of seed. The noxious weeds are divided into two types: primary and secondary noxious. Primary noxious weed seeds are very serious and are usually perennial in nature, being very difficult to control. Most seed laws prohibit sale of lots containing seed of this category. Secondary noxious weed seeds are less serious than primary weeds, but when occurring in sufficient numbers, do become serious. State laws usually set limits on the amount of secondary noxious weeds allowable in a lot. In most cases, the name and number of the weed seeds must show on the label.

Last, but not least, we come to the germination tests. Seeds from the pure seed are planted, and only those seeds which visibly appear to be good are used. Germination methods vary according to the kind of seed, but set standards are again uniform throughout the United States for each kind of seed. Four hundred seeds are always planted in 4 x 100 seed replicates. The germination percentage is based on the average number of good seedlings counted in each of the 100 seed replicates. A total percent figure is then calculated. Only seedlings which possess all of the essential parts needed to develop into a normal plant are counted as good. One exception is hard seed. Some seeds are impermeable by water at the time of testing and so will not grow. These are called hard seed and are reported separately, but are considered potentially good seed.

Let us consider what all this means to you as a consumer. In the early 1950's, Merion bluegrass was a new variety, difficult to get, and high priced. There was an individual selling this scarce grass door-to-door for $1.00 per pound. At a local retail store, this grass was selling for approximately $5.00 per pound. This was real competition for the retailer, and he questioned the law enforcement officials as to the legality of this practice. I was involved in law enforcement work at this time, and when

we investigated this situation, we found that it was a farmer who was growing the Merion bluegrass. He had raised his crop, cleaned his seed, and sold the clean seed for probably $2.00 to $3.00 per pound. When the material which had been cleaned from his seed was returned to him, he fingered through this high-priced material and noticed that there appeared to be seeds still in it. He realized that there was some other material there, but felt that those seeds present would be valuable, so he arbitarily cut the retail price 4/5 and figured that the material would be well worth the price. We immediately took a sample, ran a purity test, and found the pure seed content to be about 13%, with a germination of about 9%. Fortunately, he was a good grower and kept his field clean, so there were no noxious weeds or other serious contaminants in the sample.

Let's figure out just how much per pound an individual was paying for the "good seed" in this material he was buying.

The term "pure live seed" is used often to express the quality of seeds, even though it is not shown on the label. It is expressed as a percentage and means the amount of the contents of a container that is pure seed and will germinate. The percentage is determined by multiplying the percent of pure seed by the percent of germination and dividing by 100.

$$\text{PLS} = \frac{\%\text{ pure seed} \times \%\text{ germination}}{100} \quad \text{or} \quad \frac{13 \times 9}{100} = 1.17\%$$

We can then divide the price per pound by the pure live seed percent and obtain the cost per pound of pure live seed.

$$\text{Cost per pound of PLS} = \frac{\text{cost per pound}}{\%\text{ pure live seed}}$$

The cost in the illustration was $1.00 per pound. The pure live seed was 1.17%. Substituting, we have cost per pound of $\text{PLS} = \frac{\$1.00}{1.17\%}$

When this is calculated, we find that his customers were actually paying $85.47 for each pound of pure live seed. It is easy to see that if one hundred pounds of seed were needed to seed a lawn, the cost would be $8,547. For this kind of money, a person could have paved his yard and gone fishing for a year!

This is just one example why one should read his guarantee — or analysis in this case — and learn to interpret what it means.

WHICH GRASSES ARE BEST FOR TURF?

by Dr. Norman Goetze
Extension Farm Crops Specialist, Oregon State University

Decisions on grass varieties and mixtures are often made on the basis of price or in haste. Grass seed is one of the lowest costs in the total turf installation operation and the decisions should be based on quality and expected performance. The response of the grass variety or mixture is dependent upon the use made of the turf, the intensity and quality of the management given it, the type of soil, and the climate. Changes in any one of these factors may drastically affect a given grass's response. Each of the above factors must be carefully weighed in making the choice.

Very little is known at the present time about the individual grass

variety performance in each of the discrete areas of the Pacific Northwest. During the last four years, extensive field demonstration plantings in various locations in Oregon have been conducted. The results of these plantings by individual species and varieties are reported below.

Creeping bentgrasses

Seaside: This variety is an extremely homogenous mixture of many different types. On older putting greens, it has shown a tendency to develop patches of drastically differently behaving plants. It spreads vigorously by stolons. If a given type is superior to others in a particular location, this type will eventually predominate in the planting. Seaside bentgrass has a wide range of adaptation, as far as soil pH and temperature is concerned. When mowed shorter than ¼ inch under putting green conditions, and not properly fertilized, it has a tendency to allow the invasion of excessive amounts of *Poa annua*. It still is the best putting green grass for the entire state of Oregon.

Penncross is a Polycross creeping bentgrass produced in seed fields from a random crossing of three parents. This variety has been vigorously promoted in certain parts of the eastern United States and most of the seed is produced in Oregon and Washington. Preliminary experiences under Oregon conditions show that it is an extremely aggressive grass and forms excessive thatch in a very short time. If the thatch is properly handled by mechanical renovation, its performance has been satisfactory. Under western conditions, it has no advantages over Seaside bentgrass.

Vegetatively propagated varieties: Preliminary experiences with Cohansey, Congressional and Old Orchard varieties of creeping bentgrass have shown that Old Orchard produces the tightest turf in the shortest time under arid conditions. These three selections are being evaluated in additional tests under humid conditions. Other varieties have not been tested under Pacific Northwest conditions.

Colonial bentgrass

Highland bentgrass has best drought tolerance and is the most aggressive of the Colonial bentgrasses. It is darker blue in color and develops a high percentage of aerial branching, which causes some browning of turf when using fluctuating mowing heights.

Astoria: This variety develops a lighter green color, but requires more carefully managed irrigation schedules than Highland.

Fescues

Chewings fescue has dense sod-forming characteristics, especially under the more dry sites. It has an ability to go into partial dormancy during periods of drought. When reacting to drought conditions, the grass turns slightly bluish in color and is very difficult to mow. When kept under normal irrigated conditions, mowing is no problem.

Creeping red fescue is slightly darker green in color than chewings fescue and is quite compatible with both bentgrasses and bluegrasses. It is not as drought tolerant as chewings fescue, but has much more drought tolerance than the bentgrasses. No varietal differences have been consistently observed under Oregon conditions. Varieties most commonly available now include Illahee, Rainier, and Pennlawn.

Tall fescue is normally not considered to be a turfgrass because of its wide, coarse leaves. Tests have shown, however, that it has excellent capabilities for heavy wear areas and adaptation to a wide range of environmental factors. Tall fescue tolerates soil pH's as high as 8.3 and is also quite acid tolerant. It is the most drought tolerant of any of the species used for turf and also provides a firm sod under quite poorly drained conditions. Since it does not have an active rhizome system, its

seeding rate needs to be quite high and if any mechanical damage is suffered, overseeding must be used. It needs to be mowed quite high (2 inches or more). The variety Alta is the only one that has been extensively tested in Oregon and it has been found to be quite satisfactory.

Bluegrasses

Kentucky bluegrass is the most commonly used turfgrass species throughout the United States, but in the Pacific Northwest is adapted only to areas of the state having nearly neutral or alkaline soils. In other words, it is not adapted to the acid soil conditions of the Willamette Valley and coastal regions. Kentucky bluegrass has a very special rhizome system and is able to adapt to a wide condition of soil moisture and soil fertility. For best turf development, it needs good fertilization and thorough but infrequent watering schedules. There are many varieties of Kentucky bluegrass being used for turf. Some of them have been extensively tested under Oregon conditions. The following observations have been made:

Delta is a rapidly germinating and developing variety. Its leaf width is quite narrow and it is not as dense as common Kentucky bluegrass after the second or third season.

Park, under Oregon conditions, has not been distinguishable from common Kentucky bluegrass.

Newport is best adapted to higher temperature regions like the Snake River or Rogue River Valleys. It forms a dense, heavy sod very quickly, but after two or three years tends to weaken somewhat.

C-1 has not been distinguishable from Newport bluegrass under Oregon turf conditions, although one greenhouse trial has indicated that it is slightly faster in emergence than Newport. Its general turf characteristics are similar to Newport.

Merion has a wide, dark blue leaf and forms an extremely dense sod when heavily fertilized and properly watered. Its turf characteristics are superior to the other bluegrass varieties only when good intensive management is given. It is extremely slow in emergence, but once well established is a consistent performer.

Other Varieties

Many older varieties, as well as some experimental and privately developed varieties, are now becoming available on the market, but not enough detailed information under Pacific Northwest conditions is available to make comment on their use at this time.

Poa trivialis (roughstalk bluegrass)

This grass is a common constituent of shady lawn mixtures because if its excellent shade tolerance. Its turf is rather weak and many of the stems and leaves develop a prostrate habit under consistent mowing patterns. It is an excellent shade grass, but has no real use in full sun situations.

Ryegrass

Ryegrasses are a common constituent of many of the more economical retail lawn seed mixes. They are used primarily because of their low cost and rapid germination. Generally ryegrasses are not satisfactory for turf use in the Pacific Northwest. Recent experiences have shown that some of the perennial ryegrass varieties are good companions in athletic turf mixtures, where the turf is needed for fall use following spring establishment. Perennial ryegrass is just about as tough as Alta fescue and is much more rapid in germination. However, the life of the stand is usually short lived.

WHAT HAPPENS TO PESTICIDES APPLIED TO TURF

by Dr. V. H. Freed
Department of Agricultural Chemistry
Oregon State University

Verbal presentation to the Conference. No paper was submitted.

CALIBRATION OF SPRAY EQUIPMENT

by Herb P. Hill
FMC John Bean Division District Representative
San Jose, California

Thank you, Dr. Goetze. Good morning, gentlemen. Before I begin my presentation, please allow me to say how pleased I am to be with you this morning and to be a part of your meeting. Speaking not only for myself, but also for the Company I represent, I want to say we consider ourselves fortunate to be associated with your industry, whose rate of growth and expansion continues to be so outstanding. The development, care and maintenance of turf areas today is big business. In California alone, a survey conducted in 1962, indicated the development, care and maintenance of turf areas to be a 20 million dollar industry. We are most happy to be counted as a manufacturer and supplier of some of the specialized equipment which is used in your industry.

And now to my presentation which will this morning cover the calibration of sprayer equipment for turf operations. Please do not become too alarmed, I doubt that I shall be able to use the full 45 minutes allotted to me for this subject. First. In this discussion I would like to present some of the requirements of a good turf sprayer, and to review quickly with you, some of the chemicals which might be used as well as some recommendations for control of the more important weed and disease problems. Secondly I would like to discuss some of the methods and formulas commonly used in determining the correct application rates for these chemicals. Thirdly I would like to discuss briefly, the nozzles, nozzle spacings, booms and boom widths, as well as some of the boom features which are in general use today in this work. Finally I would like to introduce a simplified method of quickly and easily determining accurate application rates and to present you with a John Bean Spray Delivery Computer and to review its useage. If time permits I would also like to discuss some tips on Shade Tree Spraying and present some information on this subject together with a brief discussion and explanation covering spray hose friction losses. If time permits I shall be glad to answer any questions which I am able.

Beautiful fairways and healthy greens do not come easy. In the care and maintenance of really good turf areas, turf managers are faced with a baffling array of problems. Aside from weed control, parasitic and disease problems in turf are of major importance. Only a few of the problems faced by maintenance supervisors are: Insects, parasites, nematodes, parasitic fungi, and a generous assortment of virus and bacterial diseases. Because these turf areas are initially expensive, good maintenance makes good sense, and good maintenance means close supervision of an effective control program. Noteworthy progress in the study of these problems by turf experts in our State experiment stations and universities has made

the job easier for us. The combined efforts of these dedicated men have given us effective programs which, if followed carefully, can result in the effective control of these common problems.

A good sprayer, properly equipped and calibrated for accuracy, can be one of your most effective weapons in the everlasting battle against insect and disease problems in turf areas. Correctly calibrating the sprayer and boom is as important as being sure to follow the recommendations which have been developed by the conscientious men working on these problems. If the sprayer is not calibrated properly, the rate of application will be off as well as the control problem.

There are four major factors to consider in calibrating your fairway sprayer, these are, (1) Nozzle spacing on the boom and boom width, (2) Ground speed of the sprayer in MPH, (3) The recommended application rate, and (4) The discharge rate per nozzle in GPM. The discharge rate of the nozzle depends on the size of the nozzle orifice and the operating pressure of the pump. Now let us consider all of these factors and how we may utilize them to arrive at the recommended rate of application we are trying to achieve. First, the nozzle spacing is, almost without exception, known, as is the boom width. To determine the spray swath or effective width of your boom, simply measure the distance between nozzles and multiply by the number of nozzles.

For example let us assume you have a boom with 13 nozzles which are spaced 20 inches apart, thus: $13 \times 20 = 260$ inches divided by 12 = 21 ft. 8 in. The effective width or spray swath of the boom. Now secondly let us consider the ground speed of the sprayer. Here one should select the most desirable speed for the operation and for the equipment. This should be a speed which will permit you to move easily over the type of terrain on which you will be working. The determination of this speed is made with the tractor and sprayer in motion on average ground. When the desired speed is found, drop a marker, a stick or a wrench will do, and exactly one minute later drop another marker. Measure the distance between markers to determine the exact number of feet traveled in one minute. Now armed with this information and a pencil and paper, you can use this formula to compute the speed of travel or MPH factor. This formula, to exactly determine the speed of travel or MPH factor, can be shown thus:

$$\frac{\text{Distance covered in feet}}{\text{No. of seconds traveled} \times 1.47} = \text{MPH}$$

As an example: If 360 feet are traveled in one minute or 60 seconds, the speed of travel or MPH factor is found to be thus: $\frac{360}{60 \times 1.47} = 4$ MPH

In this problem 360 represents the distance traveled and according to our formula is divided by 60 which represents the time during which the distance was traveled, in seconds, and which is multiplied by the constant 1.47. Thus: $60 \times 1.47 = 88.2$ which now becomes our divisor and our problem is simplified thus: $\frac{360}{88.2} = 4.00$ MPH

The determination of the speed of travel factor is the most important step in the calibration of your fairway sprayer. The method described here is easy to accomplish and should be followed unless you are fortunate enough to have a speedometer on your equipment which will, of course, eliminate this step. The third factor we will consider is the recommended application rate. This is almost always a known factor and should

be the Gallons per acre recommended by your turf advisor or experiment station. Entomologists, weed control specialists, or other turf specialists concerned with spray chemicals should be consulted for recommended rates of application for various types of spray materials and programs. They are best qualified to advise you on the concentration of chemicals.

The fourth factor we will want to consider will be the rate of discharge per nozzle in GPM or in other words, the nozzle capacity. This important factor can usually be obtained from the sprayer manufacturer or the original manufacturer of the nozzle tip. There are several reputable manufacturers of low volume nozzles which are used in this work. All of them can provide nozzle information and capacity ratings. Most sprayer manufacturers also are able to provide this information. In this John Bean Agricultural Spray Accessories catalog there appears excellent information of this kind. I have a number of these which I'll leave here on the table for any who wish them, later on. If you don't get one, ask your turf equipment supplier, he will have a supply on hand.

However if such data is not available to you, of if it is suspected that the nozzle orifice is worn enough to lose its original efficiency, here is how you can determine its actual capacity. The formula used to determine the GPM per nozzle for a blanket type spray such as is used in overall weed control operations, and assuming the rate of travel in MPH is known and that the application rate in GPA is known, would appear thus:

$$\frac{\text{GPA} \times \text{MPH} \times \text{W}}{5940} = \text{GPM per nozzle}$$

In this problem the GPA is multiplied by MPH and W or the nozzle spacing in inches, and the product is then divided by the constant 5940. Now if the nozzle spacing is 20 inches, and this is standard in most programs and for most booms sold today, the above formula is simplified and becomes the MPH multiplied by the GPA required and this product is then divided by the constant 297. The problem would appear thus;

$$\frac{\text{MPH} \times \text{GPA}}{297} = \text{GPM per nozzle}$$

For example, if the ground speed is known to be 4 MPH and the nozzle spacing on the boom is 20 inches, the GPA required to gain control, or the GPA recommended by your turf advisor is 65, then, first the gallons per nozzle needs to be determined. Now let us assume for this example, we are using a standard boom of 13 nozzles which are spaced 20 inches apart and providing an effective spray swath of 21 feet 8 inches. The 65 gallons per acre which is needed is divided by the 13 nozzles on the boom giving us 5 GPA per nozzle which is required. Next multiply the GPA per nozzle (5) by the MPH (4), this product (20) is then divided by the constant 297 and the answer is .067 gallons per minute per nozzle which would be the required GPM for each nozzle for the program we wish to accomplish. The problem would appear thus;

$$\frac{65 \text{ GPA (required)}}{13 \text{ nozzles}} = 5 \text{ GPA} \times \frac{4 \text{ MPH}}{297} = \frac{20}{297} = .067 \text{ GPM}$$

Thus we find that in order to accomplish our objective in this example, in other words to apply 65 Gallons per acre using a boom of 21 ft. 8 in. on which the nozzles are spaced 20 inches apart and the rate of travel or ground speed is 4 MPH, each nozzle must discharge .067 GPM. To determine whether or not the nozzles on hand are discharging the correct amount which in this example is shown to be .067 GPM, and when a nozzle chart is not available or the marking or number on the

nozzle tip is obliterated, catch the discharge from one nozzle while the sprayer is operating at 40 PSI, for one minute. Measure the trapped fluid in a calibrated measuring device. Since the amount we need, .067 converted to ounces equals 8.5 fluid ounces we can quickly determine whether the nozzle is under or over capacity.

If the nozzles being calibrated turn out to be the proper size, then everything is fine. However, in case the calibration does not come out as required, don't throw the nozzles away, here is another formula which will permit you to learn what gallon per acre application they *will* give. In this formula you will multiply the constant 5940 by the actual GPM per nozzle and then divide the result by the miles per hour times the nozzle spacing in inches. The answer will be the actual gallons per acre the nozzles would apply. The problem would appear thus;

$$\frac{5940 \times .067}{4 \times 20} = 5 \text{ Gallons per acre per nozzle}$$

Now since we have 13 nozzles this answer is multiplied by the number of nozzles or 13 $\times$ 5 which gives us the required 65 gallons per acre we want.

At this point it might be well to briefly discuss nozzle numbering systems and what they mean. When you see a nozzle tip which reads 650067, or 65015 or 73039, or 800067 or 8002, just what do these numbers mean to you? Actually nozzle number systems are quite simple and easy to understand once they have been explained. The first thing to remember is that the first two numbers *always* indicate the spray angle or degree of the nozzle. Thus any nozzle beginning with 65 such as the 650067 has to be a 65 degree nozzle, any nozzle beginning with 80 such as 8002 likewise has to be an 80 degree nozzle. The reason for having these different degrees in the first place is to provide the required 25% overlap in the pattern for good performance, when the nozzles are used at various heights from the ground. For example when spraying height is 17 to 19 inches from the ground the wider angle 80 degree nozzles are recommended. When spraying heights are 19 to 21 inches an intermediate nozzle, the 73 degree series is recommended, and when spraying heights are from 21 to 23 inches the 65 degree series is recommended. This last series is far the more popular and most widely used today. The wider the angle the finer the atomization and the greater risk of drift, the narrower 65 degree nozzles provide a coarser droplet size and reduce risk of drift. Now back to our numbers, what do the rest of the numbers mean? Simply, they indicate the GPM of that particular nozzle at 40 PSI which is the norm from which all other calculations are made. Now lets take nozzle tip number 650067 which happens to be the same nozzle which we have used in our previous examples. To know the GPM of this nozzle at 40 PSI you would simply count three decimal points from the left and place a decimal point.

In counting over three decimal points from the left and placing our decimal point we find we have the decimal .067 which is the GPM of this nozzle at 40 PSI. If you had a nozzle numbered 65015 you'd count over three places from the left and place your decimal between the zero and the 1, you would then have the decimal .15 which represents the GPM at 40 PSI of this nozzle. If you had a nozzle carrying the number 73039 you'd place your decimal 3 places from the left between zero and three, the nozzle would have a capacity of .39 GPM at 40 PSI. Now let us say you have some nozzles marked 800067, counting three places from the left you'd place your decimal between zero and zero. The remaining decimal would be .067 GPM at 40 PSI the same as the 650067 but in the

80 degree series. If there are any questions remaining on these nozzle numbering systems please ask them at the end of this discussion. I'll be glad to explain them again.

Now up to this point we have not discussed pump pressures, or pounds of pressure per square inch which is required. It must be remembered that in order to maintain gallonage requirements per nozzle, this factor must be known. When a nozzle chart is not available, this can pose a problem because it is necessary that exacting pressures be maintained in order to obtain an accurate rate of discharge from the nozzles.

The formula for obtaining the GPA per nozzle has been shown. From this it was determined that .067 GPM per nozzle was required in the example spray program we have been discussing. Now to determine the proper pressure setting at the relief valve or regulator, the following steps should be taken; (1) Install all nozzles in the boom (2) Start the sprayer and run at factory governed speed if engine drive. If PTO drive set tractor throttle at pre-determined position for proper ground speed and PTO speed. This should be the equivalent of 560 RPM on the PTO shaft. (3) Set the sprayer relief valve at an approximate setting of 40 to 60 PSI (4) Start spraying, open the boom valves to full capacity. Now catch the discharge from two or more nozzles, in separate containers, for exactly one minute, and (5) Measure the material discharged and compare it with the quantity needed. As we have previously determined this quantity is .067 gal. or 8.5 fluid ounces. If the quantity discharged is too low, increase the pressure slightly and re-check, if the quantity discharged is too great, lower the pressure slightly and recheck. Several settings may be required the first time this pressure calibration is made, but with a little experience, much less time may be required for later calibrations if they become necessary.

Now before we close lets take another look at the several formulas we have been discussing. First we used the formula which gave us the speed of travel or MPH factor,

$$\frac{\text{Distance covered in feet}}{\text{time in seconds} \times 1.47} = \text{MPH}$$

The example was 360 feet traveled in one minute. The time traveled in seconds, 60 was multiplied by the constant 1.47 resulting in 88.2 which was divided into 360 resulting in a speed of travel factor of 4 MPH.

Secondly we used the formula which gave us the GPM per nozzle this formula would appear thus;

$$\frac{\text{GPA (read)} \times \text{MPH} \times \text{W (nozzle spacing)}}{\text{5940 (constant)}} = \text{GPM per nozzle}$$

If the nozzle spacing were 20 inches then the problem became simplified and would be represented thus:

$$\frac{\text{MPH} \times \text{GPA}}{297} = \text{GPM per nozzle}$$

For example, if the rate of travel or ground speed was 4 MPH, a boom with 13 nozzles spaced at 20 inches and we wished to apply 65 GPA and we need to know which nozzle size to use or how much capacity in GPM each nozzle should have. First we would take the 65 GPA which is required and divide it by the total number of nozzles, thus;

$$\frac{65}{13} = 5 \text{ GPA per nozzle}$$

which is needed. Next we multiplied the GPA per nozzle (5) by the rate of travel or MPH (4) and this product (20) is then divided by the constant 297 and the answer is .067 GPM per nozzle which is required. The problem appearing thus;

$$\frac{65 \text{ GPA (required)}}{13 \text{ nozzles}} = 5 \text{ GPA} \times 4 \text{ MPH} = \frac{20}{297} = .067 \text{ GPM per nozzle}$$

Now still another formula which we have not yet discussed is very simple and quite useful in the determination of manpower distribution for your spraying programs. This formula has to do with the number of acres sprayed in one hour, or in another way we might say, the number of acres which ought to be sprayed in one hour according to the program which you have adopted. The formula for determining this factor would be represented thus; With the symbol "Y" representing the boom width in feet, multiplied by ground speed or MPH divided by the constant 8.25 the product would be the APH or acres sprayed in one hour. The problem would appear thus;

$$\frac{\text{"Y"} \times \text{MPH}}{8.25} = \text{APH}$$

For example let us say you are using a John Bean Duo-flex boom, a 13 nozzle boom with 20 inch spacing giving an effective spray swath of 21 ft. 8 inches and you have adopted a spray program which requires a ground speed of 4 MPH, you would have;

$$\frac{21.67 \text{ (ft)} \times 4 \text{ (MPH)}}{8.25} = \frac{86.68}{8.25} = 10.5 \text{ APH}$$

These and other formulas are useful but require a lot of arithmetic My Company has devised a slide rule type, spray delivery computer which can make these computations a lot easier for you. I'd like to pass one of these out to each of you and we'll have a little school session on their operation. If there are not enough to go around see Art Marston of N. W. Mower and Marine in Seattle or Byron Reed of Baltz & Son here in Portland. I'll see that they are provided with sufficient extras.

The calibration of your sprayer equipment is an important factor in your overall operation. Experiment stations and universities should be consulted for recommendations before the spraying program is started, if their recommendations are followed faithfully, your spraying program will be successful and will lead to the expected control measures, if not the best sprayer manufactured cannot do the job for which it was intended. Another important point to consider is the choice of your spraying equipment, whatever your choice be sure it has provided equipment with ample capacity to carry out your spraying program. Buy it from a reliable source, preferably your regular turf equipment supplier, he has access to the factory warranty and service programs which can be very helpful to you. Make sure your new sprayer has a tank and piping which is well protected against the ravages of modern spray chemicals, make sure it has a good filter of ample capacity, plugged nozzles will upset your rate of application and throw your whole program off, make sure it has a pump that can handle the abrasive chemicals you will be using and that it is equipped with a reliable pressure gauge and regulator. Make sure also, that the boom has piping protected against rust and corrosion. With good sprayer equipment on hand, and following the recommendations of your turf consultants, your program will be successful and your course will continue to have healthy turf and you

will be safeguarding your most valuable assets, beautiful fairways and healthy greens.

Well gentlemen this concludes my presentation, thank you very much for your attention, and now if there are any questions I shall be happy to answer them for you.

PRINCIPLES OF DRAINING TURFGRASS SOILS

by Marvin N. Shearer

Drainage is the process of removing excess water from soil by gravity. It may be accomplished through either surface run-off or percolation.

In water management on turfgrass, it is desirable to control the maximum *amount* of water that soil contains at specific periods. In most situations it is not possible to do this by drainage alone. To understand procedures which can be used requires knowledge of how water behaves in soil and why.

The soil is much like a sponge. It has pores of different sizes and shapes. Take two sponges of exactly the same dimensions, one having mostly small pores and the other mostly large ones. Submerge them in water, squeeze and release them so the pores become completely filled. Place them on a screen so they will drain by gravity. When drainage is completed, squeeze the water from each sponge and catch the "stored" water in containers. Notice the difference in the amount of water each of the sponges held.

You have demonstrated two truths about soil-water behavior. (1) All water stored in soil cannot be removed by drainage. (2) Soils with different size pores store different quantities of water.

There will always be some water remaining in soil after drain tile quits running. Whether or not that which remains is excessive depends upon how the soil is going to be used. That is, if it is just going to be used just to grow grass, a higher moisture content can be tolerated than if it is going to receive considerable foot traffic.

Since pore size is determined largely by soil texture, the maximum amount of water that turfgrass soil stores after drainage has ceased can be controlled through *selection* of the soil used according to textural analysis.

The size and shape of pores are important in turfgrass soils because they affect, in addition to the amount of water which is stored in the soil, the rate which water can move through it.

To demonstrate, take two pipes—one of 1/8 inch diameter and one of 1/2 inch diameter. Stand them on end and pour the same quantity of water through both of them. The smaller pipe will require a longer period to pass the water through it. In some soils, the pores are so small that water will not drain through them at all.

Let's consider a little more thoroughly now the relationship between soil and soil water.

People who work with soil water have classified soil water according to its behavior and use.

Presented at the 17th Annual Northwest Turfgrass Conference September 26, 1963 at Portland, Oregon.

Assume the sponge to be soil. When it was submerged in water and all the pores were filled, it was *saturated.* The water which drained from the sponge when it was placed upon a screen was *excess or free water.* When drainage ceased it was at a moisture content known as *field capacity*—the upper limit of available water. If we planted grass, the grass would remove about half of what remained. This water would be called *useable or available water.* With the useable water removed, the plants wilt and eventually die. At this point, the soil moisture would be reduced to the *wilting point.* There would still be considerable water in the soil but it could not be removed by either gravity or plants. It would be removed only as vapor.

Water will not move through soil unless there are forces acting. The major forces causing water movement are capillary (adhesion and cohesion) and gravitational.

Soil particles and water molecules have an attraction for one another. This is called adhesion—the attraction of unlike molecules for each other. The first row of molecules attached to a soil particle is held with a force equivalent to about 147,000 pounds per square inch. As additional water is added, the water molecules continue to attach to one another due to the force of cohesion—the attraction of like molecules to each other. The water forms in films around the soil particles and as the layers of molecules build up the films become thicker. As the films become thicker, the tension with which the molecules are held together at the air-water interface decreases until finally it is not strong enough to support the weight of the water against the pull of gravity and the water falls.

We see this occur with medical eye-droppers. As we squeeze the rubber bulb and allow the drop to form at the end of the glass tip, the drop eventually becomes so heavy that the surface tension of the liquid can no longer support it and the drop falls.

Water held by capillary forces can keep the smaller pores in the soil entirely full of water and can also maintain thick films in the larger pores.

We see then that gravitational forces are important only in large pores and capillary forces are important mainly in the smaller pores. The capillary forces are of much greater intensity than the gravitational forces and, therefore, prevent complete drainage of soil.

In addition to this, we should understand that capillary forces act equally in all directions while gravitational forces act downward only.

So far, we have stressed that the size and shape of pores have a major effect upon moisture in the soil. It is important, therefore, that we consider some of the factors that control the size and shape of pores.

These factors include such things as soil texture which is the size and shape of individual soil particles, soil structure which is the arrangement of soil particles in aggregates or clusters, and soil management which includes the physical manipulation of the soil causing the soil pores to change in both size and shape.

When a soil is wet, it is easier to "work" than when it is dry. This means that it is also easier to compact. Compaction destroys the desirable pore space characteristics of soils. Human traffic is one of the major causes of soil compaction. The more water a soil stores, the more it will be affected by foot traffic. It is for this reason that initial planning of land use is important to prevent problems from occurring in the first place.

Where land use patterns have already been established, however, and where foot traffic is extremely concentrated during all periods of the year, we must work with what we have from where we are.

If we understand the basic principles already discussed, we can evaluate the more common drainage problems encountered in turfgrass soils. Let's take a look at typical situations and consider the type of problems which exist.

First, let's assume that your school board has constructed a football field on heavy clay soil. Your job is to maintain a growing turf that the players can enjoy. If it were possible to keep people off the field, it would have a chance at developing adequate internal drainage to grow turf. Clay soil particles fit together in such a manner that the size of the individual pores can be extremely small although the total quantity of pore space may be large. Since the pores are small, water will be stored in most of the pore space after excess water has been removed. The little percolation which might occur normally will be quickly reduced following a few games.

Under this situation, sub-drainage with tile or gravel is of little use except as a means of conveying water away from the field underground. The only real water control which can be developed is the diversion of water in the first place. This must be accomplished through proper grading of the soil which will result in surface collection and run-off and by covering the field during heavy rains just prior to games. In some particular sites, it may be possible to intercept water from moving into the field area from higher elevations by interception tile drainage. This, however, depends entirely upon the site location.

If there were a choice in the matter, the school board should be discouraged from developing a football field in such a soil type to start with.

Another alternative considered by some schools is to control pore size by completely rebuilding the soil according to soil texture specifications. Some of the larger, more expensive football fields in the northwest which are heavily used have done this—but it is expensive.

Excessive soil water problems also exist around public and commercial buildings and in formal gardens where it *is* possible to control human traffic. Even though these soils may frequently be heavy, it is possible to use agricultural drain tile effectively because grass roots continually forming and dying develop channels which will convey water to the tile. If human traffic can be kept off this soil when the soil is wet (so that pore space is not destroyed), satisfactory turf can be grown. Frequently, water moves in from a higher elevation. It is relatively easy to locate the strata on which the water is riding and install agricultural drain tile to intercept it. Proper drainage away from the buildings and the channeling of downspout water into storm sewers rather than dumping it on lawns or in dry wells will help this situation considerably.

Around buildings where there is considerable human traffic, such as in school bus loading areas, maintaining turf is a losing battle and it is easier to put the area under concrete, blacktop, or some other type of surface.

When we look at large areas such as golf course fairways or central parks, it is necessary to give the entire site a thorough evaluation, just as we do agricultural land, before developing an overall drainage plan. If drainage tile will work, it is usually more desirable although more costly than surface drainage. Complete areas can be tile drained for a cost of $100 to $200 per acre depending upon the obstacles in the path of the tile lines.

When we consider turfgrass areas having extremely high human use such as is the case with putting greens, then the need for adequate drainage and the benefits from it can justify considerable expense. It is

essential that the green be well drained if it is to be kept in a playable condition. More and more golf courses are building soil on a prescription basis for putting greens. Sufficient research has been done so that by the proper selection of soil textures adequate internal drainage can be provided regardless of the amount of foot traffic involved. It must be borne in mind, however, that when this action is taken, it will require frequent irrigation and fertilization. The amount of water stored per foot of soil is small and the clay content which stores the nutrients is also very low.

In summary, the cheapest way to solve drainage problems is to prevent them from occurring in the first place. Most of us, however, find ourselves in situations where problems have already developed. Even here, however, it is usually most economical to eliminate the source of water before it causes the problem. Where we cannot control foot traffic and where internal drainage is impossible because of the nature of the soil, we must recognize this fact and consider alternate ways of treating the soil with landscaping or surface material.

The procedures used and the decisions made in correcting drainage problems must be considered on an individual basis because of the expense and variation of site situations involved. A good drainage consultant can give you good estimates on costs, procedures, and on the extent of drainage possible through the various procedures you may choose to use.

PUBLIC RELATIONS AND THE TURFGRASS SPECIALIST

by J. L. Gray
Public Relations Manager, Fraser Valley Milk Producers' Assn.
Vancouver, B. C.

In the past decade, the term 'public relations' has become a household word. As an integral part of the area of idea communications, it has been glamourized in some circles, maligned in others. Many of us have gained our first impressions of it from Hollywood motion pictures or highly-coloured newspaper and magazine stories. Inevitably, the heel in the executive suite is the public relations director. A present-day phenomenon of the business world is the oft-times poor P. R. of the public relations profession.

But in spite of our frequent inabilities to tell our own story well, some of us have the audacity to come out on a platform and tell others 'how to do it'.

During my preparation of this talk, I was privileged to read several excellent articles on public relations in the "Golf Course Reporter". This capably-edited publication, as well as your fine news letter "Northwest Turfgrass Topics", offer the reader valuable information.

Todays talk will first review basic established procedures, and later discuss suggested approaches to public relations I feel are of pertinent concern to your industry.

WHAT IS PUBLIC RELATIONS?

Definitions of "public relations" range from wordy proclamations to abbreviated statements.

A widely-accepted definition is the following:

> "Public relations is the management function which evaluates public attitudes; identifies the policies and procedures of an individual or organization with the public interest; and executes a program of action to earn public understanding and acceptance.

Here is another classical description:

> "Public relations is the continuing process by which management endeavours to obtain the goodwill and understanding of its customers, its employees and the public at large; inwardly through self-analysis and correction; outwardly through all means of expression."

The aforementioned definitions are pretty strong stuff. More popular definitions, and certainly easier to remember are:

> "Public relations is the simple art of getting along with folks."
>
> "Public relations is everything you do or say; or everything you don't do or say."
>
> "Public relations is the art of making people want to do business with you—opinion creation by peaceful means."
>
> "Public relations is doing unto others as you would have them do unto you."—(the Golden Rule)

The essence of public relations is getting along with people; and doing unto others as you would have them do unto you; these actions pre-suppose mutual understanding, mutual confidence and mutual respect.

Let's take a look at our first definition where-in public relations is described as a *management function.*

Evaluating Public Attitudes is one responsibility. Briefly, this phrase means putting ourselves in the other fellows shoes and asking—"What does Joe Doakes think about us . . . our actions . . . our products . . . our service."

Identifying the Policies and Procedures of the organization with the public interest simply means being a good business citizen as reflected by your company's attitudes to employee welfare, community service, guaranteed quality products, advertising ethics, to name but a few items.

A Chairman of the Board of General Mills, Harry A. Bullis, has written:

> "Public Relations seeks to identify a corporation with what in an individual would be good manners and good morals . . . it is good manners to win friends. It is being a good business citizen, from the of your organization to the bottom."

In carrying out the management function, public relations completes the final part of the definition, *executes a program* of action to earn public understanding and acceptance.

IS PUBLIC RELATIONS REALLY NECESSARY?

An attitude to public relations prevalent among what are described as 'Rip Van Winkle' or 'Head in the Sand' types is—

> "We are too big (or to small) to worry about public relations of our business."

These people do not realize that they have public relations, whether they want it or not, or whether they do anything about it or not. It may be good—it may be bad, but it is always there.

Public relations is not a new idea or concept. Lets look at a typical small businessman of 200 years ago, and trace the evolution of his public relations to the present day as described in "Reporting Agriculture."

Our hero is Mr. Brown, the village blacksmith. He has excellent personal contact with the public. They passed his place of business every day and they could look in and see him at work. Longfellow immortalized his public relations in the poem "The Village Blacksmith."

'The burning sparks that fly' (seeing is believing)
'He goes on Sunday to the church' (his neighbors knew he was a good man)
'An sits among his boys' (he lived openly among his neighbors)
'For he owes not any man' (he paid his debts)

But as the years go by, look what happens. He takes on an apprentice. Now he is an employer. He has labor relations problems. Then the time comes when he makes a piece of equipment that is used by all the farmers in his area. A fellow comes to him and says, "let me be your agent in the next county for this equipment." Now he has the beginnings of a sales department. Soon he is hiring more helpers to make more equipment. He is now spending more time talking to his foremen, laborers and salesmen.

One day a salesman says, "Boss, why don't we put an ad in the local paper." He has become an advertiser. He calls in an advertising copy writer. More and more of his time is spent with agents and buyers of all kinds.

As he grows older he decides to protect himself and incorporate his business. The banker enters the picture. Now he has a money problem. As the business becomes complicated, he seeks out legal aid. Incorporation has brought shareholders. The business must be accounted for each year—and so onto the scene come the auditors.

Mr. Brown begins to worry about cost, how to make a good piece of equipment at lower prices. He has jobbers and salesmen all over the country. Distribution is a problem. Life has become pretty involved.

He hasn't personally forged a piece of iron or touched his smithy's hammer in years.

What do his neighbors say about him now? Well, they likely say the Brown Company is a soulless corporation. But Mr. Brown hasn't changed. He still has the same problems and the same attitudes. In the early days, he could tell his story man to man in the blacksmith shop. Now his many publics have grown, and he must tell his story through special channels—he must synthesize his story, which by the way, is still the same story. Although the Brown Company is now big business, Mr. Brown is still a good citizen and a good neighbor.

He cannot see and meet his public across the forge, and tell and show them he is still making good farm equipment. When he is unjustly criticized, he cannot go around to each individual and set the record straight. He must depend on mass media. And these channels must get the message over that Brown and the Blacksmith and Brown the Company are one and the same.

In the public mind, there are four alternative opinions held about an individual or an organization.

* People think well of you.
* They are lukewarm towards you.
* They think badly of you.
* They don't know enough about you to have any opinion.

Good public relations is directed towards the attainment of the first alternative. As Dr. Samuel Johnson once wrote, "a man, sir, should keep his friendships in constant repair."

Business has been likened to an ice-berg . . . one eighth seen . . . seven-eighths unseen. It is human to fear and misinterpret what he cannot see or understand. How can we go about showing the public the whole picture of our business.

An International Harvester president has set forth a sound public relations philosophy:

> "We need to put less emphasis on telling people and more on finding out what they want to know about us, and then answer those questions. It is our general faith that if people come to understand us and our problems, and if they like us and approve of our policies and actions, then they are automatically going to extend that knowledge and sympathy to the problems of our business system as a whole."

Everyone knows that there is a constant battle between truth and falsehood. It is amazing how rapidly a lie and mis-information will spread, and how slowly the truth will plod. For some reason, truths are the hardest things for the human mind to accept. In essence, the fundamental function of public relations is to bring the truth into the light.

Yale University research has found that people will believe what they consider to be facts just as quickly from an untrustworthy source as from a trustworthy source, and people retain a remembrance of facts only about four weeks. These conclusions point up the need for continuity in a public relations program.

Public relations seeks to identify an organization with what, in an individual, would be good manners, good character and good morals. As one authority says—"bring a good business citizen from the top of your organization to the bottom."

A CAUTION—one of the curses of public relations is the assumption on the part of some management executives and boards of directors that it is merely a device to meet crises . . . a sort of fumigating process. It must be realized that public relations can only interpret—it can't whitewash.

It has been rightly said that "no amount of publicity will improve your public relations if deep down in your heart you are a *stinker.*"

It is cheaper to prevent crises in public opinion towards your business or profession, than to try and cure them after they have developed.

YOUR PUBLICS

Turf men, in common with all other professional groups and businesses, have three general types of publics:

Local
State or Provincial
National

LOCAL PUBLICS include:

Customers
Consumer Groups
Shareholders or Members
Firms buying your products or services
Suppliers
Business People—bankers, merchants, wholesalers, small businessmen
Newspapers—publishers, editors, reporters, columnists
Radio & TV Stations—communication personnel
Civic Organizations
Service Clubs
Fraternal Societies
Church Groups
Community Groups
Young People's Organizations—Scouts, 4-H, Little League
Schools & Other Educational Institutions
Business and Professional Organizations

Some of the above-named groups may be favorable to your company—others unfavorable; some are indifferent—others are neutral. The job is to maintain the good relations we have and try to improve some of our lukewarm or poor relations.

PROVINCIAL PUBLICS include:

Governments—State, Provincial, County, Municipal, City, Town
State and Provincial organizations
State and Provincial Business and Industry Groups
Universities and Colleges
State and Provincial Service Organizations
Professional Groups

In a case where business is being carried on throughout the state or province, the publics may embrace many of the groups named in the "Local" category. Here again opinions held will vary.

NATIONAL PUBLICS include:

Federal Government
Federal Government agencies
National Service Organizations
National Business, Industry and Professional Organizations

THE MECHANICS OF PUBLIC RELATIONS

We have discussed the necessity of coordinating the facts about a company, its products and its several publics. In this reconciliation decisions must be made on three topics:

What Makes News?
Which Public Relations Tools are to be Activated?
Which Communications Media are to be Utilized?

WHAT MAKES NEWS?

Annual Meetings
Annual Picnics
Official Addresses
Members Community Service
Election of Officers
Staff Community Service
Special Meetings
New Construction
New Equipment
Scholarships—Bursaries
Staff Promotions
Sports Sponsorships
Community Projects
Tours
Business Awards
Company Community Service
Staff Accomplishments
New Products & Services
Youth Club Promotions

PUBLIC RELATIONS TOOLS

- Publications
- Other Company Publications
- Public Service Booklets
- Films & Film Showings—Slides
- Talks
- Tours
- Community Service
- News Releases
- Photo Releases
- Advertising
- Displays & Exhibits
- Meetings

COMMUNICATIONS MEDIA

- Daily Newspapers
- Weekly Newspapers
- Radio Stations
- Television Stations
- Trade Publications
- Professional Journals
- Fraternal Publications
- Labor Publications
- Religious Publications
- Employee House Organs
- Farm Magazines
- Service Organizations
- Magazines
- Bill Boards
- Posters

A WORKING PLAN FOR PUBLIC RELATIONS

Careful planning is needed to implement a working public relations program. Budgetary limitations, may not allow the hiring of a full-time director or part-time consultant. However, successful P. R. programs have been carried out by non-professionals following basic rules.

The person responsible for the program should be objective. He or she has to study how other people are going to think—to wear the other fellows shoes—then come up with the facts on how that fellow feels about you and/or your organization. These facts must not be coloured. They must reflect truth, honesty, sincerity and integrity.

What are the facts? First, there are facts about the organization or individual—their products—their services. Secondly, there are facts about the several publics with which they are in contact.

When these facts are assembled, the communicator must determine the best way to coordinate them into what is popularly called a "corporate image". It could also be described as a "corporate personality" or an "individual personality".

What is the "corporate image"? It is a composite of all the parts of a company—name, products, building, vehicles, landscaping, advertising, credit rating, service and product guarantees, employee and labour relations.

A customers decision to buy your product or service is not decided on quality or price alone, but also on his impression of the maker and seller.

It is the way people feel about an organization or individual, or simply, "what you think about them when you think about them."

There are as many opinions as there are people. A company or individual cannot expect to be thought of in the same way or image by all of them.

A few years ago, a U.S. public opinion pollster ran a survey to find out how people felt about certain corporations. The list included the big electrical firms, the major automobile makers, giant chemical and oil companies . . . among the G.E.'s, the Standard Oil's and others were "The American Improvement Company" and "The International Molybdenum Cartel". Almost unanimously, the people polled voted the A.I.C. the firm they held in highest esteem. Their overwhelming choice as the company most likely to be up to no good, and least likely to be loved was the International Molybdenum Cartel. Of interest, of course is the fact that neither of these companies exist.

This incident points up the great importance of the company name. Choosing the *right* name is a major decision for businesses and organizations.

Obviously, the individual has a great advantage over the company in improving his personal public relations. He is one step ahead in the public relations process. Why? Because people like to relate their opinions on a personal or human basis. They prefer to *humanize* a company by attributing personality characteristics to it, says a Canadian banking publication. A firm is summed up in the same way we assess an acquaintance . . . *friendly* . . . *solid* . . . *human* . . . *public-spirited* . . . *human* . . . *sincere* . . . *honest* . . . or Heaven forbid . . . *crummy!*

A firm can try to make all the ideas expressed by it through print, the radio, television or other media project as if coming from a real personality, and not from a huge, inanimate mass known as "Company X". If it can accomplish this objective, it has gone a long way toward developing the idea in the public mind that it is a warm, down-to-earth, good-for-the-country organization. Remember Mr. Brown, our village blacksmith.

Several years ago I spent a couple of hours between planes in a visit to the wonderful Chicago Museum of Art. My interest was aroused by a display of typographic art in an exhibit of organization brochures. One title was unique. It read—"*The Only Real Difference Between Companies is People.*"

Today, you see this idea expressed in many forms. A Canadian banking firm, for instance, has profitably adapted the phrase into their advertising copy—"People Make the Difference." We are all familiar with the phrases—"your friendly department store" . . . "our smiling waitresses". Another clever slogan to sell a vocation is—"a carpenter is known by his chips."

Product promotion on familiar themes is a popular merchandizing practice—"Tastes Like Home-made Bread" or "Just Like Mother Used To Make" or "Home Cooking" or "Colonel Saunders Southern Fried Chicken" and "Aunt Jemima's Pancakes".

KEY FEATURES OF THE P. R. PLAN

Key features in the framework of your public relations program may cover the following subjects

* Your Business and Community Policies
* Your Attitude to Community Responsibilities
* Person to Person Relations
* Positive Approach to Issues

YOUR BUSINESS AND COMMUNITY POLICIES

How do you adjust to community situations? You will be judged by your attitudes to local endeavours and problems—parkland expansion, United Appeal drives, Red Cross, civic improvement by-laws, and contributions to charitable institutions. How is your relationship with salesmen, suppliers, customers, business associates and other companies? Here again we bring in the "corporate image" or "personality". Are your buildings, vehicles and facilities run-down or well-maintained? Are you and your employees courteous or surly? American Airlines spend $1 million a year on courtesy training for ticket agents, phone agents and stewardesses. This fact would suggest big business is very conscious of courtesy as a business asset.

What about your business methods—are they efficient? Do you guarantee your products and services?

YOUR ATTITUDE TO COMMUNITY RESPONSIBILITIES

Participation in community affairs by the company as a whole, and shareholders, directors, members, management and staff individually is of significant importance to the successful operation of a good public relations program. A recognition of social and civic responsibilities is evident in activities such as scouting; service clubs; fraternal societies; school boards; city, county or municipal, state or provincial and federal governments; youth programs such as little league and scouts and church organizations.

Community work brings personnel into direct contact with people who are affected and involved by your actions. Remember, they may be potential or actual customers, members or users of the product and service you are selling.

The ability of you and your staff to explain and interpret the why's and wherefore's of your policies can do much to determine how welcome you are in an area. An informed staff can go a long way to providing a climate of understanding.

It's true—people have more confidence in an organization when they associate it with a person they know, respect and like, and have they, themselves placed in a position of responsibility.

Employees can be the strongest public relations force available to a company. They can also be our poorest P. R. A community's opinion of the firm can be in reality a reflection of the opinions of that company held by the staff.

PERSON TO PERSON RELATIONS

A good program should encourage person to person public relations. It is not feasible or desirable for the head of the firm or his senior people to handle all the P. R. Rather, it is the responsibility of every member and employee to carry on a continuous effort to develop better understanding on the part of the public as to what the company stands for—what kind of an organization it is, and what it does.

The foreman's relations with his staff, the general manager's popularity with his subordinates, the purchasing agents attitude to salesmen, the telephone operator's answering of calls, the receptionist's courtesy to visitors, the tone of correspondence to suppliers and others, members pride in their club or facilities—all of these things go to create what has been described as the *corporate personality* or *corporate image.*

The person-to-person approach brings attention to a work now appearing frequently in our current literature. *Empathy,* briefly defined as *"the mental entering into the feeling or spirit of a person or thing; appreciative perception or understanding",* almost sums up the meaning of public relations. It has been called the "heart of selling",—the ability to place yourself mentally in the shoes of the customer, or learning to speak the customers language.

Would you talk to a member of your golf club about fertilizer mixes, grass mixtures, Hybrid Bermudas, Creeping Bent when you know he is actually unconcerned and unfamiliar with technical terminology? Maybe you think you are dazzling him with your mastery of scientific jargon. More likely you are boring him stiff. But he *might* be interested in why the new turf will resist the wear and tear of golf carts and the tramping of hordes of spectators. He identifies these things to his own experience. His understanding will extend to the realization that such measures will cut down maintenance costs and save him, as a member, *money.*

A POSITIVE APPROACH TO ISSUES

An important attribute of a sound public relations program is to be

positive—to take the offensive. A U.S. business executive describes the objective thus—"be aggressive rather than defensive in answering criticism. Make clear, forthright statements."

Perhaps your industry is free of serious public relations problems. However, I don't believe you are that lucky. The effects of chemicals—pesticides, fungicides etc. have been accented in recent months. Every user of these materials could be faced at any time with a public relations crisis. We know there have been exaggerations of the undesirable effects. But don't be smug and relax. Farmers, manufacturers and crop dusting firms are not the only people under the gun in this controversy. It could happen to a backyard gardener or the custodian of a public installation. The proponents of the anti-chemicals schools are vocal.

GRASS ROOTS PUBLIC RELATIONS FOR THE TURF SPECIALIST

What of the public relations of the turf specialist? Basically, his aims and objectives, his problems and satisfactions are similar to people in other professions and vocations. He seeks to communicate with his publics. Internally, these may be club members, chairmen of committees, golf professionals, elected park administrators, employees or other people in the same work. Externally, his concern is the general public and its many component groups.

He zealously guards his appropriations and responsibilities. He may be aware of a need for more money to carry out his program. He would not be human if he did not resent actions that allow others to dip into his funds to augment their own pet projects.

He joins the company of others in our society in striving for professional recognition . . . a commendable objective. A word of caution —many "associations" or "bureaux" try to set themselves up as 'professional' bodies. A few deserve the title—others do not deserve it. It must be earned by competent example. *Up-grading qualifications and improving standards of work skills appears to be the earnest desire of the turf specialist as evidenced from a perusal of his official publications.*

You are on the right road to professionalism. A few 'grass-roots' ideas adaptable to the public relations of the turfman are respectfully offered.

CODE OF ETHICS

A step in the direction of professionalism is the writing of a code of ethics for your Association, if this step has not already been taken.

CONTINUING EDUCATION — Today's world is fast becoming a pretty complicated place. John Q. Citizen is subjected to a constant barrage of ideas and attractions, all competing for his time. He doesn't have enough time to go around. He selects and rejects his reading, listening and viewing from an enormous mass of material—apportioning his attention among a hundred and one items.

The experts say each one of us is exposed to 1600 advertising messages a day. Modern man has learned to skim read a magazine and never see an ad—listen to a radio program and block out the commercial—and absent-mindedly drop direct mail advertising into the waste basket.

In 1960, 'Printers Ink' magazine said the most important word in the 1930's was "security"; in the 1940's—"conflict"; in the 1950's—"science"; and in the 1960's it would be "communications"—both in travel and in education.

The impetus in education has seen North Americans today better-schooled and better-informed than ever before. By 1970, seven million students will be in American universities. North Americans will have 70

million TV sets in their homes in this decade. There are 70 million car radios in the U.S. In 1961, over 50 million hard-cover books were sold, along with a million copies of paperback books every day. Charles Adams, writing in Printers Ink last year, observed that 40 million people visited the 5000 art galleries in the United States. Three major news magazines boosted their circulation 40 per cent in the past five years. Since the advent of television theatre and opera attendance has jumped 115 per cent.

Adult education on the continent has risen to mammoth proportions with $60 billion spent annually in this field, compared to $40 billion for all formal education costs from primary grades through universities. The skills learned by the high school graduate of 1963 will be obsolete in 1970, accenting the need for more and more adult education. A Canadian educator says—"it will be necessary to teach our children two things—how to learn, and an unquenchable desire for development.

What does all this mean to you and me? First, it lets us know that continuing education is a must for everyone engaged in trying to disseminate ideas to the public. Our audience will disappear if we waste their time with dull, unimaginative writing.

As mentioned earlier, trying to purloin a moment of a man's time is becoming increasingly difficult. He wants facts, not generalities. Mr. Adams, again in Printers Ink, declared—"the average man must be appealed to more directly and more intelligently than ever before. You must say what you want to say quickly and straightforwardly—and treat him like an intelligent man." In other words, don't talk down to him.

To help us get the message over, we should take advantage of short courses in subjects relative to our work. The technical aspects of yours and many other professions are becoming more formidable every day. To maintain your position in society in competition with other groups requires study and self-improvement. Public speaking is an activity you should not avoid as you may be called upon to participate in it at any time. It has become a prerequisite for a person engaged in management and carrying out duties that entail meeting the public. Help yourself to tell your story by mastering the techniques of report and news release writing.

RECORD KEEPING

A sound business practice for the turfman is to set down the facts and figures on management procedures—rates of grass seedings, application of fertilizers, pesticides, turf repairs, labor time on jobs. Accurate records can be impressive documents if you are called upon to state and even legally support your case. They are valuable aids when budgets and programs are being discussed. Putting your best foot forward by acting business-like is sound public relations.

In these days of prompting the public to hysteria about chemicals being used in agriculture, it is wise to have the statistics readily available.

SELLING YOURSELF

I have been privileged to read excellent articles on doing the job of selling yourself which have appeared in some of your publications. After reading these fine articles, written in many cases by your colleagues, I am convinced you people already know the story without hearing it from a stranger. Allow me to review some of their points, and make a couple of additional suggestions.

An out-going personality coupled with courtesy, respect and friendliness will help you to mingle with others and enjoy their company—and they yours. Integrity is your greatest asset. Shop-worn cliches, you say. Yes, but true none-the-less.

It is an accepted fact that a neat, clean personal appearance is another asset. You don't have to be a glamour boy, but if you walk around looking like hard-times, people may reach the conclusion that you and the organization you represent are on the rocks financially, and sloppily-managed.

We have all met the fellow who engages you in conversation, and then won't let *you* get a word in edge-wise. If you do manage to regain the conversation ball, he fixes you with a vacant stare and is miles away from you in *his* thoughts. He thinks so little of your comments which are undoubtedly pearls of wisdom to you, that he lets his attention wander. Conversely, we feel wonderful when a person seems to hang on our every word. Give your undivided attention to the other fellow. It pays dividends to be considerate of the feelings of others.

The ability to call a man by name is an attribute we all can use. A man's name to him is the sweetest and most important sound in any language. Unfortunately, the majority of us let the names go in one ear and out the other.

Generosity to others of your time, knowledge and experience is money in the bank, but a warning—don't exceed your capacities. You will not be doing yourself or the cause a bit of good if you cannot handle the tasks adequately because of lack of time.

Civic projects, youth work, all forms of public service are rewarding to the individual, providing him with a sense of well-being and satisfaction in his endeavours.

You can also ensure your reception as a person to be given responsibilities if you are business-like, show initiative and sincerity in all your activities. Be an innovator, try new ideas. Vary your approach to old ideas.

CULTIVATE YOUNG PEOPLE

Participation in youth activities is a valuable and satisfying experience. Your profession must be interested in the youth of the country. They are your future customers, your future employees, your future superintendents. In the race for talent you have to compete with other industries. The competition is growing stronger every year. Here are a few suggestions for attracting young people into your field.

* **TOURS** of your facilities to build up interest.
* **TALKS** to school classes and assemblies on 'Career Days', outlining the opportunities in your industry. The school vocational counsellors will offer guidance and cooperation in making the 'pitch' to the students.
* **SUMMER EMPLOYMENT** of promising young folk can be a big step in the direction of up-grading your future staff, and building talent pool of skilled workers to draw on.
* **MEMBERS' SONS AND DAUGHTERS** offer a big potential for goodwill. Include them in your tour plans. First, they take home good reports to their parents; secondly, the parents are usually grateful and pleased that others take an interest in their childrens welfare and education.
* **SELL YOUR PROFESSION** by describing the interesting facets of your work. Accent the need for technical training, managerial ability, the satisfactions of working with growing things, the opportunity to get out of the office occasionally, working conditions, remuneration, fringe benefits. Eliminate the idea that may exist in their mind that 'sweat-shop' conditions prevail in your vocation.

* **SCHOLARSHIPS** Why not institute an Association scholarship program for deserving students, either at the high school or college level? Along this line are essay contests on your industry, or the provision of trophies for youth achievements.

COMMUNITY ORGANIZATIONS — AN OPPORTUNITY

Tours of your plant for garden clubs, horticultural societies, wives of members, special groups such as fraternal societies, church auxiliaries, service clubs, Chambers of Commerce offer opportunities for good public relations. A garden clinic as an annual or semi-annual affair might go over. Here you and your assistants would answer questions. I expect you are bombarded with requests now. It could be a sound decision to organize these myriad requests into a single periodical program and benefit from the resultant good will. Of course the time-consuming individual queries will still have to be handled or its back to the dog-house with some people.

To reach the community groups, including the young people, a small booklet describing your profession and your industry would be useful. A brochure can be an expensive item, but the benefits could outweigh the costs.

PRESS CONTACTS

How to deal with news media is important to every person or organization. Here are a few rules to keep in mind.

* Ask yourself—is your story worth printing or broadcasting? Don't call press conferences or issue press releases unless the news is *important.*
* Be a reliable source of news. Don't be self-centered—your story may not be as great as you think.
* Don't shut your door when news is not pleasant. 'No Comment' or 'tell them nothing' statements are dangerous. The reporter has a job to do. He is under pressure to get the facts and get them straight—from the horse's mouth. Cooperation is appreciated. Refusal arouses suspicion. Be patient.
* Give the news quickly and in detail.
* Don't expect free advertising. It is looked on as a bare-faced attempt to get something for nothing. Editors ask "why don't they pay for it." After all, advertising pays the salaries of editors, typographers, reporters, engravers, announcers—and bills to many industries.
* Names make news—use them.
* Invite news media people to your facility. They are constantly on the look-out for 'local' stories. Your course or park may be ideal for a TV feature or a story in the week-end magazine section of the newspaper, or a radio on-the-scene interview. Get to know your local editors, radio station and TV personnel.
* Press kits can be useful. Pertinent information on your course or park, assembled into a single package, is a handy reference of story background material for the news man.

FAMOUS VISITORS

Golf courses in particular have many famous visitors from the entertainment world, business, government, sports and the arts. Why not build a turf story around one of these personalities? Have you ever considered two famous golf course users—Bob Hope and Bing Crosby—as speakers at your conventions. The legal profession invites Raymond Burr, alias Perry Mason the TV sleuth as a convention speaker. The

medical profession has good words for Ben Casey and Dr. Kildare programs. Famous people, too, enjoy parklands and recreational areas, and may like to talk about it.

P. R. TOOLS — as aids for talks and tours, the use of colored slides and movies is common practice in many industries. A superintendent can build up an inexpensive set of slides for his own use. Your Association might consider a short 16 MM colored movie for use in schools, club shows and on television, describing the work of a superintendent and using various parks and courses for scenic backgrounds. The motion picture is a wonderful public relations tool. Speaking from a personal experience, we have shown one 25 minute colored film to 800,000 people since 1960. Showings have been seen on 23 television stations alone, and the demand still continues.

There is a story how an international public relations man, Guido Orlando, used his vast experience to help a blind beggar in Paris. The beggar sat all day with his little cup, and wearing a sign "BLIND"—but no one ever gave him any money. Orlando decided to help him. One day he asked—"do you want people to give you money?"

"Of course, Monsieur."

"So I turned his sign around," said Guido, "and on the back I wrote, 'Spring is Here. You Can See It—I Can't'. Everybody who passed by put money in his cup. The idea if his being unable to see the spring touched them where his blindness hadn't. *That is public relations.*"

Is public relations here to stay? Is it really needed? The answers to these questions may be found in the remarks of a famous man, expressed 125 years ago.

> "Public sentiment is everything. With public sentiment, nothing can fail. Without it, nothing can succeed. Consequently he who molds public sentiment goes deeper than he who enacts statutes or pronounces decisions. He makes statutes and decisions possible or impossible to be executed."
>
> . . . ABRAHAM LINCOLN

HOW CLIMATE AFFECTS OUR TURFGRASS DISEASES

by Charles J. Gould*

Introduction

A plant disease is frequently defined as an abnormal condition. Within the limits of this definition, disease can be caused by too much or too little food, too much or too little water, by unfavorable soil conditions, by excessive compaction of the soil and by many other factors, including fungi and other pathogens. Of these disease-producing conditions, we shall confine the discussion today to parasitic fungi and their development under various climatic conditions.

---

*Plant Pathologist, Washington Agricultural Experiment Stations, Washington State University, Western Washington Experiment Station, Puyallup, Washington.

Proceedings of the Northwest Turf Conference, September 25-27, 1963, Portland, Oregon

Climate includes not only the familiar factors of temperature and precipitation, but also factors such as visible and invisible radiation, dust, gases, electrostatic charges, etc. The climate can be considered under two categories: the *macroclimate,* or the general over-all climate, and the *microclimate,* or that which surrounds each individual plant. Naturally, macroclimate influences microclimate to a considerable extent. Leaving microclimate as a major topic for some future conference, we shall pay most attention today to the general effect of temperature and precipitation on parasitism of certain fungi on turf grasses.

What is Necesary for a Disease Epidemic?

Three factors are essential for a plant disease epidemic (or epiphytotic): an abundance of susceptible hosts, favorable environment and a virulent pathogen. Of course, the best situation for disease development is to have *all* environmental factors very favorable for the fungus and unfavorable for the host. Turfgrasses, actually, are in an unnatural environment from the day they are planted. The abundance of plants, the heavy use of fertilizers and the abnormal wear and tear on plants permit the development of many fungi that cause only minor trouble on similar plants grown in their native habitat.

Unfortunately, in the mild and moist climate of the Pacific Northwest, we usually find an abundance both of susceptible host and of major parasites such as *Fusarium, Corticium,* etc. Consequently, in this area the major factor determining the development of disease is *climate,* whether it is natural or artificial.

General Effect of Weather on the Host

Temperature:

The effect of climate is usually one of interaction between host and parasite. This has been beautifully demonstrated with a species of *Fusarium* that attacks both wheat and corn. The fungus grows best in culture at 75 to 81° F. However, it does most damage to corn at low temperatures (46 to 68° F.) but wheat is more susceptible at relatively higher temperatures (61 to 81° F.). Why? Because corn 'likes' hot and wheat 'prefers' cool weather; reverse conditions are unfavorable for each host and consequently favor the fungus. The practical result is the seedling blight due to this fungus attacks wheat mostly in the southern part and corn in the northern part of the range of each host (2).

In general, conditions that favor development of succulent tissues (such as cool, moist weather and excessive nitrogen) increase the susceptibility of grass plants. This is particularly characteristic of Damping-Off, a disease of young tender seedlings where the fungus grows faster than the host matures under cold moist conditions.

Light:

Low levels of light usually produce more succulent host tissues, which are readily invaded. However, very high light intensities may injure cells, thereby facilitating invasion by certain fungi.

Gases:

Grass injured by gasoline fumes, smog, sulfur dioxide or other gases probably is more readily invaded by weak parasites than that not injured, but little research has been done on this problem. A Russian report (4) recently stated that lawns exposed to the influence of industrial gases required more careful maintenance than ordinary city lawns. Unfortunately, quackgrass was more resistant to such gases than 16 other lawn species tested by them.

General Effect of Weather on Fungi

A. **Temperature** may affect fungus development as follows:

(1) **Sporulation.** Too low or too high temperatures are usually unfavorable for spore production. With optimum temperature the production of spores is often amazing. We have found about 50,000 spores in a one-fourth inch piece of a *Fusarium*-infested grass leaf. Stakman (29) reported that one "Shaggy-Maine" mushroom produced about 5 billion spores and discharged these at a rate of one hundred million per hour. The number of uredospores in a single acre of fairly heavily infested wheat has been estimated at 50 trillion (29). A heavy rust epiphytotic in South Dakota could produce two sextillion spores. If only one in every 10,000 of these blew north into North Dakota, there would be four spores for every wheat plant in the state (2). In eastern Washington during years of wheat smut 'showers' as many as 5,000,000 spores have fallen on each square foot of ground (30).

(2) **Germination and Infection.** Rhododendron rust spores may begin to germinate within two hours. On apple trees the scab fungus germinates and infects leaves within four hours at 68° F. but requires twice as long at 77° F. and three times as long at 43° F. (29). The common late blight fungus attacking potatoes can germinate, penetrate into leaves and produce spores, all within 2 1/3 days at 73° F. This process requires twice as much time at 59° and infection cannot even occur at 77° F. (29).

(3) **Longevity.** Pathogens vary considerably in their length of life. Small swimming spores (zoospores) of fungi such as *Pythium* may last for only 48 hours, even when kept cool and moist. At the other extreme are smut spores which have survived as long as 39 years in dry, herbarium specimens. Some of our Rhododendron rust spores have survived several months at cool temperatures but only a few days at high ones. Unfortunately, we know very little about the influence of temperature on the life span of spores and mycelium of most of our turf pathogens.

B. **Moisture:**

(1) **Sporulation.** Most fungi produce spores abundantly only at a high relative humidity. Some actually require a film of water before sporulation can occur.

(2) **Germination.** Free water is necessary for germination and infection by fungi such as *Pythium*, whose spores actually swim. However, many spores are inhibited or killed by excessive moisture, as when they are submerged in droplets of water. This is particularly true of many rust fungi. At the other extreme are the powdery mildews whose spores contain so much water that they can germinate even in relatively dry atmospheres of 25 to 55% relative humidity.

(3) **Longevity.** Extremes of moisture usually shorten the life of most spores, particularly at high temperatures.

(4) **Growth of mycelia.** A high relative humidity is essential for most fungus growth, since the cell walls are so thin that water is lost rapidly under dry conditions. This is particularly noticeable with *Fusarium*.

C. **Light:**

High intensities inhibit germination of Rhododendron rust spores, but low intensities are better than complete darkness. A little ultra violet radiation will stimulate sporulation in some fungi but high levels can kill. Most turf disease development in western Washington ceases or slows down during bright sunny weather. In this case, the effect is

believed to be indirect, since low relative humidies and high temperatures usually occur during such weather.

D. **Gases.** High levels of carbon dioxide in the soil may inhibit growth of *Ophiobolus graminis,* but this factor will be elaborated on at a later conference.

Distribution of Turfgrass Diseases in North America

It is generally recognized that turfgrass diseases vary in intensity from one area to another. This variation arises from the effects of climate on hosts as well as on pathogens. Thus, we seldom see rust in western Washington because bluegrasses (except the widespread annual bluegrass) are not common in the area. Similarly, some fungi are more abundant in hotter climates and some in colder ones, but most prefer moderate conditions.

We have just completed tabulating the results of questionnaires returned by 29 pathologists from various areas of the United States and Canada. In order to draw definite conclusions, many more reports are needed and many more detailed surveys are required. However, the general results of this survey are certainly interesting. The two pathogens that definitely appear to be generally most troublesome are *Rhizoctonia* brown patch and *Helminthosporium* leaf blight. The next eight in order of importance are: *Sclerotinia* dollar spot, *Pythium* blight, *Helminthosporium* crown and root rot, *Typhula* snow mold, *Marasmius* fairy ring, *Fusarium* patch, Damping-off and various rusts. This listing represents a combination of ratings for both putting and higher-cut turf. Of course, some diseases are much worse on putting turf and others are more serious on lawn type.

Putting Turf—*Rhizoctonia, Helminthosporium* and *Sclerotinia* appear important in all but the Northwest and West Central areas. *Pythium* is most destructive in warm regions and *Typhula* in cold ones. *Nematodes* are worse (or have been most investigated) in the Southeast. *Damping-off* appears to be worse on the West Coast, although it is fairly important everywhere. *Winter crown rot* (caused by an unidentified low temperature basidiomycete) is definitely a northern United States-Canadian problem, while the Pacific Northwest (west of the Cascades) is a haven for *Fusarium, Ophiobolus* and *Fairy Ring.* (Fig. 1). The division of North America into regions follows Musser (21) and is based upon climates favorable to certain types of grasses.)

Lawn-type Turf—The disease picture is somewhat different in high-cut turf. *Helminthosporium* is a problem in most areas, *Sclerotinia* is serious in the East, *Rhizoctonia* in the South, *Typhula* and *Rusts* in the North, *Spring dead spots* in the southern Midwest, *Powdery mildew* in the West Central, *Pythium* in the Southwest, *Damping-off* in the West Coast, while *Corticium red thread, Fusarium patch,* and *Fairy Ring* are dominant in the Pacific Northwest. We suspect that when time permits an adequate survey, both *Ophiobolus* and *Helminthosporium* will also be found to be important pathogens in high-cut turf in the Northwest. (Fig. 2).

Diseases and Climate in the Pacific Northwest

Let us next examine more closely some of the climatic factors and diseases in our own corner of North America. Average temperatures and precipitations for the months of January and July are shown in the accompanying table. (Table 1). Data for other months would be necessary for a detailed evaluation but time and space do not permit their inclusion at this time.

Fig. 1. The Most Serious Diseases in North America on Hi-Cut Turf

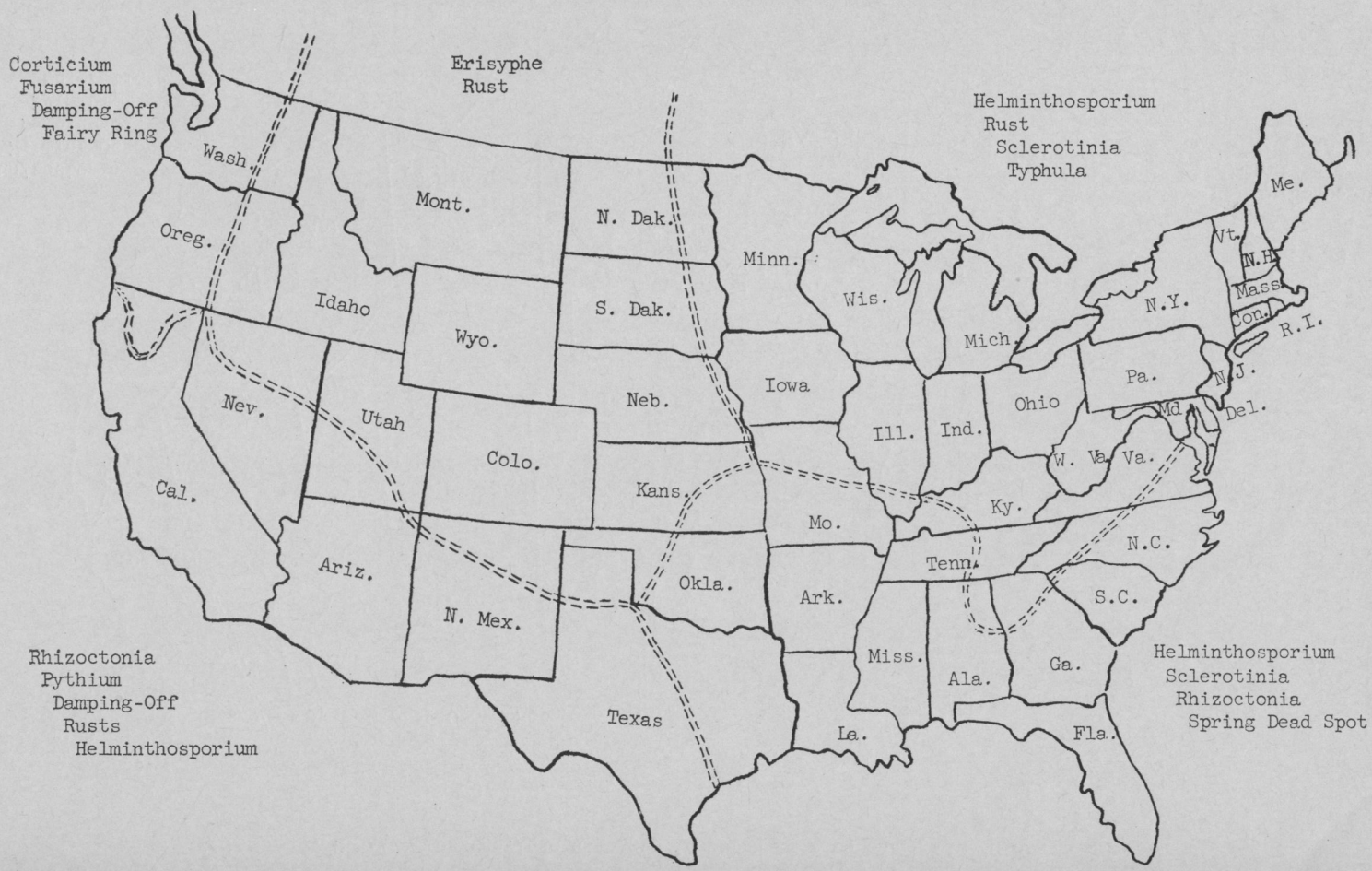
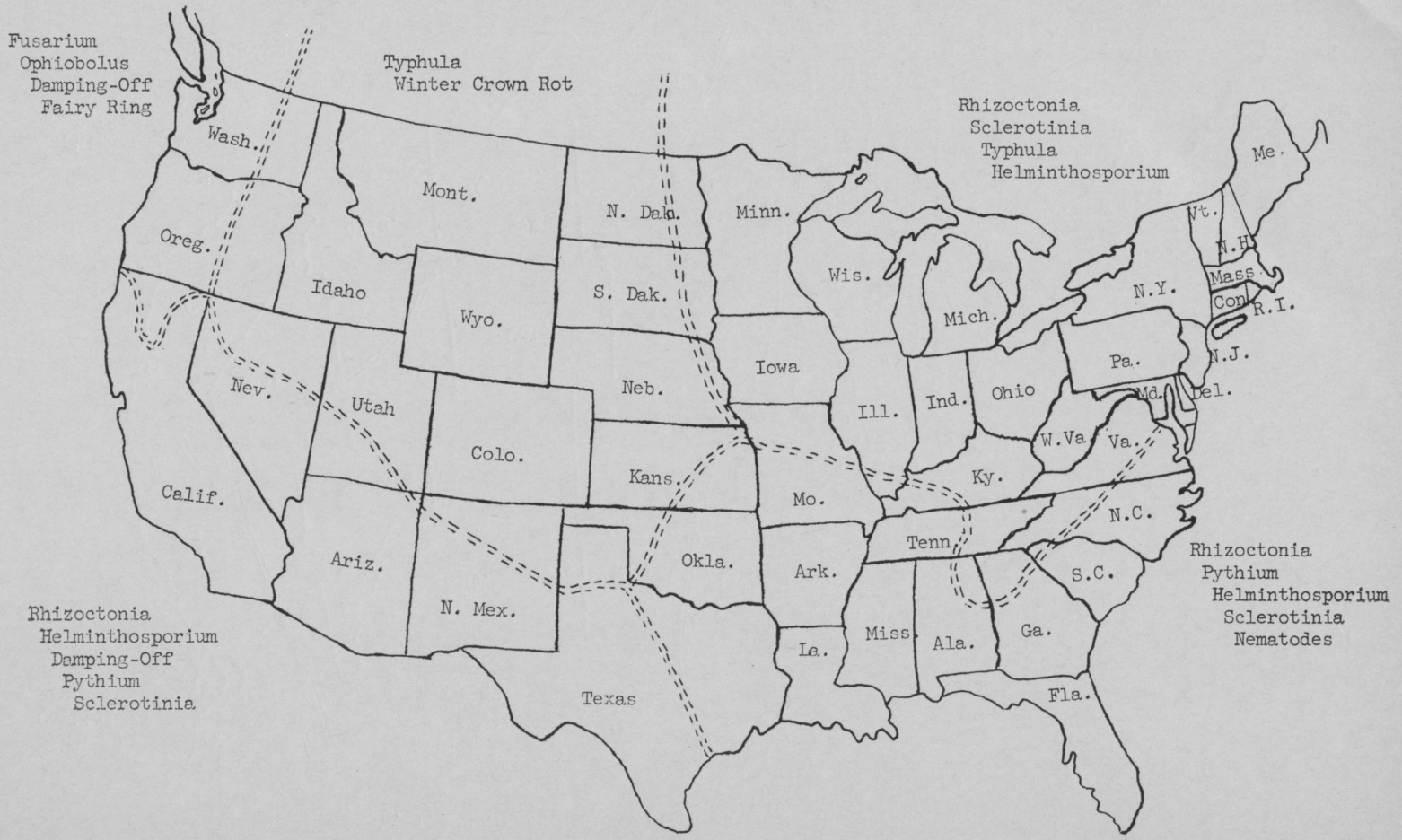


Fig. 2. The most serious diseases in North America on Putting Green Turf.



In general, disease distribution correlates well with temperature and precipitation patterns. Thus, we find both of these climatic factors favorable for development of *Fusarium* patch in January west of the Cascades and the disease often appears during this month. However, east of the Cascades January temperatures are usually too low for *Fusarium* growth. Instead of this fungus we find *Typhula* in the more northern area where snow persists longer. In July the temperatures north of the Sacramento Valley are sometimes favorable for *Fusarium* but precipitation (or relative humidity) is usually much too low. Consequently, the major diseases are *rusts* and *powdery mildews* east of the Cascades. Other miscellaneous diseases sometimes appear in the western area during this season. As we go south from Vancouver, B.C. we find that July temperatures gradually increase to a point in the Portland area and the Willamette Valley where we might expect occasional outbreaks of *brown patch* and *dollar spot*. The former occasionally develops but low daytime humidities usually keep it in check. *Dollar spot* only appears rarely, if at all.

Fairy Rings are widespread throughout the Northwest and the causal fungi often fruit west of the Cascades but seldom in the drier eastern area. The *Ophiobolus* patch fungus, which apparently spreads below the soil surface, continues to grow during the summer, except under very dry conditions.

Even within restricted areas different temperature and moisture conditions drastically affect disease development. Thus, *Fusarium patch* is usually much more important than *Typhula snow mold* in Southeastern Washington, while the reverse is generally true for the Northeastern section, probably because the snow cover persists longer. Let's look now at some of the individual requirements of our various turf pathogens.

Fusarium Patch

Although several species and forms of *Fusaria* can cause trouble in turf, the one of most concern to us at present is *Fusarium nivale.*

Temperature—The results of tests by two workers (5,10) show that the fungus can make considerable growth in culture even as low as 36° F. but the optimum temperature is near 68° F. and the maximum between 91° to 97° F. However, Dahl (10) obtained most infection of grass between 32° and 41° and only a little at 59° to 68° F. within two days. In recent tests Endo (13) obtained some infection at 40°, most at 60° and 70° and none at 90° F. In our tests more infection has occurred at 58° than at 48° or 67° F. Bennett (5) showed that the fungus could withstand 4° F. in the mycelial or vegetative stage but that it died after 5 days at 91° F. He and Smith (27) have shown also that different strains of *F. nivale exist.* It is entirely possible that the strains of *F. nivale* in eastern Washington differ from those in western Washington, where disease development practically ceases when the temperature approaches freezing.

Temperature is also important in its general effect on the turf. Thus, infections are often masked from spring through fall by rapid growth of the grass surrounding the spots but become apparent in the winter when diseased areas fail to 'fill in.' Attacks may also follow sharp frosts when the leaves are damaged and recovery is slow.

Moisture—Under normal conditions most turf is probably reinfected by *Fusarium* soon after being disinfected with a fungicide. However, the fungus apparently grows slowly at first until a ¼-½ inch spot is affected. Then, under favorable conditions, it seems to explode. In western Washington the moisture seems to be the critical factor in disease outbreaks more often than is temperature. Persistence of a high relative

Table 1.

Temperature and Precipitation Records

for the Pacific Northwest and adjacent areas in January and July (1)

West of Cascades						East of Cascades					
		January		July				January		July	
	Latitude	Temp.	Prec.	Temp.	Prec.		Latitude	Temp.	Prec.	Temp.	Prec.
Vancouver, B.C.	49	36	8.4	63	1.2						
Seattle	48	40	4.9	63	0.6	Spokane	48	28	1.8	69	0.5
						Coeur d'Alene	48	27	3.6	69	0.8
						Missoula	47	22	1.0	68	0.9
						Yakima	47	27	1.0	71	0.2
Portland	46	39	6.0	67	0.5	Walla Walla	46	33	1.8	74	0.3
Eugene	44	40	5.6	66	.04	Bend	44	31	1.8	65	0.5
						Boise	44	24	3.2	68	0.4
						Klamath Falls	42	29	2.0	68	0.3
Eureka	41	47	6.7	56	0.1	Redding	41	45	7.1	82	0.1
						Reno	40	32	1.4	71	0.3
						Sacramento	39	46	3.3	74	0.0
San Francisco	38	40	4.4	59	.01						

humidity around grass plants is necessary for the greater part of the time during several successive days in order to permit rapid spread of the fungus. In western Washington this occurs most often during September and October when there are frequent periods of heavy fog, light misting rain, or overcast skies that prevent evaporation of water of guttation. Heavy rains seem to hinder spread of the fungus.

Light—Some light is necessary for production of spores and for development of pink color according to Smith (27). Light is also one of the main factors affecting appearance of symptoms, which may range from a bright copper through tan to a dead brown, brownish green, or a grey, depending mostly on amount of light, age of the spot, temperature, and moisture.

Corticium Red Thread

This fungus (*C. fuciforme*) is widespread over all of the Pacific Northwest, but apparently is most severe west of the Cascade Mountains and in this area it is most often found on fescues suffering from lack of nitrogen. The stroma (masses of fungus strands) can withstand considerable drying and exposure to high temperature and resume growth within two days when favorable conditions return.

Temperature—The fungus grows slowly near freezing, best at about 68° F. and ceases between 77° to 86° F. in culture (14). However, the disease was worse in one of our tests at 58° than at 48° and very little developed at 67° F. In Endo's (13) experiments infection was optimum near 60° and 70°, slight at 40° and 80°, and lacking at 90° F. The stroma can withstand -4° F. and 90° F. They have also been reported surviving dry for two years (28). Rapidly growing grass apparently 'outgrows' the fungus but when turf growth is retarded (as in the case of bentgrass in putting greens during most of the winter), the fungus often causes trouble.

We may find *Corticium* becoming a very serious problem generally if growth retardants come into general use. Smith (28) reported a severe attack following use of maleic hydrazide—which may have resulted from retarded growth, injury or increased susceptibility of the grasses. Different temperature-strains of the *Corticium* apparently exist, as Erwin (14) has reported.

Moisture—Lack of moisture is the limiting factor governing spread of the *Corticium* during the summer months in both England and in our area west of the Cascade Mountains. The stroma are definitely dependent on a high relative humidity for elongation. However, spread from diseased spots is apparently suppressed by heavy drenching rains—just as in the case of *Fusarium nivale.*

Light—The greater the sunlight—the redder the color of stromata and of the entire diseased area.

Ophiobolus Patch

The causal fungus (*O. graminis*) causes a worldwide disease of cereals called "Take-all." It is also certainly capable of 'taking all' of the bentgrass in spots in areas west of the Cascades and in England and Australia. Since the fungus is so common on cereals throughout the world, it seems odd that turf is affected only in these areas mentioned. It has been most destructive both here and in Australia (3) where methyl bromide fumigation preceded planting. (Perhaps antagonistic organisms (18) were eliminated or maybe some other factor was responsible.) Although the fungus does not 'like' anaerobic conditions, it often causes severe injury in low wet spots where the grass seems to be hurt more than is the fungus. Liming increases attacks, while addition of organic matter decreases them. These factors will be discussed in detail at a subsequent conference. It should be noted that strains of

the fungus exist which vary in pathogenicity on different hosts.

Temperature—The optimum for growth in culture is about 73° to 75° F. (11) but most crown infection of wheat occurred at a lower temperature (54-61° F.) (19). Garrett (15) and others have suggested that this discrepancy may have been caused by increased microbial antagonism in soil at the higher temperatures. Tests were made at the Western Washington Experiment Station using naturally-infested turf. The turf was most rapidly affected between 69 and 76° F., but considerable spread developed subsequently at temperatures as low at 51° F.

Moisture—Symptoms are most noticeable in late summer under dry conditions, presumably because diseased plants absorb or transport less water. However, the disease is more severe generally in wet years than in dry ones (28). Detailed studies are needed on turf.

Light—Markedly stimulates formation of the fungus fruiting bodies (perithecia).

Typhula Snow Mold

This fungus can certainly be characterized as a winter type and is appropriately called Snow Mold. It usually, but not always, appears under melting snow or just beyond its edge. Several species cause considerable damage to cereals. Two species (*T. incarnata and T. idahoensis*) cause most loss in turfgrasses, and of the two the former is apparently the more serious. Older plants and weak or injured plants are more susceptible than are seedlings to attack (7).

Temperature—Several reports (7,22,23,24,25) indicate that the fungi can attack at freezing temperatures or even somewhat below freezing. Based upon these reports the upper limit of growth in culture seems to be near 64° F. and the optimum is about 48-54° F. However, most infection occurred between 32 and 41° F. in their tests. Smith (28) obtained most infection within two weeks at 36 to 41° F. but also found the fungus could become well established at 32° F. Dahl (10) also noted that the temperature under snow stayed near 32° F. even when air temperatures dropped to -20° F.

Moisture—Garrett (15) reports more disease with higher rainfall in spring or summer, but Cormack and Lebeau (7) report both growth and infection are reduced in saturated atmospheres. They obtained most infection with a combination of 35-41° F. temperatures and 80-90% relative humidity.

Light—Development of sclerotia and mycelia are stimulated by diffused light but inhibited by strong sunlight and darkness (22). Ultra violet light stimulates development of fructifications (24). Meiners (20) found sporophores occurred mostly from late October to mid-December and were occasionally abundant enough to give a pink cast to diseased areas of turf in eastern Washington.

Fairy Ring

The national turf disease survey showed that the Fairy Ring disease is widespread in North America and that it frequently causes considerable trouble to turf. The causal fungus is usually the mushroom *Marasmius oreades* but species of Psalliota, Lepiota, puffballs and other basidiomycetes are sometimes responsible. Some mushrooms adversely affect turf; others merely stimulate it; and some produce no appreciable effect except for formation of the fruiting bodies. Effects from *Marasmius* also vary. In western Washington we have seen dead grass rings as much as two feet wide in turf that is suffering from a deficiency of moisture, organic matter and nutrients, while in nearby, but better-kept lawns, the same fungus produced only a stimulated zone of grass and its mushrooms.

The fungus starts in one spot and most often grows outward in a circle, usually at a rate of 3-14 inches per year. Some rings have been found that are over 200 feet in diameter and presumably are over 400 years old (20). The mushrooms produce an enormous number of spores but new rings are formed relatively infrequently—indicating that conditions specifically favorable for spore germination and infection seldom occur. Our experimental efforts to inoculate healthy turf by transplanting infested plugs have usually ended in failure—as have similar efforts by many others.

Shantz and Piemeisel (26) mentioned a report that rings were uniformly broken on the downhill side—suggesting a harmful influence on the fungus of decomposition products washed toward the lower side.

Few careful investigations have been made on the effects of various climatic factors on fungus infection. Soil moisture seems to be the chief factor governing fruiting. Thus, most sporophores are found in western Washington after the fall rains begin (16). If the weather dries up after fruiting starts, the mushrooms are much smaller and tougher than under normal conditions. Mushrooms develop much less frequently in eastern Washington where rainfall is lower during the crucial period than in western Washington.

Damping Off

Damping-off is a disease of seedlings, usually occurring under conditions that delay seed germination and/or growth. The disease is often responsible for poor stands of grass in the spring when seed is sown too early in cold, wet soil. High soil moisture may slow germination by reducing seed respiration but dry soil may also retard germination. Excessive seeding rates also provide more abundant succulent tissues for the spread of the various causal fungi (particularly *Pythium, Fusarium* and *Rhizoctonia*). Optimum temperature and moisture requirements vary for the particular fungi concerned, but in most areas any condition that delays germination and retards rapid maturation of the seedlings is likely to result in damping-off.

Helminthosporium Diseases

Many species of *Helminthosporium* attack different types of grasses under differing climatic conditions. This group of parasites has not yet been adequately studied in western Washington on turfgrasses, but we certainly suspect that they are present, particularly in turf that looks 'thin,' where improper culture is not the obvious cause. Some species of *Helminthosporium* cause a leaf-spotting, some a general blighting, and some may do both.

Spores of some species may germinate within 30 to 40 minutes, penetrate into leaves within 8 to 10 hours, and produce disease symptoms 5 days later. Some species can grow at almost freezing temperatures, others at temperatures as high at 86 to 104° F. The optimum seems to be around 77° F. for one of the most common species (*H. sorokinianum*) (12). Spores may survive five years or longer. Symptoms vary with temperature. Thus, Weihing (31) reports leaf spotting at 68° F. and a severe and general leaf blighting at 95° F. Spotting is generally most common at low temperatures and low relative humidity and blighting at high temperatures and high relative humidity. Results of root infection are usually most severe in either extremely wet or extremely dry soil.

Rhizoctonia Brown Patch

Although Brown Patch is the number one disease in most of North America, it is not well known to golf course superintendents in western Washington, primarily because our weather usually does not favor its development. Apparently the fungus is widespread but we usually have

only one or two outbreaks here lasting a few (2-7) days each year. Couch (9) states that penetration of leaves begins at 73° F., is highest at 80-85° F. and ceases at about 90° F. Endo (13) found two pathogenic strains: one with an optimum pathogenicity at 80 to 90° F. and another slower acting between 70 and 80° F. The mycelium dies when temperatures drop below 62° F. If inoculum is widespread, large areas may be blighted within 6-8 hours. Otherwise, the fungus spreads as a 'smoke ring' at about 1 inch per day. The soil moisture level is apparently not too critical a factor as long as the relative humidity around grass blades remains high with the temperatures over 62° F. Fortunately for our turf, the days are usually too dry and the nights are too cool for the fungus here.

Nematodes

This group of microscopic worms was reported in the survey as troublesome to turf only in Florida, Georgia, Pennsylvania, and Nebraska. But it is extremely likely that additional investigations will reveal them to be serious in other areas, either as direct parasites or as precursors to various fungi. Most of them generally cause more trouble under warm than under cool conditions so we in the Pacific Northwest can take some comfort in this knowledge—for a while at least. Under their own power nematodes move only about 2-3 feet a year but such cultural measures as aerifying and thatching can assist their spread (6).

Sclerotinia Dollar Spot

Howard (17) reported that the fungus (*S. homoeocarpa*) will grow slowly near freezing, makes most growth between 68 and 86° F. and stops growing at about 99° F. Endo (13) got a little infection at 60°, most between 70 and 80°, and none at 90° F. However, he found that the fungus could grow in culture as low as 40° or as high as 90° F. Its inability to infect grass at these temperatures may be due to failure to produce a toxin that injures roots. Couch (9) stated that it becomes active at 60° F. A high relative humidity around grass blades is necessary for its spread, but there is less damage to turf grown in saturated soil than that in dry soil (8). In view of the temperature and moisture requirements, we expect that the fungus may occasionaly develop here (more likely in southwestern Washington) but certainly not as a serious problem, unless a drastic change occurs in the climate.

Pythium Blight

Although we have not observed any trouble from this disease and do not anticipate much, we have included it for comparison with our known pathogens because it is so important in the southeastern United States. The fungus is most serious in a hot and humid climate, and can completely destroy stands of turf within 24 hours. Most infection occurs in saturated atmospheres at high temperatures. Thus, in Endo's (13) tests the optimum was 90° or higher, and the minimum was 60° F. Although the spores need water in which to swim, infected grasses actually show most damage when the soil moisture is near the permanent wilting point (9). Various species of *Pythium* also may cause Damping-off.

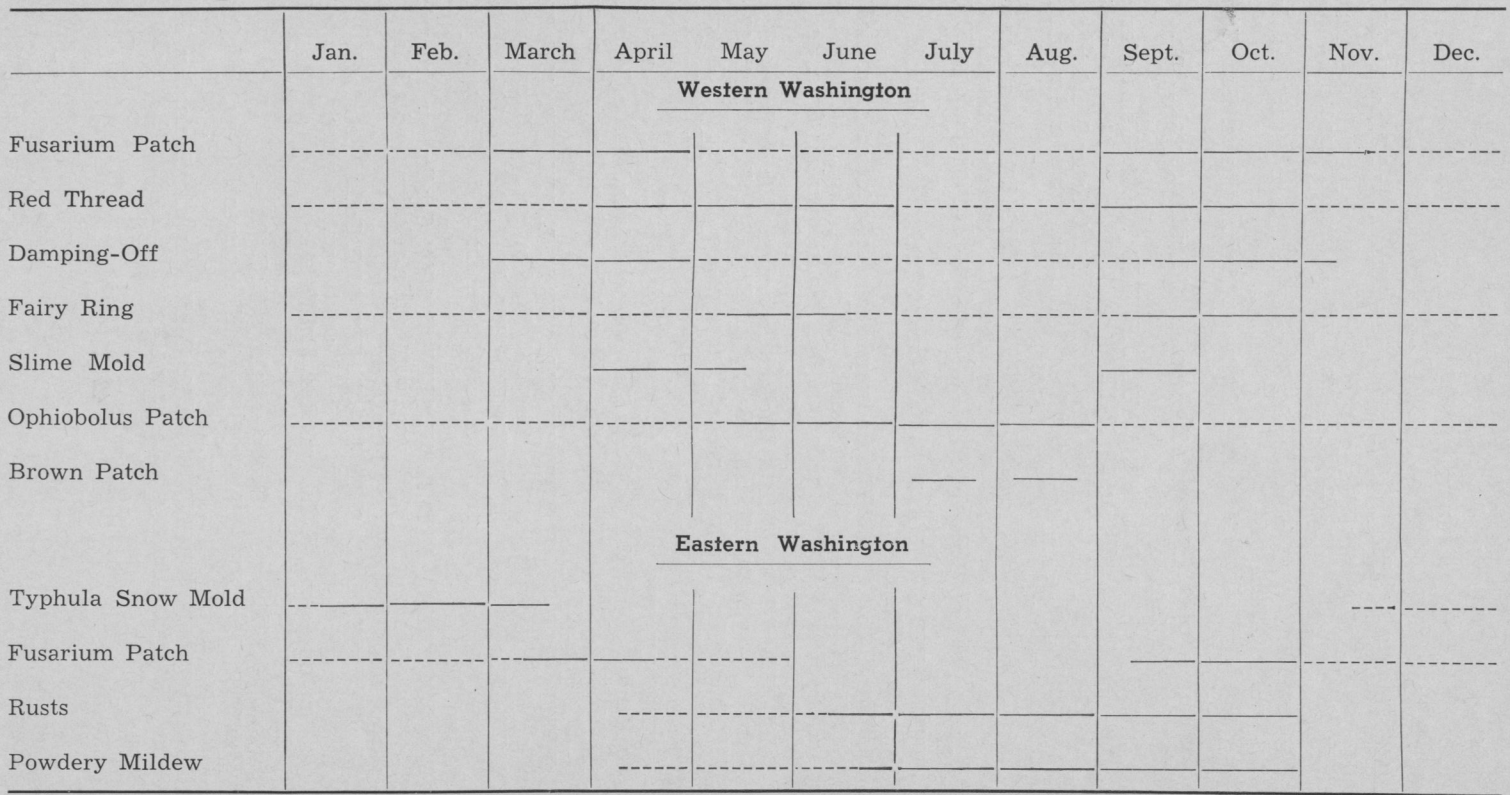
Summary

Perhaps the most effective way to summarize the diseases known to occur in Washington State is in the form of a chart. (Fig. 3) The solid lines represent the usual period of greatest losses, while the dotted lines indicate times when each fungus is either less destructive or not evident.

Control

Control measures for most of the diseases just described are summarized in Washington Extension Mimeograph No. 2049, available from any Agricultural Extension office in Washington.

Fig. 3 Normal or Maximum (___) and possible or minimum (---) appearance of turfgrass diseases in Washington State.



Literature Cited

1. ANON. 1941. Yearbook of Agriculture—Climate and Man. Published by the U.S. Dept. of Agriculture.
2. ANON. 1953. Yearbook of Agriculture—Plant Diseases. Published by the U.S. Dept. of Agriculture.
3. ANON. 1962. Ophiobolus Patch disease. J. Sports Turf Res. Inst., England. 10:467 & 468
4. ANTIPOV, V. G. 1959. Gas resistance of lawn grasses. Bot. Zurnal, 44:990-2.
5. BENNETT, F. T. 1933. Fusarium species of British cereals. Ann. Appl. Biol. 20:272-290.
6. BLOOM, JAMES R., AND PAUL J. WUEST. 1961. Nematodes and Turf. Golf Course Reptr. 29:12-17.
7. CORMACK, M. W., AND J. B. LEBEAU. 1959. Snow Mold infection of alfalfa, grasses and winter wheat by several fungi under artificial conditions. Can. J. Botany 37:685-693.
8. COUCH, HOUSTON B., AND JAMES R. BLOOM. 1960. Influence of environment on diseases of turfgrasses. II. Effect of nutrition, pH, and soil moisture on Sclerotinia Dollar Spot. Phytopathology 50:761-763.
9. COUCH, HOUSTON B. 1962. Diseases of Turfgrasses. Reinhold Publ. Corp., New York.
10. DAHL, ARNOLD S. 1933. Snowmold of turf grasses as caused by Fusarium nivale. Phytopathology 24:197-214.
11. DAVIS, RAY J. 1925. Studies on Ophiobolus graminis Sacc. and the Take-all disease of wheat. J. Agr. Res. 31:801-825.
12. DOSDALL, LOUISE. 1923. Factors influencing the pathogenicity of Helminthosporium sativum. Minn. Agr. Exp. Sta. Tech. Bull. 17.
13. ENDO, R. M. 1963. Influence of Temperature on Rate of Growth of Five Fungus Pathogens of Turfgrass and on Rate of Disease Spread. Phytopathology 53:857-861.
14. ERWIN, LESTER E. 1941. Pathogenicity and control of Corticium fuciforme. Bull. 278 Agr. Exp. Sta. of Rhode Island State College.
15. GARRETT, S. D. 1956. Biology of Root-Infecting Fungi. Cambridge Univ. Press. 252 pp.
16. GOULD, C. J., H. M. AUSTENSON, AND V. L. MILLER. 1958. Fairy Ring Disease of Lawns. Sta. Circ. 330, Washington Agr. Exp. Stations.
17. HOWARD, F. L., J. B. ROWELL, AND H. L. KEIL. 1951. Fungus Diseases of Turf Grasses. Bull. 308, Agr. Exp. Sta. Univ. of Rhode Island.
18. LUDWIG, R. A., AND A. W. HENRY. 1944. Studies on the microbiology of recontaminated sterilized soil in relation to its infestation with Ophiobolus graminis Sacc. Can. J. Res. 21:343-350.
19. MC KINNEY, H. H., AND R. J. DAVIS. 1925. Influence of soil temperature and moisture on infection of young wheat plants by Ophiobolus graminis. J. Agr. Res. 31:827-840.
20. MEINERS, JACK P. 1955. Etiology and control of snow mold of turf in the Pacific Northwest. Phytopathology 45:59-62.
21. MUSSER, H. BURTON. 1962. Turf Management. (Rev.) McGraw-Hill Book Co., Inc. 339 pp.
22. POTATOSOVA, MME. E. G. 1960. Conditions of germination of the sclerotia of the fungi of the genus Typhula. Zashch. Rast., Moskva 4:40.

23. POTATOSOVA, MME. E. G. 1960. Typhulosis of winter crops. Trud. vses. Inst. Zashch. Rast. 14:135-142.
24. REMSBERG, RUTH E. 1940. Studies in the genus Typhula. Mycologia 32:52-96.
25. REMSBERG, RUTH E. 1940. The snow molds of grains and grasses caused by Typhula itoana and Typhula idahoensis. Phytopathology 30:178-180.
26. SHANTZ, H. L., AND R. L. PIEMEISEL. 1917. Fungus Fairy Rings in eastern Colorado and their effect on vegetation. J. Agr. Res. 11:191-245.
27. SMITH, J. DREW. 1953. Fusarium Patch Disease. J. Sports Turf Res. Inst. 8:1-23.
28. SMITH, J. DREW. 1959. Fungal diseases of turf grasses. Bull. Sports Turf Res. Inst. 90 pp.
29. STAKMAN, E. C., AND J. GEORGE HARRAR. 1957. Principles of Plant Pathology. Ronald Press Co., New York. 549 pp.
30. STEVENS, NELL E., AND RUSSELL B. STEVENS. 1952. Diseases in plants. Chronica Botanica Co., Waltham, Mass.
31. WEIHING, JOHN L., STANLEY G. JENSEN, AND RICHARD I. HAMILTON. 1957. Helminthosporium sativum, a destructive pathogen of bluegrass. Phytopathology 47:744-746.

CURRENT RESEARCH ON CONTROL OF TURFGRASS DISEASES AT THE WESTERN WASHINGTON EXPERIMENT STATION

by Charles J. Gould

Fusarium Patch

with **Fungicides**—Testing several treatments and rates. PMA alone (when disease is most severe) and alternating PMA and Caddy (at other times) remain our top recommendations. (Coop. with Vern Miller and Roy Goss)

with **Fertilizers**—in cooperation with Roy Goss. Disease increases with increasing nitrogen—particularly with organic sources.

with **Soil Mixes**—in cooperation with Roy Goss. We expect that the best-aerated mix will give the best control.

Corticium Red Thread

with **Fungicides**—One test involving several different materials and times. Cadmium compounds look best so far, followed by Panogen and PMA. (with Miller and Goss)

with **Fertilizers**—Nitrogen continues to given good control except during winter months when grass growth is reduced. (with Goss)

Ophiobolus Patch

with **Fungicides**—Two large tests. Two treaments appear especially promising at present time. (with Miller and Goss)

with **Fertilizers**—High nitrogen from urea increased disease development in our plots. However, in England and Australia ammonium sulfate has given good control, apparently by making the soil more acid. It is worth testing here. (with Goss)

The financial assistance for these tests by the Northwest Turf Association, U.S. Golf Association-Green Section, and California Chemical Corporation is gratefully acknowledged.

PANEL DISCUSSSION

TOPIC: Advances in turfgrass management

PANEL MEMBERS:
Ed Fluter, chairman
John Zoller
Harvey Junor
Milt Bauman

WHAT IS MAINTENANCE? — OR WHAT IT TAKES TO MAINTAIN A GOLF COURSE

by Ed Fluter
Superintendent Glendoveer Golf Course, Portland

At the close of the Northwest Turf Conference at Pullman last year, most superintendents agreed that it was a very good educational session and many of us thought we had learned several things that we could put to good use during the coming months.

Some of us had a program of work already lined up to go ahead with during the late Fall and Winter months. Some of this work we had been putting off on account of maintenance and other things crowding us.

We have found that maintenance schedules cannot be put off or side-tracked; they must come first and head the list of our daily work program.

Grass does not quit growing because the mowers are out of order and fungus and other turf diseases do not always show up when we have lots of spare time to take care of them. Machinery seems to have the habit of breaking down when you are most crowded for time and are behind in your work program. However, sometimes our plans and intentions are rudely interrupted by some things that seem to come from out of a "clear blue sky".

WEATHER CONDITIONS:

That is what happened to many of us when on Columbus Day in October, a hurricane hit us with such force that our courses were shambles in a matter of minutes. Trees and shrubs uprooted—boughs and debris scattered from tees to greens. Electric poles toppled—transformers blew up—wires were lying on the streets and no one had lights or heat for days—some as long as ten days before their power was restored.

I happened to be home at the time the storm hit watching my trees being blown down, when the phone rang and a voice from the clubhouse said, "Ed, we haven't got lights, what shall be do?" You can imagine what I replied with the wind blowing over a hundred miles an hour. Evidently he was looking across No. 1 fairway and he said, "Boy! You are sure going to have one 'hell of a job' cleaning up this course." That was an understatement—it was really a mess and it took a lot of man power, etc. to get the course opened again for play.

Maintenance is a matter of taking things as they come—the planned and the unexpected.

One of the courses that was hit the hardest in that storm was the Eugene Country Club where John Zoller is the superintendent. He has some pictures to show us what he ran into there—

John Zoller.

Thanks John.

Maintenance is a matter of taking care of the course regardless of how old man nature treats you. Sometimes you have to work with him—sometimes you have to work against him.

MANAGING AND MAINTAINING:

However, there are some things that are fundamental and everyone managing turf has to keep them in mind. Plants like animals (including man) have to be fed in order to live; whether it is Nitrogen, Phosphorus or some of the trace elements. All are necessary for the building of healthy plant tissues, and must be supplied in proper proportions. Water must also be supplied at the right time and in right amounts. Sometimes that can be a problem on a golf course where there is heavy play.

The turf manager must be alert to the diseases of grass—either to prevent them or to cure them. Compaction must be minimized by aerifying and if necessary by top-dressing with the right materials. All this together with a rigid mowing program must be taken care of and systems have to be developed to suit the individual or peculiar problems of each course or turf project.

With play starting at daybreak and continuing heavy until dark, the question is—when can you get all these things done?

Milt Bauman who is superintendent at the beautiful Overlake Golf and Country Club will tell us how he maintains his course and what it takes to keep it in such fine condition—Milt Bauman.

MAINTENANCE AND OPERATIONS PRACTICES AT OVERLAKE GOLF AND COUNTRY CLUB

by Milt Bauman, Supt.

We will start with mowing practices which change very little from year to year and during the growing season the following procedure is standard:

It takes us about 15 hours to mow our fairways depending upon the condition of the grass and the amount of play. Our fairways are cut at three-quarters of an inch and during the heavy growing season the fairways are mowed more than four times a week; the rest of the growing season three times a week.

Our tees are cut at ½ inch with a tri-plex and are mowed every day except Sunday.

Our greens are cut at 7/32″ from the first of May until such time as we run into hot weather or some other problem which necessitates raising the mowers to one-quarter inch. About the middle of October, maybe sooner depending upon weather conditions, we raise the cutting height to 5/16″ where it remains until the weather breaks in the spring.

VERTICUTTING:

We practice vertical mowing during the lush growth and puffing season; weather and grass conditions have to be right or we do not use this machine. At no time do we set the machine to take off more than 1½ baskets of grass from a 5,000 sq. ft. green when this is done after

the greens are mowed. In other words, what we are doing is trueing the surface of the green.

FERTILIZATION:

Our fertility program is as follows: We generally fertilize fairways twice a season—a shot of urea in March with about 80 lbs. of actual Nitrogen per acre; then during the first part of June we use a complete fertilizer as, for instance, this year we used a 15-5-10 with a dolomite filler applied at the rate of 200 lbs. per acre. Some years we have come in later with a light application on the fairways.

Tees and aprons are fertilized about eight times a season with three applications of a complete fertilizer and the other applications of urea.

Our greens receive for the season as follows: 13 lbs. of N, 5 lbs. of P, and 10 lbs. of K per 1,000 sq. ft. in about 30 applications. The reason for so many applications is that we usually apply muriate of potash separately and then use light applications of ammonium nitrate with our fungicides.

From the middle of August until the first or middle of November, depending on the weather, we apply a fungicide every two weeks and if weather conditions warrant, we apply them more often. The rest of the year we apply a fungicide about once a month.

During the good weather months our traps are raked daily except Monday. Ball washers are cleaned and clean towels placed as needed; the two starting tees are changed daily during the heavy play season.

AERIFICATION:

We aerify and top dress both spring and fall. We have a greensaire and use ½" tines. Both spring and fall we have been overseeding with highland bent at the rate of 1 lb. per 1,000 sq. ft., and we definitely can see an increase in our bent grass population. We use a light loamy sand material for top dressing and apply about 1/3 of a yard per 1,000 sq. ft. We mat this material in, pulling a standard steel drag mat with our terra-tired Cushman Cart. This does a fine job; in fact, with this method one man can do the job better than was previously done by two.

I will not mention watering practices as there is no set standard or procedure to follow. We water as water is needed and we try to keep our course as dry as possible.

LIMING:

I will touch on lime now. Our fairway fertilizer has a dolomite filler and staying with this formulation, we should not have to worry about liming our fairways. We have used quite a bit of Dolomatic lime on our greens and tees, in fact in eight years we brought our pH up from 5.3 to 6.1 on an average of all of our greens. Now I will ask a question. Does bent grass require a pH above 6 to thrive and be healthy? Does a heavy liming program help improve our poa annua crop? Does a program with a high pH and heavy fertility have a tendency to give us coarse heavy bladed leaves and stems on our grasses?

SIGNS:

We have quite a few signs on our golf course and contrary to what a lot of people say, signs do get results. We fasten our signs on pieces of reinforcing steel, sharpened on one end and having a handle on the other. These signs can be moved very easily while the grass is mowed and then be replaced in the ground. We have placed such signs as "Let faster players through" and "Did you lift your ball mark" etc. They have helped speed up play and the members have taken better care of their golf course. We also have some wickets or gates made out of

reinforcing steel, 3/8" material, that keep the traffic from pulling carts through narrow openings between traps and greens. These also are pointed and can be moved very easily.

TRAILER EQUIPMENT:

One thing we do have that is of quite an interest to Superintendents, especially on the west side of the mountains, is our trailer equipment. We have three utility trailers with airplane wheels and tires, the tire size being 29 x 13-5. Our mechanic built these trailers. They are well balanced, heavily constructed and have lots of floatation. We have our sprayer mounted on one of them and have the other two for whatever jobs come along—hauling tile, gravel, dirt, limbs, etc. It is so wet during the winter that a dump truck cannot be used, so you can well imagine the use we have for these trailers.

Our mechanic also built a small lowboy tilt trailer we pull behind our Cushman cart. We haul such things as our greensaire, sod cutter, greens mower and what have you. We even use it for hauling sod when it is to be moved a short distance. It certainly is a labor saver.

Getting back to a cart for the golf course superintendent to get round in—I feel it makes him 25% more efficient than if he has to walk, and with terra tires he does no damage to the course.

During the winter months we check all of our equipment and get it in shape for the growing season. We are especially thorough with our fairway units. After they are two years old we go through them every year and check bearings, bushings and gears. We also paint almost every piece of equipment we have each winter.

RECORDS:

I also keep records of maintenance and construction costs as well as fertility and application of fungicides. Some people feel record keeping is a waste of time, but it takes all of the guesswork out of what you have done in the past. Also, it is nice to know how much was spent the previous year when submitting a budget, especially for maintenance.

I keep a pad in my desk and each month I ad up our labor costs, and when I check the bills at the office I mark down what items are charged to our department. I have found this to be a pretty easy way to keep a record of expenditures.

GREENS COMMITTEE:

This past year we have had a Greens Committee meeting about every three months. There are five members on this committee and the meetings have been held at one of their homes in the evening. My first reaction was to resent this, but after attending a couple of them I think they are fine. Previously, meetings were held at the clubhouse during the day and the committee members had one thing in mind—get through so we can play golf. These evening meetings have been very constructive and interesting, and I endorse them.

EMPLOYEE-CLUB RELATIONS:

The Club has a good relationship with its employees. We try to keep the wage scale up so that we can be selective and have a better class of men on our greens crew. We have paid vacations, an insurance program, and all of the permanent employees are on salary. We do not have much turn over. All of our employees can find something to do whether or not someone is there to direct them, and they respect their job and the golf club.

In closing I might say that the golf courses and employees have both made great strides in the past ten years.

* * * *

Thanks Milt for such a good paper.

The next superintendent on the panel is Harvey Junor from the lovely Portland Country Club. He also has had an unusual maintenance problem. Awhile back it was decided that the local sewer line had to go through the golf course. Sometimes the contractors are more concerned with getting their job finished than they are in preserving good turf. Harvey will tell us some of his maintenance program—Harvey.

SEWER PROBLEMS

by Harvey Junor
Portland Golf Club

In August of 1961 the Portland Golf Club was confronted with one of the problems of a fast growing area.

An easement for construction of a sewer line directly through the center of the course was required. This year we again face the same problem. Many clubs in the area may be in similar situations as golf courses seem to be the hub of many growing communities.

The main concern of all involved was to have the operation move along as fast as possible.

Problem No. I

The route across the course. The most direct for the engineer crossed several greens, tees, and the creek several times, leaving us with a great deal of damage. After meeting with the engineers a plan was agreed upon that caused the least amount of destruction.

Problem No. II

Access to and from the course had to be provided for heavy equipment. The trench was to be 18' deep and 6 to 10 ft. wide on the surface. A 50' easement was granted to the contractor with the understanding that all work was to be completed within this area.

Problem No. III

Keeping the golf course playable. One nine was to be kept open for play at all times. The contractor was required to complete fairways as soon as possible before starting on the next area.

Problem No. IV

Keeping irrigation system in operation. Due to the fact that the work was being performed in August made this the most important problem. The contract required the irrigation system be kept in operation at all times.

The contractor tunneled under most of the lines but many were broken. We were able to repair most lines within a few hours and as a result no harm was done.

There has been very little settling as the dirt was packed back firmly with heavy equipment.

Problem No. V

Drainage Problem. In all fairway areas the sod was removed and layed back, the roughs were seeded. All drain tiles were replaced and back filled with gravel. After the project was completed and it looked like a good job, we are having a definite drainage problem. The solid fill has spoiled all the natural sub drainage.

We dislike thinking about having these same problems next year

KNOW YOUR PRODUCT

by Harvey Junor
Portland Golf Club

Todays management problems do not all fall into the category of turf. The superintendent has to have the ability to handle many different types of problems outside the field of turf. These problems require many hours of time, but basically we are hired for good turf and no matter how well we handle these other matters it is the condition of the course that we are graded by.

This is the field that we all want to advance in and through the years the superintendent and his methods of turf management have done so in many ways.

Many new types of equipment and products have given us a greater advantage over the superintendent of 20 or 30 years ago, making many of our jobs easier and yet producing better turfs.

The old timers learned from trial and error. Through the years we also have made many mistakes but we have much more help from Agronomists and other outside sources. Years ago the superintendent developed a habit of testing their new methods on the nursery as this was the only way available to them, and to me this is something that should never be forgotten.

Today's superintendent has many products available to him and many different types for the same job. Many of these products are new to us and many companies are new in the turf industry while other companies have new products.

To me this brings up one of the most important things in turf management, and that is in knowing the product you are using and are absolutely sure of the effects it will have on your turf. Without proper information sometimes this type of advancement ends up with more problems than it anticipated. The results of one little mistake can cast a shadow over all our good work as good turf is taken for granted and errors are quickly seen. Don't use anything unless you have information from a dependable source or have tested it for a long period of time on your nursery. This way of thinking has stemmed from three words of advice passed on to me by one of the old timers. When I was all enthused with a brand new product, they saved me a lot of trouble. Maybe they will you: *"Proceed with Caution."*

* * * *

Thanks Harvey.

We have heard how some of the maintenance problems are met. Probably among the newer turf managers there are some questions they would like to put to the panel members. What is your problem?

TURFGRASS FERTILITY RESEARCH REPORT[1]

by Roy L Goss[2]

The fastest and best guide to proper plant nutrition is through laboratory soil tests. The reaction and appearance of the plant is very important as well, but sometimes we cannot correct a deficiency in time to help the crop. In the case of turf, if we wait until it shows a deficiency symptom for potassium, phosphorus, or calcium, the lacking element cannot be applied to the root zone as easily as with annual crops. It is important, then, to know what our fertility level is before planting a permanent turfgrass.

Table I gives us an idea of what our fertility balances are in some of our turfgrass areas.

TABLE I.—Fertility Status of Some Golf Course Putting Greens.

	Phosphorus Deficiency		Potassium Deficiency	
No. of Samples	No.	%	No.	%
227	11	4.8	108	48

Putting greens are illustrated, in this case, since these represent recent tabulations of soil tests from well managed golf courses. Potassium was being used in the fertilizer programs, but obviously not enough. The same general trend is true for all other turf soil tests. These results indicate that (1) insufficient amounts of the formulated fertilizer were not applied or (2) the fertilizers were not properly formulated to meet the crop needs. These potassium deficiencies must be corrected slowly in order to avoid injury to the grass.

HOW MUCH POTASSIUM DOES YOUR TURFGRASS USE?

Table II illustrates some results from a turfgrass fertilizer experiment in progress at the Western Washington Experiment Station.

TABLE II.—Comparison of soil Potassium* Levels after 3 Years of Clipping Removal.

N-P-K Treatments lbs./a./yr.	Initial K lbs./a.	Present K lbs./a.	Lbs. K applied per acre in 3 yrs.	Relative net use K lbs./ acre
1. 870-0-0	500+**	184	0	316+
2. 870-77-0	500+	149	0	351+
3. 870-77-289	500+	329	867	1038+
4. 522-0-0	500+	183	0	317+
5. 522-77-0	500+	175	0	325+
6. 522-77-289	500+	330	867	1037+
7. 261-0-0	500+	217	0	283+
8. 261-77-0	500+	220	0	280+
9. 261-77-289	500+	348	867	1019+

* Extractable with Morgan's solution
** 500/a. = Highest standard used by W. S. U. Lab.

---

[1]Paper presented at 17th Annual Turfgrass Conference, Portland, Oregon, September 27, 1963.

[2]Assistant Agronomist and Extension Specialist in Agronomy — Western Washington Experiment Station, Washington State University, Puyallup, Washington.

These data do not take into consideration certain variables, such as possible leaching, fixation, and the release of non-exchangeable postassium in the soil. It is apparent, however, that large amounts of potassium have disappeared from these plot soils. The rates of nitrogen applied were 20, 12, and 6 lbs. per 1000 Sq. ft. per season. Phosphorus (P) was applied at 1.76 lbs./1000 Sq. ft. per season, and potassium (K) was applied at 3.32 and 6.64 lbs./1000 Sq. ft./season. All nitrogen was applied as urea and potassium was applied at muriate of potash. They were dissolved and sprayed on the plots at regular intervals to make up the annual total. Phosphorus was applied as treble super phosphate separately.

NITROGEN INFLUENCES POTASSIUM USE:

As the rate of nitrogen application increases there is also an increase in use of potassium. This trend is illustrated in comparing treatments numbers 1, 2, 4, and 5 with numbers 7 and 8. It is surprising to note that in spite of what was thought to be adequate applications of K all plots showed a net loss of potassium over the 3 year period. These data are in agreement with several other investigators who have briefly reported on turfgrass fertilizer requirements. Just how high we would have to go with our potassium applications to show a net gain is not known for putting green turf. However, preliminary results (Table III) on lawn turf fertilizer plots show that some net gains have been made, especially when available N was applied at 8 lbs./1000 Sq. ft./season and K was applied at 6.64 lbs./1000 Sq. ft. per season. See treatments No. 4 and 6 in Table III.)

TABLE III.—Relative use of potassium by lawn turf when variable rates of N-P-K are used.

N-P-K Treatments	Initial K	Present K	Lbs. K applied per acre in 3 years	Relative net use K lbs./ acre
1. 348-0-0	479	180	0	299
2. 348-77-0	466	145	0	321
3. 348-77-145	419	289	435	565
4. 348-77-289	415	438	867	844
5. 348-0-145	414	386	435	463
6. 348-0-289	414	481	867	800
7. 174-0-0	428	180	0	248
8. 174-77-0	414	180	0	234
9. 174-77-145	449	381	435	503

Again, these data do not take into consideration the variables of fixation, leaching, and release of non-exchangeable potassium.

WHAT ABOUT FERTILIZER BALANCE FOR TURFGRASSES?

Results at this time indicate that balances are important to turfgrasses but not in the same proportion as for most field crops. For example, only small applications of phosphorus are necessary to maintain a good healthy turf, but considerably more potassiusm is required to maintain quality. Plots with high potassium levels have better color and growth characteristics than those with low levels when observed in the field. Nitrogen levels influence the uptake of postassium by turfgrasses. The higher the nitrogen level, the more potash is removed.

In computing phosphorus use, it was found that potassium influenced the levels considerably. When potassium was applied, larger amounts of phosphorus were taken up. Likewise, phosphorus influences potassium uptake, but to a much smaller degree.

TABLE IV.—Relative use of phosphorus by **Lawn Turf** when variable rates of N-P-K are applied.

N-P-K Treatments	Initial P	Present P	Lbs. P. applied per a. in 3 yrs.	Relative net use lbs./a.
1. 348-0-0	21	13	0	8+
2. 348-77-0	22	20	221	223
3. 348-77-145	22	20	221	223
4. 348-77-290	21	21	221	221
5. 348-0-145	23	14	0	9
6. 348-0-290	23	14	0	9
7. 174-0-0	23	14	0	9
8. 174-77-0	21	18	221	224
9. 174-77-145	22	20	221	223
10. 174-77-290	20	18	221	223
11. 174-77-145	20	14	0	6
12. 174-0-290	18	14	0	4
13. 0-0-0	18	16	0	2

TABLE V.—Relative use of phosphorus by Putting Green Turf when variable rates of N-P-K are applied.

N-P-K Treatments	Initial P	Present P	Lbs. P. applied per a. in 3 yrs.	Relative net use lbs./a.
1. 870-0-0	15	9	0	6
2. 870-77-0	16	14	221	223
3. 870-77-145	15	15	221	221
4. 870-77-290	15	16	221	*220
5. 0-0-0	15	14	0	1
6. 870-0-145	16	9	0	7
7. 870-0-290	14	9	0	5
8. 522-0-0	14	10	0	4
9. 522-0-145	15	10	0	5
10. 522-0-290	16	9	0	7
11. 522-77-0	16	17	221	*220
12. 522-77-145	17	15	221	223
13. 522-77-290	17	15	221	223
14. 261-0-0	17	10	0	7
15. 261-0-145	18	11	0	7
16. 261-0-290	18	9	0	9
17. 261-77-0	19	17	221	223
18. 261-77-145	18	19	221	220
19. 261-77-290	18	12	221	227

WHAT ABOUT DISEASE?

Nutrition plays a major role in disease development. In cooperative disease control experiment with Dr. C. J. Gould of this station, we have definitely established the fact that Fusarium patch disease is stimulated by heavy applications of nitrogen. It was further observed that organic forms stimulated greater infection than inorganic. Ophiobolus patch disease, an increasing problem in the northwest, is similar in its response as Fusarium patch when considering nitrogen. Other examples of disease and nutrition interrelationships can be found.

Just how much these diseases are being affected by potassium, phosphorus, or combinations of these nutrients still remains to be seen. As we approach the critical levels, both high and low, it appears that the picture is changing somewhat and more can be said in the near future. A vigorous, healthy turf will respond to management and resist disease attacks. Hence, for the average conditions of the northwest, a fertilizer

with about 3-1-2 ratio of nitrogen, phosphorus, and potassium will give this health and vigor if the level is kept high enough and no serious deficiencies were apparent initially.

TABLE VI.—PUTTING TURF RATINGS—Sept. 23, 1963

Treatment Lbs. N-P-K/1000/Season	1 Quality (Color, etc.)	2 Ophiobolus	3 Scalp & Thatch
1. 20-0-0	8	10	1
2. 20-4-0	8	5	3
3. 20-4-4	9	2	1
4. 20-4-8	8	4	4
5. Check	9	0	0
6. 20-0-4	9	5	4
7. 20-0-8	7	10	0
8. 12-0-0	8	7	6
9. 12-0-4	7	5	4
10. 12-0-8	7	9	4
11. 12-4-0	6	0	8
12. 12-4-4	8	0	7
13. 12-4-8	7	0	7
14. 6-0-0	7	4	2
15. 6-0-4	6	0	10
16. 6-0-8	7	0	8
17. 6-4-0	5	2	10
18. 6-4-4	7	0	8
19. 6-4-8	6	5	10

1 — Based on 10 as perfect quality
2 — Based on 10 as severely infected
3 — Based on 10 as severe scalp and thatched.

SUMMARY OF TURFGRASS AGRONOMIC RESEARCH AT WESTERN WASHINGTON EXPERIMENT STATION

by Roy L. Goss

EXPERIMENTS WITH PARAQUAT

Experiments on renovation of turfgrass areas have been conducted since the fall of 1962 with paraquat (1:1-Dimethyl-4,4'-Dipyridylium dichloride or paraquat dichloride). In all cases paraquat was effective in rendering an immediate contact kill on all vegetation contacted. Plants with storage root systems usually recover from these applications. Grasses such as bent grass, *Poa annua,* and others not having underground storage organs are effectively killed.

Rates of 1/2-1 and 2 pounds of Cation per acre have given excellent kills especially when used with a wetting agent. Paraquat is also effective for edging and immediate contact kills where residual activity for extremely short periods of time (1 to 2 days) is desired.

EXPERIMENTS WITH MALEIC HYDRAZIDE (A growth regulator)

Applications of maleic hydrazide were made in May, 1963 at the rate of two and four pounds per acre. The two pound application rate was repeated in two weeks after the first treatment. The four pound per acre rate discolored the grass slightly, but recovered its color quickly as compared to the two pound rate repeated twice. A second application at the

two pound rate discolored the grass somewhat more than the four pound original rate.

In September, 1963 the plots treated with maleic hydrazide still showed reduced growth rate as compared to other materials tested and to the check plot areas. The color in the MH treated plots was extremely good indicating that the treatment is very effective. It would seem from these results that the use of maleic hydrazide in secondary turfgrass areas such as roughs, and perhaps even in some fairway areas, highway roadsides, and certain other areas would be a beneficial program.

POA ANNUA CONTROL

As a pre-emergence treatment, Dacthal at ten pounds per acre, Zytron at ten pounds per acre, Enide (formerly referred to a U4513) and Betasam (formerly referred to a R4461) have all given satisfactory results in the inhibition of the growth of *Poa annua* seedlings. Some field testing is required on some of these materials, however, at the present time Dacthal has been the most widely tested for phytotoxic reaction. At this time no phytotoxicity has been found with Dacthal on putting greens especially. However, some minor reports have come in on the thinning of fescues by Dacthal; however, the author has not corroborated such results in his tests. More will be outlined at a later date on the control of *Poa annua* with these pre-emergence materials.

Several materials were tested for post-emergence control of *Poa annua* and briefly maleic hydrazide and Endothal produced considerable burning to the bentgrass putting green turf and only Betasan showed reasonable results in the control of mature *Poa annua*. More will be coming on this in the future.

FERTILITY AND DISEASE

Fusarium patch continues to be aggravated by high rates of nitrogen. This is essentially the same information that has been reported in several previous instances. It seems likely then that during the disease season the amount of nitrogen should be cut back and since evidence indicates that urea and organic fertilizers increase the incidence of Fusarium these should be reduced or eliminated from formulations during the extreme disease season. Ammonium nitrate and ammonium sulfate can be used with reasonably good success, however, the rates of these should be kept low also.

Fusarium patch disease was extremely severe on plots with 20 pounds of available nitrogen per thousand square feet per season particularly where no phosphorus or potassium was included in the formula. Extreme disease was also observed where twenty pounds of nitrogen, no phosphorus, and 8 pounds of potassium per thousand square feet was used. This indicates when imbalances of fertilizer are employed, disease conditions can occur.

Extreme thatching was observed on all low rates of nitrogen. In particular, this was noticed on some plots where high rates of potassium were used. At this time, the cause of this reaction is not exactly known, but it is supposed that potassium is actually stimulating better growth and under a better management program these plots that are thatching and scalping badly can be brought into excellent culture.

For a complete review of fertilization, disease, and thatch results, refer to Table VI.

MEMBERS

NORTHWEST TURFGRASS ASSOCIATION

Adams, Fred	1200 Stewart Avenue Seattle, Washington	Turfco
Banks, Harvey L.	P. O. Box 397 Bremerton, Washington	Kitsap Golf & CC
Bauman, Clayton	2036 9th St. W. Kirkland, Washington	Glendale G & CC
Bentley Company	4126 Airport Way Seattle, Washington	
Cabinet View CC	Box 441 Libby, Montana	
Chase, J. V.	4101 Beacon Ave. So. Seattle, Washington	
City of American Falls	American Falls, Idaho	
Down River Golf C.	Spokane, Washington	
Everhart, C.	Box 8025 Manito Station Spokane, Washington	
Evergreen Memorial Pk.	11111 Aurora Ave. No. Seattle, Washington	
Faulkner Spray Service	2820 S. 150th Seattle, Washington	
Federspiel, Fred	Oswego Lk. 20 Iron Mt. Blvd. Oswego, Oregon	
Fircrest Golf Club	6520 Regents Blvd. Tacoma, Washington	
Floral Hills, Inc.	409 Filbert Rd. Alderwood Manor, Washington	
Fluter, E.	14015 N.E. Glisan Street Portland, Oregon	Glendoveer GC
Forest Lawn Cemetery	5409 Kitsap Way Box 1279B Bremerton, Washington	
Galbraith and Company	2428 Alaskan Way Seattle, Washington	
Gese, P.	Box 68 North Bend, Washington	Mount Si Golf Club
Goddard, Murl	Box 187 Selah, Washington	Elks Golf & CC
Grays Harbor CC	Route 1 Aberdeen, Washington	

Greco, J.	P. O. Box 2446 Parkland, Washington	College GC
Greenup Spray Service	12437 1st Ave. S. W. Seattle, Washington	
Gueho, E. M.	771 Austin Road New Westminster, B. C.	
Harrison, J.	Coeur d'Alene CC Hayden Lake, Idaho	
Harrison, George	2030 Lincoln Avenue Tacoma, Washington	NULIFE
Haskell, D.	100 Dexter Ave. N. Seattle, Washington	Golf Director Seattle Park Dept.
Hemphill Bros. Inc.	201 Boren Ave. N. Seattle, Washington	
Hogan, D.	9060 37th Ave. So. Seattle, Washington	
Holms, J.	Box 1196 Fairbanks, Alaska	
Jacklin, A. W.	8803 E. Sprague Dishman, Washington	Jacklin Seed Company
Jaslowski, J.	2340 Broadmoor Dr. E. Seattle, Washington	Broadmoor GC
Junor, H.	5900 S. W. Scholls Ferry Road Portland, Oregon	Portland Golf Club
Kuhn, C.	901 Lane Street Seattle, Washington	H. D. Fowler Inc.
Land, Sr., H.	320 129th So. Tacoma, Washington	Tacoma Country Club
Land, Jr., H.	8333 55th Ave. N. E. Seattle, Washington	Sand Point CC
Latimer, D. W.	Route 3 Olympia, Washington	Fort Lewis GC
Lawton, G.	P. O. Box 1063 Olympia, Washington	Olympia C & GC
Lewiston Golf & CC	Lewiston, Idaho	
Lilly Company, Charles	1900 Alaskan Way Seattle, Washington	
Liotta, A.	1235 College Station Pullman, Washington	Pullman GC
Lufkin, H.	1031 N. E. 114th Seattle, Washington	General Spray Service of Magnolia
Macan, A. V.	1110 Beach Drive Victoria, British Columbia	
Michel Lumber Company	Box 555 338-A North State St. Lake Oswego, Washington	
Mihelich, J.	Rt. 3, Box 599 Enumclaw, Washington	

Miller, D. J.	520 So. 53rd Tacoma, Washington	A-1 Spray
Miller, R. E.	7737 N. E. Killingsworth Portland, Oregon	Millers Products
Mount View Cemetery	P. O. Box 632 Walla Walla, Washington	
Mt. View Memorial Park	4100 Steilacoom Blvd. SW Tacoma, Washington	
Northwest Mower & Marine	7710 24th N.W. Seattle, Washington	
Pacific Agro Company	3308 Harbor Ave. S. W. Seattle, Washington	
Peace Portal Golf C.	Box 130 190 King George Highway White Rock, British Columbia	
Putnam, Ken	145th N and N Greenwood Seattle, Washington	Seattle GC
Quast, T.	Route 1 Marysville, Washington	Cedarcrest GC
Reger, A. S.	P. O. Box 235 Liberty Lake, Washington	Liberty Lake Golf Course
Ripley, Clarence	Route 5 Spokane, Washington	Wandermere Golf Course
Royal Oaks CC	8917 N. E. 4th Plain Road Vancouver, Washington	
Salishan Beach GC	Gleneden, Oregon	
Sander, B.	8105 N. E. Sunderland Ave. Portland, Oregon	Riverside Golf
Schmidt, L. J.	W. 4302 West Drive Spokane, Washington	Indian Canyon GC
Scott, L. A.	3252 Ferdinand St. S. Seattle, Washington	W Seattle GC
O. M. Scott & Sons	P. O. Box 327 Salem, Oregon	
Ed Short Company	2400 6th Ave. So. Seattle, Washington	
Spokane Park Dept.	504 City Hall Spokane, Washington	
Sunset Hills Memorial	Box 461 145 Pl. S. W. 16th St. Bellevue, Washington	
Van Waters & Rogers	4000 1st Ave. So. Seattle, Washington	
Veterans Memorial GC	Walla Walla, Washington	
Wagner, C	12221 Gravelly Lake Dr. SW Tacoma, Washington	

Waite Company, Ramsey	P. O. Box 5173 Eugene, Oregon	
Walla Walla CC	P. O. Box 523 Walla Walla, Washington	
Walters Co., Charles R.	Bothell, Washington	
Reed, B.	9817 E. Burnside Street Portland, Oregon	E. P. Baltz & Sons
Wenatchee G & CC	P. O. Box 1479 Wenatchee, Washington	
Werth, R.	1000 N. E. 135th Street Seattle, Washington	Jackson Park GC
Western Plastics Corp.	3110 Ruston Way Tacoma, Washington	
Western GC Supply	1240 S. E. 12th Ave. Portland, Oregon	
White, Sidney S.	Route 3, Chenowith RD. The Dalles, Oregon	The Dalles CC
Woods, N. H.	6144 Wilson Road RR 7 Langley, British Columbia	
Zoller, J.	255 Country Club Road Eugene, Oregon	Eugene CC
Zook, S.	1100 S. E. Waverly Drive Portland, Oregon	Waverly CC

CONFERENCE ATTENDANCE 1963

Allen, Elmer	McCall, Idaho	McCall Golf Course
Allen, Milt	Enumclaw, Washington	
Atkins, Luther B.	Warrenton, Oregon	Gearheart GC
Baltz, Tom	Portland, Oregon	
Bashor, Noble	Salem, Oregon	
Banks, Harvey	Bremerton, Washington	Kitsap GC
Baptiste, Roscoe	Grants Pass, Oregon	Grants Pass GC
Bauman, Clayton	Bellevue, Washington	Glendale CC
Bauman, Milt	Medina, Washington	Overlake G & CC
Beggs, Robt.	Victoria, B. C.	Victoria GC
Bengeyfield, Bill	Garden City, California	USGA
Booth, Victor	New Westminister, B. C.	British Columbia Highway Department
Brown, David	Island City, Oregon	LaGrande CC
Burkette, Art	Seattle, Washington	Magnolia Company
Carbaugh, W. S.	Neskowin Beach, Oregon	Neskowin Beach GC
Chase, Jack	Seattle, Washington	Jefferson Park GC
Clark, Phil	Moses Lake, Washington	Moses Lake Park Dept.
Clark, Virgil	Everett, Washington	Everett G & CC
Cockburn, Robert	Everett, Washington	Earlybird Spray
Collier, Ray	Portland, Oregon	Collier Spray
Cowan, Ritchie	Corvallis, Oregon	Oregon State University
Dauterman	Longview, Washington	Longview CC
DeChambeau, Norm	Bothell, Washington	Wayne GC
Drew, Graham	Vancouver, B. C.	University of B. C.
Deshler, Mel	Spokane, Washington	Pineacres Par 3
Everhart, Cliff	Spokane, Washington	Manito G & CC
Fairburn, Don	Spokane, Washington	Toro Supply
Feinberg, Chester	Portland, Oregon	Diamond Alkali
Fletchall, Max	Salem, Oregon	Illahe Hill GC
Florence, Paul	Salem, Oregon	O. M. Scott Co.
Fluter, Ed	Portland, Oregon	Glendoveer GC
Fortier, Bud	Albany, Oregon	Springhill G & CC
Fouts, Russ	Albany, Oregon	Springhill G & CC
Freed, Virgil	Corvallis, Oregon	Oregon State University
Fritsch, Dick	Seattle, Washington	Polson Implement
Gabel, Bill	Walla Walla, Washington	Walla Walla GC
Gavan, Frank	Victoria, B. C.	Upland GC
Gettle, Dick	Bellingham, Washington	Bellingham GC
Gleeson, Al	Richmond, B. C.	Golfland Range
Goddard, Murl	Selah, Washington	Elks GC
Goetze, Norm	Corvallis, Oregon	Oregon State University
Goss, Roy L.	Puyallup, Washington	West. Wash. Exp. Station
Gould, C. J.	Puyallup, Washington	West. Wash. Exp. Station
Gregg, Bill	Pullman, Washington	Washington State University
Gueho, Manny	New Westminister, B.C.	Vancouver GC
Gray, Homer	Corvallis, Oregon	Corvallis CC

Hamon, Clarke	Caldwell, Idaho	King Brown Gardens
Hale, Martin	Whitefish, Montana	Whitefish GC
Hamilton, Wes	Portland, Oregon	North Coast Seed
Harshaw, Wm.	Coeur d'Alene, Idaho	Coeur d'Alene GC
Harrison, George	Tacoma, Washington	NuLife Company
Harrison, John	Hayden Lake, Idaho	Hayden Lake CC
Hart, Allen	Pleasant Hill, California	O M Scott & Sons
Hartmann, Richard	Portland, Oregon	Morton Chemical Company
Harvey, George	Warrenton, Oregon	Astoria G & CC
Heider, Walt	Vancouver, Washington	Royal Oaks CC
Herman, John, Jr.	Albany, Oregon	Northrup King & Co.
Hill, Herb	Portland, Oregon	FMC Corp, John Bean
Haskell, Richard	Seattle, Washington	Director of Golf
Hogan, Don	Seattle, Washington	Irrigation Engineer
Jaslowski, John	Seattle, Washington	Broadmoor GC
Johnson, Scott	Salem, Oregon	
Junor, Harvey	Portland, Oregon	Portland GC
Keel, Tom	Roseburg, Oregon	Roseburg Parks
Kenning, John	Vancouver, B. C.	Pt. Grey G & CC
Kuhn, Carl	Seattle, Washington	H. D. Fowler Co.
Kumm, Don	Portland, Oregon	E. P. Baltz Co.
Lake, Everett	Hermiston, Oregon	Landscaping
Land, Henry Sr.	Tacoma, Washington	Tacoma C & GC
Larson, B. L.,	Portland, Oregon	Oregon Toro Distr.
Law, Al	Pullman, Washington	Washington State University
Lawton, George	Olympia, Washington	Olympia C & GC
Latimer, Dean	Ft. Lewis, Washington	Ft. Lewis GC
Locklear, O. C.	Boise, Idaho	Landscape Service
Lufkin, Howard	Seattle, Washington	General Spray Service
Macan, A. V.	Victoria, B. C.	Golf Architect
Mackaness, Frank	Portland, Oregon	Port. Gen. Elec.
Malpass, Dick	Junction City, Oregon	Shadow Hills CC
MacLean, Neil	Vancouver, B. C.	University of BC
Martin, Wm.	Newport, Oregon	Agate Beach GC
McKenzie, Ken	Seattle, Washington	Pacific Agro
McLeod, Don	Richmond, B. C.	Richmond CC
McNeilan, Ray	Gresham, Oregon	Multno. Co. Ag.
Martinell, Wm.	Seattle, Washington	Toro Supply
Mihelich, Joe	Enumclaw, Washington	Enumclaw GC
Mills, Claude	Portland, Oregon	Miller Products
Mitchell, CB	Clarkston, Washington	Clarkston G & CC
Mock, Don	Seattle, Washington	Regional Chemical
Moore, Lefty	Oak Harbor, Washington	Gallery GC
Morrison, Ken	Pullman, Washington	Washington State University
Murphy, Robert	Chilliwack B. C.	Chilliwack G & CC
Neidlinger, Tom	Corvallis, Oregon	Oregon State University
Newport, LeRoy	Bend, Oregon	Christmas Valley
Nial, George	Caldwell, Idaho	Municipal GC
Oliphant, Richard	Portland, Oregon	Lilly Co.
Orton, Stan	Puyallup, Washington	West. Wash. Exp. Station
Pauling, John	Washington, D. C.	US Dept. of Ag.

Pierson, Robt.	Coos Bay, Oregon	Coos CC
Porterfield, Jim	Ashland, Oregon	Oak Knoll GC
Pottenger, Joe	Yakima, Washington	Yakima CC
Proctor, Glen	Seattle, Washington	Rainier G & CC
Proctor, Larry	Tacoma, Washington	McChord AFB GC
Putnam, Ken	Seattle, Washington	Seattle Golf
Reed, Byron	Portland, Oregon	E. P. Baltz
Rowe, "Chen"	Tacoma, Washington	Tacoma Seed Co.
Ripley, Clarence	Spokane, Washington	Wandermere GC
Sander, Wm.	Portland, Oregon	Riverside G & CC
Schmidt, Louis	Spokane, Washington	Indian Canyon GC
Schmidt, Ray	Great Falls, Montana	New Meadow Lark CC
Schwabauer, Richard	Corvallis, Oregon	Oregon State University
Scott, Lloyd	Seattle, Washington	West Seattle GC
Shearer, Marvin	Corvallis, Oregon	Oregon State University
Shults, Jack	Cornelius, Oregon	Forest Hills GC
Smith, Harold	Vancouver, B. C.	Capilano G & CC
Staib, Bob	Napa, California	Hercules Co.
Stuiber, Edwin	Tumwater, Washington	Western Tree Service
Thorpe, Tom	Victoria, B. C.	Royal Colwood GC
Venable, Marc	Seattle, Washington	Northwest Mower
Vinson, Jim	Portland, Oregon	Oregon Toro Distributors
Ward, Joe	Silver Lake, Oregon	Christmas Valley
Werth, Rudy	Seattle, Washington	Jackson Park GC
Willis, Frank	Longview, Washington	Longview Parks
White, Sid	The Dalles, Oregon	Dalles CC
Wright, Vernon	Spokane, Washington	Lilly Company
Zook, Sam	Portland, Oregon	Waverley CC
Zoller, John	Eugene, Oregon	Eugene CC
Lindsay, W. Dean	Wasatch Chemical Gresham, Oregon	
Mahan, Glen	Portland, Oregon	Lilly Company
Garner, Ray	Portland, Oregon	Cushman Mtrs.
Couch, John	Hood River, Oregon	
Woods, Norman	Langley, B. C.	Golf Course Archt.
Rogers, Eddie	Seattle, Washington	Northwest Mower & Marine
Butchek, Ken	Portland, Oregon	Webfoot Fert. Co.
Carper, John	Seattle, Washington	Naugatuck Chemical
Wilkerson, Jim	Portland, Oregon	University of B. C.
Brink, V. C.	Vancouver, B. C.	
Sater, Neil	3414 Royal Oaks Drive Vancouver, Washington	